Lt Gen Sir J Robert Charles KCB CMG DSO
Chief Royal Engineer April 1940- June 1946

HISTORY

OF THE

CORPS OF ROYAL ENGINEERS

VOLUME VIII
1938–1948

CAMPAIGNS IN FRANCE AND BELGIUM, 1939–40. NORWAY, MIDDLE EAST, EAST AFRICA, WESTERN DESERT, NORTH WEST AFRICA, AND ACTIVITIES IN THE U.K.

By

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C.B., M.C.

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VOLUME IX

1938–1948

CAMPAIGNS IN SICILY AND ITALY: THE WAR AGAINST JAPAN: NORTH WEST EUROPE 1944–45: MINOR AND NON-OPERATIONAL AREAS: POST-WAR, 1945–48

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FOREWORD

THE writing of any Regimental History is a most difficult task, while in the case of a Corps the difficulties are even greater. This became abundantly clear when the Council of the Institution of Royal Engineers tried to draw up a "brief" for Major-General Pakenham-Walsh as a guide for writing these two Volumes VIII and IX, covering the period 1938–48. It at once became apparent that there was a great divergence of views amongst officers on the general lines on which the history should be written and how much detail should be included. In the end the "brief" was prepared on very general lines and most of the detail was left to the author to use his own judgement.

The collection of material for any history entails an immense amount of reading of documents, a great deal of correspondence, and the making of vast quantities of notes. After that comes the exacting task of condensing the whole and putting it into a form which is both interesting and easy to read.

General Pakenham-Walsh has been fully occupied on this work for nearly ten years. In spite of being handicapped by arthritis he has not spared himself in any way, and he has produced a first-class account of the very varied activities of the Corps all over the world during the period under review which includes the Second World War. He also personally prepared the large number of very clear sketch maps, which are of great value in conjunction with the text.

In the Second World War units were changed so frequently from one formation to another, and the commanders of units, as well as Commanders Royal Engineers and Chief Engineers, also changed so rapidly that it was clearly not practical to attempt to give as many comprehensive lists as was done at certain stages in the history of the 1914–18 War.

These two volumes should be carefully read by all R.E. officers in order to learn how the problems and difficulties of the last war were tackled and overcome. The atomic age is bringing tremendous changes, but the basic military engineer problems will still be with us, and there is much to learn from the lessons of the past. Taking the volumes as a whole they present a fascinating and readable account of the activities of the Royal Engineers during a most thrilling period of our history.

E. L. MORRIS, GENERAL,
CHIEF ROYAL ENGINEER.

September, 1957.

PREFACE

THE writing of a Corps History always presents many problems, and though I have had the advantage of having available before starting the excellent examples left by previous authors in the earlier volumes of the History of the Royal Engineers, the methods of approach have in every case to be examined afresh.

The fact that the period 1938 to 1948, which I have been asked to cover, is almost entirely dominated by one major war necessitates a slightly different approach, as does the fact that the nature of warfare has radically changed. I have also considered afresh the types of reader for whom the History must cater and have tried to meet the needs of each, without producing a story which is too diffuse for anyone. I have had in mind, first the general reader interested in military history; then of senior R.E. officers of the future who, faced with problems, technical and administrative, want to know how their predecessors solved similar difficulties. There are also younger members of the Corps of future generations who wish to know about the deeds of their forerunners in war and peace. Finally there are those who took part in the events described and want to read a record of the achievements of themselves and their old units.

A consideration of the needs of these classes of readers and the type of activities recorded has led me to a slightly different approach to that of previous authors. My own experience of reading about a period which lies outside my own personal memory has led me to describe in somewhat greater length the general course of operations. This would seem especially important when dealing with the Second World War as so often tactical considerations had to take account largely of engineering possibilities. Indeed sometimes these latter considerations influenced a tactical, and even the strategic, plan of the higher command. While avoiding technical detail I have tried to give in general terms in many cases how the main features of technical problems were met. For those interested in the "stories" of the Corps I have, at the risk of crowding out facts of greater importance, given space to details of minor actions and the conditions attending them so as to give a "picture" of events with the atmosphere in which they took place. If in consequence of endeavouring to meet the requirements of various readers I have failed to produce a homogeneous and useful book I can only apologize to those who are disappointed.

Major-General Pritchard has called attention in his Preface to Volumes V to VII to the question as to the ideal period after events recorded for history to be written. If written too soon valuable information may not be available or mature judgement on events not formed. If too late the personal experience of participants may not be available through death or faulty memories. In these two volumes work on preparation of material started within a short time after the end of the period covered, but in the intervening eight years of research and writing considerable fresh material has become available, but even at the time of writing, 1957, only a few volumes of the *Official History of the War* have been published with their judgements on events based on a wealth of official and other records. Further delay in publication might have led to more mature judgement, but on the other hand such delay might rob the narrative of much of its freshness and would keep those who participated in events waiting unduly long.

Owing to the close integration of the forces of the British Commonwealth and of their allies, including those of the various engineer corps, the Council of the Institution of Royal Engineers decided and instructed me that where units and formations of Royal Engineers were employed in any theatre, the work of their sister units of other engineer corps should be described, though not in such detail as that of the R.E. The story of work in theatres in which units of the Royal Engineers were not employed, such as in the South-West Pacific, are not included though their comrades of Commonwealth and Allied Engineers performed notable work.

Most of the Dominion Corps of Engineers have published, or will shortly do so, their own histories which will therefore be complementary to these volumes. The case of the Engineer Corps of India and Pakistan, during World War II both forming part of the Indian, or Royal Indian, Engineers, is somewhat different as their officers were largely drawn from the Royal Engineers. Their operations have therefore been described at greater length than those of the other members of the Commonwealth but not so fully as those of the Royal Engineers. A further volume of the *History of the Indian Engineers* to cover the same period has been prepared by Lieut.-Colonel E. W. C. Sandes, for whose assistance in exchange of material and most helpful co-operation I am deeply grateful.

In connexion with the Indian Engineers I have taken the liberty in my references to them to simplify, to the extent of technical inaccuracy, the titles of their units. At various dates during the war the

Sappers and Miners were absorbed into first the I.E. and later the R.I.E., those units forming part of the old Corps retaining the title Sappers and Miners as well as that of the new Corps. For simplicity in chapters covering the earlier years of the war, such as that in the African Desert, Malaya, and the withdrawal from Burma, I have generally used the term Sappers and Miners. In later chapters I refer to all Indian units as I.E.

Though the various Corps games clubs and other organizations were quickly revived and flourished after the end of hostilities the frequent movement of units and the rapid change in personnel on demobilization hampered activity and it is thought advisable not to attempt to give any account of their doings in these volumes.

I would like to take this opportunity of expressing my warmest thanks to the many officers and staffs who have given assistance in the collection and preparation of material. I must mention first the great help given me by Major-General A. G. B. Buchanan who collaborated with me in the early stages of the work and prepared a great deal of material especially on the Works side of which, having held the post of Director of Fortifications and Works during an important phase of the War, he was especially well placed to advise. I have also had from the committee set up by the Institution of Royal Engineers, under the Chairmanship of successive Engineers-in-Chief at the War Office, to advise me, to make recommendations and criticisms on the early drafts and to decide questions of policy, the greatest assistance and sympathy. Amongst others who have rendered my task easier are successive Engineers-in-Chief at the War Office and their staffs who have allowed me to study the large numbers of documents covering engineer work in the various theatres; Brigadier H. Latham and the staff of the Historical Section of the Cabinet Office including the curators and staff in charge of its records and Major-Generals I. S. O. Playfair and S. W. Kirby, both late R.E., authors of volumes of the *Official History of the War*; the Director of Survey at the War Office, Brigadier L. F. de Vic Carey, who has given great assistance in the selection of maps on which those in these volumes have been based; Major-General Sir Eustace Tickell who has been most generous with his time in the supply of information and help in the preparation of the script, and Brigadier C. C. Phipps and the staff of the Institution of Royal Engineers who have dealt promptly with an incessant stream of correspondence from me and rapidly cleared up points of doubt on policy. I must also acknowledge with gratitude the authors of various works,

mentioned in the text, in permitting me to quote from their books.

To these and many officers of the Corps, too numerous to mention individually, who have helped me with detail on which they had personal knowledge and of whose articles in the *R.E. Journal* and elsewhere I have freely made use, I would tender my warmest thanks.

Finally I would wish to thank Major A. C. Jenner for the way he has produced the maps included in both volumes from the very rough sketches with which I have asked him to work; and also my daughter-in-law, Mrs. Felicity Pakenham-Walsh, who has not only typed the manuscript with extreme accuracy but has at the same time pointed out endless errors in grammar and the spelling of place names in my drafts.

As in the previous volumes it has been possible to describe only a small proportion of the work carried out by members of the Corps in widely scattered localities, from Spitzbergen to the islands of the Antarctic and from the American continent, through Europe, Asia and Africa, to the Far East, so as to give some small idea of their achievements under varying conditions. In consequence it is to be regretted that many deeds of gallantry and fine feats of engineering, all well worthy of mention, have had to be omitted.

NOTE. Where a R.E. officer or senior Commander of British forces is mentioned for the first time in each volume, a footnote is added giving the ultimate rank achieved and decorations awarded on or before the last day of 1948 or approximate date of death if previous to that date. For the provision of much of this information I am indebted to Messrs. H. J. Hassell and J. M. Chatfield and the staff of the War Office Record Centre.

R. P. PAKENHAM-WALSH,
MAJOR-GENERAL.

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ABBREVIATIONS special to World War II, or which were introduced in the period covered by these volumes, or in comparatively recent years, only are included in this list. Where the abbreviation is pronounceable and so commonly used as a word, full stops between letters have been omitted, e.g., AVRE.

A.A.I.	Allied Armies in Italy.
A.A.S.F.	Advanced Air Striking Force.
A.F.H.Q.	Allied Forces Headquarters. (N.W. Africa and Italy.)
A.F.L.O.C.	Africa Force L. of C.
A.G.R.E.	Army Group Royal Engineers.
ALFSEA	Allied Land Forces South-East Asia.
AVRE	Armoured Vehicle, Royal Engineers.
B.A.O.R.	British Army of the Rhine
B.A.S.	British Army Staff. (Washington.)
B.E.F.	British Expeditionary Force. (France and Belgium, 1939–40.)
C.A.G.R.E.	Commander Army Group, Royal Engineers.
C.C.G.	Control Commission in Germany.
C.E.S.	Controller of Engineer Services.
C.M.F.	Central Mediterranean Force.
COSSAC	Combined Operations Staff, Supreme Allied Command.
D.R.E.E.	Director of Royal Engineer Equipment.
E.B.E.	Experimental Bridging Establishment.
F.B.E.	Folding Boat Equipment.
G.R.E.F.	General Reserve Engineer Force.
I.S.T.D.	Interservices Topographical Department.
L.C.I.	Landing Craft Infantry.
L.C.T.	Landing Craft Tanks.
L.S.T.	Landing Ship Tanks.
L.V.T.	Landing Vehicle Tracked. ("Buffalo".)
M.E.F.	Middle East Force.
M.E.X.E.	Military Engineering Experimental Establishment.
M.G.R.E.	Major-General Royal Engineers.
N.W.E.E.F.	North-West Europe Expeditionary Force. (Norway, 1940.)

OCTU	Officer Cadet Training Unit.
P.B.S.	Prefabricated Bituminous Surface.
P.I.A.C.	Persia–Iraq Army Command.
P.S.P.	Pierced Steel Plank.
R.A.P.W.I.	Repatriated Allied Prisoners of War and Internees.
SACSEA	Supreme Allied Commander South-East Asia.
S.B.G.	Small Box Girder.
SEAC	South-East Asia Command.
SHAEF	Supreme Headquarters Allied Expeditionary Force.
UNRRA	United Nations Relief and Rehabilitation Administration.
U.X.B.	Unexploded Bomb.

CHAPTER I

Introductory

The whole of the eleven years covered by this and volume IX of the *History of the Royal Engineers* are overshadowed by war, its threat, its prosecution, and the aftermath in the uneasy "peace period" of "Cold War". It is, therefore, necessary to go back to the events of preceding years to appreciate the situations that faced the British nation and Armed Forces, and to see the effects on the actions and development of the Corps.

By the Treaty of Versailles in 1919, after World War I of 1914–18, Germany was restricted in the size of her army and navy and was forbidden to raise or train air forces. As a guarantee for the peace of the world, and to provide an instrument for the settlement of international disputes, the League of Nations had been formed of which almost all the powers of the world became members. In addition to the League many treaties of non-aggression, or of mutual support in case of aggression, were signed between certain nations. Amongst the more important of these to which Britain was signatory, and which were to be affected by coming events, were those with France, Czecho-Slovakia, and Poland. All seemed well in a peaceful world to such an extent that for a considerable period the policy of the British Government was based on the assumption that there would be no major war within ten years.

Unfortunately the outlook was not so rosy as appeared on the surface. Germany, a proud and warlike nation, had never accepted the fact that her forces had been defeated in the field in World War I, holding with complete accuracy that the war had been fought on the soil of her enemies and that Germany herself had never been invaded. To a nation in such a temper only a leader with a nationalistic policy of restitution of her former position was needed to inflame its spirit of revenge. The man and the policy were soon forthcoming.

In 1920 Corporal Adolf Hitler joined the German Workers' Party and by the middle of the following year had ousted the former leaders and had become the "Fuehrer". Attacked by the Communists, Hitler formed a band of storm troopers, and, in November, 1923, with the support of the German war leader, General von Ludendorff, attempted a revolution in Bavaria. This was suppressed, and Hitler was imprisoned for four years. Released from prison in 1924, he set about organizing a party of National Socialists, known for short as Nazis. Slowly but surely his party won support throughout Germany. In the quadrennial elections for the Reichstag it steadily gained ground and in 1932 won 230 seats. Meanwhile Hitler had planned and encouraged the formation of a semi-military body of supporters, the Storm Troops or Brown Shirts known as the S.A., with its then small hard core the S.S., not without creating alarm and suspicion in the Regular Army, the Reichswehr. But the hold of Hitler on the nation as a whole was now such that the leaders of the Reichswehr were forced to join hands with this new-born power.

The powers that had been victorious in 1918 did not then realize the strength of the movement, and in 1932 a Conference of Powers met at Geneva to discuss the reduction of their armaments. This mood suited the war weariness of Britain, now stricken like the rest of the civilized world with a period of economic depression, and the British Government became one of the heartiest supporters of the policy of disarmament. Under such circumstances little money could be obtained for the maintenance, much less the expansion, of the armed forces.

In January, 1933, Hitler became Chancellor of the Reich, and in the ensuing elections the Nazis came into power, and voted complete emergency power to Hitler for four years. Though Hitler's policy of armed strength was clearly enunciated in his writings and public utterances, and in spite of the warning words of some statesmen, particularly Mr. Winston Churchill, Britain and her late allies slept on in imagined security, and pursued discussions on disarmament.

But danger was not threatening from only one quarter. In Italy Benito Mussolini had raised the standard of Fascism against the infiltration of Bolshevik Communism. In essence Fascism bore close resemblance to National Socialism which followed close on its heels, involving as it did the complete supremacy of the State in a totalitarian régime. Though primarily directed against Communism, and therefore not antagonistic to the principles of the League of Nations, Fascism also had its potential dangers in the bolstering up

of a militant nationalism in the Italian nation. By its very nature Fascism drew Italy into at least a closer understanding with Nazi Germany when the latter state emerged. The Nazi–Fascist "Axis" if not born had been conceived.

The passion for disarmament which had been most intense in the United States of America, was also partly the cause of the rise in the relative importance of another warlike power in the Far East, and less directly of the estrangement of Britain from one of her former allies, Japan. By the Washington Naval Agreement of 1921, the chief naval powers agreed to limit the size of the respective fleets to certain proportions and Britain and the United States proceeded in consequence to sink or dismantle many of their larger ships. The quota assigned to Japan, though smaller than these two nations, was not nearly covered by her constructive capacity. But the Government of the U.S.A. pressed on Britain the necessity of not renewing the Treaty of Alliance which the latter had long maintained with Japan. That country felt that the refusal to renew the Treaty was an insult, and her previously warm feeling of friendship for Britain was dissipated. Then in 1933, the last link that in any way held the two countries together in amity was broken when, as the result of a refusal by the League of Nations to recognize the State of Manchukuo which Japan had wrested from China, Japan left the League of Nations. Thus Britain not only lost the friendship of an ally who had been a good friend and supporter in the war of 1914–18, but had antagonized an ambitious country which might be a potential danger in the Far East, an area in which formerly we had little cause for apprehension.

Almost coincident with this action of the League of Nations and the Japanese withdrawal from membership, Hitler, having announced his intention to rearm Germany, also withdrew from the Disarmament Conference and the League of Nations.

But still the apprehensions of the British people, weary of war and financially unhappy as the result of the recent economic depression, were not aroused sufficiently for the Government to take action. But events in 1936 demonstrated unequivocally the seriousness of the position. In March, Hitler, in defiance of the terms of the Treaty of Versailles, reoccupied with German troops the Rhineland. This followed an announcement by Hitler that Germany had already achieved air parity with Britain. The efficiency of the German air force was in the same year demonstrated by the participation of German aircraft on the anti-Communist side in a civil war which

had broken out in Spain, in which Russian aircraft were engaged on the other side. Italy also sent air forces to help the anti-Communists.

The gravity of the situation was now obvious to all. In 1936, Army Estimates for the first time showed a noticeable increase, the Works Vote being augmented by 25 per cent. The major expansion in the Army at this stage was in anti-aircraft defence and was continued in 1937, the Works Vote in that year being double that of 1936.

Thus we come to the period covered by these two volumes with the country alarmed and increasing sums being voted for the Armed Forces. 1938 opened with a clear indication of the aggressive designs of Nazi Germany. In March German troops marched into Austria and set up a Nazi Government. In September, under the excuse of Czech ill treatment of the German minority, Hitler made demands on Czecho-Slovakia with which country both Britain and France had Treaties of mutual support. The rape of Austria and the threat to Czecho-Slovakia roused the apprehension of Mussolini, who with the Prime Minister of Great Britain, Mr. Neville Chamberlain, and the French Premier made protests to Hitler. The situation was so tense that the anti-aircraft defences of the country were manned, that part of the Territorial Army concerned with such operations being embodied. At the moment neither Britain nor France felt themselves militarily strong enough to threaten active interference. In an effort to solve the crisis, Mr. Chamberlain flew three times to Germany for discussions with Hitler. On the last occasion, at Munich, Hitler, in exchange for an undertaking by the British Prime Minister that he would endeavour to persuade the Czechs to surrender the German inhabited area round their frontier, agreed to settle all questions which might arise between the two countries by consultation. Mr. Chamberlain returned to London saying that Britain had once more obtained "Peace with Honour", and added that he believed that it meant "Peace in our Time". With a sigh of relief the country responded to his mood, and sank back into a comparative feeling of security, though there were many who were not so sanguine of the outcome.

The period of tension before the Munich crisis is chiefly reflected in Army Estimates for the year 1938–9, by an increase of 35 per cent for the provision of Warlike Stores and of 25 per cent on the Works Vote. Much of this latter is accounted for by the construction and modernization of defences both at home and abroad, particularly at

Singapore; the provision of extra accommodation at home for the storage of ammunition; the construction of anti-aircraft practice camps, and the beginning of the lay-out of anti-aircraft gun sites about the country. But it is interesting to note that the total establishment of the Royal Engineers for the year was slightly less than that for 1937–8.

Besides the effects of the crisis on the Works Service, considerable attention was being paid, and money voted, to the improvement of barracks. A noteworthy move in this direction was the introduction of the "Sandhurst Block". This type of building was based on the design of modern German barracks: it provided for the inclusion of all accommodation such as barrack rooms, dining halls, kitchens, etc. in one block which amongst other advantages allowed for satisfactory systems of central heating. It had, however, serious drawbacks in that it was expensive to build, involved long passages, and was inelastic.

But the sunnier period of "peace in our time" was not to last long. On 12th March, 1939, Hitler invaded Czecho-Slovakia, and, on the 14th proclaimed a German protectorate over the country which was incorporated in the Reich. There could now be no possible complacency. The gloves were off. Britain, though left far behind in the armaments race, at last began seriously to set her house in order. As a first step, in the same month that Hitler invaded Czecho-Slovakia, March 1939, the Territorial Army was doubled in strength, fourteen new divisions but no corps or army troops being formed, in addition to the increase already in hand for anti-aircraft defence. In May compulsory service for young men in the Militia was introduced. The effect of these changes on the army in general and the Royal Engineers in particular, and the engineer work involved are described in the chapters which follow. The work on defences at home and abroad, both coastal and anti-aircraft already in hand, was speeded up, as was that on ordnance depots and for the storage of ammunition. The proportional growth of anti-aircraft units in comparison to other units led in 1938 to the decision that searchlights of all kinds should be handed over to the Royal Artillery with whose guns they had co-operated. But this change over was gradual and was far from complete at the outbreak of war.

Besides military development, Britain naturally tried to strengthen her position by undertakings with other countries. France was in full sympathy and had participated in the conference at Munich, having a Treaty of Alliance with Czecho-Slovakia. But she also had

taken her part in the wave of disarmament which had swept the world. She changed her policy more rapidly than Britain after the German reoccupation of the Rhineland and was anxious to take positive action against Hitler. But she was still weak as an armed nation, and had put most of her increased military expenditure on purely defensive measures, such as the creation of the great Maginot Line along her eastern frontier with Germany. France was therefore not in a position to act alone and, through lack of active support from other states, had to remain passive. On Germany's eastern flank lay Poland, and beyond that country Soviet Russia. Against Poland, Germany was known to have aggressive designs. As early as 1937 the German Ambassador in London had openly stated that Germany needed expansion in the East, the Danzig "Corridor", Poland and the Ukraine. Here was probably Hitler's next victim. At the Locarno Conference of 1925, France had signed a Treaty of Mutual Support with Poland. Now, on 31st March, 1939, Mr. Chamberlain announced that Britain would come to the help of Poland if that country were attacked.

Russia, apart from being an obstacle to Germany's designs in the East, was the centre of Communist ideology and power against which National-Socialism was from the first the sworn enemy. In spite of Russian politics, to which Britain was also, if not so outspokenly, opposed, it was essential as a curb on Germany's ambitions to win her support. After prolonged diplomatic exchanges a British mission went to Moscow on 12th June, 1939. The discussion dragged slowly along till, on 23rd August, the world was electrified to learn that Soviet Russia had signed a pact of non-aggression with Germany.

Hitler's hands were now free, and a short period of tense anxiety reigned in Great Britain and France. On 25th August the British Government proclaimed a formal treaty with Poland, confirming the guarantee already given. It was hoped this action might cause Germany to pause. It did in fact, for Hitler had given orders for an immediate invasion of Poland. This he postponed, but only for a few days. On 1st September German troops crossed the Polish frontier. The British armed forces were mobilized, and an ultimatum sent to the German Government. At 11.15 a.m. on 3rd September Britain declared war on Germany, in conjunction with France: this action was followed in a matter of hours by the British Dominions. World War II had commenced.

The effect of the events narrated above on the Royal Engineers has been indicated only in general terms. To preserve the continuity

in the description of their employment and the changes involved in the organization of the Corps, the details have been reserved for the chapters which follow. In them will be found the narrative, for the whole eleven years, of events in the Home Country and the various theatres and the chapters dealing with organization. It has, however, been felt necessary to explain in some detail the events which led up to the war as they often affected the degree of preparedness for, and the strategy and political direction of, the war as a whole.

CHAPTER II

FRANCE AND BELGIUM, 1939–40

The outbreak of war—Plan of operations—British defence sector—Base and L. of C.—Formation of new R.E. units—Airfields—Survey—Works organization—Transportation—Deployment of B.E.F. on frontier—Germans invade Belgium. British advance to River Dyle—Withdrawal from the Dyle—German penetration towards the Channel Ports—Withdrawal to River Lys—Decision to withdraw to Dunkirk—Occupation of Dunkirk perimeter—Evacuation from Dunkirk—South of German break through.

(See Maps 1 and 2 facing page 46 of this chapter)

Outbreak of War

On 1st September, 1939, the German forces invaded Poland. Great Britain in accordance with her treaty obligations to the latter country immediately presented an ultimatum to the German Government demanding the withdrawal of their troops, and ordered mobilization. As no reply had been received from Berlin by midday 3rd September Britain declared war. Similar declarations followed in a few hours from France and the British Dominions. Belgium and Holland declared themselves neutral.

The order for mobilization found formations of the Regular Army short of many units and personnel. As far as the Royal Engineers were concerned certain field companies allotted to Regular divisions had been detached for service overseas. Their places had to be filled by selected companies from Territorial divisions. Both Regular and Territorial units had also suffered in the recent introduction of National Service and the doubling of the strength of the Territorial Army: the Regulars in having to find experienced officers, W.O.s and N.C.O.s as permanent staff for the new units, and the latter in having to throw off, if not half their strength, at least substantial cadres to produce the new units. It speaks highly for the efficiency of the old units of both armies that they were able to carry out these reorganizations with limited loss of efficiency. T.A. units were however, woefully short of trained officers.

It was possible to mobilize at once only two corps, each of two Regular divisions, and a proportion of units for employment at the base and on the L. of C. for transportation, survey, and chemical

warfare duties. Many of these latter were provided by the Supplementary Reserve of the Royal Engineers.

It had been agreed between the two Governments that, owing to the small size proportionately of the British Army forces, the direction of the war on land and the command of the land forces should rest with the French. Almost all that was known of the French plan of campaign was that it was based on a defensive attitude until sufficient forces could be built up to enable the Allies to take the offensive. To avoid French territory being overrun, the line selected for defence was for the most part close to the frontier and was based on the Maginot Line which, during the previous five or six years, had been developed at great cost in time and effort. This line, which ran near the common frontier between France and Germany, consisted of a number of massive forts, each self-contained, constructed in concrete and running some ninety feet underground, with casemates, cupolas, and other emplacements on the surface. Though the works were mutually supporting, there was little depth in the position, and it had been completed only as far north as Sedan. From here to the coast, near Dunkirk, the line gradually petered out.

Plan of Operations

The plan of operations for the British Expeditionary Force (B.E.F.) therefore, could go little beyond that for the concentration of the two corps in a "safe" area and the establishment of a base. In view of the danger from aerial bombing the ports of disembarkation selected were those in Brittany and Western Normandy, Cherbourg, Brest, Nantes, and St. Nazaire, and the concentration area was that lying between Laval and Le Mans in Normandy. In view of the same threat from the air, the sites selected for base installations were kept clear of the ports and widely dispersed in the area west of the concentration area.

There was, therefore, little "operational" planning, and, indeed, as will be seen later (Chapter VII), from the engineer point of view there was in the War Office at that time no organization for such planning. For the administrative plan, including the lay-out and construction of the bases and the provision of the necessary stores and personnel, the offices of the D.F.W., Major-General G. B. O. Taylor,[1] and the D.Tn., Brigadier J. P. S. Greig,[2] were available.

[1]Major-General Sir G. B. O. Taylor, K.B.E., C.B.
[2]Brigadier J. P. S. Greig, C.B.E.

The planning of the bases was greatly prejudiced by the decision not to include in the reconnaissance party sent to France before the declaration of war any representative of the Works Service. In consequence, it was found on arrival of the advanced parties of the B.E.F. that of the two sites allotted for Engineer Stores Base Depots, one near Nantes was hopeless, being three-quarters of a mile from a railway and with little possibility of making a connexion, and the other, near Rennes, was little better, having one ramshackle siding only and no roads. The site was developed at great expense in labour and material, but even then with inadequate rail facilities. The development of the bases and L. of C. under the Director of Works, Brigadier W. Cave-Browne,[1] as regards Works services, and the Director General of Transportation, Brigadier D. J. McMullen,[2] as regards railway facilities and ports, will be described later.

As regards the operational plan, it was decided, after a reconnaissance of a considerable part of the frontier defences by the D.C.G.S., Major-General P. Neame,[3] late R.E. and the E.-in-C., Major-General R. P. Pakenham-Walsh,[4] and discussion between the C.-in-C. B.E.F., General Viscount Gort,[5] and the Supreme Commander, Général Gamelin, that the B.E.F. would take over a sector of the line about Lille between the French First (right) and Seventh (left) Armies.

British Defence Sector About Lille

This sector coincided with the French Secteur Défensive de Lille in which the existing defences consisted of a partially completed anti-tank ditch, flanked about every 800 yards by a medium sized concrete pillbox. Each of the latter was designed to take two anti-tank weapons and also, in some cases, one or more machine-guns. This single line of defences was for most of its length within a few yards of the frontier with neutral Belgium, and in many cases used the stream marking the frontier as the anti-tank obstacle. Any expansion in depth had, therefore, to be made in rear of the existing French line.

The German forces, at this time busily engaged in the conquest of Poland, showed no immediate sign of advancing, but it was clear

[1] Major-General W. Cave-Browne, C.B.E., D.S.O., M.C.
[2] Major-General Sir D. J. McMullen, K.B.E., C.B., D.S.O.
[3] Lieut.-General Sir P. Neame, V.C., K.B.E., C.B., D.S.O.
[4] Major-General R. P. Pakenham-Walsh, C.B., M.C.
[5] Field-Marshal Viscount Gort, V.C., G.C.B., etc.

that the task of the B.E.F. was to develop the defences as rapidly as possible. Apart from normal field defences it was decided to build a large number of smaller concrete pillboxes in depth throughout the position, and also a considerable network of anti-tank obstacles. At one time it was thought at the War Office that it would be necessary to create large works on the lines of the Maginot Line. This was impossible in the time likely to be available, and in any case such a course would have been useless if confined to the British front and the French forces on either flank did not develop similar defences. Nevertheless a special Engineer Force was raised for the purpose and sent to France. This formation, "X" Force, commanded by Brigadier A. Minnis,[1] with Colonel J. L. French[2] as Second-in-Command, was composed of two groups, each of five field companies and one field park company, drawn from Territorial Army divisions. Though not used for its intended purpose, as will be seen, this force was to prove of the greatest value on other defence works.

The production of large numbers of concrete pillboxes and many miles of anti-tank obstacles threw a heavy extra load on the R.E. units of formations already fully employed on the normal duties of engineers of a force undertaking the preparation of a strong defensive position, and the many duties which fall to the Corps with a force settling down in an area which it expects to occupy for a considerable time. It was, therefore, necessary to simplify as far as possible the construction of these works. With this end in view the C.-in-C. agreed that, except in special circumstances, the types of pillboxes should be limited to about half a dozen. This decision had advantages beyond those immediately obvious. From the operational point of view similarity in design made relief by garrisons easier, and, further, as it could never be certain which allied force would in operations occupy a particular sector, it was necessary that each work should be suited to the weapons of both armies. From the technical point of view, apart from the obvious advantages of standardization, very few R.E. officers had at the time experience in the design of reinforced concrete to withstand shell fire. Standard designs were therefore produced in the E.-in-C.'s office, with the help of the fortification branch of the D.F.W.'s office and of French Military engineers who had had considerable experience in the design and construction of the works in the Maginot lines. The French Inspecteur Général du Génie, Général Philippe, also undertook

[1]Brigadier A. Minnis, C.B.E.
[2]Brigadier J. L. French, C.B.E., T.D.

that, in future, works constructed by his engineers would similarly be designed to take the weapons of both armies.

These designs were issued to the R.E. of formations and used almost exclusively. The composition and organization of "X" Force made it ideal for the mass production of pillboxes. Its field park companies formed a central workshop in which standard shuttering was produced until specially designed steel shuttering could be obtained from England, and reinforcement bars could be cut and bent *en masse*. Its efforts were chiefly directed to the construction of works in the rear portions of the position. In this way a rapidly increasing speed of erection was attained, so that, when the German offensive started and the Allies moved forward from the prepared position, over 400 pillboxes had been completed and another 100 were in various stages of construction. This number of 400 was well in excess of the standard of six works per kilometre set by the Supreme Commander.

The other major task in connexion with the development of the position was the construction of a network of anti-tank obstacles. These were, for the most part, excavated and revetted ditches, though existing streams and rivers were improved, and sites for minefields selected. Various forms of anti-tank road blocks were also constructed. As some of the ditches were excavated by hand this proved a slow and difficult job in Flanders mud. Mechanical excavators were therefore pressed into service. The use of these machines was at this time not yet general in British engineering practice, and there was a scarcity both of equipment and trained operators in the country, nor was manufacture developed to any great extent. The Regular Army was almost entirely lacking in machines and operators and most of those existing in Britain were fully employed on the large programme of construction of camps and airfields in that country. A completely new organization had therefore to be built up. Equipment was obtained from the United Kingdom and America and operators had to be trained on the spot, personnel being drawn from volunteers of all arms of the B.E.F. A mechanical equipment unit, the 135th Excavator Company, R.E., containing operating sections and a maintenance workshop, was formed under Major S. A. Westrop,[1] an experienced officer transferred from a Territorial infantry unit. Using all available means some forty miles of ditch had been dug when active operations started in May, 1940.

Though sites for minefields were selected and mines stored in the

[1]Brigadier S. A. Westrop, C.B.E., D.S.O.

neighbourhood, no actual mines were laid. To have done so would not have been possible at this juncture. The "War" at this time was most unrealistic. The B.E.F. was sitting down more than a hundred miles from any enemy forces and these were also quiescent. The life of the countryside was going on peacefully. Farmers were ploughing their land and the inhabitants were pursuing their normal vocations. Troops and military transport were similarly moving continuously about the country. Well did the period deserve the nickname of the "Phoney War". Under such circumstances the laying of minefields would have been dangerous even with the most experienced supervision. In actual fact the Army as a whole, and a large proportion of the Royal Engineers, had no experience with this new weapon. As late as 1937 it proved impossible for a C.R.E. to obtain one mine, even unfilled, for demonstration purposes.

At a later stage tunnelled dugouts for the principal headquarters were undertaken by newly formed tunnelling companies. The largest work was that for G.H.Q., excavated 70 ft. below the old Citadel at Doullens. This, which was nearly completed by May, 1940, consisted of some seventy chambers with forced ventilation and anti-gas protection.

Base and L. of C.

The occupation of such a position and the concentration of the field force some 350 miles from the ports and rearmost base installations considerably complicated the administrative arrangements. It was, therefore, decided to form advanced bases north of the River Somme and to use ports farther north than those originally selected as long as the absence of enemy bombing continued. This threw further strain on the Works and Transportation services, already stretched to their utmost by existing commitments. Further, there was a danger of inefficient co-ordination of engineer work on the L. of C. owing to the lack of a senior R.E. officer on the staff of the Commander L. of C., Major-General P. de Fonblanque,[1] himself fortunately lately an officer of the Corps. There were, therefore, insistent demands for extra R.E. units which at the time did not exist.

Formation of New R.E. Units

Two other causes lent additional urgency to this demand for more units. The first of these was due to the fact that "X" Force

[1]Major-General P. de Fonblanque, D.S.O., died 1940.

was composed of field units R.E. of Territorial Army divisions which, as they completed their mobilization and training, needed them back. "X" Force was at the time indispensable in default of any general pool of engineer units, and so it was necessary to replace the units composing it by others. The second was the requirement for units for aerodrome construction, a matter which will be referred to later. These combined requirements amounted in all to more than sixty companies of R.E. A proportionate quantity of unskilled labour was also needed.

The problem was solved by two methods, one temporary, that of sending to France for work the engineers and infantry of three territorial divisions, 12th, 23rd and 46th,[1] low on the list of readiness for operational use. The other was the raising of about sixty new units of two types. The first of these types, for general work, was made up largely of men of building trades, and known as an artisan works company. The other, specially designed for concrete work and aerodrome construction, consisted mainly of civil engineering concretors and road construction workmen and was known as a general construction company. The recruitment and organization of such a large number of companies at such a time was a prodigious problem which was solved, thanks to the co-operation of all concerned, in a surprisingly short time. Some companies were formed by direct enlistments, others were formed, both as regards officers and other ranks, from the personnel of big firms of contractors and of the roads departments of local authority. These units were hastily thrown into uniform, given what scanty training was possible while they were being fitted out, and shipped to France in a matter of days or weeks. Very few of the officers or other ranks had any previous military experience, and it was possible to find only one or two trained N.C.O.s to fill the roles of senior Warrant Officers etc. in each unit. For instance in one company the only member with previous full-time service besides the C.S.M. and C.Q.M.S. was a veteran who had been in the Lincolns in the South African War.

[1]Note: 12th Division, C.R.E. Lieut.-Colonel W. E. Dewdeney,[1] 262nd, 263rd and 264th Field and 265th Field Park Companies.

23rd Division, C.R.E. Lieut.-Colonel J. R. Kennedy,[2] 234th and 507th Field and 508th Field Park Companies.

46th Division, C.R.E. Lieut.-Colonel A. J. Adams,[3] 270th, 271st and 272nd Field and 273rd Field Park Companies.

[1]Lieut.-Colonel W. E. Dewdeney, O.B.E., T.D.

[2]Lieut.-Colonel J. R. Kennedy, D.S.O., T.D., killed in action, 1942.

[3]Lieut.-Colonel A. J. Adams.

Much of the credit for recruiting these companies must go to the Chief Engineer Air Component B.E.F., Brigadier K. C. Appleyard,[1] and Colonel J. L. French of "X" Force, both of whom in civil life were well known in engineering circles.

Some of the three Territorial divisions were employed on airfield construction, others on work on the L. of C. "X" Force was reformed into two construction battalions under Lieut.-Colonels C. P. Worsfold[2] and W. G. R. Nutt,[3] each of four general construction companies. The rest of the new R.E. units were employed on works on the L. of C. and at the bases (mostly artisan works companies) and on aerodromes (mostly general construction companies).

Airfields

The maintenance and provision of aerodromes by the Corps was one of the most important R.E. developments of the war. It had been recognized that in war this duty would fall on the Royal Engineers. Field Service Regulations laid it down that:—

"Preparation of the surfaces of aerodromes and the provision of aeroplane hangars is the duty of the Air Force, but the necessary labour and material will be supplied from Army sources.

"All Works Services for the Air Force will be carried out by the Army."

A somewhat ambiguous statement, but, however it is read, it meant that the Army, and therefore the R.E., would have to do the job. Accordingly, when the B.E.F. went to France, a Deputy-Director of Works (R.A.F.), Colonel P. W. Clark,[4] was appointed to control works for the R.A.F. For the purpose he was allotted one Army Troops company, one Road Construction company, and two companies of the Pioneer Corps, all under a C.R.E., Lieut.-Colonel E. T. G. Carter.[5] Two officers of the staff of the Director of Works, Air Ministry, holding commissions in the Supplementary Reserve, R.E., were also included in the Staff of E.-in-C., B.E.F. It would appear that it had been hoped that the majority of the work could be carried out by French civilian contractors, and that the French Air Ministry would provide most of our requirements from existing aerodromes. Neither assumptions proved correct. Few contractors

[1]Major-General K. C. Appleyard, C.B.E., T.D.
[2]Colonel C. P. Worsfold, M.C.
[3]Brigadier W. G. R. Nutt, C.B.E., M.C.
[4]Brigadier P. W. Clark, C.B.E., D.S.O., M.C., died 1943.
[5]Lieut.-Colonel E. T. G. Carter, O.B.E.

were available for any work for the B.E.F., least of all for such major tasks as aerodrome construction, and the aerodromes made available by the French authorities were not nearly sufficient, either in numbers or extent, for the needs of the R.A.F.

The British plan provided for two air contingents:—

(*a*) The Advanced Air Striking Force (A.A.S.F.), acting independently of the B.E.F., based on aerodromes to be taken over from the French, mostly in Champagne.

(*b*) The Air Component, B.E.F., consisting of those air formations which would act in direct co-operation with the Army. This force would operate from such French aerodromes as might be available in the vicinity of the B.E.F. This, in view of the role allotted to the British force, meant the region of Picardy and Flanders.

The small engineer force mentioned above was allotted to the A.A.S.F., it being presumably thought that the Air Component could be looked after by R.E. units of the B.E.F.

It soon became evident that the requirements of the R.A.F. would outstrip the provision made to meet them. Matters were brought to a head in November, 1939, when the R.A.F. formulated their requirements for the next twelve months. This amounted to a total of twenty-five aerodromes and twenty-five satellites, of which five of each were wanted by the Air Component by March, 1940, five more of each for the same contingent in July, and the balance for the A.A.S.F. at varying dates to the end of 1940. Satellites were to be of the same operational standard as aerodromes, but would not have the same complement of subsidiary buildings.

It may be noticed here that the term "aerodrome" was used till the American forces arrived in Europe, when the R.A.F. conformed with their nomenclature and adopted the term "airfield". This latter term will be used in future throughout this History.

It was this programme that eventually forced the formation of the new companies referred to above. The first of these arrived in France at the end of January, 1940, and by May nearly sixty were at work. To organize the work for the R.A.F. two C.E.'s headquarters were set up, one for the Air Component B.E.F., Brigadier K. C. Appleyard, and one for A.A.S.F., the latter being found by the conversion and promotion of the former D.D.W. (R.A.F.), Brigadier P. W. Clark. Both of these were responsible technically to the E.-in-C. and not to the Director of Works.

Little was known at that time about the rapid production of airfields under active service conditions, and, owing to the fact that their construction in peace at home was under the aegis of Director of Works, Air Ministry, and was generally carried out by civil contract, few R.E. officers had experience in the work. A few officers had supervised work for the Air Ministry in the East. In recent years the increased weight of aircraft and higher speeds of landing and taking off had led to improved standards of strength and increased length of runways being demanded. In consequence few of the airfields made available by the French were up to the required specification. Some were capable of improvement but others had to be abandoned except in the driest weather.

First in priority were those for the Air Component, all of which, as has been shown above, were required to be ready in March or July. It was these airfields, unfortunately, which demanded the most work. The majority of them were situated on Flanders mud which is renowned for its instability in wet weather. Except under the driest conditions, grass tracks could not be relied on, and it was clear that concrete runways, or something similar, would be required. It was decided to provide one "hard" runway, orientated into the prevailing wind, on each airfield, and to sow the rest of the field with grass so that, if dry weather was experienced before other runways could be built, a greater area of the whole would be operational. In the drier area of Champagne, where the programme of work for the A.A.S.F. did not rank so high in priority, it was decided in the first instance to put all fields down to grass, though it was accepted that in many cases "hard" runways would have to be provided as well.

Besides skilled and unskilled labour such a programme demanded considerable resources in plant and materials. The shortage of mechanical earth-moving equipment has been referred to above, and great care had to be taken in the allotment of the machines available. Gradually, however, what was considered at that time a large quantity of graders, scoops, excavators, dumpers and concrete mixers was assembled for work in the area of the Air Component, but hardly anything but tractors, ploughs, and rollers could be provided for the lower priority fields of the A.A.S.F.

The programme for the defence system and the airfields required at the peak period fourteen train loads of stone a day. This was drawn from French worked quarries in the valley of the River Seine and from others worked by R.E. quarrying companies in the neighbour-

hood of Marquise near Calais. In spite of great efforts by Transportation, receipts seldom rose above seven train loads daily. Slag from pitheads near Lens, spread and consolidated, was also used to save rail transport. Grass seed had to be obtained from as far away as New Zealand and only arrived in time for the spring sowing because the latter was delayed by a prolonged and heavy frost. The frost also put a stop to concrete work everywhere for several weeks.

In spite of all these difficulties, by 10th May, 1940, when active operations began, the following progress had been made with the airfield programme:—

In the area of the Air Component nine fields had been levelled and sown and, owing to the exceptionally dry weather, were usable. Four other airfields with "hard" runways and two in grass could be made operable within ten days, and another with a concrete runway in about two weeks. For the A.A.S.F., twelve new main airfields and eight new satellites had been levelled and sown, and were capable of being used for operations in dry weather. Work on buildings, water supply and roads was well advanced, and existing airfields taken over from the French had been improved and enlarged. Thus, while the target set to be completed by March, 1940, was from the start manifestly impossible to attain, progress towards the July requirements was well advanced. To have achieved such a result barely six months after the first demand had been made and at a time when there was neither organization nor provision in units or equipment, is an accomplishment of which the Corps as a whole, and these hurriedly raised units in particular, may be justly proud. The subject has been treated at some length, not only because of the notability of the achievement, but because in this campaign were laid the foundations of the organization within the Corps for airfield construction and maintenance which was to become henceforth such an important aspect of engineer work in the field.

Survey

The selection of the British defence sector along the Belgian frontier brought special problems in connexion with survey.

The Royal Engineer Survey organization under the Director of Survey, Brigadier A. B. Clough,[1] consisted of a Headquarters, 19th Army Field Survey Company and 1st Field Survey Depot, with Corps Survey Directorates and 13th and 14th Corps Field Survey

[1]Brigadier A. B. Clough, C.B.E., M.C.

Companies with I and II Corps respectively. Later III Corps Survey Directorate and 514th Corps Field Survey Company, which was formed after mobilization, arrived. The Geographical Section General Staff (G.S.G.S.) maps did not cover the assembly area of the Force, and it was necessary to buy from the French Service Géographique copies of their 1/50,000 sheets covering the billeting areas and base ports. The Survey Directorate produced hurriedly from these road maps at 1/million scale for the use of convoys.

As soon as the concentration area and defensive zone of the B.E.F. were settled, maps of the area which had been brought over with the Field Survey Depot were distributed. The opportunity was taken to recast the trigonometric data available so that the triangulation should have a clear run from northern France across the frontier into and across Belgium without being burdened with the disturbing discrepancies which were known to exist between the French and Belgian values for common points along the frontier region. The French Service Géographique agreed to accept these values, and even went so far as to label the system "Nord de Guerre Anglaise".

During the static period 19th Army Survey Company established itself in a derelict sawmill in Frévent which it converted into a most effective machine-shop housing two printing machines and accessory plant. The existing 1/50,000 sheets were found to be very out of date. The survey companies set to work to carry out a revision from ground work and air photos, the results being sent back to Ordnance Survey in the U.K. where new plates were produced and sent to France. New editions were issued to troops before active operations commenced.

Besides its normal activities in triangulation, preparation and storage of maps, and making arrangements for their distribution as and when required, the Survey Directorate also undertook several special tasks. Typical of these was the survey of various underground caves and workings which were to be developed as battle headquarters or shelters.

Works Organization

It has been mentioned that the length of the L. of C. involved the formation of advanced bases north of the River Somme. Besides the provision of extra units the Works establishment had to be expanded. The original plan allowed for only three Cs.R.E., under D.D.W. (Works), Colonel J. H. Stafford,[1] two for the main bases

[1]Brigadier J. H. Stafford, C.B.E., M.C.

and one for the Medical base at Dieppe for whom seven Army Troops Companies, 104th, 106th, 110th, 212th, 218th, 290th and 291st, were provided. This organization had to be expanded to provide a second Chief Engineer, Colonel R. L. Withington[1], and seven Cs.R.E. There was also a D.D.W. (Airfields) referred to above, a D.D.W. (E. and M.), Colonel H. H. Bateman,[2] and a D.D.W. (Stores), Colonel V. E. G. Guinness.[3]

One of the most important tasks of the Works organization was to get the L. of C. troops and reinforcements under cover before the winter. It had been expected, somewhat optimistically, that the French would provide billets for the majority of the troops. In consequence there had been collected in peace practically no war reserve of hutting or shedding. Though every effort was made in the U.K. to speed up provision, by 15th November only 1,250 huts had been sent to France. Therefore efforts had to be made to provide the maximum accommodation by conversion of buildings in towns. For this, as far as possible, French civilian contractors were used but Cs.R.E. were short of supervisory staff. This showed the necessity of works sections which were provided in other theatres later.

All this greatly delayed the start of the work on base installations and depots.

As has been mentioned, the positions chosen for the main base installations and depots were in Brittany and Normandy, inland of the base ports. Here much work was done in the erection of storage accommodation, workshops, etc., with their accompanying requirements in roads, railway connexions and yards, water supply, and power, and in spite of the delayed start the majority were in fair working order by the time of the evacuation. Early in 1940, in accordance with the new policy, advanced depots, almost on an equal scale to those originally constructed, were started north of the Somme, and many were well advanced, though few were in full working order, by the end of the campaign. Some of the work was done by R.E. units, the balance being carried out by French civilian contractors. The main medical sub-area was round Dieppe. Here as far as possible the Casino, hotels, and schools were first used, but these were supplemented later with hutted hospitals using 24-ft. Nissen huts. On the steeply sloping ground these huts, with their

[1]Brigadier R. L. Withington, M.C.
[2]Brigadier H. H. Bateman, C.B.E., D.S.O., M.C.
[3]Colonel V. E. G. Guinness.

large floor area, gave a great deal of trouble and involved considerable levelling operations carried out entirely by hand, in the absence of mechanical plant. A problem that was new to hospital design in the field, and for which no allowance had been made in the original plans, was the provision of Passive Air Defences (P.A.D.) against air bombing.

The nucleus of the engineer stores organization was 109th Workshops and Park Company which took over the unsatisfactory site at Nantes mentioned above. This unit was followed by Nos. 1 and 2 Engineer Stores Base Depots and an Engineer Base Workshop. The latter, with No. 1 E.S.B.D., set up at Rennes but, owing to the delays in construction, had only just reached production when France was overrun. No. 2 E.S.B.D., in accordance with the plan for advanced bases, moved up to Le Manoir, near Rouen, where it began to develop a depot. Meanwhile 109th Workshops and Park Company moved up to the head of the L. of C. near Arras where it organized a park and workshop. A camouflage factory, employing French civilian workpeople, was set up near Rouen.

TRANSPORTATION

Port Operating

The main task of the Transportation service at the commencement was the reception and unloading of the B.E.F., its stores and equipment, at the ports of Le Havre, Brest, St. Nazaire and Nantes. Nos. 1 and 2 Docks Groups were landed at Le Havre prior to the main body of the B.E.F. and were moved by rail to their various ports.

Besides the ports originally used, as the L. of C. extended other ports were taken over so that on 30th April, 1940, just before the German offensive opened, No. 1 Docks Group was working Nantes, St. Nazaire and Marseilles; No. 2, Brest, Cherbourg, Caen and St. Malo; No. 3, Le Havre, Rouen and Boulogne, while other ports were being worked by French civil organizations.

Railways

It had been agreed with the French that the British Army would construct all additional railway facilities required. At the start of the campaign only one railway survey company (29th), three railway construction companies (150th, 151st and 152nd), and one railway construction and operating company (8th) were available. Even though these were reinforced, early in 1940, by four more railway

construction companies, work had to be confined almost entirely to developing the new rail served depots, which had to be restricted to a minimum, and feeder lines to several of the airfields which were being constructed. In all 141 miles of track with 665 turnouts were laid. Of this 70 per cent was done by British units, and the remainder by French engineers. The British provided a hundred shunting engines complete with crews for work in the depots. By the end of April, 1940, operating companies were working main line trains between St. Malo and Rennes in addition to manning all the depots and marshalling yards in the bases.

I.W.T.

At first Inland Water Transport was operated by French organizations under arrangements made by the British D.D.Tn. (I.W.T.). Later, to assist in bulk movement of petrol, power barges with R.E. crews were sent from the U.K. to assist.

Stores

The main transportation stores depot was at Brayc near Rennes.

Organization

As the strength of the Transportation Service increased and its programme of work extended the higher staff of the Directorate was reinforced on a prearranged plan. The Director-General, Brigadier D. J. McMullen, then had two Deputies, Colonel H. L. Woodhouse[1] in charge of railway operating, mechanical plant, docks and inland water transport, and Colonel J. R. Roberts[2] controlling construction, stores and personnel. Directors in charge of various branches included Colonel J. R. Sadler[3] for docks, Colonel R. D. Waghorn[4] for construction, and Colonel F. A. Pope[5] for railway operation.

Deployment of B.E.F.

The original deployment of the B.E.F. on the frontier found I Corps, commanded by Lieut.-General Sir J. G. Dill[6] with 1st and 2nd Divisions, on the right, and II Corps, commanded by Lieut.-General A. F. Brooke[7] with 3rd and 4th Divisions, on the left in and around Lille. As they completed their mobilization other divisions,

[1]Brigadier H. L. Woodhouse, C.B.E., M.C.
[2]Colonel J. R. Roberts, O.B.E., M.C.
[3]Colonel J. R. Sadler, C.B.E.
[4]Brigadier R. D. Waghorn, C.B.E.
[5]Brigadier F. A. Pope.
[6]Field-Marshal Sir J. G. Dill, G.C.B., etc.
[7]Field-Marshal Viscount Alanbrooke, K.G., etc.

5th and 48th, joined them, and the sector was extended gradually westwards. III Corps, commanded by Lieut.-General Sir R. F. Adam,[1] and four more divisions, 42nd, 44th commanded by Major-General E. A. Osborne,[2] late R.E. and R.C.S., 50th commanded by Major-General G. le Q. Martel,[3] also late R.E., and 51st arrived in April, 1940, and the B.E.F. sector was extended to beyond Bailleul. A certain amount of interchange of field companies between divisions took place as new divisions arrived. This reorganization, which unfortunately entailed severance of the divisional ties of the units affected, was naturally not popular with the latter. It was part of a policy decided on by the Commander-in-Chief for all arms. Owing to the recent doubling of the Territorial Army many units of the latter were seriously short of training, and many of the officers were entirely lacking in experience. It was felt that the standard of T.A. divisions would be improved by the inclusion of a few regular units, while T.A. units moved to regular divisions would more rapidly gain in efficiency. The advantage in the case of R.E. units was not nearly so one-sided. While the training and experience of some T.A. field companies left much to be desired, they possessed within their ranks officers of high and varied civil engineering qualifications and tradesmen of a very high standard. These units were, therefore, valuable acquisitions to the engineers of a regular division.

After the completion of this reorganization the order of battle of R.E. units in the fighting formations was as follows:—

(NOTE: Owing to constant changes in the composition of corps the divisions are shown in numerical order.)

Engineer-in-Chief	Major-General R. P. Pakenham-Walsh
Deputy E.-in-C.	Brigadier C. J. S. King[4]
G.H.Q. Troops	C.R.E. Lieut.-Colonel H. M. Cadell,[5] 100th, 101st and 216th Field and 223rd Field Park Companies
I Corps	C.E. Brigadier R. L. Bond[6]
I Corps Troops	C.R.E. Lieut.-Colonel G. R. Pim,[7] 102nd, 107th and 221st Field and 105th Field Park Companies

[1]General Sir R. F. Adam, Bart., G.C.B., etc.
[2]Lieut.-General E. A. Osborne, C.B., D.S.O.
[3]Lieut.-General Sir G. le Q. Martel, K.C.B., K.B.E., D.S.O., M.C.
[4]Lieut.-General Sir C. J. S. King, K.B.E., C.B.
[5]Colonel H. M. Cadell, O.B.E.
[6]Major-General R. L. Bond, C.B., C.B.E., D.S.O., M.C.
[7]Lieut.-Colonel G. R. Pim, M.C., killed in action, 1940.

II Corps	C.E. Brigadier C. C. Phipps[1]
II Corps Troops	C.R.E. Lieut.-Colonel P. F. Foley,[2] 222nd, 234th and 240th Field and 108th Field Park Companies
III Corps	C.E. Brigadier J. E. Chippindall[3]
III Corps Troops	C.R.E. Lieut.-Colonel W. H. Grindlay,[4] succeeded by Lieut.-Colonel E. Bader,[5] 213th, 214th and 217th Field and 293rd Field Park Companies
1st Division	C.R.E. Lieut.-Colonel W. A. M. Stawell,[6] succeeded by Lieut.-Colonel R. D. B. Perrott,[7] 23rd, 238th, 248th Field and 6th Field Park Companies
2nd Division	C.R.E. Lieut.-Colonel R. Briggs,[8] 5th, 209th and 506th Field and 21st Field Park Companies
3rd Division	C.R.E. Lieut.-Colonel J. S. W. Stone,[9] succeeded by Lieut.-Colonel A. R. Hildebrand[10] and Lieut.-Colonel D. Harrison[11] 17th, 246th and 253rd Field and 15th Field Park Companies
4th Division	C.R.E. Lieut.-Colonel N. A. Coxwell-Rogers,[12] 7th, 59th and 225th Field and 18th Field Park Companies
5th Division	C.R.E. Lieut.-Colonel R. L. C. Colvill,[13] succeeded by Lieut.-Colonel J. H. R. le Sueur,[14] 38th, 245th and 252nd Field and 254th Field Park Companies

[1]Brigadier C. C. Phipps, C.B.E., M.C.
[2]Colonel P. F. Foley, C.B.E.
[3]Brigadier J. E. Chippindall, C.B.E., M.C.
[4]Lieut.-Colonel W. H. Grindlay, T.D., D.L.
[5]Brigadier E. Bader, C.B.E.
[6]Major-General W. A. M. Stawell, C.B., C.B.E., M.C.
[7]Brigadier R. D. B. Perrott, D.S.O., O.B.E., M.C., killed in action, 1942.
[8]Brigadier R. Briggs, C.B.E., D.S.O., M.C.
[9]Brigadier J. S. W. Stone, C.B.E., M.C.
[10]Lieut.-Colonel A. R. Hildebrand.
[11]Major-General D. Harrison, C.B., D.S.O.
[12]Major-General N. A. Coxwell-Rogers, C.B., C.B.E., D.S.O.
[13]Colonel R. L. C. Colvill.
[14]Lieut.-Colonel J. H. R. le Sueur, killed in action, 1940.

42nd Division	C.R.E. Lieut.-Colonel J. L. Lishman,[1] 200th, 201st and 250th Field and 203rd Field Park Companies
44th Division	C.R.E. Lieut.-Colonel B. T. Godfrey-Faussett,[2] 111th, 208th and 210th Field and 211th Field Park Companies
48th Division	C.R.E. Lieut.-Colonel H. E. Moore,[3] 9th, 224th and 226th Field and 227th Field Park Companies
50th Division	C.R.E. Lieut.-Colonel W. M. Spires,[4] succeeded by Lieut.-Colonel D. C. T. Swan,[5] 232nd and 505th Field and 235th Field Park Companies
51st Division	C.R.E. Lieut.-Colonel H. M. Smail,[6] 26th, 236th and 237th Field and 239th Field Park Companies

GERMANS INVADE BELGIUM. BRITISH ADVANCE TO RIVER DYLE

On 10th May, 1940, the German forces invaded Holland and Belgium, and immediately the Anglo-French troops advanced in accordance with a long prepared plan. This was that the Allied forces on the left flank, from about Sedan to the English Channel, should swing forward to the line of the River Meuse as far north as Namur and thence along a line approximating to that of the River Dyle, through Louvain to the Eastern defences of Antwerp. The B.E.F. were to hold a sector between Wavre and Louvain with First French Army on its right and Belgium troops on the left. The French Cavalry Corps was pushed forward in front of this line, and it was understood that the Belgian Armies would resist the invaders near their eastern frontiers. As regards the latter, no previous co-ordination was possible owing to the refusal of the Belgian Government to discuss mutual action before the invasion started so as not to prejudice their neutrality.

This is not the place to discuss the wisdom of adopting this forward policy, but in view of the fact that it had certain elements of risk as

[1]Colonel J. L. Lishman, D.S.O., O.B.E., T.D.
[2]Brigadier B. T. Godfrey-Faussett, C.B., D.S.O., O.B.E., M.C.
[3]Brigadier H. E. Moore, D.S.O., M.C.
[4]Lieut.-Colonel W. M. Spires, T.D.
[5]Brigadier D. C. T. Swan.
[6]Lieut.-Colonel H. M. Smail, O.B.E., T.D.

to whether our troops could arrive in sufficient time on the selected line to organize an efficient defence, the advance was made in considerable depth and steps were taken to secure the various river lines which would be crossed *en route*. Three divisions of I and II Corps moved direct on to the Dyle position by motor transport, covered by the 11th Hussars, and were soon afterwards joined by three other divisions by march route. III Corps with three divisions was to secure and prepare for defence the lines of the rivers Escaut and Dendre in rear.

In such an operation the tasks of the engineers of formations was naturally chiefly directed to the development of anti-tank obstacles on the various defensive positions, including the preparations of bridges for demolition. With this in view arrangements had been made to hold near the rail-heads of the old frontier position, and to move forward as soon as possible, sufficient explosives to destroy, if necessary, all bridges on the Rivers Dyle, Senne, Dendre, and Escaut in the British sector. A large proportion of these bridges were of reinforced concrete construction, which, until the evolution of the "overload" method of demolition, had presented a difficult problem in rapid destruction. Luckily experiments in this method had recently been completed and the formulae received in France in time to be disseminated to units before the advance began.

On the main line on the Dyle the Belgians had done a little work before the invasion, but, what was of considerable value, they had collected some dumps of defence stores in accordance with lists forwarded by E.-in-C. through the British Military Attaché in Brussels. Plans had been worked out with the French to co-ordinate a belt of demolitions in front of the position, but, owing to uncertainty as to the movements of the Belgian armies and to the crowds of refugees which soon blocked the roads, it was not put into effect.

The Corps field survey companies rapidly completed the fixing of the value of points and these were handed to field survey regiments R.A. for the most part by 14th May. These units also undertook the remapping of the complicated tracks through the Forêt de Soignes, which were a cause of confusion to the troops.

An advance of some sixty miles necessitated the provision of airfields to enable the Air Component B.E.F. to cover the advance. There were few Belgian airfields in the area, and it was not known if any of these would be available to our squadrons. Information as to possible new sites was no more encouraging. The little information that our Air Attaché in Brussels could give indicated that the

most promising sites were under plough. Little was known at this time about the rapid production of airstrips, and none of the prefabricated surfaces used later were yet available. The most promising method seemed to be the laying of coir matting, with or without the addition of rabbit wire, but the few experiments that had been carried out on these lines had not been very successful. However, *faute de mieux*, it was decided to carry forward enough of this material to make four strips. In fact, owing to the exceptionally dry weather it was found possible to make usable landing grounds merely by rolling down the young crops.

On 11th May, 1st, 2nd and 3rd Divisions of I and II Corps were deployed as planned on the line of the Dyle, with 4th and 48th Divisions moving up into Corps reserve. III Corps had soon deployed 42nd and 44th Divisions on the line of the Escaut. By 15th May, 5th Division was moving into II Corps reserve on the line of the River Senne, and 50th Division was taking up a position in G.H.Q. reserve on the River Dendre. The engineers of all divisions were chiefly employed on preparing for demolition, and, in some cases with forward divisions, in actually making first cuts in, all bridges. Where necessary help was also given to other arms of the divisions in the preparation of defensive positions. So far as the B.E.F. was concerned events were moving according to plan, and no contact had been established with the enemy except for attacks by their aircraft. On the morning of 10th May, the day of the German invasion of Holland and Belgium, enemy aircraft attacked some of the nearly finished airfields and the projected G.H.Q. camp at Doullens and some of the R.E. units working there suffered the first casualties. During the advance to the Dyle, Colonel Æ. F. Q. Perkins,[1] A.A.G. II Corps, and for many years a well-known figure in R.E. cricket and golf matches, was killed by a bomb.

Though no attack was made on the British front till the afternoon of 15th May, the situation was already serious. The Dutch Army had laid down their arms. The Belgium forces had been driven from the lines of the Meuse and the Albert Canal and were retiring in none too good order on the left front of the B.E.F. Finally a German force including at least two armoured divisions had crossed the Meuse between Sedan and Mèzières, on the front of French Ninth Army. That evening (16th) the Germans penetrated the front of the French Division on the right of B.E.F., but the position was stabilized by the 48th Division.

[1]Colonel Æ. F. Q. Perkins, M.C.

Withdrawal from River Dyle Ordered

In view of the now exposed position of French First Army, the French High Command, on 16th May, ordered the withdrawal of all forces north of Namur to the River Escaut, the movement to start that night and to be completed by the night of 18th/19th May.

In accordance with plans already made, the various R.E. units now indulged in an orgy of regulated destruction. Particularly on the Senne, which ran through Brussels and Hal and other towns, there were large numbers of bridges of massive construction, and the charges used were heavy. In many cases we read of as much as four tons being used on a single bridge. As far as can be ascertained the majority of the demolitions were successful, and, owing to the orderly nature of the retreat, in the few cases where the first attempt did not produce a satisfactory result, there was time to try again. This chiefly occurred where charges previously laid by Belgian engineers were used, and possibly the methods adopted and equipment used were not known to the British companies which had to put the demolitions into effect. The work was rendered difficult by the hordes of refugees pouring westwards on every road and by the attentions of German low-level air attacks. The *Official History* sums up the work of the Corps in these operations: "The Royal Engineers had a busy time and the effectiveness of their demolition of bridges and river crossings as each line was evacuated helped considerably to delay the enemy advance." (*Official History*, page 62.)

At least one R.E. unit learned there were other uses for explosives besides blowing things up. This particular unit had some argument with an artillery regiment as to whom a bivouac belonged. The argument was settled by the Sapper officer in charge pointing out that seven of his three-ton lorries were loaded with explosives and that he did not intend to move them. The Gunners departed to find a better and more healthy hole.

III Corps, which it will be remembered had been directed to the Escaut, was there employed on the preparation of a defensive position behind the river, with a bridgehead to the east round Tournai. The engineers of 42nd and 44th Divisions and of III Corps Troops were therefore employed on preparing bridges for demolition, clearing fields of fire, and even running a factory, the management of which had disappeared, for the manufacture of barbed wire. The construction of the bridgehead to the east, which was required

not only to cover the final withdrawal of the troops but also to allow of counter-attack if necessary, was a difficult job in the time likely to be available as there was no natural anti-tank obstacle. Some large excavators from 135th Excavator Company were put on to the job of digging a ditch, but had completed a short stretch only when the order was given to withdraw. The driver of one claimed to have shot down a German plane which tried to interfere with his work.

When the formations in front fell back on this position all three Corps were in line, and the question arose whether the demolitions should be handed over to the incoming R.E. units, or whether demolition parties who knew how the charges had been prepared should be left to complete the job. Both solutions of this old engineer problem were adopted by differing formations in this case. In most cases, as there was plenty of time for checking over, either solution was satisfactory. Only one serious error occurred. On the extreme left one bridge, which had been prepared by the 44th Division, R.E., was in the front taken over by a Belgian formation. It was decided that the British demolition party should remain and be given orders to fire the charges by a nominated Belgian officer on the bridge. The commander of the Belgian formation, wishing to make the position clear, sent a written order addressed to the Belgian officer at the bridge and marked on the cover "Not to be opened unless the enemy arrive within 300 yards of the bridge". Inside was an order to fire forthwith. The Belgian officer on receiving the message did not notice the instruction on the cover, tore it open and ordered the R.E. officer to blow the bridge. This officer, thinking the order premature, as it was, queried it, but on being shown the order, without the envelope, had no other course but to obey.

Considerable anxiety was caused when the level of water in the Escaut began to fall, and it was feared that it would no longer be an effective obstacle. It was believed that the French were using the water to cause inundations about Valenciennes. After consultation with the French canal authorities, C.E. II Corps was able to arrange for water to be diverted from other canals to prevent the level from falling farther.

German Penetration Towards the Channel Ports

Meanwhile the German penetration on French Ninth Army front on the Meuse was rapidly deepening and expanding. This was in

fact the main German thrust with a mass of armoured divisions, supported by strong air forces, and backed up by large columns of all arms. The main direction of advance was now north-west, parallel to and north of the Somme, towards the Channel ports. In the German path lay most of the airfields under construction for the Air Component B.E.F. with the general construction and other R.E. companies working on them. In the words of Lord Gort's Dispatch on the Operations: "Few if any of these units or their commanders had any experience in fighting, but their determination was beyond all praise. . . . The General Construction Companies of the Royal Engineers, . . . set to work to place their localities in a state of defence and manned them till they were overwhelmed, relieved, or ordered to withdraw. Wherever possible transport was collected or requisitioned to enable parachute detachments to be dealt with. These many small delaying actions all contributed to gain the time required for the withdrawal of the main forces."

All the R.E. construction units working in the threatened area were withdrawn under the orders of their Cs.R.E., Lieut.-Colonels R. C. R. Stevenson[1] and C. E. Foster.[2] The majority made their way through St. Pol towards Boulogne and Dunkirk, though a few crossed to the south of the Somme and joined the troops on the L. of C. and at the bases. If few of them actually held the positions they had prepared against enemy attack, they at least had adventures. It was reported that one General Construction Company in its withdrawal came on a deserted workshop containing some tanks and anti-tank guns. Though they had never seen a tank at such close quarters, they took charge, hitched the anti-tank guns on behind and drove the tanks away to safety.

Owing to the threat caused by this enemy advance to the southern flank of the B.E.F., the Commander-in-Chief formed several special detachments to protect this flank. "Mac" Force, "Pol" Force, "Petre" Force, and so on. For each of these R.E. elements had to be found, and for the purpose many specialist units, tunnelling companies, chemical warfare companies (58th, 61st and 62nd), as well as the divisional R.E. of some of the Territorial Army divisions which had been sent out to work, were used. Grouping was facilitated by using the C.R.E. and his headquarters of various unattached groups, for example, the C.R.E. (Lieut.-Colonel W. G. R. Nutt) and Headquarters of one of the Construction Battalions of "X"

[1]Colonel R. C. R. Stevenson.
[2]Lieut.-Colonel C. E. Foster.

Force was used for "Mac" Force, and the C.R.E. (Lieut.-Colonel R. H. Maclaren[1]) of No. 1 Chemical Warfare Group first for "Petre" Force and later for "Pol" Force. All of these, as they were formed and the threat extended farther west, were soon busy preparing for demolition the bridges over the canals and streams from near Douai through Bethune and St. Omer to the sea about Gravelines. Besides the destruction of bridges it was also necessary to deal with the thousands of barges which were lying in the canals, and which could be used by the enemy for bridging. As far as possible these were got away up branch canals, or drawn to the near bank and scuttled.

With such a number of improvised forces and in a fluid situation it was difficult to ensure co-ordination of engineer work. Further, some of the units which were swept into these forces, such as the general construction companies, had had no training in demolitions. It was also uncertain for which portions of the canals our allies were making themselves responsible. "Pol" Force, which was chiefly responsible for this line, gradually extended its sphere of influence and eventually covered from Carvin to St. Omer and on to Watton. At first G.H.Q. Troops, R.E., provided the engineers for this force but later it absorbed No. 1 Chemical Warfare Group, R.E., whose commander became C.R.E. of the Force, and some tunnelling and general construction companies. "Pol" Force engineers eventually numbered some ten or a dozen companies in all. Later this line was taken over by III Corps.

Often it was a race with the enemy for the bridges and some very hasty demolitions were accordingly carried out, on the whole it is believed successfully. No. 3 Section 58th C.W. Company arrived at two bridges near Blaringen and found the enemy in possession. The section drove off the enemy troops, it is reported with the bayonet, and attempted hasty demolitions. On one of the bridges a demolition was effected by driving a lorry loaded with explosives into the centre of the span and detonating the explosives in the lorry. The report ends: "Enemy pressure has prevented the full result of this expedient being known."

It was now clear that the L. of C. would soon be cut and it was decided to use the northern channel ports, Boulogne, Calais, and Dunkirk, to maintain the force. But by 21st May, Boulogne was threatened by the approach of an enemy column of all arms. Rear G.H.Q. was at the time in the town and the Director of Works,

[1]Colonel R. H. Maclaren, M.C., killed in action, 1941.

Brigadier W. Cave-Browne, using some of his own officers and those in E.-in-C.'s rear headquarters, and tunnelling companies, organized the demolition of bridges over the River Canche to delay the German advance from the south. This was only partially successful as German tanks in some cases forestalled the demolition parties on the bridges. Meanwhile the 24th Guards Brigade less one battalion had arrived from England on 22nd May, and its commander took over the defence while the administrative headquarters and units were evacuated. It was joined by part of the 262nd Field Company of the 12th Division, which had been working on airfields. This unit destroyed a bridge over the river and took up and held a position between the two Guards battalions. The defenders were reinforced by a small force of French troops on the 23rd, but after repeated enemy attacks were driven back to the outskirts of the town from which evacuation was then ordered. This was almost completely successfully carried out during the night of 23rd/24th May. At the last moment a shipload of 100 tons of explosives, asked for by the E.-in-C. when the L. of C. was threatened, arrived in the port and was unloaded and the explosives got away under the direction of Major H. H. C. Withers,[1] of the E.-in-C.'s staff, assisted by Captain W. B. R. King[2] (geological adviser). These officers collected abandoned transport, got volunteers from men about to embark to unload the explosives from the ship into the lorries (the port being under heavy air bombardment at the time), and with volunteer drivers drove away. The tail of the convoy at which Major Withers was driving with a car full of detonators was attacked by German tanks. These were engaged by Withers and his driver with rifle fire. Both were wounded but got away with practically all the lorries, and the explosives were dumped safely near Dunkirk.

Withdrawal to River Lys, and the Position Prepared in Winter 1939–40

Owing to the continued penetration to the south, and the pressure on the Belgians on the left, it was found necessary on the night of 22nd/23rd May to fall back on to the defensive position prepared during the "Phoney" period as far north-east as Halluin, whence the line was continued along the Lys to join the Belgians. Chiefly owing to the acute administrative problems caused by the cutting of the

[1]Colonel H. H. C. Withers, D.S.O., died, 1948.
[2]Lieut.-Colonel W. B. R. King, O.B.E., M.C.

L. of C., but also because the possibility of eventual evacuation could not be ignored, it was decided to embark at the Channel ports still open, troops whose services could be dispensed with. To this end some of the general construction and other L. of C. companies, R.E., were evacuated, but not before three or four special companies had been organized under Lieut.-Colonel R. W. F. Poole[1] (C.R.E. 1st Army Troops designate) from men with previous military training and war experience. These companies were directed to the region of Dunkirk available for work as required.

Plans for the formation of a bridgehead about Dunkirk were by now in hand, and all spare R.E. units, stores and equipment were directed there in readiness. Arrangements were made with the French authorities to put in action a scheme for inundating the country south of this bridgehead. This scheme involved the flooding of the country for a depth of one to three miles about the canals running from Bergues to Furnes and Nieuport. Most of the ingress roads were above flood level, thus allowing free passage but not deployment of attacking troops. The inundations took about four days to mature, so it was fortunate that the scheme, so far as the part lying in France was concerned, was put into operation in good time. The Belgian authorities did not carry out their part of the flooding at the same time, and in consequence that portion on the left flank of the eventual B.E.F. position was not so covered.

A counter offensive by an allied force, most of which was to be provided by 5th and 50th Divisions under III Corps, was planned to take place in the direction of Cambrai on 26th May. It was hoped that this would, in co-operation with a larger blow by French forces moving north from the Somme, pinch out the base of the enemy salient. The R.E. of the formations under C.E. III Corps, Brigadier J. E. Chippindall, made preparations for bridging the River Sensée and the canal of the same name to enable the force accompanied by Infantry (Matilda) tanks to cross, all bridges having been blown earlier to limit the expansion of the German front of attack. Pontoon equipment of No. I Bridge Company, R.A.S.C., was sent up, and use was to be made of girders and equipment lying in one of the engineer store dumps at the head of the old L. of C. at Farbus near Arras. Owing to the necessity of strengthening the left flank, the Germans having penetrated the Belgian front on the Lys, and to the unlikelihood of any French offensive from the south, this counter-attack had to be called off.

[1]Colonel R. W. F. Poole, O.B.E., M.C.

The situation at this time, 25th May, was that the Allied northern forces, comprising the First and Sixth French armies, the Belgian forces, and the B.E.F., were now entirely isolated and were holding a perimeter of 128 miles, of which 97 were held by the nine divisions of the B.E.F. Boulogne had been captured by the enemy and Calais isolated. Under such circumstances a further withdrawal was essential, and during nights of 26th/27th and 27th/28th May it was ordered that the Allied line should be withdrawn, swinging their right back to the line of the Lys, thus shortening the perimeter by about fifty-eight miles. This entailed for the R.E. units of the formations affected more demolitions and the preparation of defensive positions. As there were certain bottlenecks in the lines of retreat, particularly at the bridges in Armentières, pontoons were brought up to the neighbourhood of the danger points in case it became necessary to provide other bridges.

Decision to Withdraw to Dunkirk

On 26th the decision was taken that it would be necessary to withdraw to the Dunkirk perimeter, and Lieut.-General Sir R. Adam was instructed to proceed there with the Q.M.G. and E.-in-C. to organize the defences. At first the troops available were chiefly R.E. units of all sorts which had been directed thither, and three artillery units. The R.E. units were put to work to prepare the bridges over the canals and the causeways over the inundations for demolition, and were also allotted sectors of the front to prepare for defence and to hold if attacked. Thus chemical warfare companies, companies formed from general construction companies, and other units found themselves preparing to meet the enemy, while the 105th Workshops and Park Company collected dumps of stores and tools at various points along the perimeter ready for the troops which would fall back on them. A special force, known as "Poole-force", commanded by Lieut.-Colonel Poole, and composed of 22 R.E. units from the L. of C. and from airfield construction as described above, with a small contingent of infantry, was allotted a sector north-west of Bergues. Colonel Poole posted the infantry in an outpost position, his "field companies" formed from men with military experience were set to prepare bridges over the canals for demolition, the less highly trained remainder being used to man the defences behind the canal.

R.E. units of the divisions withdrawing had on some occasions to make use of the bridging material earmarked for the relief of bottle-

necks. On 27th May, 253rd Field Company of 3rd Division was ordered to build three bridges over the Yser at Elsendamme in case the existing bridges were damaged by bombing. The bridging column on its way to the site was attacked by enemy fighter aircraft, as a result of which only two bridging vehicles remained fit to move. Even from these the boats when unloaded were found to be full of holes for the repair of which the number of patches was inadequate. The balance were stopped with sticks and clay. Just as the repaired boats were launched they were again attacked and more holes were made. However, after this attack the unit was left in peace and completed the bridge before nightfall.

Meantime divisional engineers with the rearguards were destroying bridges, and frequently, in the absence of infantry, holding the line of the demolitions to the time appointed for further withdrawal. Though the withdrawal was not closely pressed, several units, especially on the southern flank, had brisk encounters with the enemy, some chemical warfare companies suffering serious casualties.

Possibly the most noteworthy example of the use of R.E. units in an infantry role, and one which is probably unique in the history of the Corps, in that the divisional engineers were used as a whole in a counter-attack, was that of the three field companies of the 4th Division, 7th, 59th and 225th Field Companies. On 26th May, the Division was holding the defensive position prepared during the winter north of Lille with its left on the Lys at Halluin. Orders were given that day to move all possible transport and impedimenta to the rear. The field companies sent back most of their headquarters transport, and the field park company also went back. Later in the day the three field companies were ordered to move back during the night, under command of Major R. R. Gillespie[1] of 7th Field Company, to an area behind Warneton, on the Lys–Quesnoy Canal, and there to select and dig in on a line, using the canal as an obstacle, on which the Division would fall back on the following night. Owing to congestion on the roads the move took the whole of the night, and after reconnaissance, the companies deployed, without having had any rest, at 8 a.m. 59th Field Company (Major A. J. Macdonald[2]) was on the right, 7th Company astride Warneton bridge, and 225th Company (Major J. B. Windle[3]) on the left stretching nearly up to Commines.

[1]Lieut.-Colonel R. R. Gillespie, O.B.E., M.C.
[2]Major A. J. Macdonald, killed in action, 1940.
[3]Major J. B. Windle, T.D.

At 9 a.m. the enemy attacked the left flank of 225th Company and made progress, but Major Windle collected the company off the work and resisted them. Major Gillespie concentrated the other two companies and deployed them east of Warneton between its important bridge and the enemy, 7th Company in front of the village with 59th Company on its left. One section of 7th Company with about forty lost infantrymen without officers formed a reserve in the village. While this deployment was being carried out 225th Company, which had been ordered to hold on till 11 a.m., kept off the enemy. Then, though almost surrounded, this company by straight shooting managed to disengage and withdraw over dead flat open country to take post on the left of 59th Company.

The enemy came on to within range of the position and there halted and remained inert, but registered Warneton bridge with machine guns. Contact was made well away to the left with a brigade of 5th Division, in whose area the R.E. companies were now engaged, and which took charge of the stray infantrymen. Touch was also gained with some 5th Division, R.A., in rear who were, however, unable to support as, owing to shortage of ammunition, they were not allowed to fire without permission of their C.R.A. The position was also reported to Headquarters 4th Division as it looked as if the Division would have much trouble in crossing Warneton bridge, and help was promised. This arrived about 3.30 p.m. in the shape of the C.O. of the 13th/18th Hussars, with a carrier and two light tanks, and a platoon of the Black Watch consisting of nine men under a second lieutenant. After a quick reconnaissance, a counter-attack was organized and launched at 4.40 p.m.

The country was very flat and bare and there were a few farms with fences dotted about. The frontage was about 2,000 yds. and the objective the dry Ypres–Commines canal 3,000 yds. away. The platoon of Black Watch was attached to 7th Field Company, and the reserve section of that company was brought up to occupy the position held by the company in front of Warneton. The attack was made in echelon from the right with the two tanks in front, 7th Company leading, with 59th and 225th Companies at 400 yds. interval. They soon came under fire; 7th Company captured some buildings and the garrison surrendered, but before the Germans were seized they re-armed themselves and caused some casualties at close quarters. Another farm, by-passed by the platoon of Black Watch, was captured by 7th Company which, not having any bombs to clear it, set it on fire. The smoke from this helped the advance of

59th Company. One of the light tanks caught fire early, but the other reached the objective well ahead of the sappers and there also burned out.

By this time the enemy outposts had all been dealt with or were running, but the fire from their main postion was strong. Twelve machine-guns were firing on 7th Company, but the latter put three of them out of action by fire, and the steady advance upsetting the aim of the others the company reached its objective in gratifying numbers. The advance was covered by the fire of the headquarters Bren gun, manned by C.Q.M.S. Fryer, who continued to fire the gun although his foot had been smashed in the action. On the objective the unit was pinned down and heavily mortared, and Major Gillespie although wounded carried on until the end of the action; 59th Company had a hard battle for a small wood, which delayed the advance, and in the reorganization which followed, Major Macdonald, who was directing operations on a bicycle, was killed. It reached its objective an hour after 7th Company, "marching", as a spectator describes it, "as if on parade, under a storm of fire"; 225th Company also reached its objective, having met no enemy, after passing through a heavy artillery barrage. At dusk forward elements were drawn back and a strong defensive line was taken up for the night, and Major Gillespie handed over command and was evacuated.

The result of this action was that the enemy were pushed back out of range of Warneton bridge and kept there. Casualties in the Divisional R.E. were comparatively light, amounting to about 10 per cent of those who went forward; 7th Field Company suffering most highly. Next morning the R.E. were relieved by a Guards battalion.

Though probably unique as an example of divisional R.E. being used as a whole for offensive action, other cases are recorded of their use in an infantry role in defence. On 20th May, the withdrawal to the Escaut of one infantry brigade of 1st Division was delayed by congestion of refugees on the roads. The Divisional R.E. were ordered to take over its sector which they did and held it for thirty-six hours. At a later stage of the withdrawal on 28th–29th May, the Divisional R.E. of 44th Division was ordered to form a rearguard with artillery support to the Division which had suffered heavy casualties, and to hold a position on Mont des Cats. This it did for thirty hours till the rest of the Division had withdrawn successfully within the Dunkirk perimeter.

Occupation of the Dunkirk Perimeter

To avoid congestion within the perimeter, orders were given for the destruction of all transport, with certain exceptions, before entering the position. An important exception was that of vehicles carrying folding boat equipment, which were all directed to the beaches to assist embarkation.

During 29th May, main bodies of formations began to arrive within the perimeter and to relieve the R.E. companies from their garrison duties. Some of the latter were then immediately evacuated. But on the previous evening a further threat had arisen; the Belgian Army capitulated and thus left the left flank to the B.E.F. exposed. Further, the Belgians had failed to destroy the bridges over the Yser between Dixmude and the coast. In all other places the bridges over that river and the neighbouring canals had been successfully blown and, in most cases, the approaches heavily cratered by British engineers. The wide gap on the line of the Yser was filled as far as possible by the 12th Lancers, a few French troops, and 101st Field Company and 13th Field Survey Company, the latter, assuming the role of a field company, showing that the R.E. are men that "do something all round". These units successfully destroyed all the bridges on the front over the Yser. Only at Nieuport, where the Germans had already gained possession of the bridge, and despite the efforts of the Lancers and the Survey Company, they formed a bridgehead. In this, however, they were held. On this flank, owing to the delayed arrival of II Corps, the perimeter was held successfully by a composite force of R.A. and R.E. units acting as infantry till relieved.

By the morning of 30th May, the whole of the B.E.F. had withdrawn inside the perimeter defences and the last of the bridges had been blown. It is not possible to give the full number of demolitions carried out during the three weeks' operations, as many reports went astray and in some cases bridges were blown by improvised detachments under R.E. officers in Staff and other extra-regimental appointments, but details of over 620 bridges destroyed were received at E.-in-C.'s headquarters. This takes no account of craters on approach roads. One division reports having blown as many groups of craters as bridges, each group including four or five separate craters. This activity must have had considerable effect in delaying the enemy's pursuit, and its value may be summed up in the words of the Commander-in-Chief, General Viscount Gort, in conversation with

the E.-in-C., at one of the most critical moments of the campaign:—

"If our Allies' engineers had done their job half as well as your fellows have done theirs, we would not be in the hole we are in now." He was referring to the failure to blow up some of the bridges over the Albert Canal and the River Meuse.

In spite of the orderly withdrawal there was serious congestion within the perimeter. This was rendered more acute in the B.E.F. area by the passage of French troops who had been in Belgium on the left flank moving across to join their compatriots in the western sector of the perimeter. Furthermore many of these units had not abandoned their transport outside the bridgehead, and this was now congesting the roads. Lieut.-Colonel W. Porter[1] of the E.-in-C.'s staff managed to find an angle-dozer which had arrived inside the perimeter in the early stages, and with this he proceeded to clear the roads by brute force.

The Corps Survey units endeavoured during the early stages of the retreat to perform their functions, and to keep the army supplied with maps. But their map depot was soon overrun. Luckily considerable stocks of maps of the area about and immediately west of the Escaut had been dumped in stores in the frontier defence area when the advance to the Dyle commenced. These were therefore available for distribution to the troops as the latter withdrew. Thereafter the pace of events moved too rapidly and the situation became too confused for the survey units to fulfil their functions. They were therefore for the most part either evacuated early to the U.K., or withdrawn to the Dunkirk bridgehead where they showed that Survey units could turn their hands to all sapper jobs, including fighting. A.D. Survey I Corps received orders on the night of 27th May, to take 13th Field Survey Company to defend Furnes. On arrival it was found that the town was occupied by Belgian troops, the commander of which said he did not require assistance. Fresh orders were then given for the company to proceed to Nieuport and arrange for its defence. Here the company joined up with the 12th Lancers and operated as already described (page 38). On 30th May, when staff officers of III Corps were endeavouring to sort out the many small parties and individuals who were moving down the roads to the beaches, they were surprised to see a complete unit, fully armed and equipped, and with their officers in position, moving closed up in threes. This was 514th, the last formed Field Survey Company, maintaining to the end the standard of R.E. units everywhere.

[1]Brigadier W. Porter, C.B.E., died, 1944.

On 28th May, A.D. Survey III Corps was appointed Chief Embarkation Staff Officer for his Corps, and continued this duty till 31st May, when he personally was ordered to embark.

Evacuation of B.E.F.

The curtain was now up for the last act of the drama. It has been related how certain units no longer essential for fighting had begun to be evacuated from Boulogne, Calais, and Dunkirk as early as 22nd May. The earlier embarkations were carried out in comparative order by shipping from the various ports. But one by one these fell into enemy hands. On the night of 23rd/24th, the remainder of the garrison of Boulogne and the remnants of rear G.H.Q., already hemmed in for thirty-six hours, were evacuated by destroyers. Calais, reinforced by a Rifle Brigade of 1st Armoured Division with a battalion of tanks, was isolated by 24th. In view of the importance of maintaining a threat to enemy forces trying to strike towards Dunkirk, it was decided that the town should be held to the last, even at the risk of losing the garrison. These orders the garrison faithfully carried out, holding the town until forced to surrender on 27th May.

From about 22nd May, Dunkirk became the centre of interest. Ships of all natures plied into and out of the port bringing in supplies and ammunition and returning to England with unessential men and wounded. But soon the German air force turned its attention to this vital spot and bombed it continuously. In these early stages few fighter aircraft were available for its defence, and these, all airfields north of the Somme having fallen to the enemy, had to operate from England. This was the only point at which ships of any size could approach close in to the coast as the latter shelved very slowly. It was under such circumstances that the evacuation of the B.E.F. was undertaken.

In spite of the bombing, ships continued to embark troops from the mole in Dunkirk harbour, though much of the work had to be restricted to the hours of darkness. During the 27th and 28th, the Allied forces withdrew within the perimeter bounded by the floods and canals, the French to the west of the port and the British to the east extending as far as Nieuport; I Corps with 1st and 46th Divisions and a brigade of 42nd Division, was on the right of the B.E.F. sector, and II Corps with 3rd, 4th, 5th, and 50th Divisions on the

left flank. From the 28th, III Corps started to get away. As many as possible were embarked at Dunkirk, but owing to the numbers to be handled and the bombing of the town, it soon became necessary to use what small craft could be collected and ships' boats to ferry the men from the open beaches along the six mile stretch of coast from La Panne to Dunkirk out to the waiting ships. At first the latter were made up chiefly of naval craft from Dover and Harwich and cross-channel steamers, but from the 29th, these and the small craft were supplemented by the most amazing collection of craft of all kinds collected by Admiral Ramsay in charge of operations at Dover. As a result of a public appeal naval vessels were joined by craft of all kinds, many manned by their amateur yachtsmen owners, from small motor and sailing boats to fishing trawlers and pleasure steamers from every resort in south-east England. The small craft plied backwards and forwards between the beaches and the larger craft lay off shore, the latter sailing for England as soon as they were full, only to return when they had landed their precious cargo. The troops on shore lay up amongst the sand dunes or queued up, by units or as individuals, on the beaches when the bombing was less intense and waited their turn to be taken off. But the majority still passed out through Dunkirk, where French and British in two streams filed out along the mole into the waiting ships.

Though extra fighter squadrons of aircraft from England had now been sent to help, and though these caused considerable casualties to the attacking German aircraft, the bombing along the beaches, at Dunkirk, and that directed against the ships was at times intense. On the soft sand of the beaches casualties from this cause were surprisingly low, and even at Dunkirk they were not as high as might have been expected, but many of the warships and other craft lying off shore and in passage to and from England were hit and many of the occupants, both crews and passengers, were killed or drowned.

Among the small boats plying from the beaches before the arrival of the armada from England and forming the majority of the small craft available, were the folding boats of the field park companies and of the bridge company which had been directed to the beaches. These folding boats were manned by sappers of the various units, many of the crews doing several trips before handing over to others and being evacuated themselves. The appearance of these Charons caused considerable surprise to the sailors of the larger craft, who seemed to think that the job of ferrying was the perquisite of the Royal

and Merchant Navies. The attentions of German bombing and dive bombing aircraft made this task extremely unpleasant, and many of the little craft with their gallant sapper crews were sunk.

The R.E. of 1st Division built a jetty of 3-ton lorries driven into the sea at low water, close together, side by side, and with gangway planks over the canopy frames. This enabled men to be embarked dryshod, and for larger craft to pick up passengers direct. Similar jetties were built by other units, and, though the sea ends whipped about in an awe-inspiring manner at high tide, greatly assisted the work of embarkation.

Thus the drama went on, for the most part epic, such as the efforts of the men in the little ships to get the waiting troops off to the larger vessels, and sometimes tragic, as when craft of all sizes were sunk when their occupants felt themselves at last clear of the encircling German forces. But there were also moments of comedy, such as when C.E. I Corps, Brigadier R. L. Bond, found himself in an overcrowded folding boat going round in circles propelled by some very amateur oarsmen, till, with the Corps Commander's A.D.C. also a "wet-bob", he himself took the oars and rowed successfully to an awaiting destroyer: and when the Engineer-in-Chief, with his wounded arm strapped to his side, tried to direct the navigation of a pleasure rowing boat named the *Margate Belle*, without oars or any other means of propulsion apart from the willing hands of the conglomerate crew, till they grabbed a rope from a naval paddle steamer and scrambled aboard only to find it grounded on the top of the tide.

And so for about six days and nights the work of evacuation went on, the extent of the perimeter being gradually reduced and the holding troops thinned out. On the evening of 31st May, the strength of the defending force having been reduced to about three divisions, Lord Gort, in accordance with explicit orders issued by the Government, handed over command to Major-General Hon. H. R. L. G. Alexander,[1] Commander 1st Division, and was himself evacuated, embarking from a "lorry" pier built by 38th Field Company. On the afternoon of 4th June the last troops that could be disengaged were embarked, a few thousand having to be left behind. In all 337,000 Allied troops, of whom 224,000 were British, had got away, but all their weapons except personal equipment had had to be abandoned.

[1]Field-Marshal Viscount Alexander, K.G., etc.

South of the German Break-through

The only British formations in the area south of the country overrun by the Germans in their drive to the coast were 51st Division, the Support Group of 1st Armoured Division, and portions of the partly trained and equipped Territorial divisions which had been working on the southern airfields and on the lines of communication. Of R.E. units, besides those with formations, there were the many units constructing and operating base and L. of C. installations. Many of these, such as the newly formed artisan works companies and general construction companies, had had very little military training and possessed the minimum of fighting equipment. There was also the organization of C.E. A.A.S.F. with units working on airfields chiefly in the area centred on Rheims.

The 51st Division (C.R.E. Lieut.-Colonel H. M. Smail) was at the time of the German offensive taking its turn, as other divisions of B.E.F. had done previously, in a sector of the Maginot Line near Metz. Up to this time this part of the line along the German-French frontier had been the only one in which there had been direct contact with enemy forces and where active experience in raiding and meeting raids had been possible.

When the Germans attacked farther north, 51st Division, to the Divisional Engineers of which 213th Army Field Company of III Corps Troops was attached, was moved into reserve under orders of the French. After some moving about it was directed to hold the line of the Somme from Abbeville to the sea. Here it was joined by the Support Group of 1st Armoured Division which had lately arrived in France. With the latter was the C.R.E., Lieut.-Colonel H. Williams,[1] and 1st Field Squadron. The R.E. of the combined force, under command of Major-General V. Fortune[2] of 51st Division, prepared and eventually blew the bridges over the River Bresle. This was the situation when German armoured formations broke across the Somme to the south-east on the 5th June. The British Government pressed immediately that General Fortune's force should at once be withdrawn to Rouen where it could cross the Seine into Normandy. Too late the French Higher Command on 9th June ordered the withdrawal of their IX Corps and General Fortune's force to Le Havre. Meanwhile the German thrust had cut off their retreat to the south and the greater part of the combined

[1]Major-General H. Williams, C.B.E.
[2]Major-General Sir V. Fortune, K.B.E.

force was hemmed in near St. Valery. The majority of the R.E., who had been preparing demolitions on the line of retreat got away with a brigade of 51st Division which had been sent to prepare defences at Le Havre, being evacuated from that port and Fécamp. Some of 1st Field Squadron, 26th Field Company, part of one section of 213th Field Company with its O.C., and Headquarters 51st Division R.E. with the C.R.E. were in the force encircled. During all these operations, besides their work on demolitions and defences the R.E. units took their share in fighting as infantry, one section of 26th Field Company, under Lieutenant H. S. M. Hogg,[1] defending a bridgehead over the Bresle for a considerable time until relieved by infantry.

Efforts made to evacuate the force at St. Valery, as had been done at Dunkirk, were unsuccessful, the Germans penetrating to the cliffs and dominating the beach with fire. On the 12th June, General Fortune, having resisted even after the French IX Corps in the neighbourhood had surrendered, was forced to capitulate with all his troops.

On 13th June, Lieut.-General Sir A. Brooke, who had commanded II Corps in the Flanders area, landed in Brittany with the staff of his Corps (C.E. Brigadier C. C. Phipps) to form a nucleus G.H.Q. to command the British forces south of the Seine and such other reinforcements as might be sent, with the idea of forming a bridgehead in Normandy and Brittany to enable a fresh British Army to be formed and landed in France. After seeing the French commanders, General Brooke reported on the 14th that the position was hopeless and, accordingly, orders were issued cancelling the dispatch of reinforcements and for the embarkation of the British force and as much as could be evacuated of its stores and equipment. The arrangements for this were in the hands of Major-General de Fonblanque who, already seriously ill, died on arrival in England as the result of his exertions.

Meanwhile Brigadier Beauman, the senior area Commander on the L. of C., was endeavouring to organize resistance with what troops he could gather from the bases and L. of C., and from the remains of those Territorial Army divisions which had been working and which had withdrawn south across the Somme. As the D.W. had been isolated in, and eventually evacuated from, the north, C.E. L. of C. North, Brigadier J. H. Stafford, took over his duties,

[1]Major H. S. M. Hogg, M.C.

and Lieut.-Colonel J. B. H. Doyle,[1] who had been C.R.E. Medical Base at Dieppe, became C.R.E. to "Beauman Force". The R.E. units available were 218th Army Troops Company, and four artisan works companies. All of these except one artisan works company were attached to "Beauman Force", and prepared for demolition and defence about eighty bridges over the Bresle and Seine and other bridges above Rouen. The remaining company under Lieut.-Colonel G. F. H. Alms,[2] who had been C.R.E. in the area north of the Seine, took charge of the operation and eventual destruction of the ferries over the Seine downstream of Rouen. These companies, normally almost immobile, provided themselves with transport from depots and abandoned civilian cars and lorries. On 7th and 8th June, the bridges over the rivers north of the Seine were successfully blown and the force withdrew. The Germans having crossed the Seine higher up on the front held by the French and where the bridges were not blown, "Beauman Force" partly withdrew across the bridges in their own sector, and partly moving seaward along the north bank, crossed by the ferries kept going by Lieut.-Colonel Alms' Sappers during 17th/18th June. It moved to a new position on the River Dives near Caen. The 52nd Division were by this time deployed on the left, and this Division, having just arrived from England without its engineers, had 218th Company attached to it.

On 19th June, the bridges over the Dives were blown and the withdrawal was continued to Cherbourg. During these operations the various R.E. units , besides carrying out their duties on demolitions and defences, had on many occasions to take their places in the line as infantry and acquitted themselves well in spite of the lack of military training of the newly formed artisan works companies.

Away to the east, in the area of the A.A.S.F., the Chief Engineer, Brigadier P. W. Clark, when active operations commenced stopped work on new construction of airfields and, leaving a party on each operational airfield for maintenance and repair of bomb damage, collected the remainder of his units into reserve ready to move to any point where the damage might prove too serious for the maintenance party. When the enemy broke through and it became necessary for the A.A.S.F. to withdraw, the C.E. was faced with two problems, first, to prepare new airfields as requested by the R.A.F. farther back in the neighbourhood of Orleans, and, secondly to get his immobile troops away. The latter, and indeed both requirements,

[1]Lieut.-Colonel J. B. H. Doyle, O.B.E.
[2]Brigadier G. F. H. Alms, C.B.E.

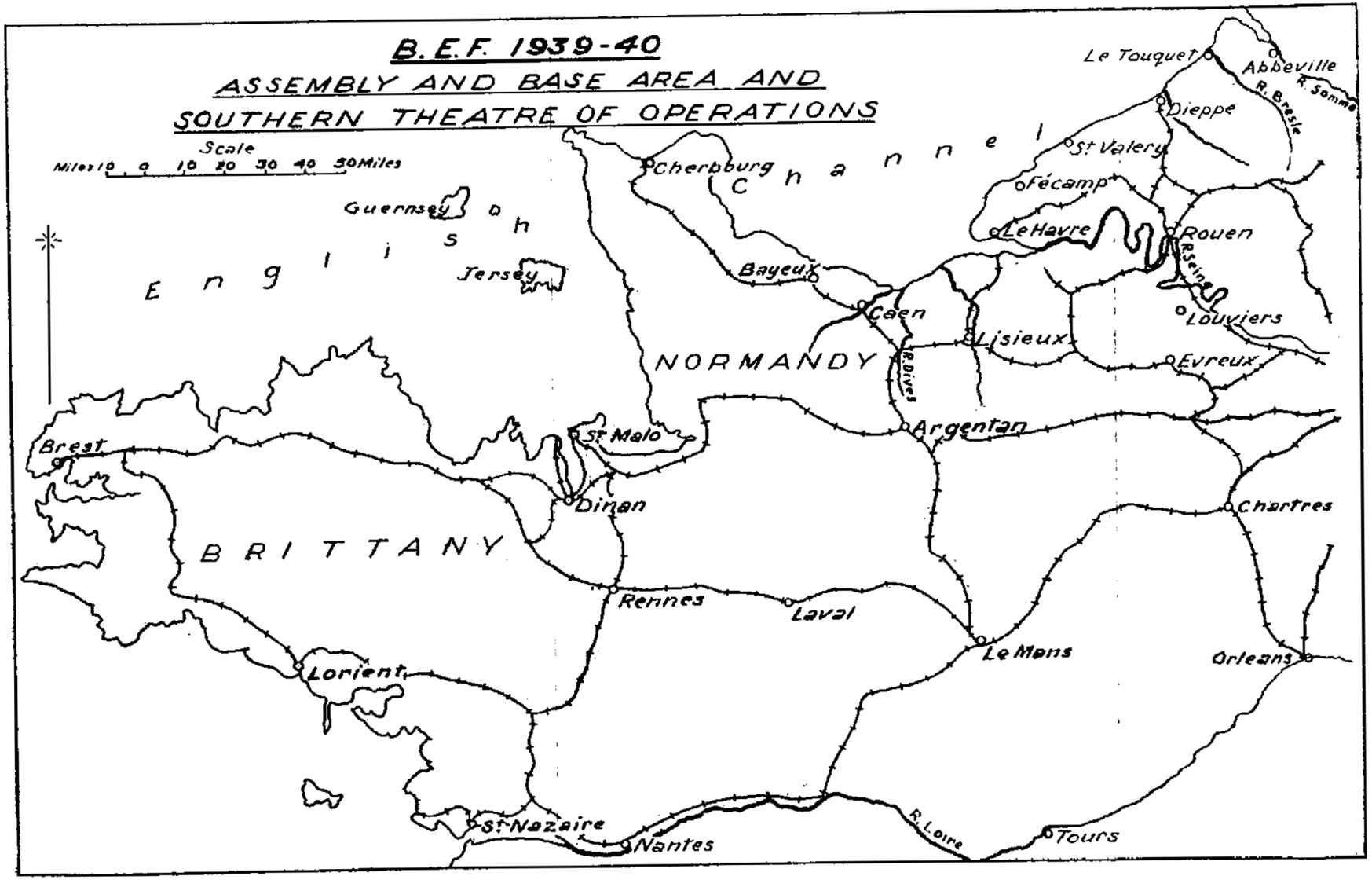
was only met owing to the presence for stores carrying of a half G.T. company R.A.S.C. Work was started on the preparation of four new airfields as required, and when the area had to be abandoned after four days work, in spite of having no mechanical equipment available for levelling, clearing hedges, etc., all four were capable of being used by fighter aircraft. Thereafter all the units were safely transported to the base ports in Brittany and evacuated to England.

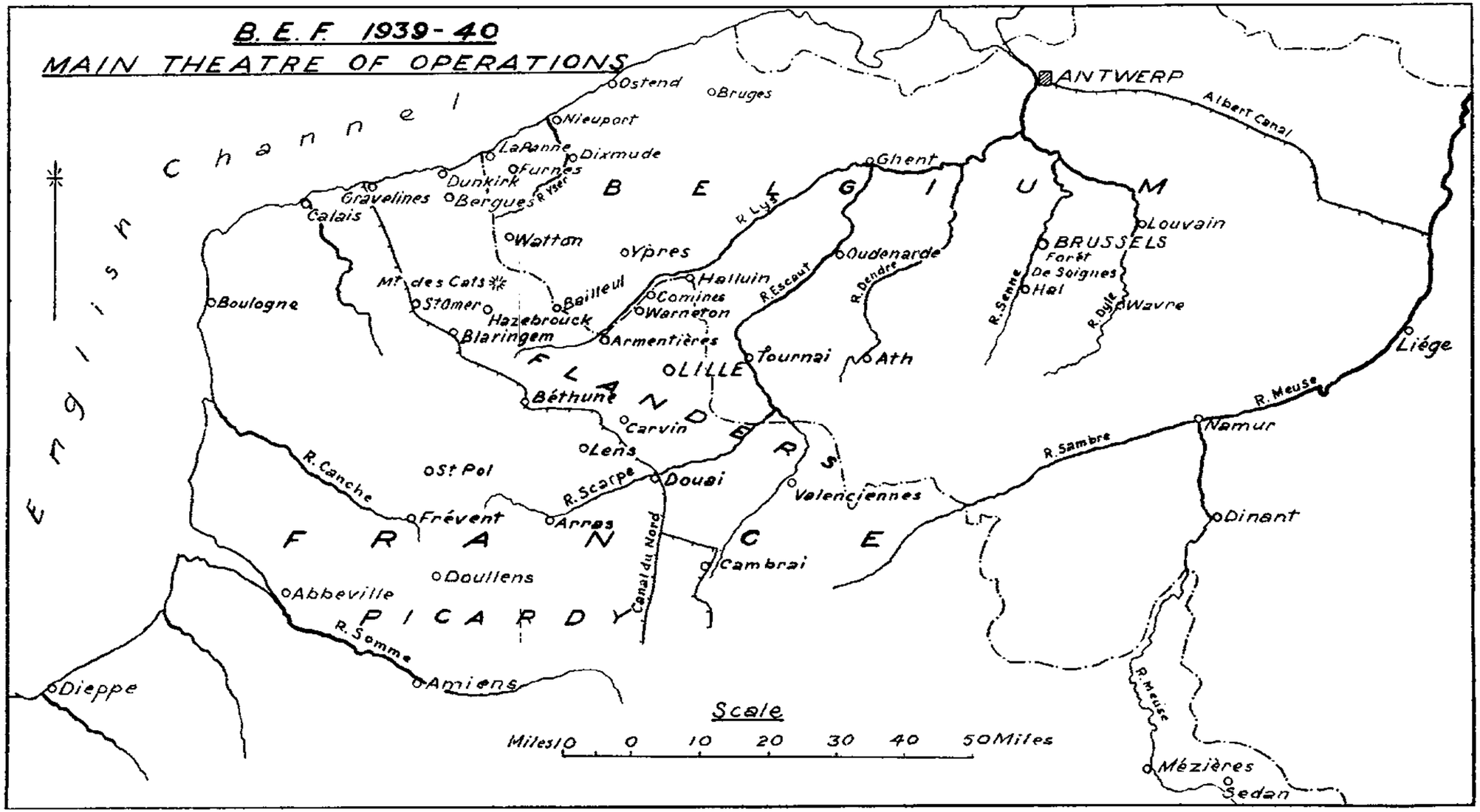
While "Beauman Force" had been fighting its rearguard actions, evacuation of personnel and as much of the most valuable equipment as possible had been proceeding through the various ports, Nantes, St. Nazaire, Brest, and Cherbourg. This work was not carried out without interference and casualties to men and shipping from the German aircraft. A most serious disaster was the loss, on 17th June, of the liner *Lancastria* which was bombed and sunk when leaving St. Nazaire with 5,000 troops on board, including a considerable number of Royal Engineers. The rescue work by small craft was considerably hampered and endangered by the masses of burning oil floating on the surface of the water. In consequence over 3,000 lives were lost.

On 20th June, the R.E. of "Beauman Force" started to prepare the defences of Cherbourg, but on the news that the French Government had concluded an armistice with the Germans, the last of the tanks and guns were hurriedly embarked, but most of the transport had to be driven into the harbour. During the night the last of the troops were embarked in destroyers without further molestation.

Thus ended the campaign of the B.E.F. in France and Belgium, and the last British soldiers left the country, not to return in force for almost exactly four years.

Map I


B.E.F. 1939-40
ASSEMBLY AND BASE AREA AND
SOUTHERN THEATRE OF OPERATIONS
Scale
Miles 10 0 10 20 30 40 50 Miles
English Channel
Guernsey
Jersey
Cherbourg
Le Touquet
Abbeville
R. Somme
R. Bresle
Dieppe
St Valery
Fécamp
Le Havre
Rouen
R. Seine
Louviers
Evreux
Bayeux
Caen
Lisieux
NORMANDY
R. Dives
Argentan
Chartres
Orleans
Le Mans
St Malo
Brest
Dinan
BRITTANY
Rennes
Laval
Lorient
St Nazaire
Nantes
R. Loire
Tours


B. E. F. 1939-40
MAIN THEATRE OF OPERATIONS
English channel
BELGIUM
FLANDERS
FRANCE
PICARDY
Ostend
Bruges
Nieuport
La Panne
Dixmude
Furnes
Dunkirk
Gravelines
Bergues
R. Yser
Calais
Watten
Ypres
R. Lys
Ghent
ANTWERP
Albert Canal
Louvain
BRUSSELS
Forêt De Soignes
Hal
Oudenarde
R. Dendre
R. Senne
R. Dyle
Wavre
Liége
R. Meuse
Namur
R. Sambre
Dinant
Mt. des Cats
Boulogne
St Omer
Hazebrouck
Blaringem
Bailleul
Comines
Warneton
Armentières
Halluin
R. Escaut
Tournai
Ath
LILLE
Béthune
Carvin
Lens
St Pol
R. Canche
R. Scarpe
Douai
Valenciennes
Frévent
Arras
Cambrai
Canal du Nord
Doullens
Abbeville
R. Somme
Amiens
Dieppe
Mézières
Sedan
R. Meuse
Scale
Miles 10 0 10 20 30 40 50 Miles

CHAPTER III

NORWAY

Early planning—Start of operations, 6th April, 1940—Allied plan of operations—Plans for capture of Trondheim—Operations from Aandalsnes—Namsos—Narvik.

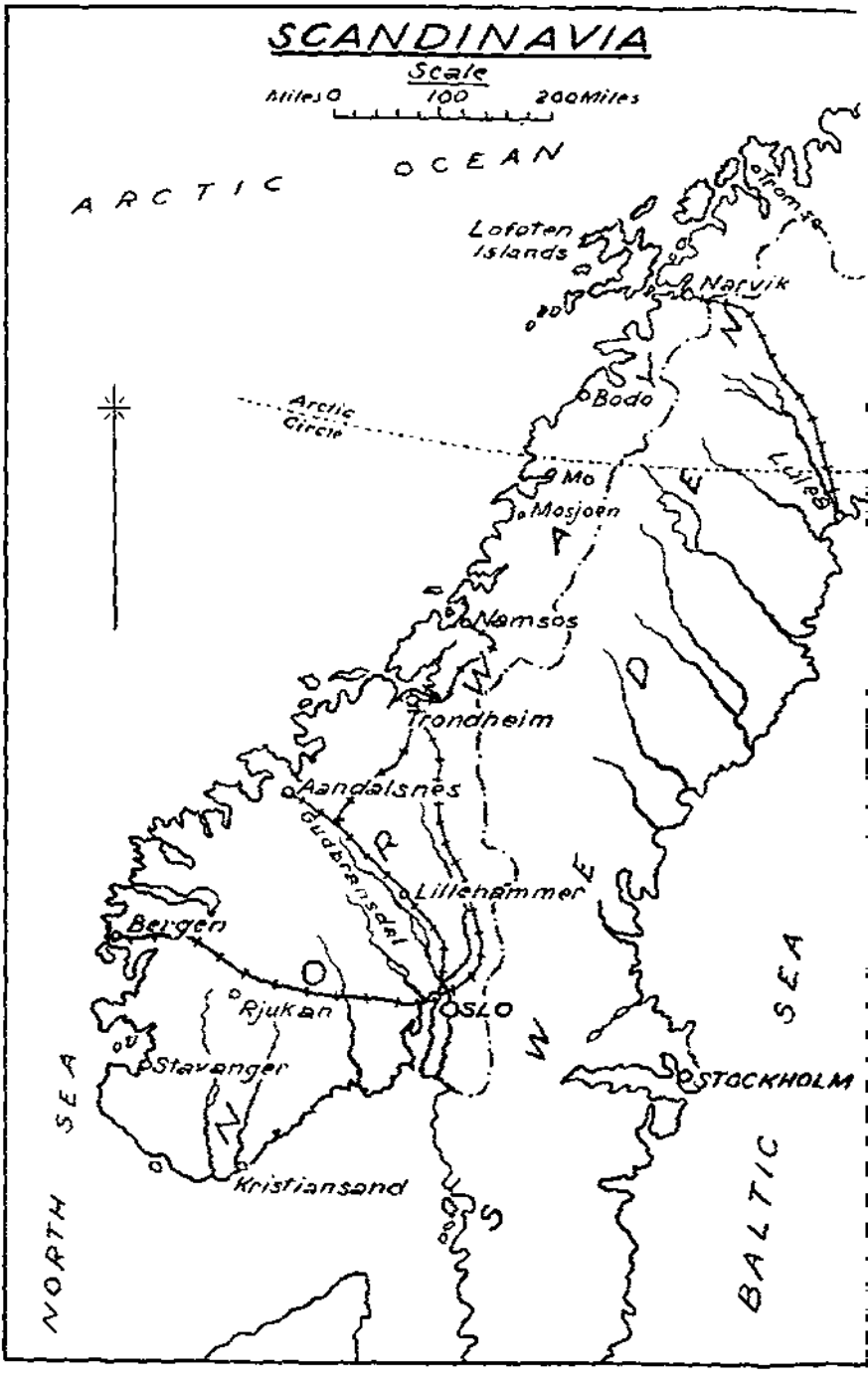
(See Map 3 facing page 49, Map 4 facing page 55, Map 5 facing page 65, in this chapter)

Early Planning

Scandinavia had from the outbreak of the war attracted the earnest attention of both protagonists in the struggle. Its importance lay chiefly in three factors. Across these countries the French and British Allies could most easily send military aid to Finland now engaged in a desperate struggle with the might of Soviet Russia; the west and north coasts of Norway lay on the flank of the northern exit from the North Sea into which moved much of the shipping so vital to Britain's existence and war effort; and the majority of the valuable iron ore, so essential to German war production, was shipped from the Norwegian ice-free port of Narvik rather than by rail to the Swedish port of Lulea, ice-bound as it was through the winter months. In spite of the representations of Mr. Churchill, then First Lord of the Admiralty, on the one side, and of Admirals Raeder and Doenitz on the other, neither of the Supreme authorities were at first prepared to consider the extension of the war to the Scandinavian peninsula. The Governments of Norway and Sweden also made clear their wish to remain neutral in the struggle, and though more sympathetic to the cause of the Western Allies, announced their intention of opposing invasion by either of the combatants.

In January, 1940, however, the likelihood of some action becoming necessary ultimately was borne home both on Hitler and on the British and French Governments, and the planning of possible operations commenced. On the British part the first plans were concerned chiefly with the possible transport of troops and stores to Finland through the port of Narvik, and the prevention of German use of Norwegian territorial waters for the passage of iron-ore ships from Narvik, and also to stop naval supply ships serving raiding warships in the Atlantic. From the military point of view this would

Map 3


SCANDINAVIA
Scale
Miles 0 100 200 Miles
ARCTIC OCEAN
Lofoten Islands
Narvik
Tromsø
Bodo
Arctic Circle
Mo
Mosjoen
Lulea
Namsos
Trondheim
Aandalsnes
Gudbrandsdal
Lillehammer
Bergen
Rjukan
OSLO
Stavanger
Kristiansand
STOCKHOLM
NORTH SEA
BALTIC SEA
NORWAY
SWEDEN

involve the dispatch of a force for the seizure and occupation of Norway and for the opening of a land line of communication through that country and Sweden to Finland. Naval participation would chiefly be concerned with the laying of minefields in Norwegian waters to prevent the passage of German shipping through the shelter of the many islands which fringed the coast, and so to force the traffic out into open waters where it might be dealt with by the Allied Navies. The first military plan envisaged, therefore, consisted of the preparation of a force, predominantly British, but including French and Polish elements, to be transported to Narvik. The 49th Division, commanded by Major-General P. J. Mackesy,[1] late R.E., with Lieut.-Colonel F. L. Colley[2] as C.R.E., was selected to form the basis of the force and went into special training for the purpose.

Owing, however, to the capitulation of the Finnish Government to that of Russia on 13th March, 1940, one of the main objects of the military operation lapsed, and the force was "stood down", but only for a short time. On the 28th March, the Allied Supreme War Council decided to notify Norway and Sweden that they intended to tighten up the blockade of Germany by laying mines in Norwegian waters. It was realized that such action might give an excuse to Germany to invade Scandinavia, and therefore General Mackesy's Force was reconstituted to stand by for a landing at Narvik, and at three ports farther south, Trondheim, Bergen and Stavanger. The instructions issued to General Mackesy on 6th April, indicated that a British landing would be made only with the agreement of the Norwegian Government after German aggression. The force placed at his disposal consisted of his own 49th Division including 24th (Guards) Brigade, five Independent Companies and a French alpine brigade or light division. Brigadier R. S. G. Stokes,[3] who in civil life was Chief Engineer of the De Beers Diamond Mines in South Africa, was appointed Chief Engineer of the Force.

START OF OPERATIONS, 6TH APRIL, 1940

On the morning of 8th April, the ships of the Royal Navy laid mines off the Norwegian coast. But the Germans had not waited for this event to invade Norway. On 6th April, the first detachment of the German Fleet, some carrying troops, and escorting troopships,

[1] Major-General P. J. Mackesy, C.B., D.S.O., M.C.
[2] Lieut.-Colonel F. L. Colley.
[3] Brigadier R. S. G. Stokes, C.B.E., D.S.O., M.C.

had sailed from German ports. The sailings were synchronized ensure simultaneous arrival at the principal points at which landin were to be made, Oslo the capital, Kristiansand, Stavanger, Berge Trondheim and Narvik. These constituted the principal points which the Allied forces might be expected to land. Simultaneous with the arrival of the fleets, airborne troops descended on and seize the airfields in proximity to these towns. The initial forces used i each case were small. That at Oslo amounted to little over 1,5(men, but the Norwegians were taken completely by surprise and a the towns were occupied without encountering resistance. Th Norwegian Army, at its peace stations and unmobilized, was quit unprepared, but under the gallant leadership of their newly ap pointed Commander, General Ruge, collected as it could in unocct pied parts of the country. As the various detachments got into som sort of order they put up stubborn local resistance, and operated s as to attempt to confine the invaders to the southern part of th country to allow time for the arrival of the hoped for aid from th Western Allies.

Allied Plan of Operations

This *fait accompli* necessitated another change of plan for th Allied Force. It was decided that General Mackesy's force was t land at the entrance of Narvik fjord and then to eliminate the sma German force in Narvik town and seize the railway leading to th Swedish iron mines. Another force was to land in the neighbourhoo of Trondheim to take the port by direct assault. But before this latte force could sail it was found that the enemy was holding Trondhein in such strength that such a straight-forward plan was unlikely to b successful. Instead one force under Major-General Carton de Wiart v.c.[1] was to land at Namsos, north of Trondheim, while an indepen dent brigade would be put ashore at Aandalsnes. This latter brigad was to strike inland to capture the important railway junction a Dombaas and so prevent reinforcement by rail of the German forc in Trondheim, while General Carton de Wiart's force dealt with th latter. When this had been successfully accomplished a naval forc should force the passage of Trondheim fjord and put ashore a furthe force under Major-General F. E. Hotblack.[2] With Trondheim secured the Allies would have a secure base and be able to operate t

[1]Lieut.-General Sir A. Carton de Wiart, v.c., K.B.E., etc.
[2]Major-General F. E. Hotblack, D.S.O., etc.

seal off the southern portion of the country. Once more the plan was changed. To aid the Norwegian army as soon as possible it was decided to divert the Aandalsnes force southwards to their aid, the sailing of General Hotblack's force was cancelled, and General Carton de Wiart's was left alone to carry out the attack on Trondheim. Even now the teething troubles of the expedition were not over. The night before he was to embark General Hotblack, after receiving his final instructions from the C.I.G.S., disappeared and was found next morning unconscious, having had a stroke at the foot of the Duke of York steps leading to the Mall. Immediately Major-General H. P. M. Berney-Ficklin[1] was appointed in his place and after being briefed, started by aircraft to join the convoy at Scapa Flow. The aircraft crashed near Kirkwall, and the General and some senior members of his staff, including his G.S.O.I., Colonel E. A. L. Gueterbock,[2] a R.E. officer, though escaping with their lives, were out of action for several weeks. The appointment then fell to Major-General B. C. T. Paget,[3] but before he could join his command the sea-borne attack on Trondheim had been cancelled, as mentioned above, and he and his headquarters were assigned to another task as will appear later.

Still another cause entailed further changes in the dates of sailing of the various expeditions and also in their means of transport across the sea. This was that the majority of the German Fleet came out to cover the movement of their invading forces and in many cases to transport the troops themselves. Such an opportunity could not be lost to the Royal Navy and the British troops, which had already been embarked in some of H.M.'s ships, were hurriedly put ashore again, and the sailing of the convoys postponed, while the Fleet steamed to search out the enemy. The successes and failures of these naval operations, and the many gallant actions of H.M. ships, do not fall to be recorded here, except in so far as that by 16th April, when the first convoys of Army troops arrived in the fjords, the command of the approaches to the Norwegian coasts lay with the Allied navies.

More than usual space has been devoted to the overture of this drama than would normally be necessary in an account of the doings of a particular group of actors in the main body of the play, but it was felt necessary to describe in some detail the preliminaries, as

[1]Major-General H. P. M. Berney-Ficklin, C.B.
[2]Brigadier E. A. L. Gueterbock.
[3]General Sir B. C. T. Paget, G.C.B., etc.

these were the cause of many of the difficulties and of the considerable disorganization with which the engineer units and commanders had to cope in the course of the campaign.

Having heard the overture, and witnessed something of the confusion behind the scenes as the stage was set, we can now turn to the events of the play and follow the doings of the actors, particularly those of the Royal Engineers. From what has been said above regarding the original planning it will be seen that the Allies had two principal objectives for the first phase, the capture of Narvik in the north, and that of Trondheim as a base of future operations farther south. While the latter was originally designed to achieve its purpose by the converging action of three separate forces, the conception rapidly changed to that of the action of two almost independent forces landed at Aandalsnes and Namsos respectively. The actions of the various forces were controlled in the first instance direct from Whitehall, all three Services being concerned, and it was not till 19th April that a Commander was provided with the necessary staff to co-ordinate the actions of the various military forces. This was Lieut.-General H. R. S. Massy[1] whose command was entitled the North-West Expeditionary Force. Owing to the circumstances of the campaign General Massy was unable to establish a headquarters in Norway and had to exercise his command from London during the short period of its existence.

It is proposed under the circumstances not to attempt a chronological account of the whole campaign, but to follow in turn the adventures of the various independent forces. Though in point of view of actual landing in Norway the expedition to Narvik might claim prior attention, owing to the short duration of the southern operations and the effect of their failure on the whole strategy of the campaign, it is proposed to deal with the latter first.

Plans for Capture of Trondheim

It will be remembered that the original intention was that these operations, aimed originally at the capture of the port of Trondheim and of certain airfields, should take the form of converging attacks of Allied forces landed north and south-west of the town, to be followed by a direct assault by sea on the port itself. The whole of these operations were to go by the code name of "Strat Force"

[1]Lieut.-General H. R. S. Massy, C.B., etc.

The troops allotted to the various parts of the operation, with their original objectives, were as follows:—

(*a*) 148th Infantry Brigade (only two battalions), under Brigadier H. de R. Morgan[1], to land in Trondheim fjord and at Stavanger, to destroy the airfield at the latter place and to advance on Trondheim from the west.

(*b*) That commanded by General Carton de Wiart, consisting of 146th Infantry Brigade, to land at Namsos and advance on Trondheim from the north.

(*c*) The force originally to be commanded by General Hotblack, consisting of 147th Infantry Brigade, escorted by a strong force of the Royal Navy, to sail up Trondheim fjord and take the town by assault.

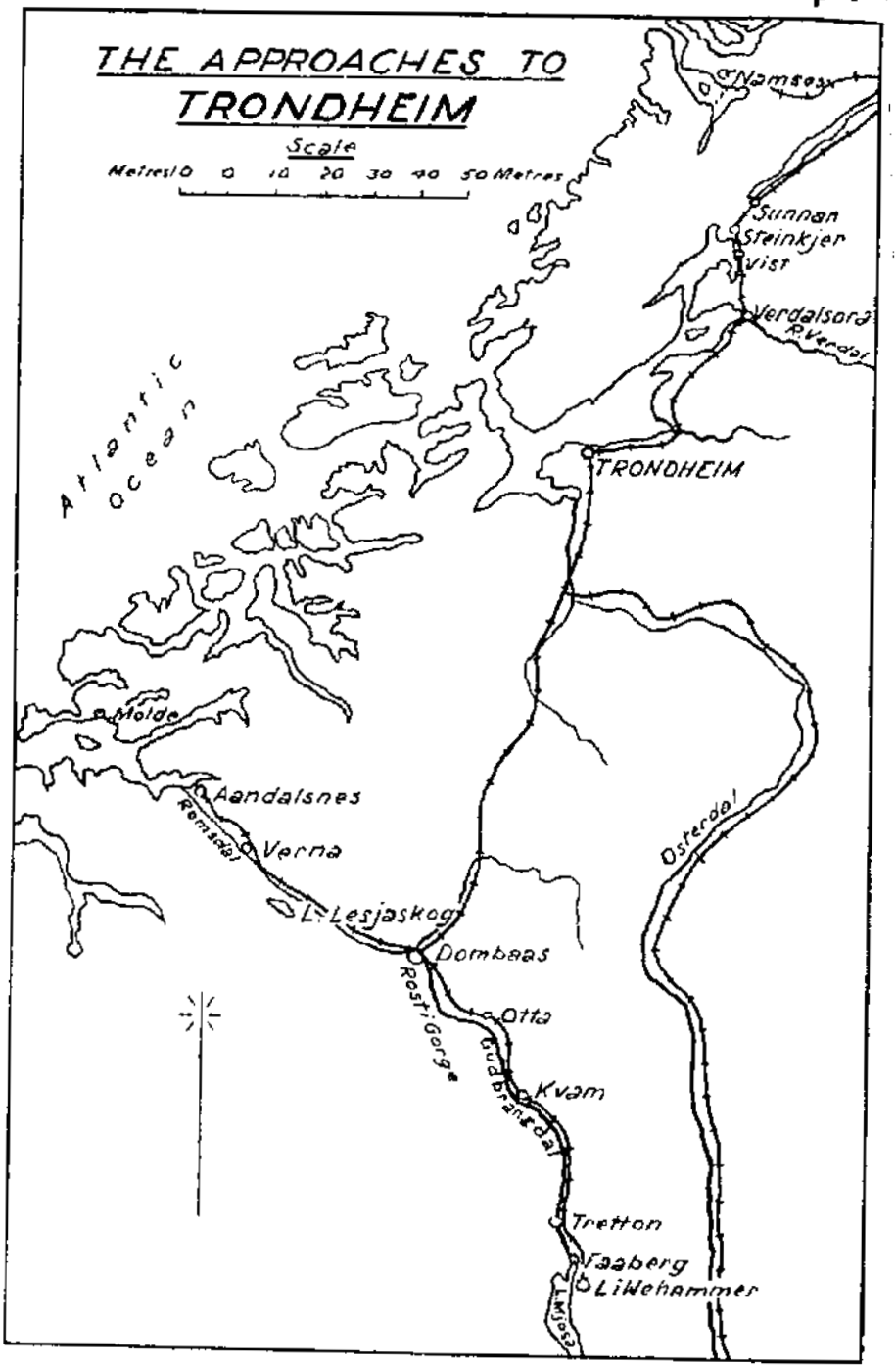
The R.E. component of all these forces was limited to a Headquarters, C.R.E. Lieut.-Colonel R. A. Turner[2] and 55th Field Company R.E. (Major Sir J. Forbes[3]), while certain base and L. of C. units under a Works C.R.E., Lieut.-Colonel R. D. Keane,[4] were held in readiness to follow up to Trondheim when the port was captured.

Under the original plan 55th Field Company (less one section) was to land at Stavanger with one battalion of 148th Brigade, destroy the airfield there and then move on to join the main body at Trondheim. For this purpose the company was equipped with four times its normal quantity of "Drivall" equipment for the cratering of airfields. The other section was to accompany General Carton de Wiart's force to Namsos.

The main body of the company embarked in H.M. ships at Rosyth on 8th April, only to be put ashore again a few hours later when the Fleet sailed to intercept the German escorting warships. After about a week ashore they once more embarked, this time in S.S. *Orion*, only to be transferred again to ships of the Royal Navy on 17th April, as it was found that the *Orion* was too large to enter the port intended for disembarkation. By this time the plans had changed, the direct assault on Trondheim had been cancelled, and the destination of Brigadier Morgan's Brigade, now the advanced troops of "Sickle Force" to be commanded by Major-General Paget,

[1]Major-General H. de R. Morgan, C.B., etc.
[2]Lieut.-Colonel R. A. Turner, D.S.O., M.C.
[3]Lieut.-Colonel Sir John Forbes, Bart., D.S.O.
[4]Brigadier R. D. Keane.

Map 4


THE APPROACHES TO
TRONDHEIM
Scale
Metres 0 0 10 20 30 40 50 Metres
Namsos
Sunnan
Steinkjer
Vist
Verdalsora
R. Verdal
Atlantic
Ocean
TRONDHEIM
Molde
Aandalsnes
Romsdal
Verma
L. Lesjaskog
Dombaas
Rastri Gorge
Otta
Gudbrandsdal
Kvam
Osterdal
Tretton
Raaberg
Lillehammer
Lagen

had been changed to Aandalsnes only, Stavanger being omitted as the enemy had already occupied the airfield there. The special task of 55th Field Company had therefore lapsed. It was now the intention that "Sickle Force" should advance inland as quickly as possible to seize the important railway junction at Dombaas on the main line from Oslo to Trondheim, and then turn north to co-operate with General Carton de Wiart's "Maurice Force" in capturing Trondheim.

Operations from Aandalsnes

Brigadier Morgan's force landed on the night of 18th–19th April at Aandalsnes and Molde, on the opposite side of the fjord, without opposition, but found the harbours quite unsuitable for the maintenance of a large force. It had been the intention that General Paget should have in "Sickle Force" a fully equipped division. Brigadier Morgan's force consisted of only two weak infantry battalions, some light A.A. guns and the 55th Field Company (less one section). Moreover the ship carrying the transport and engineer equipment of the field company, and of much of the whole of Brigadier Morgan's detachment, was sunk at sea and the force had to requisition what transport it could from the inhabitants.

The little force thus equipped pushed rapidly forward, dealing with a few small parties of German paratroops at various points. The route lay along the narrow Romsdal and Gudbransdal valleys through which ran, in close proximity, the single road and railway. The hills on either side were steep and snow covered and the specially trained ski troops had been dispersed when the possibility of a campaign in Finland came to an end. So flank protection was impossible. In spite of the risks involved, the leading detachment of Brigadier Morgan's force, having managed to get hold of a train, pushed ahead in this and arrived at Dombaas early on the morning of 19th April. Here it was soon joined by part of the rest of the force, including the two sections of 55th Field Company. The latter had of course none of its own transport or the equipment normally carried therein, and to make matters worse a lucky hit by German aircraft, which were now busily bombing Aandalsnes, had destroyed much of the engineer stores which had been landed. The headquarters of the company remained at Aandalsnes and with the M.T. drivers, who luckily had not travelled in the same ship as their vehicles, formed a railway repair gang and kept the station yard and sidings

in repair and managed to get at least one train away to the forward area each night in spite of the intense and accurate bombing. Tools had to be borrowed from the Norwegian Railways, but there was no shortage of these as most of the civilian labour disappeared. Their efforts in this work were greatly assisted by the discovery that the M.T. Sergeant of the unit proved to be an excellent platelayer foreman.

On arrival at Dombaas, contact was made with the Norwegian High Command. The Commander-in-Chief, General Ruge, supported by the British Military Attaché, pressed on Brigadier Morgan the necessity of pushing south and of relieving the elements of the Norwegian Army who, for the last two weeks, had been fighting a withdrawal action and were now exhausted. Though Brigadier Morgan's instructions were explicit that he should not advance farther south than Dombaas, the case made out by General Ruge was so strong that he decided to take the responsibility of departing from them, at the same time referring the matter to London. The Cabinet immediately endorsed his action and permitted him to move south to join the Norwegians and to assist them to hold up the enemy's advance from Oslo. This decision was of vital importance to the future course of the campaign. The forces at the disposal of General Paget, who was at that moment being appointed to command, were insufficient to hold, even with the assistance of the small Norwegian detachment, the enemy advancing from the south, and at the same time to move any troops northwards to assist General Carton de Wiart to capture Trondheim. It was doubtful, moreover, if the ports of Aandalsnes and Molde were, at the best, capable of maintaining any much larger force, and under the intense bombing the ports were now undergoing, they were stretched to their utmost in keeping Brigadier Morgan supplied.

This control of the air by the enemy was to prove a decisive factor in the campaign. All existing airfields in south and central Norway were in German hands, and efforts to provide others for the operation of British squadrons proved abortive. An attempt was made to use the surface of the frozen Lake Lesjaskog. The snow was cleared, by civilian labour under R.E. direction, from the surface which it was estimated would stand the weight of fighter aircraft for another three weeks till the spring thaw occurred. This "airfield" was ready by about 23rd April, and a squadron of eighteen Gladiator aircraft moved in. On the 25th after an early morning reconnaissance the Lake was attacked by eighty enemy bombers. In spite of the efforts

of the Gladiators, which made forty-nine sorties during the day, and the defence put up by anti-aircraft guns landed from the Fleet, thirteen Gladiators were destroyed while refuelling, and only three were got away in a serviceable condition. Assistance by aircraft flown from naval carriers was unavailing in the face of the large numbers of aircraft the enemy now put into action from a number of land airfields, and the enemy gained complete command of the air. Not only did they bomb the ports and roads and railways leading from them, but, as they had done in Poland, and in the next month they were to do in France, they co-operated closely with their troops on the ground, attacking our troops with dive bombers and machine-guns. Against such concentration of air force the few anti-aircraft guns available with the Army could make little impression.

In accordance with the decision now made, Brigadier Morgan's small force moved south and on the evening of 20th April was disposed at the southern end of the Gudbrandsdal valley astride the northern end of Lake Mjösa near Lillehammer, integrated with Norwegian troops who had arrived in the area. As we have seen, the force consisted of only two battalions of infantry of the Territorial Army, very few of even the officers and N.C.O.s of which had previously seen active service. It had no artillery support and no anti-tank guns. What transport it possessed was almost entirely civilian vehicles requisitioned in the country. Though, in view of the arctic climate to be encountered at this time of year, each man brought ashore with him three kit-bags full of warm clothing, this provision against the cold was largely abortive owing to the lack of transport or adequate rail communications. The plight of these troops in the bitterly cold conditions, and in snow frequently averaging several feet in depth, must be remembered when following their efforts to check the advance of specially trained German troops, well provided with units trained in operations on skis and snow-shoes, and supported by an overwhelming air force which, apart from direct action against the Allied forces, bases and communications, dropped parachute troops freely to seize points of vantage. On the 21st contact was first made with the advancing German forces. After air attacks in the morning enemy infantry attacked in the afternoon and succeeded in breaking through a screen of Norwegian Dragoons on the left flank. It was decided to withdraw about five miles to Faaberg during the night. The movement was delayed by the crowds of refugees and vehicles on the roads and the transport which was to ferry the troops failing to materialize. Though the pursuit

was somewhat delayed by demolitions carried out by the Fiel Company sections and Norwegians in Lillehammer, enemy armoure cars harassed the later stages of the withdrawal. As all the Britis explosives had been lost or destroyed, as already recounted, ex plosives had to be obtained for these and later demolitions from th Norwegians, though some depth charges were provided by the Navy The latter though effective were somewhat large for easy use in the field

To man the position south of Faaberg only a mixed force from tw weak battalions was available. By this time the Norwegian forces in the area were worn out and disorganized and help from them wa almost entirely limited to that of ski detachments operating to guard the flanks. Attacked in strength by German forces, the small British force had to withdraw again after a few hours' fighting, losing in doing so two companies to which the order to withdraw did not arrive. A short stand was made at Tretten on 23rd April, on which day the greater part of 15th Infantry Brigade disembarked at Aandalsnes. It was now decided between the two Brigadiers that 15th Brigade should take up a position at Kvam, about thirty miles north of Tretten, through which 148th Brigade should withdraw to rest and reform; 15th Infantry Brigade, which had nine anti-tank guns, the first to arrive with the force, had considerable difficulty in its move forward and on the morning of the 25th only one battalion, the K.O.Y.L.I., was in position at Kvam. No. 1 Section 55th Field Company (Lieutenant W. G. F. Jackson[1]) generally supported 15th Brigade after the arrival of the latter, No. 2 Section (Lieutenant H. Fitz G. Boswell[2]) normally working with 148th Brigade. On this small body of R.E., with the company headquarters at Aandalsnes and Lieut.-Colonel Turner, C.R.E., with his small headquarters, fell the whole burden of engineer work of the expedition. In the later stages Lieutenant J. M. Calvert,[3] who had arrived with the R.E. Staff of the administrative sub-area at Aandalsnes, assisted in the role of unofficial field engineer.

Luckily the Germans did not show great initiative in following up the retreat and, as they did not attack the new position till late in the day, when part of another battalion of 15th Brigade had arrived, it was possible to hold them till nightfall, by which time General Paget with the remainder of 15th Brigade had disembarked at Aandalsnes.

[1]Lieut.-Colonel W. G. F. Jackson, M.C.
[2]Lieut.-Colonel H. Fitz G. Boswell.
[3]Brigadier J. M. Calvert, D.S.O.

The situation which faced General Paget on arrival was far from encouraging. The 148th Brigade might be written off as a formation of fighting troops. Only five officers remained with the Brigade and the men were tired, cold and hungry. Little more could be expected of the Norwegian Army after a fortnight of continuous action in retreat. The disaster to the Gladiator aircraft on Lake Lesjaskog had occurred that day and the force had to rely for air cover on what assistance aircraft from fleet carriers could afford. True, Blenheim aircraft had been promised for the 27th, but it was extremely unlikely that a landing ground could be found for them. With complete control of the air the Germans attacked the forward troops with impunity, the base at Aandalsnes and Molde, and the road and railway which served as the single line of communication of the force. On the 24th alone, the railway had been cut by bombing five times, and it was only due to the efforts of 55th Field Company, in conjunction with a few Norwegian railway men who remained at work, that any trains got through. It was clear that the Kvam position could not be held for more than another day as it would be impossible to get the remainder of 15th Brigade forward in time. General Paget decided that he would make a further effort to hold the enemy at Otta, the last readily defensible position south of Dombaas. The possession of the latter junction was vital for, once occupied by the enemy, the latter would have free access to Trondheim and all chance for a combined operation for its capture by "Maurice Force" and "Sickle Force" would be eliminated. At the same time General Paget reported on the situation to London and stressed the necessity of air support and of the immediate dispatch of reinforcements headed by 147th Infantry Brigade which had been intended for the now cancelled "Hammer Force" attack on Trondheim. Finally he pointed out that the possibility of evacuation must be considered and preparations made.

All through the 26th, the K.O.Y.L.I. at Kvam stood at bay, but at 5 p.m. General Paget, seeing the position could not be held much longer, ordered a retreat at nightfall. Luckily the German commander apparently did not favour night operations, and with the exception of one company which did not receive the order, the little force withdrew, 55th Field Company carrying out the usual demolitions, the sites of which were selected in advance by the C.R.E. and calculated to slow up the movement of enemy tanks and guns. In covering the withdrawal to Otta another (Y. & L.) battalion of the Brigade suffered heavily, and so the brunt of the occupation of the

position at Otta fell on one (Green Howards) battalion. But, befor any action developed there, news was received of the decision of th Cabinet to withdraw all troops from southern and central Norway Such a course had been recommended independently of General Page and General Carton de Wiart and backed by General Massy in London

All through 28th April, the position at Otta was held agains repeated German attacks and by nightfall the enemy attacks wer spent. Shortly afterwards the defenders were withdrawn to Dombaas the R.E. blowing up the important bridge over the Rosti Gorge an thus preventing the forward movement of enemy heavy weapons an transport for forty-eight hours. The movement was little interfere with by enemy bombing, as the full weight of the German air effor was directed against Aandalsnes which, with most of the supplie and stores which had been landed, was completely destroyed i spite of the efforts of a naval anti-aircraft ship and fighter aircraf from carriers. Though resenting strongly the decision to evacuat the British troops, General Ruge undertook to cover the withdrawa and evacuation as far as possible with Norwegian troops. On 30t April, an enemy attack on Dombaas was successfully repulsed wit the help of a Norwegian battery, the first artillery to be used i support of the many actions fought during the short campaign, an 2,600 troops of 148th Brigade and base details were evacuated durin the night. The train carrying the defenders of Dombaas was wrecke in a bomb crater and the troops had to move on foot to the shelte of a tunnel at Verna where they remained hidden during 1st May That night another train carried the remains of the force to Aandals nes where they were embarked on H.M. ships, the last to leave being the rear party of 55th Field Company which, having destroyed al the guns and completed demolitions in the port, embarked i H.M.S. *Auckland* and were at sea shortly after midnight.

Namsos

The story of events at Namsos follows much the same lines as tha just related as regards the expedition to Aandalsnes. In the original plan it was intended to use 148th Infantry Brigade for the landing, but in the changes of plan which preceded all the expeditions it was diverted to Aandalsnes, and 146th Infantry Brigade, originally destined for Narvik, was allotted to General Carton de Wiart's force. This change was made indeed so late that, when the brigade landed, its Commander was on his way in another ship to Narvik

and did not arrive till after his leading troops were ashore. The brigade was to be followed either by three battalions of French Chasseurs Alpins, or by 147th Infantry Brigade with ancillary troops. A further brigade, intended for France, might also be diverted and follow. With 146th Brigade sailed No. 3 Section 55th Field Company (Lieutenant R. D. Macleod[1]), which had been intended to form part of "Hammer Force" in the seaborne direct assault on Trondheim, and this remained the only engineer unit of the force. A small advanced party and General Carton de Wiart arrived at Namsos on 14th April, while the rest of "Maurice Force", as it was called, was still at sea. Owing to the length and narrowness of Namsos Fjord and the prevalence of enemy air action the General decided that the main convoy should be diverted to Lillesjona, a hundred miles to the north, where the troops and stores would be transhipped to destroyers. Here it arrived early on the morning of 16th April to be attacked immediately by enemy aircraft. Luckily no damage was done but, to avoid further risk, five destroyers sailed immediately with what troops could be got on board, including the R.E. detachment, and arrived safely at Namsos the same evening, but it was possible only to unload part of the stores as the destroyers had to be clear by dawn.

General Carton de Wiart, realizing that speed of action was essential if the plan for the capture of Trondheim was to be successful, decided to push on as rapidly as possible though there were two feet of snow and no M.T. had arrived for the force. Two routes to the south were open, and he chose the more direct route, which was also the better road, through Beitstad, but realized that it might be necessary also to develop the longer route farther to the east in case enemy bombing might close the former. The two routes converged just north of Steinkjer which lay on an isthmus between the upper end of Trondheim Fjord and a chain of lakes stretching to the east. South of Steinkjer the main road to Trondheim ran for most of its length along the eastern shores of Trondheim Fjord and whichever navy controlled the fjord could land parties at intervals along the road. Recognizing the importance of early occupation of Steinkjer and of picketing the road beyond, General Carton de Wiart dispatched by train on the evening of their arrival two battalions and the R.E. Section, one battalion to occupy Steinkjer and the other with the R.E. to take up positions in the villages to the south as far as an important bridge at Verdalsora, twenty miles farther

[1]Major R. D. Macleod, M.C.

on, now held by a Norwegian detachment. The third battalion of the Brigade was concentrated in reserve. Strict orders were given as to concealment and wireless silence imposed and these measures were successful in causing the German troops to advance with the utmost caution. The evening after these moves had been carried out (19th April), the demi-brigade of three battalions of Chasseurs Alpins disembarked. Unfortunately its baggage was seen from the air next morning and in consequence the town and docks were heavily bombed all day and practically destroyed. The force was therefore in much the same plight as "Sickle Force" at Aandalsnes with no reply to the enemy's domination of the air, their base almost useless, and no heavy supporting weapons.

On 20th April, the leading troops with a detachment of R.E. were in contact with enemy patrols at Verdalsora where the Sappers were examining the railway bridge, which had been destroyed by the Norwegians, with a view to its repair in case of a further advance, or its more complete destruction with that of the road bridge if it was necessary to deny passage to the enemy. That evening in view of the presence of German naval craft in the fjord, from which landings could be made in rear of the advanced detachments and which could not be dealt with in view of the absence of any form of artillery, Brigadier Phillips decided to withdraw his advanced detachments to the neighbourhood of Vist and Steinkjer, leaving only a detachment of eighty Norwegians armed with heavy machine-guns and the R.E. detachment to hold the bridges at Verdalsora. The R.E. could do little to deny the bridges to the enemy as no explosives were available and it was possible only to barricade the roadway and erect wire on the bridges. The R.E. detachment then took up a defensive position in conjunction with the Norwegians. At 6 a.m. on the 21st, the Germans attacked the troops holding the bridges but were held off by fire till it was learnt that the enemy were also landing troops from craft in the fjord some miles in the rear. The Norwegian Commander decided to withdraw and the R.E. party rejoined the brigade in the Steinkjer area, having to move by a roundabout route to the east owing to the cutting of the main road by the landing party of Germans.

A battalion (K.O.Y.L.I.) was in the area about Vist holding the neck of the isthmus leading west to the Inderroy peninsula where other detachments of the enemy had landed, the other two battalions being respectively between Vist and Steinkjer (Lincolns) and about Hjelle (Hallamshire), with the French in reserve farther north.

Owing to the German threats from the fjord the advanced troops had early to withdraw to Steinkjer which was destroyed during the day by bombing enemy aircraft. Due to this bombing most of the stores which had been got forward to the town were lost, but a considerable portion of the rations were saved through the action of Major A. S. T. Godfrey, R.E.,[1] who with the help of some members of the Brigade staff got a train of four loaded wagons safely away across the railway bridge which was burning furiously.

Owing to German infiltration from the fjord on the west and by ski-troops on the east, after a gallant defence the positions, first at Vist and then at Steinkjer, had in turn to be abandoned, the troops which had held the eastern portion of the positions having to retreat by side roads through a blizzard and having great difficulty in rejoining the rest of the brigade. In the retreat of these eastern detachments a demolition party R.E. was left to blow up the bridge at Sunnan on the 24th, but did not carry out the demolition at the insistence of the Norwegian troops who were remaining in the neighbourhood, an act which gravely imperilled the retreat of the British troops. This is but one more example of the difficulties which may arise in connexion with demolitions, especially when more than one allied army is operating in the same area. Though the casualties were not heavy, many of the troops which had held forward positions were much exhausted by continuous movement through deep snow, and much of their heavier equipment had been lost in addition to the stores destroyed by bombing in Steinkjer. As early as 22nd April General Carton de Wiart had felt bound to draw the attention of the British Government to the possibility of an evacuation of the force being necessary and to ask that provisional arrangements should be made for the dispatch of the necessary ships.

On the 27th, General Carton de Wiart was informed of the Cabinet decision to evacuate all the troops in Central Norway, and that as far as the troops at Namsos were concerned, embarkation should take place on the night of 1st–2nd May concurrently with that of "Sickle Force" from Aandalsnes. After the action at Vist and Steinkjer the Germans, having achieved their object of stopping an advance from the north on Trondheim, adopted a comparatively defensive attitude. This enabled the force to concentrate to the rear, the most tired troops being pulled out first to rest and to reform. Owing to the number of men to be evacuated, the destruction at

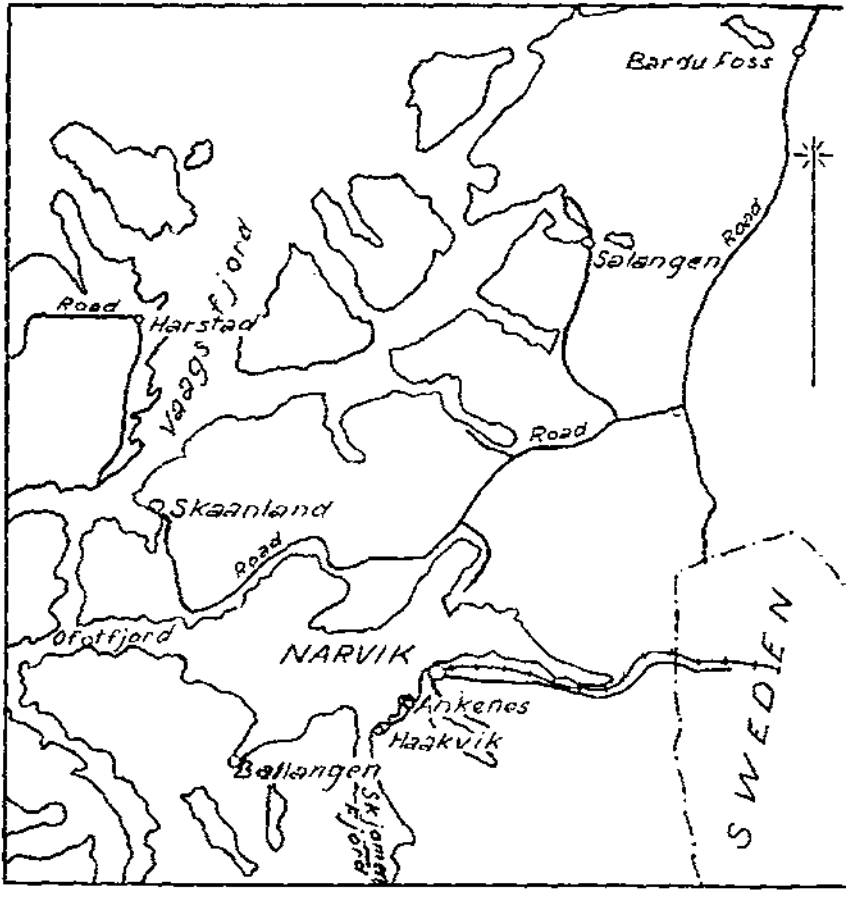
[1]Lieut.-Colonel A. S. T. Godfrey, killed in action, 1942.

Map !

ENVIRONS OF NARVIK

Scale

Metres 10 0 10 20 Metres



Namsos due to enemy bombing, and the shortness of the northern night, it was planned to use two nights for the operation; the French troops to go the first (1st–2nd) night, and the British on the second. A dense fog in the fjord, however, prevented all but a few Chasseurs Alpins embarking on the first night. Luckily the next night was clear and the evacuation of the whole force was completed by 4.30 a.m. on the 3rd: as at Aandalsnes a R.E. detachment remained to the last to carry out some demolitions, including a large bridge at Bangsund across the fjord to the south of Namsos.

NARVIK

The expedition to Narvik in many ways started under better auspices than those to Aandalsnes and Namsos. There was one definite objective: the seizure of the iron ore port at that place, and this remained constant throughout. The objective was further removed from the main German landings in southern Norway, and was not so easily covered by enemy air forces operating from the main airfields in the south. Finally before the expedition sailed the Royal Navy had, on 10th April, gained a major success in the waters neighbouring Narvik when Captain Warburton-Lee with five destroyers sailed into Narvik Fjord and sank, or put out of action, seven enemy destroyers and several supply ships including a ship carrying all the reserve ammunition for the German warships at Narvik which was set on fire and blew up. The few enemy craft which remained seaworthy were unable to leave the area, and for want of ammunition were of little use in defending the approaches to the town.

The British force was, however, as at the other points of invasion, handicapped by changes of plan and uncertain direction. Originally, it had been intended that a force of the strength of one division (49th Division including 24th Guards Brigade) should occupy Narvik if such a course was agreed to by the Norwegian Government. Being forestalled by the action of the enemy, as we have seen, the whole plan for the expeditions to Norway was changed. The 146th Brigade of the Division was diverted to the southern attack and it was now proposed to back up the emasculated 49th Division with French Chasseurs Alpins and Polish troops. Major-General Mackesy, who was in command of what was now to be known as "Rupert Force", was ordered to establish his base at Harstad on an island thirty-five miles from Narvik and separated from that town by two fjords. In

his instructions no clear mention was made of Narvik as his objective, and he was ordered not to attempt to land in face of opposition. At the same time a personal letter to him from the C.I.G.S. instructed him to take advantage of any naval success and to act with boldness. The Commander of the accompanying fleet, Admiral Lord Cork and Orrery, on the other hand states in his report on the operations that his impression was that "It was desired by H.M. Government to turn the enemy out of Narvik at the earliest possible moment and that I was to act with all promptitude in order to attain this result." These divergencies in instructions to the Commanders on the spot, coupled with the fact that the latter did not meet till after their arrival in the neighbourhood of Narvik, must be borne in mind when following the course of operations.

On 12th April, General Mackesy with his force, at that date in the main consisting of 24th Guards and 146th Infantry Brigades, sailed from Gourock. The Engineer contingent, though as usual inadequate for prospective tasks, showed that some consideration had been given to what might be expected of it. Under the direction of a Chief Engineer, Brigadier R. S. G. Stokes, were the Divisional Engineers of 49th Division, less one field company which had gone to France with the B.E.F. (C.R.E. Lieut.-Colonel F. L. Colley. 229th and 230th Field and 231st Field Park Companies), a Works Staff, and an Airfield Construction Staff (Lieut.-Colonel E. N. Clifton[1]). Transportation was represented in the original force by a D.A.D.Tn. with a docks section and a movement control detachment. The latter were followed a week later by the advanced party of a docks group headquarters, a second docks section and a company of a stevedore battalion. Owing to a misunderstanding all this reinforcement was immediately shipped back again to the United Kingdom without the knowledge of the D.A.D.Tn., who however managed to get the stevedore company out again some three weeks later, with a railway construction company.

Advanced Headquarters, with two companies Scots Guards, went ahead of the main convoy in the cruiser H.M.S. *Southampton* to gain touch with the Norwegian troops in the area and to reconnoitre for the initial landing. In the face of the Germans, who had seized Narvik on 9th April, the bulk of the still unmobilized Norwegian troops had retired north-west towards Bardu Foss. In view of this, and of what was known of the German dispositions, the *Southampton* made for Salangen some thirty miles from Narvik, and within touch

[1]Brigadier E. N. Clifton, C.B.E.

with the Norwegian Commander. Meanwhile the main body headed for Harstad where the base was to be established.

On 13th April, while the convoys were still at sea, in accordance with the aggressive instructions given to Lord Cork, a fleet of nine destroyers backed by the battleship H.M.S. *Warspite* flying the flag of Vice-Admiral Whitworth, sailed up Narvik Fjord and attacked the remains of the German flotilla. By evening, without the loss of one of His Majesty's ships, all the German destroyers and a submarine had been eliminated. The German troops in Narvik were panic-stricken and streamed away eastwards heading for the Swedish frontier. Unfortunately there were no British troops at hand to follow up the naval success. When next morning, Lord Cork suggested the diversion of H.M.S. *Southampton* with the two companies of Scots Guards from Salangen, the troops and their stores had already been landed there and General Mackesy did not consider it feasible to re-embark them and get them through the hundred miles or so of fjord to Narvik. He did, however, propose the diversion of part of the main convoy now approaching Harstad. But this had already been largely reduced by the diversion to Namsos of the ship carrying 146th Infantry Brigade, and General Mackesy soon learnt that the Germans, recovering from their panic departure, were streaming back into Narvik and taking up positions covering the suitable landing places. With his force reduced to 24th Guards Brigade, till the promised French and Polish reinforcements should arrive, and his orders not to attempt a landing in face of opposition, General Mackesy decided, having already secured a foothold on the mainland at Salangen and gained touch there with the Norwegian troops, to stick to the original plan and to establish a base at Harstad and from there to maintain an overland advance on Narvik from Salangen and the neighbouring fjord at Lavangen. After personal reconnaissance he decided that, without the assistance of the ski-trained troops of the Chasseurs Alpins, and with no proper landing craft, a direct assault on Narvik, the garrison of which had now been reinforced by airborne artillery and the guns of the destroyers put out of action on the 13th, was too hazardous. He had no field or anti-aircraft artillery and there were no fighter aircraft to cover his operations. Harstad was far from being suitable for the site of the base for a force of the size which it was then planned should be under General Mackesy's command. It was a small town of about 4,000 inhabitants with few industrial buildings. It possessed only one small stone quay, no railway and few roads. It was, moreover, on an island

separated by a fjord from the mainland on which there were few other ports nearer than Narvik, some seventy miles away by sea. Communication with other points at which troops might be required to land could only be maintained by small coastal and fishing steamers which must be obtained from the Norwegians.

While a plan for concerted future operations was being discussed, the weather broke and for a week there was heavy and continuous snow, which prevented all movement, but the bulk of 24th Guards Brigade had been transferred across the Vaagsfjord to Skaanland, which lay on a long isthmus of the mainland running along the northern shores of the Ofotfjord which led to Narvik. With an improvement in the weather during the 26th and the 27th a battalion (S.W.B.) was ferried across to the southern shore of the Ofotfjord to Ballangen and thence advanced towards Narvik over the Skjomen Fjord to Haakvik on the Ankenes peninsula.

Meanwhile the R.E. had remained for the most part at Harstad doing little of importance. An officer of one of the field companies in a letter giving his experience at this period wrote: "Our employment at Harstad consisted mainly in examining and counting our equipment, carrying it down to the shore for hypothetical operations, carrying it back to our billets, recounting and checking, carrying it back again to the shore for further hypothetical operations, and yet another carry back to our billets, and so on *ad nauseam*. We also constructed slit trenches against air attacks. . . ." The only useful thing that was done during this period was the reconnaissance of all bridges on the major route to Narvik. The report, which was sent to the C.R.E. with a copy to "G", indicated that none of them should take more than two tons. The next thing that happened some weeks later was an urgent message from Force Headquarters inquiring why a French 7½-ton tank had broken one of the bridges and fallen into the gap.

But life for the Sappers was not to remain uneventful for long. On 27th April the whole situation altered. On that day a demi-brigade of three battalions of Chasseurs Alpins disembarked. This reinforcement about doubled the fighting strength of the Force, but unfortunately, instead of being fully trained and equipped for arctic warfare, only seventy men per battalion were trained skiers. But more important still, on that day the Cabinet decision was made to evacuate all our forces from Aandalsnes and Namsos. This meant that Narvik would be the only theatre of operations in Norway and that therefore it might be expected that a steady flow of rein-

forcements and equipment would begin shortly. At the same time it followed that in future the Allied force at Narvik would not only have to deal with the German forces already in the area, but that steps must be taken to meet enemy troops advancing up the coast from Namsos. To delay such an advance it had been proposed to General Carton de Wiart that he should leave a detachment behind when he embarked at Namsos, which would fall back as slowly as possible northwards. General Carton de Wiart reported that such a course, in the state of his force, was not feasible, and the Cabinet, in accepting his view, ordered General Mackesy to detach part of his force southwards to delay the enemy as much as possible. Accordingly on 1st May, a company of Scots Guards, followed two days later by a hundred Chasseurs Alpins and a section of A.A. guns, was landed at Bodo, some hundred miles south of Narvik and where the main road from the south came to an end. To assist further in the task of delaying the enemy, four of the new Independent Companies were landed at various points to the south of Bodo. These Independent Companies, which were the fore-runners of the Commandos so much used for similar operations later in the war, had been specially formed and trained for guerrilla tactics against the Germans in Scandinavia. They were equipped with arctic clothing and snow-shoes, and being ship based had no transport. On 10th May, the foremost of the Independent Companies encountered the enemy just south of Mosjoen but, being outflanked, had to abandon the port.

General Mackesy decided to use the whole of 24th Guards Brigade with this delaying force, now known as "Scissors Force", and, as a start, another company of Scots Guards with A.A. guns and the O.C. (Major R. K. Millar[1]) and one section of 230th Field Company sailed for Mo, where it arrived two days later. The rest of the brigade (less South Wales Borderers) with Headquarters and another section of 230th Field Company (the third section was detached at Narvik with the Chasseurs Alpins) followed, sailing from Harstad on 14th May. Unfortunately the convoy was attacked from the air and a large transport carrying the R.E. and the Irish Guards received a direct hit which killed the C.O. and several officers of the Irish Guards. Fire broke out amidships and most of the men were isolated in the forepart from which it was not possible to lower the boats. The pile of ammunition on deck caught fire and there was imminent danger of an explosion. The troops however formed up

[1]Colonel R. K. Millar, D.S.O.

on deck with arms and kit and stood steady as on parade, while parties searched for injured in the blazing wreckage. Thanks to this discipline it was possible to transfer 694 men, the large majority of those on board, in sixteen minutes to an escorting destroyer, the Captain of the latter afterwards describing the conduct of the troops as reminiscent of that in the wreck of the *Birkenhead.* The destroyer returned to Harstad where the troops were landed to refit. A second attempt to reinforce "Scissors Force", in which no engineer units were concerned, met with similar disaster. Eventually the two remaining battalions of 24th Brigade reached Bodo on 20th and 21st May, but the O.C. and the one section of 230th Field Company provided the sole engineer element in the force.

On arrival at Mo on 12th May, the infantry and artillery of the advanced detachment, which had safely arrived, immediately took up tactical positions, leaving the R.E. to unload the ship. This proved a slow matter, for the Norwegian pilot in coming in had rammed and carried away half the pier, and was rendered no more pleasant by the constant attention of enemy dive bombers. Thanks to the work of the section, its commander, Lieutenant L. M. Ward-Walters[1], himself working the ship's steam winches, when the escorting destroyers signalled that they and the ship could remain no longer, practically all the stores and ammunition had been got ashore. Unloading completed, the section joined the rest of the force which had taken up a position south of Mo. This it helped to strengthen by demolitions and craters. The position was attacked by the Germans on 18th May, their advance from Mosjoen having been delayed for a week by the efforts of British detachments to the south. Owing to the strength of the enemy and their power of manoeuvre due to their use of ski-troops and parachutists, Brigadier Gubbins, who had succeeded Brigadier Fraser in command of the brigade when the latter was wounded, decided that it was impossible with the troops available to offer determined resistance, and fell back on a number of successively prepared positions in the 150 miles which separated Mo from Bodo. During the withdrawal the R.E. section destroyed thirty-two bridges and a number of jetties. It had to carry out the retreat and its work largely on its own feet, being equipped with only one compressor truck and one 15-cwt. lorry for the carriage of stores. For a time it had the use of an impressed thirty-seater bus until this was destroyed in an air attack. By the time the withdrawing troops had reached the position south of Bodo on 25th May, the

[1]Captain L. M. Ward-Walters.

Irish Guards had at last arrived and, thus reinforced, a determined stand was put up for two days at the end of which the German enveloping attacks by ski-troops and domination of the air made further resistance on this line hazardous. On the 26th Brigadier Gubbins was informed by Force Headquarters of the decision to evacuate the whole of Norway. He accordingly, during the last phases of the action, gradually withdrew his forces to the northern shores of the Saltdal inlet fifteen miles in rear. The enemy seemed determined that the evacuation of Brigadier Gubbins' force should not proceed so unmolested as that of the troops at Namsos and Aandalsnes, and on 27th May, in spite of the efforts of two Gladiator aircraft operating from Bodo airfield, completely destroyed the town and port of Bodo by an intense air attack. The force, however, moving westwards along the northern shore of the inlet, the R.E. section carrying out some useful demolitions to delay the enemy, embarked in H.M. ships during the next three nights and on the evening of 31st May the rearguard was successfully evacuated. "Scissors Force" had kept the field for a month and in a fighting retreat of 200 miles had gained time for the main body to achieve its original object, the capture of Narvik, the story of which now remains to be told. In this retreat the single section of Royal Engineers in spite of its small numbers and shortness of equipment and transport had gallantly carried out all that was required of it. That this was done by a unit whose peace time training was of the scantiest, and with which the only man with war experience was an attached R.S.M., reflects the greatest credit on the spirit of the men and the leadership of the officers.

The situation at Narvik, as last described on 27th April, was that one battalion (S.W.B.) lay on the Ankenes peninsula facing Narvik across a fjord to the south-west of the town; two companies (Scots Guards) on the mainland at Salangen in touch with the Norwegian forces based on Bardu Foss, and the Chasseurs Alpins about Skaanland. The 229th Field Company and the detachment of 231st Field Park Company had remained largely inactive at Harstad, where they were joined after the sinking of its transport by part of 239th Field Company. In view of the decision to evacuate central Norway, at the beginning of May, the Cabinet pressed for an early assault on Narvik, and plans and preparations for this were pushed forward. It was, however, important that, in face of the enemy air strength, the operation should be covered by fighter aircraft, but the thaw had only just started and no suitable airfield was ready for their operation.

The necessary preparations called for great activity on the part of the available engineers, particularly 229th Field Company. Unfortunately the requirements were so diverse that there was considerable dispersion of effort. Further, security precautions were carried to such extremes that the company commanders were not informed in advance of what was required in each case. As a company commander reports, "Soldiers, in various sized packets, were sent off to unknown destinations in Norway to carry out (as far as I was concerned) totally unknown tasks." Eventually when only one section of 229th Company remained in hand it was ordered to proceed to Skaanland to set up an advanced base, the Company Commander, Major H. I. Pocock,[1] being made responsible for finding out the requirements of the various services. On arrival at Skaanland it was found that the work required was not the construction of an advanced base but of an airfield. The site for this had been selected in co-operation with the R.A.F. and the Norwegian Air Force by Lieut.-Colonel Clifton, C.R.E. Airfields. Owing to the deep snow accurate reconnaissance was difficult and Lieut.-Colonel Clifton was not altogether happy about it, for there were signs of open drainage ditches across it. However, as the site was at least level, in the absence of local information of any other suitable site, except that at Bardu Foss, on which work had already started and of which more anon, it was decided to make the best of it. Major Pocock with the section of his company was put in charge of the work and 2,000 Norwegian civilian workmen were enlisted. After a fortnight's work No. 1 Mechanical Section R.E. with a small amount of plant arrived. The chief task was the clearance of snow by hand and carrying it clear of the runway on stretchers and sledges. Under the snow was found peat on blue clay and, though drainage was put in, Major Pocock was not satisfied and asked that before the airfield was taken into use it should be tested by landing a Gladiator on it. The aircraft narrowly escaped disaster. A R.A.F. senior officer then ordered, against the advice of the R.E. officers on the spot, that the runway should be covered with coir matting with chain linked netting on top. C.R.E. Airfields considered that the coir matting would prevent the surface drying out, and that the iron pickets would not hold in the boggy soil. He again asked when the work was finished that it should be tested, but a squadron of fighter aircraft was ordered to fly in from a carrier. The first four or five to land sank in the soft ground till their wheel fairings caught in the wire mesh and they

[1]Lieut.-Colonel H. I. Pocock.

upturned. The remainder were diverted to Bardu Foss which they just reached before their petrol gave out. The matting and netting were immediately removed and in sunny dry weather the runway was soon fit for use, but only shortly before evacuation was ordered.

The airfield at Bardu Foss, which was the most promising on initial reconnaissance, was a small existing Norwegian field which required snow clearance and extension through forest country. It was constructed by civilian labour under the direction of an officer of the Staff of C.R.E. Airfields and was the first completed and the most satisfactory of all made in Norway. This airfield, and two others on which work was started, could not be cleared of snow and completed in time for an assault on Narvik staged for 8th May, and the more deliberate plan of an advance by Chasseurs Alpins in conjunction with Norwegians from Salangen in the north-east was adopted. Welcome reinforcements of two battalions of French Foreign Legion and a brigade of Poles arrived between 6th and 9th May. Then on 13th May, the status of the force was raised, Lieut.-General C. Auchinleck[1] arriving as G.O.C. North-West Expeditionary Force with command over the Allied land forces and the air component. Brigadier H. G. Pyne[2] accompanied him as Chief Engineer. On the same day, after a naval bombardment, French and Polish troops landed north-east of Narvik and by evening were facing the town on that side across a narrow strip of water. General Auchinleck having reviewed the situation, reported to the Government that to carry out the task assigned to him he would require certain reinforcements, particularly in aircraft and anti-aircraft artillery. Owing to the serious situation in France, where the enemy had at this time cut the Allied forces in two, the Cabinet were not able to meet the demands, and General Auchinleck was therefore forced to plan what he could towards at least the capture of Narvik with the forces at his disposal.

The supply of the various detachments scattered over several hundred miles of coast indented with straggling fjords presented from the beginning a major problem. The only railway was that from Narvik to the Swedish frontier and, this apart from being in the hands of the enemy, was of no value for present operations. Roads were few, poor, and at this time mostly deep in snow. The base at Harstad was on an island. Maintenance of the force therefore depended on water transport. For this purpose a number of steam driven local fishing craft, known as "puffers", had been

[1]Field-Marshal Sir C. Auchinleck, G.C.B., etc.
[2]Brigadier H. G. Pyne, C.B., M.C., died, 1945.

impressed. In default of an army I.W.T. organization the Royal Navy had taken charge. They had however not nearly enough staff to cope with the numbers of craft working to as many as eighteen points of unloading. On the arrival of General Auchinleck's enlarged force headquarters, including an A.D.Tn., out of 126 craft engaged the position of only thirty-eight was known. The rest were lost, and as they had been loaded with large quantities of valuable stores, the situation was serious. At the suggestion of A.D.Tn., Movement Control took charge of the organization and two officers and a hundred men of the railway construction and operating company which had by then arrived were lent to assist. Within a week eighty craft, each with a Sapper aboard, were under control and carrying goods to required destinations. By the time of the eventual evacuation thirteen officers and 260 men of the Royal Engineers were operating a fleet of 140 craft, without which it would have been virtually impossible to maintain the various elements of the force.

In spite of the fact that, on 25th May, orders were received for the evacuation of all troops from Norway, on the night of 27th–28th General Auchinleck launched an attack on Narvik. Under cover of a heavy naval bombardment French and Norwegian troops from the north and a Polish Brigade from the south attacked across the fjords separating them from the town, and, though the Germans fought back fiercely, by next evening the town was clear of the enemy. One of the first British officers to enter was the second-in-command of 230th Field Company, Captain R. L. France,[1] who disconnected many demolition charges and booby traps on the quay. But elsewhere in the port the Germans before withdrawing carried out complete devastation. The whole of the port installations and those of the Swedish Iron Ore Company were wrecked to an extent that it is unlikely our troops would have been able to achieve when it came to their turn to withdraw. They thus completed for us one of the prime objects of the operations. From information received later it appears that no ore could be shipped from the port for over six months, and even by mid 1943 the output from the port was only just a quarter of the pre-war shipment.

The German force retreated up the railway towards the Swedish frontier and, though our Allies were anxious to pursue them and either mop them up or drive them into internment in Sweden, the situation in France was such that it was of vital importance to extricate at the earliest possible moment every soldier and piece of

[1]Lieut.-Colonel R. L. France, M.C.

equipment possible. Evacuation started on the night of 3rd June, when the last troops had left Dunkirk and, aided by unsuitable flying weather, the Royal Navy continued to embark all the 25,000 personnel and the majority of the equipment during the succeeding five days and nights, the last ship leaving on the morning of 8th June. On the night before their departure the field companies were ordered to destroy their equipment, the order being cancelled half an hour later by a telephone message transmitted over the public telephone by a voice from the C.E.'s Headquarters speaking in Urdu.

The lack of clear direction involving continuous alteration of plans throughout the campaign is reflected clearly in the experience of the R.E. units engaged. *Ad hoc* decisions led to dispersion of effort and to a lack of preparation for the tasks undertaken. In spite of this the various small parties of R.E. succeeded in carrying out a multiplicity of jobs of vital importance to the various detachments of the force they served.

CHAPTER IV

RAIDS

Destructions of oil installations in N.W. Europe, May and June, 1940—Apulian Aqueduct north of Taranto, February, 1941—Spitzbergen—Bruneval—St. Nazaire—Vermork, November, 1942—Dieppe, August, 1942—Greece, 1942–3.

FROM an early stage of the war raids were carried out from the United Kingdom against objectives in enemy hands, or in danger of falling into his power. Depending on the nature of the objective and the circumstances of the particular case the raids were carried out by large or small bodies, and were transported to their destination by sea or air. In many of these personnel of the Royal Engineers, or of their sister Corps of the Commonwealth, took part either as individuals or in bodies of suitable size. It is not intended in these pages to record the doings of individuals except where they were specially selected on account of their training in Engineer duties. Further for convenience the accounts have been collected here in one chapter and recorded in chronological order, though on many occasions the raids were carried out in connexion with more extensive operations which find their place in the records of events in the various theatres.

DESTRUCTIONS OF OIL INSTALLATIONS IN N.W. EUROPE, MAY AND JUNE, 1940

In the strategic planning before the outbreak of war it had been appreciated that one of the weak points of Germany's war economy was the maintenance of supplies of oil. For this reason plans were made to deny to the enemy any oil installations and stocks which might fall into his hands. Accordingly, in September, 1939, the R.E. of 12th Division (T.A.) were ordered to be prepared to proceed to Holland, Belgium and France to destroy large scale installations for the storage of oil and petrol, especially those at the ports. The duty was transferred to Kent Fortress R.E. in April, 1940, and that unit immediately went into training for the purpose.

Combined with the operations of the Kent Fortress R.E. against oil installations, attacks were to be carried out by the Royal Navy

against port facilities in the same areas. In general, the R.E. parties would be carried in naval ships and would be under the over all command of the Naval officers in charge of the operations at each port. Owing to the neutrality of Holland and Belgium no reconnaissance was possible in those countries before the German invasions on 10th May, 1940. Planning had, therefore, to be made on what information there existed in the United Kingdom.

Holland and Belgium

On 10th May, 1940, three parties, each of approximately forty other ranks under an officer, sailed in destroyers for Dutch and Belgium ports, Amsterdam, Rotterdam and Antwerp. The destroyer crews were also to provide detachments to attack port facilities.

Amsterdam

At dawn on 11th May, after an adventurous journey during which the destroyer was hit by a German dive bomber suffering some damage and some casualties to the crew, the parties of Kent Fortress R.E. under Captain R. Keeble,[1] and Royal Navy were put ashore at Ymuiden, twenty miles from Amsterdam. The R.E. party with a naval covering party, after the local authorities had been contacted, went on by train to Amsterdam. It was, however, not till next afternoon that permission could be obtained from the Dutch Naval authorities for the party to go with their gear and explosives to the oil depots but not to take any action, other than reconnaissance, for the demolition of the oil tanks. During the next few days the situation became very confused. Fighting broke out in the city between Dutch troops and Nazi sympathizers who had been joined and organized by Germans dropped by parachute. Bombing became more constant and then, about the 16th, German parachute troops in large numbers began to be dropped. These seized centres of importance including the telephone exchange. No orders could be obtained from the Dutch authorities.

On the 17th, Captain Keeble decided he must act and sent out three parties to the various depots to start work. Holes were blown with explosives in the tanks, about 130 in all, and then, when a sufficient quantity of oil and petrol had escaped into the surrounding bunds, the whole was set alight. In due course the tanks blew up. The job was done.

The intention was that the party should return to Ymuiden by launch but, hearing that the river had been mined, some lorries

[1]Major R. Keeble, D.S.O., M.C., T.D.

were obtained from the Dutch army by which the trip to the port was made. Here the R.E. helped the naval demolition party in the last stages of the destruction of the port installations, dock gates, cranes, etc. under intermittent bombing. That evening all was finished, and the combined parties sailed in a tug and tramp steamer, transferring to a British destroyer in which they reached England in safety.

Rotterdam

A similar party, the R.E. under Captain T. F. Goodwin,[1] went at the same time by destroyer to Rotterdam. Here, although it meant that the work had to be done without previous reconnaissance, the tanks were fired on 13th May. In most cases the tanks were punctured by fire from anti-tank rifles, but the consequent flow of oil being too slow, valves were knocked off or forced open. During the operation the parties witnessed, from the far side of the River Lek on which the oil installations were situated, the complete and systematic destruction by the German air force of the whole of the centre of Rotterdam, a sight which, it can be imagined, lent urgency to the work. Before leaving, the party loaded on to their ship about eight million pounds worth of gold bullion, the property of the Dutch Government, which was brought back safely to England.

Antwerp

Owing to the more prolonged resistance of the Belgian forces, the party, under 2nd Lieutenant W. H. Wells,[2] which went to Antwerp had an easier task which it completed satisfactorily. The total amount of petrol and oil destroyed or spoilt by these three parties amounted to a total of about 200 million gallons.

French Channel Ports

When the situation became serious in France, other parties of Kent Fortress R.E. were sent to destroy the oil installations at the Channel ports, Dunkirk, Calais and Boulogne. Sometimes they found, at this late stage, little to do as most of the tanks had already been destroyed by enemy bombing or even shell-fire. The party for Dunkirk, under Captain H. C. West,[3] arrived under naval command in a destroyer in the middle of a bombing raid, but got ashore and to the oil tanks safely. The destroyer had to depart immediately, leaving sailors and R.E. to get away as best they could after com-

[1]Major T. F. Goodwin, D.S.O.
[2]Captain W. H. Wells.
[3]Brigadier H. C. West, C.B.E.

pleting their task. The situation, as described by Captain West, was somewhat ludicrous. "We were busy destroying the oil stocks to prevent the Germans getting them; the Germans were bombing them to prevent the French and ourselves getting them; and the French fire brigades were trying to put out the fires started by the German bombs." For the "get-away" the Naval officer in command had earmarked a small French ship. When the time came to leave, it was found that the ship had been hit by a bomb and only its funnel and masts were above water. However, a small diesel-driven vessel was found in which the survivors of the parties returned to England.

Normandy and Brittany

At the end of May, Lieut.-Colonel C. C. H. Brazier[1] went to France with a much larger detachment to deal with oil installations on the Seine between Le Havre and Paris. Early in June, these were all destroyed, as was also a large British Army dump in the area. Two other parties proceeded to France on 16th June, one under Captain B. Buxton[2] to Brest and a smaller one, under 2nd Lieutenant B. J. Ashwell,[3] to St. Malo. The Brest party, after accomplishing its mission, had an adventurous trip back to England. The engine of their launch petered out in mid-channel and the craft drifted back to the French coast. The party was hidden by French fishermen for nearly a week on an island off the coast of Brittany. It eventually got to Falmouth, early in July, in a fishing boat.

Second Lieutenant Ashwell's party arrived in a destroyer, which also provided a naval demolition party, at St. Malo on the morning of 17th June. At first the French authorities were averse to any preparatory steps being taken, but, in spite of numerous French sentries, the officers were able to check the position of the objectives. The last of the British troops in the neighbourhood, except the demolition parties, were evacuated by sea that day, but it was not till the morning of the 18th that permission could be obtained to fix charges in position. At 1.15 p.m., on receipt of news that German troops were within fourteen miles, orders were given to commence demolition. About 2.15 p.m. all the tanks were alight and the dock gates destroyed. By 3.30 p.m. the whole party had embarked with a few stragglers in a converted life-boat and a naval launch and arrived at Jersey about midnight. Here, after distributing to farmers and others what petrol they could accept, the balance was destroyed

[1]Brigadier C. C. H. Brazier, O.B.E.
[2]Major B. Buxton, D.S.O.
[3]Lieut.-Colonel B. J. Ashwell, M.C.

or spoilt. Next morning the party returned safely to Weymouth.

The total of oil stocks of all descriptions destroyed in France, in addition to that destroyed in Holland and Belgium already noted, amounted to 400 million gallons.

Raid on Apulian Aqueduct North of Taranto, February, 1941

This raid is of special interest as it was the first operation carried out by British air-borne troops. The latter were still in the early stages of formation and training, as will be seen by reference to Chapter VIII, pages 191–194. In June, 1940, Italy entered the war. That country as a whole was not enamoured with the idea of war and militarily it was not strong. It was therefore felt that any action which might bring home to the mass of the people the vulnerability of their country might have a marked effect on their determination to continue the fight. It was therefore decided to deliver an air-borne attack on the Apulian Aqueduct near Taranto. This was believed to carry the main water supply from the well watered slopes of the Apennine Mountains to the comparatively waterless district in the heel of Italy in which lay the important naval base of Taranto, and the ports of Bari and Brindisi. Accordingly a party was formed under the command of an infantry officer, Major Pritchard, and consisting of a detachment of air-borne R.E. under Captain G. F. K. Daly,[1] and an infantry covering party. The party rehearsed for three weeks using a mock up of part of the aqueduct for practising laying the charges. At dusk on 7th February, 1941, the party set off from England in six specially prepared Whitley aircraft and landed next day at Malta. From photographs received at the last minute at Malta it was found that there were actually two aqueducts some 200 yards apart. The point selected for attack was in a valley to the south-west of Mount Vulture, a wild and desolate region. It was the intention that, after blowing up the aqueduct, the party should scatter and the members should make their way to the west coast of Italy near Salerno, where they would be picked up by a submarine on the night of D + 8, and failing that on D + 15.

On the evening of 10th February, the party took off and arrived over the target area about 9.30 p.m. The first five Whitleys located the target area accurately and the drop was fairly successful, some of the party landing within fifty yards of the objective. The sixth

[1]Captain G. F. K. Daly, M.C.

was delayed by engine trouble at the start and, losing its direction, dropped its passengers in the wrong valley, too far to take part in the operation. Unfortunately the party in this aircraft included Captain Daly and a number of the sappers of the detachment. Major Pritchard set his party to collect the equipment from the scattered containers, impressing to their assistance a number of Italian peasants who, with the usual phlegm of their kind in most parts of the world, worked peacefully for the strange invaders who had descended from the sky. Meanwhile the second-in-command of the R.E. detachment examined the piers of the aqueduct in preparation for the placing of the charges. He found that they were built of concrete, not masonry as had been supposed. Under the circumstances, as only 800 lb. of explosive had been found, he decided to concentrate the whole on the westernmost pier and the abutment. While the infantry took up covering positions the R.E. got to work and shortly after midnight Lieutenant Paterson was able to report that all was ready. The Italian peasants having been shepherded to safety, at 12.30 a.m. the charges were blown. The pier collapsed and the waterway it supported broke in two, and soon the water was flooding down the valley.

The party then made off for their rendezvous on the west coast in three groups each with an officer in charge. Though they moved by night and lay up by day, in the snow-covered mountains they were easily traced and were all rounded up. Captain Daly, hearing the explosion from the next valley, knew that the job had been done and started off westwards with his party. By the 15th, three days before the date fixed for the rendezvous with the submarine, they were about eighteen miles from the appointed spot, but short of food. They then posed as German airmen and tried to impress a car, but on being asked to show their papers their bluff was called, and they too were taken prisoner.

Though the raiders carried out the task set to them, the main object was not achieved. The water supply of Taranto did not depend entirely on the aqueduct, and the latter was repaired in two and a half days before the reserve reservoirs had been emptied. At the same time much valuable experience in the mounting of airborne operations had been gained.

Spitzbergen

In July, 1941, it was decided that it was advisable to deny the use of the Spitzbergen Islands to the enemy. These Norwegian owned

islands lay to the north of that country and within 600 miles of the North Pole. Their importance lay in the facts that they contained important coal mines, and, lying on the flank of the northern route from the Atlantic to Russia, in enemy hands they would form a threat to the passage of supplies from the United Kingdom and America to Russia. Conversely in possession of the Allies, they would afford a base for the protection of the convoys.

The first intention was to occupy the principal islands during the summer and evacuate them before the seas froze up. Later it was decided to destroy the coal mines and berthing facilities and to evacuate the inhabitants. The original intention of sending a modified brigade group to occupy the islands was therefore changed to the dispatch of a small force, about 550 strong, a large proportion of which were engineers as the major tasks would be demolitions. The task was allotted to the Canadian forces then training in England and the basis of the engineer component was 3rd Field Company R.C.E. under Major G. Walsh who acted as C.R.E. of the force. With them went a detachment of four officers and thirty other ranks of 3rd (Kent) Corps Troops R.E. and some Canadian and R.E. specialist officers.

The objective of the force, which sailed on 19th August, was to put the mines out of action for at least six months but not to wreck them completely (one of those difficult problems which confront engineers carrying out a "scorched earth" operation), to destroy all stores which could not be carried away, and to evacuate the inhabitants.

There were two major settlements, one Norwegian at Longyearby and one Russian at Barentsburg, and a number of smaller villages. While the rest of the force arranged the embarkation of the inhabitants, the Russians for Archangel and the Norwegians to accompany the expedition on its return to England, the engineers got busy with destruction. Essential parts of mine machinery, power stations and the wireless station were removed or destroyed by explosives. The most difficult task was the destruction by fire of the fuel stocks. At Longyearby alone there was a pile of coal 1,000 ft. long, 100 ft. wide, and 30 ft. high containing approximately 150,000 tons. At Barentsburg the fire from the coal dump set fire to the town. In spite of the efforts to save it this was completely burnt out, being almost entirely of timber construction and there being a dearth of water. Eventually, when all the damage considered necessary had been done, the expedition re-embarked on 3rd September, and

reached Glasgow on the 8th. Of only one item of stores was there any doubt as to its ultimate fate though there was strong circumstantial evidence at the ensuing Court of Inquiry. This concerned liquor. A party of sappers, we do not inquire as to their home country, were placed in charge of a considerable stock. When the time came for its embarkation no liquor could be found and the sapper party had to be carried on board.

BRUNEVAL

During and after the Battle of Britain in which, in the autumn of 1940, the R.A.F. had foiled the efforts of the German Air Force to destroy our air power and so open a way for the invasion of Britain, great attention had been devoted in the United Kingdom to the development of Radar, then in its early stages, for the early detection of aircraft approaching our shores. Much progress had been made and a highly developed system of radar stations had been installed all round our threatened coasts. It was thought that the Germans had devoted similar attention to the problem, and it was known that a chain of radar stations had been created along the coasts of western Europe and on the approaches to Germany from the west. It was not known, however, what success the German development of radar had had or whether it had developed on similar lines to our own. The most satisfactory way of discovering this was to capture one of the latest installed German stations and examine the equipment.

The post selected was one recently erected at Bruneval, on the French coast about twelve miles north of Le Havre. The installation was situated in a shallow depression near the top of the cliffs bordering on the shore in an isolated position, the only house within 500 yds. being a small modern villa occupied by the radar specialists who, it was believed, numbered about ten. The place was however guarded, particularly on the sea side, by machine-gun and rifle posts. It was decided to attack with parachute troops who would be dropped inshore of the installations and to take off the attackers after the raid with their booty, if any, by sea.

A party of six officers and thirteen men of the newly formed 1st Airborne Division, including a detachment of R.E. under Lieutenant A. C. D. Vernon,[1] was selected in January, 1942, and started training and rehearsing for the operation. The tasks allotted to the R.E. were: first, to dismantle the radar equipment, and for this they were

[1]Major A. C. D. Vernon, M.C.

joined by an expert radar engineer, a flight sergeant R.A.F.; secondly, to lay mines on the roads approaching the area to prevent interference by enemy armoured cars; and lastly to clear any mines from the beach before embarkation after the raid. In order to carry out the first of these tasks, the Sappers were given sufficient training in radar to enable them to recognize the parts of the radar set which it was hoped to bring home. The whole party was trained and rehearsed their roles on an excellent model of the immediate neighbourhood including the radar pit, the villa, and the known enemy posts, made by 9th Field Company which formed part of 1st Airborne Division.

The party embarked in twelve Whitley aircraft on the evening of 27th February, and, in perfect weather conditions and bright moonlight, were over the target at midnight. All but two of the aircraft dropped their parachutists exactly where intended, some five or six hundred yards inland from the radar station. The other two aircraft, diverted by anti-aircraft fire, dropped their passengers about a mile away to the south across a deep gulley leading down to the sea. The main body made a perfect landing and, after they had assembled, the commander, Major Frost, dispatched on their tasks the four parties into which the force had been organized. One party led by Major Frost would attack the villa in which it was thought the radar experts lived. At the same time the second would attack the radar pit and try to carry the equipment away intact. The third and fourth respectively would take up a position to meet any counter attack which might come from some farm buildings to the north-east, and clear and hold a line of withdrawal to the beach down the gulley to the south.

The villa was captured with little trouble, so Major Frost was able to reinforce the detachment at the radar station. Here again success was complete, five out of six Germans found there being killed and the other captured, and the flight sergeant and the sappers proceeded to dismantle the equipment and pack it on to a collapsible hand cart which had been dropped with the parachutes. The Germans in the farm building were now fully alarmed and opened up a brisk fire on the radar station, some of the bullets striking the instruments as they were being dismantled. The task completed the party started to withdraw, blowing up the site of the installations to make the enemy believe that the object of the raid was the destruction and not the capture of the apparatus. The party dealing with the gulley met with some opposition but this was soon cleared with the assis-

tance of the detachment from the stray aircraft which, moving to join their comrades from the south, took the opposition in rear. The whole force with their precious burden moved down to the beach from which, just two hours after their initial drop, they were picked up by landing craft and returned safely to England, having suffered few casualties, of which none was sustained by the detachment of R.E. The radar set was found to be one of the latest German types and showed that the enemy had not advanced as far in radar development as had our own service.

St. Nazaire

Though no unit of the Corps took part in the raid on the docks at St. Nazaire in March, 1942, some account of the action must be given because for his part in the operation a sergeant of the Royal Engineers was posthumously awarded the Victoria Cross.

The sea war in 1941 had become largely a battle for supply. For the existence of the inhabitants, and for the supply of munitions of war, Britain depended on shipping from across the Atlantic. One of the enemy's main bases for warships and submarines for the attack of convoys approaching England by routes leading to her southern ports was St. Nazaire. This port was not only farther from our air bases, and consequently less vulnerable to air attack than Brest and the other ports on the French coast to the north, but it also possessed a dock large enough for the reception of the largest ships afloat. Its neutralization was therefore of the utmost importance and plans were made to destroy its potentialities as a base for warships and submarines.

Accordingly on the evening of 26th March, 1942, a naval force, under Commander R. E. D. Ryder, R.N., with a Commando detachment of 277 all ranks under Lieut.-Colonel A. C. Newman, the Essex Regiment, on board, set sail from Falmouth, and arrived off the entrance to the Loire shortly after midnight on 27th/28th. The plan was that the old destroyer *Campbeltown* should charge and become jambed in the lock gates at the entrance to the large dock and be blown up there, thus blocking the entrance to the whole port for vessels of any important size. At the same time detachments from the Commando were to land from motor launches at selected points to attack the same lock gates and other important objectives in the port, while other motor launches would move up the channel and open fire with light weapons on enemy posts on shore. The raiding detachments were eventually to be taken off by the launches

and by a motor gun-boat and a motor torpedo boat which also formed part of the force.

The approach of the force seems to have gone undetected by the enemy. Not till eight minutes before the time at which the *Campbeltown* was scheduled to strike the lock gates did the defenders spring to life and illuminate the flotilla with searchlights. Even then four precious minutes were gained by bluff and the replying to the German signals in their own code. Then every German gun and weapon opened fire, and the *Campbeltown* and the smaller vessels were struck by a hail of shells and bullets. But the old destroyer kept on and at 1.34 a.m., four minutes after the appointed time, she crashed fairly into the entrance of the lock and became firmly wedged, delay action charges in her interior blowing up later and completing the job. The main object had been achieved. Immediately after, men of the Commando who had sailed in the *Campbeltown* and in the launches climbed ashore. Many of the launches with their detachments were sunk or set on fire before they could make land, others were destroyed after they had put their detachments ashore, a few, cruising in the inferno, kept up fire on enemy posts till they too were put out of action.

In one of these launches, manning a Lewis light machine-gun, was Sergeant T. F. Durrant, Royal Engineers. While his launch moved up the Channel Durrant kept up a steady and accurate fire on all active enemy posts he could see. The launch then turned downstream and was engaged by an enemy destroyer which raked it from stem to stern with all its weapons. Durrant, whose station was entirely unprotected, returned the fire and though wounded hung on with one hand to the gunmounting and continued to fire his weapon with the other. The Captain of the German destroyer called on the launch to surrender, Durrant's reply being to fire at the destroyer's bridge. Eventually the destroyer grappled the launch and overwhelming the remaining crew took them prisoner. Durrant died shortly afterwards of his wounds in a German hospital, being posthumously awarded the Victoria Cross. Even the officers of the German destroyer commended him for his gallantry.

Owing to the sinking of the launches few of the landing parties got back to the motor gun-boat, the motor torpedo boat having been sunk, though before extermination they had done considerable damage to the port installations. A few of the motor launches eventually extricated themselves in a damaged condition and with the motor gun-boat, still carrying Commander Ryder, who had been

ashore with Lieut.-Colonel Newman during the action, rejoined the destroyers which were supporting the flotilla, and eventually returned to British ports. Besides the posthumous awards of the Victoria Cross to Sergeant Durrant and Able Seaman W. A. Savage, the Cross was also given to Commander Ryder, Lieut.-Colonel Newman and Lieut.-Commander S. H. Beattie. Of 630 men of the two services committed (exclusive of the men in the supporting ships which were not closely engaged) 403 failed to return.

The raid was completely successful in denying the use of the port to larger German warships, though the enemy made serious efforts to clear the blocks and repair the damage. That part of the raid designed to stop the use of the port as a base for submarines was not so successful, chiefly owing to so many of the launches being sunk before they could land their demolition crews.

VERMORK, NOVEMBER, 1942

This is a tale of tragedy and of failure, though for the latter the Engineer participants can in no way be held responsible. It was known in 1942 that the Germans, like the British and American scientists, were carrying out experiments for the production of the atomic bomb. The power of this weapon when made was known to be so great, and the advantage to the country first to produce it so decisive, that no effort could be spared to interfere with enemy research or to destroy the installations concerned with its ultimate production. Amongst the more important of the latter was the electrolysis plant for the production of "heavy water" (one of the most important elements in the development of the bomb and a compound extremely difficult to produce in any large quantity) at Norske Hydro plant at Vermork near Rjukan, about fifty miles due west of Oslo. This plant provided the majority of electric power for the whole of southern Norway. Rjukan is situated in the bottom of a deep valley with forest clad slopes so steep that the rays of the sun never penetrated to the houses of the town. Above it towered the 5,400 ft. high Gaustal Fjell, from the slopes of which the water power for driving the turbines was obtained.

After other methods had been considered it was decided that the attack should be made by airborne troops. It was desired to destroy the total stock of "heavy water" at Vermork, the more important parts of the equipment used for its production, and the electric power station. For this a large quantity of explosives would be

required, and, as at this stage in the development of air bombing it was not considered feasible to attack the works by that method, it was decided that airborne attack was the only satisfactory method of transporting the explosives to the site. For the same reason glider borne attack was preferred to one by parachutists, though the latter form of attack was not ruled out, and in case it was decided at a later stage to substitute that form of transport it was agreed that the selected party should be capable of using either method. The task naturally fell to the R.E. of the (1st) Airborne Division but the only parachute unit R.E. then existing (September, 1942) was 1st Parachute Squadron R.E. and that was fully committed in preparations for the coming landing in North Africa. There were, however, in the ranks of two other R.E. units of the Airborne Division, 9th Field Company and 261st Field Park Company, men who had completed training as parachutists and from these there was no difficulty in obtaining the necessary two officers and twenty-six other ranks required. These men volunteered with no knowledge of the purpose and nature of the operation except that it would involve great risks and the likelihood of severe privations. Throughout training and preparation the strictest security measures were imposed and no trace of leakage of information was at any time discovered. As a reason for the formation of the party and its training it was given out that they formed a team selected to compete against an American Engineer unit in a test of endurance, powers of initiative and of finding the way over difficult and mountainous country to an objective at which knowledge of demolition technique would be tested. The operation was given the code name "Freshman".

The training for a competition on these lines was carried out over four weeks of intense rigour to get the party up to the necessary standard of physical fitness and technical efficiency, and, on 15th November, the party moved to Skitten airfield in Scotland from which it was to take off. The force was divided in two completely similar teams each calculated to be sufficient for the purpose in hand, and each team was to travel in a separate glider each towed by a Halifax bomber, so that in the event of accident to one team or glider the other would be capable of carrying out the job.

From the beginning the difficulties and risks of the operation were fully realized, but the importance of the objective was such that these were accepted. This was to be the longest operational glider flight attempted to date, and the terrain in the neighbourhood of Vermork offered few suitable sites for landing, all being situated

in the bottoms of deep valleys with mountains towering around. The most suitable appeared to be the marshy edge of a lake called Mosvatnet not far from the factory. To confirm its suitability two Norwegian agents were dropped by parachute near the lake a few nights previously and in due course sent the pre-arranged code message, "It's a boy", signifying it was suitable for glider landings. These agents were to meet the gliders on landing and help to guide the party to the factory. There was no hope of being able to pick up the party from the coast by shipping as had been done after the Taranto and Bruneval raids, so it was decided that the men should wear civilian clothes under their battledress and that, their task completed, they should shed their uniform, dump their arms and equipment, and try to make their way to Sweden, where they should pose as escaped prisoners of war and thus be eligible for repatriation.

On the night of 18th–19th, the two towing aircraft started out to fly over the landing ground on reconnaissance, dropping leaflets over Oslo as a blind as to the purpose of the flight. In one of the aircraft the C.R.E. 1st Airborne Division, Lieut.-Colonel M. C. A. Henniker,[1] flew as a passenger to make sure that everything possible from the engineer angle was known. His aircraft unfortunately broke down *en route* and had to return to Skitten. The other located Lake Mosvatnet and returned without incident.

On the night of 19th–20th November, the teams emplaned in two gliders, Lieutenant A. C. Allen and thirteen other ranks in the first, and Lieutenant D. A. Methven, who had replaced 2nd Lieutenant M. D. Green, who was injured in an accident a few days before, with a similar party in the other. The Group Captain in charge of the air side of the operation himself flew in the first towing aircraft.

At 5.50 p.m. the first aircraft with Lieutenant Methven and party took off, followed a quarter of an hour later by the other aircraft and glider with Lieutenant Allen's team. The tale must now be told in two parts, first what was known by the watchers at Skitten airfield during the remainder of the night, and then the fuller story as pieced together from investigations made after the war.

Just before midnight a signal was received from the leading aircraft saying "Glider released in sea". By intersection of bearings, confirmed later on the return of the aircraft by a check of the pilot's log, it was found that the glider had been released over the Norwegian mountains about forty miles from Rjukan. The report of the pilot showed that a correct landfall had been made and the

[1]Lieut.-Colonel M. C. A. Henniker, D.S.O., O.B.E., M.C.

aircraft flew on towards the target. Mosvatnet Lake could not be found and after circling the pilot decided that as there was barely enough petrol to get tug and glider home turned accordingly, hoping if it were necessary to make a forced landing, probably in the sea, that the Air-sea Rescue Service would aid them. Immediately he ran into a towering cloud, and climbed to get out of it. In the upper fringes ice formed on both aircraft and glider and as they plunged into the cloud again the tow rope parted. On emerging from the cloud no sign of the glider could be seen and the operator sent out the signal reporting the glider as released over the sea.

At 11.41 p.m. a faint signal was heard which was believed to come from the second tug aircraft asking for a return course. No more was heard and the aircraft did not return. On 21st November, the following announcement was made over the German wireless.

"On the night of November 19th–20th two British bombers each towing one glider flew into southern Norway, one bomber and both gliders were forced to land. The sabotage troops they were carrying were put to battle and wiped out to the last man."

Thus the matter rested till May, 1945, when 1st Airborne Divisional R.E. flew to Norway, and immediately began inquiries as to the fate of their comrades. Bit by bit, from one source and another, the details were discovered, till the main outline of the story was unfolded. One of the agents waiting to meet the gliders heard a heavy aircraft circle overhead and then turn eastwards. The first aircraft had at first correctly located the lake. It appears that the first glider, after the tow rope had snapped, crash-landed on top of a snow-covered mountain just north of Stavanger. Lieutenant Methven, the two pilots, and seven R.E. other ranks were killed outright. Norwegians helped the Germans to bury them in a communal grave. When the Germans had gone the Norwegians fenced in the grave and planted flowers at the head. Four other ranks were severely injured and were taken to a German Headquarters and later poisoned by a German military doctor, their bodies being weighted and dumped in the sea. The remaining five men were uninjured in the crash and were taken away by the Germans. After moves to various gaols and concentration camps, on 18th January, 1943, they were shot and were buried at Trandrum.

The other aircraft and its glider, having made a satisfactory landfall, crashed in the mountains near Helleland. All the crew of the aircraft were killed in the crash, but only three of those carried in the glider. It is presumed that the senior surviving officer or

N.C.O. must have decided that it was impracticable to carry out their task or to reach Sweden, and surrendered to the German troops. Within a few hours all were shot in accordance, the German zone commander claimed, with an "Order of the Fuehrer". They and those who had been killed in the crash were buried in one unmarked grave. Eventually, in 1945, all the bodies except those dumped in the sea were recovered and reburied together in the military section of a cemetery near Oslo. The grave is marked by a black granite stone on which is carved the Divisional sign, the winged Pegasus, and the inscription:—

In Memory of
Thirty Royal Engineers
of the
1st British Airborne Division
Two Glider Pilots
of the
Army Air Corps
and
Two Pilots
of the
Royal Australian Air Force
The occupants of two gliders which crashed at Helleland and Fylesdalen on 20th November, 1942, whilst engaged on a gallant mission against the German atomic bomb installation at Rjukan.
Og det er det stora
Og det er det glupa
Et Merket det stend
Mannen han stupa.
Per Sivle.

So ended the ill-fated venture. The brutal tragedy of the story and the failure to achieve the purpose in no way detract from the courage of these men of the Royal Engineers and their comrades of the Air Forces. With the sense of duty and the spirit of adventure which always mark the personnel of the Corps, they volunteered gladly for a task the risks of which, thought to be great, could not be fully appreciated beforehand.

Was it worth while? It is hard to judge whether the purpose was worthy of the overwhelming risks. But later knowledge of the power of the atom bomb shows at least the vital importance that the enemy

should be prevented in every way possible from forestalling the Allies in its manufacture. Eventually the job was done by Norwegian saboteurs.

Dieppe, August, 1942

Though no units of the Royal Engineers took part in the raid on Dieppe, following our policy of describing the actions of the sister Corps from the Dominions and Allied forces in theatres where the R.E. were also engaged, an account of the raid and the part played in it by personnel of the Royal Canadian Engineers is not out of place in this history. This is more particularly the case, as much of the experience gained and many of the lessons learnt were later made use of by the engineers of the Allied Armies in the landing in Normandy nearly two years later.

Unlike the other raids recounted in this chapter the object in this case was not the destruction or capture of an enemy installation. The intention here was twofold. First, to give an indication to the enemy of the offensive intentions of the British forces facing the coast line of North-west Europe and of the threat of ultimate invasion, and so to pin as large a proportion as possible of the German troops in Western Europe in order to relieve the pressure on our Russian Allies. Secondly, the raid was staged so as to gain experience in landings against opposition on the coasts of France, and to try new methods and equipment which might ultimately be employed when the invasion of the Continent took place. Various forms of landing craft had been produced but not yet tried under active service conditions; the problems connected with the landing of tanks and the clearance of minefields and obstacles had so far been studied only under peace conditions, and the whole system of co-ordination of sea, land and air forces in an opposed landing needed testing. To achieve such purposes, the raid had to be carried out by considerably greater forces of all services than had been employed in any of the raids carried out up to date.

The military forces engaged consisted of two Infantry brigades, 4th and 6th, of 2nd Canadian Division (Commander Major-General J. H. Roberts, C.R.E. Lieut.-Colonel L. F. Barnes, R.C.E.), 14th Canadian Army Tank Regiment, Nos. 3 and 4 Commandos, and Royal Marine "A" Commando. The engineer element consisted of some 350 all ranks drawn from all units of the Divisional Engineers. All were under the command of General Roberts. The naval component, under command of Captain J. Hughes-Hallet, R.N., had

the task of transporting the troops across the channel, putting them ashore, providing covering fire, and eventually re-embarking and bringing back the soldiers and their prisoners. It consisted of over 250 ships and landing craft, including eight destroyers and one gunboat. For all the tasks required of them, reconnaissance, attack on enemy defences by bombing, cannon fire and smoke, and counter action to interference by the German Luftwaffe, the Air Forces under Air Vice-Marshal Leigh Mallory assembled sixty-nine squadrons.

The objectives named in the directive given to General Roberts, designed to test out the various problems likely to be encountered in such a landing, were the destruction of the enemy defences at Dieppe, the demolition of a radar station and of an airfield some three miles inland, the capture of the German Divisional Headquarters, and the destruction of German barges originally intended for the invasion of Britain which were lying in the harbour.

The natural coast-line favoured the defence. Much of it was backed by high, almost unclimbable cliffs, broken here and there by valleys through which rivers and streams made their ways to the sea. At Dieppe itself, astride the mouth of the river Arques, lay a mile-long stretch of beach about fifty yards wide at high water backed by a sea wall and the carriage-way and gardens so frequently found on the front of a seaside resort. The majority of the buildings lay inland of these gardens, an exception being the Casino which stood at the edge of the sea wall at the western end of the beach. The Germans had done considerable work in preparing the coast against the threat of invasion. Cliff faces, gullies, and the front at Dieppe had been plentifully covered with barbed wire obstacles; concrete pillboxes for machine guns and riflemen studded the coast; batteries of field and anti-tank and anti-aircraft artillery had been sited and protected with concrete and earthwork; and road-blocks constructed on all avenues leading from the beaches inland. The defences, natural and artificial, were therefore formidable. They were manned by one German Division, but this was of low category and was responsible for the defence of forty miles of coast. It was, however, supported by a considerable force of artillery and other mobile divisions were known to be held in reserve in rear. It was thought, correctly as it proved, that the latter could not arrive to interfere within the time allotted to the raid.

After several postponements the force embarked on the evening of 18th August, 1942. All went well till the ships were approaching the French coast. Then the left hand detachment encountered a small

German convoy escorted by a few armed trawlers. The latter immediately opened fire and so the alarm was given. The plan envisaged landings just before dawn by Commandos at points about four miles from Dieppe to each flank, with the object of silencing batteries which might interfere with the landings of the main body half an hour later at Dieppe. Coincident with the arrival of the Commandos two forces of about a battalion each were to land at Puits, a mile to the east of the town, and at Pourville, a similar distance to the west. Both were to converge on Dieppe while that at Pourville was to detach a force to attack the airfield two miles inland. Owing to the nature of the raid the R.C.E. were broken up into small parties to accompany various parts of the force with definite tasks to perform. They were thus split up between the various landing craft, the largest party in one vessel being sixty-five strong for work on the beaches at Dieppe with the main body. This arrangement, coupled with the necessity of secrecy about the details of the plan, produced a difficult problem in connexion with the loading of the equipment and engineer stores. This was got over by placing responsibility for the loading of stores on one party of an officer and twenty men. This party was responsible for the collection, preparation, packing, and delivering to each naval craft of the stores and equipment required by the parties to be embarked on the several ships. This arrangement worked well, all the parties afterwards expressing complete satisfaction with the work.

As the majority of the engineer effort was concentrated in the main attack on Dieppe, the events on either flank will only be described in sufficient detail to explain the general course of the action. Of the two Commando landings, that to the west was completely successful, the battery which was their main objective being effectively silenced. That on the eastern flank was disorganized by meeting the German convoy and found the German troops fully alarmed. In consequence only seven of the twenty-three vessels succeeded in reaching the shore, where they were met by devastating fire and few men were able to be re-embarked, the rest being killed or captured. Of the inner flank landings, that at Puits came under heavy fire as the landing craft approached the shore, and the troops who landed were mown down while endeavouring to cut the wire to get off the beach. Only a small party under the battalion commander succeeded in penetrating inland and moved towards Dieppe, but were cut off and were forced to surrender. At Pourville the troops were put ashore astride the entrance to a small river, and so were split in two,

the majority being on the west bank away from Dieppe. Held up by enemy posts and reinforcements and vainly awaiting the arrival of the tanks which were to break through Dieppe from the main attack, they were unable to reach the airfield and were ordered by General Roberts to withdraw. Covered by the fire of a destroyer most of the two battalions engaged were re-embarked.

In the main attack on Dieppe two battalions, Royal Hamilton Light Infantry on the right, Essex Scottish on the left, were to land and seize the beaches to enable the tanks to be disembarked. The latter would then push ahead with the infantry to clear the town. Then, while the infantry fanned out to make contact with the troops which had landed on the inner flanks, the tanks would drive through to the airfield making contact on the way with the troops designated for the purpose which had been landed at Pourville. The main tasks of the engineer parties, which accompanied various units in the attack, were the demolition or crossing of obstacles encountered on the beaches, the removal of anti-tank mines, and the destruction of pill-boxes, roadblocks and of certain special targets such as the telephone exchange. In anticipation of their job in getting the tanks across the beach and over the sea wall, which at the point of attack was about 2 ft. 6 in. to 3 ft. high, the R.C.E. units had developed certain devices which they took with them in the landing craft. It had been found that a mat of chespaling would enable tanks to climb walls 28 in. high from a sloping pebbly beach. While some such mats were carried by the Canadian sappers to be laid by hand, they further developed a device, the precursor of the "Bobbin" used later in the Normandy landing (Chapter VIII, page 199), by which the mats could be laid by the tanks themselves. To enable tanks to cross the sea wall where it was higher specially prepared wooden ramps were carried. Otherwise the main stores carried were explosives in various forms.

At 5.20 a.m., just as dawn was breaking, the landing craft approached the shore, the naval ships opening an intense five minutes bombardment against the buildings and defences on the sea front. They then lifted their fire on to the two headlands which dominated the town on each flank while cannon firing aircraft carried out an intense but short attack on the frontal defences. This lasted till the leading landing craft were within about 500 yds. of the beach and for the moment the fire of the defence was smothered. Then as the aircraft swept away, the defenders, now fully alert, opened a devastating fire on the invaders. It is clear now that the

preliminary bombardment was too short, and this was one of the main lessons stored up for correction when the real invasion of Europe began. Under this heavy fire the Canadian troops lost heavily, but the survivors made for the sea wall which was their first objective and afforded some slight cover. With them went the detachments of R.C.E. searching for mines which it was found the enemy had not laid, carrying the chespale mats for the tanks, and humping the necessary explosives. All the wooden ramps to aid the tanks in climbing the sea wall were destroyed or lost in the landing.

The landing craft carrying the tanks were delayed and the first touched down 15 minutes late. In spite of the intense fire, of the thirty tanks, twenty-seven landed on the beach and advanced up the shingle. The chespaling mats laid by the sappers were completely successful, though most of those laid by "Bobbins" failed, their construction proving to be too flimsy. It does not appear that any breaches were blown in the wall by explosives. Thus fifteen of the tanks surmounted the wall and climbed on to the esplanade where they came under heavy anti-tank fire and were faced by road blocks leading into the town. The demolition parties of R.C.E. pressed forward to clear these obstacles but neither tanks nor infantry were able to get forward to cover them. In spite of the heavy casualties they persisted in their task. A portion of one party managed to reach a block only to find that all the men carrying explosives had become casualties. At the cost of further casualties more explosive was brought up but it proved insufficient to clear the block. The tanks unable to advance farther returned to the beach and took up hull down position to cover the infantry.

The remnants of the R.C.E. demolitions parties, foiled in their first task, were not idle. Many of them assisted the infantry in blowing in the entrances to concrete pillboxes, cutting ways through the walls of buildings, and destroying German guns in emplacements. One party, intended for the destruction of the telephone exchange in the middle of the town, accompanied the infantry in attacking the Casino, which had been converted into a fort by the enemy. Under Sergeant G. A. Hickson, it blew an entrance into the building and thence blew passages from room to room for the infantry, and eventually killed the garrison of a gun emplacement by blowing in the steel door on top of them. They then destroyed the gun itself. Mindful of his primary task Sergeant Hickson and his sappers and an infantry party then endeavoured to make their way to the telephone exchange. They penetrated a considerable way into the town but were

brought to a halt by enemy fire. They took cover and returned the fire until their ammunition was exhausted and then returned to the beach.

Reports reaching General Roberts in the Headquarter ship were confusing and inaccurate. Under the impression that the battalion on the left of the main attack had been successful, at 7 a.m. he committed his reserve on that flank. Though some parties of this battalion penetrated a short distance into the town and towards the docks, their success was short-lived. It was now plain that no good would be achieved by continuing the fight and the Naval Commander feared if evacuation was postponed much longer it might become impossible. So about 9.30 a.m. orders were given for re-embarkation as soon as the ships could move close to the shore, and for arrangements to be made for cover by the R.A.F. At the hour fixed, 11 a.m., Hurricane aircraft laid a perfect smoke screen along the whole length of the beach. By the aid of this the withdrawal commenced, but with enemy posts and machine-guns within 200 yds. of the points of re-embarkation casualties were severe and there was much unavoidable confusion. The tank crews, most of their vehicles immobilized with broken tracks and other damage, helped gallantly to the end to cover the operation. Conditions became more and more difficult, and at about 12.30 p.m. in spite of the gallant efforts of the Royal Navy, it was found necessary to give up the attempt to extricate any more of the troops. By this time there were none but dead or badly wounded on the beaches and many of the detachments still in buildings on shore, with their retreat cut off and their ammunition exhausted, were being forced to surrender.

The total of casualties among the 5,000 Canadians who took part amounted to nearly 3,000 in killed and prisoners, many of the latter being wounded. The losses amongst the R.C.E. were on a par with those of the rest of the force. Of 333 all ranks who disembarked, 185 were killed or missing, and thirty-one were evacuated wounded.

Once again it must be asked, "Was it worth it?" And again it is doubtful if a complete answer to the question can or will ever be given. It is possible, but unlikely, that the experience gained might in some measure have been achieved by some less costly method. To carry out a useful test it was necessary to mount an operation on such a scale that the co-operation of all three services should be tried out fully, and that it should be carried forward to such an extent that more than the actual landing should be investigated. There is, however, no doubt that the lessons learnt and the experience gained when applied to future planning certainly reduced the casualties

and possibly ensured the success of future amphibious landing operations in Sicily, Italy, and eventually on the coast of Normandy.

Greece, 1942–3

When preparations were being made, in the autumn of 1942, for the final British counter-offensive in the Western Desert, commencing with the battle of El Alamein (Chapter XV), it was considered important to obstruct, in every way possible, the reinforcement and supply of the German forces in North Africa across the Mediterranean. An important route for such traffic was through the Greek port of Piraeus, the sea passage being protected for much of its length by the Axis occupied Greek islands. This port was served from central Europe by a single railway, largely single tracked, along the east coast of Greece between Salonica and Athens. On this railway were a number of important viaducts the destruction of which would close this line of supply.

Contact had been established with some of the resistance movement which was then forming in Greece and weapons and explosives had been dropped by parachute with which the Andarte, as they were called, had carried out some minor raids and sabotage. In September, 1942, they were asked if they could undertake the demolition of one or more of the big viaducts on the railway. A reply was received on 21st September, that this could only be done if the Andarte could be assisted by some experienced British officers. These, to get advantage of best moon conditions, should be dropped between 28th September and 3rd October, at an indicated locality which would be marked by agents by bonfires.

A party of twelve was selected from a number of officers and wireless operators already under training. These, besides the Commander, Brigadier E. C. W. Myers,[1] included three engineer officers, Lieutenant I. S. Gill, R.E.,[2] and Captains T. Barnes and A. Edmonds, R.N.Z.E. On the night of the 28th, the party took off from Egypt in three aircraft and arrived safely over the dropping point. After circling for some time, as no bonfires could be seen, all three aircraft returned. It was discovered later that just before the fixed date the principal agent had been arrested by the occupying Italian troops. Another effort was made on the night of 30th September/1st October, and, though again no signals were seen,

[1]Brigadier E. C. W. Myers, C.B.E., D.S.O.
[2]Lieut.-Colonel I. S. Gill (Rajput Rifles).

the parties from two aircraft jumped; the third, dropping its stores containers, returned with its party to Egypt. This party, which included Lieutenant Gill, dropped some weeks later and did not join up with the remainder till mid-November. The first two parties dropped in thick forest country, widely scattered, and it was not till 8th October that all, with the majority of their stores, were concentrated. Their wireless sets were damaged in the drop and the container with most of the spare parts was lost, so communication with Headquarters, Middle East Command, was not possible.

Brigadier Myers soon gained contact with the local leaders of the Andarte, by whose help the stores were collected and stored in mountain caves and a meagre supply of food provided. Reconnaissances were made of the three viaducts. That farthest north, at Papadia, had been destroyed by the British force in their retreat in Greece in 1941, but had been rebuilt by the Italians who were guarding their "child" in considerable force and great attention. The approaches to that at Asopos were also strongly guarded except on one side from which approach along a narrow gorge seemed almost impossible. It was finally decided to make the attempt on the southernmost bridge, that at Gorgopotamos. This consisted of steel girder spans supported on two masonry and two steel piers.

Weeks of delay occurred while negotiations were carried on with leaders of various bands of Andarte who were keenly divided on personal and political grounds. Contact had also to be made with resistance leaders in Athens through whom spasmodic communication was established with Cairo. By this means extra supplies, explosives and arms for the Andarte were obtained by air and parachute from Egypt. During these weeks the party remained in the mountains in the bitterest of weather, sometimes lodged in peasants' houses, sometimes in caves, and frequently in rough shelters made of boughs or parachutes, moving continuously to escape detection by the Italian troops in occupation. Nearly all movement had to be carried out on foot over rough paths through the steep mountains, and this with the minimum and poorest of food. However, by mid-November, a force of 150 Andarte, under two rival and mutually jealous leaders, had been collected, the wireless sets had been made to work, and sufficient explosives obtained.

The attack on the bridge was fixed for 25th November. Two parties of Andarte, each about thirty strong, were to attack the garrisons at the two ends of the bridge. A reserve of another thirty was held in hand, and the demolition party, under Captain Barnes

and including Captain Edmonds and Lieutenant Gill, remained concealed till Brigadier Myers considered that its moment for action had arrived. Two other small parties went to each flank prepared to cut the railway if any train with reinforcements approached. Starting about 6 p.m. the various parties began to move into position, zero being fixed for 11 p.m.

The attack on the north end of the bridge was at first repulsed, and as things seemed to be going well at the south end the reserve was launched to help the northern attack. Shortly afterwards the success signal came from the south side and, as this was the nearest to the piers for attack, Brigadier Myers gave the word for the demolition party to advance. He then went forward to the battle on the north end of the bridge which was still raging furiously. Barnes on his arrival at the bridge found that the legs of the piers were of U, not L section as had been thought and for which the charges had been prepared. Hurriedly re-adjusting the charges they were placed in position on one pier and a whistle blown as a signal for everyone to take cover. Immediately the firing died away and a few moments after there was a tremendous explosion and one of the 70-ft. spans leapt into the air and crashed into the gorge below a twisted mass. The Andarte leaders, realizing that the explosion would have alarmed all Italian garrisons within miles, wanted to withdraw immediately, though the northern force had now reached the bridge, but Brigadier Myers persuaded them to stay for another twenty minutes to allow Barnes' party to attack the other steel pier, and to twist the spans lying partly on the ground. He then ran along the bridge to the gap and shouted instructions to Barnes. At the same time a train was heard approaching from the north but the party, sent out for the purpose, cut the rail and brought the train to a standstill. Fifteen minutes later Barnes' whistle was heard again, followed shortly afterwards by another great explosion. The spans already down were badly twisted but, presumably due to faulty explosives, only two legs of the second trestle were cut and the remaining spans remained in position. Nevertheless the railway was completely cut and Brigadier Myers estimated that the breach could not be repaired properly under six months.

It had been arranged previously that all the party, except two who were to remain to organize further sabotage by the resistance, neither of whom were engineers, should be evacuated by submarine when the job had been done. Brigadier Myers accordingly sent by wireless a message to Cairo that they should be picked up at a spot

on the west coast of Greece on one of four nights between 22nd and 25th December, inclusive.

And so the little party, now swelled by a number of escaped prisoners of war, set out once more on its weary trek through the mountains. It was now winter and bitterly cold, and as it moved westwards they entered a region which was even poorer than that in which they had been operating. Though the peasants showed them the utmost hospitality they had themselves little to eat, and by the time the party reached the coast they were hungry and exhausted. It reached the rendezvous in good time and for the first three of the appointed nights went down to the shore and flashed the prearranged signal. But there was no sign of a submarine. On Christmas Day a runner arrived from the officer who was remaining in Greece who, by means of a new wireless set which had been dropped, had received a message from Cairo that no submarine could be sent and that fresh orders were being sent by an officer who would shortly be dropped.

Bitterly disappointed, Brigadier Myers and his party set out once more on their weary march across the mountains to the headquarters of the resistance leaders whom they had left a month before. Arrived there on 3rd January, 1943, Myers found orders from Cairo that he was to remain in Greece to co-ordinate the activities of the Andarte, and that the rest of the party was to remain with him.

The task set to Brigadier Myers was no easy one. The rivalries of the various sections of the resistance movement had now crystallized into the political situation which was eventually to lead to the civil war, some aspects of which will be treated later (Volume IX, Chapter XVIII). We are not, however, concerned here with such matters though they complicated the efforts, now to be described, of the British officers to organize further sabotage.

In February, it was learnt that the Italians had succeeded in six weeks, by crib pier construction, in repairing the demolished bridge at Gorgopotamos for trains running at slow speed. It was, therefore, necessary to cut the railway again, and it was decided that the target this time, in spite of the difficulty of approach, should be the Asopos bridge. This bridge was about 330 ft. long and of peculiar construction. The single line railway emerged from an almost vertical mountain face directly on to the bridge which carried it on an incline, and round a curve, over the gorge some hundred feet deep, to disappear once more into a tunnel in the equally steep face of the other side of the gorge. About seventy feet from the southern end, a

high stone pier carried a span from the tunnel mouth. Two other spans were cantilevered inwards, from each end, on to the main central span which consisted of a huge archway of steel lattice work. The whole was held together by three large steel pins, one connecting the two sections at the crown of the arch, the others fixing the ends to the faces of the gorge. There were only four humanly feasible methods of approaching the bridge; those through the tunnels; that down the gorge which owing to its steepness was considered impracticable; and finally that up the somewhat wider valley from below which was certain to be most heavily guarded.

The first plan considered was that a force of Andarte should seize a train as it puffed slowly up hill to the tunnel from the south. It would be boarded and driven on to the bridge where, while the Andarte overcame the guard, R.E. officers should destroy the bridge. Further reconnaissance showed that owing to the dispositions of the guard and the nearness of a battalion in reserve, success by this means was too uncertain, and it might be necessary to try to seize the bridge by attack of a large force of Andarte up the valley from the east. It was certain that in any case more engineer officers and others would be required for the operation. Headquarters Middle-East were accordingly asked to train and send such a party. It was not till 11th May that these officers could be found, trained and dropped. The officers of the Royal Engineers who thus arrived were Major P. J. F. Wingate,[1] and Captains M. F. Scott[2] and H. N. McIntyre.[3]

By the time they arrived in Greece German troops had relieved the Italian guard on the Asopos bridge, and it was considered that an attack in force up the valley would have little chance of success. There remained only the approach from the west down the gorge which, from the physical difficulties to be overcome, had been considered impracticable, though for that very reason it was not likely to be so closely guarded. On 21st May, Major Gordon-Creed of the Commandos, who was to be in charge of the operation, with another officer made a close reconnaissance of the approach down the gorge and reported that, with enough rope to get down some awkward places, prepared explosive charges in waterproof covering and food for the party for several days, the operation was feasible.

Accordingly, on the 23rd, the explosives and other gear having been

[1]Major P. J. F. Wingate, M.C.
[2]Major M. F. Scott.
[3]Major H. N. McIntyre, M.C.

dumped previously at the head of the gorge, the party of seven, under command of Major Gordon-Creed and including the three recently arrived R.E. officers, set out down the narrow gorge which was never more than ten feet wide and sometimes only two or three. The greatest difficulty was in keeping the explosives dry as the descent of several waterfalls, sometimes as much as forty feet high, had to be achieved by means of ropes. Also the party had sometimes to wade through deep pools of icy water carrying the charges above their heads. The first day they got only a short way down the gorge, where they found a dry spot and rested there during the night. Next day having reached a point about two-thirds of the way to the bridge they were halted by a particularly difficult waterfall for the negotiation of which they had not sufficient rope. They hid the charges in a dry spot and returned to the base camp.

A fresh attempt could not be made till mid-June while more rope was being obtained and till the next suitable phase of the moon. On 16th June, a reconnaissance was made and the officer in charge got within 100 yds. of the bridge. On it were seen a crowd of workmen riveting and concreting, with scaffolding all round its ends. The party, which had now been reorganized and for this final attack included only two engineer officers, Captains Scott and McIntyre, moved down the gorge on the 20th to the spot where the explosives had been left a month before. While the R.E. Officers dried and reorganized the charges, Major Gordon-Creed, who again led the party, made a final reconnaissance, and found that a steep path led up to the scaffolding on the north bank. Up this he decided to attack.

At 6.30 p.m. the party moved on, reaching the foot of the path about 8 p.m. It was found that gaps had been cut for the workmen in the wire round the central span and that a ladder had been left leading up to a platform 30 ft. up. The two R.E. officers mounted the ladder and started placing the charges while Major Gordon-Creed and another officer stood at the foot. Just at this moment a German guard approached. All remained motionless, and as he passed Major Gordon-Creed hit the German on the head with a "cosh". Without a sound he toppled over the cliff, the noise of his fall being drowned by that of the torrent. Though the Germans at intervals swept the bridge and its approaches with a searchlight, and one of the R.E. officers accidentally kicked a steel nut from the platform which fell with a clang against the structure, the guards noticed nothing.

All was well and shortly after midnight the fuses, each with one and a half hour's delay action, were ignited. The party hurriedly withdrew up the gorge wondering if the explosives had deteriorated from their month's exposure. But at 2.15 a.m., when the party were about half-way back up the gorge, a roar reverberated through it. With a complete cut across the sections of the central span the whole thing collapsed, dragging with it the cantilever spans which projected on to it from either bank. All three spans thus fell a tangled mass of steel-work into the valley below.

Though the Germans using forced labour managed to repair the bridge in two months, the work had been sabotaged, and when the first train went over it a pier collapsed and the train and one span fell into the ravine. It took another two months to rebuild the bridge, which, with the railway, was thus out of action for four months.

Shortly before the Asopos viaduct had been destroyed, Brigadier Myers received fresh orders that, from the end of June, widespread sabotage should be undertaken. This was timed so as to give the impression to the enemy that, now that North Africa had been cleared, the Allies were now planning an invasion of Greece and not, as in fact was the case, a descent on Sicily. By this time the force at the disposal of Brigadier Myers, other than those of the politically divided Greek resistance movement, had been swollen by escaped prisoners of war and a number of Cypriots. More officers, including a number of R.E. officers, had been flown in. With better wireless communications the supply dropping of explosives, ammunition, and food could be better organized. So when the time came an orgy of sabotage broke out in the whole country, in which the R.E. officers took their full share, and continued till 11th July, when the news of the successful landing of the Allied Forces in Sicily was received.

Later in the year further widespread sabotage was undertaken. The country was divided into areas in which the operations were directed by liaison officers, some of them of the Royal Engineers, and in most of which engineer officers were in charge of the major demolition work. In some places aircraft landing grounds were prepared and kept in operation through which personnel were flown in and out and stores imported. This work was chiefly done by Greek civilians working under the direction of R.E. officers, of whom for this work Major R. Harris was the senior.

CHAPTER V

THE UNITED KINGDOM

Pre-war activity—The outbreak of war—Phase I. September, 1939, to June, 1940—Phase II. The period of threat of invasion—Bomb disposal—Accommodation—Transportation—Phase III. June, 1942, to June, 1944—Entry into the war by U.S.A.—Accommodation—Training and new developments—Preparations for the invasion of N.W. Europe—Transportation—Movement control—Survey—Phase IV. From June, 1944.

Pre-War Activity

As has been noted in Chapter I, the eighteen months before the outbreak of World War II found the Royal Engineers in the United Kingdom coping with a heavy programme of development of defences, improvement of barracks, and provision of more extensive administrative depots. At the same time the introduction of compulsory service in the Militia and the doubling of the Territorial Army made heavy calls on the trained personnel of both Regular and T.A. units of the Corps.

The principal work called for in connexion with the defence of the country was in connexion with the large expansion of anti-aircraft defence. Sites for guns and searchlights, with accommodation for crews, were scattered widely about the country. As many of the sites were in very isolated positions they had to be provided with amenity buildings, cookhouses, dining, rooms etc, and the supervision of such construction, so widely scattered, threw much work on the already fully employed works staff.

The expansion of the Ordnance Service and the increase in holdings of warlike stores involved the extension of ordnance depots. The two largest jobs of this nature taken in hand before the war were a considerable increase in size of the vehicle depot at Chilwell and the provision of a new depot at Barry. Extra storage had to be provided for ammunition and for this one of the largest and most interesting engineer projects undertaken for some time was started. This was the underground magazine at Corsham in Wiltshire. The nucleus of this depot was the underground quarries from which the well-known building stone used in Bath and other towns had been

obtained. The stone had been hewn from tunnels about twenty feet wide with natural roofs arched so as to stand indefinitely. The unwanted debris had been shovelled into tunnels from which extraction of stone had ceased. This debris had first to be cleared and then, in some places, where the walls and pillars supporting the roofs had been cut to too great an extent, the roof supports had to be strengthened. This done there remained many acres of storage space which, when properly ventilated, were remarkably dry. At this stage concrete floors and tram tracks were laid and lifts installed. Stone from the tunnels was used to build quarters, first for the works staff, and later for the operating personnel of the depot. During the war, as will be narrated later, there was considerable further development. The work in the pre-war period was in the charge of Major A. Minnis, R.E.

The passing of the National Service Act in May, 1939, and the introduction of compulsory training in the Militia, meant that large numbers of semi-permanent camps for the reception and training of the militiamen had to be built all over the country and at great speed, producing problems for the works service which will be dealt with later (Chapter VII, pages 163–170). The provision of training staffs for these militia units and for the doubling of the Territorial Army caused a considerable drain on the trained officers and N.C.O.s of Regular Army units which, in the Home Country, had been reduced by the necessity of sending a number of field units to Palestine and other centres of disturbance in various parts of the world.

The period of tension before the actual outbreak of war in September, 1939, found the resources of the Corps stretched to the limit with no increase of establishment.

The Outbreak of War

Never before, since the invasion of William the Conqueror, had the home land been so directly involved in war as it was during the period of World War II. Not only, as it had been in the past, was it the scene of the formation and training of the forces raised in the country and to a limited extent for certain troops of Empire countries, and the source of much of the warlike supplies, but now it was to be the target of an intense air assault, the close threat of actual invasion, and the assembly ground for forces of the Empire and her allies, including immense forces from the United States of America, for the launching of forces for operations in North Africa, Sicily,

Italy, and eventually for the great assault on North-West Europe. The whole kingdom became an armed camp prepared to meet direct assault, a hive of industry, and at the same time suffered enormous damage to material, and casualties to individuals both civilian and military from intense attack by enemy aircraft and rockets. It may be imagined that the transformation of the country from its peace-time calm with a garrison which, as a bishop so aptly expressed it, would fit into the stands of two Liverpool football grounds, involved the Royal Engineers, with their empire and allied brethren, in a programme of intense activity, much of it of a novel nature.

The mobilization and departure for France of the B.E.F. in September, 1939, left a very inadequate strength of regular R.E. personnel in the country to carry on the already large works programme with the extensions necessitated by the mobilization of the Territorial Army and reserves, and to provide staff for the many training establishments and units now necessary to maintain the flow of reinforcements to the field army. The holders of many of the more senior engineer appointments in the United Kingdom had been taken to fill posts in the B.E.F. Most of the Chief Engineers of Home Commands were thus wrested away at short notice at a moment when work in their offices was at a maximum and fresh planning was essential. Similarly the Commandant S.M.E., with his extra responsibilities as Commander R.E. Depot and Inspector Royal Engineers, departed with his Deputy at twenty-four hours notice, leaving their replacements, officers from the Reserve, to pick up the threads as best they could. In this bleeding of its organization in the home country the Corps was in no peculiar position. Other arms and services were possibly worse affected. A review of the position of the R.A.S.C. a few years before the war showed that when all overseas mobilization posts had been filled, the remaining serving regular officers available would be sufficient to provide one officer, a quartermaster, for each of the Home Commands. As a result of the increase of establishments sanctioned in the last few years before 1939, matters were slightly better, but it speaks volumes for the sound organization in the engineer offices in Commands, and for the devoted work of the officers who hurried back into uniform from the reserve and the retired list (one garrison engineer was 82 years old), that the engineering output was so little disorganized or delayed. To fill the gaps, particularly on the Works side, gentlemen with suitable civil experience, usually on the architectural side,

were recruited as officers of the Corps. While usually well technically qualified, these officers were not conversant with the army or military works procedure, and it took some time, and the efforts of the already hard-pressed, experienced officers of the Corps, before they could fully pull their weight in the military machine.

The story of the experiences of the Royal Engineers in the Home Country during the war naturally falls into four phases into which this narrative will be divided. These are:—

1. September, 1939, to June, 1940, i.e., till the evacuation of the B.E.F. from Dunkirk, a period of expansion and development of the country as a base for our overseas forces.
2. June, 1940, to June, 1942. The period of major air attacks and the threat of invasion. A time of preparation of defences and the rebuilding of our forces.
3. June, 1942, to June, 1944. The arrival of American forces and preparation for the invasion of Europe.
4. June, 1944, to September, 1945. Great Britain as a base for the invasion of North-West Europe and for the maintenance of the war in South-East Asia. A period of gradually lessening commitments.

Phase 1. September, 1939, to June, 1940

As we have seen above, the outbreak of war found the Works Service faced with a heavy programme for the accommodation of units of the Air Defence of Great Britain, for militia camps, and for a number of small and large projects all over the country. Apart from new services most of the above had to be extended and speeded up. By April, 1940, the numbers employed in Air Defence of Great Britain amounted to 154,000, or about half as much again as the whole peace garrison of the British Isles. In the first nine months of the war about £19 million was spent on works services for Air Defence of Great Britain alone. The programme of militia camps, now no longer required for their original purpose, was pressed ahead as these would make some contribution to the new camps required for the accommodation of troops and for training camps. Early in the war a programme to provide fifty-five training camps for infantry to accommodate 110,000 men was launched, to be followed by another of approximately equal extent in the spring of 1940, when the work on militia camps had been almost completed. The camps in this latter programme were chiefly designed for the accommodation of brigade groups and, having to be sited in the neigh-

bourhood of good training areas, were often far distant from large centres of population from which the necessary labour could be drawn. This naturally added to the difficulties of organizing rapid construction. Other camps started at the same time included a number of artillery practice camps.

Work on certain depots, expansion of which had been started, or included in the pre-war estimates, such as those at Corsham, Chilwell and Barry, was continued, and construction started at new ones, such as Donnington and Old Dalby. The peace-time schemes for the improvement of the coast defences at several ports were speeded up with the purpose of the defence of the ports themselves against sea and air attack, there being at that time no threat of invasion.

This enormous mass of work threw on the Works organization a burden which was beyond its capacity. The work was carried out but administrative and financial control nearly reached breaking point. The measures taken to meet the situation will be described in Chapter VII.

As explained in Chapter VII (pages 166, 167), little provision had been made in peace-time for the accumulation of engineer stores. The necessary expansion in staff to handle the mass of stores now required for the Expeditionary Force and for the works programme at home will be described here. No depot for the holding of stores existed at the outbreak of war and it was some months before the necessity for provision was recognized. As a makeshift arrangement the new R.A.O.C. depot at Donnington, referred to above, was taken over, but soon became terribly congested and two smaller depots, at Charlton and Swindon, were taken into use in the spring of 1940. These were the sole installations available for the collection and distribution of engineer stores, and were already quite inadequate for the purpose, when the remnants of the B.E.F. were evacuated from Dunkirk, and a new phase commenced.

On mobilization, the Inspector General of Home Forces became Commander-in-Chief Home Forces and set up his Headquarters in London. He had operational control over all troops in the United Kingdom, and was responsible for the supervision of the training of those forces. Responsibility for administration remained with commands. At this stage of the war there was little thought of operations in the country, so the principal job of G.H.Q. Home Forces was the supervision of training. From the engineer point of view the G.O.C.-in-C., General Sir Walter Kirke[1], had the assistance of the Inspector

[1]General Sir Walter Kirke, G.C.B., etc.

Royal Engineers, Major-General G. H. Addison,[1] and many factors combined to make the task in this respect far from easy. The doubling of the Territorial Army in 1938 had led to disorganization and shortages of personnel in the majority of units of that force. While the gaps were soon filled, the training of the new entry was rendered difficult by the shortage of experienced officers and N.C.O.s, and the establishment of the Regular Army, already stretched to the limit by the claims of the B.E.F. and training establishments, was insufficient for the provision of the necessary permanent staff. Then the absence abroad of many R.E. units of regular formations entailed the absorption into the latter of certain units from Territorial Army Divisions which were also milked to provide R.E. units for Corps Troops. Fresh units had to be raised and absorbed into Territorial formations at this period of stress, to replace those so transferred.

The initial and technical training of officers and other ranks, other than that normally carried out in service units, is described in Chapter VI.

The first ten months of the war was therefore a period of intense activity for the Corps in the home country. While a comparatively small nucleus of trained personnel was busy carrying out a wide expansion of numbers and units, those employed on the Works service were carrying out, with totally insufficient numbers, a tremendous programme of construction to prepare the country for defence against aerial attack, to accommodate the rapidly growing strength of the forces, and to provide an administration base for the forces both at home and overseas.

Phase II. The Period of the Threat of Invasion

The withdrawal of the Expeditionary Force from Dunkirk at the beginning of June, 1940, produced in the home country an entirely new situation which threw new tasks on the Corps, while those which had occupied its representatives during the earlier ten months remained as urgent as previously. No longer was the United Kingdom a comparatively peaceful country, where even the threat of attack from the air had so far proved of little substance. No longer could the troops in the country devote all their energies to training so that they could take their places in due course with the army in the field

[1]Major-General G. H. Addison, C.B., C.M.G., D.S.O.

overseas. Now there was an urgent threat of invasion by sea by enemy forces themselves not menaced by any other European power. The possession by the enemy of air bases close to the shores of the English Channel and North Sea increased greatly the danger of air attack and deprived the defending air forces of early information of the approach of hostile aircraft.

The military forces in the United Kingdom were not at the beginning of this phase of the war in good shape to resist a determined invasion from which the Royal Navy, though superior in strength to the German Fleet, could not, in the face of shore based aircraft and in narrow waters, guarantee immunity. The formations already in the country were rarely in a sufficiently advanced state of either training or equipment to meet organized forces of trained enemy troops in open combat. The troops which had returned from France were disorganized and had lost all their heavy equipment and transport and much of their personal weapons. The Royal Engineer units were in most respects better placed than many others. They still possessed their technical skill, much of their equipment was that in common use in civil engineering practices in the country, except for that required for rapid bridging construction and this was a branch of their art which was unlikely to be called into action in the early stages of an invasion. The majority of their transport being of largely standard type was fairly easily replaced.

But the threat was serious, and the military position was, to those in a position to judge it, almost desperate. It required strong leadership and a whole-hearted determination by the forces and people of the country to meet the crisis. Both were forthcoming. On 10th May, the day on which the German forces started to advance into France, Belgium and Holland, the Prime Minister, Mr. Chamberlain, resigned and Mr. Winston Churchill was called on to form a new Government. This was a National Government of all parties and soon showed its determination to take active measures to meet the situation. The spirit which animated it was well exemplified in a great speech made by Mr. Churchill in the House of Commons in which he declared:—

"I have nothing to offer but blood, toil, tears and sweat. We shall defend our island whatever the cost may be. We shall fight on the beaches, we shall fight on the landing grounds, we shall fight in the fields and in the streets, we shall fight in the hills.

"We shall never surrender: and even if, which I do not for a moment believe, this island was subjugated or starving, then our

Empire beyond the seas, armed and guarded by the British Fleet, would carry on the struggle until, in God's good time, the New World, with all its power and might, steps forth to the rescue of the Old."

The country responded to the call. Civilian men over 40, and others in occupations, poured in to fill the ranks of the newly formed Local Defence Volunteers, later known as the Home Guard, and, though at first armed with elementary weapons, sporting rifles and shot guns, and even pikes, trained vigorously to carry out their allotted duty of dealing with enemy parachute troops, and harassing enemy bodies which might land and penetrate inland. Men and women in industry toiled without rest long hours to produce the weapons and war-like stores required by the forces. The ranks of civil defence organizations including fire brigades, rescue squads, first aid detachments, air raid wardens, etc., filled rapidly with men and women. The trumpet having sounded with no uncertain sound, all prepared themselves for the battle. Those formations which were in the most advanced stage of their training moved to the parts of the country most liable to invasion from the Continent. The personnel from the disorganized formations recently evacuated from France were quickly sorted out into their units and re-equipped as far as resources permitted. Headquarters of Home Forces and of Commands, up to this time chiefly concerned with administration and training, now became the headquarters of operational G.H.Q. and armies, and Corps were allotted responsibilities for operations in certain areas while others took command of reserve forces ready to move to the assistance of threatened spots. Almost overnight the situation had completely altered.

The United Kingdom now became a theatre of war and the position of the forces became similar to those operating in a friendly country whose Government was still in control. It was the first time for nearly a thousand years that such a thing had happened and naturally many difficulties arose. The tasks of the R.E. were now both tactical and administrative, while at the same time intensive training continued. To Headquarters Home Forces, a Chief Engineer, Major-General C. J. S. King, was appointed. As administrative control was still in the hands of the War Office dealing direct with Commands, General King's duties were chiefly concerned with the technical direction of defence works and the training of R.E. personnel and units. With his assumption of the supervision of the latter, the post of Inspector Royal Engineers became redundant and was abolished.

The control of engineer work in Commands led to some of the major difficulties which arose from the fact that the United Kingdom was now a theatre of war. In peace expenditure was approved by the War Office to Commands, where the executive control was exercised by the Major-General in Charge of Administration on behalf of the Commander-in-Chief of the Command. The fundamental basis of control is that no expenditure can be incurred without War Office approval with the necessary financial provision. In a theatre of war there is no financial limit to expenditure and operational requirements are met as they occur. The only limits are man-power and the availability of material.

Now, the policy of operational work was determined by the Commander-in-Chief, Home Forces. There was therefore a dual control, namely the War Office and Headquarters, Home Forces. This led to confusion which was only cleared up when the active threat of invasion lessened, and various measures taken with regard to the reorganization of the Works Services, as described in Chapter VII, were carried out.

The two main tasks of the Corps at this time were:—

(*a*) Anti-invasion defences, and
(*b*) Increased accommodation both for troops and service installations.

Anti-invasion Defences

It can be imagined that, in the state of disorganization and the necessity for training of the troops immediately after the fall of France, the R.E. units could shoulder only a comparatively small part of the extensive work required in the preparation of the country to resist invasion. A great deal had therefore to be carried out by the Works service employing civilian contractors. In making plans for this work it came to light that, scanty as was the accumulation of engineer intelligence about possible overseas theatres, none was available centrally about the Home country. No complete investigation had been made as to the beaches most suitable for sea-borne invasion, and the possibility of an air-borne invasion on a large scale had never been contemplated and consequently the most likely areas for such an operation had never been investigated. Knowledge of details of road, railway and water communications had not been collected, though the information thereon was available in the offices of the organizations concerned. While much of the information had to be collected and sifted by other services, the Royal Navy

and the R.A.F., the duty of amassing a large proportion fell on officers of the Corps, and chiefly on the Chief Engineers of Commands for the areas for which they were responsible. This entailed a great deal of personal reconnaissance, and reference to transport organizations, and, at the time, the staffs of Chief Engineers were totally inadequate for the purpose, especially as they were already inundated with work on urgent services. A staff officer was appointed to each Chief Engineer to co-ordinate the work and to collate the material as it was received. For the practical work on the ground officers were borrowed from engineer training units and establishments.

As Eastern Command, then commanded by an officer of the Corps, General Sir G. Williams,[1] was responsible for almost the whole of the most threatened part of the coast, that between the Wash and Portsmouth, a new South-Eastern Command was formed to take charge of the defensive preparations and administer the forces in that area of the old Eastern Command which lay south of the Thames.

But the start of work on defences could not be postponed while the information was being collected and considered. Chief Engineers had to decide on the most urgent work as far as that could be judged at the time and arrange for its prosecution by any means at their disposal. One rang up a big building contractor and asked him to build 200 concrete pillboxes, hurriedly sited by the General Staff, on a fifty-mile stretch of coast, and to complete the job in three weeks. The contractor agreed and the work was very nearly completed in the time specified, in spite of great difficulties due to the shortage of transport. Similar efforts were being made along much of the east and southern coasts of the country. Inland, where local defence was largely in the hands of the newly formed Local Defence Volunteers, somewhat primitive road blocks, later covered by pillboxes of varied types of construction, were erected often by small local contractors or even by the personnel of the L.D.V. under what R.E. supervision could be made available.

It may be imagined that, under such extemporized arrangements many mistakes were made which would not have occurred if previous planning had been possible. In spite of this much valuable work was carried out in this period by the hard pressed engineer organization. But soon formation engineers became available and

[1]General Sir G. C. Williams, K.C.B., C.M.G., D.S.O., Chief Royal Engineer.

took over much of the actual work, and supervised most of the rest in their own areas.

Thus C.E.s of Commands, who in peace had been entirely concerned with Works, had now as C.E.s of Armies to combine attention to operational requirements with that to their works responsibilities, while R.E. units, and contractors working under the direction of R.E. officers of the Works Service, were used indiscriminately on all engineer work. The distinction between R.E. employment on Operations and Works was rapidly disappearing.

From the outset, it was decided that all effort should be concentrated on preventing the enemy from landing, rather than on defeating his troops by counter-attack farther inland. The principal effort was therefore concentrated on beach defences, particularly, as information became available from the Royal Navy, on those portions of the coast-line which offered the best facilities for landings in force. In the first place all exits from suitable beaches were blocked by anti-tank obstacles of all forms of construction, concrete, steel, and ditches. Between these, extensive minefields were laid and wire obstacles erected. On the beaches themselves anti-personnel and tank obstacles were sited to hold up the invaders under the close small arms and artillery fire of the defenders who were provided with concrete works, field defences and trenches. Later other ingenious devices were added and included installations, constructed by civil oil companies, designed to cover the water near the beach with oil when the invaders' ships appeared, and to set fire to the floating oil as the landing craft approached the shore.

An important addition to the engineers in Home Forces Command at this early stage was provided by the Royal Canadian Engineer units of 1st Canadian Division (C.R.C.E. Lieut.-Colonel G. S. L. Hertzberg, R.C.E.) and of Canadian Corps Troops (C.R.C.E. Lieut.-Colonel Melville, R.C.E.). Not only were these units more richly endowed with mechanical plant than their British comrades of the same period but, thanks to the insistence of their Commander, Major-General A. G. L. MacNaughton, himself an engineer, they were backed up in Corps Troops by Canadian Pioneer Battalions R.C.E., whose title was soon changed to Canadian Battalion R.C.E. These formations were absorbed in July, 1940, into VII Corps to the command of which General MacNaughton was appointed, the other formations of the Corps being 1st (British) Armoured Division (C.R.E. Lieut.-Colonel H. Williams) and 2nd New Zealand Division. The Corps Troops Engineers, which were entirely Canadian,

comprised 2nd Field Company, 12th Army Field Company, 1st Canadian Pioneer Battalion, 2nd Road Construction Company and 1st Tunnelling Company R.C.E. The last named unit had been formed originally as a special pipe-pushing and diamond drilling section of 12th Field Company R.C.E. It was specially valuable in preparing for cratering roads leading from the beaches which were required for use till an actual landing was in immediate prospect. It is interesting to note that the policy aimed at by General MacNaughton for engineer organization in formations was that, that of divisions should follow the lines of the British establishment, but that the Corps Troops engineers should be much stronger, including besides the normal three field companies and one field park company, four battalions R.C.E., two road construction companies, and two tunnelling companies, giving a total strength of 5,000. By Christmas 1940, 2nd Canadian Division had arrived (C.R.C.E. Lieut.-Colonel J. P. MacKenzie, R.C.E.).

The laying of minefields was the first large scale practical experience the British Army had had in this branch of warfare. Lack of experience, and hurried operation, led to many mistakes being made which were to cause much trouble to units and members of the Corps later, as will be seen as the narrative progresses. Drill for laying out, recording and marking had not been fully developed or practised. In consequence it was difficult to locate the mines when it became necessary to alter or move the fields. The trouble was intensified by the fact that many of the minefields were located in sandy ground near the beaches and in the course of time the drifting sand covered the mines and obliterated all trace of the markings. Often the mines themselves moved several yards.

When the higher priority work on the beach defences had progressed sufficiently, work on defence lines farther inland, which had, as has been shown, been carried out by less organized methods in the meanwhile, was taken more seriously in hand. Defence lines with continuous anti-tank obstacles were now constructed to cover the approaches to London and to afford check lines against invaders who might penetrate the defences on the coast. To permit of normal civil movement and that of reserves removable blocks were constructed on roads passing through defence lines. In the early stages these were constructed hastily with materials immediately available, but later more efficient designs were produced. These normally took the form of solid concrete blocks on each side of the road and forming part of the continuous obstacle, while in the road-

way itself concrete sockets were sunk in several lines into which steel stanchions, four or five feet high, could be dropped when it was desired to close the block. In conjunction with these, concrete cylinders were placed at the sides of the roads in front of the blocks which could be rolled on to the road and would themselves prove an efficient obstacle to tanks. The blocks were covered by the fire from concrete pill-boxes the camouflage of which afforded much scope for the ingenuity of those responsible.

Defence against enemy air action was of both active and passive form. The active defence was in the hands of the R.A.F. and, under their direction, of army units of Air Defence of Great Britain. In this connexion the chief duty of the Royal Engineers, as has been indicated above, was the provision of accommodation and amenities at the thousands of sites for gun, searchlight and radar stations scattered all over the country which had been begun in the earliest stages of the war. This work will be further considered in connexion with the account of the provision of accommodation for all military troops and establishments in this period of the war.

Airfield Maintenance and Construction

On the other hand the growth of our air force, all of which was now concentrated in the Home Country, and the necessity for more airfields for the defence of the country and the seaways leading to our ports, made essential a large programme of airfield construction. The responsibility for the construction of airfields in the British Isles lay with the Air Ministry, but no organization existed for the repair of airfields damaged by enemy bombing, and the Air Ministry had no means of dealing with sites in outlying parts, such as the west coast of Scotland or Northern Ireland, and which were far from centres of population which might produce the necessary labour. With the troops returned from France with the B.E.F. it will be remembered there were many general construction companies R.E. which had been specially raised for this type of work. The first five of these companies to be reorganized were dispatched for maintenance duties at the end of May, to nineteen airfields first in priority. By the end of June, 1940, no less than 134 airfields had had R.E. maintenance parties assigned to them. These units had not long to wait. The first damage to an airfield by enemy bombing attack was reported on 5th June, and in the next few weeks incidents increased rapidly till in August, 1940, there were one hundred raids. Manston airfield, in the Isle of Thanet, was distinguished by suffering a raid

every day in August, September, and October. The virulence of these attacks on airfields is accounted for by the fact that they formed the first phase of Hitler's plan for the invasion of Britain. Before any seaborne invasion could be undertaken it was necessary to neutralize the British air forces and so prevent the latter interfering with the passage of troop-bearing craft across the Channel and the North Sea. This led to what was known as the "Battle of Britain" in which swarms of German aircraft attacked airfields and centres of production and were met by the numerically inferior British Air Force, the latter backed by guns, searchlights, and radar stations of Air Defence of Great Britain. Heavily outnumbered, the British fighter pilots gradually wore down the attack while the guns took their toll of the invaders. The battle waged in growing intensity till in mid-September, 1940, the proportionate losses of the enemy became so heavy that the aerial offensive was called off and the invasion at first postponed, and later abandoned by the enemy.

At first the lack of transport and mechanical plant made the work of airfield maintenance difficult and arduous, but in spite of these handicaps the units managed to keep their airfields operational and to repair all damage. In fact it may be said that it was largely due to the efforts of these parties of R.E., and their pertinacity in keeping the airfields serviceable, that the R.A.F. fighter squadrons were able to keep in the air and so win "The Battle of Britain". The units were grouped for control under a steadily increasing number of Cs.R.E., there being six by the end of July, 1940, stationed at Edinburgh, Leeds, Hendon, Andover, Tatterhall and Belfast respectively. Besides their job of repairs, the companies were largely responsible for the construction of defence works and indeed for manning them. Consequent on their rapid formation this entailed a considerable amount of military training in which they had been up to date largely deficient.

In view of the difficulties experienced by the Air Ministry in building airfields in out-of-the-way places, the War Office agreed to undertake the work at four sites in Northern Ireland with military labour, and for the purpose four general construction companies and nine road construction companies R.E. with 1,250 pioneers were dispatched. As the airfields were mostly required for squadrons of Coastal Command covering the sea approaches to western ports, the majority of them were situated in isolated places on the north coast. The units had first to build their own accommodation and be entirely self-contained. The spirit of these units, hurriedly thrown

into uniform from civil life, may be judged by the fact that when the District Commander visited them and asked what arrangements they would like for the provision of entertainment, the reply was that they were perfectly happy as the men, on their own volition, spent their evenings drilling and carrying out military training in and about their huts.

Later, in March, 1941, other units were sent to Scotland to construct airfields in similarly isolated sites at Campbeltown and Islay. But the War Office could not afford to lock up indefinitely general construction and road construction companies on the repair of airfields. Accordingly the Air Ministry agreed to raise special works companies for the purpose which should take over the work progressively. The R.E. units north of a line from Liverpool to the Wash were accordingly freed at the end of June of that year. By this time the intensity of enemy raids had decreased and the newly formed Air Ministry units were able to cope with the work.

Passive Air Defence

Passive defence was concerned with the protection from, and remedying the effects of, enemy bombing, and also with measures to counter the threat of enemy airborne landings in the country. The protection of the civil inhabitants and installations was in the hands of the civil authorities, though Royal Engineer units were frequently called in to assist with urgent work which, for one reason or another, could not be carried out by the depleted staffs of Local Government Authorities or by civilian firms of contractors. The provision of bomb-proof accommodation for command posts and other vital military centres, whether constructed in concrete or tunnelled underground, was largely carried out by the engineers of the formations. But generally the protection of troops was afforded by the use of slit trenches dug by the troops themselves in the neighbourhood of their posts or billets. Troops, particularly engineers with mechanical equipment, were frequently called on to clear debris, the result of bombing in towns. This work was given high priority, not only for the rapid restoration of communications, but also because it was found that the prompt clearing up of the havoc caused by bombing had a marked effect on the morale of the civilian population.

In London in the autumn of 1940, the work of repairs, necessary owing to the effect of enemy bombing, became too great for the civilian forces available and the War Office was asked to assist.

Accordingly a "Special Force" of twelve general construction and five docks maintenance companies was formed to help, with Colonel C. F. Carson[1] as Chief Engineer. Other groups of units were similarly made available in other parts of the country. The basis of the agreement between the military and civil authorities was that the military authorities placed the resources of this force in manpower and plant at the disposal of the civil authorities to be used where it could best render service to the community, with the stipulation that the jobs allotted were to be really worth while engineering undertakings as distinct from mere clearance work requiring no special skill. At first, as was natural, the civil authorities were somewhat shy of handing over to the Army important tasks on their most cherished possessions. But the results achieved by these R.E. units soon created a sense of confidence in their work and more and more important jobs were handed over for their attention. A tribute to their efforts was paid by Sir Peirson Frank, Chief Engineer of the London County Council, in his Presidential address to the Institution of Civil Engineers in 1945.

What might be called the climax was reached on 11th January, 1941, when the engineer in charge of bomb repair work in the City of London handed over to the Officer Commanding 691st General Construction Company R.E. the task of dealing with what was one of London's largest craters. A bomb of unknown calibre, but obviously heavy, had fallen in the open space in front of the Royal Exchange and the Bank of England, where six important thoroughfares met, and which has been called "The Hub of the Empire". This space, though apparently solid roadway, was in reality a roof, consisting of approximately 2 ft. 3 in. of mass concrete on steel troughing carried on a framework of steel girders and columns, covering the Bank Tube Station. The bomb had apparently penetrated the roof and exploded on impact with the floor of the station. The effect of the explosion in the confined space lifted and shattered the roof, which fell back into the cavity, forming a crater of about 18,000 sq. ft. in area, 150 ft. long and from 10 to 30 ft. deep, filled with the debris of twisted girders, steel troughing and blocks of concrete.

Within an hour and a half, forty Sappers and 260 Pioneers, with five cranes, one bulldozer, twelve compressors (later increased to nineteen), six oxy-acetylene cutters and twenty-five lorries were on the site, the plant being provided from civil resources. The first job

[1]Brigadier Sir C. F. Carson, Kt., C.B.E., M.C.

was the clearance of debris and the rescue of casualties. In this the party was greatly assisted by two sappers of a New Zealand forestry company using New Zealand timber jacks. This implement, though previously little used in this country, was of simple construction and rapidly lifted the large blocks of concrete to enable slings to be passed under them. In the first thirteen days 2,713 tons of concrete, 225 of steel troughing and 131 of girders were hauled clear and carted away. But the gigantic crater still remained and it was essential to restore the flow of traffic as quickly as possible. As it was clearly impossible to cover the whole area of the crater at once, it was decided to restore east-west traffic first by building a bridge from Queen Victoria Street to Cornhill and then to clear a roadway approximately twenty feet wide round the edges of the crater to form a kind of improvised roundabout by which access could be gained to all streets leading into the area. When the latter had been completed it would be possible to remove the bridge and commence re-roofing the area. Owing to the position of lift and escalator shafts the selection of a site for any intermediate pier was limited to one which was built of standard light railway trestle equipment. Two spans, 50 ft. 6 in. and 113 ft. 6 in., each composed of a four girder large box-girder bridge, were used and it was calculated that such a design would carry 12½ tons London Passenger Transport buses with no spacing restrictions. The construction of the bridge took four and a half days, the bridge being opened by the Lord Mayor who thanked the officers and men on behalf of the citizens of London, adding, "You have shown magnificent spirit, the spirit that is going to win the war."

Concurrently with the construction of the bridge, work proceeded on the new carriage way round the crater. In most places the inner side was supported by a brick wall which the unit built on the floor of the booking hall, and the space between this and the edge of the crater was bridged by salvaged steel troughing. The first section, Queen Victoria Street to King William Street, was open to traffic seven days after the completion of the bridge. When sufficient roadway had been completed to allow traffic to flow round the perimeter, the bridge was dismantled and the job of the R.E. was finished.

The duty of obstructing all flat open spaces on which enemy aircraft could land was given to the Civil Defence authorities, and Regional Commissioners, who were charged with the direction and co-ordination of civil defence, warned local authorities and large landowners of their duty to put up obstructions on ground suitable

for the landing of aircraft. In the early days old carts, tree trunks and all kinds of "junk" were used for the purpose, and frequently trenches were dug criss-cross over fields. This caused considerable difficulty in the case of land under cultivation or scheduled for ploughing in the near future. The importance of increasing the output of foodstuffs, for which the country was so largely dependent on imports, made some modification of this practice necessary. For example the county of Lincolnshire, while being an important food raising area, forms, to all intents and purposes, one huge airfield. Obstruction was therefore limited in the case of agricultural land to that in the neighbourhood of large towns or centres of military importance, while the Royal Engineers assisted by filling in trenches and replacing them and other obstructions by concrete posts which permitted the freer use of agricultural machines. In the East Riding of Yorkshire alone the Chief Engineer Northern Command provided, and arranged for the erection of, 100,000 such posts at a cost of £1 a piece.

Bomb Disposal

Before 1939, little had been done in the British Army to provide any organization for the disposal of unexploded aircraft bombs or artillery shells. The responsibility for the destruction of the latter, usually performed on artillery ranges under peace conditions, rested on the R.A.O.C., which Corps had no special organization for carrying it out. In practice, both on ranges and in the field in World War I, the work was largely carried out by field units R.E.

The problem of the disposal of aircraft bombs which had failed to explode first began to be recognized during the civil war in Spain in 1938. Here for the first time extensive bombing of towns became common as a result of the concentrated attacks by aircraft, principally of Fascist Axis and Russian origin. The stories of the effects which reached Britain gave rise to active consideration of the problems of passive and active air defence, including that of the disposal of bombs which fell and failed to explode in areas where it was dangerous that they should remain. While considerable attention was devoted to the steps to be taken for the protection of the civil population and for active anti-aircraft defence, little was done, chiefly because of the absence of technical information about enemy munitions, to provide for bomb disposal.

When Germany invaded Poland at the end of August, 1939, reports reached the Government of the devastation caused, and also

of the delaying and disorganizing effect of bombs which failed to explode. To meet a similar danger in this country it was at first proposed to set up a civilian organization to deal with the menace, but in the absence of civilians trained in the handling of explosives it was decided that the War Office would undertake the responsibility till such time as a sufficient body of civilians could be trained to take it over. Accordingly in November, 1939, a number of men were found who were trained by field companies and were then formed up into Bomb Disposal parties, R.E., each consisting of a junior N.C.O. and two sappers. Each party was equipped with a van or car, explosives, picks and shovels and sandbags. When trained these parties were sent out to places considered likely to become targets for enemy bombers. At the same time the Royal Navy and the R.A.F. set up similar organizations to deal with unexploded bombs which might fall on their establishments.

At this time the only instructions issued for guidance were a "hash-up" of the peace-time ordnance regulations for the building of sandbag parapets round the bomb or shell before it was detonated. No information was available as to the types of enemy bombs which might be encountered, or of the nature and mechanism of their fuses. Under such circumstances the training given to the disposal parties was of the flimsiest, and they had largely to rely on their own commonsense.

In the first two months after the return of the B.E.F., few bombs were dropped in the United Kingdom, the urgency of the problem faded, and interest died away. In consequence the R.E. parties became waifs and strays abandoned by their parent companies and unwanted by the local military authorities. They soon became fatigue men doing the odd "chores" that might crop up in their vicinity. Even the task of training the civilian crews who were to replace them evaporated for, in February, 1940, the Home Office declared its inability to find men and form the necessary organization. The ball was thrown back at the War Office which was asked to report to the Cabinet as to what should be done. The result of this report, which was rendered in May, 1940, was that it was decided that, as the work was highly dangerous, a special, properly equipped organization would be required which must act in close concert with the Civil Defence organization. The basic unit of the organization decided on was the "Bomb Disposal Section", consisting of one officer and fifteen other ranks, divided into two sub-sections, one for "removal" and one for "sterilization". Each was completely

self-contained and mobile. One hundred and nine of these sections were formed and distributed according to the relative importance of the various towns and centres. The order approving this organization was issued on 17th May, and by the end of June, the 109 parties, shortly increased to 120, were in position.

For the time being the sections were attached to Home Defence battalions and placed under the operational command of area commanders, but with increased threat of enemy activity a more fully co-ordinated organization was necessary. The service was therefore placed under C.-in-C. Home Forces whose C.E. was called to a personal interview on the subject with the Prime Minister. It was decided that a complete organization under one officer was necessary, and accordingly Major-General G. B. O. Taylor, who had recently been D.F.W., was appointed Director of Bomb Disposal. He was succeeded in 1942 by Brigadier H. H. Bateman. The completion of the organization came just in time, for intense bombing began in July.

Imperfections in the organization soon came to light in the face of practical experience. As, contrary to expectations, most unexploded bombs penetrated deep into the earth, it was found necessary to increase the proportion of "Removal" to "Sterilization" Sub-Sections.

Finally operational control was taken from Area Headquarters and the units detached from Home Defence battalions.

Under the hail of bombs which descended on the country in the late summer and autumn of 1940, the imperfect organization was soon overwhelmed, and by the end of August 2,000 U.X.Bs. (Unexploded Bombs) remained to be dealt with. In consequence the size and number of sections were doubled. At the same time, by the direct order of the Prime Minister, high priority was given to the development and production of special equipment both to assist excavation and for the sterilization of the bombs. To find the personnel required for expansion seven general construction companies and four quarrying companies R.E. were converted; and, as a basis for technical development, a system of reports on enemy missiles was introduced. To handle the increased sections, company headquarters, each to control twelve sections, were set up. A further advantage of these companies was that senior officers were available to keep touch with the various civil defence headquarters. The new organization also gave more flexibility in that groups of units could be held in hand and moved to stricken areas as required. About the

same time additional companies were formed at Halifax with a nucleus of trained men to which were added in each unit 200 men from the normal army intake. These units, in January, 1941, relieved the expanded quarrying and general construction companies, absorbing from the latter experienced men surplus to their normal establishment.

But, while above their heads these changes in organization were going on, the officers and men of the sections were quietly carrying on with their job. It was a cold-blooded business. When reports of the arrival of a bomb which had not exploded came in, it was first necessary to reconnoitre to see if it was really there. In a great many cases the original report proved to be a false alarm. Either the object was not a bomb, or in some cases it had penetrated deeply into the ground before exploding and made no crater. Once confirmed, and if the position of the bomb demanded immediate attention owing to the proximity of buildings, etc., which could be damaged in its explosion, the section moved up and started work. Very frequently considerable excavation was necessary before the bomb could be reached. Penetration up to sixty feet was recorded. This was a "jumpy" occupation, as any violent disturbance might set the bomb off, and often the soil where the penetration was deepest was such that casing or timbering was required. For this, usually timber (at first) but later steel became available. Once the bomb was reached its type and probable performance had to be determined by inspection. It might be fitted with a delay action fuse which had not run its allotted time. It might be that the delay action mechanism had been put out of gear by the shock of landing, in which case any disturbance might set it in action again. Or it might be a simple contact fuse which had not operated. Later the enemy added all sorts of ingenious complications, the most serious being attachments to the fuse which caused the bomb to detonate if attempts were made to withdraw the fuse. In the early days, before information about enemy fuse markings had been collected and collated for the use of investigating officers, this inspection had to be carried out by the light of nature. Many of the delay action fuses were operated by clockwork and stethoscopes were used to hear if they were still ticking, or if the disturbances caused by the work started them in action again.

Such primitive methods could not be allowed to continue to be used indefinitely and, by the personal intervention of the Prime Minister, the aid of scientific and civil engineering organizations

was called in to investigate and follow the development of enemy devices, to produce methods and implements for the sterilization of fuses, and to develop means and tools for their extraction and for the more rapid and simple methods of excavation of the bombs themselves. For sterilization, various methods of gumming up or "freezing" the mechanism of the fuses were gradually produced and brought into use. For digging out the bombs better methods of revetting the sides of the excavation were introduced.

With all these aids the work of the bomb disposal personnel became easier and considerably safer, though it was still to remain an extremely dangerous job, and one that demanded a very high standard of courage and devotion to duty on the part of officers and other ranks. But the greatest admiration must be extended to those members of the service who, in its early stages with little knowledge of the problem, with inadequate equipment, and a very elementary organization, carried on cheerfully, and who suffered a high percentage of casualties. These small parties were called on at short notice to deal with bombs neither the nature of which nor the method of operation of their fuses was known. Lying frequently in soft soil at considerable depth the R.E. parties had to dig down to them, never knowing when they might explode, timbering the sides of the excavation largely by the light of nature, and with inadequate tools. Then having uncovered the bomb it had to be decided, in regard to local circumstances, whether it should be destroyed where it was, removed complete to a place where it could be destroyed with impunity, or whether the fuse, possibly of unknown performance, should first be extracted. Whichever of the two latter methods were employed, there was always the danger that tampering with the fuse, or moving the bomb, would set off the fuse or restart the delay action mechanism. It is not surprising that such cold-blooded heroism, displayed under the eyes of the population, should have captured the admiration and affection of the public.

Thirteen members of the Bomb Disposal Service were awarded the George Cross in the United Kingdom during the war, for especially hazardous work in a particular incident, or for continuous devotion to duty in dealing with U.X.Bs., including investigation of new types of bombs or fuses so that others might in future handle them with greater safety. It would not be possible in the space available, and largely repetitive, to give details of the acts for which all the awards were made, but, after giving the names of the recipients, two typical cases will be described.

Recipients in the Bomb Disposal Units of the George Cross

Lieutenant Edward Wormersley Reynolds[1] of 101st and 102nd B.D. Sections R.E. Citation in *London Gazette* dated 17th September, 1940, for two incidents at Congresbury and Bristol.

2nd Lieutenant Ellis Edward Talbot[2] of 103rd B.D. Section R.E. Award dated 17th September, 1940, for an incident at Loughor, Wales.

2nd Lieutenant Wallace Launcelot Andrews[3] of 22nd/23rd B.D. Sections R.E. Award dated 17th September, 1940, for an incident near Croydon, Surrey.

Lance-Sergeant William John Button[4] of 48th B.D. Section R.E. Award dated 17th September, 1940, for action near Hook, Surrey.

Lieutenant Robert Davies[5] of 16th/17th Section, 5th B.D. Company R.E. Award dated 30th September, 1940, for action at St. Paul's Cathedral, London.

Sapper George Cameron Wylie.[6] ditto.

Lieut.-Colonel A. D. Merriman.[7] Award dated 3rd December, 1940, on Civil Defence recommendation.

Captain Herbert John Leslie Barefoot[8] of 4th B.D. Company R.E. Award dated 22nd January, 1941, for numerous incidents, and for continuous investigations of many types of bombs and fuses.

2nd Lieutenant Alexander Fraser Campbell[9] of 68th Section, 9th B.D. Company R.E. Award dated (posthumously) 22nd January, 1941, for action at Coventry.

Sergeant Michael Gibson[10] of 9th B.D. Company R.E. Award dated 22nd January, 1941, for an incident at an important factory.

[1]Captain E. W. Reynolds, G.C.
[2]Lieutenant E. E. Talbot, G.C., M.B.E., killed in action, 1941.
[3]Major W. L. Andrews, G.C.
[4]Sergeant W. J. Button, G.C.
[5]Major R. Davies, G.C.
[6]Corporal G. C. Wylie, G.C.
[7]Colonel A. D. Merriman, G.C., O.B.E.
[8]Major H. J. L. Barefoot, G.C.
[9]2nd Lieutenant A. F. Campbell, G.C., killed in action, 1941.
[10]Sergeant M. Gibson, G.C., killed in action, 1941.

Captain Michael Blaney[1] of Headquarters B.D. R.E. London. Award dated 15th April, 1941 (posthumously), for a large number of actions and for initiation of new methods on disposal.
He was responsible for the adoption of the policy of removing bombs wherever practicable in preference to blowing them up where they landed.

Lieutenant Bertram Stuart Trevelyan Archer,[2] R.E. Award dated 30th September, 1941, for numerous incidents.

Major Cyril Joseph Martin[3] of 1st B.D. Group R.E. Award dated 11th March, 1943, for numerous actions and for continuous work on experimenting with new types of B.D. equipment.

Among so many gallant men it is hard to select two men of whose deeds to give a fuller account. Of those chosen one represents experience in the early days when knowledge was limited and equipment primitive. The other, at a later stage, when technique both of fuse construction and counter measures were more highly developed.

On 24th August, 1940, when the Battle of Britain was approaching its climax, 2nd Lieutenant Talbot set off with his party of 103rd B.D. Section R.E., to deal with an unexploded bomb which had fallen in the neighbourhood of Lougher railway station in Wales. They had had little or no experience of the practical side of their work. As equipment they had only a lorry, simple digging tools, some timber and carpenter's tools for revetment, and some spanners for attacking the fuse. The bomb was found to have penetrated deeply into the soil and for 12½ hours the men of the party worked in relays on the excavation, all of which time 2nd Lieutenant Talbot superintended the work. Eventually the bomb was secured and brought to the surface. When Talbot examined it he came to the conclusion that the fuse was of a new delay action type and he ordered his men to move away to a safe distance. After some careful examination he decided to move the bomb to a place where it would do no damage if it detonated. Accordingly, keeping his men still under cover, he lifted it. It was one of the smaller type usually met with in early days, and carried it on his shoulder some 200 yds. to a safe spot. Though, as the citation records, it was "a fine example of courage and devotion to duty", the deed was typical of many incidents in the history of the Bomb Disposal service.

[1]Captain M. Blaney, G.C., killed in action, 1941.
[2]Lieut.-Colonel B. S. T. Archer, G.C.
[3]Major C. J. Martin, G.C., M.C.

The main incident leading to the award to Major Martin is well described in the citation announcing it in the *London Gazette*:

"During the night attack on London on the night of 17th/18th January, 1943, a large calibre bomb fell in the warehouse of the Victoria Haulage Company at Battersea, and, after tearing its way through roof girders, machines and packing cases, came to rest unexploded immediately beneath the bed plate of a very large lathe.

"Owing to the fact that the warehouse was full of new and heavy machine tools from the U.S.A., the Ministry of Supply applied to the Regional Commissioner for Category A.1. (i.e., highest priority, involving the immediate removal in spite of risk). This was granted and on the morning of 18th January, 1943, a working party commenced disposal operations.

"During the day, 18th January, another Category A.1. bomb had been found to contain an entirely new type of fuse which, on examination, during the night of 18th/19th January, was found to embody characteristics which indicated it to be not only more formidable as an anti-handling and booby trap than any other type so far met, but to be proof against any known technique or equipment. On the same night the bomb at Battersea was identified as a 500 kilogram (½ ton) projectile with two fuses and the casing so distorted as to render their withdrawal impossible. On further examination one of the fuses was found to be of the new type. This necessitated the closing down of the large flour mill (flour was strictly rationed on account of shortage of supply) next door to the Victoria Haulage Company owing to the excessive vibration, and work on the bomb was temporarily suspended.

"In view of the urgent necessity of getting the flour mill working again and for removing the threat to machinery of the utmost importance to the war effort, it was decided to attempt to remove the base plate of the bomb and extract the main explosive filling. Major Martin, who was fully aware of the extremely formidable characteristics of the new fuse, undertook the task and assisted by Lieutenant Deans, on 20th January, succeeded in removing the base plate only to find that the bomb contained solid cast T.N.T., which could only be removed by the application of high temperature steam. It was considered that the risk of detonating the bomb would be too great if the normal steaming out process was used by remote control owing to the very high temperature generated and the excessive force of the steam jet, the effect of which on a possibly loosened fuse pocket could not be foreseen. It was decided, therefore, that the

only way was to apply the steam nozzle by hand, and only long enough at a time to soften the T.N.T. sufficiently to allow it to be scraped away in small quantities. This not only entailed further excavation to make working space and supporting the bomb in such a way that it could not slip or be moved, but also involved two men being constantly in the bomb pit to manipulate the steam and cooling water pipe and to scrape away softened explosive. This extremely arduous task was undertaken by Major Martin who, assisted by Lieutenant Deans, worked continuously from the afternoon of Wednesday 20th January, through the night until 8.30 a.m. on 21st January, by which time they had succeeded in removing the entire main filling of cast T.N.T. from the bomb. The work was carried out in a cramped hole filled with steam and water in which they had to lie alongside the bomb for nearly twenty-four hours during which time both officers had every reason to believe they were in extreme danger. Throughout the long and hazardous operation Major Martin displayed cold-blooded courage and tenacity of purpose with complete disregard for the appalling risks involved."

After referring in detail to two other incidents in which Major Martin dealt with bombs containing fuses of novel type, and mentioning eight other similar tasks, the citation concludes: "Major Martin has been intimately concerned with Bomb Disposal operations in the London area since September, 1940. During the heavy raids of 1940–1, he personally dealt with a large number of U.X.Bs. many of which were of the delayed action type. His contributions to the technical development of Bomb Disposal technique have been valuable and at all times he has displayed the same cool deliberate courage and complete disregard for personal danger."

With the cessation of intense bombing on the United Kingdom in 1943, the Bomb Disposal units were able to clear up some of the backlag of U.X.Bs. which, owing to their comparatively innocuous situations, had been left while more urgent cases were dealt with. This work continued with steadily decreasing intensity till the end of hostilities and on into the period of peace. Indeed the work was still going on to the end of the period covered by this volume. But with reduced activity in their own sphere, Bomb Disposal units assisted in the clearance of the many minefields which surrounded our coasts (see pages 138, 139). Indeed this became for a time their greatest activity.

The total number of explosive items dealt with in the United Kingdom up to the end of hostilities amounted to 45,441 bombs,

6,983 A.A. Shells, and nearly 300,000 beach mines. Casualties amounted to 55 officers and 339 other ranks killed, and 37 officers and 172 other ranks wounded. The high proportion of killed to wounded is a clear indication of the nature of the work.

Bomb Disposal units accompanied all the major expeditionary forces to overseas theatres, except the B.E.F. 1939–40, and references to their work will be found in the chapters devoted to the campaigns.

Accommodation

It well may be imagined that the concentration of the majority of the British forces, with considerable contingents from the Dominions, in the United Kingdom, involved serious problems in the provision of accommodation for fighting formations, training units, and administrative installations, and caused a considerable expansion of the already hard pressed works service. This came at a time when much labour had to be diverted to defence work, and the extensive damage caused in towns by enemy bombing led to a further diversion of labour for repair work. As far as possible troops were accommodated in requisitioned buildings, but even so it was estimated in the summer of 1940 that 30,000 huts would be required to be erected by October, to get all the troops under roofs before the winter. Shortage of materials, cement, timber, steel, asbestos sheets, added to the problem, and it speaks wonders for the works service that the job was done as successfully as it was.

With such a demand for huts for use in Britain, added to that to provide accommodation in the Middle East and elsewhere, the design and production of a suitable hut was of vital necessity. The Nissen hut, used with such success in World War I, was still in production, and with permission of Messrs. Nissen Ltd., large numbers of these huts were manufactured and considerable numbers were shipped, and used by the B.E.F. in France, only to be lost at the fall of that country. The chief disadvantage of this type of hut was its curved covering sheets which were troublesome in packing and transport.

For storage a modification of the large Nissen hut, known as the "Iris", was produced but failed under the weight of snow in the hard winter of 1940–1.

Owing to the shortage of steel, the Ministry of Works produced a number of designs of concrete and plaster-board huts. The former proved too heavy, would not stand up to rough handling, and

required a large proportion of skilled labour for erection. The plasterboard types were flimsy and liable to leak.

The office of the D.F.W. therefore applied themselves to the task of producing a more satisfactory hut. The result was the "Romney", so named after the new office of the Directorate. This hut consisted of four curved segments of tubular steel, bolted together to form a semi-circular arch, with purlins of angle irons. The covering was corrugated iron and the lining plasterboard secured by hook bolts. Roof lights were provided. The standard hut measured 96 ft. by 35 ft., and the total weight of steel in each amounted to not quite ten tons. The hut was an immediate success and was used eventually in almost all theatres of operations. It might be said that it ranks with the Bailey Bridge as one of the outstanding military engineering triumphs of the war.

Other modifications of the Romney hut were later produced and widely used. Amongst these were the "Semi-Romney" which was merely the framework of the Romney with canvas instead of corrugated iron covering, and smaller types of similar design known as the "Abbey" and "Tufton" huts.

The provision of accommodation for units of A.D.G.B. has already been referred to, and the programme of provision of depots and workshops for the various services grew apace. The requirements of the Ordnance Service were amongst the major of the new demands for construction. These will be dealt with in the next period under review when they reached their zenith, but even in 1940 and 1941, a start was made on several projects for the expansion of old depots and the construction of new ones. Particularly noticeable was the enlargement of the great vehicle depot at Chilwell, near Nottingham, and the beginning of work on two immense ammunition depots at Edge Hill and Shrawardine, later renamed Kineton and Nesscliffe.

To support these great efforts by formation engineers and the works service the small engineer stores organization had to be greatly expanded, as described in Chapter VII. We have also seen above that the depot at Donnington, taken over from R.A.O.C., had become hopelessly congested, and that, as a makeshift, two smaller depots had been opened at Charlton and Swindon. But something on a larger scale was obviously required, and in the summer of 1940, reconnaissance for a site for a new depot were started, with the result that one at Long Marston, near Stratford-on-Avon, was selected and development was commenced on 350 acres, with a possibility of

expansion on to another 350 acres of flat land. It was clear that it would not be possible to start operating a depot there for some time and the congestion at Donnington was steadily increasing. At the end of September, 1940, there were 715 railway trucks of bridging material held up in the yards there, and it became necessary temporarily to use civil depots. But work at Long Marston was pushed ahead and it was possible to open a large portion in April, 1941, when much of the surplus held in Donnington began to be transferred. Though further expansion came in a later phase it will be convenient here to note the progress made on this, the main engineer stores depot, and the provision of subsidiary depots elsewhere. By the end of 1942, 435,600 sq. ft. of covered storage was in use, with other stores stacked in the open over another 155 acres; 45 miles of railway siding, and 5½ miles of road had been constructed, and still expansion went on. In addition a number of other engineer stores depots were opened in various parts of the country, the principal being at the Royal Victoria Docks in London (a quarter of a million square feet of covered storage and ten acres of stacking space), Carston (near Liverpool) and Queensferry (Chester). Commands and Corps areas also had their own dumps, chiefly of defence stores, many of which were of considerable size.

The demands on the other services involved further requirements in depots, workshops, etc., and there were many calls on the Royal Engineers for extension of existing installations and the construction of new.

Transportation

The situation also called for operational activity by Transportation units which normally in the United Kingdom had been solely concerned with training. There was indeed so much to do that it became necessary to separate railway construction from operation. The operating troops had in the first instance to prepare themselves to carry out essential tasks, especially in the coastal areas in case of invasion. To this end the few units available were split up into detachments and scattered about the country in rail served military depots, with armoured trains and rail mounted artillery batteries. Others doubled up with civilian railway staffs "learning the line", on important stretches. Twelve armoured trains were formed and stationed along the coast, being manned by Polish troops with R.E. train crews. The R.E. crews of the four artillery trains were formed into one special railway operating company. Railway construction

companies constructed spurs for these mobile batteries and also to serve new coast defence batteries. They also helped the civil railway companies in constructing alternative routes for use in case of emergency and gained valuable experience in helping to restore lines damaged by enemy bombing.

Port construction and operating units were also called into service. This was in connexion with the provision of new port capacity in the United Kingdom to take the place of that on the east and south coasts which were virtually closed to ocean-going ships. It was decided to build two new ports on the west coast and for reasons of secrecy that these should be located at out-of-the-way spots. Faslane on Gare Loch and Cairn Ryan near Stranraer were selected. The difficulty of getting the work done by contract under war conditions in areas where there was no local labour, and the availability of R.E. Port Construction units, led to the job being handed over to the latter, and to their operation on completion by Port Operating units. Six berths, 500 ft. long, were erected at Faslane and five at Cairn Ryan, all with a minimum of 30 ft. of water alongside at low water. In addition, lighterage wharves of timber construction, each 900 ft. long, were erected at both ports to permit of loading and discharge of ships lying off in deep water. Both ports were fully equipped with roads, railway tracks, cranes, etc. Railway construction units R.E. in all laid fifty miles of track in the docks and in connecting them to the main lines, three and six miles away. Work commenced at the end of 1940, and the first ship berthed at Faslane in July, 1942, and at Cairn Ryan a year later.

As the ports were used for purely service purposes it was possible to operate them with a degree of secrecy impossible elsewhere. They were controlled entirely by the Transportation Service, and manned mostly by Transportation personnel. They thus formed an ideal training ground in practical work for docks operating and maintenance, railway, and movement control units R.E. The total tonnage handled to the end of 1945 was 645,000 tons as Faslane, and 284,000 tons at Cairn Ryan.

Phase III. June, 1942, to June, 1944
Entry into the War of U.S.A.

The attack by Japan on the U.S. Fleet at Pearl Harbour in December, 1941, and the consequent entry of the United States into the war, changed the whole situation in the United Kingdom.

Backed by a powerful ally, whereas before she had stood alone with her brethren of the British Empire and Commonwealth, Britain could now look forward to striking back rather than adopting a purely defensive attitude. The danger of invasion was now almost negligible, though her own preparedness had already made such an eventuality most unlikely. Indeed, we know, now that German documents are available, that as early as 17th September, 1940, as a result of the Battle of Britain, Hitler had postponed "indefinitely" the launching of "Operation Sea-Lion", as the projected invasion was called, and finally cancelled it on 13th February, 1942. Measures for defence, therefore, assumed a secondary importance, but the task of the engineers was not lightened. With the United States as an active partner, it was clear that the United Kingdom would become an advanced base for American forces intended for operations against the Axis Powers, and that American air forces would operate against Germany from British soil. The coming of the Americans was not unforeseen. Early in 1941 preparations were in hand for the formation of an American naval base in Northern Ireland, technicians had arrived from the U.S.A. and camps were cleared for the use of U.S. personnel, and by the autumn 4,000 had arrived. In June, 1941, U.S. Troops had begun to relieve the small British force in Iceland.

Accommodation

With the declaration of war on the Axis by the Government of the United States a much more extensive scheme for the reception and accommodation of American forces in Britain had to be undertaken. This was given the code name of "Bolero". It was agreed between the two Governments that Great Britain would be responsible for the planning and execution of the scheme, but that America should help particularly as regards labour. The first American troops were accommodated by clearing and expanding the existing accommodation in N. Ireland and by July, 1942, 42,000 troops had arrived. But this was only a first step. A first key plan was drawn up in May, 1942, which provided for the reception of over a million men. To those accustomed to peace-time financial control the handling of this project may cause some satisfaction, or the reverse! Presented with the outline of the plan the Treasury called for an estimate of what it would cost. Within half an hour the Engineer-in-Chief, Major-General C. J. S. King, returned a statement on half a sheet

of notepaper showing the estimated cost as £50 million. The expenditure was approved within another hour! In fact, the actual cost of the work included in the plan at this stage amounted to £49.9 million. It was fortunate that the expansion of the Works Organization had proceeded far enough to meet this task.

It may be imagined that provision for accommodation of a million men and their installations in these islands, where already two million British troops were deployed, presented no easy problem. After Northern Ireland the general scheme was to clear the majority of British troops from the south and south-west of England, and to concentrate the Americans in those areas. But even where existing accommodation was cleared and handed over difficulties abounded. British and American standards of accommodation and fitments varied considerably, as did their standards of construction. Even the so-called common language caused misunderstandings: tap and faucet, lift and elevator, lorry and truck, were among the simplest terms to be sorted out, and a glossary of building and engineering terms used by the two nations had to be prepared. Under the arrangements made much of the work was carried out by British contractors, some by Royal Engineer units, and a considerable amount by American engineer units with materials supplied from British sources. While in the early stages the provision of accommodation for troops took first priority, the construction of depots for the U.S. Service of Supply soon loomed large in the programme. The first of these was a large depot near Burton-on-Trent which was built by a combination of British civil and military labour. This was soon followed by others, the most important of which was at Wem in Shropshire. This, which was started in December, 1942, and finished in the following June, included nearly half a million square feet of covered storage space and 1,375,000 sq. ft. in the open. Four other depots were commenced in May, 1943, two being built by U.S. engineers and two by British with the assistance of some American labour. The total programme of depot construction for U.S. forces produced 18 million square feet of covered and 45 million of open storage space. An American report on the programme stated, "Although the depot programme required the most time, energy and material of all the ground projects, it was the best organized and most effectively executed. The British Ministries exerted every effort possible to provide the labour and material. Of those depots constructed, the construction methods of the Wem depot, which was done by a British contractor, should show it as

being the outstanding project completed by British labour. The Lockerby depot, accomplished by U.S. engineer troops, is an outstanding example of good troop construction".

But it was not only for the Americans that large new administrative installations were required. As mentioned earlier, work had started on many new depots for the various services, of which the lion's share was required for the R.A.O.C. Work continued during this period, and was indeed extended on the large vehicle depot at Chilwell, the ammunition depots at Corsham, Kineton and Nesscliffe, and many other smaller installations. But the most important job of all was the huge central ordnance depot at Bicester, started in autumn 1941, at an estimated cost of £5 million and which was to form the main post-war ordnance depot. For its construction a special C.R.E., Lieut.-Colonel J. P. Haugh,[1] was appointed and he had at his disposal a large civil labour force besides artisan works companies, pioneers, and 1,000 Italian prisoners of war. Besides 6¾ million sq. ft. of covered storage, mostly steel framework with brick cladding, and 5 million sq. ft. of open storage space, accommodation, with all necessary amenities, was provided for 14,000 personnel. There were 60 miles of railway and 24 miles of roads, and extensive drainage was necessary in many parts of the area. The work was well advanced when the invasion of Normandy was launched but the whole depot was not finished when the end of the war came, for, owing to the extra demands of "Bolero" and other requirements, the original estimate had been increased to nearly £6¼ million.

Work had also been going on during all these periods of the war on the great underground ammunition depot at Corsham, the inception of which has been referred to above (pages 105, 106). The coming of war had added greater urgency to the development of this project. Fresh chambers were opened up and taken into use for the storage of ammunition. Lifts and mechanically driven transporters were installed and an underground connexion with the railway had been developed. Then the seclusion of the site and its safety against bombing attacks attracted other claimants with high priority to its vaults. In one section a complete headquarters for a command centre for part of the air defences of the country was built and furnished with complete signal communications. Then, though the Royal Engineers were not concerned, a large new section was opened out and developed into an underground factory for special aircraft parts.

[1]Lieut.-Colonel J. P. Haugh, O.B.E.

Great secrecy was supposed to be maintained over this work, the effectiveness of which was somewhat spoilt by the fact that hundreds of workmen from Eire were employed in the work. These men, who could not be bound by any Official Secrets Act, were free to go backwards and forwards to and from their home country where a German Embassy was maintained throughout the war.

And so the great "Bolero" scheme progressed, while American troops and material flowed in a steady stream across the Atlantic. But with this concentration of military force the Allies were not going to be content to sit still. The time had not yet come for the invasion of Europe across the Channel. The German air forces had to be subdued before that operation could be undertaken with reasonable hope of success. But a landing in North Africa, to co-operate with the advance of the forces in the Middle East across the desert, was early on the planning table. This development caused some doubt as to the ultimate full extent of the "Bolero" programme. Some of the American and British troops already in the country were likely to take part in the new operation, while some American troops previously destined for Britain might be shipped direct across the Atlantic to the new theatre of operations, as indeed actually happened. This of course involved modification of the scheme, but luckily mostly in the way of reductions.

Training and New Developments

With active operations in view attention turned once more to training and to the development of new methods of warfare and equipment. The war in the desert had shown the importance of mine warfare, and the development of the Bailey bridge opened a new chapter in military bridging and much attention was given in training to these new elements.

Mine Clearance

In connexion with the former considerable practical experience was gained in the maintenance, and in some places the removal of minefields laid along the coast under the threat of invasion. It has been mentioned how, due to haste in laying and inexperience, the position of the mines in these fields had not been properly recorded. Partly in consequence of this, and partly through carelessness, accidents were of frequent occurrence, and when these happened there was always a call for the R.E., as the experts, to give assistance and to rescue people, both soldiers and civilians, who were lying dead or

wounded amidst the mines. This was very dangerous and unpleasant work and called for great courage and devotion to duty on the part of the members of the Corps involved. Many deeds of cold-blooded gallantry were recorded in which sometimes valuable lives were lost and which at times led to awards for gallantry. One out of many stories which might be told of such incidents may be recorded as an example of what this work involved.

Some men of an infantry unit, holding a sector of the defences on the coast near Chichester, strayed into a minefield and stepping on mines some of them were killed or wounded. A call for assistance to 262nd Field Company was answered by the O.C., Major A. H. M. Morris,[1] R.E., and a detachment. The rest of the story is best told in the words of the citation in the *London Gazette* announcing the award of the George Medal to Major Morris.

"Although it was not known whether other mines had been displaced, nor where they lay, at great danger to himself, Major Morris jumped into the crater of an exploded mine to trace the recovery wires and so enable the remaining mines to be disarmed.

After jumping into the crater, Major Morris was unable to locate any recovery wires to assist him in disarming any of the mines. He noticed, however, a small mound near by which appeared likely to be a mine and determined to investigate it. He therefore came out of the crater, crawled forward, found that it was a mine and rendered it safe. A recovery wire attached to this mine enabled him to disarm another and with the assistance of a Warrant Officer and an N.C.O., he was able to take the first body off the minefield.

He then proceeded to the other side of the minefield and, helped by the N.C.O., located and disarmed further mines in order to recover the other bodies. The whole operation was one of extreme danger and difficulty as the force of the explosion had severed many of the connecting wires and shifted the mines from their original position. The mines were themselves in many cases difficult to locate.

Major Morris's gallant action, at the risk of his own life, was in accordance with the highest traditions of the Corps of Royal Engineers."

Preparations for the Invasion of N.W. Europe

With the spring of 1943, and the approaching clearance of Axis forces from North Africa, serious planning and preparation for the

[1]Lieut.-Colonel A. H. M. Morris, D.S.O., M.C., G.M.

invasion of North-West Europe was taken in hand, as will be described in more detail in Volume IX, Chapter XI, dealing with the launching of the invasion. Planning was carried out in London, first, pending the appointment of the Supreme Commander, by COSSAC (Chief of Staff Supreme Allied Commander), and then by SHAEF (Supreme Headquarters Allied Expeditionary Force). As a result of the study of the problem some special engineer requirements came to light and the solution of these was in turn studied by the two Allied engineer corps.

From the point of view of special equipment, the most important question was the development of armoured equipment for the destruction and passage of obstacles which might be encountered during the landing, and for the assistance in the reduction of enemy defences. The organization and equipment involved are treated at some length in the section dealing with "Assault Engineers" in Chapter VIII (Organization).

As there narrated, 1st Assault Brigade R.E. came gradually into being during the summer of 1943, and carried out training and experiment at 79th Division training camp at Linney Head, though at this time it possessed little special equipment, "a miscellaneous assortment of Churchill tanks, a few training fascines and bridges, some General Wade charges, and some Snake pipe". (*History of 1st Assault Brigade R.E.*). During the winter an "A.R.E. School" was opened in the Orford "Battle Area" in Suffolk, and here, as at Linney Head, many experiments were carried out in dealing with the types of obstacles to be met with in a landing. It was not till April, 1944, two months before the invasion, that the first AVREs, complete with Petards, were received, and during the ensuing two months the units of the formation were busy collecting other gear from all over the United Kingdom.

The R.E. units of other formations which were to take part in the initial landing also carried out intensive training in their special duties. This mostly took place, with other units of their formations, at training camps on lochs in Scotland where landing craft, of the types to be used in the assault on the beaches of Normandy, were available. In the cold and stormy days of the winter and spring these periods of training, under ultra-service conditions, were a good test of endurance, but when tasks were successfully accomplished, they gave to the participants a feeling of confidence that, whatever the weather they could carry out their job on "The Day".

While those members of the Corps who were cast for active parts

in the drama of the landing were rehearsing, others were busy building and arranging the "set" from which the actors would emerge. The "back of the stage" spread all along the south-east, south, and west coasts of England, and the British Second Army was to emerge from Harwich to Weymouth inclusive, while the U.S. First Army was to embark from the western ports. In all 3¼ million men were accommodated in the country before "D Day", and, though troops to embark in the later stages were held back farther to the north, the great concentration of troops near the points of embarkation entailed the provision of a great deal of extra accommodation in the southern counties. Security arrangements required that those taking part in the initial landings should be isolated after they had been briefed, so many of the camps had to be surrounded by barbed wire fences. Numerous headquarters had to be provided and fitted, and some of the more important of these were afforded tunnelled accommodation, particularly at Dover, Portsmouth, and Plymouth.

As every suitable stretch of foreshore was to be used for the loading of landing craft many "hards" had to be made or improved, chiefly by the Admiralty, and extra roads and tracks were constructed leading from the concentration camps to the ports and hards. Most of this latter work, which entailed the construction of 16 miles of new roads and the improvement of 230 miles of existing approaches, was in the hands of the Ministry of War Transport, but assistance was given in some places by R.E. units especially in the construction or strengthening of bridges.

The task of collecting, sorting, forwarding, and embarking of engineer stores was in itself a tremendous job. Besides the simpler forms of tactical stores, large quantities of technical equipment, including earth-moving and road construction machinery, bridging material, water storage tanks and oil storage tanks, etc., were got ready, as well as much tar, cement and surfacing for airfields and roads. Altogether 70,000 tons of engineer stores were got forward ready for early embarkation, in addition to 120,000 tons used in the preparation in the Home country.

Transportation

In all the preparations for the moves to the sea coast, and for the movement of the invading forces across the Channel, the various branches of the Transportation Services were heavily involved. Railway construction units were called on to assist the civil railway

companies in the provision of extended rail facilities at the ports, and for the stabling of rolling stock awaiting shipment overseas. Port construction units were called on to provide a number of piers along the south coast to meet the local military requirements, and also ferry terminals for the rapid loading and discharge of locomotives and rolling stock, and to equip hards at Southampton, Folkestone and Dover to permit of the loading of locomotives and rolling stock on to the barges.

In preparation for their tasks on the Continent, training was carried out, special units raised and equipped, and new equipment developed. Special attention on the railway side was directed to the design and production of standard quickly erected bridges. Under the direction of Lieut.-Colonel W. T. Everall,[1] R.E., in civil life an engineer of wide experience of such work in India, and now Chief Bridging Instructor at No. 2 Railway Training Centre, Derby, there was developed the Unit Construction Railway Bridge, the Everall Through Truss Bridge and other equipment which proved its worth in the field. In connexion with port construction and repair it was early recognized that specially trained units would be required for the rapid repair of captured ports and for emergency construction on open beaches. These included port construction and repair companies, dredging companies, port artisan companies, port floating equipment companies, and port repair ships. In order to provide the facilities for the collective training of these units, and for the storage and maintenance of special plant, the formation of two port and I.W.T. repair depots was approved early in 1943. Of these, No. 1 was located at Marchwood on Southampton Water and was to become a permanent centre of Corps activity, and the other at Richborough, the old Roman port in Kent. Work on the development of Marchwood was started in June, 1943, and included a jetty which would accommodate coasting vessels at all states of the tide, railway sidings and storage area, as well as facilities for launching concrete pontoons. Accommodation for 1,500 men was also provided. During the war in addition to its designed functions, it was used for the construction and assembly of parts of the "Mulberry" artificial harbour, which were transported across the Channel to be used on the open beach at Arramanche (Volume IX, Chapter XII, pages 369–372). After the war it was retained as the headquarters of the Port and I.W.T. branch of the Transportation Service. Owing to the position, in the heart of the Yachting

[1]Lieut.-Colonel W. T. Everall, O.B.E.

waters of the Solent, it became a second "home" for the R.E. Yacht Club, and a base of operations for the ocean racing activities of the Club. Not so much work was necessary at the depot at Richborough as wharves and hutting erected for the War of 1914–18 were still in existence.

Movement Control

The control of the movement of troops and stores to their points of embarkation and their loading for transport across the Channel was the largest combined operation the Movement Control Section of the Corps had to tackle in the course of the war, and a general description of the task is given in the section of Chapter VIII (Organization) devoted to the growth and operations of this branch of Corps activity.

Survey

In view of the threat of a war against Germany, as early as 1936, the General Staff, with Treasury approval, ordered the preparation of a series of maps of various scales to cover the likely theatre of operations in N.W. France, Belgium and Holland. These were produced by the Geographical Section, General Staff, with the assistance of Ordnance Survey. Plates for all were prepared and all but those of the largest scales were printed and stored in sufficient quantities for the proposed Expeditionary Force. This work entailed considerable expansion in both survey organizations.

With the actual outbreak of war in September, 1939, work was speeded up and expanded in spite of the drain from the home organizations of skilled personnel to fill the survey units of the B.E.F. The steps taken to achieve this are described in Chapter VIII (Organization).

With the fall of France and the return of the B.E.F., all efforts had to be diverted to the production of operational maps of the British Isles and the many special maps required in connexion with the defence of the country. As soon, however, as this requirement had been met attention was once more directed to the production of maps which might be required for possible future operations outside the country. As will be seen later, those for operations in the Mediterranean and South-East Asia theatres were produced largely by local resources. So the chief preoccupation of the Survey Directorate at the War Office was in preparation for a future invasion of

the Continent of Europe. In these early days it was impossible for the General Staff to indicate with any precision in which areas operations were likely to take place, but could only give an order of priority in which map coverage should be provided.

This large programme of work called for the maximum effort of all available Survey Organizations in the War Office, the Ordnance Survey and that in the hands of the Director of Survey Home Forces, Colonel M. Hotine[1] succeeded by Colonel R. E. Fryer.[2]

With the entry of the United States into the war in December, 1941, and the setting up of an inter-allied planning organization (COSSAC) which included its own Survey Directorate, the direction of survey policy for the invasion passed to that body, though the War Office, and through it the Ordnance Survey, remained responsible for most of the production of maps. This work, which more closely concerns the invasion operation than that of engineer activity in the United Kingdom, will accordingly be dealt with in the section of this History dealing with the invasion of North-West Europe.

Phase IV. From June, 1944

Little remains to be said regarding engineer work in the United Kingdom in the last phase of the war, when the invasion of the Continent had been launched and the numbers of troops in the country rapidly declined. The danger of invasion, for some time less imminent, was now completely negligible, though immediately after "D" Day, there was a recrudescence of damage demanding repair due to bombardment by V.1 bombs, as pilotless aircraft were called, and their counterpart in rocket bombs, known as V.2. Even this direct evidence of war soon disappeared as the victorious Allied forces swept up the coasts of France and Belgium and overran the launching sites. With the departure of the American invasion forces from the country, and the flow of U.S. reinforcements direct from America to the Continent, much of the accommodation they had occupied became vacant, and a new scheme was put into operation to rearrange the available accommodation, retaining for American use only such as was required for their depots, hospitals, and base units, and that which would be required eventually in connexion with their withdrawal from

[1]Brigadier M. Hotine, C.M.G., C.B.E.
[2]Brigadier R. E. Fryer, O.B.E.

Europe. This scheme, which was the reverse of "Bolero", was in consequence given the code name of "Orelob".

Constructional works services therefore almost ceased, the only new work of any magnitude to be undertaken was provision for prisoners of war and demobilization centres, though for some time garrison engineers were kept busy taking over from the Americans the buildings the latter were surrendering. Probably the busiest Sappers in the country at that time were those concerned with the supply of engineer stores, the movement control sections, and the training units. Into and out of Long Marston, Donnington and smaller depots, engineer stores poured in a steady stream to provide the requirements of our forces fighting in North-West Europe, Italy, and South-East Asia and for the maintenance of troops scattered all over the world. These, and stores required by the various administrative services, together with a constant flow of reinforcements, were speeded on their way to and through the ports, by personnel of the movement control section.

CHAPTER VI

TRAINING ESTABLISHMENTS AND UNITS

Initial training of officers—Royal Military Academy—School of Militar Engineering—Primary Training of war-time officers—Primary train ing of other ranks—Individual specialist and technical training— Transportation—Survey—Training of other specialist branches— R.E. Depot.

At the outbreak of war there were a number of training units an establishments, most of which had existed and remained in the mai unaltered for many years. Some were for the initial training o officers and other ranks, others for special technical training i different branches of the Corps activities. The rapid expansion o the forces and the demand for extra technicians caused an immediat increase in the facilities for training of all kinds. For the initia training of officers the School of Military Engineering operated a Chatham, while the mass of other ranks went through their recruit course in the Training Battalion at Brompton Barracks, Chatham almost the only exception being that drivers for M.T. vehicles di their intial course of six months at the M.T. Training Depot a Aldershot. Specialist technical training of both officers and othe ranks was carried out at the S.M.E., in the case of those for Trans portation at the Railway Training Centre at Longmoor, and fo those for Survey employment with a small Survey Training Unit under the control of the Director General of Ordnance Survey, a Fort Southwick, Farcham, Hants.

Initial Training of Officers. Royal Military Academy

Much the largest proportion of the entry of new officers was drawn from the Royal Military Academy, well known to all as "the Shop" Woolwich. For many years consideration had been given to th amalgamation of the two institutions for training Gentlemen Cadet for the Army, the "Shop" and the Royal Military College, Sand hurst. The reasons put forward in favour of this amalgamation hav been referred to in Vol. VII, pages 148 and 149, and are too compli

cated to deal with here, but in the main they are based on the desire to break down any isolation in outlook of officers of the Technical Corps, the Royal Artillery, the Royal Engineers, and the Royal Corps of Signals who received their initial training at the "Shop", in relation to those of other arms trained at Sandhurst. Also it was desired to give to the cadets a more general education on University lines, which could better be arranged at the larger establishment by amalgamation. A firm decision to amalgamate into one organization to be called the Royal Military Academy and to be situated at Sandhurst was taken shortly before the outbreak of war, and it fell to the lot of an officer of the Corps, Major-General P. Neame, who was Commandant at Woolwich at the time, to make preparations for the closing of the "Shop" and its move to Sandhurst. The end came suddenly. On the declaration of war, the "Shop" was closed and in accordance with the plans made for war conditions, the cadets were transferred to Sandhurst which became the first of the war-time Officer Cadet Units. And so ended a long connexion between the Royal Engineers and the "Shop", where for over 150 years the future officers of the Corps had received their first military training. Though efforts were made by transferring memorials and record boards to the new home to preserve the traditions of the old place, and though the new combined establishment was given the name of the Royal Military Academy, to the then serving officers of the Gunners, Sappers, and Signals, most of whom had passed through the "Shop", it could never be the same again. *Sic transit.*

The School of Military Engineering

Though new developments in engineering and the science of war caused some changes in the curriculum of young officers courses at the S.M.E. in the years immediately preceeding the War of 1939–45, the general organization of the place remained similar to that which had obtained since the Cambridge course was introduced after World War I. In the two and a half years spent by officers on first commission under the aegis of the S.M.E., two academic years, the second and third of the Mechanical Science Tripos course, were spent at Cambridge University where, in order to qualify for engineer pay, the young officers were expected to take an Honours degree. The balance of the time was spent at Chatham where military training was given and the military application of the engineering science learnt at Cambridge taught in the various schools. The S.M.E. also

gave technical instruction in certain subjects to other ranks of th Corps. The only immediate pre-war change at the S.M.E. was th appointment in July, 1939, of an Assistant Commandant. This wil be referred to further in Chapter VII.

Immediately on the outbreak of war the courses at Cambridg were cancelled and the initial training of officers transferred t No. 1 R.E., Officer Cadet Training Unit (O.C.T.U.) which opene immediately at Shorncliffe. Thereafter the traditional role of th S.M.E. for the training of "Young Officers" for the Corps ceased and the school was chiefly used for training instructors and tech nicians of all ranks. Though in this section we have been specially considering officer training, it would appear advisable to continue in one place the history of the S.M.E. throughout the war.

Though the young officers had departed the School continued t expand as the formation of the new units, and the scarcity of fully trained N.C.O.s in old, involved a heavy demand for instructor who were put through courses as quickly as possible. There was also a demand for special courses in bridging and for courses in field engineering for infantry personnel. Short courses were also arranged for skilled civilians in military procedure to fit them for immediate enlistment into the rank of Staff Sergeant Mechanist or Military Foreman of Works.

And so through the first months of the War life at the S.M.E. though at increased pressure and without the Young Officers Courses, carried on under much the same conditions as in peace But in June, 1940, as for the rest of the country, everything altered For all troops, whatever their immediate job, first priority was t prepare for defence against invasion and attack from the air. Wit the return of the B.E.F. from Dunkirk, Colonel R. Briggs, who had been C.R.E. of 2nd Division in France and Belgium, succeeded Colonel Mackintosh[1] as Commandant, and found himself also in charge of a sub-area with operational responsibilities, and in com mand of a brigade composed of a R. Navy Battalion, one of R Marines, two of R. Engineers and a group of Home Guard (o L.D.V. as they were then called). The staff and students of th school were taken continuously for reconnaissance duties and t take charge of work on the defences of the area. Then when the ai raids started, Chatham being a dockyard town received its ful share of attention from enemy bombers, indeed Colonel Brigg reports that the area for some months was almost as much subjec

[1]Colonel E. E. B. Mackintosh, D.S.O.

to air raids warnings "Red" (immediate danger) as to "All clear". Somewhere in the region of a hundred bombs fell in the barrack area alone during the Battle of Britain. One hit the Survey School, another burst in the basement of a barrack block causing heavy casualties, another wrecked a block of officers' quarters near the Mess, and one damaged the Commandant's house.

A gap in the line of trees along the north side of the parade ground of Brompton Barracks for some years bore silent witness to the gallantry of a fighter pilot of the R.A.F. who was shot down over the town during the Battle of Britain in September, 1940. Realizing that if he baled out his aircraft would fall in the crowded mass of streets and buildings, he decided, in order to save the lives of others, though in doing so he faced certain death himself, to put the aircraft down in Brompton Barracks square. This he did successfully, at the cost of his own life, without damage other than the uprooting of the aforementioned tree.

Under such circumstances, it may be imagined, it was difficult to carry on the work of the school, or for the students to concentrate on their studies. The Director of Military Training, therefore, gave instructions for a more tranquil spot to be sought, and eventually it was decided to move the school to Ripon, in Yorkshire, where a militia camp formed the basis of the accommodation required. The move was completed, with the exception of the Workshop portion of the Electrical and Mechanical School, later called the Trades Training Wing, in November, 1940; there was only one month's disruption of work.

Developments in Military Engineering as the war progressed involved the expansion of the S.M.E. and the formation of new subordinate schools within its organization. In 1940, an Experimental Tunnelling Section was formed, followed in 1941 by the Bomb disposal School and the Engineer Assault School; 1943 saw the institution near by of an Infantry Wing Mines School, and the transference from Newark of a Mechanical Equipment Training School.

And so during the war years the S.M.E. expanded and flourished in its pleasant surroundings amidst the Yorkshire dales, while the Royal Navy became the temporary tenants of Brompton Barracks. But as the end of hostilities came within sight consideration was once more given as to the future of the site of the School. For many years the growth of the Medway towns had hemmed in activities, and made difficult the carrying out of instruction in the practical

and tactical application of military engineering. The war-time move brought discussion to a head, and consideration was given to sites in various parts of the country where better facilities for training were available in closer touch with schools and stations of other arms. Amongst the favourites were Blandford and Poole, but neither was entirely satisfactory and Treasury opinion on the cost of providing permanent quarters on the scale now required decided the question, and it was agreed that the S.M.E. should return to Chatham.

Pending the final decision, which was not made till 1948, the Construction School returned and with the Trades Training Wing of the Electrical and Mechanical School formed the nucleus of the Chatham Wing of the S.M.E. The next three years, with the division of the establishment in two places so widely separated, were full of difficulties, and the decision to move the balance back to Chatham in 1948 was hailed with satisfaction. For another year, however, the division was to continue. Though Headquarters had moved back in 1948, it was not till 1950 that the Field Works School and Bridging School, which with the Field Engineer Regiment formed the Ripon Wing, returned to its old haunts.

With expansion in numbers and in variety of activities the School now overflowed its old quarters in Brompton and Kitchener Barracks, even though the purely depot part of the old Depot Battalion had moved elsewhere, as will be recorded later. Accordingly the pre-war hut barracks at Darland, now known as Gordon Barracks, were taken over. At the end of the period under review the various parts of the S.M.E. were distributed as follows: Housed in the main "Institute" building are the Headquarters, the Civil Engineering and Tactical Schools, and the offices of the Institution of Royal Engineers; in Kitchener (the old Infantry) Barracks, 10th Trades Training Regiment, the successor of "M" Company of the old Depot Battalion, occupies its old quarters, as does the Electrical and Mechanical School in its somewhat ornate building on the edge of "The Lines". Brompton Barracks houses the successors of "L" Company in the shape of 12th S.M.E. Regiment, which includes the staff of the S.M.E., the permanently commissioned young officers under instruction and the instructors and students of the Civil Engineering and Electrical and Mechanical Schools. In the recently acquired Gordon Barracks 11th S.M.E. Regiment is accommodated and includes the Field Engineer School and the National Service Cadet Squadron.

The following officers held the appointment of Commandant S.M.E. in the period 1935–48.

Major-General L. V. Bond[1]	1935–9
Major-General R. P. Pakenham-Walsh	1939
Colonel E. E. B. Mackintosh	1939–40
Colonel R. Briggs	1940
Brigadier M. Luby[2]	1940–1
Brigadier N. A. Coxwell-Rogers	1941–2
Brigadier D. Harrison	1942–3
Brigadier H. T. S. King[3]	1943–5
Brigadier B. T. Godfrey-Faussett	1945–8
Brigadier B. C. Davey[4]	1948

Primary Training of War-time Officers

As mentioned above, No. 1, later No. 141, R.E. O.C.T.U. opened at Shorncliffe under Lieut.-Colonel R. S. Rait-Kerr[5] in September, 1939. The course was for six months and the curriculum was designed to meet the appreciation of the General Staff at the time that mobile war would last only about three months and that it would be followed by static conditions. As we now know almost exactly the reverse proved to be the actual course of events.

A second R.E. O.C.T.U., No. 142, opened at Aldershot under Lieut.-Colonel E. V. Binney[6] shortly after the first. Then, in the autumn of 1940, with the increase in the number of units for the Lines of Communication area and for Transportation, a third O.C.T.U., No. 143, with a shorter course of twelve weeks was opened at Hamilton near Glasgow by Lieut.-Colonel D. Portway,[7] R.E. (S.R.) In August, 1942, a new system of preliminary training of potential officers was instituted throughout the Army. Candidates for commissions did first a preliminary course at a Pre-O.C.T.U. for all arms, the length of the course at which depended on the standard of experience of the cadet. Approved cadets then passed to the O.C.T.U.s of their arms. It was therefore possible to cut some of the elementary drill and mechanical transport training

[1]Lieut.-General Sir L. V. Bond, K.B.E., C.B.
[2]Brigadier M. Luby, D.S.O., M.C.
[3]Brigadier H. T. S. King, O.B.E., A.D.C.
[4]Brigadier B. C. Davey, C.B.E.
[5]Colonel R. S. Rait-Kerr, C.B.E., D.S.O., M.C.
[6]Lieut.-Colonel E. V. Binney, D.S.O., died 1941.
[7]Colonel D. Portway, T.D.

from the course at the R.E. O.C.T.U.s, the time saved being devoted to extra bridging, demolitions and mine warfare.

In November, 1942, the two O.C.T.U.s for field units were amalgamated into No. 140, commanded by Colonel C. G. Martin[1] and moved to Newark-on-Trent. The new centre had a capacity for 1,350 cadets under training at one time, batches of about sixty joining weekly and doing a six months course.

As early as August, 1940, a conference held by the Inspector of R.E. had shown the necessity of officers and men of units normally employed on the L. of C. having a general tactical and military engineering training. Though by special courses much had been done to remedy this deficit in officers, who had been hurriedly commissioned for service in rear areas, in June, 1943, it was decided in future to abolish the separate L. of C. No. 143 O.C.T.U. and that all cadets should pass through No. 140 O.C.T.U. at Newark and have the same curriculum of training.

The following officers in turn succeeded Colonel Martin in command of No. 140 R.E. O.C.T.U.

1943	Colonel J. R. T. Aldous[2]
1944	Colonel B. C. Davey
1945	Colonel C. C. Duchesne[3]
1946	Colonel C. M. Maclachlan[4]

In November, 1943, in view of experiences in previous campaigns, and in preparation for the operation for the invasion of North-West Europe, the course was lengthened to twenty-eight weeks, extra time being devoted to bridging, especially with Bailey pontoon equipment, and mine warfare, and for the first time the use of mechanical equipment was taught to all officer cadets. Even with this extension the time available for the wide syllabus was still lamentably short, and with the numbers passing through the O.C.T.U.s, over 3,000 in 1943, it was difficult to reach the standard required. Besides those passed through the O.C.T.U.s, some 2,330 other officers joined the Corps, either on transfer from other arms, or highly qualified men granted direct commissions. These were given at the Officer Wing of 6 Training Battalion R.E. a three months course in the use of military engineering equipment.

[1]Brigadier C. G. Martin, V.C., C.B.E., D.S.O.
[2]Brigadier J. R. T. Aldous, C.B.E., M.C.
[3]Brigadier C. C. Duchesne, O.B.E., M.C.
[4]Colonel C. M. Maclachlan, O.B.E.

Another source of supply of officers was the Army Officers Emergency Reserve (A.O.E.R.). Enlistment for this was opened in 1937, in view of the great deficiency of officers required on mobilization. In the case of the Royal Engineers these officers were drawn from gentlemen who had served in the Corps in World War I, or had sufficiently high engineering qualifications to be suitable. These officers had before the outbreak of war to do a certain amount of military training. Many were affiliated to R.E. units of the Territorial Army with which they carried out their training. Others attended courses at the S.M.E. or at one of the specialist training establishments of the Corps. The majority in the first few months of the war took a three months course with one of the Training battalions.

No. 140 R.E. O.C.T.U. was redesignated in March, 1946, the R.E. O.C.T.U. and Pioneer Wing, and again had its title changed in September, 1947, to 2nd (Officers) Training Regiment R.E. Eventually it was disbanded in July, 1948, and its functions transferred to the R.E. Officer Cadet School at the S.M.E.

The technical training of officers for duties in the specialized branches, Transportation and Survey, is dealt with in the sections describing the general training of these branches. Special courses for instructors and for officers in new types of equipment and methods have been dealt with in the section dealing with the S.M.E.

Primary Training of Other Ranks

At the outbreak of war the training of recruits was carried out in the Training Battalion at Chatham and in the M.T. Training Depot at Aldershot. A gigantic problem had to be faced after mobilization in dealing with the mass of recruits required for the immediate expansion of the Corps. No less than 100,000 joined the Royal Engineers in the first twelve months of the war. Plans had, however, been made beforehand for the formation of three extra training battalions, including one for Chemical Warfare units, to deal with the influx of militia men who were just starting to join up in considerable numbers. These battalions formed at once, together with another for the training of recruits for L. of C. units. The period of training for field units was cut from the peace-time course of nine months to fifteen weeks, and that for L. of C. units to eleven weeks. Further training units were formed as quickly as staff could be found and, by April, 1940, had amounted to a maximum of nine including

three for chemical warfare, and three M.T. Training Depots and not including those for Transportation and Movement Control.

NOTE.—The following is a list of units with their situations.

Training Battalions

No. 1. Formed at Shorncliffe from the peace-time Training Battalion immediately after mobilization. Moved to Clitheroe 1940. In 1948 became 1 Training Regiment R.E. at Malvern.

No. 2. Formed at Newark October, 1939. Disbanded September, 1942.

No. 3. Started at Newark as a Militia Training unit in June, 1939. In 1948 was 3 Training Regiment R.E. at Cove, Hants.

No. 4. Opened at Colchester, September, 1939. Moved to Yorkshire 1940, and to Preston 1942. Disbanded 1943.

No. 5. Formed at Chester, October, 1939. Disbanded October, 1943.

No. 6. Formed at Elgin October, 1939. Disbanded 1946. A new unit 6 Training Regiment R.E. formed at Worcester, August, 1952.

No. 7. Formed at Chatham August, 1942. Disbanded September, 1945, being absorbed into the S.M.E.

No. 8. Formed as 5 Training Centre R.E. June, 1940, at Cleethorpes. Became 22 (L. of C.) Training Centre R.E. and redesignated 8 Training Battalion R.E. in March, 1945. Moved to Elgin as 8 Training Regiment R.E. in 1947.

No. 9. Formed March, 1945, at Portland. Became 9 Training Regiment R.E. at Cove, Hants., in March, 1948.

No. 10. Formed at Pangbourne May, 1945. Disbanded May, 1946.

M.T. Training Depots

No. 1. Formed from peace-time M.T. Depot at Aldershot in September, 1939. Designated 4 Training Regiment R.E. in June, 1947.

No. 2. Formed at York, September, 1939. Moved to Halifax. Disbanded October, 1943.

No. 3. Formed December, 1942. Disbanded January, 1946.

No. 4. Formed at Haydock Park, November, 1940. Disbanded August, 1942.

Even so these units could not cope with the influx of recruits, and, as will be seen elsewhere (Chapter II, page 14), some units for work on airfields and base projects in France were formed by civilian firms and organizations and sent overseas almost as soon as they had received their uniforms and with practically no military training. Even for field units it proved necessary to send recruits untrained to their units which had to give them the best training they could. The result of these makeshift arrangements was that there was, for some considerable time, a very uneven standard of training in the units which materially affected their efficiency.

The experience of the B.E.F. and of the troops engaged in the Middle East, in time led to some adjustment in the period and curriculum of training. The importance of mine warfare demanded extra time to be devoted to that subject, though it proved difficult to give the necessary training owing to shortage of our own types of mines and the difficulty of getting enemy mines sent home from the Middle East as each had to be emptied of explosives, a slow and risky job for which men in the theatre of war could not be spared. In January, 1942, an extra two weeks military, as opposed to technical, training was added to the course, bringing it up to seventeen weeks, and extra training was given in mine warfare and demolitions at the expense of tunnelling. Another major change took place in June, 1942. In future recruits were enlisted in a General Service Corps in which they did their primary military training before being posted to their corps. In consequence the courses at the R.E. training battalions and depots were reduced to twelve weeks. There were at the same time other entrants into the Corps who did not require primary military training. This was a result of the Beveridge Committee on the employment of trained men in the forces. As a result of its recommendations, a large number of skilled tradesmen were transferred from other arms and services into the R.E. in 1941 and 1942.

In July, 1943, as a result of a decision that Chemical Warfare was to be in future an all-arms responsibility, the three C.W. training battalions were disbanded.

In anticipation of the invasion of North-West Europe the intake of recruits into the Corps in 1943 was exceptionally heavy, 51,000. In the short time available, twelve weeks, it was impossible to give recruits adequate training. Accordingly a four weeks continuation course was instituted by which four weeks were spent with field companies of reserve divisions. This collective training and

experience in practical bridging and road making was very valuable.

With the separation in the winter of 1943–4 of 21st Army Group from Home Forces, the Chief Engineer of the latter, Major-General B. K. Young,[1] became responsible for the supervision of R.E. training units. Under his direction the syllabi were altered to allow of a reserve period, which could be allotted at the C.O.s' discretion to enable the use of new equipment to be taught as it became available. Such a course could only have been adopted when the training was supervised by one authority.

A difficult problem for the staffs of training units was that of trade testing. This duty was laid on the training units to enable men to draw their tradesmen's rates of pay from the earliest possible date of their service. Training units had neither the staff nor the facilities for this work and time could not be afforded to send recruits to the S.M.E. or other technical establishments where facilities existed. The training units did their best but the system never worked satisfactorily and, indeed, no satisfactory solution of the problem was found during the war. After the war the training regiments were grouped into a Training Brigade R.E. with Headquarters at Aldershot. All recruit sappers were posted to one regiment where, during the period of their basic military training, their future trades or employments were assigned. When this was complete (2 weeks) they were posted to other training regiments to complete their basic military training (6 weeks). While some were then posted to units the majority remained for a further period to undergo basic technical training.

Individual, Technical and Specialist Training

Technical and specialist training of all ranks was carried out for the most part at the S.M.E., as explained above, and at the training establishments of the various branches of the Corps as will be set forth below under the sections on training dealing with those branches, e.g., Transportation, Survey, etc.

Transportation

The peace-time facilities existing at the Railway Training Centre at Longmoor were quite insufficient to deal with the large influx of new personnel required immediately after the outbreak of war.

[1]Major-General B. K. Young, C.B.E., M.C.

Luckily, at this time, the majority of those joining were already skilled engineers and tradesmen who required only military training to become efficient members of units. To cope with the extra numbers, No. 2 Railway Training Centre was opened at Derby in November, 1939. Near by was the excellent Traffic School of the then London, Midland and Scottish Railway, now the North-Western Group of British Railways, and, by arrangement with the company, full use was made of this and also its workshops for training in mechanical trades. In addition a branch of the railway, eleven miles long between Ashby Junction and Chellaston East Junction carrying heavy colliery traffic, was taken over for training in railway operating and maintenance, and named the Melbourne Railway. On this line a bridging school was developed in conjunction with the Transportation Stores Depot. The two training battalions for recruits formed part of these two depots. Later Longmoor catered particularly for the formation of units, while Derby, with its better facilities, looked after mechanical training, and that for movement control personnel till the latter responsibility was removed from the Transportation Service in 1944.

During the first nine months of the war the influx of personnel was at its peak, the two centres dealing with an intake of 800 per month, and their combined establishments, including trainees and unit-forming battalions, totalled 15,000. The capacity of No. 1 Depot at Longmoor and its facilities for training were gradually extended, and by July, 1941, with decreased entry it was possible to close No. 2 Railway Training Centre at Derby, but the vacated accommodation was used to form a Collective Training wing of the Longmoor Training Centre. Under the new arrangement, recruits joined at Longmoor for an eight week basic course. They then joined a unit being formed at Longmoor and went with the unit to Derby for unit training in railway operating or construction as the case might be. Construction units did an extra eight weeks course at the Railway Bridging Wing near by. Further unit experience was obtained on the many depots which were being constructed and furnished with railway sidings and yards, on the Melbourne Railway and on the new military ports in Scotland. A further relief to Longmoor Training Centre was afforded by the separation, in May, 1941, of Movement Control from Transportation and the setting up of a combined Movement Control Depot and Technical Training Establishment near Longmoor.

Up to 1942, no special provision was made for the training of personnel for Port, Docks, and Inland Water Transport. At first

stevedore and dock crane drivers were trained at Longmoor on a "mock-up" ship's hold. Personnel for Inland Water Transport could not be afforded any training at Longmoor and arrangements were made with civilian firms and organizations to run courses for men entering that service. At the beginning of 1943, it was decided to send stevedores and crane drivers to No. 6 Docks Group at Penarth Docks. When this group mobilized in preparation for Operation "Overlord", a Port Operating Technical Training Wing of the Transportation Training Centre was formed and after several moves came to rest after hostilities as 17th Port Training Regiment at Marchwood, on Southampton Water, which has remained its permanent home.

Thus No. 1 Railway Training Centre, concentrated at Longmoor, grew from two companies, 8th and 10th Railway Companies, with a strength of about 500 all ranks at the outbreak of war, to become the Transportation Training Centre with Headquarters at Longmoor but with six wings scattered about the country, with an establishment of 2,325 permanent staff and a capacity for dealing with nearly 4,000 trainees and three units forming up. After the war the centre became concentrated once more as far as railway activities were concerned at Longmoor, its regular training component being 16th Railway Training Regiment R.E. In 1948, the Centre at Longmoor once more changed its name to that of Transportation Centre R.E., the Commandant combining his duties there with those of Director of Transportation at the War Office.

The following officers were Commandants at Longmoor under its various titles during the period 1938–48:—

Railway Training Centre, R.E.

1937–9	Lieut.-Colonel D. J. McMullen.
1939	Lieut.-Colonel R. D. Waghorn.
1939–41	Brigadier W. G. Tyrrell.[1]
1941–2	Brigadier R. D. Waghorn.

Transportation Training Centre, R.E.

1942–6	Brigadier H. A. Joly de Lotbiniere.[2]
1946	Brigadier C. A. Langley.[3]
1946–8	Brigadier R. Gardiner.[4]

Transportation Centre R.E. (Combined with D.Tn.)

1948	Brigadier R. Gardiner.

[1]Brigadier W. G. Tyrrell, D.S.O.
[2]Brigadier H. A. Joly de Lotbiniere, M.C.
[3]Brigadier C. A. Langley, C.B.E., M.C.
[4]Brigadier R. Gardiner, C.B., C.B.E.

Survey

At the outbreak of war in 1939, all recruits from the Training Battalion R.E. destined for survey employment received their specialist training in a small Survey Training Unit, forming part of 19th Survey Company, and located at Fort Southwick, near Fareham. From this unit men passed to the Survey Battalion, R.E., which held on its strength all the R.E. officers and other ranks employed in the Ordnance Survey Department, Southampton. It also ran courses for the personnel of the Survey Battalion. On mobilization the Training Unit moved to the neighbouring Fort Widley, Fort Southwick being used for the mobilization of the first few survey units required to go overseas with the B.E.F.

In April, 1940, a Survey Training Centre was authorized with an establishment of about 650 all ranks and was accommodated in the two forts. About the same time the Survey School of the S.M.E. closed. In the beginning of 1941 it moved to Wynnstay Hall, near Ruabon in North Wales. The Survey Training Centre, unlike its predecessor the Training unit, which came under the control of the Director of Ordnance Survey, was under that of the Director of Military Survey at the War Office. Officers with emergency commissions were given at the Centre training in field survey methods and the systems of reproduction, etc., used in the Army. A Cadet Wing was formed to give military and technical training to specially enlisted personnel and to those pre-war soldiers of the Survey Battalion R.E. who were recommended for commissions as the result of service in Survey units.

The Survey Training Centre, renamed after the war the School of Military Survey and situated at Hermitage, near Newbury, filled a gap which undoubtedly existed in pre-war days, and proved a valuable asset to the army which has since been maintained. Even so, particularly in North-West Europe, it was found that the conditions in the United Kingdom did not afford suitable opportunities for training in field survey, and that units in the field were not sufficiently experienced in that branch of the work. Much of their time in the home country had been devoted to map reproduction and in preparations for the launching of Operation "Overlord", to the detriment of gaining experience in check surveys, triangulation, and other forms of topographical field survey.

Training for other Specialist Branches

The arrangements for giving the necessary specialists training

required for other specialist branches of the Corps such as airborne engineers, assault engineers, bomb disposal units, etc., are dealt with in the sections of this volume devoted to the organization of these activities.

R.E. Depot

Though not strictly a training unit, it is convenient here to describe the experiences of the R.E. Depot. Strictly speaking in pre-war days the depot functions of the Corps were carried out by "G" Company of the Depot Battalion at Kitchener Barracks, Chatham. This unit, naturally greatly expanded, continued to function in the same place until February, 1941, when the heavy bombing of Chatham made a move necessary. Brigadier A. T. Shakespeare[1], who then commanded the unit, was accordingly ordered by the War Office to find accommodation at Halifax and move the unit there. The move was unpropitious, for in some way Northern Command were not informed of it and it was only with difficulty that even rations were provided. But if the military reception was cool, that of the civilians was warm. At Christmas 1942 there was hardly a man in the Depot who did not receive an invitation to a private house. Owing to lack of serious casualties in the field men spent a considerable time at the depot, and it was difficult to find employment for them. However, by assistance to the local C.R.E. and by picking up tram lines for the local authority, the time was reasonably occupied. The unit consisted at this time of Headquarters and two battalions.

In 1943, Brigadier Shakespeare was relieved in command by Colonel J. M. Gornall[2] and expansion continued so that by the termination of hostilities in 1945, the Depot consisted of a Headquarters and four battalions accommodated in various buildings in Halifax and neighbouring towns. To meet the changed conditions of peace, a fifth battalion was added to deal with men on release. In the summer of 1946, the Depot, now reduced to three battalions under command of Brigadier H. E. Horsfield,[3] moved to Barton Stacey, near Winchester, where it has since remained. In 1946 one battalion was disbanded, the remaining two becoming No. 12 Drafting Regiment and No. 13 Holding Regiment, and at the end of the period covered by this volume, these were merged into one self-contained R.E. Depot.

[1]Brigadier A. T. Shakespeare, D.S.O., M.C.
[2]Colonel J. M. Gornall, T.D.
[3]Brigadier H. E. Horsfield, C.B.E., M.C.

CHAPTER VII

ORGANIZATION

PART I

HIGHER ORGANIZATION

Pre-war—Changes during the war—Major-General King's Report—Engineer-in-Chief at the War Office—Directorate of Fortifications and Works—Transportation—Survey—Engineer Intelligence—Organizations for development of equipment—Stores procurement agencies—British Army Staff, Washington—Eastern Group—Post-war.

IT is felt advisable, before continuing the narrative of events in other theatres of war, that some account should here be given of the various changes introduced in the higher organization and in that of units and in the equipment of the Corps. Many of the changes were introduced as the result of early experience during the war, and an account of them at this stage will help readers to appreciate their effects as the war progressed.

Probably in no previous decade in the history of the Corps had there been so many and such important changes in organization, both of higher control and within units, and of equipment, than in the period between 1938 and 1948. This was largely due to the introduction of new methods of warfare as a result of scientific invention and development in engineering practice, and also to a more general appreciation of the complexity of the tasks of the military engineer and the necessity for a more complete organization for the execution of engineering work. At the same time the limitation of resources enforced a rigid control to ensure the economical use of men and machines.

When the period under review opened, the organization for the direction of engineer effort, and the form and types of units of Royal Engineers, differed little from that which existed ten years before when the mechanization of field units was commencing. The major change decided on up to 1938, and which was in process of being put into effect, was the transfer of responsibility for searchlights, both for anti-aircraft and coastal defence, from the Corps to the Royal Regiment of Artillery. The process was gradual and was only completed after some years of war. Several senior R.E. officers,

however, as shown in Volume VII, held high command in anti-aircraft formations.

Pre-War

For many years the only purely R.E. branches of the War Office were those of the Director of Fortifications and Works, the Assistant Adjutant-General R.E., the Transportation Section of the Q.M.G.'s Department, and Survey represented by the Geographical Section, General Staff. In theory the Inspector Royal Engineers was available for consultation, in an advisory capacity only, by all branches of the Staff. In practice, however, as this appointment was combined with that of Commandant of the School of Military Engineering and other posts, and his headquarters was at Chatham, such consultation was very ephemeral. Normally the Director of Fortifications and Works, as the senior R.E. officer permanently in the War Office, was consulted on many matters outside of the particular purview of his own department.

The introduction of compulsory military service in the Militia, and the doubling of the Territorial Army involving the formation of fourteen new divisional engineers, in 1938, added greatly to the load on the Inspector of R.E., and the more frequent calls on him for consultation led to his being allotted a room, or at least a seat in the War Office. In the summer of 1939, two Inspectors General were appointed, one for home and one for overseas forces. Amongst his other duties the Inspector General of Overseas Forces was charged with the supervision of plans for war, and for this he called on the Inspectors to assist. In future the various Inspectors of arms of the service acted under the instructions of, and reported to, these officers. It thus came about that one individual, commonly referred to as the Commandant, School of Military Engineering, had four full-time posts which operated in four widely dispersed offices. As Commandant S.M.E. and of the R.E. Depot he operated with divided responsibilities in the S.M.E.; as Commander Chatham Area he had an office and staff in Kitchener Barracks at Chatham; and as Inspector Royal Engineers he had offices in the War Office and in those of the Inspectors General in Millbank. Major-General L. V. Bond, who held the multiple posts at the time, pressed for assistance. Shortly after he had handed over in June, 1939, to Major-General R. P. Pakenham-Walsh the appointment of an Assistant Commandant S.M.E. was approved, Colonel C. G. Woolner[1] being the first

[1]Major-General C. G. Woolner, C.B., M.C.

occupant of the post. Hardly had Major-General Pakenham-Walsh and Colonel Woolner assumed office than war was declared on Germany on 3rd September, 1939, and both left to fill their mobilization appointments, Major-General Pakenham-Walsh as Engineer-in-Chief of the Expeditionary Force in France under General Viscount Gort, and Colonel Woolner as his Operations General Staff Officer. Three officers shared out the multiple job, a Major-General to command the Chatham Area, Major-General G. H. Addison as Inspector R. Engineers, and Colonel E. E. B. Mackintosh as Commandant, S.M.E. and R.E. Depot. The fact of this multiple relief demonstrates the absurdity of the previous situation.

In the summer of 1939, owing to the stress of work laid on D.F.W.'s Department due to the introduction of militia training, and the threat of war, Major-General D. S. Collins,[1] on relinquishing the appointment of D.F.W. in which he was succeeded by Major-General G. B. O. Taylor, was given a new post of Controller of Engineer Services and was charged with the direction of the higher policy of the Works Service. This new post remained in existence only till October in the same year, when Major-General Collins was appointed D.Q.M.G. (B), the duties of which post covered those he had previously held as C.E.S.

Changes During the War

Thus at the outbreak of war the higher organization of the Corps representation at the War Office was much the same as at the close of World War I, except for the existence of an Inspector Royal Engineers, and he, with the setting up of Headquarters Home Forces on the outbreak of war in September, 1939, became responsible to the Commander-in-Chief of that Command, the appointment eventually lapsing in 1940, when the duties were absorbed by the Chief Engineer at the same Headquarters.

In 1940, the Select Committee on National Expenditure of the House of Commons formulated certain criticisms with regard to the administration of the building of militia camps. This had been a thorny problem for some time as the decision to embark on a scheme of National Service was taken hastily and little regard was given in high places to the difficulties of the problem or the steps necessary to overcome them rapidly. In consequence the Works Service had to make prompt decisions, best suited to the speedy production of

[1] Lieut.-General Sir D. S. Collins, K.B.E., C.B., D.S.O.

camps and their accessories, without too close regard to the normal regulations for the carrying out of military works. The situation was fully realized in the War Office, but the demands of the Treasury necessitated at least apparent lip-service to financial regulations. A story is told that, on the same day as a certain Chief Engineer of a Command had received a letter conveying the "displeasure of the Army Council" for his breach of regulations, two members of the Army Council appeared in his office to congratulate him on the progress made and to inquire how it was done.

But the political criticism, particularly over the employment of the system of "cost plus" contracts, was strong and led to the appointment of the "Jameson" Committee composed of civil engineers to advise the D.F.W. particularly as regards works contracts. Then in May, 1941, Major-General C. J. S. King, then Chief Engineer Home Forces, was appointed Controller-General of Military Works Services. His instructions were to report on and carry out a reorganization of the Works Services, and to report on the necessity of there being an Engineer-in-Chief at the War Office, and if so what should be the duties, and the place in the War Office organization, of the holder of the appointment.

Major-General King's Report

Major-General King presented his first report on 28th May. In this he pointed out that:—

(*a*) There was no existing organization for the collection and dissemination of civil and military engineer intelligence.

(*b*) He could find no trace of an engineer appreciation having been prepared for any projected operation. As an instance, the requirements of the R.A.F. Component of the B.E.F., a service which absorbed 25,000 men, were so grossly underestimated that it was clear that they had never been correctly appreciated. These tasks, amongst others, would have been the duty of the Engineer-in-Chief at the War Office to carry out in conjunction with the General and Administrative Staffs.

He recalled that the Rawlinson Committee, 1919 (see Vol. VII, pages 145–50), had recommended the appointment of an Engineer-in-Chief at the War Office, but the suggestion had been turned down. The Finlayson Committee had recommended that there should be an Engineer-in-Chief at the Headquarters of the Field Force, and in consequence one had been appointed. This officer should have been able to deal with one officer at the War Office.

As regards the position of an Engineer-in-Chief in the War Office hierarchy, Major-General King suggested there were three alternatives.

1. An Engineer-in-Chief as a member of the Army Council. Though there was a precedent for this in the early position of the Inspector General of Fortifications and Works, it would cut across the whole system of army administration, and could not be recommended.
2. An Engineer-in-Chief as an Advisor and planner with full control over works and stores. This he recommended.
3. An Engineer-in-Chief, as adviser only to the General Staff with no executive functions. If this plan were adopted the situation would be that the E.-in-C. would advise the C.I.G.S. and the D.F.W. would advise the Q.M.G. It was too much to expect that their advice would always be the same, and when it differed an impossible situation would arise.

Engineer-in-Chief at the War Office

Major-General King's recommendations were accepted almost *in toto* and, in October, 1941, the appointment of an Engineer-in-Chief at the War Office was promulgated, Major-General King being himself made the first holder of the post. The duties of the office included advice to the C.I.G.S. on all engineering matters connected with policy and operations; responsibility for engineering planning and advice to branches of the staff regarding provision of resources; under the control of the Quartermaster-General executive control of the Works Services; advice to the General Staff on engineer organization, equipment and training; and co-operation with the General Staff on the collection, collation and dissemination of engineer intelligence. Responsibility in connexion with the transportation services was limited to ensuring that the construcural resources of the Army as a whole were used in accordance with policy. In view of the Engineer-in-Chief's responsibility for the Works Services the D.F.W. became his subordinate.

To assist the E.-in-C. in his duties, two Deputy Es.-in-C., Brigadiers, were appointed in addition to the D.F.W. In July, 1943, the E.-in-C. was given the further duties and title of Director Royal Engineers. This brought his appointment more into line with that of other existing Directors of Arms and Services and established his position *vis-à-vis* the General Staff more clearly, and added responsibility

for the organization and equipment of R.E. units. At the same time responsibility for chemical warfare, up to then exercised on his behalf by one of the two Deputy Es.-in-C., was removed. These changes involved further alterations in the organization of the office. In future the E.-in-C. had one Deputy, a Major-General, and the work of the department was divided between three Brigadiers, a Deputy Director R.E., the D.F.W., and the Director of Engineer Stores. This reorganization remained constant, except for some internal changes, to the end of the period of hostilities of World War II.

Directorate of Fortifications and Works

These changes, as will have been seen, involved major changes in the status and responsibilities of the historic office of the Director of Fortifications and Works, which, in 1904, had to a large extent replaced that of the Inspector General of Fortifications and Works. Shortly after the outbreak of war in September, 1939, the various branches of the D.F.W.'s Department which had been scattered in buildings about London, were concentrated in Romney House, Westminster. While a convenience in the running of the office to have all branches under one roof, the fact that the Director was separated from the Director of Movements and Quarterings and from the Quartermaster-General, both of whose offices remained in the War Office main building, made consultation more difficult. The various branches of the Department had held the titles of Q.M.G. 9, 10, etc., but in February, 1940, in conformity with a general change in nomenclature in Q.M.G's. Department to express in the title the functions of the various branches, the title of the branches of the Directorate reverted to their earlier titles of F.W.1, 2, etc., at the same time those of the Transportation Directorate were amended to Tn.1, 2, etc.

After the withdrawal of the B.E.F. from Dunkirk in June, 1940, the work of the Directorate, already greatly increased by the requirements of the Army in the United Kingdom acting as a base for overseas forces, swelled even more as new commitments poured in. The existing five branches were increased in strength and two new branches, F.W.6 to deal with emergency home defence and F.W.7 to take charge of forestry, were added. But the most notable increase in importance and size amongst the branches was to be found in that dealing with stores. In peace-time the total staff of Q.M.G.9 (c), the branch which dealt with engineer stores, amounted to three officers (one retired), a technical assistant and seventeen clerks. As no store

depots existed nor plans for making one, and few stores, this establishment was apparently sufficient for the task then envisaged. On mobilization only one officer and a few clerks, besides a small movement section were added. To meet the requirements of the B.E.F. and the base in the home country, later aggravated by the new situation brought about by the investment of the country, increases in the establishment of the branch became imperative and were found first by improvisation and then by approved additions, so that by the beginning of 1941 the strength had risen to 257. During the expansion, in March, 1940, Brigadier W. C. H. Prichard,[1] the senior officer of the branch, was raised to the status of Deputy Director. In July, 1943, with the preparation for further overseas expeditions, the importance of the branch had become such that it was raised to the status of a Directorate, independent of D.F.W., and directly responsible to E.-in-C., Brigadier Prichard being the first officer in charge.

About the same time the status of the D.F.W. was, as we have seen above, reduced from that of a Major-General to that of a Brigadier, Major-General A. G. B. Buchanan[2], the former holder of the office, being succeeded by Brigadier H. E. Hopthrow.[3]

It will be remembered that General King on his appointment as Controller-General of Military Works Service had been instructed to report not only on the advisability of the appointment of an Engineer-in-Chief at the War Office, but also to report on and to carry out a complete reorganization of the Works Service. His second report accordingly dealt with this latter subject. He stressed in this that the investigation would take considerable time to complete since it meant continual executive work.

The Report set out four main principles:

1. The necessity for the formulation by the Staff, both G. and Q., of requirements in sufficient time and the avoidance of change.
2. The existence, both in the War Office and at Command Headquarters, of an organization to transform the requirements into technical projects.
3. An executive to carry these out, and so organized as to allow of rapid expansion when required.
4. An organization to complete the final accounting.

In support of these, the report quoted many cases where the Works

[1]Brigadier W. C. H. Prichard, C.B., C.B.E., D.S.O.
[2]Major-General A. G. B. Buchanan.
[3]Brigadier H. E. Hopthrow, C.B.E.

Service had carried blame which in fact arose from lack of decision or changes in plan. It also emphasized that it was not the duty of the Works Service to refuse changes, it was its duty to point out the effect both in finance and time of a proposal. At the same time, since forethought and timely planning were essential, it is an important duty of the engineer to bring continually to the notice of his superiors the need for timely decisions in engineer matters.

In the proposals for the production of technical instructions, stress was laid on the necessity of standardization. For example, the exact fitting of a camp to an existing War Establishment was clearly waste of time and effort, since the War Establishment was certain to be changed before the camp was finished, or the unit for which the camp was designed might never occupy the buildings. At the same time the mis-spent energy of subordinate staff in producing "improvements" was to be checked by a drastic reduction in drawing office staffs of subordinate formations.

Works Organization in Commands

The organization of engineer offices in Commands and lower formations was produced at the same time as the Gale Committee produced a scheme for the administrative organization in the United Kingdom. By some mischance the work of this Committee was not known to Major-General King until both reports were complete. It was found, however, that the engineer proposals fitted with remarkable accuracy into the main scheme.

The Works Service had become grossly overloaded. In Major-General King's opinion the Directorate of Fortifications and Works had been expanded on an *ad hoc* basis to meet demands placed on it from time to time. Many of these duties had been assumed by the Directorate because there was at the time no other organization ready to accept them, and many, indeed, should not have been placed on any branch of the War Office. With these duties eliminated the Directorate could be, and in due course was, organized on a logical basis to perform its proper functions. Commands were attempting to deal directly with anything up to twenty Cs.R.E., who in their turn were overloaded. Though between 1937 and 1940, the number of Cs.R.E. Works had risen from twenty-eight to forty-five, the average annual expenditure controlled by each had risen from £0.24 million to £1.56 million, an increased load of 650 per cent. No change in the superior organization had been made to deal with the increased number of Cs.R.E. Major-General King's report

pointed out that an increase in size of an army was made by increasing the number of units and not by increasing their size. The method of expansion of the Works Service he proposed was, therefore, by the interposition of the District C.E. with a suitable staff between the Command and the Cs.R.E. This solution reduced the load on Commands and on the Cs.R.E. to reasonable size. At the same time C.E.s were given an operational staff, thus acknowledging the fact that the U.K. was a theatre of war and that there was no division between the operational and works side of the duties of the Royal Engineers.

The full "family tree" therefore became:—

C.E. Command.
C.E. District.
C.R.E. Area.
D.C.R.E. Sub. Area.

Special Cs.R.E. were provided for exceptional projects such as Chilwell Ordnance Depot.

The hectic days of building defences and accommodation in 1940 had spread a feeling that in war financial control could be ignored. While it is a fact that purely financial limitations are removed in war, finance is a useful measure of effort, indeed the only practicable one. In war, no one could be rash enough to claim that the manpower of the country was unlimited.

By 1941, when the immediate danger of invasion had receded, the Works Services inherited two difficult problems. One was the clearance of the bills incurred in 1940, many of which were not ordered by the Works Services, and the continued existence of which had the makings of a serious public scandal. The second was the necessity for the restoration of a reasonable control to ensure the best use of limited resources.

The clearance of the smaller bills was dealt with by the establishment of a special billing office under the R.A.P.C. at which bills up to £500 were paid on demand without check. By this means, many thousands of bills were cleared. Larger bills were dealt with by a special section in the Surveyor of Works branch of the D.F.W. and by continual pressure on the subordinate formations to report unpaid bills. It took many months to clear these.

The establishment of control presented several problems, or rather several facets of the same problem. There was at the time a national allocation of labour in the building trade of which the Army received

its share. This produced a very loose control but suffered certain limitations. For example, a deficit in one area could be used to set off over-employment in another area. In addition the use of troops gave opportunities for the execution of work without calling on civilian labour. It was found that the amount of work in hand, much of it ordered by the W.O., was far in excess of the capacity of the available labour to execute in any reasonable time. The fault largely arose from a mistaken interpretation of the returns showing that numbers employed were less than the Army allocation. It was assumed that capacity was available, whereas the true deduction was that the numbers obtainable could not reach the official allocation.

In the face of doubts expressed by the Finance branch at the W.O. Major-General King decided that the only feasible control of labour and materials was a financial one. Trained staff for the old system were not available and it was therefore decided to adopt a Central Accounting System with machine accounting. This centralization permitted the use of fully qualified accountants in limited numbers, while the use of modern accounting machines reduced the subordinate staff to manageable dimensions. A Central Accounting Office was, therefore, installed in each Command in which the accounts were compiled and stock records maintained. After the inevitable first suspicions, the system was generally accepted as a satisfactory and improved method.

The institution of the system produced in due course certain advantages which were not fully appreciated at the outset. Firstly, the co-ordination of the Pay Accounts with the Construction Accounts was simplified and expedited since it occurred in the Central Office. Secondly, the submission to the War Office of the year's account was expedited. In the old system in peace, this submission was seldom made before September. The new system produced the accounts before the end of April and reduced the Audit queries to small dimensions. At the end of the war when the problem of reinstating peace methods of control had to be faced, the Works Services could point with some pride that they had a better system than that of pre-war days actually in operation. The control of Engineer Stores was an essential part of the duties of the Central Accounting Office. Many dumps existed, without records or control. These were gradually brought into the orbit of central control, where the collected information permitted the more effective use of existing stocks.

In all these reorganizations, the Finance Branch was closely concerned. Throughout, its attitude, under the leadership of the

Permanent Under Secretary, Sir James Grigg, was one of wholehearted co-operation, showing that the traditional antagonism was unnecessary.

TRANSPORTATION

At the end of World War I, in 1918, the large transportation organization which had been built up in the previous four years was largely dispersed, and in 1938 what remained was similar to that which existed in 1914. At the War Office, Transportation was represented by one branch, Q.M.G.13, of the Directorate of Movements and Quarterings, under the charge of an A.D.Tn., Colonel J. P. S. Greig. On mobilization the Director of Movements and Quarterings became Deputy Quartermaster-General (A) and his department was divided into two directorates, that of Movements including Q.M.G.13. In October, 1939, Q.M.G.13 was raised to the status of a Directorate of Transportation, Colonel Greig being promoted Brigadier and becoming the first Director of Transportation. At the same time a new post, that of Director-General of Transportation and Movements, was created to co-ordinate the work of the Transportation and Movements Directorates; Mr. G. S. Szlumper, then General Manager of the Southern Railway, being appointed with the rank of Major-General. The post was, however, abolished on the withdrawal of the B.E.F. from France in June, 1940.

By the end of 1939, the Transportation Directorate had been enlarged and divided into three branches, Q.M.G.13 (dealing with Policy, Training and Stores), Q.M.G.15 (Railways), and Q.M.G.19 (Ports and Inland Waterways), and, in February, 1940, the designations were changed to Tn. 1, 2, etc. With the increase of units in the United Kingdom, owing to the withdrawal from the Continent and the raising of new units, an Inspector of Transportation Troops and Services was appointed, Brigadier D. J. McMullen being the first holder of the post. In October, 1940, he and Brigadier Greig changed places.

With a considerable increase of work at home, the planning and organization of future overseas operations, and the increase in number of Transportation units, further expansion and reorganization of the Branch was approved in March, 1941, involving the appointment of three D.D.Tn., each in charge of two sections and covering respectively Policy and Stores: Railways; and Ports and Inland Waterways. In May, 1941, the post of Director was raised to a Major-General's appointment.

In March, 1943, in view of the intensive preparations for a return to the Continent, involving the preparation of the "Mulberry" harbours, and the setting up of South-East Asia Command, the post of D.D.Tn. Ports and Inland Waterways was upgraded to that of a Director, Brigadier Bruce G. White[1] holding the appointment. This period marks the maximum growth of the Transportation Directorate, the strength in military and civil officers in the War Office amounting to 161.

After the successful landing in Normandy the strength of the Directorate declined gradually, and at the end of the war against Japan in Summer, 1945, rapid reductions were made, and Brigadier R. F. O'D. Gage,[2] who had been successively Director of Transportation in North-West Africa, Italy, and North-West Europe, replaced Major-General McMullen.

Survey

For many years before 1938, the direction of military survey at the War Office had been in the hands of a Branch of the Directorate of Military Intelligence known as the Geographical Section, General Staff, or M.I.4. The Section, the officers of which were mostly of the Royal Engineers, was at the outbreak of war, in 1939, headed by Colonel P. K. Boulnois.[3] The threat of war, first realized as far as financial provision was concerned in 1936, led to the placing of orders by the General Staff for a large supply of maps of north-eastern France and Belgium. Ten times the normal allotment of funds for this purpose became available in that year and large orders for maps were placed on the Ordnance Survey. The Munich crisis of 1938 led to a speeding up of the programme and the staff of M.I.4 was somewhat enlarged.

It had been planned that on the outbreak of war many branches of the War Office should be dispersed to provincial towns and, in spite of protests of the evil effects of divorcing it from the operational and principal administrative branches of the Staff which were to remain in London, in September, 1939, M.I.4 was moved to Cheltenham. The move led to many difficulties chiefly because, in fact, few branches of the War Office actually left London, but also it entailed wide separations from the main Map Depot, which remained at Alperton, in North-West London, all through the war. A further

[1]Brigadier Sir Bruce G. White, K.B.E.
[2]Brigadier R. F. O'D. Gage, C.B.E., M.C.
[3]Colonel P. K. Boulnois, O.B.E., M.C.

danger was caused by the wide separation from the map section of the Air Ministry, the relations with which were, in the nature of things, somewhat delicate. The difficulties became rapidly so apparent that, after a few weeks, the whole branch was moved back to Eastcote, on the fringe of London's suburbs. One great advantage of the move back was that it was possible to integrate the map section of the Air Ministry with M.I.4 which then became recognized as an organization common to both services.

With increase in work and extended responsibilities as the number of active operational theatres increased, the branch was raised to the status of a "B" grade directorate, Brigadier M. Hotine, who had succeeded Colonel Boulnois in charge of the Branch, becoming Director of Military Survey and remained in that position till the end of the war

Engineer Intelligence

In spite of the experiences of World War I, little had been done in the inter-war period to collect and collate engineer intelligence about possible theatres of operations, or to provide for its handling in the field. At the War Office, till a very late date, no branch or individual was responsible for this very necessary adjunct to engineering planning and operation. In 1938, a R.E. officer, Colonel K. J. Martin,[1] in charge of the co-ordinating branch of the Directorate of Military Intelligence at the War Office, recognizing the need, detailed his only available officer, a Major of Indian cavalry, to collect what information he could. On the staff of the Engineer-in-Chief of the B.E.F. there was at least some recognition of the requirement, and in the war establishment of his branch two officers were included to join on mobilization to carry out the work. Only because these two officers were serving at the time on the Staff of the School of Military Engineering was it possible for them to take over two or three days before mobilization the small box of undigested documents which the officer at the War Office had collected.

Thus the engineer intelligence available to the Engineer-in-Chief at the outbreak of the campaign was insignificant. But material about France, and to a limited extent about Belgium, was readily available in the offices of the French administration, particularly in those of the *Ponts et Chaussées*. Geological data, which was handled by the Geological adviser to the E.-in-C., Major W. B. R. King, who had held a similar post in World War I, was obtained

[1]Major-General K. J. Martin, D.S.O.

through the French Universities. In various ways, and with the assistance of extra officers attached to the staff of the E.-in-C., a large amount of useful information was collected, collated and disseminated to the Force.

The relative responsibilities for the collection and distribution of such material was once more a subject for discussion between the General Staff and the E.-in-C., B.E.F. It was agreed that the two staffs, while continuing to work in their respective headquarters, should interchange all information. Further, that intelligence material of value to others than engineers would be issued by the General Staff to formations though it might have been prepared in the office of the E.-in-C. The latter would only issue material of purely technical interest through engineer channels. The same principle was adopted in the War Office and other theatres.

In the War Office in October, 1939, a R.E. officer was absorbed into the Intelligence branch of the General Staff for the handling of technical intelligence, the number being increased to three before the end of the year when a separate branch, M.I.10, came into being. As we have seen there was little foundation on which to build and the collection of the material took a long time under the war conditions of enemy security and in default of enemy deserters and prisoners during the non-operational period commonly known as the "Phoney War", before the German irruption into Belgium and France in May, 1940. As the branch grew, it attained an ultimate strength of twenty-four officers. The majority of intelligence of importance to engineers was handled by the sub-section M.I.10 (b), though this sub-section dealt with other than purely engineer matters. M.I.10 (c), which dealt with economic intelligence and communications, was also of importance to the R.E., especially those of the Transportation Service.

With the arrival of American troops and the appointment of General Eisenhower as Supreme Commander for the Invasion of North-West Europe, a new combined organization was set up. On the intelligence side the central organizations served all theatres of war, and the first element to come into being, in May, 1943, was the Inter-Service Topographical Department (I.S.T.D.). Included in this was an Engineering Section. The special duty of this section, which at first consisted of three officers, was the collation of information about roads collected by the other sections. Later it was expanded to undertake other duties, such as studies of river lines and the supply of local material, at the request of E.-in-C. and the staffs

of theatres. The personnel was drawn from both British and American forces. As will be seen in the chapters dealing with the various campaigns other combined intelligence organizations were set up for each theatre.

Organizations for Development of Engineer Stores and Equipment

The absorption of the Royal Engineer and Signals Board into the organization of the Ministry of Supply has been described in Volume VII, pages 173 to 176, and the creation of the Experimental Bridging Establishment at Christchurch and of the Experimental Demolition Establishment (E.D.E.) at Bovington in pages 175 and 180 of the same volume. The R.E. side of the R.E. and Signals Board was absorbed into the Directorate of Royal Engineer Equipment (D.R.E.E.) of the Ministry, and the responsibility for the two experimental establishments was transferred from the War Office to the Ministry of Supply.

Up to 1938, the Experimental Bridging Establishment (E.B.E.) consisted of one Superintendent, Captain (later progressively Major and Lieut.-Colonel) S. A. Stewart,[1] with a part-time experimental officer, a civilian designer, Mr. (later Sir Donald) Bailey,[2] with a small military and civilian staff. About that time, with the increased tension in Europe, three more designers and extra staff were added to the establishment. Up to 1938, the accommodation consisted of a few offices converted from stables, and a few huts to house workshops and stores. The remainder of the barracks was occupied by a battery of R. Artillery. In 1938, new workshops and huts to accommodate extra staff were built.

The outbreak of war brought a period of intense activity to the E.B.E. and the workshops worked twenty-four hours a day, in two shifts to keep pace with the work. At intervals during the war extra buildings were added as necessary.

In 1941, a Special Tunnelling Training and Development Centre, with Lieut.-Colonel C. D. A. Fenwick[3] as Superintendent, was formed at the S.M.E., Ripon. On completion of its training commitments in 1942, it moved to Christchurch where it came under the control of D.R.E.E. but retained its identity separate from the E.B.E. It was renamed the Experimental Tunnelling Establishment (E.T.E.) and, in addition to continuing its role of developing mining technique

[1]Colonel S. A. Stewart, O.B.E.
[2]Sir Donald Bailey, K.B.E.
[3]Lieut.-Colonel C. D. A. Fenwick.

and equipment, including ancillary electrical and mechanical plant and the use of explosives, it took over the development of all electrical and mechanical projects from the E.B.E., and later the development of earth-moving and road-making plant from the Mechanical Equipment Base Park.

Towards the end of the War, the E.D.E., Superintendent, Major J. A. Hill, R.A.R.O., also moved to Christchurch where it was joined by the Land Assault Wing of the Specialized Armour Development Establishment, itself an offshoot of 79th Armoured Division of which we will read later, as the organization charged with the development and operation of assault armoured equipment.

In 1946, all three of the above establishments were concentrated in one organization, still located at Christchurch, known as Military Engineering Experimental Establishment (M.E.X.E.) under Brigadier G. R. McMeekan[1] as Chief Superintendent. It was divided into two wings, the Bridging Wing under Sir Donald Bailey and the Mechanical and Explosives Wing, of which Colonel L. R. E. Fayle[2] was the first Superintendent. In 1948, the Mechanical and Explosives Wing was subdivided, the explosives side being separated as an independent Group under the Chief Superintendent M.E.X.E. The Mechanical Wing, besides developing E. and M. equipment, was also concerned with earth-moving and road and airfield construction plant. In addition a good deal of work was carried out on soil stabilization in co-operation with the civil Department for Scientific Investigation of Roads.

As a result of these changes the M.E.X.E. was, at the end of the period covered by this volume, concerned with the development of all varieties of engineer equipment for the Service, with the exception of Mine detectors and other electronics, Flails and AVREs and a proportion of mines and demolition equipments. The staff, which numbered about 800, was largely civilian, but about twenty R.E. officers and a number of other ranks were included. The buildings are being continuously expanded and improved and there are extensive testing grounds in the neighbourhood. Some of the equipments developed by the various components of M.E.X.E. are described in the section dealing with equipment in Chapter VIII.

Stores Procurement Agencies

The requirements of the Allied forces in weapons, stores and

[1]Brigadier G. R. McMeekan, D.S.O., O.B.E.
[2]Colonel L. R. E. Fayle, D.S.O., O.B.E.

equipment threw considerable strain on the production of the various countries, and if steps had not been taken to counteract the tendency, there might have been serious competition for their procurement. For this reason organizations were set up to state in various centres the requirements of each Ally, and to arrange for an equable allocation. For the British forces procurement was in the hands of the Ministry of Supply, but military staffs were formed to state the requirements in terms of specifications and quantity. In these staffs there was, normally, an engineer section to deal with requirement in engineer stores and equipments. The following paragraphs deal with the organization and operation of these engineer Sections.

Engineer Section, British Army Staff, Washington

From a very early stage of the war it was necessary to obtain from the U.S.A. large quantities of weapons and warlike stores. At first these stores were purchased on behalf of the Ministry of Supply by a British Purchasing Commission in New York. At this time, the United States being neutral, and since stores had to be purchased under strict "cash and carry" terms imposed by American legislation, the quantities obtainable were strictly limited and included few engineer stores.

Early in 1941, on the proposal of President Roosevelt, a "Lend-Lease" Act was passed by Congress which allowed greater freedom of purchase to be carried out by the American Government on behalf of Great Britain. At this time a number of military missions, which had been advising the British Purchasing Commission on orders for the various arms, were combined in one British Military Mission in which the R.E. were represented by the senior staff officer, Colonel, later Brigadier, D. Campion[1] and Major, later Colonel, J. A. Davies.[2]

In the spring of 1941, the British Military Mission was expanded and in its new form included representatives of all Corps and Services concerned with the supply of military stores. An ex-officer of R.E. and R.C.S., Lieut.-General Sir Colville Wemyss,[3] arrived to control the whole Mission. The R.E. side was represented by Lieut.-Colonel F. I. de la P. Garforth[4] who dealt with General Staff subjects such as Training and Intelligence, and by Brigadier W. E. R.

[1]Brigadier D. Campion, C.B.E.
[2]Colonel J. A. Davies, O.B.E.
[3]General Sir H. Colville B. Wemyss, K.C.B., K.B.E., D.S.O., M.C.
[4]Brigadier F. I. de la P. Garforth.

Blood[1] to advise on the supply of engineer stores and equipment. The latter had a small staff organized in sections to deal with various classes of stores. Orders were prepared by this Engineer Staff and placed by the Purchasing Mission on the American Government. Transportation and shipping sections were added. Later the two Engineer branches were amalgamated under Brigadier Blood, Colonel Garforth becoming his Deputy. Brigadier Blood was also made responsible for liaison with the R.C.E. in Canada, and for the supervision of the work of Cs.R.E. in the Caribbean, and thus became to all intents and purposes Chief Engineer, North America.

With the attack by Japan on the American Fleet at Pearl Harbour in December, 1941, and the consequent entry of the U.S.A. into the war, the situation changed considerably. The equipping of the American forces threw a heavy strain on the productive capacity of the country. Then the attack by Germany on Russia in the summer of 1942, necessitated the diversion of a large amount of stores to the latter country in order to maintain her war effort. Questions of priority, therefore, became acute, and to decide on these the U.S. War Department set up an International Supply Committee. The only British representative on this body was Brigadier Campion, though heads of branches attended meetings when supplies in which they were interested were being considered.

To enable him to support the priority of claims for the production of engineer stores, the head of the Engineer Section received from London the list of stores required, with an explanation of the supply position of these stores in the United Kingdom, and direct from the senior R.E. officers of theatres the necessary arguments as to urgency to enable him to put his case to the committee.

Besides his duty of presenting the case for priority in supply of engineer requirements, the Head of the Engineer Section was responsible for detailed specifications of the stores ordered. This was of great importance in view of the differences in commercial standards between those current in U.S.A. and in Great Britain.

During 1942, General Wemyss was relieved by another ex-officer of the Corps, Lieut.-General Sir G. N. Macready,[2] and Brigadier L. F. S. Dawes,[3] late R.E., replaced Brigadier Campion as Chief

[1]Brigadier W. E. R. Blood, C.B.E., M.C.

[2]Lieut.-General Sir Gordon N. Macready, Bart., K.B.E., C.B., C.M.G., D.S.O., M.C.

[3]Brigadier L. F. S. Dawes, M.B.E.

Staff Officer of the Mission. The Deputies, as a matter of principle, were relieved every year.

Eastern Group

When, in 1940, Italy entered the war on the side of Germany and the route to and from the East through the Mediterranean was closed, the Viceroy of India, realizing that the forces of the Allies east of Suez must rely to a greater extent on their own resources, called together in Delhi, in September, 1940, a conference of representatives of all eastern Commonwealth and Allied countries to discuss what could be done. In consequence an organization was set up with its headquarters in India, first in Delhi and later in Simla, with the purpose of providing Allied forces in areas, or based on ports, east of Suez inclusive, as far as possible with stores produced in the same areas. The organization was in two parts. First the Eastern Group Supply Council composed of leading personalities of the countries concerned, India, Australia, New Zealand, South Africa, and Dutch East Indies, under a Chairman from the United Kingdom. The task of this council was to find out the spare capacity in warlike stores of the various countries, to encourage development of production of suitable and badly wanted stores, and to place orders on the governments of the countries for articles required by the forces. The other part of the organization was a military-air staff, with close liaison with the Royal and Dominion Navies, called the Central Provision Office, Eastern Group. The duty of this office was to find out the needs in warlike stores, barring petrol, oil and food, which were still handled in London, of all forces in the area; to place demands for these stores on the Eastern Group Council, and, if the latter was able to obtain production, to take delivery in the country of origin and forward the stores to the destinations where they were required. The head of the Central Provision Office, who was also a member of the E.G. Supply Council, was called Controller General Army Provision, Eastern Group, the position first being held by Major-General W. C. Holden, who was succeeded early in 1943 by an officer of the Corps, Major-General R. P. Pakenham-Walsh.

It was divided into branches corresponding to Services and Corps, R.A.F., R.E., R.A.O.C., each being manned by officers and other ranks of the corresponding Commonwealth Corps.

Thus the Engineer Branch, which had the maximum strength at Headquarters of thirty officers and was in the charge first of Colonel

L. G. Sillar,[1] late I.E., and later of Colonel F. Read,[2] late R.E., was manned by representatives of R.E., R.I.E., R.A.E., R.N.Z.E., and S.A.E.C. all working as one team. The organization was, therefore, probably unique as an example of completely integrated Commonwealth co-operation. In its three and a half years of existence the Branch had orders placed by the Supply Council for £24½ million worth of stores; some of the principal items being timber from East Africa and Southern Rhodesia, cement from South Africa, steel wire rope from the same country, electric wire and cable from Australia and South Africa, railway equipment from Australia, bridges and aircraft hangers from India, Australia and South Africa. The stores were received into and shipped from depots under control of the Central Provision Office in the countries of origin, the depots being manned by personnel of the local forces attached to the organization.

Post-War Organization

The organization of the E.-in-C.'s Office and its subordinate branches evolved during the war, remained fairly well as it stood at the end of hostilities into the "peace" period, though minor adjustments were constantly being made, and these are still continuing. It will be well, therefore, to give here an outline of how it stood at the end of the period covered by this volume. It will be noted that the chief change was that the nomenclature of sections of D.F.W's. Directorate had been changed from F.W. to E.

The E.-in-C. was assisted by a D/E.-in-C., a Brigadier, and two headquarter sections, E.4 for departmental administration, and E. Statistics. Responsible to E.-in-C. were three Directors and three Colonels each with a number of sections. Director of Fortifications and Works, whose status once again was raised to that of a Major-General in 1947, with a co-ordinating section and four sections each under a A.D.F.W. (Colonel); E.7 Works Services Abroad; E.8 Works Services at Home; E.9 Quantity surveying and Contracts; E.10 Design and Specification. Director of Engineer Stores (Brigadier) with a D/D.E.S., a co-ordinating section, and seven sections each under a A.D.E.S. (Colonel), numbered E.S. 1 to 7, and dealing with various aspects of stores administration.

Director of Transportation (Brigadier), also Commandant of

[1]Colonel L. G. Sillar, O.B.E.
[2]Colonel F. Read, M.B.E.

Transportation Training Centre and only subordinate to E.-in-C. in certain respects, with four deputy Directors, "O", Stores, Railways, Ports and I.W.T., controlling six sections numbered "Tn. 1 to 6".

Colonel "E" (O), controlling two sections, E.5 Training, and E.3 for Operations, planning organization and unit equipment. Colonel "E" (Equipment) in charge of three sections; E.1 for allocation of engineer stores and explosives; E.2 Research and design of field equipment; E.12 Research and design of E. and M. equipment.

Colonel (B.D.) Bomb Disposal.

Survey

Post war changes in the Survey organization, both at the War Office and in units, are described in Chapter VIII, pages 203–205.

CHAPTER VIII

ORGANIZATION

PART II

UNIT ORGANIZATION AND EQUIPMENT

Field units—Army, G.H.Q. and L. of C. units—Equipment—Bridging and river crossing equipment—Explosives—Transportation units—Airborne engineers—Assault engineers—Airfield Construction units and organization—Mechanical Equipment units—Survey—Tunnelling units—Quarrying units—Forestry—Postal Service—Movement control—Expansion, casualties, etc.—Post-war unit organization—Territorial Army and Army Emergency Reserve.

BEFORE describing changes in unit organization it will be well to quote a paragraph in Major-General King's report on the higher organization of the Corps, because the principles enunciated therein underlie the development of both units and equipment as well as of higher organization which subsequently took place.

"There can be no arbitrary division between the various services carried out under the general heading of Military Engineering. The essence of economical and efficient engineering practice lies in the correct application of the available mechanical and civil resources to the tasks in hand. The most up-to-date developments of engineering practice must be made available for the solution of the engineer problem of the Army in peace and must be applied to its military problem in war. There is no longer a demarcation between combatant and non-combatant zones of action; the requirements of modern field defensive systems have turned field defences into complex works demanding large quantities of mechanical equipment and engineer material for their execution, and the construction of aerodromes is a major engineering task which may fall to the lot of any field force. Limitation of supply of material, equipment and of skilled labour make it essential that all available resources are used in accordance with the priority needs of the Army as a whole. The existence of water-tight compartments results in idle labour and in loss of time which centralized authority could prevent. Finally, the organization, equipment and training of engineer units at home and

abroad, and the distribution of engineer resources between the many varied tasks to be done, must all be directed to one single end and that the carrying out of the policy laid down from time to time by the General Staff."

Field Units

In the years between the two World Wars the mechanization of R.E. field units proceeded fairly rapidly: a record of this and of the first inclusion of a Field Company (17th) with the Experimental Armoured Force has been made in Volume VII, page 231. As a sequel to the formation of the Tank Brigade the development of armoured formations had followed, so that in 1939, at the outbreak of World War II, several Tank Brigades, an armoured division, and several unbrigaded units of tanks and armoured cars had been formed largely by the conversion of the majority of cavalry regiments to a mechanized and armoured basis. In conformity with this reorganization and re-equipment 1st Field Squadron had been completely mechanized, though in no respect armoured, to provide the engineer element with the Armoured Division. The Field Squadron consisted of a headquarters and three troops, all personnel and equipment were carried in motor trucks, and the equipment included certain mechanical appliances, such as air-compressors, and a complement of subsidiary tools such as power drills, and power-driven pumps.

As a result of experience with the mechanized 17th Field Company and a realization, long overdue, that if engineer units are to keep pace with their formations and also carry out work, they must have mobility at least equal to, and preferably greater than, that of the troops they serve, the complete mechanization of all R.E. units of Infantry divisions was undertaken. By 1932, the conversion of the divisional R.E. of 1st Division was almost complete, and by the outbreak of World War II, all field companies had been mechanized and the field park companies, though they existed only in cadre form, had had their establishment and a proportion of their transport and equipment mechanized. The composition of the field companies on the mechanized establishments was in principle the same as that of the horse-drawn units, a headquarters and four sections. As far as vehicles and equipment were concerned there was little difference between them and the field squadron. All personnel and equipment was carried in lorries, and a similar type of mechanized equipment was carried, though the field company had rather more heavy

equipment than the squadron to which unit mobility was of more vital importance.

The field units of the Territorial Army followed suit, though by 1939 little mechanized transport or equipment had been issued to them.

In peace time no Army field units of the Regular Army existed, the few Army troops and workshops and park companies being provided by the Supplementary Reserve. Some of the regular units were detached for special duty in countries where there was unrest, such as Palestine, so that the outbreak of war in September found many formations lacking in their complement of R.E. units. The filling of these discrepancies and the provision of corps engineers was met by the absorption of units from Territorial Army divisions which were not noted for early dispatch overseas, while the units for G.H.Q. Troops R.E. were found from the Monmouth Special Reserve (Militia). To even out the more complete training of the regular units, and to make full use of the high standard of trade efficiency of the personnel of Territorial Army units, some rearrangement of units between formations was put into force, thus breaking up the long association of certain units with particular formations.

As the war progressed the nature of the operations, and the frequent necessity of concentrating engineer effort, led to a demand for greater standardization in field units and an increase in the proportion of these necessary to meet the requirements of formations. We thus find that the organization and equipment of field squadrons and companies became more similar. The number of troops in the field squadron was increased to four, and the equipment of the two units became more and more identical. To provide the increased proportion of Corps and Army troops, a number of new R.E. formations, of the same organization and equipment as divisional engineers, were raised either by conversion of the engineers of formations which had been broken up or by the raising of new units.

During 1943 and 1944, to come into line with the rest of the Army and so to avoid confusion, the title, first in the field companies and later in all R.E. companies, of the subdivision of the unit was changed from "section" to "platoon"; the term section applying henceforth to the subdivision of the platoon. The sub-unit of the squadrons remained the "troop" and was composed of a number of sections.

A most important development in the organization of field engineer units and formations during the war was the provision of signal communications. In 1939, at the outbreak of war, and for

many months to follow there was no means of internal communication in the R.E. of both armoured and "infantry" divisions except a number of motor cyclists. Even the C.R.E. had to depend on the pooled communication provided by R. Signals at divisional headquarters. To communicate with his field squadrons or companies he could only send a message to the headquarters of some formation to which the sub-unit was attached or which was located in the same neighbourhood. This militated greatly against the rapid performance of engineer work by causing delay both in the communication of the results of reconnaissances on which engineer plans could be based, and in transmission of the necessary orders for work. This difficulty was early recognized by the General Staffs of formations in the field, particularly in the widely dispersed and rapidly moving operations in the desert of North Africa, and for important occasions signal sets were specially allotted for use in the engineer organization. But this could only be a makeshift, and wireless signal communications were introduced into the R.E. organization. First in armoured divisions, and later extended to all divisions, sets were allotted to connect Cs.R.E. with their units. Next the field squadrons were given wireless communications between their headquarters and troops, the same facilities being extended to field companies when the latter became identical in organization with field squadrons. C.Es. were also given communications with their Cs.R.E. Some of the sets were manned by personnel of R. Signals and some by R.E.

For major engineering tasks it was often necessary to concentrate a number of R.E. formations together, and to prevent senior R.E. officers from being overloaded with the control of these concentrations, a form of headquarters was introduced which, with no fixed complement of subordinate units, could be placed in charge of any desired number of units or formations. This was the Army Group, R. Engineers (A.G.R.E.), the commander being a Colonel (C.A.G. R.E.).

The engineer requirements of new types of warfare such as airborne and assault engineers, airfield construction units, and mechanical equipment units, involved the raising of new types of R.E. units and these are dealt with in separate paragraphs which follow.

Army, G.H.Q. and L. of C. Units

At the outbreak of war only a small number of Army troops, electrical and mechanical, and workshops and park companies existed, and these were almost entirely provided by the Supplementary Reserve. Many more of these units were raised as the war

proceeded. Few new types of units were raised as the policy adopted was that of standardization. Amongst the latter were artisan works companies (a revival of a type of unit raised in World War I), general construction companies, a form of unit which was soon abandoned, and road construction companies. For special purposes a few types of technical units such as forestry, tunnelling, quarrying and oil-pipeline companies, were raised. The necessary units to man engineer depots at the bases, e.g. engineer base depots and workshops, had been planned for in peace-time and raised on mobilization and for each campaign.

Equipment

In a mechanized age, considerable development occurred in the standard equipment carried by units or held for their use in depots, etc. That for certain specialized units, such as assault and airborne engineers, mechanical equipment units, bomb disposal units, etc., will be dealt with in the sections dealing with those organizations. It remains here to describe changes in equipment for bridging and river crossing, and in explosives.

Bridging and River Crossing Equipment

The position with regard to bridging and rafting equipment at the beginning of the period here under consideration has been described in Volume VII, pages 176–9. When in 1937 financial strings were somewhat loosened by the threat of war, development at the Experimental Bridging Establishment at Christchurch became more active. The first step, brought about by the growing power and number of machine-guns, was investigation into types of boat in which the latter could be ferried, as the Kapok assault bridge no longer met requirements. As the result of a regatta held at Christchurch, in which seventeen types of craft were tested, a folding Assault Boat Mark 1 and a Reconnaissance boat were adopted.

The increased weight of the "infantry" tank led to modifications in design of the pontoon equipment which stretched its potentialities to the limit, left no margin for further increase in load and even for existing loads was not entirely satisfactory. For a heavier tank only the large Box Girder of 130 ft. span existed and was slow in erection.

In 1939 the "Class" system of marking bridges and vehicles was adopted. Previous the only method of telling whether a vehicle could pass a bridge safely was to stop it, determine its type and number, and look up in a table as to whether it was classed as light, medium or heavy. By the new system vehicles were marked clearly

on their wings with a number showing their laden weight in tons, and bridges were similarly marked with a figure showing the maximum load they would take. These figures were not accurate weights but the highest figure in a series of "Classes", Classes 5, 9, 25, 40, 70, etc. This method of nomenclature of bridges and rafts is adopted throughout this volume and Volume IX.

Early in 1940 Professor (later Sir Charles) Inglis of Cambridge University produced a new type of his tubular bridge as used in the war of 1914–18, which by using a truss system produced a bridge of variable strength which could be used for a variety of purposes. This was so versatile that it was adopted for divisional R.E. in place of the small box girder. It had, however, certain disadvantages, the most serious of which was that it did not lend itself easily to mass production. The Staff of the Experimental Bridging Establishment, therefore, once again applied themselves to the problem, and its Chief Designer Mr. (later Sir) Donald Bailey produced in 1941 his idea for a new bridge, which subsequently became famous as the Bailey Bridge. Basically it had much in common with Martel's box girder, being built up of a number of easily handled panels pinned together, which could be added together both longitudinally for extra length, and in stories or parallel trusses for extra strength. Working rapidly Mr. Bailey and the staff of the Experimental Bridging Establishment produced the finished design in two months. Three months later the prototype bridge was manufactured and ready for the test. After tests and certain modifications the bridge was accepted for production, and after another five months, in December, 1941, the first of these bridges was in the hands of the troops. It proved to be easily handled and launched, it would cater for a great variety of loads up to 70 tons, it could be made into a heavy floating bridge without the use of trestles, and it lent itself to mass production. With all these advantages it could now take the place of the majority of bridges in use heretofore. Production was therefore stopped on the Pontoon bridge Mark I, S.B.G., L.B.G., Hamilton, and Inglis bridges and concentrated on the Bailey. During the war 200 miles of fixed and 40 miles of floating Bailey bridge equipment was produced in the British Isles, in addition to further quantities manufactured in America. Supply to the troops was never short, chiefly due to the insistence of the E.-in-C. as to the extent of the original order in face of considerable opposition.

Coupled with the introduction of the Bailey bridge came the acceptance of the principle that bridging equipment was an

expendible store. The pre-war policy was to put down a quickly built bridge with the divisional equipment with the full intention of replacing it by a semi-permanent structure. The development of the use of armoured fighting vehicles rendered such a policy impossible to carry out. The Bailey bridge, if provided in large quantities, provided the solution. Bridging equipment henceforth became an "expendible store" which was replaced from the rear as soon as used.

Even with the possibilities of rapid bridge construction of the folding boat equipment and the Bailey bridge, it still remained necessary to secure a considerable bridgehead before a bridge could be built. It was therefore necessary to get anti-tank and close support weapons across the stream by means of rafts. Assault boats were used to form the basis of the smallest and most easily carried of these and would carry anti-tank weapons and jeeps. Class 5 and Class 9 rafts were next produced, based on folding boat and pontoon equipment, but for tanks a special Class 50/60 raft was designed. To propel these rafts outboard motors, varying from 4 to 50 h.p., were used as well as shallow draft motor boats.

Following the Germans, the Americans produced a fast storm boat driven by a 50 h.p. outboard motor at 25 knots. This was designed so that it could be driven ashore on any reasonable bank at full speed. As this craft would not carry jeeps or anti-tank guns the British produced a larger edition.

Special bridges and obstacle crossing equipment were developed for use with armoured columns. These are described in the section of this chapter dealing with assault engineers (pages 194–199).

At the beginning of the war a set each of F.B.E. and of S.B.G. were carried in the field park company of each division. The S.B.G. set was replaced by a 60 ft. bridge (Inglis) in 1940 but, shortly after, this and the F.B.E. bridge were replaced by an 80-ft. Bailey bridge. All other field bridging equipment was carried in the Bridge Companies, R.A.S.C., and in 1942, these latter units were reorganized in the "brick" system. Under this organization the company could consist of a variable number of bridge platoons (for Bailey, Pontoon, F.B.E., Raft, etc.) to suit the projected operation. These could then be sent forward and attached to field park companies.

Explosives

For many years before 1938, the standard explosives carried by

field units had been limited to gun-cotton and ammonal with the necessary detonators and fuses. It had been realized that a form of plastic explosive would generally be more suitable, but shortage in supply, and the extra priority given to its use for the filling of anti-aircraft shells and bombs, prevented its availability for engineer use. Commercial explosives such as dynamite, gelignite, etc., were too sensitive to be carried in the field, but, as they were likely to be found in theatres of war, R.E. personnel were trained in their use. During the war plastic explosive became available and T.N.T. and other explosives were largely used. The successful introduction in 1940 of the "over-load" method of destroying bridges, particularly those constructed of reinforced concrete, is referred to in Chapter II, page 26.

But the most important development in this respect was that in regard to "shaped" charges. Scientific investigation found that if detonating explosives were made up in a certain shape, a hollowed out cone at the end of a cylinder, the force of the explosion could be canalized so as to produce a punching effect. This force could be used for the penetration of reinforced concrete or steel plates. For engineer purposes such charges were made up in a number of different sizes known generally as "Beehives". The first type, issued early in 1943 to field units, weighed about 10 lb. with 6¾ lb. of explosive. This would punch a hole 2 or 3 in. in diameter through 5 in. of armour plate, or 33 in. of concrete. Larger types, varying in weight from 15 to 75 lb., and known as "General Wades", "Hayricks", and "Hollow Cone", were issued later. These shaped charges were too local in effect for the attack on anti-tank walls. For this "plaster shot", commonly used in the projectile of the petard of A.V.R.E.s, was adopted. Here the explosive was plastered like a pancake on the object to be destroyed.

In the case of explosives, as well as for bridging material, the principle became accepted during the war of 1939–45, that they should be supplied as required and not treated as stores for which a fixed establishment was held. While field units still had their quotum of equipment explosives carried in their unit transport, extra supplies were ordered forward as the requirements of the situation seemed to demand. They were thus treated on the same lines as ammunition.

Mines

The development of anti-tank and anti-personnel mines, and

methods of using and lifting them, are so closely connected with experience in various campaigns, particularly in those in the North African desert, that the matter is dealt with in the narratives of the various campaigns (see particularly Chapter V, pages 115–116, and Chapter XIII, pages 365–371).

Transportation Units

At the outbreak of war in September, 1939, the only regular transportation units in existence were 8th and 10th Railway Companies and 29th Railway Survey Section R.E. There were also a number of units of the Supplementary Reserve R.E. making a total of nine different types of transportation units. The total strength of all these units in September, 1939, amounted to 500 regulars and 3,500 Supplementary Reservists. As the war proceeded and the special needs of the various theatres had to be met, there was a very large expansion both in the number of different types of units and their total strength. In all, the Transportation Service eventually included over sixty different types of units comprising more than 146,000 personnel counting those drawn from the Dominions and India. In France in 1939–40, the major expansion was due to the necessity of making port operating units self-contained as regards labour. Before it had been assumed that local labour would be available, and that it was sufficient to provide supervisory staffs. With the mobilization of the French forces and the necessity for that country to maintain its port traffic for internal needs, little labour was available for the British forces. In the Middle East the development of railways in Palestine, Syria, Iraq, and Persia coupled with the construction of track in the extensive base installations in Egypt and Palestine, necessitated the formation of many new railway construction and maintenance units, many of which were provided by Australia, South Africa and India. The development of ports in the area also demanded the introduction of a considerable number of port operating and construction units, and extension of the Inland Water Transport organization. To handle these many new units, headquarters, known as Groups, were established enabling numbers of units from the various branches of the Service to be brought together and their work controlled. The chief expansion to the Transportation Service in the campaigns in South East Asia was in the department of Inland Water Transport to meet the requirements of seaborne maintenance on the coast of the Bay of Bengal, and traffic on the rivers of Burma. The problem

of the landing in Normandy and the campaign in North-West Europe brought fresh problems and the introduction of specialized units. Among these were the units required for the construction and operation of the artificial "Mulberry" harbour, and those required for the rehabilitation of ports which had been completely put out of action by German demolition. Finally the requirements for transportation facilities in the United Kingdom beyond those which could be provided by the civil organizations, were far higher than anything that had been envisaged in the past. The details of the work and special organizations in these various theatres are more fully narrated in the chapters dealing with the various campaigns and areas of activity.

Airborne Engineers

Though it was known before the opening of World War II that some continental armies were considering the use of parachute dropped troops, and mass drops of such units had been witnessed as much as two years earlier at manoeuvres in Russia, no steps had been taken even to experiment in this direction in Great Britain. In May, 1940, the Germans used both parachute and glider-borne troops to capture certain objectives and to cause disorganization behind their enemy's forces in Holland. On 22nd June, 1940, Mr. Winston Churchill, who had recently become Prime Minister, announced that we should have a corps of at least five thousand parachute troops, and gave orders for the nucleus of such a force to be raised forthwith. Two days later a Royal Engineer officer, Major J. F. Rock,[1] was ordered to take charge of the organization of airborne troops and to collaborate with the R.A.F. in their training. Thus, once again, a Royal Engineer officer was responsible for the earliest development of an adjunct to our armed forces.

Shortly after, Major Rock found himself in charge of the military side of the General Landing Establishment at Ringway, near Manchester. By October, 1940, the first gliders had been delivered, and before the end of the year it was possible to carry out exercises with both parachute dropped and glider-borne troops. We are not concerned here with the development of airborne forces in general, and must confine our attention to that of R.E. units.

In these early days the exact role of airborne troops had not been established, but it was plain that part of their duties would be the carrying out of raids on limited objectives. In such operations it

[1]Lieut.-Colonel J. F. Rock, killed in flying accident, 1943.

was clear that a main part of the duty of the engineers would be demolitions, but they might also be required to assist the other troops in various ways.

At first the parachute troops were obtained from volunteers from all branches of the service, and in exercises and raids, such as that against the aqueduct supplying Taranto with water carried out on 10th February, 1941, *ad hoc* groupings of personnel were adopted. In November, 1941, Major-General F. A. M. Browning[1] was appointed to organize and command the 1st Airborne Division. His staff included a S.O.R.E., Major M. C. A. Henniker being appointed to fill the post. The new commander had first to consider the composition of his formation and the organization and establishments of its various units. Even before this, Chief Engineer, Home Forces, Brigadier B. K. Young,[2] realizing that it seemed probable that the Division would be composed of three brigade groups, decided that a R.E. unit would be required for each and some form of field park company as well. Accordingly he had earmarked 9th Field Company and 261st Field Park Company, which, with one or two units to be formed from the R.E. parachute personnel, would form the nucleus of the divisional engineers.

By 15th January, 1942, an establishment for Headquarters R.E. of the Division had been approved, Major Henniker being promoted to fill the post of C.R.E. The establishment of a Parachute Squadron had also been approved. Major S. L. Dorman[3] was appointed to command the first of these latter units the ranks of which were filled by personal selection from the many volunteers who offered themselves. In the cases of 9th Field and 261st Field Park Companies, which were to be glider borne, men of the existing units who volunteered, and this was almost all, and who were considered suitable were accepted, vacancies being filled from volunteers from other units. This latter system was found to be better as the men of the unit had already a unit *esprit de corps*. The organization decided on for the Division was of two parachute and one glider-borne brigades, and for these two parachute squadrons, a glider-borne field company, and a field park company R.E. were required. The field company was of normal organization with reduced transport, the field park company, whose establishment was not decided on till the unit was leaving for active service in North Africa, was much simplified and

[1]Lieut.-General Sir F. A. M. Browning, K.C.V.O., K.B.E., etc.
[2]Major-General B. K. Young, C.B.E., M.C.
[3]Major S. L. Dorman, presumed killed, 1942.

had no bridging section. The parachute squadrons had practically no transport except hand carts and later jeeps, and had five officers per troop, a total of seventeen. The shortage of transport was severely felt when, as so often happened, the unit had to operate on the ground for considerable periods. In the autumn of 1942, 2nd Parachute Squadron was formed, under the command of Major P. Baker,[1] from the Holding Company of the Kent Fortress R.E., every man of which volunteered for service with the new unit. On the formation of 6th Airborne Division, in the spring of 1943, the R.E. units under Lieut.-Colonel F. H. Lowman[2] were 3rd Parachute Squadron formed from 280th Field Company, 591st (Antrim) Parachute Squadron, 249th Airborne Field Company, and 286th Airborne Field Park Company, the three latter being formed from existing units; 4th Parachute Squadron was formed independently from volunteers from other R.E. units.

The equipment of the units was gradually developed as the result of experience in training and operations. Under this procedure there was a danger of the units becoming "White Knights", loaded up with a mass of gadgets which they could not possibly transport on service, and senior officers had to exercise rigid control and selection. Much of the equipment was common in principle with that of other R.E. units, but the special conditions of airborne warfare, and the necessity that the gear should be capable of being packed in the standard dropping containers, required that modifications should be made. This work was the responsibility of the field park companies who displayed great ingenuity in the solution of the various problems thus presented. A special problem arose over the carriage and dropping of detonators. The R.A.F. naturally objected to these being packed with bulk explosives, and R.E. officers were equally desirous of not asking their men to jump with the detonators loose in their pouches or pockets. A special packing was evolved by which fused detonators could be safely carried on the man. But for the detonators of the Hawkins anti-tank mine, which depended for action on the breaking of a glass phial of acid, no satisfactory solution could be found. It reflects great credit on the men of the units that never did they complain of having to jump with these or electrical detonators in their pouches packed tightly in cigarette tins.

The limitation in transport has already been mentioned. Parachute squadrons had for long to be content with hand carts, folding

[1]Lieut.-Colonel P. Baker.

[2]Lieut.-Colonel F. H. Lowman, D.S.O., M.B.E.

bicycles and light-weight motor bicycles. The airborne field companies and field park companies could be accompanied in gliders by jeeps, and motor cycles and side cars. After the operations in Normandy, where the airborne troops had to fight for a considerable time on the ground, extra transport was added to all establishments which, left behind in the first instance, could rejoin the units when the troops on the ground made contact with the airborne troops.

A great loss to the Corps and to the airborne troops as a whole was suffered when Rock, who had been promoted Lieut.-Colonel and placed in command of the Glider Pilot Regiment, was killed in an accident in a glider. Thus one more pioneer of a new development of war gave his life in the further development of his ideas.

Assault Engineers

At the outbreak of war no vehicle in any R.E. unit was armoured, although many officers had realized that if engineers were to accompany armoured units into battle they would need some sort of protection. The experience of 1st (the only) Field Squadron in France in 1940 was not sufficient to point to the necessity of any such development. But as soon as operations, particularly those of armoured formations, began in the Libyan Desert it became plain that if even reconnaissance parties or small detachments of R.E. were to accompany armoured columns they could not continue to do so in "thin skinned" vehicles. As a first step armoured scout cars were issued to field squadrons of armoured divisions, but it soon became obvious that field companies were equally liable to be called on to take part in such operations and the issue was gradually extended to them. By October, 1942, an armoured personnel carrier had been adopted to carry seven men, and these, as they came into use, were issued at the rate of two per section (or troop) to field companies and squadrons.

About the same time it was accepted that some form of engineer tank was required to enable R.E. personnel to force routes over or through defended anti-tank obstacles. History was repeating itself and it now became possible for the Royal Engineers once more to lead the assault. In the Crimean War of 1854, there was a catchword "Follow the Sappers" who in the assault were clearly identified by wearing a white band. The "Engineer Training" of the period laid down: "It is the privilege of the senior engineer subaltern to lead the forlorn hope."

At that stage of the war tanks were in too short supply for any to

be allotted permanently to engineer units, but it was agreed that it might be necessary for particular operations for a limited number of heavy tanks to be assigned by the commander to the R.E. to enable his units to clear passages through the obstacles. To enable the tanks to perform this function it was necessary to design certain fittings which could be mounted and dismounted in a matter of hours. A number of such gadgets were accordingly developed, mostly at first in the field but later on a production basis in factories in the U.K. A description of some of these fittings will be given later. An exception to the general rule of rapid convertibility was the flail tank, variously known as the "Scorpion" or "Crab". This machine, the first of which was developed secretly in the desert by a field park company of the South African Engineer Corps, consisted of a revolving drum with a number of chains attached. As the tank advanced the drum revolved and the chains flailed the ground in front of the tank, thus exploding any mines in its path. At first these were manned by personnel of R. Tanks with a sapper to operate the flail mechanism. Then they were taken over entirely by R.E., and finally became a responsibility of R. Tanks.

By the spring of 1943, experience in North Africa and in the Canadian operation at Dieppe had proved the necessity of a R.E. tank if engineers were to operate in the forefront of an armoured assault on prepared defences, and the provision of such a weapon was put in hand. The Churchill tank was selected as the most suitable, and investigation proceeded as to the best form of permanent modification. By this time the six chemical warfare companies of 5th and 6th Chemical Warfare Groups R.E. had been converted into field companies as G.H.Q. Troops R.E., and had taken part in exercises to evolve a technique for land assault on defended positions. In April, 79th Armoured Division was formed under the command of a R.E. officer, Major-General P. C. S. Hobart,[1] to co-ordinate the development of armoured assault technique and equipment, and the former chemical warfare units joined the Division as 5th and 6th Regiments Engineer Assault troops, Colonel G. L. Watkinson[2] being appointed to command as C.A.R.E. (Commander Assault R. Engineers). By the end of October, 1943, six other units had been converted to Assault Squadrons, and 1st Assault Brigade R.E., as it was now known, consisted of Headquarters, three assault regiments, each of four squadrons and an assault park squadron.

[1]Major-General Sir P. C. S. Hobart, K.B.E., C.B., D.S.O., M.C.
[2]Major-General G. L. Watkinson, D.S.O.

The table on page 197 shows the organization at this time with the titles of the units from which the component parts were formed. This organization remained unchanged up to the landing in Normandy in June, 1944. During the campaign in North-West Europe the term "Armoured" was substituted for "Assault", the number of squadrons in a regiment was reduced to three, as was the number of troops in each squadron. An armoured experimental and training establishment and an armoured engineer dozer squadron were added, and the role of certain squadrons was altered After the war the title "Assault" was reintroduced. In North-West Europe assault units were for command concentrated in 1st Assault Brigade R.E. of 79th Division and attached to, or in support of, other formations as required. It therefore happened that each assault squadron worked at one time or another with all corps and many of the divisions of the British and Canadian armies, and also with American formations.

In Italy an equal demand for assault units R.E. arose for the attack on prepared enemy defences. The high casualties suffered by engineer units in that theatre in 1944, and the success of assault units in Normandy, led to the formation in Italy in the autumn of 1944 of 1st Armoured Regiment, R.A.C./R.E., followed early in 1945, by that of an assault brigade. This was formed from the headquarters of a tank brigade, a battalion Royal Tank Regiment, an assault regiment R.A.C./R.E., and the divisional R.E. of 1st Armoured Division, which had been broken up. The composition of this brigade was:—

Brigade Headquarters and headquarters squadron.
One R.A.C. regiment with H.Q. Squadron, two "Crocodile" (flame thrower) squadrons, two flail squadrons.
Two R.E. assault Regiments each of H.Q. and three squadrons.
Service units including an armoured engineer park squadron.

Each armoured squadron R.E. had one H.Q. Control tank, two armoured troops each with a Control tank, three "AVREs" and three "Arks" and two dozer troops each of three tank dozers.

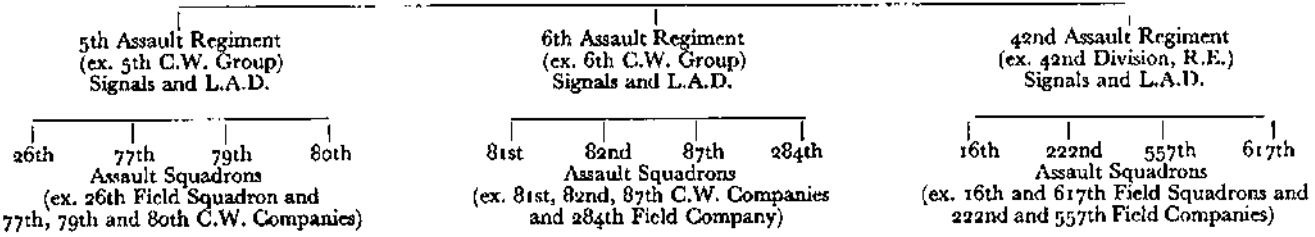
An R.E. officer, Brigadier E. W. H. Clarke[1], was appointed to command the Brigade with a R.T.R. officer as Second-in-Command.

Owing to the higher priority of the campaign in North-West Europe at this time few complete vehicles were received from home production and even component parts and fittings were slow in delivery. In consequence much of the work of equipping the units had to be carried out in Italy in already overworked units of R.E.,

[1]Brigadier E. W. H. Clarke, C.B.E., D.S.O., died, 1947.

1st ASSAULT BRIGADE, R.E., October, 1943

Brigade Headquarters
H.Q. Brigade Signal Squadron
H.Q. 149th Assault Park Squadron 149th Assault Park Squadron (ex. 149th Field Park Squadron)



R.E.M.E., and Ordnance. Thus, when the Brigade was called forward for action in March, 1945, only some of the units, including only one R.E. Assault Regiment, were ready.

The New Zealand Division Engineers included a similarly improvised squadron consisting of:—

Four "Scissors" bridge layers.
Four dozer tanks.
Four fascine carriers.
Four "Arks".
Four troop carrying tanks for N.Z.R.E. parties.

The basic vehicle of assault units R.E. was the Armoured Vehicle R.E. known by initials A.V.R.E. which, being pronounceable, was still further shortened to "AVRE" by which name it is referred to in the accounts of operations. This was a Churchill tank with its turret removed and to which was attached permanently, or as required, certain special fittings. The latter included:—

The Petard. This was a spigot mortar which could throw a 40-lb. missile, known as a "Dustbin", accurately a distance of some eighty yards.

The Assault Bridge. A modified small box girder bridge capable of passing the heaviest tanks over a 30-ft. gap. It was attached to the front of the AVRE rather like the boom of a crane. It could be lowered across a gap from inside the tank without the crew exposing themselves.

Fascines. An enlargement of a store well known to R.E. for many years. It consisted of a number of rolls of chestnut paling and brushwood tied up with wire rope into a cylindrical bundle 8 ft. in diameter and 12 to 14 ft. long. It was carried on the front of the AVRE and on reaching a tank-proof ditch was released from inside and rolled off to form a causeway over which tracked vehicles could pass.

Dozers. Normal dozer blades hinged on the front of the tank.

Flails. These have been described and were handed over for operation by R. Tank Regiment.

Snakes. For clearing passages through minefields. They consisted of 400 ft. of steel tube filled with explosive and could be pushed or towed through a mine-field. When disconnected from the AVRE, the explosive was fired, thus detonating or removing any mines within a few feet on either side.

Conger. This apparatus was carried in a special trailer towed by an

AVRE. It consisted of 300 yds. of canvas hose which could be thrown across a minefield by a rocket. It was then filled with liquid explosive by air pressure and detonated to clear a path through the mines. *Roly-Poly* and *Bobbin* by which a carpet was laid from a drum on the front of the AVRE to form a path over soft sand or mud.

Another machine, not in the same class as it was a more permanent adaption of the Churchill tank, was the "Ark". These were tanks with the turret removed and tank tracks laid over the top and with hinged tracks at either end. These were driven into ditches, the hinged tracks lowered on to the grass banks, thus forming a causeway over which other tanks could cross. Several "Arks" could be used in series in wide gaps, and in deep ditches one "Ark" could stand on another.

Other attachments, many quite fantastic, were tried but were not adopted for use in the field.

Airfield Construction Units and Organization

In the interval between the first two World Wars few R.E. officers had any experience in the design and construction of airfields for the R.A.F. The provision of aerodromes, as they were then called, was the responsibility of the Director of Works at the Air Ministry, and the construction of those situated in the United Kingdom was generally carried out by contract under the direction and supervision of that officer's department. Sometimes abroad, particularly in Iraq and India, R.E. officers were employed in the direction of construction to the plans and specifications of the Air Ministry. It was laid down that in war responsibility for the construction and maintenance of airfields for the R.A.F. overseas lay with the Army, but few steps had been taken to provide for this new commitment. As has been seen, some small provision for the task had been made in the order of battle of the B.E.F. which was to move to France on the outbreak of hostilities on the Continent. To provide the necessary technical experience, a number of officials of the staff of the Director of Works at the Air Ministry had been granted commissions in the Royal Engineers, Supplementary Reserve, and two of these officers were included in the establishment of the office of the Engineer-in-Chief of the B.E.F.

It was apparently assumed that the construction and maintenance of airfields required by the R.A.F. formations working in direct co-operation with the field army would be carried out by the field engineers of Army formations. Only for the Advanced Air Striking

Force, which was to operate in an area remote from the B.E.F., was a small allotment of two companies under a Chief Engineer allowed. It was also probably assumed that existing airfields in the country would be placed at the disposal of the British Air Force by our allies. This assumption proved accurate only to a very limited extent. A complete new organization had to be built up as the needs of the R.A.F. grew and the details of this are given in the chapter dealing with the operations of the B.E.F. (Chapter II, pages 15–18). It will suffice here to record that a second Chief Engineer Airfield Construction was appointed to take charge of airfield construction work for the Air Component of the B.E.F., and that the necessary technical personnel was provided by the hurried raising of some fifty artisan works and general construction companies R.E.; unskilled labour being provided by units of the Pioneer Corps and by infantry of partially trained formations of the Territorial Army.

The requirements of the R.A.F. in the Middle East also soon outpaced the potentialities of the engineers originally earmarked for the purpose and a new organization was set up in the theatre. This consisted of a Chief Engineer, Airfields, on the staff of the Engineer-in-Chief, Middle East, who worked in close co-operation with the Air Officer Commanding-in-Chief and with the Chief Engineers of the armies in the field. Under this Chief Engineer were a number of Cs.R.E. Airfields working either with the headquarters of certain R.A.F. commands or in particular areas. For the executive work Airfield Construction Groups were formed each with a headquarters under a Lieut.-Colonel R.E. and usually two artisan works companies, two sections of a mechanical equipment company and two companies of pioneers. Field units were frequently allotted temporarily to assist and these and bomb disposal units were much used for the initial clearance of mines and booby traps. As a result of experience, in November, 1942, some reorganization was carried out in the theatre. The Cs.R.E. of Groups, the composition of which was little altered, were given three D.Cs.R.E. Within the group organization Mobile Construction Parties were organized, highly endowed with transport and mechanical equipment, to move with forward troops to start on the reclamation or new construction of airfields at the earliest moment.

The operations of this organization had been watched at the War Office, which in autumn 1942, after further investigation, ordered the formation of two officially recognized Airfield Construction

Groups for the coming campaign in North-West Africa. In principle the organization used in the Middle East was accepted, but the new groups contained only one artisan works company and one mechanical equipment section with four companies of pioneers and a bomb disposal section. But the chief point of difference lay in the chain of engineer control. The organization which had grown up in the Middle East involved the existence of a separate engineer force divorced from the normal engineer chain of control. That evolved in the United Kingdom maintained the normal engineer chain of command. When the forces from North-West Africa combined with those from Middle East Command for the invasion of Sicily, this variation in organization had to be eliminated, and in the new organization, evolved on the spot, the principle of the normal chain of control as favoured by the War Office was accepted. After a tentative reorganization, the composition of Groups became fixed at Headquarters, two road construction companies, two companies of pioneers, and a bomb disposal section. It was found that road construction companies were more suitable for the purpose than artisan works companies.

In Burma the system of groups was also used, they being named Forward Airfield Engineers. The composition of the groups was in principle similar to that used finally in Sicily and Italy, but they frequently split up into smaller and more mobile bodies to suit the very mobile type of operations and the nature of the very inadequate land communications. In the campaign in North-West Europe again the same organization was adopted but here the R.E. groups were joined by a similar type of unit, the Airfield Construction Wing R.A.F., which, similar in composition, was more completely self-contained in transport. Some of the groups worked in L.-of-C. areas under the Director of Works while others, in which the R.E. groups were rendered fully mobile by the permanent attachment of extra transport including tank transporters for the heavier mechanical equipment, were placed under C.A.G.R.E.s subordinate to the Chief Engineers of the Armies of 21st Army Group.

In the realms of equipment, besides that for mechanical earth moving, various forms of surfacing for airfields were produced. These are described in chapters dealing with operations, the most important being Prefabricated Bituminous Surfacing known as P.B.S., and Pierced Steel Plank or P.S.P. These enabled runways to be constructed and kept in operation on soft ground at a pace quicker than would have been possible with concrete.

Mechanical Equipment Units

Before the outbreak of war in September, 1939, little mobile mechanical equipment in the form of earth-moving machines and cross country tractors formed a standard part of the equipment of the Royal Engineers, except to a limited extent in the Transportation Service. What little there was, was treated as a base store to be issued when and where required. In this the Army followed British civilian practice, which, up to that time, had not adopted the use of such equipment on anything like the scale on which it was used in the United States of America, or indeed the more rapidly developing countries of the Commonwealth. Few types of these machines were at the time manufactured in the United Kingdom, and so there was no great reserve of such plant in the country.

The problems facing the B.E.F. in France in 1939–40, more especially the production of an extensive defensive position with excavated anti-tank obstacles, and the construction of numerous airfields, produced a demand from that theatre for considerable quantities of excavators of various types, dozers, graders, dumpers, etc. To handle these machines, the operation of which in many cases demanded considerable skill, and the maintenance of which was highly specialized, a Mechanical Equipment Company R.E. was formed under the command of an infantry officer of the Territorial Army, Major S. A. Westrop, who had had considerable experience with this type of equipment in civil life before the war. This unit was composed of three operating sections and a workshop section for maintenance. Machines and operators were sent out for attachment to units requiring their help for particular jobs. Officers of the operating sections were available to advise units on the use of the machines and to look after their maintenance. Though in the later stages of the campaign in France and Belgium, plant, largely obtained from America, as the small amount available in the United Kingdom was absorbed in the large contracts then in operation in that country, was coming forward in fair quantities, the problems of this newly formed company were great. Its first trouble was to obtain operators for the machines. Few were available for enlistment, some were combed out of units of the B.E.F., but the majority had to be trained *ab initio*. Owing to the shortage of instructors, most of whom were already employed in the Company, and the necessity of keeping the machines on the work, likely recruits drawn from all branches of the service had to be trained on

the job. This would have been easier if the unit had been concentrated, but the demands for mechanical assistance came from widely scattered parts of the theatre, forward defences, airfields for the Air Component of the B.E.F. and for the Advanced Air Striking Force away in Champagne, and the bases. The experience of this unit proved of the greatest value when the time came to form new ones for service in other theatres. Generally it may be said that in principle the organization stood up to the test and the major changes made later were towards rendering the sections or platoons of the units more independent.

With the inclusion of a limited quantity of tractors and earth-moving machines in the establishment of other R.E. units in the field, more particularly in road construction companies, and field park companies and squadrons, the mechanical equipment units could be more concentrated on major tasks and not be frittered away on small jobs where one or two machines only were required.

The value of mechanical equipment, largely a "new toy" even to R.E. officers, is vouched for by many reports from senior engineer officers in the field. E.-in-C. Middle East reported in August, 1942, "We never had enough (angledozers and bulldozers) nor could we have too many of these machines. It is no exaggeration to say that D4s (the smallest type) have come into their own, and are looked on by all arms as life savers." A little later C.E. First Army in North-West Africa wrote. "The angledozer has been one of the features of the campaign. Without angledozers it would not have been possible to have finished by the time required the tracks, diversions, and wadi crossings which were needed for deployment before each major battle." As will be seen in the accounts of the various campaigns the armoured bull-dozer proved its value for work under fire on countless occasions.

SURVEY

Before the outbreak of war, the only Survey organizations existing in the United Kingdom were the Geographical Section General Staff, M.I.4, at the War Office, and the Ordnance Survey at Southampton which was a department of the Ministry of Agriculture and Fisheries. The development of the former has been described above, pages 171–173. The Ordnance Survey, much of the early history of which had been recorded in earlier volumes, had from its inception had as Director-General an officer of the Royal Engineers, the post being filled at the commencement of the period covered by this

volume, by Major-General M. N. MacLeod.[1] Most of the senior appointments on the staff were similarly held by R.E. officers, and a large proportion of the subordinate staff was filled by other ranks of the Corps who were held on the books of the Survey Battalion R.E. These men normally completed their colour service with the battalion, and then remained in the organization as civil servants.

It was the accepted policy in pre-war years that the survey directorates and survey units of expeditionary forces would be drawn from the Survey Battalion, and that the Ordnance Survey would be responsible for the production of maps for the services in case of war. These divergent duties might have had serious repercussions owing to the sudden departure of much of the skilled staff at a moment when demands for new maps and for printing were at their peak. Luckily the extra work thrown on the Ordnance Survey, referred to above, owing to the threat of war, had involved the recruitment and training of a number of young technicians as civil servants. As the war progressed many of these enlisted in the Corps to fill vacancies in units, and many of their places were taken by women who were recruited and trained for map drawing and many forms of technical work in which they proved extremely competent.

In peace-time there was no survey representation with the staffs of home commands and formations, and this state of affairs continued till after the withdrawal of the B.E.F. from France and Belgium in June, 1940. With the return of the forces to the home country, and in the face of the danger of invasion, G.H.Q. Home Forces was established, and Commands became Headquarters of operational armies. No survey organization was included in these new headquarters, it being held at the time that liaison officers from M.I.4 would be sufficient. As a result of representations made by the D.G.O.S., Major-General MacLeod, who realized the necessity of a proper appreciation of requirements in maps and survey work, a committee was set up to examine the situation. One of the outcomes of the recommendations of this committee was that a Director of Survey, Colonel M. Hotine, was appointed to G.H.Q. Home Forces in June, 1940, and an A.D. Survey with one field survey company R.E. was allotted to each command. Colonel Hotine's responsibilities included the provision of maps for defence and training, the control of field surveys all over the country, and the training of survey units. In October of the same year, Colonel

[1]Major-General M. N. MacLeod, C.B., D.S.O., M.C.

Hotine, who had been appointed Director of Survey in East Africa, was succeeded by Colonel R. E. Fryer, and three months later two corps survey directorates were formed, followed in April, 1941, by a third for X Corps which was mobilized for overseas service. Thus early in 1941 there were nine field survey companies serving in home commands.

To hold and distribute the large stocks of maps required in each command, six reserve map depots were formed with five field survey depots to man them, a sixth of the latter units being raised to enable one to be sent overseas when required.

In January, 1942, when an armoured corps was formed in Home Forces, a special (97th) Armoured Corps Field Survey Squadron was raised equipped with lorry-mounted reproduction plant and organized on a very mobile basis. This unit had a very short life as it was soon agreed that no special unit of this type was required and it was converted to a field survey unit of the normal type.

As a result of problems arising in connexion with planning for major overseas expeditions in conjunction with American forces, six general survey sections R.E. were raised and trained in air-photo mapping, and later combined in an Air Survey Group under the Director of Survey, Home Forces. Directorates were formed for the headquarters of these expeditions and as these became operative, Survey units were transferred from Home Forces.

As the new headquarters took control of their own survey units, the responsibilities of Home Forces gradually decreased, and in January, 1944, the survey directorates in three commands were abolished and the work in commands was doubled up under the directorates at the other command headquarters.

Tunnelling Units

A number of Tunnelling Companies were raised early in the war for service with the B.E.F. These were officered by mining engineers drawn from the United Kingdom and from the Dominions. Brought back from France, their activity in which country is referred to in Chapter II, they were soon busy in the home country chiefly on the preparation of underground headquarters. Here they were joined by Canadian companies, including those employing "push-pipe" technique. (See Chapter V, pages 115, 116.)

Their most important work later was in the construction of the accommodation cut out of the Rock of Gibraltar, an account of which will be found in Chapter XII, pages 325–328.

Quarrying Units

Amongst the units specially raised in the winter of 1939–40 for employment on airfield construction in France was a Quarrying Company formed by a Welsh quarrying firm. This was the precursor of a number which were raised later for service in various theatres. Reference to their work will be found in the narratives of the various campaigns.

Forestry

The large requirements of the forces in timber and the scarcity of skilled labour in the United Kingdom and France, other than that necessary in peace and still required in war by civil requirements, led to an early decision to raise Forestry companies. It was estimated in 1939 that forty such companies would be required. As the Home Country could find few personnel, the Dominions were asked to assist. In consequence thirty-nine such companies were formed and collected in Great Britain. Of these thirty were Canadian, three each came from Australia and New Zealand, and the remaining three were raised at home. Some of these proceeded to France to join the B.E.F., and then were employed chiefly in the north of England and Scotland. Later several units went to Italy to work, chiefly in the forests of Calabria.

If Hitler failed to conquer Britain, these Dominion foresters were more successful. Out of the 1,200 Australians and New Zealanders who came to these islands about 240 carried off British brides.

In India and Burma units were raised locally from the personnel of the Forestry departments, being assisted by Elephant companies to which reference will be made in the chapters dealing with the campaigns against Japan.

Postal Service

Though an Army Postal Service has existed for many years in war, if not continuously in peace, the only reference to its existence as part of the Royal Engineers in previous volumes of the History has been the inclusion of a few postal sections in orders of battle of R.E. units taking part in campaigns. To repair this omission, it is therefore thought right to give here some account of the history of the Service from its earliest days.

There are indications that an Army Postal Corps existed as far

back as 1869, but the records are incomplete and not altogether reliable. The Army Post Office first saw active service in the Egyptian campaign of 1882, and on a larger scale in the war in South Africa in 1899–1901. At that time the Corps had responsibilities for the provision of certain signal facilities as well as for the postal services. In 1913, the two functions were separated and the Army Postal Service became part of the Royal Engineers with responsibility for postal and private telegraphs, but not official signal services, the latter being concentrated under the charge of the Signal units, R.E.

The close relationship between the duties of the new service and the Signal branch of the Royal Engineers is the chief reason of the otherwise apparently strange alliance between the deliverers of mail and the R.E., but the service also claims, with considerable cause, that its function of bridging the gap between the soldier and his home bears at least some similarity to the job of the military bridge-builders.

From the time of the South African War until 1914, the Army Postal Service existed only as a part of the Supplementary Reserve of the Royal Engineers, and, as a small nucleus, had contact with the Regular Army only occasionally on annual manoeuvres. When, on the outbreak of World War I in 1914, the British Expeditionary Force went to France, the Army Postal Service therefore had to be built up almost from nothing. In August, 1914, the establishment of the Supplementary Reserve Section was a mere 300 all ranks, the bulk of whom were immediately dispatched to France, only a few being retained to form a depot.

As new expeditions were fitted out fresh branches were formed for the Dardanelles, East Africa, Salonika, Italy and North Russia, so that by the end of the war the strength of the Postal Service amounted to 7,000 all ranks. It is a tribute to the ingenuity and resourcefulness of the men taking part in the various campaigns that an organization built up almost from nothing should have won from the writer Ian Hay the tribute that the Postal Service provided for the forces in 1914–18 was "one of the unadvertised marvels of the war". By this time the duties of the Army Postal Service had extended to cover the whole range of Post Office responsibilities; delivery of mail for each unit to the point at which it was taken over by the unit postal orderly; collection, sorting and dispatching of mail from the troops to the home country; cross posting of correspondence from one unit to another in the same theatre of operations;

selling of postage stamps and the issue and cashing of postal and money orders in the exchange of the country concerned; handling of registered mail and various other classes of business.

The home depot fulfilled two functions, the recruiting, training and dispatch of reinforcements and detachments for service overseas; and, secondly, it served as a collecting point and central sorting office for all mail to be dispatched to the Forces serving overseas. This depot, beginning with a strength of thirty men, grew to an establishment of 2,500 of whom nearly 1,200 were women. This unit quickly outgrew its original accommodation, and in 1915 a temporary building covering five acres of ground and with 200,000 sq. ft. of floor space was put up in Regent's Park simply to deal with the sorting of Army parcels.

In the first few months of World War I mails were dispatched in bulk from the United Kingdom and sorted in Base Post Offices in France. But in order to relieve the men overseas of all extraneous work, "unit sorting" was later introduced in the Home Depot which, from then on, made up separate bags of letters and parcels for every unit. These bags were then dispatched to the port from which the unit was served, duly labelled for the proper railhead or Field Post Office according to location information obtained from a simple, though very efficient, system. From railheads the mails were carried by motor transport to Field Post Offices where they were handed over to unit postal orderlies and usually carried up by ration parties.

When the armies abroad were at their maximum strength the outward mail consisted of about 12 million letters and a million parcels weekly. At Christmas the bulk was much greater and, in the four weeks preceding Christmas 1916, nearly 4¾ million parcels were dispatched to France alone.

All over the world mails for the forces, after reaching the ports of destination, were entrusted to a strange variety of transport ranging from travelling railway post offices on the Italian and Iraq railways, to a sleigh journey of 400 miles round the shores of the White Sea. In spite of all this it was rare for a bag of mails to be lost.

After the armistice, in 1918, a nucleus of the Army Postal Service remained in the Army of the Rhine until it was withdrawn in 1920. In 1929 and 1930 volunteers maintained a postal service in China, while another Postal Section R.E. was raised and sent to Palestine for service during the Arab rebellion of 1936–9. For all practical purposes, however, the R.E. Postal Section ceased to have any contact with the Regular Army from 1929 to 1939, so when the Second

World War broke out, the Army had again to look for its postal services to the Supplementary Reserve which, at that time, was only partially trained and consisted of fifteen officers and 250 other ranks and which had virtually no experience of providing postal services overseas.

As soon as war was declared, however, the service again expanded rapidly. Volunteers, all G.P.O. employees, were forthcoming in overwhelming numbers and by 1945 the Army Postal Service had again a strength of some 7,000 all ranks. No war is like the one that has gone before it and World War II brought problems which were entirely new. In particular, the closing of the Mediterranean to Allied shipping and the general shortage of aircraft presented the Army Postal Service with a problem of the first magnitude and one that for a time seemed virtually impossible of solution. Ingenuity, however, was equal to the occasion and the emergency was met by the introduction of the "Airgraph" whereby letters were photographed on minute sized films, flown to their destination and there rephotographed and enlarged to normal size. This process allowed the greatest economy in aircraft space, 500 letters could be got on a film spool which did not weigh more than a few ounces. The same letters, had they been sent by air-mail in their original form, would have weighed approximately eight pounds. Later in the war, the Airgraph was superseded by the introduction of a light air-weight letter made of paper which did not weigh more than a fraction of an ounce.

It had been recognized by this time by all Commanders in the field that an efficient postal service was a major factor in the maintenance of morale amongst the troops. Every effort was made, therefore, to ensure a rapid and regular delivery of mails even under the most difficult circumstances. In the landing in Normandy in June, 1944, postal personnel with 6th Airborne Division landed by parachute and glider well before H hour, and those with the beach groups followed about an hour after the assault from the sea began. Field Post Offices were established in the beachhead within a matter of hours and within a week of the assault all letters and postcards to and from the troops were being conveyed by air through the emergency landing strips in Normandy. To speed up and ensure the delivery of mails these were no longer brought forward with supplies; instead a far-flung pattern of Army Post Offices was established and connected with a network of air and road mail services—the latter running night after night with unfailing regularity. Many

of these road services bore names—the "Up Special", "The Arras Limited", "The Amiens Night Down", derived from railway travelling post offices famous in British post history. Units called at their appropriate field post offices to collect their mails and deliver their postings each day.

After the armistices the Army Postal Service R.E. continued its efficient services to the troops in the various areas of disturbance and in enemy occupied territory, and at the time of going to press sixty-four officers with short service commissions in the Royal Engineers are engaged in the Army Postal Service in all parts of the world from England to Korea.

Movement Control

The Army had become accustomed in World War I to find at almost every railway station and port in the United Kingdom and on the lines of communication in overseas theatres, officers, generally elderly or of not high medical categories, with arm-bands bearing the magic letters R.T.O. (Railway Traffic Officer) or E.S.O. (Embarkation Staff Officer), a variety of the latter being the A.M.L.O.s (Assistant Military Landing Officers). These officers ushered individuals and units into trains and ships, and answered thousands of questions about journeys, local accommodation, etc. Though to the transient troops the job of these officers seemed a "cushy one", in fact for most of them it was distinctly strenuous, demanding long hours of work at times, considerable experience and initiative in dealing with situations where normal routine was upset, and infinite tact and patience in dealing with unhappy individuals and irate officers, many far senior in rank to the holders of these appointments, whose sense of self-importance was offended by not having the priority they expected given to their travels. Behind them, and giving them their instructions, lay the "Movements" Branch of the Department of the Quartermaster-General.

With the return of peace these gentlemen retired to their villas and cabbage patches, and no trace of them was left in the organization of the Army. True, a certain number of them, or successors usually selected from the retired list of the Army, had been noted for similar employment in the event of fresh hostilities. These were mostly for employment in the larger stations and ports in the United Kingdom. No definite organization existed for their supply to overseas theatres, and no training in their duties was arranged for those with no previous experience.

But the Munich crisis of 1938, which brought about an examination of so many deficiencies in our forces, led to the formation of one Movement Control Group R.E. of the Supplementary Reserve which underwent two weeks' training at No. 1 Railway Training Centre R.E. at Longmoor, and before the outbreak of war, in September, 1939, two more groups had been formed but had done no training. Nevertheless these three Groups, followed later by two newly formed groups, went to France with the B.E.F.

While the newly enlisted personnel of these groups were Royal Engineers, those drawn from the reserve or from the retired list, both in the groups and for service in the U.K., wore the badges of their old regiments. Later all newly enlisted officers and men for the Movement Control Service were commissioned in the General List of the Army. This proved very unpopular and bad for the efficiency of the service. It was a soulless organization with no tradition or loyalties. In consequence, on 1st November, 1942, the Movement Control Section R.E. was formed and all existing officers and other ranks, other than Guards and regulars, were transferred to it. A new "baby" had been born to the Corps.

In September, 1939, the training of Movement Control personnel was transferred from Longmoor to No. 2 Railway Training Centre at Derby. The latter was closed in June, 1941, and the training of M.C. personnel taken over by No. 2 M.C. Group, R.E., returned from the B.E.F., at Aberford near Leeds. In September of the same year the responsibility for training was taken over by the newly formed Movement Control (TT and D) Battalion near Longmoor. With the transference of personnel to the Corps in November, 1942, this unit, which lasted throughout the war, added Royal Engineers to its title. In all this battalion trained 1,365 officers and 9,033 other ranks, including personnel from the United States, and Canadian and French forces, as well as from the Royal Navy, R.A.F., and A.T.S.

At first as far as possible personnel with experience of railways and shipping were selected, but soon this proved no longer possible and men were enlisted from all trades and professions, clerks, coalminers, shop assistants, etc. Gone also were the days of acceptance only of aged and low category personnel. Conditions of war demanded of the members of the service considerable stamina, while the important part played by movement control personnel in Combined Operations, including work in beachgroups in opposed landings, necessitated the possession by its representatives of courage, determination, initiative, and activity. The whole conception of

Movement control work had, indeed, altered. In World War I, the main task of the R.T.O.s and the A.M.L.O.s was concerned with the smooth running of thoroughly organized railway systems and, for the most part, short sea passages. In World War II, after the operations of the B.E.F. in France in 1939–40, in which the conditions approximated to those of twenty-five years previously, much of the movement to overseas theatres involved long and often hazardous journeys, sometimes culminating in a landing on an open beach in face of the enemy. Railway journeys, even in the home country, were liable to interruption by bombing from the air, while the mobility of operations necessitated a much greater degree of flexibility demanding powers of rapid decision and improvisation by all concerned. Even road movement, owing to the danger from enemy counteraction, the limited network and condition of some of the roads in certain theatres of operation, coupled with the enormous increase in intensity and weight of traffic, required much more centralized control. To all these was added the use of air power for the transport of troops and stores on an increasingly large scale. Under these new conditions it was essential that the members of the Movement Control Service should be more highly trained both in the technicalities of the Transportation and shipping services, with which they had to work in such close co-operation, but also in military organization and administration in order to appreciate properly the instructions of "Q" Movements Staff, whose servants they were, and to be able intelligently to appreciate the situation when sudden changes had to be made.

The work of the M.C. Section Royal Engineers in general, though full of minor incident, and at times considerable excitement, presents generally a tale of steady solution of comparatively minor problems, and does not normally call for any lengthy account of its doings in the various theatres. It is therefore thought more suitable to give a short summary of the more interesting experiences of the Section in this chapter. Only in West Africa (Volume IX, Chapter XVIII, page 533), where almost the chief preoccupation of the Command was the transit of troops, aircraft and stores, is any detailed reference to the work of the Movement Control section embodied in the narrative.

On withdrawal from France with the B.E.F., the five original groups were allotted to the various home commands, a sixth being formed for Northern Ireland District. There they remained throughout the war. Nine more groups, numbered consecutively, were

formed by October, 1941, and were employed in the theatres of war round the Mediterranean Sea, Middle East, North-West Africa, and Central Mediterranean Force. Here they were joined later by Nos. 21 to 25 Groups; 26, 29, 30, and 31 went to South-East Asia Command, and, on the invasion of Normandy in June, 1944, a reallotment was made, Nos. 6, 17, 18, 19, 20, and 27 serving in North-West Europe. In all thirty-one groups and a few smaller detachments were raised.

In the United Kingdom the earliest tasks of the groups returned from France were connected with the reorganization of the troops returned from the B.E.F. and the deployment of formations for the defence of the country. On these activities were superimposed the difficulties caused by the German air attacks which disorganized railway traffic and caused considerable disturbance at the ports through which the troops and stores were continually moving to overseas theatres, especially the Middle East. The construction and operation of two military ports in Scotland, at Faslane and Cairn Ryan, by Transportation Port Construction and Dock operating units, to act as safety valves in case Glasgow was put out of action as a port, afforded an opportunity of training movement control personnel alongside transportation units to a degree not possible in existing ports which were almost entirely maintained and operated by civil organizations. But probably the most intense period of activity was during the movement of 21st Army Group to concentration areas near the south coast and its ultimate embarkation for the invasion of the Continent. For this operation new organizations, into which the movement control groups were absorbed, were set up. The concentration of units behind the ports and hards, their marshalling into shiploads, and their dispatch to the points of embarkation were handled by the existing Command and District Movement Control organization assisted by a new branch—the Marshalling Area Movement Control.

The allocation of accommodation in shipping and the carrying out of physical embarkation of troops, weapons and stores, was the responsibility of a completely new organization comprising Coast M.C., Sector M.C., and Embarkation Area M.C. The marvellous efficiency and smoothness with which the operation was completed must be to a large extent attributed to the untiring efforts of the personnel of the Movement Control Sector, R.E., and to the meticulous care with which they carried out the very detailed instructions of "Q" Movements Staff.

A somewhat comic element was provided in the arrival of the Movement Control detachment sent with the force to Iceland in 1940. On arrival at the port of disembarkation the detachment rushed ashore, eager to commence their duties and many of them sporting for the first time their brassards with the magic letters R.T.O., only to find that there was not a railway in the country.

In the Middle East few M.C. personnel were available to handle the rapidly increasing traffic and they had to be helped out by personnel from 42nd Field Company, a unit which, reference to the pages of this history will show, had probably one of the most varied experience of any in the Corps, and which demonstrates once more that the Sapper is the man "that does something all round." Here in the various activities in the theatre the movement control detachments learnt something of the wide variety of their duties. Existing ports were operated and extended, new ports constructed and their traffic organized, the operation of the gigantic base formed in the desert between Cairo and the Canal, the use of Inland Waterway Transport on the rivers, canals, and sea coast, the freight carrying air services, the control of convoys over hundreds of miles of congested roads, all added variety to the experience of the comparatively newly formed service. The ties between movement control troops and those of the transportation service in the Middle East theatre were even closer than elsewhere, for their direction was combined under one D.Q.M.G. (Movements and Transportation). The system, though not generally accepted in the Army, had certainly many advantages in that the two services received their orders from the same source.

The campaign in North-West Africa provided the Movement Control Service, in common with other parts of the services, with their first experience in a landing, liable to be opposed, after a long sea voyage. The use of beach groups for the organization and operation of movement across open beaches was made for the first time, and much was learnt of the duties of movement control personnel in such landings which was put to good use later in other theatres. In the landing near Algiers the assault troops who were to have landed on the central of the three beaches, were put ashore several miles from their destination. The M.C. officer who landed with these troops made his way as fast as he could to the correct spot and succeeded in arriving there in time to welcome the later waves as they came ashore. The chief difficulty of the officers of the section on landing was dealing with the hordes of officers of all arms

and services, some of them of considerable seniority, who gathered at the ports and beaches demanding maximum priority for their own particular needs. Even the staff were not blameless in this respect, for a stringent order was given granting overriding priority to the landing of 25-pounder guns and ammunition though the ships had not been stowed so that they could be extricated easily.

The calls on the section were heavy in Italy and from three groups which landed in the first instance, the strength of the Service in the Allied Force rose eventually to 350 officers and 1,500 other ranks. One of the biggest tasks undertaken was the handling of the move of Eighth Army back to the East Coast between 15th and 31st August, 1944. Five infantry and two armoured divisions with an armoured brigade and two Corps and one Army troops, with 80,000 vehicles, were moved to schedule over two roads, mostly one-way, across the mountains of central Italy.

In North-West Europe the whole of the movement control personnel was pooled and distributed and recollected as required at a depot at Sully near Bayeux and later at Amiens. An extra group was brought over from the U.K. in December, 1944, to deal with the traffic of coal for the forces and for industry working for the war effort. The handling of extensive barge traffic on the Belgian canals formed an important part of the work of the service. In this our combined organization proved superior to that of the Germans during their occupation of the country, for, with 3,500 craft available, our troops moved on an average 48,000 tons per day against the Germans' 30,000 with 6,000 craft.

A large proportion of the movement control personnel employed in India and by South-East Asia Command was provided by India, and rose from 300 officers and 900 other ranks in 1941, to 1,100 officers and 2,000 other ranks in September, 1945. The troop transport in the theatre rose to prodigious figures, the Indian railways carrying ¾ million per month at the peak of their activity. Not only in numbers was the problem staggering, for it must be remembered that the length of journeys far exceeded anything experienced in other theatres, and these were carried out in tropical heat to which many of the troops were not accustomed. The majority of the Indian rolling stock provided a standard of comfort far inferior to that to which European troops were accustomed. Provision had to be made for the feeding and rest of the troops *en route*; and to ensure proper co-ordination of all efforts for the rapid movement and comfort of the troops, it was found advisable that all personnel,

other than technical troops concerned with the operation of transport, should be brought under one control. Accordingly all cooks and attendants on messing carriages on railways and the officers commanding troops and adjutants of troopships were controlled by the Movement Control Organization. In 1944, Special Movement Control Groups were formed in preparation for combined operations to work with beach groups, and were trained in a special centre near Bombay. These groups each consisted of one M.L.O. (D.A.Q.M.G.(M)), one staff captain, and of the Movement Control section R.E. twelve A.M.L.O.s and forty British other ranks. As events turned out there was little call on their services. In this theatre of enormous distances the groups found themselves very widely dispersed. For example No. 26 M.C. Group in the Arakan operations between February and October, 1944, covered an area 250 miles long by 25 miles wide. This group then moved to join Fourteenth Army in Central Burma where it handled traffic on the rapidly extending L. of C. till joined in April, 1945, by No. 29 Group.

Amongst the few Corps of the British Army which served in Russia during the war was the Royal Engineers represented by detachments of the Movement Control Section. These parties were sent to Murmansk and the ports on the White Sea to supervise the transport of weapons and stores sent by shipping convoys to Russia from the United Kingdom. These small detachments, usually commanded by a N.C.O., endured the dangerous passage by convoy round the North Cape, the rigours of a North Russian winter, and the suspicious restrictions of the Soviet régime.

By the end of the war the new "Baby" had certainly found its feet, and had proved a credit to the Corps the badge of which it now bore. Up to the date covered by this volume the service was still continuing its work of expediting and making easy movement of troops and stores all over the world, and a long list of names of officers of the Movement Control Section, still serving, fills several columns in the Corps quarterly list.

Expansion, Casualties, Etc.

In the table on page 218 are given some figures showing the strength of the Corps at various dates by branches, theatres of operations, and total. Also casualties incurred in various theatres. It has not been possible to give a list of the numbers of the various

types of units as in Vol. V, pages 38–42, as a large number changed their role, some indeed more than once. For example certain Chemical Warfare Companies first became field companies and later were converted to form Assault Squadrons. There cannot be the same differentiation between Regular and Territorial Army units as, immediately on the outbreak of war, all personnel were commissioned or enlisted on one general list.

The peak strength, 280,632 all ranks, was less than that in World War I, but that of officers is considerably greater. Unfortunately no figures are available for the total number of engineers in the Empire and Commonwealth forces which in World War II were so closely integrated, and which was undoubtedly greater than in 1914–18. Casualties, mercifully, were considerably less and in this the Corps were not peculiar, for due to the nature of the fighting, losses were not so heavy as in the more static fighting in the earlier war. A Roll of Honour, handsomely bound, was laid up with those of Dominion Engineers in a niche in the Kitchener Memorial Chapel in St. Paul's Cathedral, London, alongside those of World War I. The R.E. Roll contains 10,839 names of those killed or died on service, compared with 19,794 names in the 1914–18 R.E. Roll.

Post-War Unit Organization

As will be seen in the following pages, experience during the war showed the importance of centralized control of engineer work. In consideration of the organization after the war, therefore, it was considered advisable to group R.E. units more firmly under command of senior R.E. officers provided with proper staffs and facilities for control, and their divorcement from titular attachment to particular formations. The process, which was gradual, started in 1946, but was not complete till 1951. Although the latter date lies outside the period covered by this volume, it is thought advisable to describe here the ultimate form, as it appeared in 1951, of R.E. organization. In general principle the basic unit now became the regiment made up of a number of squadrons, the old term company disappearing in 1946. Regiments in turn were grouped, or provision made for their organization in Groups, each commanded by a colonel.

What had been Divisional R.E. now became Field Regiments, and, while some or all of them could form part of divisions, they no longer carried the number of the division, but like field regiments

Statistics of Strengths and Casualties

Strength of the Royal Engineers

	Officers	*Other Ranks*
3rd September, 1939		
Regular Army	1,270	11,755
T.A. and S.R.	2,643	73,633
Total exclusive of reserves	3,913	85,388
1st January, 1941	7,981	160,822
1st January, 1943	15,584	199,682
1st January, 1945	21,313	245,438
May–June, 1945 (Peak)	21,698	258,934
1st January, 1946	17,008	209,044

Strengths in Theatres		*All Ranks round figures*
1st January, 1940	Home	47,400
	France (B.E.F.)	23,100
	India and Burma	600
	Elsewhere abroad	3,700
1st January, 1943	Home	135,300
	Middle East	47,100
	Far East	8,300
1st January, 1945	Home	78,400
	Middle East	18,200
	Far East	16,200
	N.W. Europe	87,000
	Mediterranean	58,100

Casualties	*Officers*	*Other Ranks*
United Kingdom	87	935
France and Belgium (B.E.F.)	145	3,580
Norway	4	64
Far East	185	1,989
Middle East	330	5,305
N.W. Africa	133	1,589
Sicily and Italy	298	3,034
N.W. Europe	518	5,949
At Sea	40	1,222
Total	1,740	23,667

Distribution of Strength by Branches, 1945

Field, L. of C. and Works	62 per cent
Transportation	33 per cent
Survey	1½ per cent
Movement Control	2½ per cent
Postal	1 per cent

of Royal Artillery, had their own numbers, all in the twenties, such as 22nd Field Engineer Regiment R.E. Each field engineer regiment, commanded by a lieut.-colonel, consisted of a headquarters and three field squadrons, similar to the field companies and squadrons of the latter stages of the war, a field park squadron and a light aid detachment. Regiments with divisions had also a bridging troop, while those with Corps had an E. and M. troop instead. Army troops field regiments had no field park squadron but one mechanical equipment squadron in its place. Squadrons, though forming part of the regiment, were still self-contained and capable of independent action over a long period. Army and Corps units were formed on a peace-time basis which had not occurred before as they had been provided by the Supplementary Reserve or the detachment of engineers of divisions of the Territorial Army. One Assault Engineer Regiment, based on those of the war-time 1st Assault Brigade R.E., was also raised. In addition three independent field squadrons, one of which was airborne, were also formed. The squadrons of all these regiments bore numbers of pre-war R.E. companies, both field and fortress, with new numbers added.

Groups of units at overseas stations were formed under various names, regiments, groups, or establishments. For example at Gibraltar there was a Fortress Engineer Regiment with headquarters and two fortress squadrons bearing the numbers 1 and 32. Thus the entity of the original 1st (Fortress) Company was maintained at its place of birth, and the unit bearing the number 32 still remained at its pre-war location. It should be noted here that a field squadron in 27th Field Engineer Regiment also bore the number "1" and is presumably the lineal descendant of the pre-war 1st Field Squadron. The direct ancestors of certain of the present field squadrons is obscure, for example 3rd Field Squadron is presumably the modern representative either of 3rd Field Squadron which existed only during World War I, or of 3rd Fortress Company of Dover which was disbanded before the outbreak of World War II, when the Royal Artillery took over the searchlights of coast defence. Similarly 2nd Field Squadron may be the successor of the squadron of that number which also existed only in World War I, but more probably represents 2nd Field Company. The 2nd and 3rd Field Squadrons which operated with distinction in the Mediterranean Area in World War II were (Cheshire) Territorial Army units. They have been renumbered, with a changed role, as 622nd and 623rd Assault Squadrons R.E. (T.A.). Two other regular regiments R.E. have

been formed other than Transportation and Survey units which are referred to below, namely 1st Stores Regiment R.E. which mans the Long Marston Engineer Stores Depot, and 40th (not to be confused with 40th Army Engineer Field Squadron) Advanced Engineer Stores Regiment consisting of a Plant Field Squadron and two Workshops and Park Squadrons. Chief Engineers of Corps were renamed Commanders Corps R.E. (C.C.R.E.) and a C.A.G.R.E. was provided to command each Corps Troops R.E. and for each two Army Engineer Regiments.

Transportation

Transportation units R.E. of both Regular and Territorial Armies and of the Army Emergency Reserve were similarly renamed or changed their role. Companies of all types became squadrons, and these were grouped in regiments in the case of training units (see pages 157–158) or in groups. A number of types of unit which did not formerly exist in peace, such as port and docks operating and maintenance squadrons, were maintained and were employed in enemy occupied countries and disturbed parts of the world such as Malaya. The number and types of Army Emergency Reserve Transportation units have also been increased and include three Railway Groups each comprising operating, loco running, and permanent way maintenance units, three port regiments and a transportation staff increment. Transportation docks units are also for the first time raised on a Territorial Army basis.

Survey

An important change in the Survey organization was made in 1946 when, for the first time, it was decided to retain Survey units, R.E., in peace. In the two following years a new pattern of the Survey Service emerged under the Directors of Survey, Brigadiers M. Hotine and R. Ll. Brown[1]. By 1948 the Service consisted of:—

(i) A Director of Military Survey at the War Office jointly responsible to the War Office and the Air Ministry for the survey and mapping requirements of both services. He exercised technical direction over the whole R.E. Survey organization.

[1]Brigadier R. Ll. Brown, C.B.E.

(ii) Two Survey Production centres, manned by civilians, which prepared and printed maps for the Army and aeronautical charts and documents for the R.A.F.

(iii) Military Survey units made up of:—

(*a*) A School of Military Survey responsible for the training of Regular officers and other ranks and National Service personnel. It also provided a Long Survey Course for R.E. officers specializing in survey and for Colonial Survey probationers.

(*b*) A Map Depot to hold the vast stocks of maps needed for training and operational purposes by the Army and the R.A.F.

(*c*) An Independent Field Survey Squadron to carry out the day-to-day tasks for the Army and the R.A.F. in the United Kingdom and also give assistance to Survey units in the Reserve Army.

Overseas

(*d*) A Survey Engineer Regiment and a Map Depot in the Middle East with headquarters in the Suez Canal Zone and with field parties working in Jordan and Iraq.

(*e*) An Independent Field Survey Squadron and a Map Depot in Germany.

(*f*) A General Field Survey Section in the Far East.

Until 1939 the Army had relied for the manning of the Survey units required on mobilization on the serving soldiers of the Survey Battalion R.E. which, apart from short courses, was employed full time on Ordnance Survey civil duties. Concurrent with the decision made in 1946 to retain survey units in peace, it was further decided not to revive the Survey Battalion. Experience in the war had shown that, valuable as was the experience gained by serving soldiers in the Ordnance Survey, it was inadequate in itself to meet the variety of demands made on the R.E. Survey in war. On the other hand, in order to maintain a reserve of trained survey officers in peace over and above those employed in the few Army Survey units, to provide R.E. officers in peace with experience in organizing and controlling a large map producing agency which had no equivalent in the Army in peace, and to carry out the moral obligation of the Corps to continue its long established responsibility for the supervision and

control of the Ordnance Survey, it was further decided to post about thirty R.E. Officers to that Institution.

Up to 1939 individual Colonial Governments had been responsible for all surveys in their territories and most of them had their own Survey Departments to which R.E. officers were occasionally seconded. These Departments had necessarily to concentrate on cadastral surveys for land tenure and fiscal purposes and only the largest were able to undertake geodetic and topographic surveys. To remedy this defect, in 1947 a Central Colonial Survey Organization was set up with Brigadier M. Hotine as first Director of Colonial Surveys. Field surveyors employed on ground control work in the colonies were trained at the School of Military Survey together with recruits for the Colonial Survey Departments. R.E. officers were employed also in a small staff forming part of the Directorate of Colonial Surveys.

In India and Pakistan, as a result of the partition of the subcontinent, the number of R.E. officers employed with the Survey of India rapidly declined as they were replaced by Indians and Pakistanis. However, in 1948, the senior posts both in the Survey of India and that of Pakistan were still filled by serving or retired R.E. officers.

The war gave great impetus to the use of air photographs for mapping purposes, R.E. officers playing a leading part in the United Kingdom in the development of air survey techniques and equipment. After the war Brigadier M. Hotine in the Colonial Survey, and Lieut.-Colonel E. H. Thompson[1] in the Ordnance Survey, were intimately concerned with the application of their air survey experience in their respective departments.

Territorial Army and Army Emergency Reserve

The R.E. units of the Territorial Army have similarly been organized in regiments and groups. This nomenclature was adopted at the same time as it was introduced in the Regular Army in 1946. In 1950, the whole Territorial Army was reorganized so that it now provided its proper complement of Corps and Army Troops, and not only a divisional organization as before. For the R.E. (T.A.) this involved many changes in role and designation of units while a number were transferred to the Army Emergency Reserve, which had taken the place of the old Supplementary Reserve, so as to

[1]Lieut.-Colonel E. H. Thompson, O.B.E.

provide a number of Army units available on mobilization. A number of Group Headquarters, each commanded by a regular colonel of the Corps, were established to control a group of three or four regiments. The numbers of regiments R.E. (T.A.) started at 101, while squadrons were numbered between 200 and 337, though a few units retained numbers outside this range which they had held during World War II. Thus 51st Highland Divisional R.E. of 1939 became 117th (Highland) Field Regiment R.E.; 56th (1st London) Corps Troops R.E. became 114th (1st London) Army Engineer Regiment R.E., while 48th (South Midland) G.H.Q. Troops R.E. was disbanded as such on 1st July, 1950, and reappeared the same day as 11th Plant Regiment R.E. Individual units experienced similar metamorphoses; for example 202nd (East Lancashire) Field Company R.E. of 42nd Divisional R.E. survived the war with its original title though it changed with other units to Field Squadron in 1946, which title it retained in 1948 as part of 123rd (East Lancashire) Field Engineer Regiment, R.E.; 243rd (Lowland) Field Park Company, forming part of 52nd (Lowland) Divisional R.E., in 1947 became 243rd (Lowland) Construction Squadron R.E., and in 1950 was reorganized as 243rd (Rutherglen) Bomb Disposal Squadron R.E. (T.A.). With the assumption of the duty of operating coast defence searchlights by the Royal Artillery, some fortress units R.E. (T.A.) were disbanded, others became Army engineer units, and a few, having been disbanded, reappeared as Army engineer regiments R.E. (A.E.R.).

CHAPTER IX

THE MIDDLE EAST. 1938 TO APRIL 1941

Pre-war. Egypt—Palestine—Haifa-Baghdad Road—Iraq—Sudan—Setting up of Middle East Command.

The outbreak of war—Situation in winter, 1939–40—Outbreak of war with Italy—The Western Desert—Wavell's Operations. Winter, 1940–1—Battle of Sidi Barrani—Capture of Bardia—Capture of Tobruk—The pursuit—Repair of ports and communications—Strategic situation, March, 1941—Axis counter-offensive—Tobruk isolated—Survey.

(See Map 14 facing page 404 of Chapter XV and Map 18 facing page 442 of Chapter XVI)

Pre-War

Though storm clouds were piling up in Europe in the years preceding the outbreak of war with Germany in September, 1939, more active troubles were brewing up in the Middle East, especially in the countries bordering the eastern Mediterranean Sea and the Red Sea. Strained relations between the United Kingdom and Italy followed on the attack, in 1935, on Abyssinia by Italian forces as a result of which Great Britain had taken the foremost part in endeavouring to have active and effective sanctions imposed on Italy by the League of Nations. The possibility of war with Italy forced the British Government to strengthen the defences of their naval, military and air bases at Gibraltar, Malta, and, in agreement with the Egyptian Government, at Alexandria and in Lower Egypt. This decision involved, as will be seen in the sections later dealing with these areas, considerable work on the defences against attack both by sea and air. Wishing to avoid, if possible, an active alliance in case of war between Germany and Italy, the British Government, though the Italian war against Abyssinia was still progressing, adopted a conciliatory atmosphere in its relations with that of Italy. In spite of this, the possibility of war between the countries was still far from improbable, and Italy had strong forces in Libya and Cyrenaica, on the western borders of Egypt, and her now almost victorious forces in Abyssinia and Eritrea. The threat from these forces was to a large extent offset by the presence of French troops, which would certainly be on Britain's side in a European war, in Tunis, Morocco and French Somaliland.

Egypt

Strategically the key to the whole position in the area lay in Egypt. Not only was it in a central position to the whole area, but through its territory ran the Suez Canal, a vital link in the communications of the British Empire. Following the abolition of the British Protectorate over Egypt in 1922, a Treaty had been signed between the two countries in 1936. By this, in time of war, Egypt would be the ally of Britain so that British military occupation of the country should cease in theory. But in view of the importance to Britain of the Suez Canal, Egypt agreed to the maintenance of a British garrison to protect it. It was agreed that eventually this garrison would be moved from the principal towns of the country and that accommodation would be provided for it in a strip of country bordering the Suez Canal. It was expected that the evacuation of barracks in Cairo would be completed in four years, though the troops in Alexandria might not be able to move under eight. The British Government undertook to provide missions to train the Egyptian army and air force, while the Egyptian Government undertook to improve the communications within the new British zone on the Canal, and from it to Cairo, Alexandria, and onwards into the Western Desert. The essential roads were to be built or improved, and the capacity of the railways increased especially across the Delta and between Alexandria and Mersa Matruh in the Western Desert. British army and air force training was to be permitted in areas east and west of the Canal and in the Desert.

To arrange for the carrying out of the terms of the Treaty an Anglo-Egyptian Treaty Building Committee was set up. To this was attached an engineering technical section for design and supervision of the various works on which a number of officers of the Royal Engineers were employed, under the Technical member of the Committee, Brigadier H. N. North,[1] late R.E., who was also Vice-President of the Committee. It can be imagined that with these commitments, and the ever-changing British garrison, the Chief Engineer, Colonel H. W. Tomlinson,[2] succeeded by Colonel (later Brigadier) E. F. Tickell,[3] and the large staff of R.E. Works officers under two Cs.R.E., one for Cairo and one for the Canal Zone, had plenty of work.

[1]Brigadier H. N. North, D.S.O.
[2]Colonel H. W. Tomlinson.
[3]Major-General Sir E. F. Tickell, K.B.E., C.B., M.C.

The Military Mission for training the Egyptian army was commanded by Major-General G. N. Macready,[1] late R.E., and included an Engineer School, of which the Chief Instructor was Lieut.-Colonel H. B. Harrison,[2] with a staff of R.E. officers.

Palestine

The situation in Palestine had been, as we have seen in Volume VII, Chapter XXII, bedevilled by efforts to implement the promise made to the Jews that they should be able to establish a National home in that country. The decision had been greeted with active opposition and violence by the arab population entailing the dispatch of considerable British forces to the country. By the middle of 1938, the trouble had largely died down and the majority of the troops were withdrawn. In the autumn of that year the atmosphere once more deteriorated and a serious arab rebellion broke out. It was, therefore, necessary once more to dispatch strong forces to the country and, in October, 1938, a large portion of 3rd Division was sent from England to join the troops already there. The forces were organized into two weak divisions, 7th, C.R.E. Lieut.-Colonel J. D. Inglis, based on Jerusalem in the south, and 8th, C.R.E. Lieut.-Colonel J. S. W. Stone, based on Haifa in the north. The three available field companies were divided between the two divisions, 54th and 56th with 7th Division, and 12th with 8th Division. The whole of the forces in the country were under the command of Lieut.-General H. Maitland Wilson[3], who was joined in September by Colonel G. Streeten[4] as Chief Engineer.

The companies were, for the most part, split up into detachments at the various cantonments supervising Jewish contractors in the erection of accommodation, and assisting the P.W.D. in the maintenance of roads. The R.E. had also to provide water-points at various places and to take part in punitive operations against recalcitrant villages, assisting the infantry and demolishing houses. Even the work on accommodation was not without its excitement for all vehicles carrying stores were liable to be attacked and had to be convoyed.

Throughout the winter the situation remained tense, but in the spring of 1939, after the announcement of the calling of a conference

[1]Lieut.-General Sir G. N. Macready, Bart., K.B.E., C.B., C.M.G., D.S.O., M.C.

[2]Colonel H. B. Harrison.

[3]Field-Marshal Lord Wilson, G.C.B., etc.

[4]Brigadier G. Streeten, C.B.E., M.C.

in London to which the principal Moslem states in the area bordering Palestine were invited to send representatives, the rebellion died down. The majority of 8th Division returned to England to become once more 3rd Division, but all the field companies remained.

Palestine was strategically of great importance to Britain, for through it, with its port of discharge at Haifa, ran one branch of the pipeline from the oilfields about Mosul in Iraq. The other branch ran through Syria to Beirut.

The 45th Fortress Company was stationed at Haifa and employed on the development of the defences and, till relieved of the duty by the Royal Artillery, manning the coast defence searchlights. A detachment of 8th Railway Company was based on Lydda for the development and maintenance of railway communications through the country.

Haifa–Baghdad Road

Reference has been made in Volume VII, page 240, to the construction of a road across the desert from Haifa to Baghdad. Several surveys for a railway between these two places had been made after World War I, but financial stringency had prevented the undertaking of such a project. In July, 1937, Major H. S. Briggs, R.E., was sent out to investigate the problem of building a road and to make an approximate estimate of the cost. He reported in October, 1937, giving an estimate of just over half a million pounds. In May, 1938, it was decided to carry on with the project and Major Briggs, with a number of R.E. officers and other ranks, was dispatched to carry out the work as an agency service. The total length of the road, which followed approximately the line of the pipeline of the Iraq Petroleum Company, was about 600 miles. A good road existed from Haifa to the river Jordan. The country in Transjordania was mountainous and rocky with areas of cultivated land in the valleys. East of this for 110 miles stretches a lava belt, one of the most desolate areas imaginable. Lava hills are intersected by deep gullies and the whole covered by black basalt rocks piled in confusion. Farther east the desert of Iraq stretched for 160 miles. Here in dry weather the going was good and lorries could run on the natural surface; but in wet weather it turned to a sea of mud. The temperature varies from 105°F. in the shade, of which there is none, in summer to 15°F. of frost at night in winter.

For the task Major Briggs assembled what was in those days a large collection of mechanical road-making plant of varying types

and had to build office, stores and living accommodation in the unpopulated stretches. Luckily water was available, for the Petroleum Company had sunk a number of wells at intervals along the pipeline. Further the Hedjaz railway crossed the line of the road in Transjordania, so it was possible for stores to be delivered at a point *en route*.

When World War II broke out the majority of the formation was complete as was a portion of the surfacing. Shortly before this Major Briggs was succeeded in charge of the work by Major N. L. Hammond,[1] R.E., who completed the road during the early months of the war.

Iraq

By the terms of a treaty, signed between the Governments of Great Britain and Iraq in 1930, while Britain would not retain troops in Iraq after 1937, Britain would be allowed to pass forces through the country in time of war, and would be permitted to retain active air bases at Habbaniyah, near Baghdad, and at Shaibah near Basra. For the development of these bases and their maintenance a number of R.E. officers, under a Chief Engineer, Colonel P. W. Clark, were employed under the Director of Works of the Air Ministry. In 1933, King Feisal of Iraq, a warm friend of Britain, died and was succeeded by his son Ghazi, a weak character, who was not so inclined to co-operate with the British. He in turn was killed in a motor accident in 1939, to be succeeded by his 4-year-old son for whom a cousin acted as Regent. The latter, though his position was none too stable, was favourable to co-operation with Britain. A British Military Mission, of which Major-General G. G. Waterhouse,[2] late R.E., was head, advised the Iraq army in training matters.

Sudan

A number of R.E. officers, the senior of whom was Brigadier R. G. W. H. Stone,[3] served with the Sudan Defence Force and were employed with the P.W.D. in that country.

Setting up of Middle East Command

With the growing world tension, and in view of the varied, and in some cases restless, circumstances obtaining in the many countries round the eastern end of the Mediterranean Sea, it was decided,

[1]Brigadier N. L. Hammond, C.B.E.
[2]Major-General G. G. Waterhouse, C.B., M.C.
[3]Lieut.-General R. G. W. H. Stone, C.B., D.S.O., M.C.

shortly before the outbreak of war, to set up a unified command in the Middle East and, in June, 1939, General Sir A. Wavell[1] was appointed Commander-in-Chief. In peace the Command was to comprise Egypt, the Sudan, Palestine, Transjordania and Cyprus. On the outbreak of war the area was to be extended to cover military forces in British Somaliland, Aden, Iraq and the shores of the Persian Gulf. Only a small planning staff was provided at first which included no engineer representative.

The Outbreak of War

Situation in Winter 1939–40

As long as Germany was the sole opponent there was little immediate threat to the allied forces in the Middle East, but as Italy formed a part of the Nazi-Fascist Axis there would always be a danger that that country would come into the war against the Allies. The threat to our position in the area would then become serious, as, at the time, there were estimated to be 215,000 Italian troops in Libya to the west of Egypt, and over 200,000 in Italian East Africa. Our Allies, the French, had considerable forces in Morocco, though these had been largely drawn on for the defence of North-East France, and small forces in Syria and French Somaliland.

As a precautionary measure some of the British troops then in Egypt and Palestine were moved into the Western Desert, chiefly about Mersa Matruh, about 200 miles west of Alexandria, where defensive positions were prepared. Amongst these troops were some of the field companies which were employed on helping the other arms to prepare the defences, and also in developing the water supply and improving the communications of that dry and waste area.

While thus employed at El Daba, in October, 1939, 54th Field Company received secret orders to be prepared to move at short notice to Rumania to assist in the destruction of the oil installations in that country. In December, the officer commanding, Major J. F. Farewell,[2] with Major G. A. D. Young[3], R.E., from the War Office, went secretly to Rumania and established liaison with the British engineers in the oilfields there. Returning in December to the unit, Major Farewell completed plans and training for the enterprise. In May, 1940, the company sailed to Kilia in the Dardanelles, its announced purpose being to reinforce the R.E. units

[1]Field-Marshal Earl Wavell, G.C.B., etc.
[2]Colonel J. F. Farewell.
[3]Colonel G. A. D. Young, D.S.O.

already working in Turkey. (See below pages 283–286.) On the fall of France in June, 1940, Rumania threw in her lot with the Axis powers, so the plan for destruction in the oilfields proved abortive and the unit returned to Egypt.

The insecurity of the Allied position in the area was such that, in the autumn of 1939, it was decided to send reinforcements. Owing to the need for troops in Europe few could be spared from the United Kingdom, so the majority of the formations sent were drawn from countries of the Commonwealth lying to the east. These began to arrive in the spring of 1940, but, chiefly owing to difficulties in finding the necessary shipping, arrived by brigade groups at intervals. The first to start arriving was 4th Indian Division, commanded at first by Major-General P. Neame, late R.E., with Lieut.-Colonel R. V. Cutler[1] as C.R.E. It was followed by 2nd New Zealand Division, C.R.E. Lieut.-Colonel F. M. H. Hanson, R.N.Z.E., and 6th Australian Division, C.R.E. Lieut.-Colonel L. C. Lucas, R.A.E. From the United Kingdom came part of 1st Cavalry Division including 2nd (Cheshire) Field Squadron as sole unit of Divisional R.E. With these accessions of strength, the Headquarters of Middle East Command was expanded, Major-General H. B. W. Hughes[2] arriving as Engineer-in-Chief in March, with Brigadier C. de L. Gaussen[3] as Deputy; Brigadier E. F. Tickell became Director of Works, being replaced as C.E. British Troops in Egypt by Brigadier F. H. Kisch.[4] Brigadier C. A. Langley about the same time was appointed Director-General of Transportation of the Command, and Colonel (later Brigadier) R. Ll. Brown, Director of Survey. The problems connected with the large increase in strength in the forces threw a great burden on the administrative staff of the Command of which Brigadier N. W. Napier-Clavering,[5] late R.E., succeeded Major-General R. MacK. Scobie,[6] also late R.E., as Adjutant-General in September, 1940.

Amongst the newly arrived troops were included a number of works and transportation units R.E., the services of which were urgently required in connexion with the accommodation of the troops and in anticipation of operations. The new formations on

[1]Brigadier R. V. Cutler, M.B.E., M.C.
[2]Major-General H. B. W. Hughes, C.B., D.S.O., O.B.E.
[3]Brigadier C. de L. Gaussen, M.C.
[4]Brigadier F. H. Kisch, C.B., C.B.E., D.S.O., killed in action, 1943.
[5]Major-General N. W. Napier-Clavering, C.B., C.B.E., D.S.O.
[6]Lieut.-General Sir R. MacK. Scobie, K.B.E., C.B., M.C.

arrival, and while training and equipping (for at this stage of the war equipment arrived only gradually), were sent to Palestine. The provision of accommodation, administrative installations, etc., for this greatly increased concentration of troops, even with the barracks which had been built at various points in the country for the troops sent to quell the rebellions in earlier years, threw a heavy burden on the C.E., Brigadier G. Streeten, and his Works officers, though the engineers of the incoming formations were able to help.

The British troops already in the area and which up to then had little permanent higher organization, were regrouped. A number of motorized and armoured units were brought together into a Mobile Division, renamed the Armoured Division, and still later 7th Armoured Division, under the command of Major-General P. C. S. Hobart, late R.E., but at this stage had no engineer component. The various brigade groups which had been in Egypt and Palestine were collected into the Western Desert Force later.

As a result of these reinforcements there were, when Italy declared war on 10th June, 1940, 36,000 British troops in Egypt and 27,000 in Palestine. Many of these troops were not fully trained nor was their equipment complete. The majority of the fighting formations in Egypt were, as we have seen, disposed about Mersa Matruh where a special C.R.E., Lieut.-Colonel H. P. W. Hutson,[1] was appointed to co-ordinate the engineer work. Owing to paucity of communications and water, as will be seen later, no great force could be maintained in advanced positions in the Western Desert. The defences consisted of concrete pill-boxes, field defences and anti-tank obstacles, the latter taking the form of ditches and concrete structures sufficient to stop the light tanks which at that time were the only type of armour which the Italians were known to possess.

Survey

The first Survey units to arrive in the Middle East, in March, 1940, were 512nd (Army) Field Survey Company and 2nd Field Survey Depot. It was clearly impossible, even with the assistance of the Survey Departments of Egypt and Palestine, for the former unit to cope with the extensive map production programme required, so the Director of Survey asked for, and obtained by October, 1940, reinforcements to provide for the addition of five drawing sections. The unit was mostly employed on work in connexion with the new base installations and anti-aircraft defences of Egypt.

[1]Major-General H. P. W. Hutson, C.B., D.S.O., O.B.E., M.C.

Outbreak of War with Italy

The declaration of war by Italy on 10th June, 1940, followed within a week by the collapse of France, made the situation in the Middle East an extremely grave one for the British forces in that area. No longer were the Italian forces in Libya and Tripolitania forced to face both ways in view of the French forces in Morocco, and they could now concentrate the whole of their strength against the British in Egypt, while the possibility of French collaboration, or at least acquiescence in Axis aggression, in Syria added a further danger to our northern flank. With France no longer in the alliance, and the British Empire standing alone against the Axis powers, the importance of the Mediterranean loomed larger as the shortest and most natural link between the eastern and western parts of the Empire, and after the security of the British Isles, the maintenance of our position in the Middle East became of highest priority. Such reinforcements of men and material as could be spared were sent out, occasionally by escorted convoy through the Mediterranean Sea, but more often by the long sea route by South Africa.

In the next three years, war swept through all the Mediterranean countries and through East Africa. In the many campaigns the Royal Engineers, with their Dominion, Indian and Colonial brethren, took their full part in the operations. Throughout the period administrative effort was intense in all parts of the Middle East. The administrative build up from the meagre resources initially available absorbed engineer effort on a large scale in every conceivable activity ranging from construction to manufacture. Though the operations in the various theatres took place for the large part concurrently, it will be most convenient to take each theatre in turn, giving the full story of each campaign without stopping the narrative in order to describe events in other theatres which were taking place at the same time. The only exception to this will be that the narrative events in the Western Desert will be divided into two halves and the account of operations and work in other areas, which were either completed or were in an advanced stage at the date of the interruption of the narrative, will be interposed between the two halves of the story.

The Western Desert

The Western Desert stretches along the north coast of Africa from the Nile Delta to the Gulf of Sirte with some small areas of cultivation at intervals along the coast. Over a belt some fifty to a hundred

miles wide inland from the coast the surface is on the whole hard with areas of soft sand. Farther inland this gives way to a much more sandy area unsuitable for operations by any but small mobile forces. The terrain is on the whole flat but at places the ground rises sharply in steep escarpments, generally running parallel to the coast, up which wind what roads and tracks there are. It is almost entirely waterless and wells and oases are few and far between. At the time of the Romans it was more highly developed and there are traces of the ancient irrigation and water storage and catchment systems. The principal form of the latter are "Birs" and "Aqueducts". "Birs" are underground chambers hewn out of the limestone rock, roofed in, and designed to catch and store the rain falling over a considerable area. Many of these birs had fallen into disuse and either disappeared altogether or had silted up with sand. Others were well known to the inhabitants or rediscovered during the course of operations. "Aqueducts" are trenches or tunnels dug near the sea-shore, usually on the landward side of sand-dunes. These trenches or tunnels, dug in the right place, collect fresh water which has seeped through the limestone towards the sea and which floats over the heavier sea water. These aqueducts gave surprisingly good yields in certain places, such as Mersa Matruh and Bagush. Pumping had to be carefully controlled, for if the fresh water was overpumped, the brackish water broke down the balance and that particular aqueduct would probably never recover. But such supplies were extremely scanty and, in operations of large forces, water supply became one of the dominating factors of the campaign. The majority of well water was brackish which rendered much of it unsuitable for drinking purposes, and a great deal more unusable for steam locomotives. Testing for salinity became therefore, throughout the campaigns, a major responsibility of engineer units.

Metalled roads, except that hurriedly constructed just before the outbreak of war from Alexandria to Mersa Matruh and the Italian coast road in Libya referred to later, did not exist. But on the hard desert it was generally possible for a few vehicles to move freely over the smooth hard surface, though there was at all times a danger of running into a pocket of soft sand. To enable columns of fast moving transport to run freely little more was required than to clear away loose stones and to flatten off the worst bumps. Even so it was found advisable, for the light tanks then in use, to clear a tank track parallel to the Alexandria–Matruh road. Normally owing to the lack of rain, mud was no menace, but dust was, and

after a time untreated tracks became unusable. In the occasional rains the dust turned to almost impassable mud for short periods. The Italians had built a road, with a fine surface but little foundation, from the frontier of Egypt right through their colonies, connecting up the towns and settlements along the coast. At the outbreak of hostilities this road was complete except for some surfacing at the extreme eastern end. They had built no railways.

A single line railway had been constructed by the Egyptian State Railways before the war from Alexandria to Mersa Matruh, the new road running parallel to it. There was no water suitable for locomotives west of Alexandria, and supplies had to be carried forward for the purpose by tank wagons, thus absorbing about 10 per cent of the carrying capacity of the railway, till a pipeline was carried forward to Mersa Matruh.

In peace-time much of the traffic along the coast was carried in small ships, and in consequence there were to be found along the coast a number of harbours, the majority small, the more important being Tobruk, Benghazi and Tripoli. In view of the paucity of other communications, these ports were to become strategic objectives of vital importance.

Such was the nature of the country in which for the next three years considerable forces of the Empire and Commonwealth fought with ever-changing fortune. It has been graphically described as "The tactician's dream and the quartermaster's nightmare".

Wavell's Operations. Winter, 1940–1

General Wavell had decided that, in case of Italian invasion from the west, no major resistance should be offered west of Mersa Matruh. At the same time however he sent a covering force to the frontier with orders to attack the Italian frontier posts as soon as possible after the outbreak of war. This small force was composed of units of 7th Armoured Division, and, as the Divisional Engineers of that formation had not arrived in the country, 2nd (Cheshire) Field Squadron from 1st Cavalry Division, then in Palestine, was attached.

In spite of his superior numbers and equipment the enemy remained quiescent till 13th September, when in a three days very deliberate advance he reached Sidi Barrani, the covering force of 7th Armoured Division conducting a fighting withdrawal before him. The coast road which had been extended to the frontier from Matruh was torn up by a rooter and liberally sown with mines.

At Sidi Barrani the Italians remained stationary for over two months.

Meanwhile the strength of the Western Desert Force, under Lieut.-General R. N. O'Connor[1] (Chief Engineer Brigadier H. P. W. Hutson), gradually increased as units and material arrived and as units already in the area completed their training.

In October, General Wavell issued orders for the preparation of an attack which was ultimately launched on 7th/8th December. The troops available for the operation consisted of:—

7th Armoured Division. (C.R.E. Lieut.-Colonel J. F. Farewell) 2nd (Cheshire) Field Squadron and 141st Field Park Troop R.E.

4th Indian Division. (C.R.E. Lieut.-Colonel R. V. Cutler) 4th, 12th and 18th Field Companies and 11th Field Park Company, Sappers and Miners.

16th Infantry Brigade.

7th Battalion R.T.R.

A brigade group from Matruh Garrison (C.R.E. Lieut.-Colonel P. A. Ullman[2]).

2nd, 12th and 54th Field Companies R.E. were in support.

The total force consisted of approximately 31,000 men, and 275 tanks of which over half were light. The Italian forces numbered about 80,000 with 120 tanks, and twice as much artillery as the British. They had also considerable numerical superiority in aircraft.

Though the decision to make an attack was kept very secret, in view of the possibility of a further advance certain engineer preparations had been made. These included the running of a water pipeline twelve miles from Matruh up the escarpment, which here runs parallel and close to the coast, to Charing Cross. The carpenters of 2nd, 12th and 54th Field Companies produced in one night's work eighty dummy tanks which were used in a back area to detract the attentions of the Italian air force.

Battle of Sidi Barrani

The Italians were posted in a semi-circle of defended posts running from the coast some fifty miles inland. To reach these the main body of the Western Desert Force would have to advance some seventy miles over the open desert. This involved two marches on successive

[1]General Sir R. N. O'Connor, G.C.B., etc.
[2]Major-General P. A. Ullman, C.B., O.B.E.

nights, thus the whole force would spend the intervening day in the open desert within thirty miles of the enemy, lying exposed to the enemy's air attack if observed. These marches were successfully accomplished on the nights of 7th/8th and 8th/9th December, the movement not being observed by the Italians. On the morning of the 9th, the first stronghold, Nibeiwa, was captured by 11th Indian Infantry Brigade and 7th Battalion R.T.R., the engineer element being provided by 11th and 12th Companies, Sappers and Miners. The other camps within the objective of the striking force were captured by nightfall. The success of the operation enabled part of the force to push through the gap so made to reach Sidi Barrani, thus deploying astride the main line of retreat of the Italian troops in the remaining strongholds. Sidi Barrani was captured by nightfall on 11th December. The brigade from Mersa Matruh and the remainder of the force then drove the enemy out of the remaining posts and the first phase of the operation, the battle of Sidi Barrani, ended with the destruction of the greater part of five enemy divisions. Over 38,000 prisoners, 400 guns and some fifty tanks had been captured, the British casualties being 133 killed, 387 wounded and eight missing. The brigade from Matruh, which was very weak in infantry, was almost entirely composed of dummy tanks made in the Engineer Base Workshops and mounted on lorries. The Brigadier on setting out remarked to the C.R.E., "My life's ambition has been to command a brigade in action, but I did not expect it to have been built by the Sappers from cardboard." He returned some forty-eight hours later with nearly 10,000 prisoners.

The R.E. of 7th Armoured Division, which covered the left flank, were chiefly employed in reconnoitring for and developing water supplies. The Sappers and Miners of 4th Indian Division found their chief task was the location and clearance of ways through enemy minefields. This work, which was to become almost the main preoccupation of all Sappers in the coming years in the desert, had not been encountered in operations before. The Engineers with the Western Desert Force had had some experience in laying minefields in the defences of Mersa Matruh and Bagush but not of lifting them in action. The scarcity of our own mines in the early stages of the war has already been referred to in Chapter II and few had been sent to the Middle East. This Command had, therefore, to develop production of their own mines, known as Egyptian Pattern (E.P.I.) (see Chapter XIII, page 367). Owing to the difficulty of having springs made in Egypt these mines were

actuated by the action of two chemicals normally kept apart in glass phials which were broken by the weight of the tank. Egyptian Pattern mines were therefore sensitive, and while reasonably safe for laying by experienced men, were dangerous to life when laid. The development in mine-warfare will be referred to frequently in the following pages, and, as concerns operations in the Desert, more particularly in Chapter XIII, pages 365–371.

Finding and lifting enemy mines was an even more dangerous occupation at all times and especially in these early days when so little was known of the art. Mines had to be located by inspection of the ground, by prodding with bayonets or metal rods, or by feeling with the fingers. Such work, in the case of minefields covering enemy works, had to be carried out in full view on a battlefield almost as flat and open as a billiard table and under the close small arm fire of the defence.

About this time the Italian air force started dropping a form of very sensitive bomb, chiefly on airfields. In an attempt to find a mechanical means of clearing these from airfields a form of mechanically operated swinging chain to sweep the bombs from in front of a vehicle was devised. It was in many respects the precursor of the "flail" tank, the development of which has been described already (Chapter VIII, page 195).

The unexpectedly large haul of prisoners threw a heavy strain on the R.E. on the L. of C. to provide the necessary accommodation. Camps, with water supply, and perimeter wire electrically lit, had to be constructed in large numbers.

After the battle of Sidi Barrani, 4th Indian Division moved off to the Sudan frontier, and was replaced by 6th Australian Division with its own R.A.E. Meanwhile the pursuit was continued by 7th Armoured Division followed up by 16th Infantry Brigade, and the Italians were swept on to their next defensive position at Bardia. In this way Sollum, a very small port with a single jetty, was captured and work was immediately started to develop it to enable stores to be sent up by sea.

Capture of Bardia

The enemy had concentrated in the Bardia position the great part of four infantry divisions with tanks and guns. The defences were disposed on a perimeter seventeen miles in extent, and consisted of concrete pill-boxes at intervals of some 700 yards, each post being wired and having an anti-tank ditch. Five hundred yards beyond

the first line was a second but less elaborate line of support posts. Outside the whole ran a continuous anti-tank ditch and wire obstacle, and considerable minefields.

On 3rd January, 1941, the stronghold was attacked by 6th Australian Division assisted by tanks. The infantry seized a bridgehead beyond the wire and anti-tank obstacle, the R.A.E. units of the Division, leading the assault, blowing gaps in the wire with Bangalore torpedoes. Within fifty minutes the Sappers had also filled in the anti-tank ditch at five points and enabled the tanks to move forward, thus paving the way for the capture of the stronghold. This was completed on 5th January, 45,000 prisoners and 462 guns being taken.

But, from the long-term point of view, almost more important than the capture of so many prisoners was the securing of the water supply of Bardia. The water here, though saline, was plentiful, and the Italians had installed a large pumping plant to serve both the town and Fort Cappuzzo. Luckily the Italian demolitions were not very satisfactory. An officer of the staff of the Director of Works, Lieut.-Colonel W. G. Fryer,[1] entered the town with the leading troops, rapidly assessed the damage and the spares required, and motored back through the night, 430 miles to his headquarters, arriving before the news reached Cairo that the town had been captured. The necessary stores were sent up immediately and the pumping station got into action again in a very short time.

The main Italian army in Cyrenaica was now shattered and the offensive was pressed forward. The next enemy post, Tobruk, had already been cut off from the west by our armour and preparations were immediately made for its capture.

Capture of Tobruk

The perimeter of Tobruk was 27 miles in length and resembled that of Bardia, except that the anti-tank ditch was at many points not deep enough to be effective. The Italians had incorporated a large number of diverse booby traps in the wire entanglements. These caused many casualties amongst the parties of 2nd/8th Field Company R.A.E. which reconnoitred the defences for several nights. In consequence of their efforts all trip wires were cut the night before the assault. In the latter the R.A.E. companies blew gaps in the entanglements and made crossings over the anti-tank ditch. The

[1]Brigadier W. G. Fryer, O.B.E.

main assault, delivered on 21st January, was entrusted to 6th Australian Division supported by a heavy concentration of artillery and tanks, and was completely successful, the garrison of nearly 30,000 men surrendering on the 22nd with 236 guns and eighty-seven tanks. But almost more important, a large quantity of motor transport and petrol also fell into our hands and these made an early advance against the remaining enemy forces in Western Cyrenaica more feasible.

It was found that the Italians had done much damage to the port and town installations by demolitions besides the effects of bombing by the R.A.F. It was vital to the maintenance of any operations farther west that the port should be got into full operation at the earliest possible moment. Pending the arrival of Works and Transportation units, delayed necessarily by the difficulties of maintaining extra numbers in the forward area, the R.A.E. and Australian pioneers concentrated on first-aid repairs, providing facilities for lighterage and got one quay into use. As at every other place in the desert, the rehabilitation of the water supply had high priority. This job was also undertaken by the R.A.E. field units under the direction of C.R.E., L. of C., Lieut.-Colonel N. Boddington.[1] The Italians had organized three systems each of different salinity, as well as a large distilling plant. They had also constructed a pipeline to El Adem, some sixteen miles away. These had not been very seriously damaged by the Italians or by the air and artillery bombardment, but they still needed considerable attention which was not made easy by the extremely complicated systems. In spite of this, and with at first only field company equipment and tools, the Australian engineers got both the pumping systems and the distilling plant working in remarkably short time. They also repaired the pipeline to El Adem where a large number of Italian prisoners had been collected and were very short of water under the burning sun.

The Pursuit

Two bodies of Italian troops then lay, one about Derna on the coast road, and the other near Mechili on a track running south of the Jebel Akhdar on the desert route which rejoined the coast road south of Benghazi on the shores of the Gulf of Sirte. It was however considered that the supply position would not allow of a further advance of strong forces before 12th February. The enemy force

[1]Colonel N. Boddington, O.B.E.

about Mechili withdrew on 26th January, and on 3rd February air reconnaissances showed without doubt that the force at Derna was about to follow suit. If these forces were to be brought to battle not a moment was to be lost, and in spite of the fact that the supply arrangements were far from complete, General O'Connor ordered 7th Armoured Division to move on by the southern desert route past Mechili, where its advanced troops had been in contact with the Italians, to Msus. From there it could operate against either Soluch or Agedabia as required. The rest of XIII Corps, as the mobile element of Western Desert Force was now called, and largely consisting of 6th Australian Division, was to press on by the coast road past Derna and Barce towards Benghazi.

This decision, especially in so far as 7th Armoured Division was concerned, raised serious water problems. There were no known major sources of water on the desert route between Tobruk and the coast of the Gulf of Sirte, and for reasons of secrecy no reconnaissance for potential sources had been permitted. It was only with the greatest difficulty that the advanced troops about Mechili had been supplied with a ration of half a gallon per man per day. Therefore, when the advance started on 5th February, the Divisional Engineers were chiefly employed on water reconnaissances and development. To those unacquainted with conditions of warfare in the deserts of northern Africa the implications of the term "water reconnaissance" cannot, without further elaboration, be fully understood. Information was usually vague and dependent on rumour culled from wandering arabs, or on the reports of units of other arms which could give only a general indication of the nature, and above all the location of a possible source. These, and other indications, had to be followed up by small parties moving over scores of miles of trackless desert with few landmarks by which positions could be checked. This movement had to be carried out under the pitiless glare of the sun in a region entirely without shade, and at all times liable to the attentions of enemy aircraft from which there was no possibility of hiding. A source having been found, it was necessary to test the water for salinity, frequently to find that the water was useless for any purpose. Finally a useful source had to be marked and its position fixed so that it could be found again later.

Cyrenaica Cleared. Surrender of Italian Forces

The leading troops of 7th Armoured Division reached the road along the coast leading from Benghazi through Agedabia to Tripoli

on the evening of 5th February, in time to head off the retreat of the first enemy columns moving south from Benghazi. All day long on the 6th the main enemy columns tried to break through the net, but unsuccessfully, and on the morning of the 7th, after a final effort to break through with his remaining tanks, the Italian General Berganzoli surrendered.

Meanwhile 6th Australian Division was pressing on in pursuit along the northern coast road, but, even though one brigade group was made mobile from divisional resources, it was unable to catch up with the retreating Italians till the fighting was over.

During the two months fighting the Western Desert Force had advanced 500 miles. They had beaten and destroyed an Italian army of four Corps, and had captured 130,000 prisoners, 400 tanks and 1,290 guns, at a loss of under 2,000 killed, wounded and missing.

Repair of Ports and Communications

It was now of the utmost importance to improve the communications forward so that the maximum force could be maintained in Western Cyrenaica. Reconnaissance of the port of Benghazi showed that as a result of Italian demolitions and R.A.F. bombing, it would be of little use for a considerable time. It was, therefore, decided to concentrate on the improvement of the harbour at Tobruk, and of the road from that port through Derna to Benghazi.

At Tobruk further repairs were carried out in the port chiefly by engineer field units. Owing to the scarcity of port operating personnel in Middle East, new companies for the purpose had to be raised by combing out suitable personnel from Empire units.

The road from Tobruk to Benghazi was found to be in a bad state owing to the intensive traffic and bombing it had recently had to sustain. It was decided therefore that priority should be given to repair and maintenance, but a start was also made on widening it. This last was especially necessary between Tobruk and Derna, on which stretch it averaged only 15 to 16 ft. in width against 18 ft. elsewhere. In consequence, from vehicles passing, the edges broke away and the whole width gradually disintegrated.

Water points were developed along this route and also on the southern track through Mechili and Msus. Except at sources of water, these water points consisted of storage tanks with pumps, filled by water lorries. On the northern route, owing to a good natural supply from a wadi at Derna, and the number of Italian settlements, water supply gave little difficulty. On the southern

route, however, water had in most cases to be carted to the water points.

To enable fighter aircraft to cover the advance, six airfields had been made by engineers of formations. These were at this stage of an elementary nature. In the hard flat desert it was possible to operate aircraft off strips cleared of stones, with the worst unevenness smoothed off.

Strategic Situation. March, 1941

A defensive attitude was now forced upon our troops in Western Cyrenaica. It was necessary to divert a substantial part of the trained formations to Greece where the intervention of German forces had made the situation critical (see Chapter X). Till the steps taken to improve the communications mentioned above had been brought to fruition it would have been very difficult to support adequate forces in the area in an offensive role, or indeed in a defensive attitude if attacked in superior strength. General Wavell's information led him at the time to base his calculations on an assumption that the Axis forces in North Africa were unlikely to be reinforced sufficiently to allow them to attack before the middle of April at the earliest. By this time he hoped to have received reinforcements to replace the formations sent to Greece, and that divisions already arrived would have completed their training. Further, the decision to rely on maintenance by road from Tobruk was partly based on the promised delivery of considerable quantities of extra motor transport. The latter in fact fell far below expectations.

The instructions to Lieut.-General P. Neame (late R.E.), who was then commanding in Cyrenaica, were therefore, if attacked, to fight a delaying action south-west of Benghazi, and even to evacuate Benghazi itself if the situation demanded, but to hold on to the high ground east of the town for as long as possible. In accordance with these orders a position was prepared on the escarpment five miles east of Barce under the direction of C.E. Western Desert Force. This included defended posts, minefields, preparation for the cratering of roads up the escarpment, and for the blowing up of bridges.

The Engineers of 9th Australian Division (C.R.E. Lieut.-Colonel J. Mann, R.A.E.), which had been brought forward to replace 6th Australian Division dispatched to Greece, prepared a scheme of demolitions in the forward area, and of the utility plants (water, light, power, etc.) in Benghazi. Brigadier F. H. Kisch succeeded Brigadier Hutson, who went to Greece, as C.E., Western Desert

Force. In the more open country on the left, with its forward troops in the neighbourhood of Agedabia and on a very extended front, a very weak 2nd Armoured Division relieved 7th Armoured Division, the tanks of which, after the extensive movements in which they had taken part, required overhaul. The divisional engineers of 2nd Armoured Division had not yet arrived in Middle East, so those raised for 7th Armoured Division were ordered to join it. The latter consisted of C.R.E. Lieut.-Colonel A. C. Mitchell,[1] 4th Field Squadron and 143rd Field Park troop, which had only arrived in December, just as the offensive started, and were then not considered sufficiently desert trained to take part. Their arrival now was unpropitious for one troop of the Field Squadron had been detached with an Australian Brigade into the desert to the south to reduce the Italian garrison of the oasis of Jarabub, another troop of the Field Squadron and the Field Park Troop had been sent under orders from G.H.Q. a month earlier to join the 2nd Armoured Division in the forward area. So when Lieut.-Colonel Mitchell arrived, on 24th March, to report to the Division he had with him only his own Headquarters and the Headquarters and one troop of 4th Field Squadron. The Field Park Troop was under command of an armoured brigade on the left about El Agheila, and Captain C. E. H. Edwards'[2] troop of the squadron was also under separate command, in the rear about Antelat. So the Park Troop was acting in the role of a troop of a squadron for which it was unusually well prepared since the C.R.E., unhappy at the idea of having only one field squadron, had trained within the Field Park a pioneer troop, a forerunner of the days, shortly to come, when the engineers of an armoured division would have two field squadrons. Nor was the tactical situation on his arrival a happy one.

Axis Counter Offensive

The enemy had been reinforced more rapidly than had been thought likely. Moreover, the reinforcements included a strong German contingent in which was an armoured formation, to be well known later as the Afrika Korps, under Lieut.-General Rommel. Strong formations of the German air force had also arrived. On 31st March, the advanced troops of 2nd Armoured Division were attacked in strength, and in accordance with orders started a fighting withdrawal. Thus Lieut.-Colonel Mitchell had but a week in which to

[1]Colonel A. C. Mitchell, O.B.E.
[2]Major C. E. H. Edwards, M.C.

get some control of his units and to prepare an engineer plan for future operations. The latter was almost entirely concerned with denial to the enemy of every known source of water, there being no physical obstacles in that part of the desert which could be improved by demolitions. When the enemy attacked the most forward element of the Division Captain W. Loring's[1] 143rd Field Park Troop was the first R.E. unit concerned. Two detachments, each under a young N.C.O., were involved in the first encounter and in each case completed their tasks near Brega, one of cratering the main road, and the other of destroying a well and bringing away the precious pumping gear, and withdrew safely with the rest of the troop to Antelat.

During the next few days the Division withdrew before increasing pressure. The few R.E. units were widely scattered and control by the C.R.E. was extremely difficult owing to the absence at that time of wireless sets in divisional engineers. After the first two days 4th Field Squadron, under its O.C., Major S. T. A. Radcliffe,[2] managed to concentrate, and to include even the remains of the troop which had gone on the successful expedition to Jarabub and had suffered severe casualties from air attack. After withdrawing north towards Benghazi, the Division turned east, south of the Jebel Akhdar, to cover the approach to Tobruk across the desert. The R.E. continued their work on track reconnaissance, making water points for the Division and destroying the latter ahead of the enemy.

Lack of communications, uncertainty as to the situation, the wide dispersion of troops, and the rapid movement of operations made the task on water supply an extremely anxious and difficult one. The description of one incident as described by Captain P. N. M. Moore,[3] second-in-command of 4th Field Squadron, gives a picture of such work. The particular water point consisted of an underground cistern or "bir" which had been prepared for demolition by lowering into it a waterproof bag containing explosive, and a metal wind pump on which charges had been placed. "We were without wireless of any kind and had to rely on casual passers-by for information. As the evening wore on, and with it our anxiety grew, this information became less and less reliable as each traveller was convinced that the enemy were just behind. I remember particular difficulty

[1]Captain W. Loring, died, January, 1942.
[2]Major S. T. A. Radcliffe.
[3]Lieut.-Colonel P. N. M. Moore, D.S.O., M.C.

in trying to find out anything from a unit of French Marines—remarkable for the plumes on their sun helmets and the incomprehensibility of their 'Argot'. We nearly took them for Bersaglieri until their officer spoke up with a Parisian accent.

At last 1 a.m. (the final hour for demolition) came and we fired the cistern charge. This must have had a large overcharge because the firing party were deluged with water and rubble. The charge on the wind pump then failed. A quick inspection showed that a rock had scored a bull's eye on the junction box and, after a rapid repair, the tower came crashing down at the next try."

Owing to weak strength and mechanical failures the Division could do little to stop the enemy. Further a threat by German armour to the supply dump at Msus caused the garrison at that place to destroy the petrol on which the Division so largely depended for movement. In consequence Divisional Headquarters with several units, including the majority of the R.E., was surrounded at Mechili, on 8th April, and had to surrender. A few detachments, including No. 2 Troop and "B" echelon of 4th Field Squadron, a detachment of the Field Park Troop and individuals escaped and eventually with forty German prisoners joined other British units. But with the General, the C.R.E. and many of the R.E. officers and men were taken prisoner. A number, including Captain Loring of the Park Troop and Captain Moore of the Squadron, escaped when handed over to Italian guards and rejoined safely after adventurous wanderings in the enemy infested desert. The remnants of the R.E. were collected and reformed at Alexandria, under Lieut.-Colonel P. A. Clauson[1] as C.R.E., for service with their own (7th) Armoured Division.

Meanwhile, when the enemy's offensive intentions had been confirmed, the demolition plans at Benghazi were put into effect.

The engineers with the force, chiefly Australians and Corps troops, retreating from Benghazi by the Northern road took all possible steps to delay the advance of the enemy. Roads, particularly where they wound up escarpments, were cratered, but special attention was paid to the denial to the enemy of sources of water. Reservoirs were destroyed and the water contaminated with bone oil, which is a non-poisonous substance which makes water too unpleasant to drink. Water lifting and storage gear, such as pumps and tanks, were if possible carried away or, where this was not possible, destroyed. On the escarpment east of Benghazi a position

[1]Colonel P. A. Clauson, M.B.E.

covered by minefields was prepared but could not be held owing to scarcity of troops. All this work was impeded by shortage of equipment. In the area west of Tobruk only one compressor was available for making holes for crater charges per 100 miles of road. Partly from these causes and partly from inexperience, some of the charges proved insufficient and inadequate craters were made. Otherwise the demolition work was well carried out, and C.E. Western Desert Force was able to report that he knew of only one water point which had not been efficiently put out of action.

Installations at Derna and other towns were destroyed by Corps Troops R.E. under Lieut.-Colonel N. Boddington, but he was unfortunately taken prisoner when supervising the final demolitions on the road over the escarpment near that town.

Meanwhile work was proceeding, chiefly carried out by units of 9th Australian Divisional Engineers, with the strengthening of the defences of Tobruk. Here 10,000 Italian mines which had been lifted after the capture of the port were hurriedly relaid, and extensive new minefields laid. Great stress was laid on the building up of a reserve of water, and the development of the water supply. The large dumps of enemy ammunition which he had left behind within the Tobruk perimeter were destroyed.

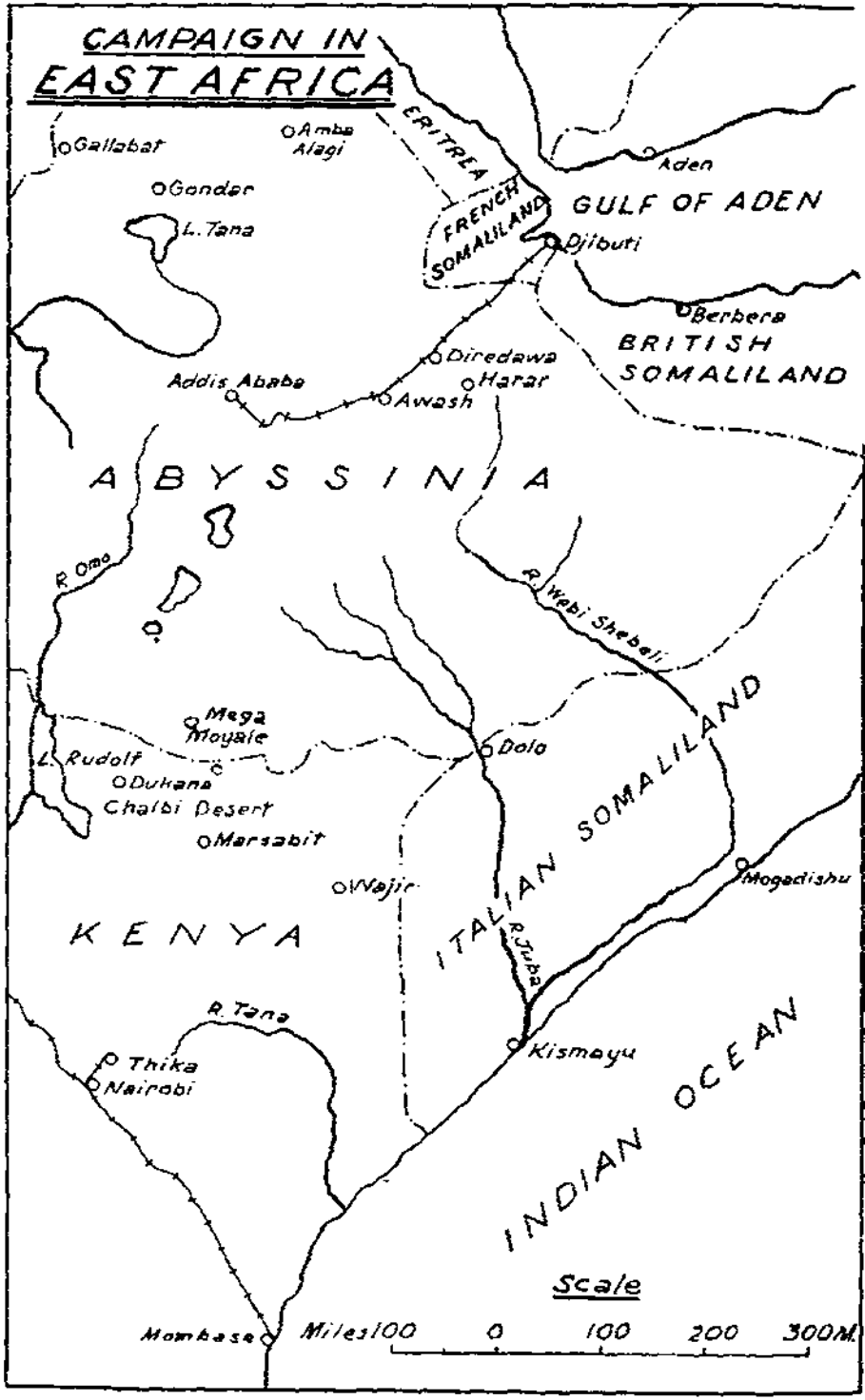
Tobruk Isolated

As the retreat continued, Tobruk was isolated, 9th Australian Division being left as a garrison. A further misfortune befell the force on the night of 6th/7th April, when Lieut.-General Neame accompanied by Lieut.-General O'Connor were held up and captured by an enemy mechanized patrol while moving in a car back to the new headquarters of the force.

The retreat was continued to the Egyptian frontier about Sollum. *En route,* Corps units R.E., including 295th Army Field Company and 551st and 552nd Army Troops Companies, destroyed installations and port equipment and jetties at Bardia and Sollum as well as co-operating with other engineer units in cratering roads and putting sources of water supply out of action. About Sollum the position was stabilized about 11th April. In view of the possibility of further retreat work had been recommenced on the defences of Mersa Matruh and Bagush, most of the technical work being carried out by engineer units of formations recently arrived and under training for desert warfare.

Survey

Though some other survey units arrived in the Middle East during the winter of 1940–41, these were detached to other parts of the theatre where operations were in progress or anticipated, and only a mobile detachment of 512th Company accompanied the Western Desert Force during its operations at this time. While busy extending the topographical knowledge of the area, its most important work was the collection of captured Italian maps of which large quantities were found giving up-to-date details of Libya. These were sent back to Cairo where the British maps were amended and new editions hurried forward to the troops. An important find was a large scale map of the defences of Tobruk. This was flown back to the base and reproductions were printed and issued to the troops in time for the assault on the fortress.


CAMPAIGN IN
EAST AFRICA
Gallabat
Amba Alagi
Gondar
L. Tana
ERITREA
FRENCH SOMALILAND
Aden
GULF OF ADEN
Djibuti
Berbera
BRITISH SOMALILAND
Diredawa
Harar
Addis Ababa
Awash
ABYSSINIA
R. Omo
R. Webi Shebeli
Mega
Moyale
L. Rudolf
Dolo
Dukana
Chalbi Desert
Marsabit
ITALIAN SOMALILAND
Mogadishu
Wajir
KENYA
R. Juba
R. Tana
Thika
Nairobi
Kismayu
INDIAN OCEAN
Scale
Mombasa
Miles 100 0 100 200 300M.

CHAPTER X

EAST AFRICA, ERITREA, CRETE AND GREECE 1940–1

East Africa. Situation before opening of hostilities—Italy enters the war—British offensive started—Invasion of Abyssinia—Final operations—Survey.

Eritrea. Situation on the outbreak of war with Italy—Advance into Eritrea—Battle of Keren—The pursuit and occupation of Asmara and Massawa—Survey.

Crete, 1940.

Greece. Negotiations with Greek Government—Arrival of British Force—The country—German invasion. Occupation of Olympus Line—Decision to withdraw to Thermopylae—Evacuation from Greece—Survey—Oil demolition—Evacuation to and operations in Crete.

(See Maps 6 to 10 facing pages 249, 261, 263, 269, and 279 in this chapter)

EAST AFRICA

Situation Before Opening of Hostilities

The East African colonies and protectorates were not garrisoned by Imperial troops before the war, the necessary military element being provided by two brigades of King's African Rifles in which, from time to time, a few officers of the Royal Engineers served. It was not till the last months before the declaration of war on Germany that any plans for expansion or reinforcements were made. Even then, as the attitude of Italy in case of hostilities was uncertain, and in view of the *bon voisinage* agreement with that country not to increase forces in Africa without consultation, nothing but plans for the expansion of the local forces was contemplated.

In the autumn of 1939, the two brigades of K.A.R. were concentrated under the command of Major-General D. P. Dickinson,[1] and a field company of East African Engineers was raised under command of a local engineer, Major J. Oates.[2] Shortly afterwards the formation of two more field companies and a headquarters Divisional Engineers, with Lieut.-Colonel F. E. Buller,[3] a retired officer of the Royal Engineers, as C.R.E., was undertaken. The field companies

[1]Lieut.-General D. P. Dickinson, C.B., etc.
[2]Lieut.-Colonel J. Oates, O.B.E., M.C.
[3]Colonel F. E. Buller, D.S.O., O.B.E., M.C.

had a greater proportion of officers than the corresponding British units, each section being commanded by a captain. Included in each company was a separate water section, but this did not prove an entirely satisfactory arrangement, though the waterless nature of the country in which they were likely to operate had indicated that they might well be useful. To train these units, composed of Africans with no military or technical background whatever, required considerable time and great effort on the part of the officers, who were mostly drawn from settlers in the colonies with some knowledge of engineering.

As the war progressed, and the attitude of Italy became more inclined towards co-operation with Germany, the threat caused by the presence of 200,000 Italian troops in their possessions north of Kenya could no longer be accepted without counter-preparation. Accordingly in June, 1940, as no troops could be spared from the United Kingdom or from the Middle East, two brigades of West African Frontier Force arrived in Kenya and, with the two East African Brigades, formed two weak Divisions, called at first 1st and 2nd African Divisions and later 11th and 12th, of which Lieut.-Colonels Buller and Oates were Cs.R.E. About the same time the leading brigade group of 1st South African Division, and a number of technical and administrative South African units, including a number of companies of South African Engineer Corps, also arrived.

Italy Enters the War

In July, a headquarters East African Command, subordinate to General Wavell in Middle East, was set up under Lieut.-General Dickinson, who was succeeded in October, owing to illness, by Lieut.-General A. G. Cunningham.[1] Brigadier A. Minnis with a small staff arrived as Chief Engineer, and Colonel A. C. Duff,[2] late R.E., as A.Q.M.G. of the Command, being joined a month later in a similar appointment by Colonel Sir B. H. Robertson[3] who had retired from the R.E. and taken up a civil appointment in South Africa. On these two officers, late of the Corps, fell jointly the direction of the administrative work of the campaigns which, as will be seen, proved to be more a fight against nature and lack of development of the country than against the Italians.

[1]General Sir A. G. Cunningham, G.C.M.G., etc.
[2]Major-General A. C. Duff, C.B., O.B.E., M.C.
[3]General Sir B. H. Robertson, Bart., K.C.M.G., K.C.V.O., C.B., C.B.E., D.S.O., M.C.

General Wavell's instructions to General Dickinson were that he should act offensively against the Italians on the northern borders of Kenya, but not till his force was trained and the necessary administrative preparations complete. It was assumed that the Italians would stand just south of the Juba River. This lay some 500 miles from railhead at Thika, north-east of Nairobi. Immediately on the outbreak of war the roads forward from Thika, about 200 miles to the Tana River, where the first adequate supply of water existed, had been improved and made suitable for heavy traffic. Accordingly on the Tana River an advanced base was set up and filled by M. T. from Thika. Few engineer stores could be got forward for, though considerable quantities had been shipped from Egypt and India, a very small share of the available transport could be allotted to carry them beyond railhead. The engineers had therefore to rely as much as possible on the natural products of the country. From the Tana, routes forward had to be developed and lorry-fed water points constructed. This work threw a heavy strain on the few engineer units at first available, and which were struggling to complete the elementary training of the African sappers. Stores had also to be collected for the crossing of the Juba River. No standard bridging equipment was available in the country, so pontoons had to be made locally. These were constructed from the wood of the country as no plywood was to hand, and proved enormously heavy. The Kenya-Uganda Railway Company workshops produced a locally designed anti-tank mine which, it is reported, accounted for one elephant and a giraffe before being superseded by imported articles.

In June, 1940, when Italy declared war, the two East African Brigades were at Wajir and in the Tana River area respectively. The one field company and a pioneer battalion were at Wajir. It was intended that both brigades should act offensively, but the Italians struck first and our advanced post at Moyale had to withdraw, but the enemy failed to follow up his success. General Dickinson decided to wait till the reinforcements, which were then arriving, could be brought up and maintained in the forward area.

With the arrival of the S.A.E.C. units, the engineer preparations went forward with greatly increased pace. Not only in skill were the South African units far ahead of any that had been available before, but also their equipment was of a very high order. Field park companies, with their workshops, were able to produce a great deal of the equipment and manufactured stores which were so lacking in

the country, and their road construction companies, manned and equipped as they were by the National Road Organization of the Government of the Union, proved invaluable in such a theatre of operations.

British Offensive Started

By the beginning of February, 1941, all was ready and General Cunningham started his offensive. The main blow, delivered by 11th and 12th African Divisions, was directed against the lower stretches of the Juba River with a primary objective of capturing Kismayu, a small port, through which the force could be maintained in a further advance instead of over the 500-mile road from Thika. A South African brigade struck well to the west in the region of Lake Rudolf on the more direct, but more mountainous, road to Addis Ababa. The 12th Division leading the eastern advance quickly overcame Italian resistance on the Juba River and occupied Kismayu on 14th February. South African Engineer units were sent up to bridge the river, the main bridge, partly of pontoon equipment and partly causeway, 320 ft. long, being constructed in 18 hours.

After entering Italian Somaliland movement depended on the Italian made roads. These though beautiful to look at had no foundation, and even in dry weather disintegrated completely and became impassable. Even in the town of Kismayu the two small jetties which existed were of little use as the approach roads were useless within 24 hours. In consequence stores had to be discharged, when sea conditions permitted, from lighters on to the open beach. The situation would have been desperate if it had not been for the presence of the magnificently equipped and efficient South African road construction companies. As Colonel Duff, who as we have seen was responsible for the organization of the administrative services, writes, "We should never have got as far as Kismayu, let alone beyond it, without the help of the South African Road Construction Companies and Road Maintenance Companies. The feats they performed were astonishing; dust, sand, mud, even lava, found them undismayed." ("Q" in the East African Campaign. *R.E. Journal*, December, 1942.)

In spite of the administrative difficulties, General Cunningham pushed ahead and occupied Mogadishu, 300 miles farther along the coast, on 25th February. This port, though a little better than Kismayu, could not be used for some weeks while the Navy swept the magnetic mines dropped in the anchorage by the R.A.F. But

the advance never halted and the S.A.E.C. toiled ceaselessly to maintain the supply roads. They and the engineers of the two African divisions were also busy bridging, building causeways, developing water supply, clearing tank obstacles and booby traps, repairing Italian airfields, etc.

The Italians offered little resistance, as may be judged by the following story. An S.A.E.C. airfield reconnaissance officer with a sergeant motored ahead through a country which had not been cleared of the enemy to investigate the state of an airfield. On arrival, and while looking round, he saw 200 armed soldiers emerge from the jungle, form up in two ranks, and stand at ease. The two South Africans moved forward to identify them, though even from a distance the sergeant said they looked "like Eyeties". As they approached the company came to attention, ported arms and eased springs. Expecting to receive a volley at any moment the two moved on to be met by the Italian officer who saluted smartly and said they wished to surrender, saying he had given the order to unload magazines as a token of good faith.

A little later, since Berbera had been reoccupied by a British force from Aden, the Chief Engineer, Brigadier Minnis, decided to see if the road from Berbera to Abyssinia was in better state than the one by which the force was being maintained from Mogadishu. He therefore started off with an escort of two armoured cars, to try to get through to Berbera. On the way an Italian post surrendered after a few shots, but otherwise the trip was uneventful. It transpired that the small party narrowly missed encountering a force of 20,000 Italians retreating from Berbera, and it seems probable that this force itself turned aside to avoid what they thought was an advanced scouting patrol of the main British force.

Brigadier Minnis found the Berbera road in much better condition, and that Lieutenant E. Joly de Lotbinière,[1] R.E., with a detachment of 20th Fortress Company from Aden, had already started work on the rehabilitation of the harbour. He was, therefore, able to advise that the advanced base should be shifted to Berbera.

Invasion of Abyssinia

As the advance moved into Abyssinia the country became more mountainous and more suited to the carrying out of effective demolitions, an opportunity of which the Italian engineers took full and skilful use. They evidently took a pride in their work, for on occasions

[1]Lieut.-Colonel E. Joly de Lotbinière.

they left notes behind for the British Engineers. In one place they had blocked a road tunnel and blown a bridge on either side. Here they left a note boasting that the block would hold up the pursuit for a month. Little did they know the ingenuity and determination of British Sappers. A deviation was reconnoitred and made just passable for motor traffic in three-and-a-half days. Not only was it Italians who under-estimated the efficiency of the engineers. A reconnaissance by the leading brigade of a series of road demolitions on the mountainous Harar-Diredawa road estimated the time necessary to clear a way through at two weeks. An East African Field Company, assisted by Nigerian infantry, had lorries running through in two days.

At Diredawa the line of the French owned and constructed railway from Djibuti to Addis Ababa was reached.

Up to this point the bridge building and repairs had for the most part been carried out without the use of standard equipment, but just before our troops reached the Awash Gorge the first of a number of small box girders manufactured in South Africa came to hand. At Awash the Italians had cut the girders of the bridge but failed to destroy the piers. One of the damaged girders was repaired, but the remaining span was too great for the S.B.G. and a timber trestle had to be built. South African Railway units later put in a very fine diversion and low level bridge at this spot.

The construction of numerous airstrips for fighter aircraft was necessary to provide air cover for this long advance. Luckily suitable sites were fairly easily found, and the fine mechanical equipment of the S.A.E.C. facilitated the rapid clearance and levelling of the runways.

And so Addis Ababa, the capital of Abyssinia and the end of the first stage of the operations, was reached on 6th April.

Final Operations

A pause was made at Addis Ababa to reorganize and re-equip, and to prepare for operations deeper into Abyssinia to complete, in conjunction with General Platt's force from the Sudan (see pages 260–266), the mopping up of the remnants of the Italian forces under the Duke of Aosta. The African engineer units were largely re-equipped from the great quantity of stores captured from the Italians. Their Meccano bridge equipment was later found of considerable value in crossing the many gorges which were encountered. It would take divisional loads up to about 110 ft. span.

Re-equipped the East and West African troops turned south for what became known as "the Battle of the Lakes". During these operations they carried out three opposed river crossings, two at Omu and one at Didessa. Assault boats ferried the infantry across to a flank, and then rafts were used, as with the equipment available it took two days to get a bridge across. In all about twelve bridges were built, generally using S.B.G. This equipment was eminently suited for bridging the deep clefts encountered, though for some gaps the Italian Meccano equipment proved useful. On the River Omo the S.A.E.C. units with the South African Brigade had considerable work in clearing minefields.

Part of the force then turned northward and joined General Platt's force for the attack on the Italian stronghold at Amba Alagi. Here, after a spirited defence of a strong but isolated position, the last large force of Italians, under their Viceroy the Duke of Aosta, surrendered to a combined force of Indian, South African and Abyssinian irregular troops on 16th May. Later, in the operations leading up to the capture of Gondar, South African Engineers replaced a blown-up bridge on the Dessiye escarpment by a causeway of some 2,000 forty-gallon oil drums.

Advance into Southern Abyssinia

Meanwhile other South African forces moved north from the Kenya border in the neighbourhood of Lake Rudolf. In December, 1940, the South African Division was feeling its way forward from Marsabit in Kenya towards the Abyssinian border east of Lake Rudolf. By the beginning of January it had driven the enemy from the water springs at Lalacha and North Horr and occupied Dukana. Marsabit is on a large and sprawling mountain of volcanic origin with numerous extinct craters. The route of the division lay from Marsabit village E.N.E. about thirty miles down the mountain to the Chalbi desert. Then over the desert for about sixty miles to North Horr, and thence over about sixty miles of, what those who had travelled it considered, the worst dry weather track in the world, to Dukana.

The Chalbi desert is an area which is for about six weeks in the year a shallow lake, and for the ensuing four and a half months an impassable swamp. For the rest of the year it is a flat sandy desert which is easily passable by M.T. As the rains were due in March, the deviation of the line of communication to a safer route was imperative. After many reconnaissances for alternative routes had

been made it was decided to construct a road round the western side of the Chalbi desert and along the eastern shores of Lake Rudolf, and thence eastwards again to North Horr. This route would, however, have to pass over an escarpment from 200 to 500 ft. high with a 45° slope, and consisting of a layer of lava boulders lying on volcanic dust.

The field companies S.A.E.C. literally clawed a number of tracks along the escarpment from water hole to water hole. The heat in this lava strewn country was intense, and there were no trees to give shelter to the workers even in their rest periods. Though the South African Sappers and their native assistants suffered severely from the pitiless sun they worked on grimly. The tracks they made were rough and tortuous, but were all that could be provided in the time, and, when the rains came and the Chalbi desert became impassable, they served as the main L. of C. during the critical period.

Following up the field companies three road construction companies, assisted by six companies of East African Labour Corps, made the road more suitable for heavy traffic. Considerable changes had to be made in the original alignment, but, in spite of this and the natural and climatic difficulties, a road over which motor vehicles could move slowly was completed by 25th February to Mega, which had been captured on the 18th. Work on further improvement started immediately, and by 1st April a first-class road on which M.T. could move continuously at high speed was completed.

Survey

In March, 1939, when Hitler invaded Czecho-Slovakia, a scheme was initiated for the formation in case of war of an East African Field Survey unit from surveyors of the Tanganyika Department of Lands and Mines. This unit was mobilized on the outbreak of war and became 1st Field Survey Company, East African Engineers, personnel being drawn from all the British colonies in East Africa. They were joined, as troops from those countries arrived, by similar survey units from Southern Rhodesia and West Africa, which with the first named unit formed an East African Survey Group under Lieut.-Colonel J. E. S. Bradford, E.A.E. of S. Rhodesia. Later 1st South African Survey Company S.A.E.C. joined the group.

In July, 1940, an East African Command Survey Directorate was formed, Lieut.-Colonel Bradford acting as D. Director pending

the arrival of Colonel M. Hotine in November. Colonel Hotine remained in East Africa only until February, 1941, when Colonel Bradford reassumed the duty. When the advance began in December, 1940, Survey sections were formed and attached to each of the three attacking divisions.

In spite of the rapid pace of the advancing forces, the shortage of transport, and the lack of up-to-date maps, the troops were supplied with maps throughout the campaign. This was largely due to the work carried out by the survey units before operations commenced and the equipment of the South African Survey Company, reinforced later by personnel and more modern equipment supplied from Middle East resources.

ERITREA

Situation on the Outbreak of War with Italy

When Italy entered the war in June, 1940, only small mobile columns of the Sudan Defence Force backed by three British battalions were available to meet the vastly superior forces of Italians on the frontiers of Eritrea and Abyssinia. These troops were reinforced in September, 1940, by the arrival of 5th Indian Division, commanded by Major-General L. M. Heath[1] (C.R.E. Lieut.-Colonel A. H. G. Napier[2]), in which the divisional engineers were represented by 2nd, 20th and 21st Field Companies and 44th Field Park Company, Sappers and Miners. But still the British troops, commanded by Lieut.-General W. Platt,[3] whose staff included Brigadier R. MacK. Scobie, late R.E., as Chief of Staff, Colonel G. F. H. Alms as C.E., and Colonel E. E. Read[4] as D.C.E., were very inferior numerically. Even so, in accordance with General Wavell's aggressive policy, offensive patrolling and limited attacks were carried out in the neighbourhood of Gallabat and Kassala which were held by Italian forces guarding the two main routes into Eritrea towards Gondar and Asmara respectively. During these operations the main preoccupation of the Sappers and Miners was to prepare for the coming offensive. This included the development of water supply, improvement of roads, and ford and ferry crossings over the Atbara and other rivers. While offensive action was the main policy, defensive measures were also taken in view of

[1]Lieut.-General Sir L. M. Heath, K.B.E., etc.
[2]Colonel A. H. G. Napier, O.B.E.
[3]General Sir W. Platt, G.B.E., etc.
[4]Brigadier E. E. Read, C.B.E., M.C.

our inferiority in numbers, and these involved the preparation of defences including concrete pillboxes, wire obstacles, and minefields, and arrangements for the cratering of airfields. In this work the Engineers of 5th Indian Division were assisted by 6th and 8th Army Troops Companies and 16th Workshops and Park Company, S. and M.

For the coming operations bases were prepared at Port Sudan, Atbara and Khartoum. This entailed the building of administrative installations, accommodation, etc., with the necessary roads and railways. The work was not easily carried out, as it was performed in a great hurry, in areas where few buildings existed beforehand, with little material available locally, and far from sources from which the latter could be provided.

Early in November, 10th Indian Brigade captured the Italian fort at Gallabat but was unable to advance farther to take Matemma, and, owing to the superior performance of Italian aircraft over the somewhat obsolescent types that the R.A.F. were compelled to use in this subsidiary theatre, the enemy gained complete control of the air. Consequently our force had to withdraw from Gallabat but not before 21st Field Company, S. and M., had destroyed all usable buildings and stores in the fort.

After the battle of Sidi Barrani, in December, General Wavell, as already recounted (page 237), seized the opportunity to relieve 4th Indian Division (C.R.E. Lieut.-Colonel R. V. Cutler), under Major-General N. de la P. Beresford-Pierse,[1] in the Western Desert and to send it to reinforce the troops under General Platt on the Eritrean frontier. Its arrival there in January, 1941, made an advance into Eritrea feasible.

The campaign in that country has been compared to one on the North-West Frontier of India, carried out by completely mechanized forces against a European enemy with all the up-to-date weapons of modern warfare. It was a dry country of precipitous mountains and deep valleys. While the Italians had built a few fine motor roads, elsewhere only fair-weather and mule tracks existed. In few places was it possible for motor transport to move off the roads or better tracks. Under such conditions the improvement, repair, and maintenance of roads and tracks was to become the chief preoccupation of engineer units. The Indian Sappers and Miners were well experienced in making roads and tracks in such country, and, in spite of a great paucity of mechanical plant at this stage of the war,

[1] Lieut.-General Sir N. L. de la P. Beresford-Pierse, K.B.E., etc.

they carried out their tasks in good time. The Italians in their turn did all they could in their withdrawals to make the task more difficult. Not only did they destroy the few existing bridges and cratered the roads extensively at points where clearance and repair would be difficult, but they scattered mines liberally amongst the debris and along the roads and their verges. The detection and clearance of these mines was for the Sappers and Miners a new experience, though those of 4th Indian Division had had some slight practice before leaving the Western Desert. Equipment at this time did not include mine detectors. The units had therefore to evolve methods by experiment for dealing with the menace, relying mainly on the elementary means of probing and feeling.

Undeterred the Sappers set to work and, though suffering serious casualties in gaining their experience, soon won renown by their efforts.

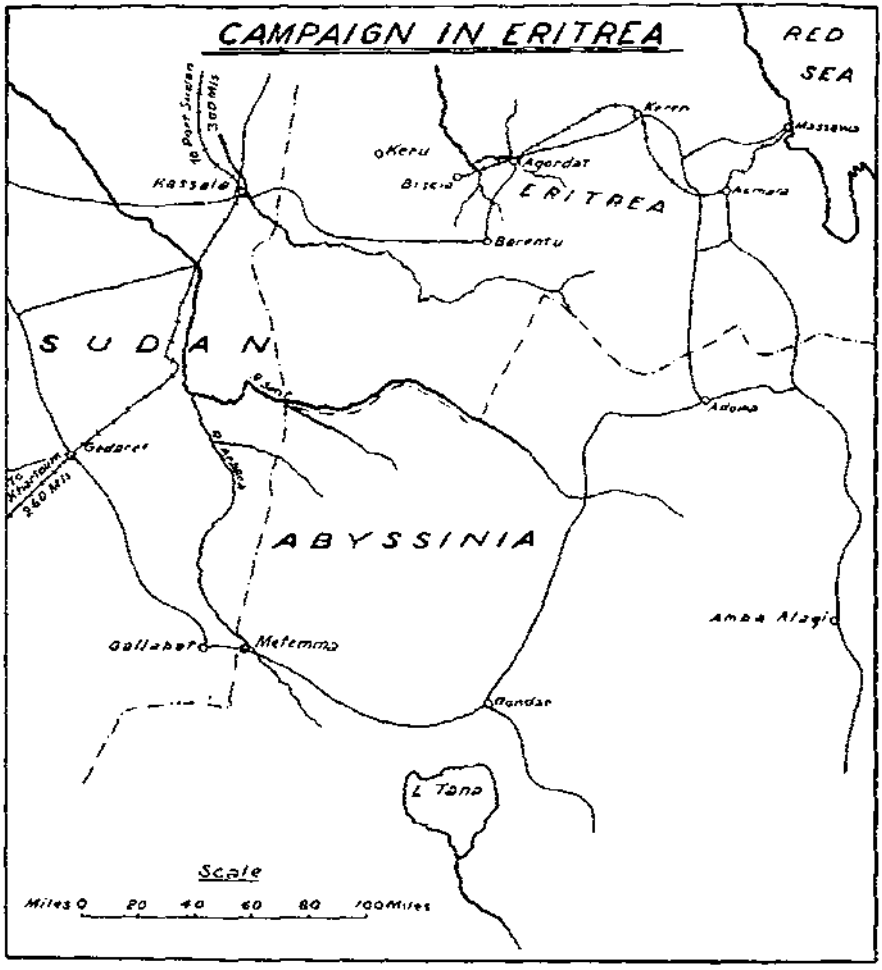
Advance into Eritrea

General Platt decided to make his main thrust from Kassala towards Asmara with the mass of his two divisions, but, in order to deceive the enemy as to his intentions, 9th Infantry Brigade of 5th Indian Division, which had relieved 10th Brigade opposite Gallabat, was instructed to keep up activity and to give the impression of a contemplated advance on Gondar. On 1st February, it was found that the enemy had withdrawn from Gallabat, and a small mobile column of all arms, and including a detachment of 21st Field Company S. and M. under 2nd Lieutenant Premindra Singh Bhagat[1], was sent to follow them up. The pursuit soon encountered numerous minefields and scattered mines. Bhagat led the column in a carrier standing next the driver and looking for any disturbance on the surface of the ground which might indicate the presence of mines. For four days Bhagat carried on and enabled the column to advance 55 miles. For his gallantry he was awarded the Victoria Cross, the first to be won in the Indian Army in World War II. The story is best told in the words of the citation:—

"For a period of four days and over a distance of 55 miles this officer in the leading carrier led the column. He detected and supervised the clearing of fifteen minefields. Speed being essential, he worked at high pressure from dawn to dusk each day. On two occasions when his carrier was blown up with casualties to others, and on a third occasion when ambushed and under close enemy

[1]Colonel P. Singh Bhagat, V.C.

Map 7


CAMPAIGN IN ERITREA
RED SEA
To Port Sudan 360 Mls
Kassala
Keru
Agordat
Barentu
Keren
Massawa
Asmara
ERITREA
SUDAN
Gedaref
To Khartoum 360 Mls
Adoma
ABYSSINIA
Gallabat
Metemma
Mandar
Amba Alagi
L Tana
Scale
Miles 0 20 40 60 80 100 Miles

fire, he himself carried straight on with his task. He refused relief when worn out with strain and fatigue and with one eardrum punctured by an explosion, on the grounds that he was now better qualified to continue his task to the end.

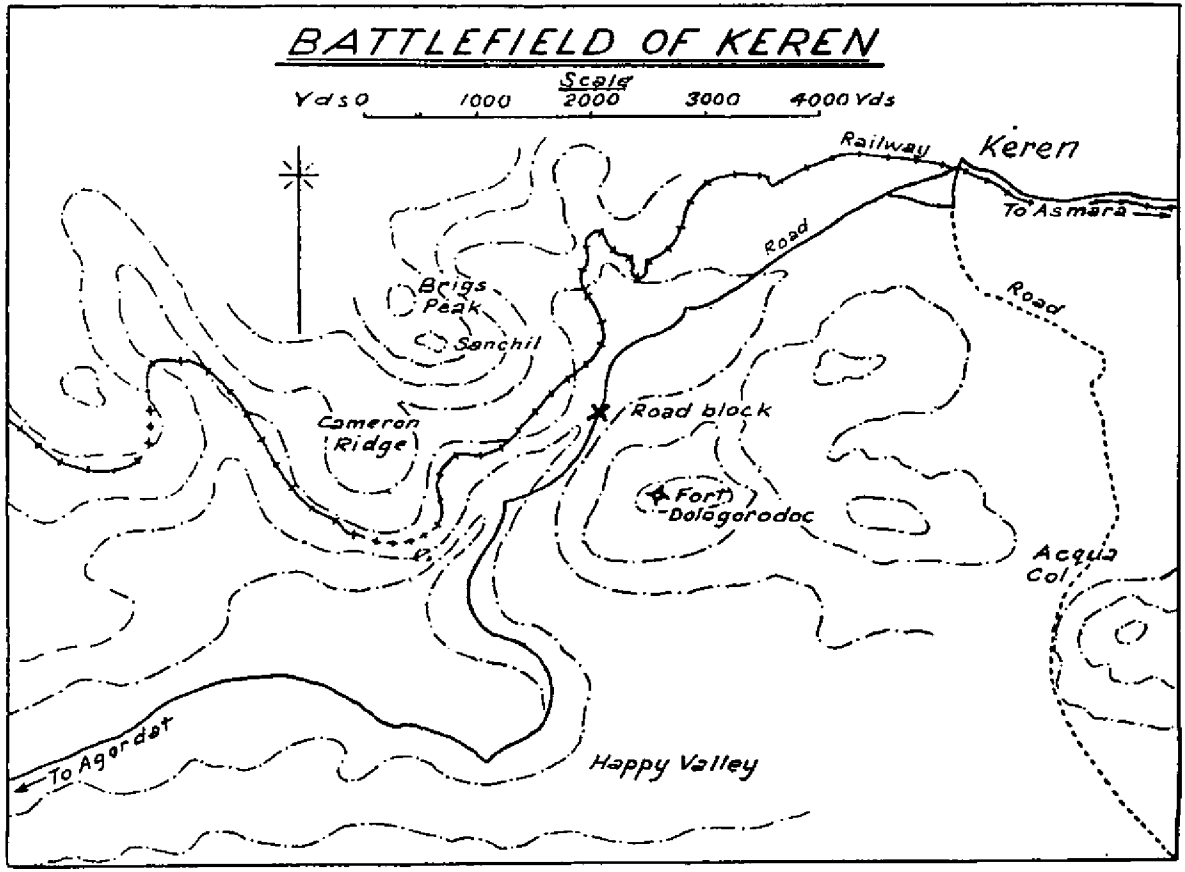
"His coolness, persistence over a period of 96 hours, and gallantry not only in battle but throughout the long period when the safety of the column and the speed at which it could advance were dependent on his personal efforts, are deserving of the highest recognition."

But to return to the main offensive. After some preliminary operations, Kassala was occupied on 18th January. The capture of the town opened up two routes forward, one on the right to Barentu, and the other to the north by Keru towards Agordat; 5th Division were directed on the right hand route and 4th Division on the left.

The Italians had retreated fast, carrying out extensive demolitions and sowing minefields. With the assistance of the Sappers and Miners in clearing the obstructions and making deviations, the two columns advanced till checked in front of strong positions at Barentu and Keru respectively. A brigade from 5th Division was accordingly sent by a poor track leading to Biscia to threaten the left rear of the Italians holding Keru who had not thought the track from the south to Biscia practicable. But they had underestimated the powers of the Sappers and Miners and the determination of the Indian troops and their commanders. Because of this threat they had at the last moment to throw out a small detachment to hold off the flanking party while their main body withdrew from the Keru position.

The Italians continued their retreat closely followed by the British forces, first to Agordat and thence to the extraordinarily strong natural position at Keren. With Keru cleared 10th Infantry Brigade, with 2nd Field Company still attached, turned back to assist their own (5th) division at Barentu by once more striking across country to cut the main motor road from Barentu to Agordat: this was the line of withdrawal and right rear of the Italian force in Barentu. The Italians had prepared a major demolition on this road to be blown after the withdrawal of their force at Barentu to Agordat. In view of the threat from 10th Brigade they now blew the charges prematurely, bringing down the hillside for more than 100 yards on to the road, and cutting the line of their own retreat. Enormous blocks of rock, some as big as tanks, were piled on each other in a gigantic landslide which took 2nd Field Company five days to clear. Barentu fell to the rest of the division; the Italians, their line of retreat to join their main body at Agordat cut, struck

Map 8


BATTLEFIELD OF KEREN
Scale
Yds 0
1000
2000
3000
4000 Yds
Railway
Keren
To Asmara
Road
Road
Brigs Peak
Sanchil
Cameron Ridge
Road block
Fort Dologorodoc
Acqua Col
To Agordat
Happy Valley

off by tracks towards the road leading from Aressa to Asmara. With Barentu in our hands and the road block cleared, 5th Division, leaving a mobile force to follow up the Italians towards Aressa, moved to join 4th Division at Agordat.

This town had been captured by 4th Division on 1st February. In this battle 4th Field Company, S. and M., had taken a prominent part. They had been employed making tracks for two battalions holding a hill feature, and at a time of stress assisted by carrying water and ammunition up to the forward troops. On 30th January, when the situation of the two battalions became critical and there was a danger of their being driven off the hill, a section of the company was ordered to fill a gap in the defence. Later other sections of the unit were also employed as infantry, one detachment under a Jemadar leading a bayonet charge to capture a troublesome machine-gun post. In a special order of the day the Divisional Commander complimented 4th Field Company as follows: "There is no doubt that their steady labour on improving tracks, bringing up water, helping to hold the position, and finally taking part in a very spirited bayonet charge, contributed to a large degree to the success of the operation on Mt. Cochen."

Battle of Keren

The capture of Agordat and the advance towards the Italian position at Keren considerably improved the communications of General Platt's force. The main motor road from Kassala through Barentu to Agordat was now available for the maintenance of the force instead of the poor road through Keru on which 4th Division had up to now been dependent. The railway from Asmara through Keren extended to Biscia. But in their retreat the Italians had blocked the roads and railway with craters and artificial landslides; the railway being most effectively blocked by the wrecking of truckloads of stone in many tunnels in which rails had been removed. A large steel four-span bridge over the river Baraka near Agordat, and named Ponte Mussolini, had been damaged and rendered unusable, while several railway trucks had been captured, and the Italians had taken away all the locomotives. The railway was badly needed to bring up stores and ammunition for the attack on Keren. The Sappers and Miners by great efforts cleared and repaired the road and rail track. Ponte Mussolini was first by-passed by a low-level road deviation, and later patched up by 6th Army Troops

Company, S. and M., for use by the railway, the rolling stock of which had to be improvised. The track was so repaired that a lorry, with its wheels outside the rails could tow railway trucks up the line to the front. There was no way of reversing at the end, so the lorries were run up on to the empty trucks which ran then by gravity back to the depot at Biscia, the line being a down gradient the whole way from Keren. The repaired Ponte Mussolini was rechristened Ponte Platt.

The Italian position at Keren was by nature enormously strong and had been fortified with considerable skill and effort by the Italians who had already collected seventeen battalions for its defence and reinforcements were brought up later. The town of Keren itself, 4,300 ft. above sea level, stood on the western edge of a plateau the escarpment of which fell from the town some 2,500 ft. to the valley up which the British forces were now advancing. As the latter approached they were confronted by a huge mass of steep rugged mountains covered with enormous granite rocks between which grew a prickly bush more effective as an obstacle than any barbed wire entanglement. Through a twisted gully in the centre, the Dongolaas Gorge, the road and railway climbed upwards with many turns and bends amongst the dominating features which thrust out in front of the range and built up tier on tier to the summit. Only at one other point in the range was there any easing to the steepness of the climb. This was to the south where an indifferent track ran up through Acqua Gap from the Happy Valley which lay across the front of the position.

To the natural strength of the position the Italians had added fortifications. Every dominating feature and ridge was crowned with defensive posts cut into the rocky hill tops, and so placed that the garrisons could direct murderous fire of small arms and hurl down grenades on troops advancing against them or endeavouring to make their way up the easier valleys.

Half-way up the Dongolaas Gorge, and at a spot on which it was not possible to get direct observation, the Italians had blown down a large block on to the one and only road. Without closer inspection than could be made from in front of the position it was not possible to estimate how long it would take to get a way for tanks, guns and transport through the block to the summit, but from distant inspection and air photographs it was thought the job would take about ten days of unimpeded work.

When our leading troops arrived in front of the position on the

evening of 2nd February, it was hoped that by vigorous action it might be possible to rush the position before the Italian garrison had settled down and before they could be reinforced. Several attempts were made in the first few days, and several peaks were captured only to be lost again when the attacking troops, exhausted by their climb, and with difficulty supplied with ammunition and supplies, were counter-attacked by fresh Italian troops from crests higher up the hills. Till the Sappers and Miners could improve the road and repair the railway leading from the rear it was not possible to maintain both divisions forward and build up reserves for an all out attack. So, while the combined engineers of the force toiled away to improve the communications and develop the water supply, 5th Division was held back and trained for the assault.

It was, therefore, not till 15th March that an assault could be staged. As a result of this, Fort Dologorodoc to the right of the main road and several of the lower ridges to the left were taken and held in spite of determined counter-attacks.

It was accordingly possible on the nights of 16th and 17th March for Sapper and Miner officers to reach and reconnoitre the road block in the Dongolaas Gorge, through which it was now thought possible that a way could be cleared in forty-eight hours' work. On the nights of 18th and 19th with a covering party of infantry, attempts were made to clear the block. But the enemy positions in the neighbouring hills so dominated the place by fire that the attempts had to be abandoned after the Sappers and Miners had suffered heavy casualties.

From his experience on these occasions, Lieut.-Colonel Napier, C.R.E. 5th Indian Division, considered that if certain Italian posts could be captured and held for two nights and a day he could undertake that a road for tanks could be cleared through the block. As the attack on the enemy posts could best be launched at dawn, the Sappers were given two days and a night for their task. Accordingly early on the morning of 25th March, 10th Infantry Brigade assaulted successfully the dominating posts on what were known as the Railway Bumps. At 6.30 a.m. 2nd Field Company started work on clearing the block. In turn, relieving each other every five hours, the three field companies of 5th Indian Division and 4th Field Company from 4th Division carried on and, in spite of frequent shelling, in thirty-two hours a track fit for tracked vehicles was through. Accordingly on the evening of 26th March an attack was launched up the Dongolaas Gorge and, assisted by tanks, swept onwards.

The enemy had had enough and were streaming away towards the capital Asmara. The Battle of Keren had been won after seven weeks' stubborn fighting. Hurriedly the Sappers and Miners improved the track through the block and soon vehicles of all natures and guns were hurrying forward in pursuit.

The Pursuit and Occupation of Asmara and Massawa

From Keren to Asmara, which was surrendered without a fight, the country was similar and, the enemy having made many road blocks and craters, the Sappers and Miners were kept more than busy, though casualties were light as the enemy seldom defended the blocks with any determination. On the evening of 31st March, 2nd Field Company cleared the last block before the city and next morning our troops entered the capital.

One of the chief problems now was the handling of the large numbers of prisoners which had fallen into our hands. They proved, however, extremely docile and little work fell on the Sappers and Miners in the preparation of cages. The captured Italians even assisted happily in the work of clearing further road blocks on the way to the Port of Massawa. At one block the work was carried out by the party which had just made the demolition and a Free French poilu, under whose eye they were working, brandishing a large stick, described the work of his "Party" as "Magnifique! Merveilleux!"

On 9th April, Massawa was occupied, but great damage had been done to the port and civil installations. More than twenty ships had been scuttled, some across the entrance, some against the quays, and others in the outer harbour, and workshops wrecked. Sapper and Miner units started the rehabilitation of port and town, till relieved by the reformed civil administration.

Meanwhile 7th Field Company S. and M. had accompanied Major-General Briggs' Force which, in February 1941, worked down the Red Sea littoral threatening the right flank of the enemy. As this force was of no great strength the chief task of the Sappers was to exaggerate its apparent size by building dummy airfields and camps, this in addition to the normal jobs of improving tracks and developing water supply for the force.

With Massawa in our hands and the Italian army in Eritrea destroyed, part of 5th Indian Division turned south to co-operate with the forces of General Cunningham: these having advanced through British Somaliland had captured Addis Ababa and were moving on the Duke of Aosta's last stronghold at Amba Alagi. This

operation has already been described in the section which gives the story of the work of Empire Sappers in the campaign in East Africa.

SURVEY

The 514th (Corps) Field Survey Company arrived at Khartoum during the winter of 1940–1, where it was immediately fully employed in preparing maps for the forthcoming operations against the Italian forces in Eritrea and in carrying out a triangulation survey to form a basis on which a trig control could be carried forward when the British force advanced.

After the capture of Agordat, early in February, the pace of the advance was so rapid that triangulation could not keep pace. Accordingly this work was suspended and the company moved forward to the Keren front. Here the unit established a new triangulation control, based on Italian data, and on this produced a number of maps for use in the operations.

CRETE, 1940 (see Map 10 on page 278)

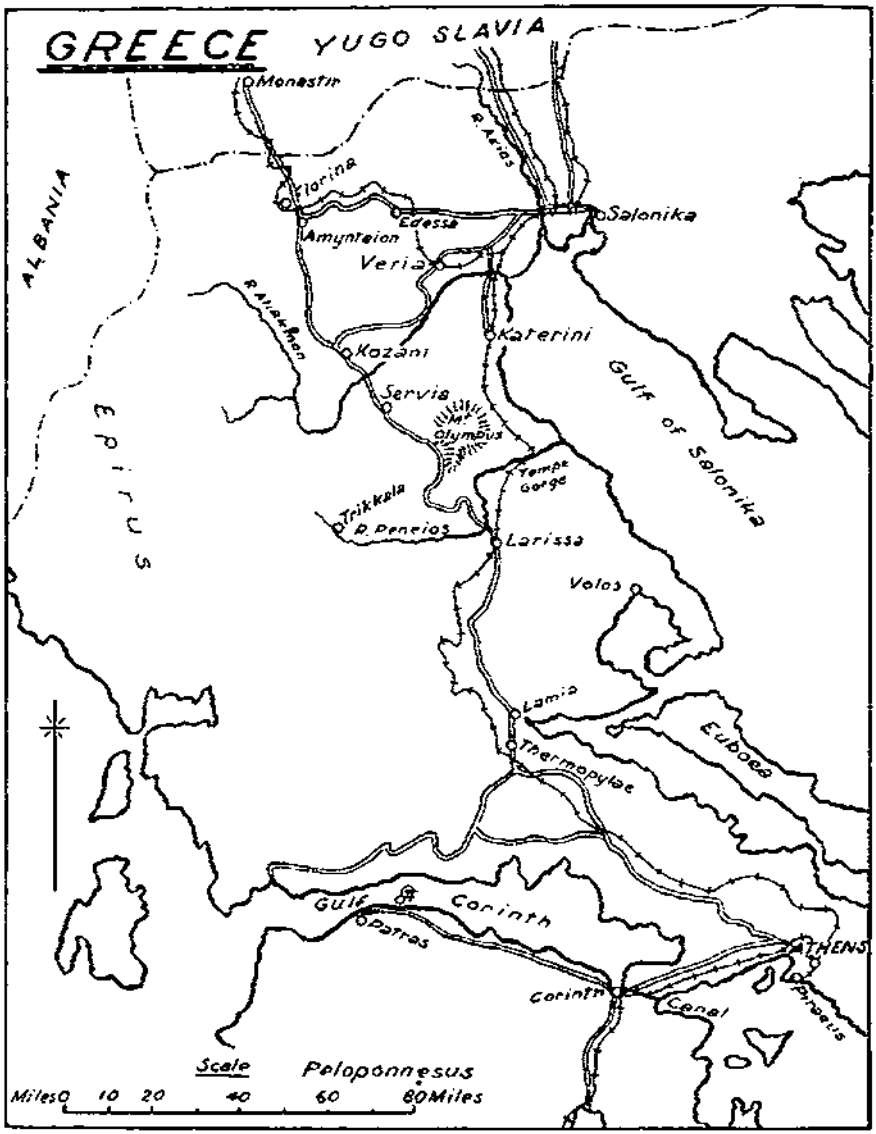
In September, 1940, Crete was occupied by an infantry brigade which was accompanied by 42nd Field Company R.E. (Major E. F. E. Parker[1]) with the role of denying the island to the enemy and of establishing a base there for a division destined to clear the Italians from Rhodes and the adjacent islands. At first the field company was employed on providing accommodation for the brigade and improving the jetty at Suda Bay for the landing of troops and stores.

In November, 1940, it was decided to fortify the island against attack and, to carry out the necessary work and to press on the preparations for the accommodation of a division, a C.R.E. (Works) (Lieut.-Colonel P. A. Clauson) and a small staff were sent from Egypt. The work consisted of accommodation work on billets and hired storage, erection of service depots in standard steel shedding, improvement of jetties and communications in the port of Suda Bay, the reconstruction of the poor road from Suda to Heraklion, and the emplacement of coast defences and anti-aircraft guns, the supply of stores for the R.A.F. Civil Works and Buildings organization which was responsible for improving and constructing airfields.

When in April, 1941, the situation in Greece deteriorated (see pages 272–275), further work was undertaken to prepare bivouac

[1]Lieut.-Colonel E. F. E. Parker, O.B.E.

Map 9


GREECE
YUGO SLAVIA
ALBANIA
Monastir
R. Aras
Florina
Edessa
Salonika
Amyntaion
Veria
R. Aliakhmon
Kozani
Katerini
Gulf of Salonika
Servia
Mt. Olympus
Tempe Gorge
Trikkala
R. Peneios
Larissa
EPIRUS
Volos
Lamia
Euboea
Thermopylae
Gulf of Corinth
Patras
ATHENS
Corinth
Canal
Piraeus
Peloponnesus
Scale
Miles 0 10 20 40 60 80 Miles

areas for the troops to be evacuated from that country and to construct defence works at important points in the island, including a large underground headquarters in the side of a hill east of Canea. The whole of these two programmes was well advanced when required, in spite of the small numbers of Royal Engineers; the transport available; the difficulty of getting rapid results from local contractors or Government organizations, and the fact that the mobilization of the Greek forces had denuded the island of useful labour.

The story of the arrival of the troops from Greece, the German attack on the island, and the ultimate evacuation belong to that of the expeditionary force which fought in Greece, as described below.

GREECE

Negotiations with Greek Government

At the end of October, 1940, Italy made an unprovoked attack on the northern frontier of Greece through Albania. Their troops had been repulsed and driven back into Albania by a swift Greek counterstroke, and during the winter of 1940–1, in appalling conditions and through most difficult country, the Greeks kept up the pressure and drove the Italians steadily back into Albania. A small British air force with certain Army units was sent to the assistance of the Greeks in November, 1940. Included in this force was a section of 292nd Army Field Company and a detachment of 111th Workshop and Park Company.

A detachment of Kent Fortress R.E., which had been trained for, and employed on, the demolition of oil refineries and stocks in Belgium and Holland (see Chapter IV), was also dispatched to be ready to ensure, in case of an Axis success, that important stocks of this commodity did not fall into the hands of the enemy.

At first the German High Command seemed disinterested in the Italian misfortunes in Albania as well as in Libya, but early in 1941 German troops were fully established in Rumania and it became clear that a further movement south-east was contemplated.

In January, an offer by the British Government of armoured troops and artillery was declined by the Greeks for fear of provoking German aggression without being strong enough to check it. On 8th February, however, the Greek Government inquired what help could be given in case of a German attack through Bulgaria. It will be remembered that on that date the last remnants of the Italian army in Cyrenaica surrendered south of Benghazi. General Wavell

was therefore instructed that the campaign was to be stopped on the western frontier of Cyrenaica, and that he should be prepared to send the maximum force possible to Greece. After further consultations with the Greek Government and Commander-in-Chief, it was decided to send the following force to Greece, under Lieut.-General Sir H. M. Wilson.

1st Armoured Brigade.
2nd New Zealand Division, C.R.E. Lieut.-Colonel G. H. Clifton, R.N.Z.E.
6th Australian Division, C.R.E. Lieut.-Colonel L. C. Lucas, R.A.E.
Polish Independent Brigade Group.
7th Australian Division. C.R.E. Lieut.-Colonel R. J. H. Risson, R.A.E.

The majority of these troops being drawn from the Dominions only one field unit R.E., 3rd (Cheshire) Field Squadron, besides the section of 292nd Field Company, accompanied the force, though a number of Works and Transportation units were also included.[1] Brigadier H. P. W. Hutson from Western Desert Force was appointed C.E.

It had been hoped that the mass of the Greek armies would withdraw from their exposed positions in Albania and the Macedonian frontier, and concentrate with the British Force for the defence of a shorter line in Northern Greece, and indeed this course had been agreed on by the Greek Commander-in-Chief. However, when German forces entered Bulgaria on 1st March, the Greek General feared the effect of such withdrawals on the morale of his armies, and decided to try to maintain his position, placing only a limited number of Greek troops under General Wilson to co-operate with the British in the defence of a line north-east of Mount Olympus and thence northward to the frontier with Jugoslavia.

Arrival of British Force

The first flight of the force, including the 1st Armoured Brigade Group, with 3rd (Cheshire) Field Squadron, disembarked at

[1]Note. These R.E. units were: 580th Army Troops, 121st Road Construction, 127th E. and M., 708th General Construction, 738th Artisan Works, and the remainder of 111th Workshops and Park Companies, and 4th Boring Section. Transportation units: 1001st and 1003rd Docks Operating, 1039th Port Operating, and one section 1000th Docks Maintenance Companies, and a Transportation stores detachment. Survey units are referred to on page 277.

Piraeus on 7th March, and immediately moved to its forward concentration area, where it was given the task of operating east of the defensive position in order "to cover the occupation of the position and the preparations for demolitions by the Royal Engineers". The New Zealand Division had completed its concentration near the right of the position on 2nd April, by which date 6th Australian Division was disembarking at Piraeus and starting to move forward.

The Country

To appreciate the problems facing the force in general, and the engineers in particular, it is necessary to have some idea of the nature of the country and its communications. To the Greeks the sea had always been the national medium of travel uniting diverse and widely separated regions. Coastal shipping had traditionally been the means of internal communication and there had been little incentive to create a large scale road or rail transport system. The Routes Nationales were few, but fit for motor traffic. Roads across high and mountainous country were almost all of a very poor quality, and even the better roads were but secondary by our standards. Tracks were many but for the most part fit only for mules.

The difficult gradients of the interior and the lack of adequate finances had also limited the construction of railways. There was only one standard gauge line connecting Southern and Northern Greece and the rest of Europe. This ran near the east coast from Athens to Salonika, following generally the path of the main road joining those two places, except that north of Larissa it ran generally parallel to the Peneios River, and through the Vale of Tempe to the coast. This it follows through Katerini to be joined again east of Veria by the road which runs through a pass west of Mount Olympus and Kozani. Through most of its length the railway was single tracked with heavy gradients and sharp curves. Its traffic capacity was therefore not great.

This single road and rail link between the forward position of the force and its base was a very precarious life-line on which a modern army might depend. Maintenance and improvement of this, and of all roads which served, or might serve, any part of the force were therefore of the highest importance.

None of the roads had been intended for the burden imposed by a constant stream of heavy military traffic. Even the main Athens–Salonika road was only lightly metalled and liable to break up under sustained traffic, and had many stretches where two-way

traffic was impossible. There was no modern road-building equipment in Greece, and the British had been able to bring very little with them. What had been made available from the spare supplies in the Middle East seldom got beyond the docks. Local labour, which was organized by villages, consisted of old men, women and children with no transport and little equipment save shovels, wheelbarrows, and hand rammers. Finally the mostly one-way roads were so congested with military traffic that it was almost impossible to do any work on them.

Under such circumstances of strategic position and terrain, the chief tasks of the engineers were, the delaying of the advance of the enemy against the selected position, the strengthening of the position itself, and the preservation and improvement of communications in rear.

The line originally chosen for defence ran from the Aegean Sea east of Mount Olympus to Veria and Edessa, and thence northward to the Jugoslav frontier. Its length was approximately a hundred miles, through high mountains in which were four main passes—those on either side of Mount Olympus and those at Veria and Edessa. The railway ran between Mount Olympus and the coast, and roads through each of the other passes.

German Invasion. Occupation of Olympus Line

The British force was hurried forward from Piraeus as fast as the disembarkation of units would allow, and the New Zealand Division had completed its concentration in the right-hand end of the position covering the passes on each side of Mount Olympus by 2nd April. But on 5th April, when the German armies started their invasion of Jugoslavia and Greece, 6th Australian Division were only beginning to assemble in their position about Veria. Away to the left in the mountains were the Greek troops whose pack and oxen-drawn transport was much more suitable for such country than the British mechanical vehicles. To meet a threat from German troops which might move through Jugoslavia to strike between General Wilson's force and the main Greek forces in Albania a detachment was formed, under the Australian Major-General Mackay, about Amynteion.

First contact with the enemy was made on 8th April, when 1st Armoured Brigade encountered elements of the enemy on the line of the River Axios. After blowing the prepared demolitions on their covering position, the Brigade, accompanied by 3rd Field Squadron and the section of 292nd Field Company, withdrew and joined

General Mackay's detachment at Amynteion. This force was vigorously attacked on 10th April, but held its ground.

The whole position was however much too extensive to be held against a determined attack, and little time had been available for its consolidation. Besides the few Royal Engineers with the covering force, only the New Zealand Divisional Engineers had arrived complete at this time. Those of 6th Australian Division were only now arriving with their division. There had been very little time or personnel for preparing any extensive demolition scheme. It was therefore decided to withdraw to a shorter line running closer to Mount Olympus and along the River Aliakhmon. This move was carried out between 11th and 13th April, the engineers blowing what bridges they had had time to prepare. Amongst these was a large bridge over the Aliakhmon demolished by a detachment of 530th Army Troops Company R.E. which had been working in the forward area.

Decision to Withdraw to Thermopylae

Hardly had this move started than it became plain that the Jugoslav armies and the Greek troops on our left were disintegrating, so General Wilson, with the approval of the Greek Commander-in-Chief, decided to continue the withdrawal to the Thermopylae position covering Southern Greece, famous for the stand of Leonidas and his 300 Spartans against the Persian invaders in 480 B.C.

The schemes for the demolitions on both the forward lines had been considered in considerable depth and so gave a nucleus for the new schemes required for defence of the Aliakhmon line and for the further withdrawal. The mountainous nature of the country enabled demolitions to be made in defiles where diversions or repairs would prove difficult.

Roads were of vital importance to both sides. It was therefore of the utmost importance to keep them open as long as necessary for our own forces, and at the same time ensure that they were thoroughly destroyed before the enemy arrived. This caused considerable anxiety as, with the enemy in complete command in the air, there was always the danger of bridges behind our troops being cut by bombing, or the charges thereon being detonated by near misses. For this reason, where alternative routes did not exist, special precautions had to be taken to provide relief crossings, and where manpower permitted, on important bridges, charges were not inserted till the situation so demanded. Besides normal explosives a

number of depth charges had been "borrowed" from the Navy by C.R.E. New Zealand Division. These formed convenient ready made up charges, although, being complete with their primers, they were not very pleasant neighbours in a bomb-stricken area.

In the hurried withdrawal, harassed as it was by the full force of the German Air Force, it speaks well for the staff duties of the force and for the efficiency of the Empire engineers that the majority of the charges were blown successfully, and that there were few instances of a bridge being blown prematurely before rearguards could cross.

Lieut.-General Wilson in his Report on Military Operations in Greece says on the subject of demolitions: "These were generally speaking well chosen and prepared and with one exception blown at the right time. The exception was brought about by an officer of a Field Company who "experimented" on what he thought was an unimportant girder on a bridge. The explosion prematurely blew the bridge with serious results. The middle of a withdrawal is not the time for experiments of this sort."

The event referred to occurred at a bridge at Trikkala, west of Larissa. A field company officer of New Zealand Engineers reconnoitred the bridge and an estimate of the charges was worked out. Next morning a discussion ensued with officers of another field company as to the amount of explosive required. The result was that they decided to make a practical test, and strapped a 10-lb. charge to a girder which seemed unimportant. The charge was detonated, and the officers were horrified to see the entire span, of which the selected girder proved to be a part, drop into the river bed 30 ft. below.

A force guarding the left flank was due to come down this road and the blowing of the bridge cut their main line of retreat; 1st Armoured Brigade was also due to withdraw by this route. Luckily two other bridges on subsidiary roads existed and the troops were diverted to one of these. To guard against any further contretemps, the C.R.E. (Lieut.-Colonel Clifton) went personally to make sure that the alternative bridge would take the traffic and that no mistakes were made in the timing of its demolition, while a bridging party from the Field Park Company was sent to the site of the demolished bridge in case it should prove necessary to ferry troops across. Happily all the troops got safely across by the other bridge in darkness. Next morning, attacked by dive-bombers, a near miss detonated the gelignite charges and destroyed the bridge which had been used for the withdrawal.

In the retreat to Thermopylae General Wilson was most anxious about his left flank as it was known that the enemy had broken through the Greek troops in the mountains. The main pressure, however, came from the speed with which the enemy followed up the main body of the force. A determined resistance by New Zealand and Australian troops at the Peneios Gorge between 15th and 18th April allowed the main body of the Corps to withdraw unharassed by ground forces. As General Wavell reported in his dispatch on the campaign, "This action, together with other minor ones, and the use of skilful demolitions, prevented the enemy's armour and mechanized units from following up closely."

Normally in a retreat of this nature demolitions which could not be kept under the close fire of the defence would not seriously delay the enemy's advance. In this operation a very satisfactory system of co-operation between Sappers and Gunners was built up and did produce sufficient delay in almost all cases to allow the rearguards to disengage. The hilly nature of the country and the paucity of roads helped to render the demolitions themselves more effective than they might otherwise have been if diversions had been more easily made. One or two demolitions are known to have held up the advance of armour and the enemy's main columns for appreciable times. In one case where, besides the demolition, a delay action charge timed to go off eighteen hours later was buried in an abutment, it is known that a delay of fifty-two hours was imposed, apart from the material and moral effect of the second charge going off when repair work was in hand.

The occupation of the Thermopylae position was completed on 20th April, and the New Zealand engineers carried out demolitions on the approaches: they also destroyed all shipping and small craft near by on the east coast which might be used by the enemy to pass parties round the right flank by water. Field companies also became railway operators and got as much as possible of rolling stock away to the south.

Evacuation from Greece

The port of Piraeus was now practically unusable from enemy air action, and it was impossible to bring in the remaining formations of the force: on 19th April, it was decided, with the full approval of the King of Greece, to evacuate the British Force. Owing to the capitulation of the Greek Army in Epirus the evacuation had to start four days earlier than was originally planned.

To cover the withdrawal from Thermopylae of the last brigade of the New Zealand Division a rearguard was formed which included R.N.Z.E. units to blow final demolitions and to keep the roads for retreat repaired. Owing to the fact that the demolitions formed a vital part in the duty of this rearguard, the C.R.E. asked for, and was given, command. This operation was completely successful.

As the remaining Hurricane fighter aircraft of the R.A.F. were destroyed on the ground, it was decided to embark the force from beaches in the Peloponnesus from which the sea trip to Crete would be the shortest possible. For such an operation the Corinth Canal, and the bridge over it, was of the highest importance in the first place to enable our troops to pass into the Peloponnesus, and then, when the bridge was destroyed, to act as an obstacle to the Germans. The bridge was prepared for demolition by 6th New Zealand Field Company and was then picketed by Sappers working in pairs, one pair at each end of the bridge. What exactly happened has not been clearly established. On the morning of 26th April, intensive bombing of the area round, but not of the bridge, was commenced by the German air force. Later parachute troops in considerable numbers were dropped on each side of the canal. In the middle of this the bridge was blown up, it is not certain by whom. The Germans undoubtedly wanted to capture the bridge intact and would not have intentionally destroyed it; in fact they were seen attacking the charges just before they blew up. The most probable explanation lies between two alternatives which are not mutually contradictory. The first of these, and that which was accepted at the time, gives the credit to an officer of the R.E., Lieutenant J. T. Tyson[1], in company with Captain Phillips of the Devonshire Regiment, both of whom were awarded the M.C. for their part in the destruction of the bridge. Tyson had brought up the explosives and delivered them to the New Zealanders the day before. He remained with Phillips to help him regulate the traffic across the bridge. When the German parachutists had landed and were approaching, Tyson and Phillips were lying some 200 yards from the bridge. The former, knowing that the charges were of gelignite, and therefore sensitive to rifle fire, suggested they should try to detonate the explosive by firing at one of the charges they could clearly see on one of the main girders. At the second shot the bridge went up.

[1]Major J. T. Tyson, M.C.

As a result of evidence of prisoners of war on release at the end of operations, the second theory came to light. This was that it was done on their own initiative by two men of 6th New Zealand Field Company which had prepared the charges and who were close by. On the arrival of the parachutists these two men were seen running towards the bridge. One was hit and fell before he reached it, the other was seen to get to the safety fuse and shortly afterwards the bridge went up. It would seem possible that this second man cut the fuse short, lit it, and was unable to get away in time. It is impossible now to say for certain whether it was a shot from the rifle of Lieutenant Tyson or Captain Phillips, or the action of the New Zealand Sapper which actually detonated the charge, or indeed whether or not both acted simultaneously. In any case great credit is due to the resourcefulness of Lieutenant Tyson, and at the same time it is quite clear that these two New Zealand Sappers, with a spirit of devotion to duty worthy of their Corps, at least attemped a very gallant action which should find its place in any record of the deeds of the Engineers of the Empire.

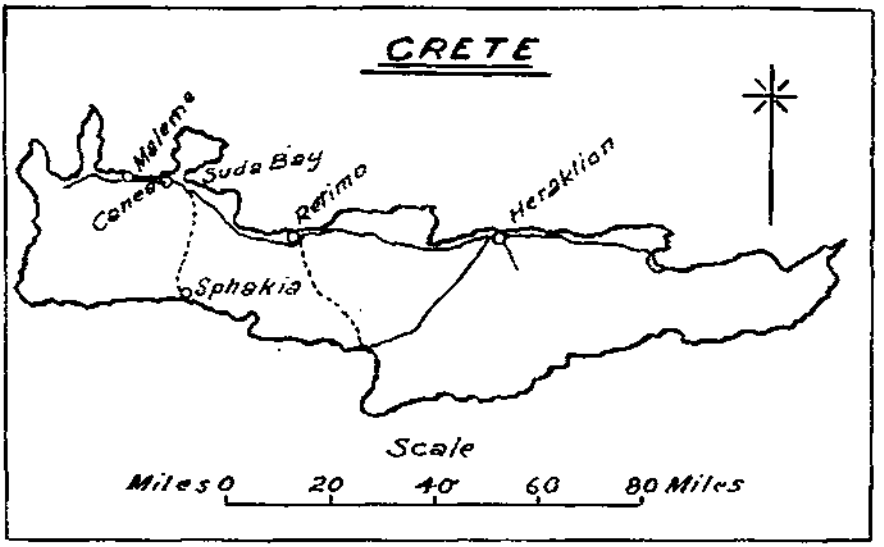
After the capture by the Germans of the Isthmus of Corinth there was little the engineers of the force could do, except as fighting soldiers, to assist the re-embarkation of the force.

Survey

The only maps of Greece available at the outbreak of war in the War Office were in most cases out of date and great difficulty was experienced in obtaining from the Greek authorities copies of their latest maps. When these were eventually received, it was found that names were printed in Greek characters and these had to be transliterated and new maps prepared. This led to considerable delay in production and issue and in consequence, using such maps as were available, it was found by the troops that different editions in their hands did not agree and most were inaccurate. By the time Commonwealth Survey units arrived in the country it was too late to produce standard maps of greater accuracy.

Thus Colonel M. Hotine, on arriving at the end of March, with a small advanced party of 512th (Army) Field Survey Company, found himself faced with an extremely difficult task, which was rendered almost impossible when, on the arrival of other survey units, including 517th (Corps) Field Survey Company, 9th Field Survey Depot, and an Australian (Corps) Field Survey Company,

Map 10



it was found that it was inadvisable to send forward heavy trailer-borne printing equipment over the bad roads on what was likely to be a mobile campaign. Moreover the technical stores of 517th Company were lost at sea when the ship carrying them was sunk through enemy action. Most of the efforts of the survey organization had therefore to be limited to operations in the neighbourhood of Athens, particularly to those required in connexion with the anti-aircraft defences.

Maps as they became available were issued by improvised means to formations, but, when the retreat commenced, it was found that maps of the areas then being fought over did not exist. Great efforts were made to remedy the situation but, owing to the rapid pace of events, little could be accomplished before the evacuation.

Oil Demolition

The detachment of Kent Fortress R.E. under Major H. C. West, to which reference has been made earlier in this chapter, had arrived at Piraeus on 9th December, 1940, the cruiser in which they were taking passage to Alexandria being involved in the naval action of 27th November.

Their orders were to prevent oil stocks and plant at certain places

in Greece falling into enemy hands. After making the necessary reconnaissances in the neighbourhood of Athens, the party were, as is so usual in such circumstances, employed on peace-time R.E. duties, repairing electric bells, etc., for the British Military Mission. Then, on 10th January, the party was ordered to prepare camps for two divisions, evidently in anticipation of acceptance by the Greek Government of the first British offer of help. These camps were in fact ready when the first troops of General Wilson's force arrived. Major West's detachment then proceeded by sea to Salonika, and on 7th April destroyed all petrol stocks and installations and also a considerable amount of dock machinery and equipment. The stores at Volos were found to have been destroyed by enemy bombing, and after assisting a Greek coast defence battery to destroy their guns, the detachment returned to Athens. Here it assisted in the cratering of roads leading to the city, and also destroyed stores and aircraft bombs at an airfield under construction at Arexos.

Evacuation to and Operations in Crete

As the German forces had complete command in the air, the embarkation was carried out under great difficulties from beaches and small harbours on the south coast of the Peloponnesus. Men could be taken on board only at night and even so the Royal Navy lost severely in the operation. Some personnel got away in local small craft, the Chief Engineer, Brigadier Hutson, arriving in Crete in a Greek caique. Little equipment was got away, and many men were left behind when the official evacuation finished though several were rescued later from beaches by individual small craft of the Royal Navy or in small boats. Thus, of the R.E. units, few except for some of the units working near Piraeus which were evacuated early, got away as formed bodies.

Of the 43,000 who were re-embarked 16,000 sailed straight to Egypt, the remainder landing in Crete where they were immediately disposed for the defence of the island, short as they were of equipment. The defence was chiefly concentrated on the ports of Suda Bay and Heraklion, and on the airfields, in order to prevent enemy invasion by sea or air. Even with the original garrison, the total strength available was but 28,000 with no field artillery and few anti-aircraft guns. The Engineers had no tools or equipment other than those of 42nd Field Company R.E., which had been working on the Island for some months, and what could be obtained locally. They were therefore used chiefly as infantry.

Owing to the heavy air attacks the few British aircraft were withdrawn on 19th May. On the morning of the 20th, after a heavy bombing attack, chiefly directed on Maleme airfield near Suda Bay, large numbers of gliders and parachutists descended near this airfield. Similar attacks on other parts of the Island occurred during the day. These airborne troops suffered heavy casualties or were eliminated, except those who, landing near Maleme, succeeded in capturing the airfield. This was recaptured during the night by two New Zealand battalions but they were forced to withdraw during daylight. It is estimated that 7,000 troops landed from the air on the first day, by far the largest airborne operation undertaken by any army to date. On the 21st and 22nd, troop-carrying aircraft continued to land on the airfield, about 600 troop carriers landing each day. Although their losses were heavy the enemy was now strong enough to drive the defenders from the neighbourhood of the airfield with the help of bomber and fighter aircraft.

What reinforcement was possible was sent to the island, but troops could be landed only by fast moving naval ships delivering at night and getting away long before daylight. No merchant ship could reach Crete in face of the enemy air superiority. The Germans also attempted to reinforce their troops by sea, but suffered heavily from gallant interceptions by ships of the Royal Navy. The latter drove in among the enemy convoys sinking many troopships, but incurred serious losses themselves.

By 27th May the situation had become hopeless. The base area round Suda Bay had been captured. Strong forces of the enemy had landed at the eastern end of the island beyond the reach of our troops. Air attacks were intense and the troops much exhausted. Major-General Freyburg,[1] who was in command, having previously commanded 2nd New Zealand Division in Greece, therefore decided that evacuation was the only course open. The Germans had command of the northern shores and embarkation was ordered from the beaches and small fishing villages on the south coast. No roads led over the mountains from the north, where our troops were in action, to the south coast. The troops had to make their way as best they could by rough hill tracks across the island. A few units, including one section of 42nd Field Company, were evacuated from Heraklion and reached Egypt in safety, though their ship was hit three times by aircraft bombs. The remainder of 42nd Company arrived after a nightmare march over the mountains, during which

[1]Lieut.-General Lord Freyburg, V.C., G.B.E., etc.

it carried out some demolitions to delay the enemy, to the south coast where it came under the command of a rearguard under Brigadier G. Vasey of the Australian Army and took part, acting as infantry, in the defence of a beach-head to cover the embarkation. As many as possible of the force were evacuated during the nights between 28th May and 1st June. It was impossible for the Royal Navy, in face of very severe losses from air attack, to continue embarkation after 1st June, by which date only 14,580 out of the 27,550 Imperial troops in Crete had been evacuated. Amongst those left behind were almost the whole of the party of 42nd Field Company: Major Parker, the O.C., was captured, and nearly all the rest were either killed or taken prisoner. Two sappers of the company managed to secure a dinghy which they sailed successfully to Egypt.

General Wavell in his dispatch considered that "the defences of Crete, though unsuccessful, undoubtedly frustrated the enemy plan for future operations by destroying so large a proportion of his airborne troops. The total enemy losses were at least 12,000-15,000, of whom a very high proportion were killed. The defence saved in all probability Cyprus, Syria, Iraq, and perhaps Tobruk."

CHAPTER XI

THE LEVANT, IRAQ AND PERSIA

Introductory.
Turkey—Preliminary arrangements—Arrival of British Engineers—1943 programme.
Palestine and Syria—The outbreak of war—Advance into Syria—French counter-offensive—Successful resumption of offensive—Defence of northern frontier—Improvement of communications—Base installations—Survey.
Iraq—Iraq rebellion—Siege of Habbaniya—Occupation of Baghdad.
Persia and Iraq—General Quinan's force and orders—Defence of northern Iraq—Occupation of Persian oilfields and Teheran—Aid to Russia—Nature of country and communications—Higher Engineer organization—Port development—Bases—Roads—Bridges—Railways—Inland water transport—Other projects.
Cyprus.
Aegean Islands.

(See Map 11 facing page 289 and Map 12 facing page 320 of this chapter, and Map 18 facing page 442 of Chapter XVI)

Introductory

We have seen (Chapter IX, pages 228, 229) that when General Wavell took over the newly formed Middle East Command in July, 1939, his responsibilities in peace covered Egypt, the Sudan, Palestine and Transjordania; while on the outbreak of war the area extended to include British Somaliland, Aden, Iraq, and the shores of the Persian Gulf.

In the last chapter we have seen what these responsibilities involved in Africa and Greece in the first months of the war, and the campaigns which were undertaken. The same and following periods were, for General Wavell, also full of anxieties, leading to operations in the countries of western Asia lying immediately east of the Mediterranean Sea.

The pre-war relationship of the British Government with those of the various countries concerned has already been discussed in Chapter IX. As long as Germany was the only enemy to be reckoned with there was no immediate danger of direct aggression in that part of the world. It was, however, one of General Wavell's first

duties to come to arrangements with Allied commanders, and potential allies in the area, as to the relative parts each was to play. The chief threat ultimately to be envisaged was that of a German incursion through Turkey, which, in the event of Italy's adhesion to the Axis' side, might be aimed as the northern claw of a pincers of which the Italian forces in Africa would form the southern component. As long as France remained our ally, the presence of three French Divisions in Syria formed a guarantee of security in that part of the world, but, on the fall of France and the adhesion of the French forces in Syria to the Vichy government, the situation entirely changed.

This chapter will deal in turn with events in Turkey, Palestine and Syria, Persia and Iraq, and islands in the Mediterranean and Aegean Seas from the outbreak of war. The full tale for each group of countries will be treated through to the end of hostilities in Europe, though most of these events were synchronous.

Turkey

The Government of Turkey had signed a treaty with that of Great Britain, and, in the winter of 1939, agreement was reached on how the military clauses of this treaty would be implemented. This involved the Allies in going to the assistance of Turkey if Thrace was invaded by the Germans, but the arrangement was operative only if Italy remained neutral.

Preliminary Arrangements

As a result of the discussions on assistance to be given to Turkey in case of a German invasion of Thrace, it was decided that lack of port facilities and communications would limit the amount of Allied aid which could be sent to a maximum of five divisions, and that even this would not be possible until adequate port works had been constructed along the north coast of the Dardanelles, between Eceabat and Gelibolu. A first-class road must also be built from the port, at least as far north as Uzunkopru, in the vicinity of which place it was expected the Allied troops would occupy positions. It was also decided that both dry-weather and all-weather landing grounds would be required for the air forces in Thrace and Anatolia. It was agreed that the Allies and Turks should co-operate in the building of the road, port works and airfields, the Allies to supply the necessary plant, stores, and technical assistance, and the

Turks skilled and unskilled labour and such raw material as was available in Turkey, e.g., sand and stone. The works allotted to the British consisted of the road between Eceabat and Ahvsa, a distance of about 130 miles; port works at Kilya and Gelibolu; and airfields in Anatolia. The British undertook to supply M.T., plant, material and stores to the value of £170,000. The estimate for the time required for the completion of the road and port works was five months, and the British authorities notified the Turkish Government of the amount of skilled and unskilled labour which the latter would be required to supply. At the same time an estimate of the M.T. and plant required was made from the information then available. As regards the M.T. this proved to be insufficient as the distances over which stone and other materials would have to be carried to the road proved to be about 60 per cent greater than had been expected. The military appreciation showed that if these works were to be of value, they must be completed by September, 1940, and to ensure this work had to begin in April.

Arrival of British Engineers

Accordingly, No. 1 Construction Party of seven officers and sixty other ranks under Colonel G. B. G. Hull,[1] arrived at Instanbul in April. At about the same time No. 2 Construction Party of similar size, under Lieut.-Colonel S. A. H. Batten,[2] arrived to carry out the construction of airfields in Anatolia. Work on the ports and airfields was for the most part carried out by Turkish contractors under the direction of the British Construction Parties. It had been understood at the preliminary conferences that the same means of construction and direction would also apply to the roads, but on arrival the Turkish Government announced, and in spite of protests maintained the view, that the work would be carried out by contractors selected by them under the direction of their Public Works Department (known as Nafia). This decision virtually limited the British interposition to the supply of plant, material and stores. As might be expected, these arrangements led to interminable delays and frustrations. Labour promised for April, 1941, did not appear until nearly two months later and then in insufficient quantities. Dilatory methods of work were adopted and materials failed to arrive. In consequence even a "winter passage" was not completed

[1]Brigadier G. B. G. Hull, C.B.E.
[2]Brigadier S. A. H. Batten, C.B.E.

before severe weather stopped work. In the spring of 1942, the Turkish Government at last realized that nothing would be attained by their one contractor and others were put on the job. By May, 1941, the work had made substantial progress, but the strategic situation had changed. As by this time the Germans had overrun Greece and Crete, an Axis attack through Thrace was now considered less likely, it being thought more probable that the enemy would attempt an advance southwards through the islands in the Aegean. The same consideration had reduced the importance of road work in Thrace. All efforts were therefore now to be directed to the development of airfields in Anatolia from which Allied air forces could operate over the Aegean Sea as well as over Thrace. No. 1 Party, whose work was now almost entirely confined to the maintenance of plant and transport, accordingly moved to join No. 2 Party on airfield work in Anatolia.

While No. 1 Party had been battling to get work on the road pushed through, they had also, with direct control over the Turkish contractors, finished the work of providing port facilities. Three jetties with a minimum of 8 ft. of water for lighters, and a mole, 600 ft. long and 40 ft. wide, with a berthing length of 400 ft. and 26 ft. of water, for ocean-going ships, were constructed in Kilya Bay, three kilometres north of Maidos. A number of small jetties were also built between Akbasi and Gelibolu for the unloading of lighters bringing in stone for the road.

Meanwhile No. 2 Party had been busy, suffering under similar difficulties and frustrations, on the work of constructing airfields in Anatolia. During the working season of 1941, in the middle of which they were joined by No. 1 Party, the original programme was completed, modified to some extent in as far as the size of runways and hard standing were concerned. The parties were based on Smyrna, where a considerable amount of plant and equipment had been collected. For 1942 the combined Construction Parties were given the tasks of (*a*) improving communications from the Middle East to Western Anatolia, (*b*) preparing sites for various bases and depots and (*c*) making a number of new airfields and improving those already built. The two original parties were combined in one (No. 2), and a new No. 1 Party was brought up from the Middle East and based on Mersin, a small port on the south coast near Tarsus. In view of the situation, with Germany pressing into Russia, and an uncertain position in Syria and Iraq, where Axis machinations were having some success in stirring up local trouble as described

elsewhere, the Turkish Government, still nominally neutral, were somewhat shy of giving open assistance to the Allies, or indeed of committing itself either way. Permission for new projects, or approval of contracts, were, therefore, hard to get and delays were innumerable. Consequently work on the new programme was not started till July, 1942, the parties spending most of their energies in the interval on overhauling and preparing their machines and plant. Lieut.-Colonel K. W. Merrylees,[1] to be succeeded later by Lieut.-Colonel N. Wilson,[2] had now taken charge of the work.

Construction was eventually started on thirteen airfields by No. 2 Party, and on the roads and bases by No. 1 Party. The task of the latter was to prepare a road approach to the Central Plateau from the coast at Mersin. Access to Anatolia from Syria or from the southern coast was virtually limited to the railway which had been built by the Germans in the 1914–18 war as part of the Berlin-Baghdad line. The construction road had been allowed to fall into disuse and disrepair and was impassable in some places. The alignment was, however, the obvious one for a new main road and work was begun in July, on the 100 mile stretch from Mersin, through the famous Cicilian Gates in the Taurus Mountains, to Ulukisla, a small town, 4,500 ft. above sea level, where the railway leaves the mountains for the central plateau. As the object of the road was to supplement the railway, and as it would be the only link with the Middle East if any of the seven miles of tunnels in the mountains were damaged or blocked, Class 70 was specified. Consequently every existing bridge had to be replaced and forty-eight new bridges and 391 culverts built. By mid-December, when work on even the lowest sections had to stop, some sixty miles had been completed and the remainder was so far advanced that it could, in emergency, have carried the designed load of 600 tons a day. In addition, a small lighter wharf had been built at Susanoglu, about twenty miles west of Mersin, and the road between the two places improved. Meanwhile No. 2 Party between July and November, completed or wholly constructed five all-weather and nine fair-weather (i.e., grass runway) airfields.

1943 Programme

For 1943, the programme of work was extended. No. 1 Party's task now included, in addition to the completion of the Taurus road,

[1]Colonel K. W. Merrylees, C.B.E.
[2]Lieut.-Colonel N. Wilson, C.B.E.

a Class 70 road from Tarsus to Alexandretta (Iskanderun), which was connected by two French-built roads to Syria, and an extension of the Taurus road for about six miles to a proposed site for a base. These made the total of nearly 125 miles of reconstructed, or (what was virtually) new, road, since only earth tracks existed previously and the alignment across the Adana plain was on difficult black cotton soil. Compared with this, the additional projects for the building of bases and camps near Ulukisla and at Afyon were minor works. No. 2 Party was presented with a much increased programme of extensions to all airfields and camps. This entailed so much work that an extra party, No. 3, 140 strong, was sent from the Middle East to assist. In spite of delays, caused chiefly by the non-delivery of stores by the Turkish railways, most of the year's programme was completed. Thereafter, owing to the successes of the Allied Forces in the Mediterranean and in Russia, new work came to a stop, and the organization gradually dispersed.

At the time of maximum activity in 1943, the parties totalled nearly 400 officers and men, with 200 items of plant and 600 load carrying vehicles. In all, thirty airfields and 220 miles of Class 70 road were constructed, and several camps and bases prepared. About £9 million was spent on contracts.

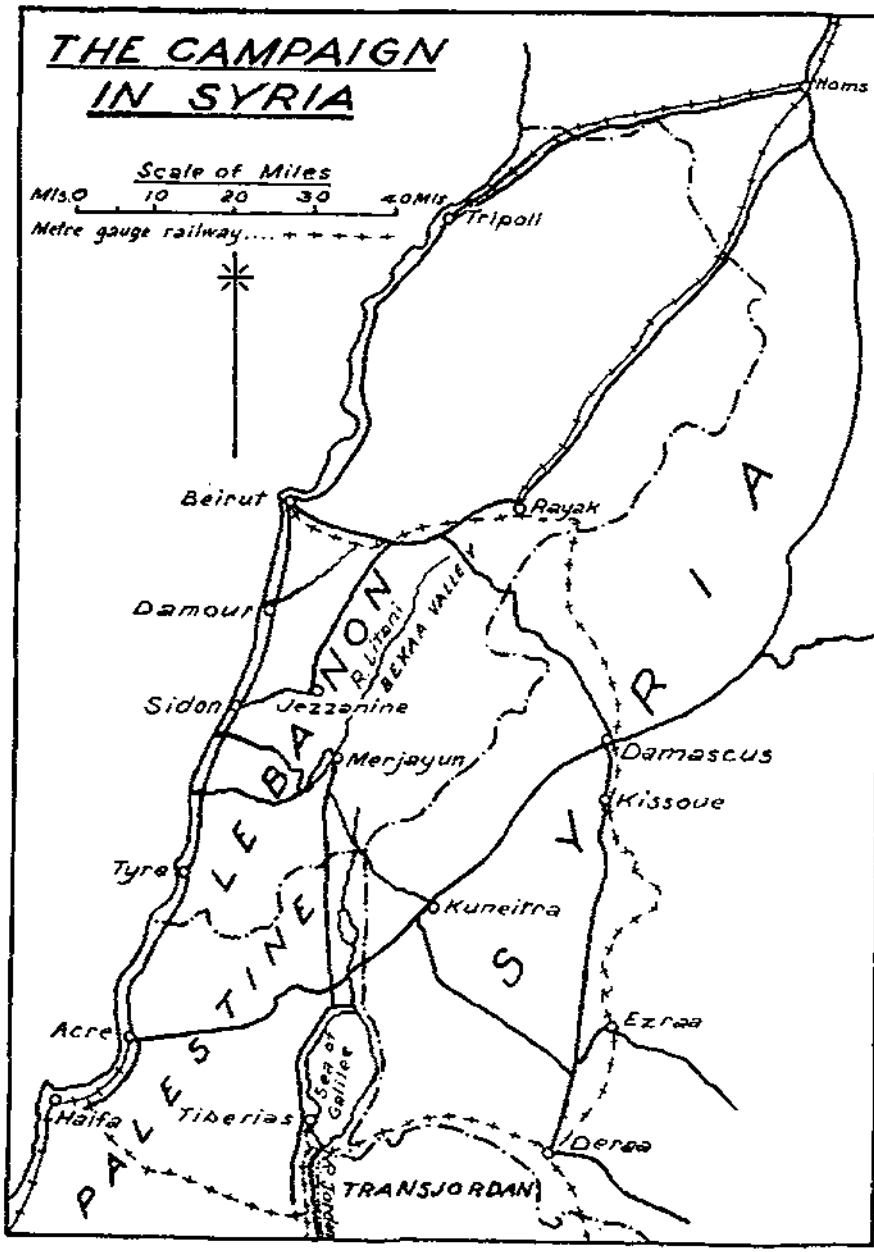
Owing to the "neutrality" of Turkey, it was always necessary to preserve secrecy, even when it was quite clear that the Axis agents knew all about the work. The German Consul at Adana, for instance, found it necessary to inspect frequently the old 1914–18 German cemetery on the Taurus road. He always took photographs of the work and talked to the workmen and staff on these visits. Although all British personnel wore plain clothes it was quite easy, even at a distance, to distinguish them as the other ranks had been fitted out in Egypt by the same firm with standard grey flannel trousers and greenish tweed coats. Further the British seldom wore hats, and the Turks were never without headgear.

PALESTINE AND SYRIA

The Outbreak of War

At the time of the outbreak of war with Germany the internal situation in Palestine was quieter than it had been for some years, and this period of comparative peace between the rival nationalities remained in being throughout the war. The Commander of the French troops in Syria at this time acted in close co-operation with

Map II


THE CAMPAIGN IN SYRIA
Scale of Miles
Mls.0 10 20 30 40Mls
Metre gauge railway....
Homs
Tripoli
Beirut
Rayak
Damour
R. Litani
BEKAA VALLEY
LEBANON
SYRIA
Sidon
Jezzanine
Merjayun
Damascus
Kissoue
Tyre
Kuneitra
PALESTINE
Acre
Sea of Galilee
Ezraa
Haifa
Tiberias
Dera
TRANSJORDAN

General Wavell in the discussion of action to be taken in various circumstances by the two commands. So for the first nine months there was little cause for anxiety about the region.

When, in the late autumn of 1939, reinforcements started to arrive for the forces in the Middle East the majority were sent for assembly and training to Palestine. This entailed for the engineers an extensive programme of construction of accommodation. Then, as base establishments for the forces in that part of the world became necessary, besides those in Egypt, a description of which follows later (Chapter XVI), a proportion of the depots and workshops were located in Palestine. Though the work on these lasted for some years, it will be well to give some description here of the major works which occupied the attention of a strong force of R.E. and their Commonwealth comrades first under Brigadier G. Streeten, and then in succession by Brigadiers P. W. Hutson, B. E. C. Dixon[1] and E. E. Read, as Chief Engineers, Palestine and Syria, the command being for a time known as Ninth Army.

As has been seen much work had been started before the war in the provision of barracks at such places as Jenin, Sarafand, Nathanya, Rehiwet, Hadera and Tulkarm, as well as accommodation for small detachments all over the country. Work on these was pressed forward to early completion and expansion. Other large camps were added as fresh troops arrived and new establishments, such as schools, base units and a Staff College at Haifa, were required. Amongst the administrative installations built were a large Ordnance depot and workshops south of Haifa and two R.E. stores, one near Haifa and one east of Lydda. A large hospital was constructed near Gaza.

Besides the large programme of road construction necessary for all these camps and depots, a considerable amount of work had to be done on main roads in the country, chiefly in improvement though some entirely new roads were built. In 1938, a good bitumen surfaced road had been constructed by the Shell Oil Company from Ismailia to Auja, and during 1939 and 1940, the continuation of this road via Beersheba and Hebron to Jerusalem was improved by contractors working under the supervision of C.E. Palestine.

The Fall of France and the Entry of Italy into the War

The whole situation in the Middle East was changed in June,

[1]Major-General B. E. C. Dixon, C.B., C.B.E., M.C.

1940, by the French armistice and the setting up of the semi-collaborationist Vichy Government, and by the entry of Italy into the war on the side of Germany. Not only could General Wavell no longer rely on the French divisions in Syria as a shield against aggression on his northern flank, but there appeared an active possibility of Syria being used by the enemy as a base for subversive activities amongst the neighbouring Arab countries, and even for the setting up of air bases.

During the preceding months, as has been noted above, reinforcements for the Middle East had arrived in Palestine and had been accommodated there while forming up and training. They then moved on to Egypt, so that in June, 1940, the garrison of Palestine consisted of 1st Cavalry Division (incomplete), two brigade groups of 6th Australian Division (C.R.E. Lieut.-Colonel L. C. Lucas, R.A.E.) and some independent units. The R.E. were represented by 12th and 56th Field Companies and 2nd (Cheshire) Field Squadron, and there were two Australian field companies with their 6th Division. These troops were joined by a Polish Brigade which had been incorporated with the French forces in Syria but escaped into Palestine on the fall of France. A number of French troops from Syria also crossed the frontier to join other Free French troops for service with the British.

At first there seemed little danger from Syria to the British position in the Levant, but soon the activities of Axis agents, who were supervising the armistice arrangements, in fomenting trouble amongst the Arabs, especially in Iraq, gave considerable cause for anxiety. The presence of German air bases in the islands of the Aegean, their conquest of Greece in April, 1941, their responsibility for encouraging Rashid Ali in starting the rebellion in Iraq and their dispatch of aircraft and arms through airfields in Syria with the connivance of the French authorities, brought matters to a head. In spite of his many other commitments and shortage of troops, General Wavell felt bound to take action in May. By this time, owing to the campaigns in Libya, Eritrea, Greece, and the detachment of "Habforce" to Iraq, there were in Palestine only a few regiments of horsed cavalry of 1st Cavalry Division, some garrison battalions which had their own job to do, and the Free French troops. It was therefore necessary to send what reinforcements could be spared from other theatres. These included 7th Australian Division, C.R.E. Lieut.-Colonel R. J. H. Risson, R.A.E., less a brigade group, and 5th Brigade of 4th Indian Division, while as fast as they could be provided

with transport brigades of 6th Division were made available. The whole force was under the command of Lieut.-General H. M. Wilson with Brigadier Hutson as Chief Engineer.

Advance into Syria

On 8th June, 1941, the advance into Syria began. On the left, between the River Jordan and the coast, the two Australian brigades moved by roads north on Beirut along the coast, and on Rayak inland. East of the Jordan 5th Indian Infantry Brigade Group and the Free French advanced from Transjordania on Damascus. On the first day the Australian brigade on the coast road advanced eighteen miles and then encountered strong opposition south of the Litani River. Next day the main enemy position on the river was encountered, the French blowing up the main road bridge as the Australians approached. By 11 a.m. a small bridgehead had been seized and the R.A.E., working all night, had built a pontoon bridge across the river by dawn on the 10th. Meanwhile the main position was pierced by a night attack, and the advance continued rapidly, and on the 15th Sidon was captured.

The 25th Australian Brigade Group, moving on the central axis of advance on Rayak, early encountered strong resistance and captured the town of Merjayoun, eight miles across the frontier, on the 13th. To the east, Indians and Free French advanced rapidly along the road to Damascus and reached Kissoue, fifty miles from their starting point, on the 13th. Here they encountered strong opposition and the Commander decided to wait for reinforcements before attacking.

French Counter-Offensive

It was now the turn of the Vichy French forces and they counter-attacked fiercely and with considerable success in the central region. Australian troops were driven out of Merjayoun, and then the enemy, striking out east and west, threatened the communications of the two flank attacks of the Allies. The left Brigade of Australians, having to send troops to assist a detached force on the left of the centre column, was not strong enough to press the advance on Beirut. The Australians in the centre were held up. Only on the right, though its communications were almost cut, did the eastern force press on towards Damascus, which after severe fighting at Mezze, just south of the city, was entered on 21st June.

Now reinforcements began to arrive. First came 16th Brigade

of 6th Division which joined the Australians in front of Merjayoun on 16th June, followed by 23rd Brigade of the same division which was sent to relieve the Australian detached force between Merjayoun and the coast. The 14th Brigade arrived later to come into reserve. Away to the east columns, detached from the forces in Iraq where the rebellion had now been crushed, started on 17th June across the desert from Baghdad, directed on Palmyra and Aleppo.

The field companies of 6th Division, 2nd, 12th and 54th, under Lieut.-Colonel C. C. Duchesne as C.R.E., were chiefly employed under brigade orders on the filling of road craters (by hand), the improvement of roads and tracks, and the clearance of booby traps and mines. The last named were normally charges buried under roads, few anti-tank or anti-personnel mines being encountered. Though in the hills water was scarce, there was ample in the valleys and therefore it was more a question of carriage than the setting up by engineers of water points. They had, however, their amusing adventures, for example the formal acceptance by a dismounted patrol of 2nd Field Company, with its bren gunner riding on a donkey because his feet were sore, of the titular keys of a village presented with ceremony by the local gendarme, and also of the only four cars in the village as a token of sympathy for the bren gunner's feet.

Successful Resumption of Offensive

Australian engineers with the force on the coast had more serious work to carry out in the last action before Beirut was reached, the crossing of the River Damour. Here, on 6th July, after a heavy bombardment, Australian infantry forded the river and formed a small bridgehead. But the bridge site was under closely observed enemy fire and the R.A.E. could not start work till nightfall. Even then they were under heavy artillery and machine-gun fire and work, though pressed ahead, was considerably interrupted, and it was not till 2.30 p.m. on the 7th that the bridge could be completed and tanks passed over to the north bank.

From Iraq a mobile detachment called "Kingcol", and largely composed of the troops of "Habforce" including the troop of 2nd (Cheshire) Field Squadron, moving along the pipeline towards Palmyra, took that town after severe fighting on 3rd July, and advanced towards Homs. Farther north 21st Infantry Brigade Group of 10th Indian Division, with 9th Field Company Sappers and Miners, moved on Raqqa along the Euphrates in which movement the Field Company had to build several bridges, while the rest

of 10th Indian Division (C.R.E. Lieut.-Colonel L. I. Jacques), to which 31st Field Squadron S. and M. was attached, advanced on the extreme right flank from Mosul to the Syrian-Turkish frontier.

On 6th July, the Vichy French General Dentz inquired about terms for a cessation of hostilities, which was signed on 11th July.

Defence of Northern Frontier

Though the threat of Vichy French and Iraqi collaboration with Germany had for the moment disappeared, the invasion by Germany of Russia in June, 1941, brought fresh, if somewhat problematic, danger of a German advance through Russia into the Levantine countries. Steps had, therefore, to be taken to fortify the northern frontiers of Syria, Iraq and Persia, and to improve the communications leading thereto from Egypt. In Syria, the troops which had been employed in the Syrian operations from Palestine, in the latter stages of which they were formed into an Australian Corps, commanded by Lieut.-General T. Blamey, with an Australian officer, Brigadier C. Steel, as Chief Engineer, moved to the frontier with Turkey. The 6th British Division, with its Divisional R.E., was located in the neighbourhood of Baalbek. Here the R.E. were employed in making defences and reconnoitring the roads and railways to the north for possible future demolition. The stay of the Division in Baalbek was short for, in September, it changed its title to that of 70th Division and sailed to relieve 9th Australian Division in Tobruk, as will be narrated in due course. For training and operational use eighteen all weather and twenty-two fair weather airfields were constructed, the work being directed by a C.R.E. Airfields acting under instruction of C.E. Airfields, Middle East.

Improvement of Communications

Behind the defences Commonwealth engineers worked to improve road and rail communications from the south. Three north-south routes, Palestine to Turkey, were brought to Class 70 standard, involving the construction of 2,400 miles of new road, the widening of 600 miles of old, and the strengthening and rebuilding of 1,500 bridges and culverts. A noteworthy job, a triumph of improvisation, for stores were very scarce, was a bridge, 1,200 ft. long, over the Euphrates at Raqqa, built by a contractor to a design produced by a Jewish engineer under the Chief Engineer's instructions. This bridge, the material for which included a burnt out tank from Haifa and well casing from Iraq all brought hundreds of miles on worn out

transport, was designed in a few days, and built in a little over three months over the river in full flood.

But the greatest task was the provision of a standard gauge railway line to connect that which ran from Egypt through Palestine to Haifa, with that running northwards from Tripoli, through Homs and Aleppo, to join the line running through Turkey to Baghdad. The gap between Haifa and Tripoli had previously been bridged only by a narrow gauge railway of small capacity running by a steeply graded, very indirect route, through Damascus. It was decided to build a new standard gauge line along the coast through Acre. Approval for the project was given in September, 1941, and the Deputy Director of Transportation Construction, Brigadier K. N. Simner,[1] issued instructions that the sector from Haifa to Beirut, ninety-two miles, should be constructed by the Railway Construction and Maintenance Group S.A.E.C., and that the northern section, thence to Tripoli, forty-six miles, be completed by Royal Australian Engineers. The majority of the southern sector, on which construction started at the beginning of November, presented little difficulty, the most troublesome part of the route being a stretch of about eight miles north of the Palestine frontier where limestone hills running down to the coast culminated in almost vertical cliffs. A careful survey, carried out under great difficulties, showed it was possible to take the line round headlands by cutting ledges, building sea walls and by boring two short tunnels. The sea walls were built by Arab masons, who were expert at the work, in some places it being necessary to lower men and materials from the cliff top by means of excavators fitted with crane booms. Seven river bridges, with an average span of 110 ft., and eight small bridges were built, and a large number of culverts constructed. The total earthwork was just over 1 million cubic yards. Royal New Zealand Engineers took over from the South Africans in June, 1942.

The Australian Engineers on the northern sector, who did not arrive to start work till the end of December, were faced with a more serious problem. Much of the alignment ran through low ground of dark sticky soil, intersected by numerous ditches and irrigation channels, which made earthwork difficult. The rest of the line ran through broken rocky country where a number of cuttings had to be made in solid rock. Finally, near Chekka, two tunnels, one 4,500 ft. long and the other 500 ft., had to be driven through a rocky headland. These last were bored by a South African

[1]Brigadier K. N. Simner, O.B.E., died, 1947.

tunnelling company in nine months. The total quantity of excavation in this sector was just under a million cubic yards, of which over a third was in solid rock. Thirteen major bridges and a large number of culverts were constructed.

The whole task, which was completed and the line open for traffic on 20th December, 1942, was a remarkable joint Commonwealth military engineers' effort, for besides the Commonwealth engineer units already mentioned, seven companies of Basuto pioneers were employed.

The main road along the coast had also run round the Chekka headland. It was, however, liable to constant interruption by landslides. In the summer of 1943, it was decided that a by-pass should be built inland, a distance of five miles. The only suitable alignment involved the crossing of hilly country. That the new road should be completed before the onset of winter, it was necessary that not more than a hundred working days should be allowed for the work. A mixed force of British, South African (Tunnellers and field), Indian Engineer and Pioneer units, Palestinian and Syrian civilians, was collected with a quantity of plant, under Lieut.-Colonel N. Wilson, and completed the job just within the specified time. It involved the building of five bridges and 350,000 cubic feet of retaining wall, and the excavation of 170,000 cubic yards of soil one-third of which was limestone. The finished road was 20 ft. wide and surfaced with bitumen.

Base Installations

In view of possible operations to the north, besides the defences already referred to, an advanced base with administrative installations and accommodation in hutments for two divisions was built in the Bekka Valley between the ranges of Lebanon and Anti-Lebanon. Owing to an almost unlimited supply of local stonemasons and the presence of good building stone a large proportion of the accommodation was provided in stone-built buildings. These proved a boon in the cold winter with heavy falls of snow. Though most of the old forest areas of the Lebanon had been largely denuded of trees in the course of years, two areas of good timber were found and forestry organized with local labour under the minimum of R.E. supervision. The supply of band saws for the mills proved a difficulty until an enterprising contractor was found in Antioch who obtained an ample supply from Germany!

Survey

In the earlier stages of the operations in Syria, the necessary survey work was carried out independently by the Australian Corps Field Survey Company. Later, on the formation of 9th Army, and the necessity arising for map production and distribution in areas which would be involved in the case of a German advance through Turkey, a Deputy Director of Survey, Colonel A Prain,[1] was appointed to the staff of the Army, and reinforcements in the shape of 517th Field Survey Company and South African Survey units arrived.

IRAQ

Iraq Rebellion

British relations with the Government of Iraq became increasingly unsatisfactory as the war progressed; although, after some pressure, it broke off diplomatic relations with Germany it did not declare war. When Italy came in the Iraqis did not even break off relations and allowed the Italian Legation to remain open in Baghdad. As Axis successes increased, the hostility of the Government, spurred on by Rashid Ali, became more effective. In one of the numerous changes of government Rashid Ali, who was known to be in Axis pay, became Prime Minister. Soon his subservience to German direction became more evident and matters came to a head on 31st March, 1941, when the Regent of Iraq, learning of a plot by Rashid Ali to arrest him, fled from Baghdad and took refuge in a British warship. The British Government decided to land a force at Basra, partly to enforce its treaty rights, and partly to be ready to protect our alternative line of communications by rail from Basra to Baghdad, and thence by the road which had recently been built across the desert to Haifa.

Siege of Habbaniya

On 18th April, a brigade group from India landed at Basra, and on the same day responsibility for operations in Iraq was transferred from Middle East Command to that of C.-in-C. India. When he learned that a second brigade would follow, Rashid Ali decided to take action against Habbaniya. By 1st May the Iraqis had a force of 9,000 men with fifty guns and tanks on the ridge overlooking the air station, which was protected by only a handful of levies. The local A.O.C. decided to attack with a force of aircraft improvised

[1]Brigadier A. Prain, C.B.E.

from his training machines and instructional personnel. This attack had apparently little immediate effect as the Iraqis remained in position. The situation was serious because, at this season of the year, both the Tigris and Euphrates were in flood and the inundations prevented the movement of troops by land from the Basra–Shaiba area. A British battalion was flown in from Basra, soon followed by a battalion of Gurkhas and a section of 10th Field Company Sappers and Miners. At the same time a mobile column called "Habforce", commanded by Major-General J. G. W. Clark,[1] consisting of 4th Cavalry Brigade, 60th Field Regiment R.A., 1st Essex Regiment, and one troop of 2nd (Cheshire) Field Squadron R.E., was dispatched from Palestine on the 570 miles trek along the desert road to the besieged station.

On 1st May, before "Habforce" set out on its journey, Iraqi police at Rutba, half-way to Habbaniya, attacked the parties working on the road in the vicinity. Major N. L. Hammond, who, as we have seen, was directing the road construction, collected his workmen and the small detachment of Arab guards, and, after a spirited action, in which he himself was wounded, conducted them in safety to the next post west along the road.

Without waiting for the arrival of "Habforce", the garrison of Habbaniya, under the command of Colonel O. L. Roberts,[2] late R.E., who had flown from Basra, made a successful sortie on 7th May, drove the Iraqi force off the dominating ridge, and took 400 prisoners and six guns. The Iraqis withdrew to Falluja on the Euphrates. This spirited action by Colonel Roberts and his gallant little force, outnumbered as it was by about eight to one, did much to stifle the rebellion.

Taking advantage of the high water in the rivers the Iraqi forces blew a number of breaches in the bunds bordering the rivers and inundated the country. They also effectively destroyed a number of bridges on roads which remained above the flood level, thus isolating Habbaniya from "Habforce" on the west, the troops around Basra in the south, and the approach to Baghdad to the east. The small force of engineers in the garrison consisted of only the two detachments already mentioned, and the staff of the A.D.M.W., Lieut.-Colonel H. de L. Panet[3], who took charge of the work. This small party started to repair the exit roads immediately the Iraqi

[1]Lieut.-General J. G. W. Clark, C.B.
[2]Lieut.-General O. L. Roberts, C.B., C.B.E., D.S.O.
[3]Brigadier H. de L. Panet, C.B.E.

force had withdrawn. First, attention was given to the desert road to the west by which "Habforce" was approaching. Here it was necessary to bridge at the site of an incomplete regulator, which had been in course of construction at Mujara, at the south end of Habbaniya lake. A certain amount of plant and material was found at the deserted contractor's yard near by. Most of the plant had been wrecked, but it was found possible to repair one scraper by cannibalization and to use it for some heavy earth work on the approaches. Some odd sizes of steel joists and sleepers were also found and pressed into use. The concrete abutments had to be demolished down to temporary road level, and concrete blocks cast to hold the spans in position. The bridge was completed and tested with the scraper on 16th May, in time for the arrival of "Habforce" next day, by three British engineers with a subsection of Sappers and Miners.

Occupation of Baghdad

Meanwhile the exits to the east had also been tackled, for it was important that the way should be opened to Baghdad, where the British Embassy and Military Mission were isolated, and through which reinforcements from the south would come. Here the Euphrates had to be bridged in the neighbourhood of the air station to enable troops to cross to capture the main bridge at Falluja, which, though it had not been destroyed, could not be approached directly on account of the floods. At the site chosen the river was 750 ft. wide and the current strong. The only material available, collected from contractors' yards, was four steel "shakturas" (rectangular shaped scows with about 25 ton buoyancy), a considerable amount of timber scantlings, a 1,500-ft. length of 3-in. steel wire rope, and some odd gear. It was decided to make a flying bridge. The wire rope was got across the river with the help of a motor boat and brute force on 14th May, and secured to an anchorage of palm logs, which, having to be buried below water level, was to be a constant cause of anxiety. Taking up the slack in the rope proved difficult and was only achieved when a looted D8 tractor had been repaired. A raft, with a deck space 20 ft by 20 ft., had meanwhile been built, and the first very halting trial trip of the ferry took place on the afternoon of 18th May. Colonel Panet, who was in charge, would have liked to have had another 24 hours to perfect the arrangements, but Colonel Roberts, who was to command the attack-

ing column, decided to take the risk and started to cross that evening, the whole force being successfully ferried over by 9.30 a.m. next day. That day, in an action which included air-bombing, the movement of columns down each bank of the river, and the delivery of an infantry company by air in rear of the enemy, Falluja was taken. But the movement of these columns down the river banks was only made possible by the efforts of the men of the Sappers and Miners. These, by rafts improvised from petrol tins, the dinghies of the R.A.F. Sailing Club, inflated inner tubes of aircraft and motor types, and other strange means, got the columns across the various gaps encountered in the bunds along which they moved. With all the Sappers and Miners working with the infantry columns, and the Field Troop, after the arrival of "Habforce", working on a wide turning movement with the armoured cars, the operation of the ferry depended on the supervision by odd R.E. officers and engineer technicians of every grade controlling the somewhat uncertain, but very willing, actions of working parties of Arab levies. The Section of 10th Field Company Sappers and Miners was composed mostly of young soldiers, and this was their first sight of active operations, but they well deserved the tribute of General Clark, when he thanked them for their share in what he described as "a campaign won on two ropes".

The combined force under General Clark, even now numbering less than 1,200 men, with eight guns and a few armoured cars, advanced on Baghdad, whence Rashid Ali, though there was a division of Iraqi troops in the city and others in the neighbourhood, fled on 30th May. The city was entered immediately, and next day the Regent returned and took charge. The rapid action nullified the schemes of the Germans who had begun to establish air bases in Iraq, and to fly in aircraft using landing grounds in Syria, with Vichy French connivance.

As has been related, on 18th April, a brigade group from India, including 10th Field Company, Sappers and Miners, had landed unopposed at Basra. It was from this force that the reinforcements for Habbaniya had been flown in. On 7th May, another brigade group of 10th Indian Division arrived and with it Lieut.-General E. P. Quinan[1] to command all troops in Persia and Iraq, in what was later known as 10th Army, Brigadier C. G. Martin, V.C., being his Chief Engineer.

[1]General Sir E. P. Quinan, K.C.B., etc.

PERSIA* AND IRAQ

*(Note: During the period of the war the official name of Persia was Iran. As the old name, Persia, has since been readopted, it will be used throughout.)

General Quinan's Force and Orders

General Quinan's original instructions were to develop and organize the port of Basra so that it could maintain such forces as might be sent by that route to the Middle East, including Egypt, Turkey, Iraq and Persia: later in May he was ordered to secure control of communications, including all airfields and landing grounds in Iraq, and to develop these to enable the port of Basra to act as a base for such troops and operations as might follow. He was also instructed to plan a system of defences for the Basra base and also to protect the R.A.F. installations at Shaiba and Habbaniya, British subjects in Baghdad, the Kirkuk oilfields and the pipeline to Haifa, and the Anglo-Iranian Oil Company's installations in south-west Persia. He was informed that it was intended to increase his force to three infantry divisions and possibly an armoured division. These tasks depended for the most part on work to be carried out by the engineers of the force, and involved large projects. At first there were available for work only the field units of formations as they arrived and a small works staff. A scheme for the development of Basra had, however, already been drawn up for the Iraq Government, and a firm of British contractors was established in the country. The Basra Port Directorate had a British staff and was able to undertake the design and control of all new work on the wharves, etc. The Army's main duty was to ensure the supply of the necessary stores. Extra berths and lighterage facilities were gradually provided in Basra, and on the east bank of the Shatt-el-Arab, enabling stores arriving by sea to be put straight on to the Persian Railways.

Immediately after the arrival of the first troops, work commenced, under Lieut.-Colonel G. H. Vaughan-Lee, R.E.,[1] on the development of a base at Shaiba on the site used in 1914–18. Its desert location made concealment of the extensive installations impossible and reliance had, therefore, to be placed on dispersion as a measure of protection against air attack. This naturally involved increased effort in the construction of roads and railways, the full sum of which

[1]Colonel G. H. Vaughan-Lee, O.B.E.

can only be realized when the extent of the ultimate commitment is told.

When reinforcements reached Baghdad a detachment was sent from "Habforce" to occupy Mosul, where pro-Axis influence was much in evidence. In the third week of June, two infantry brigade groups arrived in Baghdad from Basra and Shaiba, partly by land route and partly by river convoy up the Tigris, and these were used to relieve the troops from Palestine and Transjordan which then returned to their own command.

Defence of Northern Iraq

With the outbreak of war between Germany and Russia, General Quinan was ordered to hold northern Iraq against any enemy attack which might develop through Turkey or Persia, and to construct permanent defences on the northern frontier of Iraq to check the advance of armoured fighting vehicles along the possible lines of approach. Further, since the attitude of the Government of Persia was unsatisfactory, he was to be prepared to occupy Abadan and Naft-i-Shah on the Persian Gulf. The Basra port and Shaiba base were now to be developed to maintain ten divisions and thirty R.A.F. squadrons, and Um Qasr and Kuwait were to be developed as subsidiary ports. In accordance with the instructions to prepare defences on the northern frontier of Iraq and Syria an extensive project for a defensive position for six divisions north of Mosul was put in hand in October, 1941. Lieut.-Colonel L. D. Grand[1] was appointed special C.R.E. in charge of the work which was to include 1,000 concrete works, a hundred miles of anti-tank ditch, twenty-three air strips and 180 miles of road, not to mention a huge underground hospital for 1,450 beds. The defences were constructed partly by the troops and partly by contract and, though the position was never occupied, the majority was completed. The necessary airfields for the air forces intended for the defence in Iraq and northern Syria were constructed largely by contract under the direction of Colonel Panet, who had now become D.C.E. Airfields for the area.

Occupation of Persian Oilfields and Teheran

By the beginning of August, when joint notes were handed by the Governments of Great Britain and Russia to the Persian Government, a force had been concentrated in the Basra–Shaiba area,

[1]Brigadier L. D. Grand, C.I.E., C.B.E.

consisting of 8th Indian Division (C.R.E. Lieut.-Colonel C. M. Maclachlan, 7th, 66th and 69th Field and 47th Field Park Companies, S. and M.), 9th Armoured Brigade, and 2nd Indian Armoured Brigade Group. On 25th August, no satisfactory answer having been received from the Persian Government, operations commenced. Within a few days, in face of slight resistance, the whole of the oilfield area at the head of the Persian Gulf as far north as Ahwaz had been occupied. At the same time, north of Baghdad, British forces occupied the passes on the Iraq–Persia frontier and seized the oilfields and refineries at Kermanshah and Naft-i-Shah, and then, the Persian troops having capitulated, joined hands with Russian troops advancing from the north about Kazvin on 31st August. As the Persian Government still remained obstructive about the expulsion of Axis nationals, Teheran, the capital, was occupied by British and Russian troops on 17th September.

Thus, except for a number of minor expeditions against recalcitrant Kurdish tribesmen, ended the period of hostilities in Persia and Iraq. During these operations the engineer field units of the force, mostly drawn from the Corps of Indian Sappers and Miners, were chiefly concerned with the construction of defensive systems in the passes in the northern part of the area. Maintenance of roads was carried out mainly by local civilian labour. Behind the army the small works and transportation organizations made a start on the development of bases and communications with such local labour and contractors as could be engaged. Few stores, plant or equipment were as yet available, and even the railway construction company, which arrived with a group headquarters in June, 1941, had only recently been raised in India and was deficient in many items of equipment. Even so the railway from Basra to Baghdad, which had been badly damaged by the Iraqis, who had removed hundreds of sleepers and destroyed essential installations at stations, was reopened for traffic by 9th June.

Aid to Russia

The rapid advance of the German armies into Russia in the late summer of 1941, coupled with the duties entailed by the occupation of the two countries, now posed different problems to the forces engaged in Persia and Iraq. A German invasion in great strength of the Middle East through the Caucasus and Turkey was now more possible, and steps had to be taken to guard against such an even-

tuality. The isolation of Britain's new Ally, Russia, coupled with her then comparative weakness in industrial production, made it necessary to send the greatest possible help in weapons and military supplies to that country. The control of the Baltic by Germany, and the approaching difficulty of sending supplies in large quantities in winter by the northern sea route, made the opening, on the largest possible scale, of a line of supply through Persia to the Caspian Sea of the highest importance. This commitment now became the chief concern of the British, and later of the American forces in the area, and towards the fulfilment of which the full energies of the engineers were directed.

Nature of Country and Communications

For an understanding of the problem, some idea of the nature of the countries, their climate, and the contemporary state of development of their communications and essential services is necessary. Few people, unless they study the scales of maps carefully, have any idea of the size of the region. Roughly speaking, from Nisibin in the north-west corner of Iraq to Zahedan on the Baluchistan border of Persia is 1,800 miles, or rather farther than from London to Moscow, while from Bushire on the Persian Gulf to Tabriz in northern Persia is about 800 miles. Most of Iraq is a flat alluvial plain and desert except where watered by its two rivers, Tigris and Euphrates. South and east Persia are similarly desert, but the centre and north form a vast tableland 4,000 ft. to 6,000 ft. above sea level, crossed at intervals by mountain ranges, the passes through which reach heights of 7,000 to 10,000 ft., and the peaks of which culminate in the beautiful cone of Demavend, north of Teheran, 18,600 ft. above the sea. The Persian Gulf is very hot and humid: inland the climate is dry and the summer temperature high, rising to a peak of 130° in the shade in the plains of Iraq and south Persia. The climate on the Persian plateau is cooler, and in the mountain passes 40 degrees of frost are registered in winter.

The natural means of communication in Iraq were based on the two main rivers, the Tigris and Euphrates, which were navigable by shallow draft craft for a considerable portion of their length, but above Kut on the Tigris, and Hindiya on the Euphrates, in the period of low water, navigation of both rivers was difficult and uncertain, owing to shallows and sandbanks. The rivers of Persia were not navigable, except in some cases for short stretches near their

mouths. In both countries, to supplement the river traffic, roads and railways had been developed on a limited scale.

In Iraq the following railways were in operation:—

(*a*) A standard gauge single line extending from the frontier at Nisibin through Mosul down the west bank of the Tigris to Baghdad.

(*b*) A metre gauge single line from Baghdad down the Euphrates to Basra.

(*c*) A metre gauge single line from Baghdad up the Diyala to Kharighan, whence one branch went north to Kirkuk, and the other east to Khaniquin near the Persian border and at the foothills of the Kurdistan mountains.

In Persia the late Shah had built a railway from the Caspian Sea to the Persian Gulf. This was single line standard gauge throughout and extensions had been in progress to connect it with the Russian Caucasian railway at Tabriz. A formation had also been built as far as Isfahan but no rails had been laid. From Andimishk (near Dizful) northwards this line ran through hilly country, climbing from about 100 ft. above sea level to a peak of 6,800 ft.

A number of roads existed in some form or another before the war, and those which were developed during the war followed existing routes. In the deserts of Iraq and Persia they consisted mostly of tracks worn hard and smooth by motor traffic but impassable after rain, and many of them liable to be submerged in flood conditions. In the mountains of central Persia they consisted normally of a thin coating of metal, 15 ft. wide, worked into formation by the traffic, and in no way capable of standing up to the intensified traffic now to be imposed upon them. Mountain passes were steep, with many thousands of blind corners, and the roads were mostly incapable of taking more than a 10-ton load.

Such then was the nucleus of communications on which an extensive system was to be developed in the next few years at great labour. While the works developed gradually they eventually merged into one great scheme, and therefore it is proposed to follow the developments in each branch of engineering separately and not to attempt a strictly chronological account of the work in the theatre as a whole. Some account will also be given of the other elements of the programme, such as accommodation, workshops and airfields.

Higher Engineer Organization

As has been shown, up to September, 1941, the engineer organization was merely that normally provided for a small expedition in a semi-developed country. The engineer units with formations were mostly drawn from the Corps of Indian Sappers and Miners, and few technical units had arrived. The senior Engineer officer was at the time the C.E. British Troops in Iraq, Brigadier C. G. Martin. In January, 1942, responsibility for operations and administration in the theatre was handed back from India to C.-in-C. Middle East, and the title of General Quinan's Command was changed from that of B.T.I. to 10th Army, the Chief Engineer changing his title accordingly. Shortly after this date, in view of the very wide engineer commitments over and above the operational needs of 10th Army, an M.G.R.E. (Major-General G. B. O. Taylor) was appointed to the headquarters with a Brigadier (Operations) (Brigadier W. F. Hasted[1]), a Director of Works (Brigadier A. Minnis), and a Director of Stores (Brigadier Westrop) and a full Staff. Three Chief Engineers (Works) were also appointed:—

C.E. North Iraq (Brigadier G. F. H. Alms), primarily concerned with defences and forward communications.

C.E. Bases (Brigadier G. B. Gifford Hull), whose principal task was Port and Base Development.

C.E. North Persia (Brigadier J. L. French) primarily concerned with roads.

In September, 1942, Persia and Iraq became an independent Command under General Sir H. M. Wilson. In consequence the title of the M.G.R.E. was changed to that of E.-in-C., Persia and Iraq Command (P.A.I.C.), and he then ceased to be the subordinate in technical matters of E.-in-C., Middle East. The force had been expanded by the arrival of 31st Indian Armoured Division (C.R.E. Lieut.-Colonel R. H. Perry[2]), and 6th and the rest of 10th Indian Divisions (Cs.R.E. Lieut.-Colonels A. E. Armstrong[3] and L. I. Jacques[4]) under IV Corps of which Brigadier A. Mason[5] was C.E.

[1]Major-General W. F. Hasted, C.B., C.I.E., C.B.E., D.S.O., M.C.
[2]Brigadier R. H. Perry, C.B.E., M.C.
[3]Brigadier A. E. Armstrong, O.B.E., M.C.
[4]Brigadier L. I. Jacques, C.B.E., M.C.
[5]Brigadier A. Mason, M.C.

The 10th Indian Division went to Egypt in the spring of 1942, and the rest of 10th Army, under Lieut.-General Quinan, with Brigadier Mason as C.E., moved into northern Persia to prepare defences in the mountain passes. Brigadier F. W. T. Hards[1] replaced Brigadier Mason as C.E. IV Corps, and a new, XXXIII, Indian Corps Headquarters arrived to which Brigadier Jacques was appointed C.E.

On the Transportation side a full-scale Transportation Directorate was set up in Iraq (D.Tn. Brigadier Sir C. F. Carson) at the end of 1941, and at about the same time a similar organization was set up in Persia (D.Tn. Brigadier Sir G. D. Rhodes[2]). In January, 1942, when the control of forces in the theatre reverted to C.-in-C., Middle East, the two Directors of Transportation came under the local control of D.Q.M.G. 10th Army, and under the general supervision of D.Q.M.G. (Mov. and Tn.) at G.H.Q. Middle East. In September, 1942, when Persia and Iraq Command was established as a separate Command, a combined Movements and Transportation Headquarters, under Brigadier Rhodes as D.Q.M.G. (Mov. and Tn.), was set up at G.H.Q. Baghdad, to control Movements (Iraq and Persia), Transportation (Iraq) and Transportation (Persia). In October, 1942, it was agreed that the U.S. Army should gradually take over responsibility for the operation of the Gulf ports and of the Persian railway from the Gulf to Teheran. This transfer was completed by the end of March, 1943, when the Transportation Directorate in Persia was closed.

Port Development

As gateways to the communication systems of the theatre the ports became naturally the first items of interest. The early steps taken to develop Basra, the only well developed port in Iraq before the war, have been mentioned above, the work being carried out by a firm of civilian contractors, Messrs. Holloway Bros., though under general military direction. Two additional sea berths were provided, and two wharves, built in 1914–18, were rebuilt and strengthened. A new lighter wharf, 1,000 ft. long, was also constructed, and additional dock cranes, including one with a 70-ton lift obtained from Calcutta, were erected. As it was considered that the port of Basra was vulnerable, a second port was built at Um Qasr on the Iraq–Kuwait border. Here the work was entrusted to the same contractors

[1]Brigadier F. W. T. Hards, C.B.E., lost at sea, 1945.
[2]Brigadier-General Sir G. D. Rhodes, Kt., C.B., D.S.O.

as at Basra. Camps had to be constructed, rail and road communications built, and an 8-in. pipeline laid from Basra, some sixty miles away. Owing to the shelving beach and a considerable tidal range the port took the form of a long jetty, providing three 500-ft. berths. In addition to these two main ports, a lighter basin was built in the Iraqi part of the estuary, on the river bank opposite Basra, to facilitate cross river lighter traffic for cargoes destined for Persia.

At the outbreak of war Persia was singularly badly equipped with ports in spite of the fact that the late Shah had built, at enormous cost, a railway, referred to previously, from the Caspian Sea right through the country to the Gulf at Bandar-Shahpur. At the latter terminal he had built a small port, snatched from primeval mud, thirty miles up the Khor Musa. The port comprised a few acres of artificial fill, a very limited amount of warehouse accommodation, and a rail served jetty 45 ft. wide providing two berths. The new work on the port was carried out by a firm of contractors from India, Messrs. Burn, Braithwaite and Jessup, and included a rail served jetty with three 500-ft. berths and 1,000 ft. of lighter wharfage.

Besides Bandar-Shahpur there were only three other very minor ports in Persia on the shores of the Gulf, Bushire, Bandar Abbas, and Khorramshah (or Mohammerah) at the mouth of the Karun River. The two first mentioned were of little value, and the Shah had set his face against the development of Khorramshah as it lay on the banks of the Shatt-el-Arab in which the Basra Port Directorate controlled navigation and collected harbour dues. For this reason it was not connected with the Persian railway but it was the natural entry for goods into Persia, and the only port which gave any possibilities for large-scale development. The work here was carried out by engineers of the Military Mission of the U.S. Army, later known as the Persian Gulf Service Command, which arrived in connexion with the U.S. system of Lease-Lend of warlike stores to the Allies. A wharf comprising six 500-ft. berths was built as an extension to a small existing concrete jetty in the River Shatt some 150 feet out from the shore. Extensive development of the hinterland also took place, including warehouse accommodation, assembly plants, and many miles of road, water supply, power mains, etc. Rail and road connexions to Ahwaz, on the main railway line, were an integral part of the work of development of this port. In speaking of the ports on the Gulf on Persian soil no mention has been made of the Anglo-Iranian Oil Company's port at their refineries at Abadan. This was specially designed for the oil traffic,

and was fully employed for its own purposes. The Royal Engineers, however, did construct there an additional lighter basin, known as Army Creek.

In connexion with I.W.T. use of the rivers, docking facilities were provided, in Iraq, on the Tigris at Kut the limit of all the year round navigation of the river, and on the Karun River, just below Ahwaz. The work at Kut, which consisted of slipways, riverside berths, and a small dock for repairs of river craft, was confided to another British firm of contractors, Messrs. Balfour Beatty, which had been working in Iraq at the outbreak of war. Near Ahwaz lighter berths were constructed under R.E. direction to ease the congestion on the new railway to that town.

Bases

In connexion with the various ports, a number of bases for the maintenance of the forces and of the large organizations working on the development of communications were established, although some of these, owing to the improvement in the strategic situation in 1943, were never completed to their original design. The main base, the early work on which has been described above, was that at Shaiba. The work here was mostly carried out by units of the Royal and Indian Engineers assisted by local labour. Some of the early accommodation provided, for offices and hospital wards in particular, was built below ground as a hot weather measure. The effect was very satisfactory, but trouble arose during the winter from flooding. Thereafter a ban was placed on such underground construction, though it was thought that the flooding might have been avoided by proper drainage.

A base for the Iraq L. of C. was built at Musaiyib, near Baghdad, served both by the metre gauge railway from Basra and the standard gauge line to Mosul. This was almost completed when, owing to the improved strategic situation, work was stopped early in 1943.

The Engineer effort on all these bases included some 4 million square feet of workshops and store shedding, many miles of roads and railways and large areas of covered and open hardstandings. Cold storage for nearly 2,500 tons was built, 4 million gallons of filtered water were supplied daily, and electrical installations of over 5,000 kilowatts capacity were provided.

Roads

Road construction and improvement provided the biggest item

in the Engineer programme in the theatre. At the peak it involved some 7,000 miles, of which over 6,000 were main roads. Over 1,500 miles were fully bitumenized and 5,000 were given an all weather gravel surface. The problem was handled differently in the two countries owing to the different nature of the local civil authorities. In Iraq the P.W.D. maintained many hundreds of miles in peace, but most of the roads were fit for dry weather use only and incapable of carrying continuous heavy traffic. To raise their standards and to carry out necessary extensions, a grant in aid was made to the Iraq Government. In addition some purely military main roads were constructed entirely at British expense and largely by British military, assisted by locally enlisted, labour. These included, besides the desert road from Baghdad to Haifa, which has been referred to elsewhere and which was constructed under the direction of C.E. Palestine:

A high level road Basra–Shaiba.
Baquba–Kut.
Kut–Andimishk.
Mosul–Tel Kotchek.

To relieve the traffic congestion in the streets of Baghdad, a by-pass was built in 1943, south of the city crossing the Tigris by a boat bridge.

The main problem centred on the Persian roads. Here owing to its inefficiency and corruption, the local government organization could not be used, and the whole of the development fell directly on Allied military engineers, assisted by certain foreign organizations already in the country, and by some of the British civil contractors who were also available. During the winter of 1941, for the whole of the Engineer work in Persia there was only one C.R.E. and fourteen other officers. By July, 1942, these had expanded to a C.E., Brigadier J. L. French, four Cs.R.E., and forty-six other officers, but they could not have coped with the work if it had not been for the existence of an organization known as Consortium Kampsax. This was a body of Scandinavian Engineers brought in by the late Shah to act on lines somewhat similar to those of a P.W.D. in a more developed country. They were a competent body of engineers, speaking the language and knowing the country well. They were engaged by the Allied Army as supervisors and advisers.

The organization and maintenance of local labour occupied much of the time of the hard pressed British Engineer staff. Besides

normal trouble of recruitment, pay, and supervision, a complete medical organization had to be set up. Further, owing to the famine conditions in many parts of the country, a large proportion of the labour had to be fed, and the purchase of wheat and sugar, the staple foods, became one of the most troublesome activities. The Army organizations were of little help in these activities, as the military occupation covered a mere fraction of the country, whereas the engineering work covered the whole.

The two main trunk roads on which interest was focused were, first the main road to carry Aid-to-Russia traffic from Khorramshah through Ahwaz, Andimishk, via Hamadan and Kazvin to Tabriz, and second, a main west-east lateral road connecting with the Haifa–Baghdad desert road at the latter place and running through Kermanshah, Hamadan, Kazvin, Teheran to Isfahan, whence it forked east to the Baluchistan frontier at Zahedan and south to Bushire via Shiraz. Many subsidiary roads were also built or reconstructed. Among the latter were the old East Persian road from Zahedan to Meshed built during the 1914–18 war by R.E. and Sappers and Miners working under General Dickson; a road from Malyer on the main north-south trunk road through Qum to Teheran; two cross roads connecting the east-west road to the main Lease-Lend road; and a road from Kermanshah to Senna in the heart of the Kurdistan territory. In all, the road programme in Persia totalled some 4,000 miles. Other roads were projected, and the survey work and location completed, but changes in the strategic situation caused them to be abandoned.

The technical details of the work in the various sectors, though of considerable interest, cannot be described further here. Even with all the appurtenances of the engineering profession the work would not have been easy, but with shortage of plant and materials, adverse climate and inefficient labour, the task which faced the handful of R.E. supervisory officers was a gigantic one, and their success in driving through the roads constitutes a notable achievement.

In June, 1943, the American Persian Gulf Service Command, which had up to this been working on, and had just completed, the 150 miles stretch of road from Khorramshah to Andimishk, took over the main Lease-Lend road north to Tabriz, a total of 800 miles. The British Engineers were able to hand over a road widened to 22 ft. wide throughout, except in the gorges where widening was still in progress, surfaced with bitumen over 80 per cent of its length,

and with every bridge and culvert improved and strengthened to take 40-ton loads.

Mention must also be made of snow clearance. On five of the major passes, all over 7,000 feet high, snow clearance posts were established on each side. Winter quarters were built, and from the end of November to the end of March each winter, large detachments, equipped with bull and angle dozers, from the Mechanical Equipment units were placed at each pass. As a result, communications were maintained throughout the winter, and delay to convoys in no case exceeded four hours. Before the war the passes had sometimes been blocked for days on end.

Bridges

In the course of the work on roads and railways, it was necessary to build a number of bridges. As most of them were constructed from standard equipment or stock spans, they with few exceptions call for no special comment. Among the exceptions must be mentioned the bridge across the Shatt-el-Arab above Basra docks at Margil. This bridge was ordered in November, 1942; it was to carry a road designed for 56-ton loads across the river to connect the port of Basra to the desert road on the east bank leading to Ahwaz, and a metre gauge railway, load 61 tons, to connect the Iraq State Railway system serving the docks to the standard gauge Persian Railway from Ahwaz to Tanooma, about two miles down stream from Margil on the east bank of the river. It was also essential that the bridge should be built in such a manner that the river traffic should not be interrupted. At the time this touched 1,000 tons per day up the Tigris to Kut, carried by paddle steamers and tugs towing barges, and local sailing craft. The largest paddle steamers required 70 ft. clearance between piers and 40 ft. above water for funnel headroom. The Shatt-el-Arab at the point selected was about 1,800 ft. wide with an island half way across, the difference in water level between low tide, dry weather flow, and high tide, flood flow, was about twelve feet, and the maximum current was 4½ knots. The bottom consisted of twenty to twenty-five feet of soft mud overlaying stiff clay. The depth of water at lowest level was about thirty-five feet. A bridge to meet these requirements was designed by the C.E., Brigadier Hull, who also supervised its erection in ten months by one R.E. and various I.E. and pioneer units. The bridge consisted of a piled structure with a movable span for

the shipping fairway. As there were no facilities for making swinging mechanism and, owing to the depth of the water and the underlying mud, towers sufficiently high to raise it above the height of the funnels of steamers could not be built, the movable span was constructed so that it could be lowered to the bottom of the river. The technical difficulties, though great, were satisfactorily solved and the bridge remained in operation throughout the rest of the war. It was called, after its designer, the "Hull Bridge".[1]

The only other bridge for which space allows mention, more on account of its vicissitudes than its technical interest, was that at Manqubah on the road between Erbil and Mosul in northern Iraq. The pre-war two span girder bridge here was washed away by floods in 1940 and was replaced by a light suspension bridge for 9-ton loads, built by R.E. As this was on the main road communicating with the north, a ford was constructed alongside to take heavy military vehicles during the non-flood season. One day a laden low-loader, total weight 40 tons, by mistake began to cross the bridge. Half way across, the driver suddenly realized his error, lost his head, tried to accelerate, and bumped the deck suspension rods badly. Although miraculously the rods withstood the impact they were badly bent, and one of the shore towers carrying the main suspension cable was thrown out of plumb. But the low-loader got over. A new bridge was built in five months with three standard Hopkins spans and two central concrete piers.

Railways

After the initial development of the railways in Iraq with local personnel and tools described above (page 301), a considerable programme of work was undertaken towards the end of 1941. For this purpose the first railway units, a group headquarters and a railway construction company, I.E., arrived from India in June, 1941, to be followed thereafter by further reinforcements until, by March, 1942, there were three group headquarters, one survey company, five construction companies, five maintenance companies, five operating companies, and various workshops, stores, and accounting units. These units, which were all Indian, were not sufficient for the work envisaged, and this proved so much the case with operating units that operation of the lines constructed had to be limited.

It was decided to double the metre gauge line from Basra to Baghdad. Earthwork and bridges on this line were made so that

[1]See *R.E. Journal*, Vol. LVIII, page 76, June, 1944.

the second track could subsequently be converted to standard gauge if later it was found that sufficient rolling stock became available to operate the wider gauge right through from Basra to Turkey. In order to avoid heavy bridging on one section, some 120 miles long, following the left bank of the Euphrates between Samawa and Hindiya, the second line in this section was laid on the right bank of the river, crossing it at the Hindiya Barrage. This diversion was known as the Nejf loop. By January, 1942, the doubling was complete from Basra to Shaiba, and by October, after work had had to be suspended for some weeks owing to shortage of labour and materials, it was completed northwards as far as Ur Junction, and southwards from Baghdad to Hindiya, and work was well advanced on the Nejf loop. Work on the loop continued till March, 1943, when it was stopped owing to the change in the strategic situation. Over eighty additional crossing stations were constructed on the various lines to improve the capacity, though some of these could not be operated owing to shortage of staff.

Other lines were constructed to link up the new port at Um Qasr, from Hindiya to Salchiya near Baghdad, and from Kut to Jassimiya to link up with the main Baghdad–Khanaqin railway. A very large proportion of the railway construction work was directed to the development of the various depots in different parts of the country, particularly at the main base at Shaiba, where extensions continued until the importance of the theatre began to decrease in the spring of 1943.

The Iraq State Railway workshop at Salchiya was expanded and reinforced by a workshop company from India, and later by a Polish railway workshop company. Another Indian workshop company formed and operated a wagon assembly plant at Shaiba which, by the end of June, 1942, reached an output of thirty wagons a day for the metre gauge railway, while another at Salichiya did similar work for the standard gauge lines.

The state of the Persian Railways at the advent of Allied forces has been shortly indicated above (page 303). In October, 1941, a Director of Transportation (Brigadier Sir Godfrey D. Rhodes) and a small Transportation Staff arrived in Persia with orders to increase the capacity of the railway from the Persian Gulf to the Caspian Sea from 200 to 2,000 tons a day. Apart from the physical limitations of the railway already mentioned, it was found that the existing Persian Staff of the line was hopelessly inefficient and disorganized. The hope, therefore, that it would be possible to use the existing staff

as the main basis for development was seen to be doomed to disappointment, and it became necessary to reinforce the organization with technical staff and units from the Empire and U.S.A. to a much greater extent than had been expected or intended.

The state of the railway on his arrival is best described in the words of Brigadier Sir G. Rhodes: "It started at deep water at Bandar Shahpur, where there was a timber jetty, stretching out from mud flats, capable of taking only two steamers. It continued through the flat country through Ahwaz and Andimishk where the climb into the hills began. For the next hundred or so miles, the railway wound through deep gorges, over numerous bridges, and through a hundred long and often spiral tunnels, climbing steadily at 1.5 per cent grade to 7,000 ft., then dropping down over undulating country to Teheran, at 4,000 ft., and some 500 miles from the sea. From Teheran, the railway traversed another 300 miles of heavy country, crossing the Alburz mountains, by 2.3 per cent grades, with magnificently aligned and engineered tunnels, spirals and bridges, which make this part of the line fully comparable with some of the mighty railway achievements in the Rockies in Canada and the U.S.A. As an anti-climax, the railway ended as it began, on mud flats at Bandar Caspian at the south-east corner of the Caspian Sea. Only this time, in shallow silted water, instead of deep water, due, some say, to the use of the Volga water for irrigation purposes in Russia. Worse still it was getting shallower every year, so that the port was by this time only usable, without extensive dredging, by shallow draft vessels. The railway had been well engineered and built, but was a single line, equipped only for a few light trains. . . . Our target was 2,400 tons per day, of useful 'Aid to Russia' traffic, and we aimed at twelve to fifteen trains per day. This meant many additional crossing stations, more water, completely new telegraph and block signalling equipment, much enlarged marshalling yards, enlarged port and pier at Bandar Shahpur, and a comparatively new branch railway and port at Khorramshah on the Shatt River, and last but not least efficient train crews, and operating staff, new bi-lingual rule books, and many other less important but essential details."

Such then was the problem that faced the Railway staff on arrival, and they had to do what they could with the existing Persian personnel until the arrival, in February, 1942, of the first British Railway Construction Company. It was not until July, 1942, that the partial completion of the Iraq construction programme permitted

the transfer to Persia of a number of Indian survey, construction and maintenance units.

At first work was concentrated on the existing main line, but, in November, 1941, work was started with Persian labour and organization, supervised by British staff, on the new branch line from Ahwaz to Khorramshah. This was completed in time for the first train to leave the newly opened port on 31st December, 1942. In May, 1942, work was started on a small branch from the Ahwaz—Khorramshah line to the small port of Tanuma, and this was completed by the end of October in the same year.

In June, 1942, it was decided that the American army should take over the development and maintenance of the "Aid to Russia" railway, and the hand-over was completed in April, 1943. By this time most of the physical development of the line had been finished, and a sound traffic and maintenance organization built up. With a splendid force of men and equipment the U.S. Engineers continued the development and running of the railway until a daily delivery of 10,000 tons of tanks, guns, and stores of all kinds was being made to our Russian Allies. As a result of the combined efforts from October, 1941, to October, 1944, over 4 million tons of "Aid to Russia" traffic of all kinds were delivered, and this undoubtedly helped in no small way to make the Russian victories possible.

The achievement of the British Railway Engineers was well summed up in a letter to *The Times* after the war. In it a senior staff officer, who had been able to judge from his position on the administrative staff at Headquarters Middle East Command the value of the work done, wrote: "In October, 1941, when Brigadier Sir Godfrey Rhodes and his staff began to reorganize and develop the Trans-Iranian Railway, it could carry only 200 tons of paying load a day. In almost every department the organization of the line was, by occidental standards, chaotic. Half the locomotives were awaiting repair and the rest in a parlous condition. The Royal Engineers, exercising extraordinary tact and patience, had to overhaul the Gilbertian edifice from top to bottom, to carry out a huge constructional programme, and to keep the line in operation at the same time. Working double-headed trains through the 140 tunnels (some spiral) between Andimeshk and Dorud, British locomotive crews were often overcome by the fumes and the terrible heat. Some Sappers died: but the loads which the Russians so desperately needed were always got through. By the end of 1942 the monthly lift had been multiplied nearly eight times.

The Americans, coming with comparatively unlimited resources, were able greatly to increase the lift again. They richly deserve the tributes widely paid to their achievement. But in justice to the British Engineers it should be remembered that the Americans took over a system already completely reorganized and enormously developed by British stamina and skill."

Inland Water Transport

The third main element in the communication system of the Persia–Iraq theatre was Inland Water Transport. In the 1914–18 war much use had been made of the navigable waters of the Tigris and Euphrates to transport troops and stores in Iraq. Although a civilian organization had continued to use the rivers in the intervening years, the large majority of the craft available at the outbreak of hostilities in 1940 were those that had been imported by the British I.W.T. Organization in the earlier war, and were in consequence in continuous need of repair. Nevertheless they were pressed into service, and at first continued to be operated under military instructions by the Agents of the peace-time company. In June, 1941, in the waterborne advance up the Tigris to Kut and Amara, this system of control was continued. At this time I.W.T. was represented on the Transportation Directorate by one staff captain from a docks unit with no previous I.W.T. experience.

As the importance of the theatre grew, and it became obvious that river traffic would have to be developed to the maximum, a committee of experts—the Berry Committee—was sent from India to examine the situation and make recommendations. The Committee returned to India in September, 1941, and, pending decisions and action on the recommendations in its report, a sub-directorate of I.W.T. was set up in Iraq with an unofficial establishment, and assistance was obtained from a few officers and other ranks from a rest camp. A few I.W.T. officers were posted from India and others with suitable experience were transferred from other units in the theatre. This formed the nucleus of an organization which was to grow within a year to a strength of over 10,000.

In November, 1941, the newly appointed Director of I.W.T. for the theatre went to India to find out what progress was being made in provision of craft and personnel. It appeared that only a few paddle steamers and barges would be available from India for many months to come. Accordingly all available local craft, whatever their condition, had to be pressed into service, and advantage

taken of the offer of some American barges and tow boats, although these were not very suitable for local conditions.

The organization adopted by agreement between the Berry Committee and the military authorities in Iraq followed broadly that of the I.W.T. in Mesopotamia in 1914–18, namely a departmental organization on civil lines with a large central establishment, as opposed to the normal group and company system. In view of the almost complete dearth of army officers with I.W.T. experience, and of commissioned civilian experts with an ample knowledge of military organization and methods, this form of organization was found to be best suited to make fullest use of the specialist knowledge of both soldiers and civilians. Owing to the lack of skilled tradesmen in the personnel brought from India, every available local tradesman who could be persuaded or bribed into service was swept into the net. To control this conglomerate mass, a British I.W.T. Group which arrived in January, 1942, was immediately broken up and its officers and other ranks posted all over the theatre to take charge. It was very largely due to the efforts of these British R.E. personnel, controlling a medley of Indians of all castes and creeds, Iraqis, Kurds, Persians, Chinese and Arabs, that I.W.T. Iraq and Persia was able to move the large tonnages that it did during the next three years of the war.

By March, 1942, the Traffic Department was handling about 2,000 tons of cargo a day, half of which was harbour lighterage and the rest up-river traffic. During the summer of 1942, tugs and larger towing steamers arrived from India and were put into commission on the lower reaches of the rivers below the narrows. A depot and workshop was established on the site of the 1914–18 I.W.T. establishment at Dockyard Island, Ashar. Only a few of the old slipways had survived, and, to provide this depot, the island had to be cleared of its inhabitants, the site levelled and the level of the whole island raised an average of three feet with mud dredged from the surrounding creeks. Roads and Decauville track were laid, jetties and workshops built, and light, power and machinery installed. During the four months ending August, 1942, an average of 3,000 tons a day was handled over 1,264 miles of river and seaway with a fleet of 661 vessels.

At this time, pending the opening of the Kut–Baquba railway, Russian cargo was being carried by I.W.T. to Baghdad, and thence by rail to Khanaqin and onwards by road. The Kut–Baquba railway was completed at the end of November, and the wharves at Kut

were open to general traffic in December. In a very short time I.W.T. were discharging "Aid to Russia" cargo at Kut faster than it could be moved forward.

The peak of the I.W.T. effort was reached in the spring of 1943, when in one month the average cargo handled daily amounted to 5,208 tons and the total ton-mileage was 11,300,000. In the summer of the same year, the decline in importance of the Persia–Iraq theatre and the intensification of the campaign in Burma led to units and craft being returned to India, and a considerable reduction of activity.

Other Projects

In connexion with the development of communications and the accommodation and maintenance of the forces in Persia and Iraq, a number of engineer services had to be undertaken. At various points in the Command some 5 million gallons of filtered water and a further 1½ million gallons of settled and treated water were supplied daily. Four hundred and fifty pumping sets were in operation and over 1,000 miles of piping laid. Many bore-holes up to 250 feet deep were sunk. Over 10,000 kilowatts of electricity were provided, including 3,000 in the Shaiba Base area. Air conditioning sets were installed in operating theatres, hospital wards, signal exchanges, and certain amenity buildings. A 2,000 ton cold store was erected at Basra, and 200 ton stores at Baghdad and Ahwaz with four refrigerating barges for transport. Ice plants produced 75 tons of ice daily. The maintenance of all this hot weather plant required much effort and special sections from E. and M. companies designated "Polar Units" were formed for the purpose. Two million square feet of hutting for living and dining accommodation, and hospital wards for 11,000 patients were erected. Plants for the production of oxygen and acetylene were imported and erected at Basra. Factories were also organized for the production of "Juss", or gypsum, which was extensively used in place of lime for mortar; of Thatchboard made from reeds and used for partitions, etc., as well as a sawmill at Teheran with an output of 2,000 tons monthly.

CYPRUS

The strategic importance of Cyprus when related to the situation in the Middle East at the outbreak of war with Italy may be gauged by a glance at the map. This island formed a stepping stone to the Levant where the defection of the French in Syria gave a possible

foothold to Axis influence and forces; it covered the line of approach for seaborne forces from the islands in the Aegean held by the enemy, and offered staging facilities for aircraft on their way east. At first no troops could be spared for its defence, but the fall of Greece and the occupation by Axis forces of that country and Crete in May, 1941, necessitated definite action either to deny to the enemy the facilities of the island, or, better still, to prevent his landing thereon.

As a first step a small force, called for purposes of deception 7th Division, and including 209th and 296th Field Companies, with a Works Organization under a C.R.E. (Lieut.-Colonel A. B. D. Edwards,[1] succeeded by Lieut.-Colonel E. N. Bickford[2]) was sent to Cyprus. The chief task of the Engineers was first to prepare for demolition the jetties, oil plants, and airfields of the island and then to improve the airfield at Nicosia and to build accommodation and hospitals for a larger force when this could be sent. The R.E. were specially concerned with the airfields, other construction work being carried out chiefly by the local P.W.D.

With the arrival in the late summer of 1941, of 50th Division (less one brigade group), with Lieut.-Colonel J. R. Kennedy as C.R.E., a more active defence policy could be adopted. This division was relieved shortly afterwards by 5th Indian Division from the Western Desert. As a deceptive measure the rear headquarters of this division was given the title of XXV Corps, which was in fact composed of 5th Indian Division, C.R.E. Lieut.-Colonel A. H. G. Napier, and the so-called 7th Division, reinforced by the Household Cavalry. The garrison of Cyprus was still small for the commitments involved in the defence of the island, and it was decided that the most economical policy would be to keep the minimum number of troops on static defence and the maximum in a mobile role. As the majority of the roads were of very inferior quality, this policy involved the R.E. and Sapper and Miner units in an extensive programme of road improvement and construction, in which local labour was used as much as possible. Other work included building new, and extending existing, airfields to a total of twenty-five; accommodation and administrative installations for the increased garrison, and the construction of defences against seaborne landings and for anti-aircraft artillery.

In the spring of 1942, 5th Indian Division with its Sapper and Miner companies was called back to the Western Desert to assist

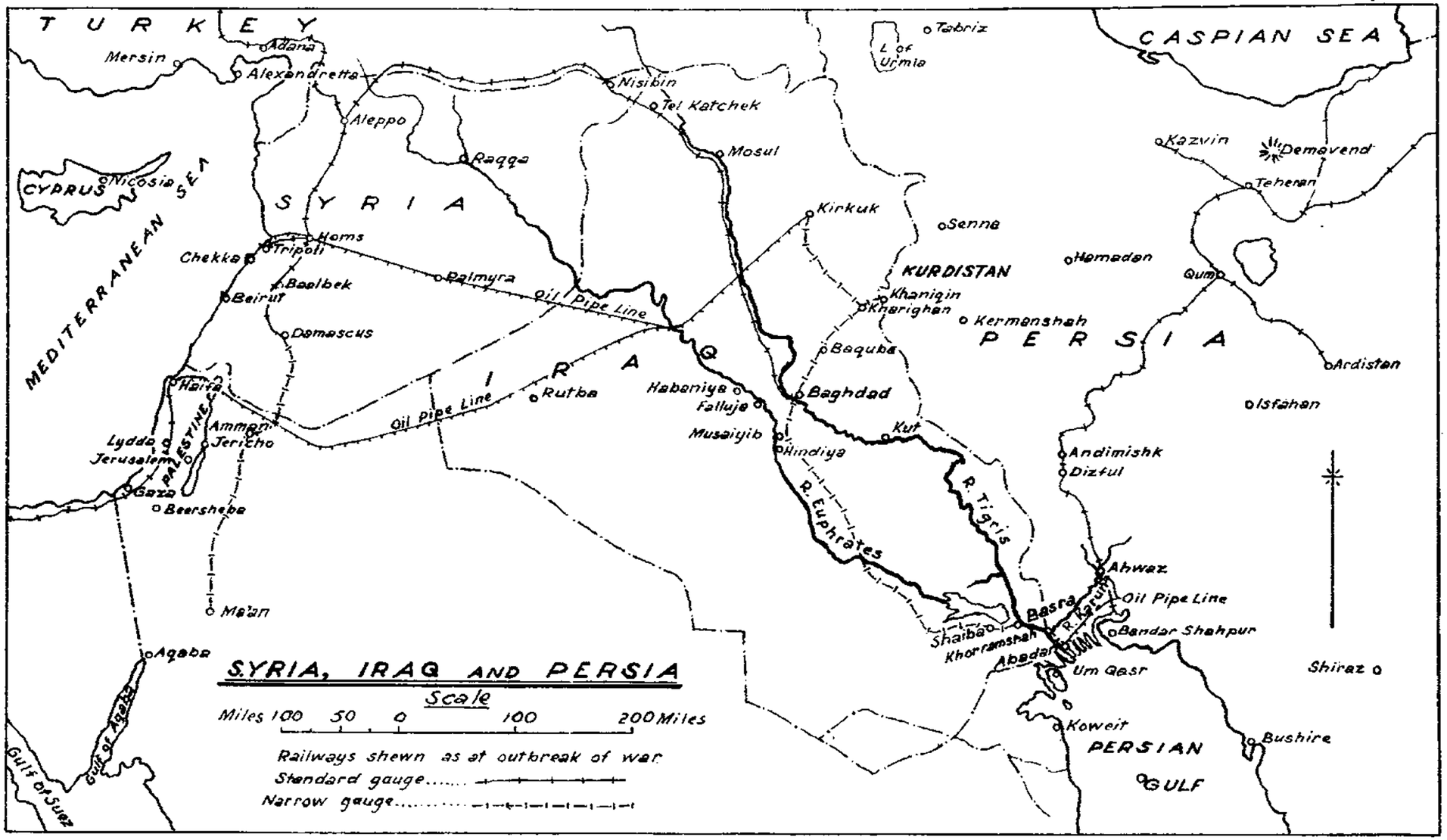
[1]Brigadier A. B. D. Edwards, C.B.E., M.C.
[2]Lieut.-Colonel E. N. Bickford.

in arresting Rommel's offensive which was to throw Eighth Army back to El Alamein. The Works organization with the R.E. units remained to continue the airfield programme on the island and to support the defensive efforts of the skeleton 7th Division. With such a meagre garrison, it was fortunate that the island was never attacked, except by limited air bombing, the German forces in eastern Europe being fully engaged on the Russian front. With the secession of Italy from the Axis, in the summer of 1943, all danger of invasion of Cyprus virtually ceased and the R.E. units were gradually withdrawn.

AEGEAN ISLANDS

As soon as the Axis powers began, in the winter of 1940–1, to move into the Balkans, the importance of the islands in the Aegean Sea, and particularly of Rhodes, became obvious. If, as happened in 1941, Axis forces overran Greece they would be able to establish airfields there which would threaten our navy and shipping in the eastern Mediterranean. Accordingly, in January, 1941, 6th Division was assembled in Egypt and prepared for movement for the occupation of Rhodes. Owing to the stress of military commitments in Africa and the Middle East the Division had to be diverted elsewhere. But the importance of the course still remained, and during the ensuing months C.-in-C. Middle East constantly endeavoured to spare troops and shipping for the purpose. But to no avail, the assembly of the necessary ships and landing craft being the greatest difficulty, for the landing must now be made in force as the Axis troops occupied the islands after the fall of Greece.

The armistice with Italy in September, 1943, put a different complexion on the position. Parts of the garrisons of the islands were Italian who might be co-operative to an Allied attempt to occupy the islands, and would at worst be neutral. Still, the demands of other theatres limited the force that could be spared both as regards troops and landing craft. The Germans rapidly overcame the Italians in Rhodes and occupied the airfields. Without aircover an attack on that island was not a feasible proposition. It was, therefore, decided to try to occupy Cos, Leros and Samos, Cos being the most important as it contained the only airfield from which aircraft could operate. On 10th September, detachments of the Special Boat Section of the Commandos landed on Castelrosso island and, having come to terms with the Italian garrison and handed over to a detachment of R.A.F. Regiment, moved on to Cos two days


TURKEY
Adana
Mersin
Alexandretta
Aleppo
Nisibin
Tel Katchek
Mosul
Raqqa
Tabriz
L. of Urmia
CASPIAN SEA
Kazvin
Demavend
Tehran
CYPRUS
Nicosia
MEDITERRANEAN SEA
SYRIA
Kirkuk
Senna
KURDISTAN
Hamadan
Qum
Khaniqin
Kharighan
Kermenshah
PERSIA
Ardistan
Isfahan
Homs
Tripoli
Chekka
Palmyra
Oil Pipe Line
Baalbek
Beirut
Damascus
IRAQ
Baquba
Baghdad
Rutba
Habaniya
Falluja
Musaiyib
Hindiya
Kut
Haifa
Oil Pipe Line
Ammon
Jericho
Lydda
Jerusalem
PALESTINE
Gaza
Beersheba
R. Euphrates
R. Tigris
Andimishk
Dizful
Ahwaz
Oil Pipe Line
R. Karun
Basra
Shaiba
Khorramshah
Abadan
Bandar Shahpur
Um Qasr
Shiraz
Ma'an
Aqaba
Gulf of Aqaba
Gulf of Suez
Koweit
PERSIAN GULF
Bushire
SYRIA, IRAQ AND PERSIA
Scale
Miles 100 50 0 100 200 Miles
Railways shewn as at outbreak of war
Standard gauge.....
Narrow gauge.....

later. Other troops and aircraft rapidly followed and occupied the airfields. The S.B.S. landed on other islands in the area and gained the adhesion of the Italian garrisons. During the latter half of September, a force, composed chiefly of 234th Infantry Brigade with a number of anti-aircraft artillery units and 9th Field Company I.E., arrived in Samos, Leros, Cos and Castelrosso. Even for this small force the shipping available was insufficient and only three platoons of the Field Company with a skeleton headquarters could be sent, a platoon going to each of Leros, Cos and Castlerosso. Shortly after arrival the O.C., Major P. G. O. Landon,[1] was killed when the aircraft in which he was visiting his platoons was shot down between the islands. The special tasks of the I.E. were assistance to the other arms in the preparation of defences, and, at Cos, the maintenance of the airfields. This last task proved a heavy and important one for, from an early date, German aircraft made heavy bombing attacks and constantly cratered the runways. Small reinforcements to the garrisons were landed gradually by the Royal Navy, which suffered severe losses in doing so from attacks by the German air force and from mines, and by parachute, including a small detachment of 74th Field Company R.E. which arrived in Cos on 1st October, to assist in the maintenance of airfields.

On 2nd October, German troops made a number of landings on Cos, the small garrison being unable to guard all the possible beaches suitable for landing. Assisted by intense air attack the enemy rapidly overran the island, and, in spite of a gallant resistance at the main airfield, in which the R.E. detachment played a noteworthy part, on 4th October resistance ceased. A number of British and Italian soldiers were rescued by the Royal Navy and the Special Boat Section on that and succeeding nights.

Reinforcements were sent to other islands in an endeavour to stop the German advance, but on 12th November Leros was invaded. In spite of determined resistance, the small garrison was overwhelmed by waves of fresh German troops landed by sea or dropped by parachute, and on the afternoon of the 16th the headquarters of the garrison had to surrender. In spite of further efforts by the Royal Navy and the Special Boat Section only a few of the garrison were rescued. From the two islands only three men of 9th Field Company I.E. escaped by boat to Turkey.

In view of German domination of the Aegean the garrisons of Samos and Castelrosso were later evacuated.

[1]Major P. G. O. Landon, killed on service, 1943.

CHAPTER XII

NAVAL BASES IN THE MEDITERRANEAN

Gibraltar—Earlier history—Situation before and immediately after the outbreak of war—Work after the fall of France—Tunnels—construction of airstrip—Later work.
Malta—Pre-war—The outbreak of war—The siege—After the siege.

GIBRALTAR

Earlier History

British military engineers have been closely connected with the defences of the Rock of Gibraltar since, as is recorded in Major-General Porter's *History of the Royal Engineers* (Vol. I, page 65), Captain Talbot Edwards landed there in 1704, shortly after its capture by Admiral Sir George Rooke. Later it was the birthplace of the Corps of Royal Military Artificers. For many years it has been the permanent station of 1st Company, now Squadron, R.E.

In World War II the Rock was the scene of as great engineering activity as it had seen since the great sieges of the eighteenth century, and probably in no area of the same extent was there so much R.E. effort expended between 1939 and 1945.

The general topography of Gibraltar and its municipal and military development have already been described by General Porter. The same extreme congestion of buildings and the lack of level ground, except on the neck on the north face bordering on Spain and at the extreme end of the peninsula, existed and had been further aggravated by the increase in buildings for accommodation and fortifications.

After much work had been done on the defences of the peninsula in and between the earlier sieges, in the third siege of 1779–83 a system of tunnels had been blasted by the Sappers and Miners on the north face to enable guns to fire on the Spanish lines. These tunnels lay some fifteen to twenty feet behind the face of the cliff which is almost vertical. They were at various levels, some connected by inclines, the top level, or Upper Gallery, culminating in an observation post some 1,000 feet above sea level. The guns were kept in openings off the main tunnels and run forward to fire through embrasures in the cliff face.

No further tunnelling of importance took place till about 1908, between which year and the commencement of World War II certain tunnels had been driven through and into the Rock by the City Council and the Admiralty through which to bring water, stone and fuel oil into the town, and to provide cover for storage of water and ammunition. In 1939 the City Council further commenced tunnelling a series of air-raid shelters for the inhabitants.

Situation Before and Immediately After the Outbreak of War

In the years immediately preceding the outbreak of World War II work was pressed ahead, as in other fortresses, in strengthening the defences. The R.E. work was under the direction of a C.R.E., Lieut.-Colonel J. S. Baines[1], succeeded before the outbreak of war by Lieut.-Colonel N. C. D. Brownjohn,[2] and a small works staff. The R.E. units of the garrison were the 1st Fortress Company manning coast defence searchlights, and 32nd Fortress Company for operating A.A. searchlights. These companies also assisted in work on the defences, constructing concrete pill-boxes and gun emplacements, etc. Attention was at this time largely directed to the improvement of the land defences. The recent civil war in Spain had shown that the new Spanish Government was favourable to those of the Nazi-Fascist countries, Germany and Italy, which had helped it in its struggle for power. In case of war between Britain and these powers there would, therefore, be a possibility of a *coup-de-main* attack by German troops through Spanish territory, if not by Spanish forces themselves. For this reason the defences on the landward side built at that time included anti-tank obstacles. In September, 1939, the defence scheme was immediately put into operation, but the R.E. Companies were not at that time brought up to War Establishment though they were allotted battle tasks with the rest of the garrison.

Till the fall of France and the declaration of war by Italy in June, 1940, there was not any apparent threat to the fortress. France was our ally, and Italy and Spain neutral. The situation from that month was entirely different. The Italian fleet was a threat to our sea communications through the Mediterranean and even to the Rock itself, and there was also the danger, with France overrun, of attack on the land side by German or even Spanish forces if Spain,

[1]Lieut.-Colonel J. S. Baines.

[2]Major-General N. C. D. Brownjohn, C.B., O.B.E., M.C.

with her Fascist government, decided to throw in her lot with the Axis powers. The garrison was therefore immediately reinforced from two to four battalions organized in two brigades, the two Fortress Companies R.E. were brought up to war establishment and the following extra R.E. units arrived in succession:—

172nd Tunnelling Company.
178th Tunnelling Company.
179th Tunnelling Company.
180th Tunnelling Company.
Detachment 1st Tunnelling Company R.C.E.
711th Artisan Works Company.
A General Construction Company.

A Chief Engineer, Colonel H. M. Fordham,[1] succeeded in turn by Brigadier T. W. R. Haycraft,[2] Brigadier E. N. Clifton, and Brigadier W. G. R. Nutt, was appointed, the first since 1925, and two extra Cs.R.E., one of whom (in succession Lieut.-Colonel D. M. Thomson[3] and Lieut.-Colonel A. R. O. Williams[4]) was for command of the Tunnelling Companies, the other taking over Works from the existing C.E.E. who commanded the Fortress R.E.

Work After the Fall of France

It had been appreciated in peace that, on the outbreak of war, the chief tasks of the R.E. would be the construction of further underground accommodation by tunnelling into the Rock, and the building of an airstrip on the North Front. Plans for the former had already been developed but little actual work had been done beyond that already described. For the airstrip as early as 1936 a firm of consulting engineers had submitted a report to the Air Ministry on two proposals for constructing a runway, but neither proposal had been implemented at the time.

While the major work of the R.E. was to be on these two projects there was also much to be done in the early stages in finishing off work on fixed defences, on petrol installations, and on laying minefields at the North Front.

The existing trenches and tunnels were strengthened and made proof against modern weapons as far as possible. Lyon lights and

[1]Colonel H. M. Fordham, O.B.E., M.C., died, 1947.
[2]Brigadier T. W. R. Haycraft.
[3]Lieut.-Colonel D. M. Thomson
[4]Lieut.-Colonel A. R. O. Williams, O.B.E.

other available searchlights of various sizes were emplaced in the old gun embrasures to illuminate the approaches from Spain. The existing tunnels were bunked up to capacity to hold personnel, and cookhouses, latrines, etc., were provided as far as possible underground. Obstacles were erected to obstruct all possible landing places. St. Michael's cave, a ramification of stalactite caves about 500 feet up the Rock overlooking the harbour and well known to visitors for half a century, was converted for storage. Brick and concrete magazines and store-houses were built in all accessible portions of the cave and concrete stairs provided. The cave was very wet and so maintenance and turn-over of ammunition entailed an enormous amount of labour.

During 1941, 575th Army Troops Company and 170th Tunnelling Company R.E., and 3rd Tunnelling Company R.C.E. arrived. The equipment of the Canadian unit was more modern than that of the British companies, and they drilled wet with drifters. Attached to that Company was a section of diamond drillers which proved most valuable for prospecting work.

Although the work on the tunnels and on the airstrip ran concurrently and covered a considerable period, it will be most convenient to describe each in turn from beginning to end, and not attempt to give a truly chronological history of the work of the whole of the engineers of the garrison.

Tunnels

Few works carried out by the Corps have captured the general imagination to a greater extent than the Gibraltar tunnels, and it may well be that they will rank with the Rhine bridges as outstanding achievements of the war. The whole of the planning, execution, and development was carried out by military personnel.

At the outset the need was to develop accommodation for troops and vital stores such as food as quickly as possible. In these early stages work had to proceed concurrently with planning, plant was very scarce and all spoil removal was necessarily manual. Also it was difficult to obtain working parties as there was so much other work going on at the time. Some of the old galleries were used as a starting point, and development drives and chambers taken off them.

The Gibraltar rock, which is a limestone, stands quite well without support for a width of twelve to fifteen feet. Above that width the excavation has to be arched with a rise of about one fifth of the span. The largest chamber constructed had a span of 50 ft. with a rise of

11 ft. in the arch. The height from ground level to the crown being 32 ft. and the length 380 ft.

The humidity was very high, and in some tunnels as much as 98 per cent. For this reason chambers cut in the natural rock were not suitable for storage accommodation without some kind of lining. Consequently the practice was to erect buildings inside the rock chamber leaving a clear space between the walls and roof of the building and the rock.

In order to induce natural ventilation it was usual to drive separate headings for this purpose, quite distinct from the access tunnel. Such a method of natural ventilation was suitable only for chambers near the surface of the rock. As and when systems were developed deeper into the heart, ventilation ducts with an extraction system became necessary.

The British Tunnelling Companies had been recruited almost entirely from coal mines, and the men had, therefore, no experience of hard rock mining. The officers, however, had been drawn from the ranks of the Institution of Mining and Metallurgy and were fully experienced. In a surprisingly short time the companies settled down to the unusual conditions and made heavy inroads on the Rock.

The diamond drilling section of the Canadian Tunnelling Company did essential work in exploring the rock for tunnel planning. Apart from one great fault there were many unpredicted pockets of inferior rock, and time spent on exploration was amply repaid.

Lining, concreting, installation of services and other work in the tunnels was carried out by 711th Artisan Works Company, 575th Army Troops Company, and a Pioneer Corps Company.

Even in this first phase of the operations, in which work had to proceed on urgent requirements without detailed exploration and planning in advance, with equipment and materials found ready at hand, and which lasted until the end of 1941, much important work was undertaken. The old galleries were improved and expanded by driving new connecting galleries and chambers: a water distillation plant was installed in tunnelled accommodation, as was storage accommodation for supplies, Ordnance and R.E.M.E. An extensive hospital, named "Gort's" after the then Governor, General Viscount Gort, was organized within the rock and connected with a through east and west tunnel, 1,200 ft. long and 12 ft. square in section, which was appropriately named "Harley Street", and the big existing "Monkey's Cave" overlooking the sea was enlarged

and had a five story convalescent hospital built within it. To give some idea of the extent of these works it may be mentioned that the wards of "Gort's" Hospital were 200 ft. long by 35 ft. wide and had a height of 12 ft., and the excavation for the laundry alone involved the removal of 11,000 tons of rock.

By January, 1942, most of the excavation for these projects had been completed, but construction lagged behind, chiefly owing to the unsuitability for rapid work of the materials available.

To speed up construction Iris, Romney, and Nissen huts were ordered from the U.K. and future chambering was excavated to accommodate these huts with one or two feet to spare all round. Owing to the great humidity the metal sheeting of the huts was liable to rust rapidly, and, as it could not be repainted after erection in the confined space, was thoroughly coated before being put up.

By now there had been a great improvement in the plant situation. Larger compressors arrived which, by providing additional air, not only speeded up drilling, but made possible the use of mechanical mucking machines, pneumatic winches, lights and fans. In consequence more ambitious work could be undertaken and in the interval before the German surrender two great tunnelled roads for lorries running almost the length of the Rock were driven and from these access roads allowed lorries to serve direct still more magazines and storage depots and workshops. Accommodation was provided for two brigade headquarters as well as for more men of the garrison. Extra gun emplacements were constructed, and connexions made for the Admiralty between the tunnelled water and oil storage tanks with the dockyard.

An extensive water supply system was installed in the tunnels. Ring mains, sited inside the Rock, connected up all sources of supply—Naval, Army, and Civil tanks, and both the Navy and Army condenser plants. By utilizing external sources—wells on the North Front and water imported by barge from Algeciras—to the fullest extent for the current requirements of the population and garrison, stocks of water in the rock tanks were kept always at a figure which would tide the garrison, the fleet and the civil population over till the next rains. Chlorinators were installed for use if required at all points where water was drawn from the tanks. Expense tanks for both fresh and washing water were provided in each section of the tunnels, to be filled from the mains. These were tunnelled chambers lined with concrete rendered with a waterproof skin, and were of the order of 100,000 gallons each.

Electric power was provided by underground stations with a total capacity of 1,200 kilowatts. Extractor fans carried the exhaust gases through shafts to the open air.

An average of 36,000 cubic yards of rock was removed per month during the second half of 1942, and during the war years the total amount excavated was 1,087,905 cubic yards. This is equivalent to a tube railway tunnel 10 ft. in diameter from London to Liverpool. Even so, by 1945, less than one-thousandth part of the Rock had been removed.

A certain number of accidents, and some serious ones, occurred, but considering the enormous amount of rock excavated and the urgency of the work, these were surprisingly few. On one occasion there was a very gallant rescue at the face after half of the charges had been lit.

This account of the tunnelling work at Gibraltar has been given in considerable detail as not only was it one of the most notable engineer achievements of the war, but the results of the efforts of the Sappers of the garrison are likely to last long after all traces of other work in the field will have disappeared, and as long as Gibraltar remains in British hands future generations of the Corps will be able to see the work of their predecessors of 1940–45, beside that of still earlier units. The importance of the work was recognized by the Canadian military authorities who presented every Canadian who took part in the enterprise with a silver watch fob which consisted of a medal superimposed on a Gibraltar key. These were presented personally to the men by the G.O.C. First Canadian Army.

(*Note:* The technical details of the tunnelling operations are dealt with at considerable length in a paper by Major W. H. Wilson, who commanded a tunnelling company at Gibraltar during the war, with a report on the discussion thereon, published in "Transactions of the Institution of Mining and Metallurgy, 1945–6 Session.")

Construction of Airstrip

The other major task of the Engineers was the construction of an airstrip on the North Front. The pre-war consideration of this has already been referred to. On the outbreak of war in 1939, the race track on the North Front was closed down and an east and west runway built from sea to sea across the flat ground, a length of 900 yds. Under favourable conditions this gave a take-off barely long enough for stripped Wellington aircraft staging between

England and Malta. Soon the waves lapped over wrecked aircraft at both ends of the runway, which must have been a grim sight for pilots coming in to land. The runway cut across the race-track and skirted the cemetery, another not very cheerful prospect for pilots. Aircraft coming in from the west and taking off westwards necessarily passed over Spanish territorial waters. After the fall of France, Spanish guns often opened up on these occasions, but presumably with no intention of making a kill as there is no record of damage having been done. Added to this the wind eddies set up by the Rock made the pilots' task in taking off and landing an extremely difficult one. Altogether it was about as nasty an airstrip as can be imagined. Here Marshal Sikorski, Commander-in-Chief of the Free Polish Forces, met his death a few seconds after taking off, and many aircraft lay at the bottom of Algeciras Bay or littered the North Front. The only way to improve the wind conditions and to avoid flying over Spanish waters would have been to take the runway through the cemetery. For political reasons this was not pressed. A suggestion was made to bury the cemetery in sand, to be removed after the war, carrying the runway over it. This would have involved raising the whole runway ten feet and was deemed impracticable.

In the autumn of 1941, as a result of the threat to Malta, due to the possession by Axis forces of most of the coast of North Africa and the consequent danger from air attack to the British Fleet in the Mediterranean, it became imperative to route aircraft direct to Egypt, touching only at Gibraltar. Something had therefore to be done to improve the conditions on the airstrip. The 1936 proposals were dug out of their pigeon hole, and a new scheme based on them but expanded to meet the increased need of modern aircraft was evolved.

It was decided to extend the existing runway into Algeciras Bay to a total length of 1,500 yds. on a width of 100 yds. Later, owing to the difficulty of landing on such a strip, which resembled the flight deck of an aircraft carrier, intensified as it was by the variable and sometimes cross winds, it was decided to increase the length to 1,800 yds. This was to be done by dumping spoil from the North Face into the sea in Algeciras Bay.

To carry out the job, the following R.E. units arrived early in 1942:—

855th Quarrying Company.
807th Road Construction Company.
An Excavator Company.

The Excavator Company was specially organized for the task, and included a Canadian Section with diamond drilling equipment and a strong workshops section.

At first spoil was obtained by blasting but this method proved difficult, dangerous, and too slow. Drilling of bore holes was found to be difficult owing to the conglomerate nature of the Rock which was full of fissures. The same causes made the effect of the charges uncertain, sometimes the force of the explosion was lost in fissures, and sometimes debris flew all over the North Front which was packed with aircraft in transit and their attendant personnel.

The Canadian officer in command of the drilling section undertook to bring down the scree by hydraulicing, of which he had some previous experience, using for this purpose the pumps supplied for another purpose. With two pumps installed, one at either end of the face, after a little practice the operators were able to bring down scree as quickly as the loaders and transport could deal with it.

For carting the material to the site tipping trucks and dumpers were used. In spite of the protests of the Brigade Commander on the North Front, all road blocks were removed. Dump trucks were given absolute priority on the roads—and used it. Any vehicle meeting them as they drove all out, often shedding rocks off the tops of their loads as they went, was well advised to leave the road!

Everything possible was done to press on with the work without interfering with the use of the existing runway by the R.A.F. The risk of accident was accepted but few occurred. One aircraft was lost after removing the cab of a lorry at night. The driver of the lorry got away with a shaking. Work proceeded at two levels. When the lower level had advanced sixty to seventy yards beyond the upper, operations at the lower level were stopped, and all hands and vehicles were concentrated on advancing the higher level 50 yds. on a width of 50 yds. This required about 6,250 cubic yards and was normally completed in the morning shift. The surface was completed in the afternoon shift.

As each 50 yds. was completed it was inspected and passed for flying use by the A.O.C., who took the opportunity of collecting all men working on the site and explaining what difference the next 50 yds. would mean to flying operations. This added greatly to the normal enthusiasm, and after his address the men doubled back to their machines and worked with renewed energy. On the important occasion when progress meant that Hudsons could cut

out Malta (where large numbers had been lost) General the Viscount Gort himself came down personally to congratulate the men.

During the intervals until the next advance of 50 yds. could be made the runway was widened to 90 yds., leaving 10 yds. for road way at the lower level.

The runway was sufficiently advanced for use in connexion with the Campaign in North-West Africa, commencing in November, 1942. But it was not finally completed to its full 1,800 yds. length until the middle of 1945. By that time 1½ million cubic yards of fill had been dumped in position.

Later Work

Apart from these major projects much work fell on the R.E. units. By 1943, the strength of the garrison, of which an R.E. officer, Major-General F. G. Hyland,[1] was Commander, had risen to 18,000. This entailed much work on provision of accommodation for men and stores, hospitals, canteens, etc. In addition there were a great number of small jobs on fixed defences which, owing to the nature of the Rock, fell on the engineers. Though the primary duty of the two fortress companies was the operation of searchlights they also assisted in these other activities and at the peak period it was not unusual for one R.E. company to be employed on seventy such tasks at the same time.

By the spring of 1944, most of the reinforcements had been withdrawn for service elsewhere as, with the Mediterranean cleared and Italy out of the war, the threat to Gibraltar had subsided. All but two of the Cs.R.E. left, and of the units only the following remained on the Rock: 1st and 32nd Fortress Companies, 218th Army Troops Company, 711th Artisan Works Company, and 172nd Tunnelling Company. Those which had left were partly replaced by two companies of Italian Pioneer Corps.

Though the Rock was never attacked except for one or two minor air raids, its importance to the strategy of the Allies remained, as it always had been, very great. The work of the Corps was of vital importance to the achievement of final victory, though its value was never tested under fire.

MALTA

Pre-War

As elsewhere, the two years before the outbreak of World War II

[1]Major-General F. G. Hyland, C.B., M.C.

witnessed great activity at Malta in the strengthening of defences and the provision of extra accommodation for men and stores. A number of new gun emplacements, especially those for anti-aircraft defences, were constructed, and concrete pilboxes with wire obstacles erected to cover points suitable for landings. Considerable attention was directed to the provision of underground command posts and storage for ammunition and other stores. The engineer work was under the control of a C.E., Colonel R. G. P. Hunter,[1] and, after his death, Colonel F. B. Barker.[2] He was assisted by two Cs.R.E., one for Works, Lieut.-Colonel F. B. Barker, and the other Lieut.-Colonel E. J. B. Buchanan,[3] who was replaced shortly before the outbreak of war by Lieut.-Colonel G. J. Eaton-Matthews.[4] The R.E. personnel included two fortress companies, 16th and 24th, and a works organization.

The Outbreak of War

At first, as in the case of Gibraltar, there did not appear to be any immediate threat to the Island, but the existence of a Fascist Government in Italy under Mussolini made possible, if not likely, the ultimate adhesion of that country to the enemy side. In that event the presence of enemy air forces on the airfields of Southern Italy and in Sicily would constitute a severe threat to Malta and the Fleet based upon it, apart from any danger of seaborne assault.

Accordingly in September, 1939, priority was given to passive air defence measures, gas proofing, and additional defence works. The existing defences, besides those for coast defence artillery, consisted of about eighty-five posts of which the majority were sited to cover the beaches, twenty-five Lyon Lights, and an anti-aircraft layout of forty-eight guns with nineteen searchlights covering the harbour area. For the latter only three static gun positions had been completed. To these were now added another 200 defence posts, and the work necessary to complete the anti-aircraft layout was speeded up.

The stores situation was unsatisfactory, and, in the spring of 1940, work on important projects had to be suspended owing to the shortages. The cement position in particular gave cause for anxiety, and the C.E. had to control its issue for the whole Island. Later on

[1]Colonel R. G. P. Hunter, O.B.E., died, 1940.
[2]Brigadier F. B. Barker, O.B.E.
[3]Brigadier E. J. B. Buchanan, D.S.O.
[4]Brigadier G. J. Eaton-Matthews, C.B.E., A.D.C.

he had also to control steel, timber, roofing felt and imported airfield construction stores. Work was carried out at first by contract, but scarcity of both stores and labour soon made it necessary to use directly employed civil and military labour. Two artisan works companies were raised locally on a Territorial Army basis.

On the fall of France and the entry of Italy into the war the situation of Malta became full of peril from the potential threats described above. Though the main base of the Fleet had to be moved to the Eastern Mediterranean, Malta was still essential as a naval and air base to cover the passage of urgent convoys which had to be sent through the Mediterranean rather than by the long route round the Cape of Good Hope. Reinforcements in men and material arrived including, for the R. Engineers, an extra C.R.E. for works, Lieut.-Colonel C. L. Fox,[1] and with the extra other ranks the fortress companies were able to provide personnel to form two Bomb Disposal platoons under Lieutenant A. Talbot, G.C. The arrival of sixty-four more anti-aircraft guns involved the construction of fourteen new four-gun emplacements.

On the appointment of Colonel Barker as C.E., Lieut.-Colonel G. H. F. Reid[2] took over the duties of the other C.R.E. (Works). Later and before the siege commenced, Colonel Eaton-Matthews replaced Colonel Barker as C.E., his place as O.C. Fortress R.E. being taken by Lieut.-Colonel G. R. McMeekan.

The Siege

The island was now to all intents and purposes in a state of siege. Owing to the exposure of convoys and their escorting fleets, only absolutely essential reinforcements and supplies could be sent to it. Rations were reduced and the small garrison had to put in long hours on essential duties. On top of this came soon intense and continuous air attacks, and further preparations had to be made to repel assault. Tunnelled headquarters and accommodation were provided and for this purpose 173rd Tunnelling Company arrived in August, 1941, in one of the few convoys which reached the Island at the time. Its transport had been sunk by a bombing attack, but all the personnel were transferred to a destroyer and brought safely to port. But all the equipment was lost and so the work of the unit,

[1]Brigadier C. L. Fox, C.B.E.
[2]Colonel G. H. F. Reid, C.B.E.

which was mostly in hard rock, was greatly handicapped till some compressors and other tools could be obtained.

Anti-invasion obstacles were erected on beaches possible for landings and the exits closed by anti-tank obstacles of all types. Even some old fougasses, which had been constructed in Napoleonic times, were brought back into use and charged.

As a result of the bombing much of the engineer effort was diverted to the repair of damage. In April, 1942, the main R.E. store at Floriana was hit several times, and, though considerable dispersion had already taken place, more was now necessary. Though the R.A.F. were responsible for construction and maintenance of airfields, during the period of intense bombing, it was necessary for the R.E. and other troops to fill in craters, and for the R.E. units to assist in the construction of extra dispersal points and taxi-tracks.

The 16th Fortress Company was at first responsible for the working of anti-aircraft searchlights and continued to be so for long after the duty elsewhere had been assumed by the Royal Artillery. Even when two R.A. companies arrived in the Island, the O.C. of 16th Company, Major J. E. T. Nelson,[1] was appointed C.O. of the R.A. Searchlight Regiment and was one of the only two R.E. officers to hold that unusual position. Though the Company was at the outset equipped with out-of-date sound locators it achieved remarkable results, Major Nelson being responsible, in conjunction with the R.A.F., for developing a successful technique of night fighter operations. The duty of 24th Company was the operation of coast defence searchlights and it had the satisfaction of assisting in dealing with one of the few enemy naval attacks on a coast fortress during the war. On 26th July, 1941, enemy "E" boats attempted to enter the Grand Harbour. Within thirty seconds of the alarm being given the approaches were illuminated and all the "E" boats were destroyed by gunfire.

Under the shower of bombs the two B.D. sections were kept fully employed. Owing to the rocky nature of the soil, bombs seldom penetrated far into the earth, thus reducing the work on digging out U.X.B.s Also there were no casualties from delayed action fuses though the men of the section had many narrow escapes. The quantities dealt with were very large, rising to a peak in May, 1942, when fifty tons of bombs were disposed of each week. To give relief from the strain the personnel were changed over periodically with volunteers from the fortress companies. During one of these "rests",

[1]Lieut.-Colonel J. E. T. Nelson, D.S.O.

Lieutenant Talbot, who was having a change of employment as liaison officer with the R.A.F., was unfortunately killed when the aircraft in which he was flying was shot down.

The lot of the R.E. units, as of the rest of the garrison and the civilian inhabitants, was far from enviable. Very short of food, owing to the long spaced arrival of convoys, the troops were for a long period on half rations, often with little sleep, the daily round of clearing debris and repairing bomb damage on top of normal duties soon became irksome. A R.E. officer who served through the siege writes that the worst enemy was boredom, and he almost welcomed for his men the excitement of an air attack with its consequent activity in rescuing people buried in the debris of stricken houses.

Thus through 1941 and 1942 the garrison held on, largely cut off from the world and under a steady stream of bombs, led and encouraged by the Governor, a R.E. officer, Lieut.-General Sir William Dobbie.[1] On the 16th April, 1942, His Majesty the King awarded to the Island the George Cross in recognition of the gallantry of the inhabitants and garrison. In May, 1942, General Dobbie was relieved by General Viscount Gort. Of General Dobbie an officer writes, "Steadfast, deeply religious and personally fearless, he inspired the Maltese in a way that few more spectacular men could have done."

After the Siege

The victories in North Africa, and the neutralization and partial destruction of the Italian Fleet, to a large extent raised the "siege" of Malta. With reinforcements the island began to prepare for its part in the coming invasion of Sicily.

In February, 1943, 171st Tunnelling Company R.E. arrived and was immediately employed on putting important headquarters, dressing stations, workshops and stores underground. Similar work was carried out for the Civil Government, the R.N. and the R.A.F. In the course of making underground workshops for the Royal Navy, two boiler shops were constructed underground measuring 150 ft. by 30 ft. by 30 ft., lined throughout with concrete. This occasioned the removal of 317,000 cubic feet of spoil and the laying of 1,560 cubic yards of concrete. Another tunnelled shelter, necessitating the removal of 170,000 cubic feet, was provided encircling the greater part of French Creek.

[1]Lieut.-General Sir William G. S. Dobbie, G.C.M.G., K.C.B., D.S.O.

Considerable extension to the water supply was also carried out by this company. At Ta Kali a shaft 8 ft. square and 322 ft. deep was sunk and concrete lined pumping chambers constructed. At Wied-Is-Sweda galleries were driven from an existing shaft to strike water-bearing fissures. These works, when handed over to the Civil Government at the close of hostilities, were yielding 5½ million gallons per week. For this the Commanding Officer and the Company were officially thanked by the Government of the Island. A well-boring platoon also worked from March to August, 1943, and another from August, 1944, to the end of the war, to supplement the water supply.

A new hospital was erected at Mellieha, and much work was done on providing another underground at Mtarfa, in anticipation of the casualties incurred in the campaign in Sicily. The latter hospital was never completed or used.

In the middle of 1943, large numbers of troops and R.A.F. personnel destined for Sicily arrived and had to be temporarily accommodated. Headquarters Eighth Army was in the island for about a week in July during the landing.

With the successful termination of the campaign in Sicily priority was now given to reconstruction and the repair of bomb damage to military buildings. Charges were removed from mines and efforts made to expedite the return to normal life. Meanwhile Lieut.-Colonel R. R. Gillespie[1] had taken over the command of the Fortress R.E. from Lieut.-Colonel McMeekan, and Lieut.-Colonel H. D. Tanner[2] had succeeded Lieut.-Colonel Fox as C.R.E. North.

[1]Lieut.-Colonel R. R. Gillespie, O.B.E., M.C.
[2]Colonel H. D. Tanner, O.B.E.

CHAPTER XIII

THE WESTERN DESERT, MAY, 1941, TO AUGUST, 1942

Preparations for renewed offensive—Development of ports—Abortive attack. June, 1941—Preparations for offensive—Siege of Tobruk—Reorganization—General Auchinleck's offensive. November, 1941—Battle of Sidi Rezegh—The pursuit—Benghazi captured—Strategic situation, December, 1941—Rommel's counter-offensive—Gazala position—Rommel renews attack, May, 1942—Demolitions in retreat—Demolitions at Mersa Matruh—Defences of Egypt—Eighth Army stand on El Alamein position—Mine warfare.

(See Map 14 facing page 404 of Chapter XV and Map 17 facing page 423 of Chapter XVI)

Preparations for Renewed Offensive

In spite of the rebuff his forces had suffered in Libya in April, 1941, General Wavell still had his mind on attack. He was anxious to resume the offensive as soon as the reorganization and re-equipment of his forces and the arrival of reinforcements would allow. In the meantime he decided to try, before the enemy should be reinforced by extra German armour and formations, to recapture Sollum and Cappuzzo as a jumping off place for future larger operations. Such an opportunity seemed to occur at the beginning of May, though reinforcements arriving from the United Kingdom had not yet been disembarked, nor had 2nd Armoured Division been re-equipped. Accordingly, on 15th May, the Western Desert Force attacked. At first all went well but then the enemy reacted in strength and, not only drove our forces back on to their original positions, but, pushing on, captured the escarpment above Sollum and the important Halfaya pass, one of the only routes by which tanks and vehicles could climb from the coast route to the higher ground to the south.

Development of Ports

The rapid build up of the force, and particularly the arrival of new tanks, was therefore of vital importance. Among the obstacles

to this was the fact that rapid disembarkation was impeded by the bombing of the Suez Canal and the shortage of heavy cranes at Alexandria. The first enemy mines were dropped in the Canal in February, 1941, and in the following month the Canal was closed for twenty-one days for the clearance of mines. This meant that some of the ships with reinforcements had to be unloaded at Suez, the port of which was unable to cope with the increased traffic. Plans were prepared for extensive development, and in the meantime the Port Operating units R.E. did what they could to relieve the congestion. A second Port Operating Group arrived in May, and of the two now available, one was located at Alexandria covering Haifa and Tobruk, with detachments at Port Sudan, Massawa, and Cyprus. The other had its headquarters at Suez and covered Port Said, the Suez Canal ports and Ataka. In one case a ship with a cargo of "I" tanks had to be sent to Port Said from Alexandria as the cranes at the former port could not lift out the tanks.

Abortive Attack, June, 1941

In spite of these difficulties, the tanks had been delivered to their units by 1st June, but, to enable the personnel to do some training and to try the guns, the attack could not be launched till the 15th. The advance was made in three columns. That on the right, which moved along the coast road to Sollum, was to help the centre column to capture Halfaya Pass. It consisted of 11th Indian Infantry Brigade with supporting troops among which was 4th Field Company Sappers and Miners. The centre column consisted of 4th Armoured and 22nd Guards Brigades with supporting units. It was to advance south of the escarpment, leaving Sollum well to the north and so avoiding the enemy's prepared defences, and then turn right to capture Capuzzo and Halfaya. The 7th Armoured Division (acting C.R.E. Lieut.-Colonel K. MacKay,[1] 4th Field Squadron and 143rd Field Park Squadron) less 4th Armoured Brigade formed the left hand column which was to protect the flank of the attack and to attack enemy tank forces wherever encountered. The Armoured Brigades were each short of a regiment which had not yet been re-equipped.

At first things went fairly well. But the right column was held up in front of Sollum by minefields and the enemy defences. Here

[1]Colonel K. MacKay, D.S.O., O.B.E.

Lieutenant N. R. Thomas[1] of 4th Field Company, Sappers and Miners, made repeated efforts to clear the mines and to convey the Brigade Commander's orders to the units trying to pass through. He brought away intact the first Tellermine to be encountered. The centre column occupied Capuzzo but was unable to push the enemy out of Halfaya and Sollum. The 7th Armoured Division on the left encountered superior enemy armoured forces and had to withdraw, having suffered severe casualties to its tanks. As strong enemy armoured forces now threatened the left of the forward troops, it was necessary to withdraw the whole force to the starting point.

It was now clear that the enemy had been reinforced, that he was in considerable superiority of strength particularly in armour, and that any offensive in force was out of the question. Work was therefore cencentrated on the defensive positions at Mersa Matruh and Bagush, and a new position, later to become so famous, in rear was commenced in the defile between the Qattara Depression and the sea in the neighbourhood of El Alamein. Many new minefields were laid by the engineers of formations, and in connexion with this work continuous investigation was made into standardizing methods of laying the fields and of recording their position and pattern.

Preparations for Offensive

Water Supply

With a view to preparation for a future offensive, and to enable greater forces to be concentrated in the forward area in the desert, the water supply to, and in rear of, the defences was improved. New wells were sunk, storage tanks installed and "birs" opened up, cleaned and filled. Some of the water points in the Matruh area were in exposed positions, and, at the request of C.E. Western Desert Force, the defences were extended forward to cover them more adequately. But the main work in this respect was the carrying forward of a pipeline from Egypt. As early as August, 1940, a start was made on the construction of a pipeline westward from Alexandria, chiefly for supply to the Western Desert Railway. Stocks of pipes, mostly 8-in. and 6-in., were bought up locally, and more piping and pumping plant scraped together as the work advanced. By early 1941, the pipeline had reached Daba, a hundred miles west of Alexandria, and added 800 tons a day to the available carry of

[1]Major N. R. Thomas, M.C., killed in action, September, 1944.

the railway. In July, it was decided to extend the line forward and this work was undertaken by the Army Engineers. First the water-head was carried forward to Mersa Matruh, and as the date of the offensive approached 145 miles of mixed 8-in., 6-in. and 4-in. pipeline were laid forward of that place, with seven pumping stations and ten large reservoirs. All work had to be hidden and each of the pumping stations duplicated. By September, the pipe-line had been carried forward to Misheifa, south-east of Sidi Barani. When the pumps were set in action on the end section no water appeared at the head. Investigation revealed that during erection a cat had got into the pipe, and its body was found blocking a reflex valve. When pussy had been extracted 300 tons of water was pumped per day into storage tanks.

Other blocks were traced to sabotage, an ever-present danger in the East. These were generally in the form of plugs inserted in the line after dark during the construction period.

To feed this extended system large new works and pipe-lines between the pipe source and the old pipehead at Daba were needed. A new 10-in. steel pipeline to Daba, 80 miles long, fed from a new filtration plant on the Nile, was constructed under the direction of the Works Service of the L. of C. In the space of two months, in spite of many difficulties, 145 miles of pipe were laid and filled, and ten large reservoirs and seven new pumping stations were built.

An important addition to the water brought by the pipeline from the Nile Delta was the development of wells at Fuka, which lay on the railway about seventy miles east of Mersa Matruh. Here at the opening of the campaign two Bedouin wells existed which produced fresh water at 38 ft. above sea level, an indication of a pocket of good water. Accordingly about sixty boreholes were sunk in the neighbourhood of the wells, and these revealed the existence of a limestone bed with a cup-shaped stratum of clay beneath. The shape of the basin was determined and the six most suitable boreholes were fitted with pumps, one to supply local needs and the other five feeding into the pipeline. By careful observation the quantity of water that could be pumped regularly was ascertained, the results showing that 25,000 gallons a day could safely be drawn. In actual practice, from September, 1941, to March, 1942, the Fuka boreholes averaged 50,000 gallons a day delivery. The project is an interesting example of the results which may be achieved by skilled work on the part of a boring section combined with a sound application of geological principles.

Though from time to time engineer units of all kinds were employed on construction and maintenance of pipelines in the Western Desert, the majority of the work was carried out by 18th Army Troops Company R.N.Z.E., assisted by a Water Supply Company S.A.E.C., a Geological Survey Section S.A.E.C., and several Well Boring Sections R.E.

Royal Engineers were made responsible for the provision and filling of 40-gallon drums which, filled with water, were brought forward to be used as a reserve in case of breakdown in other sources, or for use in waterless stretches of the desert. 4-gallon water containers were also used in very large quantities. These were produced in factories set up in Egypt by the Director of Works.

Every effort was made to assemble information as to all existing sources of water behind the enemy's line. This was collected from natives, from units which had taken part in the previous advance to Benghazi, and from other sources. It was carefully collated in the office of C.E. Army and distributed to formations and units.

Roads

The road system in, and in rear of, the Army area was developed, that part in the forward area by engineer units of formations, while the main roads from the bases in the Nile Delta were dealt with by the Works organization under Director of Works M.E.F., through C.E. British Troops in Egypt, Brigadier G. Streeten.

Airfields

The rapid growth in strength of the Air Force in the theatre made the production of airfields of considerable importance. In the earlier stages of the campaign, engineer units of formations had been able to provide advanced landing grounds for aircraft acting in close co-operation with the army in the flat desert. All that was generally necessary in the first instance was to select a level area with a hard surface (these were fairly common in the desert) and then clear the surface of stones. The cleared area was then marked with whitened stones round the perimeter, and a reasonably efficient landing ground was produced. The first task was to clear and mark one runway into the prevailing wind. Thereafter it was theoretically correct to prepare two similar strips at different angles and the necessary taxi-tracks. In practice, as each runway should be wide enough to allow of the simultaneous operation of several aircraft, it was found best to clear the whole area and mark its limits with suitable beacons.

To meet the increased demands, in June, 1941, a C.E. Works (Airfields), Brigadier R. S. G. Stokes with Colonel A. G. Bonn[1] as his Deputy, was appointed to the staff of E.-in-C., Middle East Command, to take charge of all airfield construction and maintenance both behind and in the Army areas in the various subordinate theatres. With him arrived a few mechanical equipment units, and general construction companies, R.E., and a little later, after the successful conclusion of the main operations in East Africa, these were joined by the Road Construction Companies S.A.E.C. with their fine equipment. Further a better supply of stores such as Sommerfeld track and Army track became available. At a later stage in the operations Pierced Steel Plank (P.S.P.) and Pre-bituminized Surface (P.B.S.) also arrived.

Under C.E. Airfields a number of Cs.R.E. were appointed to each theatre who were either attached to certain R.A.F. Headquarters or allotted areas of responsibility. The units allotted for work under these Cs.R.E. were organized in Airfield Construction Groups, each of which at this time consisted of two artisan or general construction companies, two sections of a mechanical equipment company, two companies Pioneer Corps, with L.A.D., transport, etc. These groups were organized in two echelons—

(*a*) A forward (mobile) party to reconnoitre and construct or repair landing grounds for Fighter Wings, and
(*b*) Rear Supporting groups to take over from the Mobile parties and to improve the airfields to the required standard.

In the earliest stages divisional and corps units R.E. were still used for starting work on airfields, and on occasions working parties of other arms were also employed. Though personnel of all R.E. units were trained in the clearance of mines and booby-traps, detachments of bomb disposal units usually accompanied forward parties to carry out this work as well as the clearance of unexploded bombs.

Dust soon came to be accepted as one of the major problems on airfields in this dry and sandy land. It not only caused difficulties in landing and taking off due to reduction in visibility, but also caused serious damage to engines. Little could be done as regards dust storms, but these were intermittent and not so common in the coastal belt where most of the airfields were built. Dust raised by

[1]Brigadier A. G. Bonn, C.B.E., M.C.

traffic on neighbouring roads could be reduced by treatment of the surface and by traffic control. But the aircraft themselves, revving up, taxiing, or taking off were liable to raise dense clouds of dust.

These could be mitigated by treatment of the surfaces of standings, taxi-tracks and runways. Watering and rolling was the first expedient tried and proved satisfactory as long as the soil could be kept reasonably damp, no easy matter in the water-starved desert. Oil, naval fuel oil preferably, was also useful but its consistency had to be carefully watched otherwise it was inclined to stick with the dust to the wheels of the aircraft. Various bituminous compounds were used as a surface dressing, or preferably for "mix in place". But this could be done only on more permanent airfields.

If surfaced runways were found necessary, it became all the more necessary to provide similar surfaced taxi-tracks, dispersal bays, and servicing aprons on which there would be more continuous traffic of aircraft and transport, and also because at slower speeds and at rest the aircraft pressed more heavily on the ground.

For the coming offensive C.E. Eighth Army organized highly mobile detachments of lorry borne sappers, with bulldozers, auto-patrols, etc., and these were attached to corps and proved highly successful. The detachments reverted to their own units later on, and in future offensives such parties were provided from airfield construction groups. During the period June to October, 1941, fourteen airfields were constructed in the Desert.

A good deal of work was carried out at this time by engineer units on dummy airfields and decoy fires, the latter to attract enemy bombers.

Extensive underground headquarters for Eighth Army and R.A.F. were constructed, frequently by the adaptation and enlargement of existing underground chambers or of birs which were either not required or were unsuitable for the storage of water.

Training

Engineer field units devoted considerable attention to training under the specialized conditions of war in the desert. Particular study was given to enemy developments of mine warfare technique, both as regards the nature of mines used and the methods of laying. From the results of this study new methods of drill for mine clearance were developed and courses run for personnel of other arms. Means of destruction of disabled enemy tanks were also evolved, and above all extensive training in movement and living in the

featureless desert was carried out particularly by units new to desert warfare.

Siege of Tobruk

We have seen (Chapter IX, page 246) that when the Western Desert Force retreated in March, 1941, to the Egyptian frontier, a garrison, chiefly composed of 9th Australian Division, was left to hold Tobruk, thus denying the use of that port, and in consequence greatly impeding the enemy's maintenance arrangements. In consequence the garrison had to sustain many assaults by the enemy during the ensuing months.

With the R.A.E. units of the 9th Australian Division, 551st Army Troops Company R.E., which had been working at the port since its capture, remained and assisted greatly in the large variety of engineering jobs which became necessary. Apart from work on the defences, which calls for no special note, and which was chiefly carried out by R.A.E. units in conjunction with other arms, the most vital task was the maintenance of the water supply. Water in the town was never plentiful, and the Italians during their occupation had imported much by sea. This was now difficult as the harbour was subject to persistent air attacks by the enemy, so that fast ships could only enter by night, discharge their cargoes, and be far away by dawn. Under such circumstances nothing that was not vitally necessary could be brought in from outside. The engineers, and chiefly the Army Troops Company, therefore, had to develop and make the most of what local sources of water there were. These consisted of two wells and a distilling plant which, with their filling points, were kept in action throughout the siege. The electric power plant was also kept in operation, and constant work had to be done in repairing bomb damage in the port.

In September, 1941, 9th Australian Division was relieved by sea by 6th, renamed 70th, British Division under the command of an officer late of the R.E., Major-General R. MacK. Scobie, who had been Chief of the Staff in the Eritrean Campaign and later D.A.G. at Headquarters, Middle East Command. The R.E. of the Division were those of the old 6th Division, 2nd, 12th and 54th Field and 219th Field Park Companies under Lieut.-Colonel C. C. Duchesne as C.R.E. A Polish Field Company was also attached. Almost immediately after arrival attention was directed to preparations for the breakout intended to meet the coming offensive of Eighth Army. The Division on arrival had taken over the Australian trans-

port which had been continuously in use since long before the commencement of the siege. Two field companies, 2nd and 54th, were equipped as far as possible with vehicles likely to run at least 200 miles. The rest of the R.E. units had to make the best of what "runners" that remained. Besides continued work on strengthening the defences, including the construction of an underground hangar for the R.A.F. with a lift for bringing the aircraft to ground level, the field companies made a special study of enemy mines as those of German make, including the Tellermine, were being encountered for the first time. Sappers accompanied infantry fighting patrols and brought back samples of the mines, and, after investigation, ran classes for other arms in methods of dealing with them.

Reorganization

On 5th July, 1941, General Sir Claude Auchinleck, who had been Commander-in-Chief in India, took over command in the Middle East from General Wavell, and continued his predecessor's policy of reorganization and training with a view to an early offensive to relieve Tobruk, to drive the enemy out of Libya, and to meet his possible thrust into Asia. In case of an enemy offensive in the Western Desert he decided that it would be necessary for his advanced forces to withdraw, and to give battle in the region of Mersa Matruh. Work on the defences of this place and of Bagush and other "boxes", and on the water supply in the area was therefore pressed forward.

In September, the conclusion of the campaign in Greece and East Africa brought about the concentration of the majority of our forces in the Middle East in Egypt, Palestine, and Syria. A regrouping therefore became necessary. Eighth Army, commanded by Lieut.-General Sir Alan Cunningham, the victor of the East African campaign, was formed to include all Allied forces in the Western Desert. Brigadier F. H. Kisch was appointed Chief Engineer. The troops in Palestine and Syria were grouped in Ninth Army, commanded by General Sir Henry Maitland Wilson with Brigadier H. P. W. Hutson as his C.E., while British Troops in Egypt, under command of Lieut.-General R. G. W. H. Stone, late R.E., became in effect a large Base and Lines of Communication Command responsible for internal security and the anti-aircraft defence of Egypt.

The organization and work of the Works and Transportation Services in the development of the Middle East Base are described later. (See Chapter XVI, pages 419–443.)

The Axis forces during this period were greatly reinforced, especially in armour; the supreme command being in the hands of General Bastico, though the German General Rommel, the Commander of the Panzer-Gruppe Afrika, became, from now on, the mainspring of the Axis command.

General Auchinleck's Offensive. November, 1941

In June, 1941, Germany declared war on and invaded Russia. Her forces made such rapid progress that there seemed a danger that they might reach the Caucasus in the spring of 1942, thus offering a further threat to the northern flank of the Allied forces in the Middle East. General Auchinleck decided that, with the forces already available and others promised, he would be strong enough to attack the enemy in Libya in November with the hope of destroying the Axis forces in North Africa before the threat to this northern flank should develop.

For his offensive General Auchinleck concentrated the maximum land and air forces he could spare from other parts of the Middle East theatre, even at the risk of rendering the troops in Palestine and Syria largely immobile by the loss of vehicles, and weak in air cover. Thus on 17th/18th November, 1941, he was able to attack with such forces that for the first time in the war Allied troops were superior in numbers and material.

The mass of the Axis forces was concentrated in the north-east angle of Cyrenaica, and General Auchinleck decided to try to envelop these forces and destroy them. With this object in view XIII Corps under command of Lieut.-General A. R. Godwin-Austen,[1] with Brigadier C. de L. Gaussen as C.E., consisting of 2nd New Zealand Division (C.R.E. Lieut.-Colonel F. Hanson, R.N.Z.E.), 4th Indian Division (C.R.E. Lieut.-Colonel H. P. Cavendish[2]) and 1st Army Tank Brigade, attacked the enemy garrisons on the frontier to pin them down, while XXX Corps under Lieut.-General C. W. M. Norrie,[3] with Brigadier E. N. Clifton, R.N.Z.E. as C.E., comprising 7th Armoured Division (of which the Divisional R.E. had been reformed under Lieut.-Colonel P. A. Clauson with 4th Field Squadron and 143rd Field Park Squadron), 4th Armoured Brigade, 1st South African Division,

[1]General Sir A. R. Godwin-Austen, K.C.S.I., etc.
[2]Colonel H. P. Cavendish, D.S.O., O.B.E.
[3]Lieut.-General Sir C. W. M. Norrie, K.C.M.G., etc.

and Guards Brigade, was directed wide to the south to find out and destroy the enemy's armour and then, assisted by a sortie by the garrison of Tobruk, to cut the communications of the Axis forces on the frontier facing XIII Corps. Every effort was made to conceal the forward concentration and preparations for the offensive; 143rd Field Park Company made a number of canvas canopies for tanks to make the latter appear from the distance and from the air as 3-ton lorries. 7th Armoured Division R.E. cleared sites for advanced landing grounds for fighter aircraft but did not mark them till the opening of the offensive. Immediately after the start of the attack 3rd and 4th Field Squadrons made and marked two more similar landing grounds in the neighbourhood of Fort Maddelina.

For once in the desert, there was too much water. Rain fell in torrents, flooding and putting out of action the important pumping station at Mahsud. Five hundred tons of water had, however, been stored at Misheifa, and the flooded pumping station was quickly by-passed by special connexions so that 200 tons of water could be delivered each day at the top of the escarpment. Extra water was also delivered by rail to Misheifa as soon as the line, which had also been washed away, had been repaired.

Battle of Sidi Rezegh

The attack of XXX Corps was delivered on the night of 17th/18th November. The removal of the minefields on its front, the responsibility for which fell mostly on S.A.E.C. units of 1st S. African Division, was slow, chiefly owing to the scarcity of detectors. Only twelve of these were available for the whole Corps. The enemy had also developed his technique in adding anti-lifting devices to his mines, usually in the form of a second mine laid under the first and connected to it so that the lifting of the upper one set off that below.

R.E. of 7th Armoured Division cut the belt of wire which the Italians had constructed along the frontier and the Corps swept on, the R.E. destroying disabled enemy tanks and guns. At first all went well. The enemy armour was located and the important feature of Sidi Rezegh, south-east of Tobruk was reached on the 19th and occupied by one Armoured Brigade and the Support group of the Division. General Cunningham gave orders on the 21st for XIII Corps to attack and for the garrison of Tobruk to sally out. Then things went wrong. The enemy armour, avoiding the leading British armoured brigades, attacked in strength the British force on

the Sidi Rezegh feature. The other two brigades coming to the assistance of the latter, a furious armoured battle ensued in which the superior power of the enemy's tanks and anti-tank guns caused over 60 per cent casualties to the British tanks and, during the 22nd and 23rd, XXX Corps was obliged to withdraw about twenty miles abandoning the Sidi Rezegh position. On the 22nd, Brigadier Kisch, C.E. Eighth Army, and Brigadier Clifton, moving to reconnoitre for landing grounds with a South African brigade on the left of the Corps, were attacked by a German armoured column and had narrow escapes. Kisch's car had nine bullet holes through it but managed to get away, while Clifton's car was stopped by one bullet and he was rescued by two armoured cars. On the same day Brigadier Gaussen, C.E. XIII Corps, in another part of the battle, had his car "shot from under him" by enemy ground forces. These adventures besides being exemplary of the activity of senior R.E. officers in the forefront of the battle, are also indicative of the changed nature of warfare compared with that to which previous generations of the Army had been accustomed.

As ordered, XIII Corps advanced westwards on the 21st, the duty of clearing lanes through the minefields falling mostly on 2nd New Zealand Division and the Sapper and Miner units of 4th Indian Division. The attack was carried out frontally by the latter division while the New Zealanders, encircling the enemy's right flank, turned northwards and reached the western outskirts of Bardia, thus severing the communications of the Axis forces in position on the frontier between the Omars and Sollum. The New Zealand Division then turned westwards and got within view of the Sidi Rezegh position on the 23rd shortly after the withdrawal of XXX Corps. After severe fighting the position was captured next day, Rommel, with his armour, being elsewhere.

The latter, on the 24th, after collecting the larger part of his Afrika Korps, moved south-east round the right flank of XIII Corps and attacked the rear areas of the latter. Here he created considerable alarm and despondency amongst corps and army units. Amongst these were two parties of 570th Field Park Company whose work was over-run. The Germans took their shirts, jackets and blankets, but, strange to say, not their rifles, and handed them over to an Italian escort to take them away. Their transport broke down and they were told to march, but turning on their guards, they captured an Italian wireless truck and got safely back to their unit. In spite of the disorganization in their rear, 4th Indian Division, to whom

an extra supply of mines had been sent by C.E. Army, stood firm, and Rommel, harried by the R.A.F. and pursued by detachments organized by 7th Armoured Division, turned back by the way he had come, and then turning north, by the route previously followed by 2nd New Zealand Division, sought haven on the 26th near Bardia. During these movements of Rommel, the two R.E. units of 7th Armoured Division were leaguered just south of his line of advance and narrowly escaped notice. On his return some of his vehicles ran into the leaguer and at least one was captured and used during the ensuing operations by 4th Field Squadron.

On the 26th the New Zealand Division at Sidi Rezegh made contact with 70th Division which had broken out of Tobruk, and on the 28th, as the result of further operations, the corridor between the two forces was further widened, and Headquarters XIII Corps with the administrative echelon of the New Zealand Division entered the town while a convoy from Tobruk reached the New Zealanders.

We have seen how the garrison of Tobruk had been preparing to break out for some time. In the later stages it was evident that the Axis forces were at the same time preparing to break in. One night an R.E. party picking up mines for the advance encountered an Italian party similarly engaged picking up the mines for their intended assault. When on 21st November, orders were received for the sortie, they arrived in time to forestall the Axis offensive. For some nights previously 2nd and 54th Field Companies had been preparing bank seats and bringing up stores for the bridging of the anti-tank ditch. Owing to the rocky nature of the ground the bank seats had to be excavated. Being in front of the British posts the digging had to be done quietly by picks, and for concealment the excavations had to be filled with wood and covered with sand each night.

During the night of the 21st/22nd, steel joists and timber were brought up and bridges laid successfully so that the tanks were across before dawn. The attack was a complete surprise. An Italian officer, who was captured shortly after it began, paid a compliment to the R.E. He said: "Your engineers did their work impeccably, the first we knew of the attack was the tanks approaching our lines." The advance continued to the El Duda feature as planned, the three field companies of 70th Division, 2nd, 12th and 54th, being employed in protective mining on the flanks of the salient so formed. It had been expected that junction would be made with the troops of Eighth Army after forty-eight hours. Actually as we have seen only

partial contact was obtained, and that after five days. Complete relief, as will be seen, was not accomplished for three weeks. During this time the garrison of little more than one division had to hold a perimeter extended from a former twenty-seven to thirty miles, the R.E. companies working all the time to strengthen the mine fields on the flanks and head of the salient.

On the 28th, Rommel again turned westwards from Bardia and, as a result of severe fighting about Sidi Rezegh and El Duda, the New Zealand Division were withdrawn some distance on 1st December and Tobruk was once more isolated. Lieut.-General N. M. Ritchie,[1] who had succeeded General Cunningham in command of Eighth Army on the 26th, decided to reorganize and refit before renewing the attempt to relieve Tobruk. In the meanwhile Rommel made another unsuccessful effort to relieve and withdraw the Axis troops now surrounded on the Egyptian frontier about Bardia and then returned once more and took up his position near Sidi Rezegh.

As the first stage of the new offensive, Lieut.-General Norrie, commanding XXX Corps, on 4th December, sent a mixed force of Indians and South Africans with a detachment of 7th Armoured Division R.E. to take El Gobi. Near this place the R.E. destroyed a large enemy petrol and oil depot and also an ammunition depot in the same area. Operations on 6th December indicated that enemy resistance was probably designed to cover his withdrawal. Accordingly General Ritchie ordered XIII Corps to attack with 70th Division from Tobruk to clear the El Duda ridge. On the morning of the 8th suspicions were confirmed, the enemy were in full retreat.

On the 9th Rommel continued his retreat westwards in good order, pursued by infantry of both corps in the centre and by motorized columns on the flanks, and harassed by the R.A.F. from the air. He thus relinquished to their fate the garrisons, largely Italian, of the posts on the Egyptian frontier. These surrendered successively between 2nd and 17th January. We know from German records that the Axis losses in the series of battles amounted to 33,000, together with 300 tanks.

During the latter stages of the battle the Support Group of 7th Armoured Division with the Divisional R.E. had been ranging the country, mopping up enemy parties and destroying vehicles and guns. On 6th December, it achieved a notable success against an enemy rearguard consisting of 500 vehicles and twenty-five light tanks. All the tanks were destroyed, as well as a battery of medium guns and

[1]Lieut.-General Sir N. M. Ritchie, K.C.B., etc.

many of the vehicles. On the second day of the battle, Brigadier Kisch, as a result of his own observation, pressed on the Army Commander the importance of R.E. parties accompanying tank columns in order to destroy enemy tanks and guns at the earliest opportunity and before they could be got away. He followed this up after the battle in a report stressing the necessity of such parties being provided with armoured vehicles as it was impossible for them to travel in "thin-skinned" vehicles in a tank battle. From this eventuated in due course the inclusion of armoured vehicles first in the establishment of field squadrons and later in all field units.

The Pursuit

After a short further stand at Gazala, on the night of 16th December, Rommel slipped away in the darkness followed up by Eighth Army. But only light forces could be used in the pursuit, and even these were much hampered by supply difficulties. Transport resources had been stretched to the limit to sustain the operations in Eastern Cyrenaica, 120 miles ahead of railhead. Rough country, waterlogged in many places after the recent heavy rains, increased the difficulties of supply. Under such circumstances, in the open desert, there was little of the normal work of formation engineer units to be done. In consequence many field units were diverted to tasks which would normally be carried out by Army engineers and those on the L. of C. This was particularly the case in the preparation of airfields, and the restoration of ports and base facilities at the various harbours along the coast. This demonstrates once more the maxim that one senior engineer officer should control all the engineering resources in the army area, both in men and material.

A large number of airfields were required by our greatly expanded air forces to enable them to support the advance. Most enemy airfields were found to be obstructed or ploughed up and freely sown with mines, and even when these had been recovered many new ones were required. This work, which had to be carried out at high speed, was too great for the few airfield construction units then in the field and field companies had to assist. In all during this offensive nine enemy airfields were reinstated and fifteen new ones constructed.

With the difficulties of transport it was also vitally necessary to make the fullest use possible of shipping to supply the Army and work started on improving the capacity of Tobruk immediately it

was relieved and later of other ports, Derna and Benghazi, as in turn they were captured. Jetties were repaired and extra ones built, bulk petrol installations were set up, and the town services of water supply and electricity got into order. In this again much of the work was carried out by field units.

Benghazi Captured

In spite of difficulties the pursuit continued and our leading troops, for the second time within the year, entered Benghazi on Christmas Eve to find the town evacuated. Another column, moving by a southern route encountered strong enemy opposition about Agedabia. Though attacks were made on 28th and 30th December, the enemy stood firm, only retiring to the stronger position about El Agheila on 7th January.

As mentioned above, R.E. units of formations had done much work in improving communications behind the Army to enable it to subsist and carry on the pursuit of the enemy. L. of C. units followed on rapidly taking over the work and extending it. Preparations had been made before the offensive started to extend forward the Western Desert Railway from the existing railhead at Misheifa. Stores not only for the construction of the railway, but also for the extension of the pipeline, on which the operation of the railway would depend, were dumped forward. Practically all water for locomotives had to be imported by pipeline, rail, or sea, as even the drinkable water obtained in the desert from wells, aqueducts, etc., was too saline for use in locomotive boilers. The requirements of locomotives in water, sixty to eighty gallons per mile under desert conditions, were a serious item in this dry area where troops were rationed to a gallon per head per day under favourable conditions, and even less during active operations. In view of this diesel locomotives had been ordered from the United Kingdom but did not arrive till later in 1942. Immediately the offensive started, work on the extension of the railway was pushed ahead and railhead carried forward to Cappuzzo, and, by June, 1942, construction had been completed to Bel Hamed, though the section forward of Cappuzzo had not been opened to traffic when our troops had to retire from Cyrenaica, as will shortly be recounted.

Strategic Situation, December, 1941

Once more events elsewhere were to prejudice military operations

in the Middle East. In December, 1941, Japan attacked the American fleet at Pearl Harbour and invaded Hong Kong, Malaya and Burma. Reinforcements intended for the Middle East had to be diverted to the Far East, and 7th and 9th Australian Divisions were recalled to the defence of their own country. During December the British fleet in the Mediterranean suffered a series of mishaps which for the time being tilted the scales of naval force in that sea in favour of the Axis powers. Aided by a concentration of German air forces in Sicily and North Africa, the movement of enemy reinforcements and supplies across the Mediterranean could be carried out with greater immunity.

In spite of all this, General Auchinleck did not give up his intention of continuing the offensive as soon as he could bring up reinforcements and reorganize and re-equip his armour. The departure of 7th and 9th Australian Divisions, with their full complement of administrative units and valuable engineer plant was a serious blow, and 7th Armoured Division, which had lost a large proportion of its tanks by enemy action or from mechanical breakdown as a result of its long campaign across the desert, had to be withdrawn to reorganize, its place in the forward area being taken by 1st Armoured Division, newly arrived from England and inexperienced in desert fighting. The R.E. of the Division, C.R.E. Lieut.-Colonel R. P. A. D. Lithgow,[1] 1st and 7th Field Squadrons and 1st Field Park Squadron were handicapped by being restricted to the authorized establishment of vehicles, and were not given the extra vehicles allowed to the units of 7th Armoured Division "for experimental purposes". This meant that a single casualty to a truck put some of the men "on their feet". The only other formations in Western Cyrenaica were 201st Guards Motor Brigade, and two brigades of 4th Indian Division near Barce and Benghazi temporarily immobilized for lack of vehicles. Under such circumstances General Auchinleck's orders were for mobile troops to watch the enemy and in the event of an attack to fall back and stand on the line Agedabia–El Haseiat until a counter-attack could be launched. During the second week in January, 1942, in preparation for a possible move by 1st Armoured Division round the enemy's southern flank, 7th Field Squadron cleared a route through El Haseiat of mines and improved crossings over wadis. Besides defensive lines, demolition schemes were prepared at Benghazi and on the routes to the east, most of the work in the Barce–Benghazi area being carried out by engineer

[1]Colonel R. P. A. D. Lithgow, O.B.E.

units of 4th Indian Division. The Divisions, other than those still employed against the enemy garrisons about Bardia, which had taken prominent parts in the Battle of Sidi Rezegh were held back to refit and reorganize. Usually their engineers were employed in the back area helping, as we have seen, the Army and L. of C. units in restoring ports and communications, preparing defences, and in clearing up the mass of minefields left behind by both sides after the recent battle. The brunt of this latter work devolved on the R.E. field companies of 70th Division. The maze of minefields made the task particularly difficult more especially as, apart from having no information as to where the enemy had laid theirs, the Germans do not seem to have developed the technique of mine laying in any scientific manner. They had not apparently realized the danger of sympathetic detonation of mines and had laid them too close together. In consequence, on one occasion, the detonation of one mine, while being cleared by the field companies, set off a line of about 900 others. In the course of the work the Divisional R.E. had over thirty casualties, half of which were fatal.

Rommel's Counter-Offensive

But the advantage was now on the side of Rommel. He had received, and was likely to get further, reinforcements now that the trans-Mediterranean route from Europe was almost free from major molestation. He was nearer his base at Tripoli than was Eighth Army to Alexandria and could therefore maintain larger forces in the forward area. The recent fighting had showed him that his tank and anti-tank guns were superior to those of the British. Finally he must have realized that the action of Japan was likely to stop for the time being the flow of reinforcements and equipment to the Middle East. All these factors, combined with his own adventurous spirit, led him not to wait for the British but to attack first. He opened his offensive early on 21st January, and breaking through along the coast road occupied first Agebadia, and then, on the 23rd, Antelat and Saunnu, overrunning and capturing a section of 7th Field Squadron on water reconnaissance. On the 25th he resumed his advance and took Msus where 1st Field Squadron destroyed the stocks in the field maintenance centre under the fire of the advancing enemy. Then turning north he attacked 4th Indian Division about Benghazi and succeeded in cutting the roads from that place to the north, thus isolating the troops in the town. In spite of

the short time available, demolitions were carried out in the port and depots at Benghazi, and the roads running eastwards were heavily cratered where they mounted escarpments. The garrison of the town, with their line of retreat cut to the north and east, made their way out to the south and then turning east rejoined the Army, though some detachments of Sappers and Miners of 4th Indian Division, which stayed to the end to complete demolitions, were captured.

Gazala Position

In view of this reverse, and remembering the experience of the previous year, orders were now given for the preparation of a defence line about Gazala, for the overhaul and strengthening of the defences on the Egyptian frontier, and, with special priority, the preparation of airfields. Instructions were also given for the preparation of demolitions at Tobruk and for the stoppage of certain of the major work on the port and base installations at that town. A reallotment of Army and G.H.Q. R.E. units was made to give effect to these schemes. While these precautionary measures were taken, General Auchinleck ordered Lieut.-General Ritchie, in command of Eighth Army, to endeavour to hold the enemy west of Tobruk, the possession of which he deemed necessary for the launching of his own counter-attack which he still hoped would be possible in the near future. Tobruk was to be held if possible, but was to be evacuated rather than it should be allowed to be invested again. In accordance with this policy, and to assist in the concentration of larger forces in the forward area, work was pressed ahead with the extension of the pipeline and railway of which the latter was now nearing Cappuzzo.

The engineers of XIII Corps, now under the command of Lieut.-General Gott,[1] were busily engaged on the preparation of the defensive position near Gazala, and, by 26th February, a strong position had been prepared, well mined and organized in depth over an area thirty-six miles square. A minefield, extending from the coast at Gazala to Bir Hacheim in the south, blocked the coastal road and all the important tracks from west to east. Unfortunately, no record is available of the total of mines laid, but, by 10th April, R.E. 1st Armoured Division alone had laid 166,000, and 4th Indian, 1st South African, and 50th Divisions and the Free French had been similarly busy. Besides the fortress of Tobruk, defensive areas were developed in rear to give depth at Akroma, El Adem, and Bir el

[1]Lieut.-General W. H. E. Gott, C.B., killed on service, 1942.

Gobi. Meanwhile the engineers of XXX Corps were at work on the defensive positions on the frontier. These preparations were carried out unhindered by enemy action as Rommel, apart from a probing attack on 16th February, was content to occupy a defensive position on the line Tmimi–Mechili. On 24th February, Brigadier K. Ray, S.A.E.C. relieved Brigadier Clifton as C.E. XXX Corps the latter having been given command of a New Zealand Infantry Brigade. During this period, in conformity with the Army policy of breaking up major formations and operating in self-contained columns of brigade group, battalion, or even company size, R.E. units and sub-units were split up under column command to the detriment of proper control of engineer work. At one period 1st Field Squadron was providing five such detachments as well as one section of a troop under command of Guards Brigade. From air attacks and other causes there was a continuous drain in casualties to men and vehicles, and early in March some men of field squadrons had to be evacuated as they could no longer be carried in the remaining vehicles.

Work on the defences of Tobruk was somewhat prejudiced by changes of policy as to its retention. Mines previously laid were lifted and then relaid. Many of the old minefields of British and Axis origin had been in position for a long time, so that the mines themselves had deteriorated or had been drifted over by shifting sand and were consequently ineffective. Particularly in the vulnerable south-east sector the defences were far from complete, the anti-tank ditch being passable in many places.

Rommel Renews Attack. May, 1942

The lull continued for three months, during which time both sides reorganized and were reinforced. But in the latter direction Rommel fared better than Auchinleck. While most British reinforcements at this time had to be diverted to the Far East, the Germans, with their greater freedom of action in the Mediterranean, were able to reinforce Rommel more easily. On 26th May, Rommel struck. At first he was held but by the 29th he had passed his armour round the minefields and cleared a passage through the latter to enable him to maintain his thrust. During these fluid operations detachments from field squadrons of 1st and 7th Armoured Divisions were kept busy destroying captured enemy guns and tanks, one troop of 1st Field Squadron running out of explosives. Owing to the recent

introduction of wireless communication within divisional R.E., the shortage was soon made up, and the troop continued its good work. A counter attack by Eighth Army on 4th June failed, and the enemy increased his penetration threatening particularly "Knightsbridge" and Bir Hacheim. On 6th June, 10th Indian Infantry Brigade Group with 21st (Independent) Field Troop R.E., was overwhelmed and forced to surrender while endeavouring to establish a "box" between Knightsbridge and the main minefields. After a stout resistance the French garrison of Bir Hacheim had to be withdrawn on the 10th, thus throwing open the southern flank, and on the next three days a fierce armoured battle raged about Knightsbridge. For laying of minefields in defence of the Knightsbridge box, most of 1st and 3rd Field Squadrons R.E. and 20th Field Company Sappers and Miners, were concentrated under C.R.E. 1st Armoured Division, while a detachment of 1st Field Park Squadron repaired the pumps at Bir Butler. After two days work, frequently under fire, this unit pumped 3,000 badly needed gallons of water into the box. It then dismantled the pumps under threat from ten German tanks and got them away safely. In this action about Knightsbridge many damaged enemy tanks were destroyed by engineer units, one section of Sappers and Miners accounting for thirty in the space of twenty-four hours. Once again the superior gun-power of the German tanks won the day and General Ritchie had to withdraw the infantry divisions of XIII Corps from the Gazala position on 14th June.

It was still General Auchinleck's intention to hold Tobruk so long as it did not become entirely isolated and have to stand a siege. Accordingly a garrison of four infantry brigades, mostly 2nd South African Division, but also 201st Guards Brigade with 1st Field Squadron (less one troop), was thrown into the town. But the Germans by-passing the defences to the south attacked the weak south-east sector and isolated the garrison, few of whom were able to break out, the rest having to surrender. The latter included the majority of 1st Field Squadron. Several R.E. parties, one under the acting O.C., Captain T. O'G. Cochrane,[1] tried to escape but were caught. A party under 2nd Lieutenant R. J. Allan,[2] got away on foot, and, after a devious march over the desert, got almost to El Alamein where they were recaptured, and sent back in lorries. Taking advantage of a R.A.F. attack, they seized the lorries, and,

[1]Major T. O'G. Cochrane, M.C.
[2]Captain R. J. Allan, M.B.E.

moving well to the south, eventually reached Cairo. Though demolition schemes had been prepared for the port, very little was put into action.

Demolitions in the Retreat

Orders were now issued for a withdrawal to a position based on the defences of Mersa Matruh, and for the maximum demolitions to impede the advance of the enemy. Little could be done, except on the escarpment near Halfaya, to destroy the roads but all airfields and landing grounds were ploughed up, sown with mines, and obstructed with crows-feet and other deterrents to the landing of aircraft. But, on the insistence of Brigadier Kisch, the greatest attention was paid to the destruction of all sources of water, which as has been seen was vital to the operation of troops in the arid desert. Wells and "aqueducts" were blown in or the water contaminated with bone-oil. Similar methods were used to deny to the enemy the use of reservoirs and birs. All pumps were either removed altogether and evacuated to the rear, or thoroughly destroyed, care being taken to break or remove all similar parts so that repairs could not be carried out by cannibalization. The pipelines were broken, emptied and sections removed. All this work required the most careful organization and timing, for it was necessary to ensure adequate supplies to our own troops and the railway as they fell back and at the same time taking care that all sources of water supply were denied to the enemy. In the event both tasks were efficiently performed, our own troops were never seriously short of water, while, as far as can be ascertained, no important source of water was left available to the enemy. The thoroughness of the removal of water supply components, and the part played by Brigadier Kisch in the operation, is well described in a note by the then Director of Works, Middle East Command, Brigadier Tickell. "The withdrawal of pumps, plant, etc., by Kisch was miraculous." He writes, "How he forced this salvage mania on his units at that hectic time was one of his greatest feats. Mountains of stuff were received in our collecting dump west of Alexandria. Tractors were coming back across country dragging up to eight pieces of plant. A roller did the trip from Sollum and towing. Every pump in the pipeline but one (the driver was killed by the enemy) was got back and they each weighed more than a ton and were eight feet below ground level and working to the last moment."

At the various small ports and towns along the route where installations had been established, most machinery, jetties, dumps of stores, etc., were destroyed, only later on, at Daba where large dumps of ammunition and stores had been established and where plans had been made for their destruction, orders were received too late for the work to be fully finished.

It eventually became clear that if the enemy pressed on, as indeed he did, it would not be possible to stop him at Mersa Matruh, and on 27th June, under orders from General Auchinleck, who had himself taken charge of operations, C.Es. of Eighth Army and XIII Corps started to lay out extensions to, and organize the work on, the position at El Alamein, all Army engineers being directed on to that line. This was the last position naturally suited for defence before the developed lands of the Delta of the Nile were reached. The front was limited, lying as it did, between the sea coast on the north and the Qattara Depression, a salt marsh impassable to any transport or formed body of troops, on the south, and had certain features remarkable in the flat desert. A description of this position and the story of its development is given later. (Chapter XIV, pages 373, 374.)

Demolitions at Mersa Matruh

The previously prepared demolition schemes at the remaining ports and defensive posts to be evacuated were put into effect. The work at Mersa Matruh, where a major base and defended area had been built up, deserves special mention, not only for its complete success but as an example of the problems such an operation entails. Large dumps of stores, petrol, and ammunition had been built up, and there were many workshops and similar installations. The garrison of administrative as well as fighting troops was considerable, involving an extensive water supply. The problem of demolition of all resources was therefore complex, but plans had been worked out in good time. Lack of continuity in control and possible confusion from frequent changes in command, from XXX Corps to X Corps (C.E. Brigadier B. T. Godfrey Faussett), from New Zealand Division to 10th Indian Division (C.R.E. Lieut.-Colonel J. M. Saegert,[1] 9th, 10th and 61st Field Companies and 41st Field Park Company, Sappers and Miners), which had been brought up with X Corps from Iraq all within the space of a week. This had been foreseen by C.E. Eighth Army, who retained in the town certain members of the

[1]Lieut.-Colonel J. M. Saegert, D.S.O.

staff of C.R.E. Works, Lieut.-Colonel E. Macdonald,[1] through whom he could maintain permanent contact irrespective of the particular C.R.E. whose division was in operational control of the fortress at any time. Further he retained as part of the garrison of Matruh a field company of South African Engineers rather than allow it to be evacuated with the other units of its Division. This unit, with its intimate knowledge of the place extending over a year, proved invaluable and carried out work that would otherwise have proved impracticable.

The total force of engineers available consisted of four Indian and South African field companies and a bomb disposal section, some 600 all ranks. Explosives were plentiful as ammunition railhead was situated in the fortress, and there was also a dump of inflammable liquid which proved most effective. Steps were taken to provide each company with sufficient transport. With the situation constantly changing no definite information could be obtained as to the ultimate intention. The first assumption was that Matruh would be required to hold out indefinitely and that water and other services would be required for the whole garrison. On this hypothesis much of the gear, spare pumps, generators, etc., being evacuated from farther west was retained in the town in dumps. It was not till the night of 25th June, that this policy was countermanded, and it was then too late, with the transport available, to evacuate more than a proportion of the more precious stores, which were shipped into lighters in the harbour and got away by sea. Had orders been given even twenty-four hours earlier, with the transport available, more of the more valuable stores might have been got away including two six-inch guns and five searchlights of the coast defences.

At midnight 26th/27th June, orders were given and final preparation of all demolitions put in hand. The new aqueducts and wells west of Matruh, which were in immediate danger of falling into enemy hands, were contaminated with bone-oil. Other preparations at this stage included the placing and connecting up of charges, the transport of the necessary petrol and oil and their distribution alongside the various dumps and buildings—but not the actual pouring of the inflammable agent on the material to be burnt or the placing of bone-oil in the water—and all other necessary measures short of actual destruction or contamination. Subsequent experience of the danger from bombing or accidental discharge shows that

[1]Lieut.-Colonel E. Macdonald, O.B.E.

it would have been wiser not to place the detonators in the charges at this stage. All these preparations were completed by 6 p.m. on 27th June, after twelve hours' actual work. It had been agreed that after this stage a minimum of four hours' warning should be given before final demolition was to commence, after which three hours would be required to put it into effect. Actually nine hours' notice was given, and the work was completed in one hour. The interval of waiting was one of considerable anxiety to the engineers. The Commander was not, as yet, committed to a policy of destruction. It was therefore of the utmost importance that no untoward incident should occur such as inadvertent or accidental demolition. Everything had to appear normal, and indeed, to function normally. For example, ammunition railhead and R.E. Stores were issuing as usual eighteen hours after the preparations for demolition were complete. This necessitated vehicles running between the dumps and passing over leads, while ammunition was moved from dumps already prepared for demolition. On the afternoon of 28th June, a dozen enemy planes bombed the harbour where a large number of demolitions had been prepared, including three jetties, seven lighters, buoys, pontoons, depth charges, ammunition dumps, distillery plant, water tanks, etc. Although many bombs fell in the area, by good fortune the only damage done was the setting on fire of some petrol dumps.

This critical waiting period ended when definite orders were received that demolitions would take place at a time to be decided, but not within four hours—being dependent largely on the progress of evacuation. The same conditions held during this warning period as before, i.e., that premature demolitions should not advertise to the enemy the intention to evacuate, with the difference that "silent demolitions" could now proceed. "Silent demolitions" were defined as any destruction, or preliminary to destruction, which could be carried out without the enemy's knowledge.

When the moment came for final demolition, which was ordered at 9 p.m., 28th June, various factors affected the order in which they could be carried out and consequently the organization of the demolition parties.

(*a*) The harbour demolitions would cut off direct access to, and escape from, the Eastern Spit on which demolitions were to be carried out.

(*b*) The proximity of main magazines and certain reservoirs.

(*c*) Breaching of reservoirs in the harbour area would inundate the docks and put out of action the prepared demolitions there.

(*d*) The prevailing wind being N.W., the parties would have to start firing dumps from the S.E. working up wind.

(*e*) Flames from the petrol issue point, if started early, would prevent certain ammunition dumps being got at.

These factors demonstrate in the first place that to get efficient results, plenty of time must be allowed for planning and preparation, and secondly that it is essential that all demolitions in an area, whether for Army, Navy or R.A.F., should be controlled and co-ordinated by a single authority, in this case the C.R.E. The demolition parties were aided in that the work was carried out at night by the light of a full moon. As far as is known the demolitions were completely successful except in one portion of the supply dump.

Defences of Egypt

Meanwhile work had been pushed ahead strengthening the El Alamein position. The general layout of the position and the story of its development will be described in the next chapter; it included field defences both excavated and built in concrete, anti-tank obstacles, and extensive minefields.

In case it proved impossible to stop the enemy on this line, from an early stage in the campaigns in the Middle East, steps had been taken to prepare defensive positions on the western edge of the Delta, along the Nile, and even on the Suez Canal. Very detailed plans for these defences had been prepared at an early date under the orders of Commander British Troops in Egypt (B.T.E.), Lieut.-General R. G. W. H. Stone, and a certain amount of work had been done at intervals when the progress and attitude of the enemy forces seemed to threaten the Delta. Now, however, work on these defences was pushed ahead at full pressure. In the Delta area a variety of Engineer units were employed as they became available or were recalled to Eighth Army, and for the most part were under the command of the local Cs.R.E. (Lieut.-Colonel J. P. Sargeant[1]—Alexandria, and Lieut.-Colonel C. L. Fox—Nubariyah). The southern defences in the region of Cairo were under the general direction of B.T.E. and the engineer work entrusted to C.R.E.

[1]Lieut.-Colonel J. P. Sargeant, O.B.E.

Cairo Defences (Lieut.-Colonel F. J. R. Heath,[1] who from 1941 had been C.R.E. Delta Defences). Certain tasks, mentioned below, were allotted to specially appointed R.E. officers. Starting from the north, the defences may be divided into four zones, (1) The western defences of Alexandria, (2) Those along the Nubariyah Canal south-east of Alexandria, (3) Along the Nile and (4) The defences of Cairo.

The western defences of Alexandria consisted of three positions, the most forward at Amariyah across the peninsula from the sea to the south-western arm of Lake Maryut. Five miles behind this the Dikheila position, across the strip of land between Lake Maryut and the sea, covered the important airfield of Dikheila which lay five miles west of Alexandria. Finally an inner line of defences consisting of concrete pillboxes and road blocks on the outskirts of the built up area of Alexandria. These defences were originally laid out and construction started in September, 1940, by the engineers of 6th Australian Division. The level of water in Lake Maryut was raised by the construction of a seawater channel and of a controlling regulator. Anti-tank ditches were dug across the peninsula and extended by dredging into the lake.

The Nubariyah line extended from the south-east shore of Lake Maryut, and ran generally parallel to the Nubariyah Canal to the point where the latter joins the Nile near Kafr Bulin. It consisted of three existing water obstacles, mostly canals, covered by concrete pillboxes. Arrangements were made by which the level of the water in the obstacles could be raised so as to render them unfordable by tanks, and on the right flank, where all three joined in one ditch, to flood an area about two miles wide.

No defence works were constructed along the Nile from the left of the Nubariyah position, as it was considered that the passage of the river would be a major operation, and the defence best carried out by the operation of mobile forces.

The outer defences of Cairo were based on three parallel water obstacles, continuous for a distance of twenty-four miles between the Rosetta Branch of the Nile at a point about five miles below the Delta Barrage on the north, and a point on the main river about three miles south of El Giza. Here again the defences incorporated three water obstacles formed by canals which were covered by concrete pillboxes and field defences. Water supply was organized in all defensive positions, and communications improved. A special force of mixed British and South African engineer units, under

[1]Brigadier F. J. R. Heath.

command of Lieut.-Colonel N. A. Armitage,[1] was detailed to improve a track from Mena due west to join up with the "Barrel Track" to El Alamein. Thirty miles of this track, mostly in Sommerfeld track, were completed when work was stopped.

In connexion with the defence schemes and the operations to be based on them, certain work on bridges and the improvement of communications in rear were undertaken. On 20th July, 1942, G.H.Q. ordered the construction of two bridges across the Nile above (south of) Cairo to enable Eighth Army, with its tanks, to cross and attack the enemy from the south while the Cairo defences were held by Reesforce. The sites chosen were at Helwan and Wasta. The maximum difference in the level of the river between high and low Nile was about twenty-two feet, the length to be spanned at high Nile being 2,688 feet at Helwan and 2,760 feet at Wasta. As pontoon equipment could not be spared it was decided to use feluccas, Egyptian cargo carrying sailing boats about forty-eight feet long with a beam of 17 ft. 6 in.

Construction was entrusted in the first place to X Corps Troops R.E. (C.R.E., Lieut.-Colonel E. N. Bickford), 572nd Field Company assisted by a Seychelles Pioneer Company taking on the bridge at Helwan, while 571st Field Company assisted by a Mauritius Pioneer Company was responsible for that at Wasta; 570th Field Park Company was responsible for stores and welding. There was considerable vacillation as to policy in tune with the changes in fortune in the field, and by November both bridges had been dismantled.

In conjunction with these bridges four new roads were built connecting the Nile south of Cairo to the shores of the Gulf of Suez, and one along the shores of the Gulf. Tracks already existed and these were made fit for three-ton lorry traffic between 10th July, 1942, and mid-October. The work was carried out by 30th and 31st Road Construction Companies S.A.E.C., while the Shell Oil Company provided a mix-in-place of bitumen surface on certain parts of the routes.

Eighth Army Stand on El Alamein Position

After withdrawal from Mersa Matruh, Eighth Army retired fighting on to the El Alamein position. Rommel followed up and during the next month made several unsuccessful attempts to break through. Eighth Army in turn tried to benefit from the undoubtedly

[1]Lieut.-Colonel N. A. Armitage, O.B.E.

difficult administrative position in which the Axis forces found themselves, and, by offensive action, limited by the necessity to re-equip and reorganize the armoured formations, tried to upset Rommel's plans with a view to an early resumption of the offensive. After a month of abortive fighting both sides became fully organized on their new defensive positions, and a lull ensued while the two armies built up their strength in troops and stores. An important engineer aspect of the strategic situation was now the question of water supply. While Eighth Army was well supplied by the pipeline and the proximity of the Nile, the Axis forces, thanks to the very thorough demolition of all sources of water and storage forward of Tobruk, were hard put to supply their forward troops facing the El Alamein position, and were, therefore, limited in the number of troops they could maintain in the forward area. If Rommel could break through the El Alamein position and reach the Delta, this advantage to the Allies would be lost. It would appear strange that Rommel, or his nominal superior, General Bastico, did not apparently appreciate the importance of water supply. He had few engineers in the forward area, and little plant, stores or boring rigs. He never found the good supply at Fuka, and never got a drop westwards through the pipeline from Mersa Matruh. He might easily have lost the battle for Egypt solely through lack of water.

At the same time work proceeded on strengthening the Eighth Army position, in developing a reserve position using 50th Division and Army Troops R.E. for the purpose, and in improving the communications in rear of the position. Extensive new minefields were laid, and, in the various offensive actions which took place at this time, much experience was gained in the clearance of passages through our own and the enemy minefields, and in what was known as operational minelaying.

Mine Warfare

It would therefore be convenient at this stage of the operations to review the whole experience and technique of mine warfare which had become one of the major aspects of war in the desert, and was certainly one of the most important aspects of engineer work in the field. The experience in this form of warfare in these campaigns, formed the basis of similar operations in other theatres. The technical development of material, both mines and the means of their detection and removal, are dealt with elsewhere (Chapter V, pages

115 and 116) and will be referred to here only shortly in so far as they concern the operations in the desert.

Before 1939, the development of armoured fighting vehicles had brought a realization of the possible potentialities of the anti-tank mine and some progress had been made in its development. Only a very few had been manufactured and all study of their use had been in consequence purely academic and therefore unsatisfactory. The writer well remembers an exercise held in England, early in 1939, to study anti-tank defence, and the incredulity, if not ribaldry, which greeted the suggestion of a R.E. G.S.O.1 of a division that his division would require five or six thousand mines on its front. Such a suggestion when actual mines were almost non-existent appeared ludicrous. The war in the desert was to show how moderate was this estimate. Though little thought had thus been given to the use of mines in defence, none had been given to the equally difficult problem of their removal in attack. While mines had been manufactured and issued in some quantities to the B.E.F. in France in 1939–40, as has been shown in Chapter II, in that campaign none had been used in the static portion of the campaign, and the conditions of the more mobile warfare of May, 1940, were not suited to their employment on any scale. In the defence of the United Kingdom, after the withdrawal from France, mines were laid in considerable quantities in beach defences, and some general rules as to their layout and the recording of their positions had been formulated. But no experience had been gained in actual fighting as to their efficacy, or in their removal.

Thus at the start of the campaigns in the desert little was known as to the practice of this form of warfare, and few mines were available in the Middle East with which to put it into operation. In a country, otherwise almost completely devoid of obstacles to the movement of armoured fighting vehicles, some form of artificial and quickly constructed anti-tank obstacle was obviously of the highest importance. The labour required to produce adequate ditches for the purpose, especially in the hard stony ground of the desert, was obviously too great to be a practical proposition except for the most static form of defence, while the maintenance of such excavations in the drifting sand would also prove excessive. Attention was therefore early directed to the use of mines. Further the limitation on the size of forces which could be maintained and supplied with water in such a country called for the employment of any weapon which would enable the maximum front to be held

with the minimum of troops. Even so, lack of experience in their use, coupled with scarcity in supply, led to little use being made by the British forces of mines in the earliest stages of the campaign. Though the manufacture of mines had started in Egypt, and they had been used to a limited extent between Mersa Matruh and Sidi Barrani in 1940, it was not till after experience of their use by the Axis forces during General Wavell's first offensive in the winter of 1940–41, that we read of any extensive use being made of them by the British forces. This was in the preparation of defence lines near Benghazi in February, 1941. During this offensive the Germans and Italians were found to have laid considerable minefields in front of various defensive positions, and these included not only their anti-tank mine, the Teller mine, but also a limited number of anti-personnel ("S") mines.

Thus it was the detection, marking, and removal of enemy mines that first occupied the attention of our troops. Only the most elementary means were at the time available for these operations. Detection was carried out by inspection of the ground for signs of disturbed earth, by prodding with bayonets, or by feeling with fingers. Removal had to be effected manually and no standardized system of marking minefields or cleared passages had yet been developed.

To make up for the shortage of supply of mines, the manufacture of locally designed mines from material available on the spot was undertaken by R.E. workshops in Egypt. The first explosive used was gelignite, but later T.N.T. from shell fillings was employed. In default of spring steel, which was not obtainable in the country in sufficient quantities, the mines had to be actuated by the fracture of glass phials of chemicals which, when mixed, produced detonation. The first of these (E.P.1—Egyptian Pattern Mark I) therefore required skill in handling and there were accidents when they came into the hands of unskilled troops. An improved mine (E.P.2) was later produced in large quantities, and use was also made of captured enemy mines.

An early problem which had to be decided was the allocation of responsibility for the laying and clearance of minefields. It had been generally agreed under peacetime conditions, before practical experience had been gained, that, while the laying of formal minefields would lie with the R.E., all arms must understand their use and be able to lay them for local defence or for delaying action in a retreat. It was further agreed that those who laid mines were responsible

for recording and reporting their location to formation headquarters, and for removing them when no longer required. Such a policy, while sound in theory, demanded a very precise "drill" to be thoroughly known and practised by all arms if it were to function properly. In practice in the Middle East, and later in other theatres, it became accepted that the major share both in the laying and in the clearance of mines fell to the engineers, so that proper recording should be ensured, and that in clearance expert knowledge of the various types of enemy mines and their ancillaries should be available. At the same time it was recognized that, as Sappers could not be everywhere, all arms must be prepared to do sufficient clearance for themselves to prevent serious delays to the advance. In consequence of this, and the growing employment of mines by both sides under the conditions of desert warfare, the work of mine laying and clearance absorbed more and more of the total engineer effort until, in the latter stages of the campaign, this work became the heaviest of all engineer tasks. In the New Zealand Division, however, much more of the responsibility for laying and clearing mines was imposed on other arms, thus freeing the engineers for the many other tasks which fall to their lot.

While minefields had been used to a limited extent earlier, the first examples of really extensive fields were laid on the return of the Western Desert Force to the Libyan frontier. They were employed in two ways; first to form an obstacle round defended localities or "boxes"—over 70,000 were laid at this time at Mersa Matruh, and secondly, as these "boxes", owing to the extension of the front and depth of the area held, tended to get farther and farther apart, to fill the spaces between the posts. These latter minefields, which became known as "mine marshes", did not fulfil one of the principles of an efficient obstacle in that they were neither under observation nor covered by fire. Consequently, when they were encountered by enemy armour, there was nothing to prevent the crews of the latter dismounting and clearing lanes through the "marshes". They did, however, take their toll of foe, and too often of friend as well, and imposed delay. But a tank so damaged not being under enemy fire could generally be salvaged.

This widespread use of minefields in ever increasing numbers brought into further prominence the importance of accurate recording of their position, lay out, and extent, and the dissemination of this information to our own mobile forces. Standard forms and methods of recording were accordingly worked out and their use

imposed on engineer and other units which might be called on to lay mines.

In preparation for the renewed offensive in November, 1941, and in connexion with the many offensive actions undertaken beforehand, it became necessary to organize systems of detection and clearance. For this the development of instruments which would detect the presence of buried mines became of great importance. This problem was already engaging the attention of technicians and scientists in the U.K. But the urgency of the problem and the scarcity of supplies from the home country forced the engineer authorities in the Middle East to improvise. Various types were developed of greater or less efficiency, but, owing to shortage of suitable parts, in woefully small numbers. We read of C.E. Eighth Army doling out a total of thirteen to the whole Army in November, 1941. So, for some time to come, detection was chiefly carried out by the primitive methods of inspection of the surface, prodding with bayonets or bars, or feeling with the fingers. Mines when discovered were lifted by hand. This lifting was always a dangerous and nerve wracking job, but from an early stage it was made still more exacting for the enemy began to connect the mines with booby-traps which exploded when the mine was moved, and to use anti-personnel mines in anti-tank fields. These booby-traps in their simplest form consisted of a second mine or charge laid beneath the first and connected to it by a pull detonating device. Later, standard attachments were connected to mines which had the same effect.

As a result of the offensive in the winter of 1941-2, and the subsequent withdrawal, the need for a more thorough knowledge of mine warfare through the force, and of improved technique and anti-mine equipment became obvious. A School of Mines, R.E., was therefore set up in the Middle East. Its original charter gave it three functions; firstly to find out the best way to breach or make gaps in minefields; secondly to evolve and teach standard drills for this and the recording of minefields; and lastly to try out ideas, devices and expedients which might be proposed. This school did valuable work during the time of the occupation of the El Alamein position. It was closed down at the time of the opening of the final offensive in November, 1942, but in view of the further experience gained in that advance, and of the arrival of reinforcements and drafts lacking training and experience in this form of warfare, was reopened first at Benghazi and then at Tripoli. One of the principal tasks of the School was to evolve a simple automatic, and fool-proof drill for the detection and

clearance of mines. The drill so evolved was taught throughout the Eighth Army, and with little modification, was adapted for use in other theatres. It covered the whole sequence of operations from preliminary plotting of known minefields from records, aerial and ground reconnaissance, the location of the individual mines within the limits of the gaps to be made, the removal of the mines, and the marking of the limits of the gaps. For these latter stages it was necessary that the drill should be simple, automatic and fool-proof. It was found, if it did not conform to these conditions, that men, from familiarity with the dangers, and from weariness or nerve strain from continuous employment on the work, became careless and the casualty rate rose. The deliberate and continuous sweeping with detectors, each man going forward slowly and intently, eyes on the ground, earphones on the head, while the noise of battle crashed round him, and then the cold-blooded investigation and lifting of the mines, no man knowing when some new heathenish invention of the enemy would not blow him to eternity, proved a terrific strain on the men employed. The work, though not so spectacular as some other tasks which fall to the lot of the engineer in war, may well be counted as one of the greatest epics of the war, and well worthy of commemoration, as it is, by its portrayal in the picture hung in the Headquarters Officers Mess at Chatham as the memento of the work of the Corps in World War II and reproduced on the page opposite.

Besides the investigations carried out by the School, engineer units, and indeed all arms, were seeking for means, mechanical and otherwise to solve the mine problem. Probably the most successful of these was the flail or "Scorpion", the development of which, and of other devices, is described in Chapter VIII, page 195. The idea had been mooted elsewhere but it fell to the lot of a field park company of the South African Engineer Corps to build the prototype under conditions of great secrecy in the desert. After much experiment and many modifications the machine proved a success and others were built in R.E.M.E. workshops as far as tanks and material could be made available. One of the chief problems to be overcome, especially in the desert, was the effect of dust on the mechanism and its operation. Dust in the desert under normal conditions is bad enough, but the dust storm caused by the "Scorpion" in action, apart from the complete "black-out" in visibility, penetrated every part of the mechanism, leading to clogging and excessive wear. In the original models "Scorpions" were manned

The Royal Engineers opening the way through the minefields at the Battle of El Alamein on the night of 23rd October, 1942, from the original by T. Cuneo

by R.A.C. personnel with a Sapper to operate the flail mechanism in an armoured sponson to one side.

In the final battles, to be described in a later chapter, the pattern of the minefields became extensive and complicated. Not only had each side developed and extended this adjunct of war, but, in the continuous ebb and flow of the war, numbers of minefields, some poorly charted, had been left behind and those of the two opponents had become inextricably mixed. The clearance of passages through this maze became, therefore, a tremendous task which occupied by far the largest amount of engineer effort. To such an extent indeed was this the case that some units became continuously engaged in mine detection and clearance, and casualties began to rise to a serious extent from sheer weariness and nerve strain, and consequent carelessness, on the part of the personnel. C.E. Eighth Army had to make representations that the units concerned were given more frequent reliefs and changes of employment.

CHAPTER XIV

THE WESTERN DESERT, AUGUST TO 5TH NOVEMBER, 1942

THE BATTLES AT EL ALAMEIN

The strategic situation—Stabilization on El Alamein position—Rommel attacks. The Battle of Alam Halfa—Preparations for the offensive—Eighth Army's plan of attack—The Battle of El Alamein—Some engineer aspect of the Battle—Engineer Order of Battle, Eighth Army, in the Battle of El Alamein.

(See Map 13 facing page 375 of this chapter.)

The Strategic Situation

The general situation in the war in the summer of 1942 is best summed up in the words of Field-Marshal Lord Alexander in his dispatch on the subsequent period in Africa: "The Japanese were hammering at the eastern gates of India, the German armies in Russia were lapping round the northern bulwarks of the Caucasus, and a tired and battered British army turned at bay among the sandhills of El Alamein, only sixty miles from Alexandria. . . . There it stood and, on the critical day of 2nd July, defeated the enemy's most desperate efforts to break through. By this stand the survivors of the old Desert Army gained the vital time necessary for the arrival of the fresh divisions and improved tanks which were to turn the scale of battle." It was in such a desperate situation that General (as he then was) Alexander was himself called upon to play the leading role, for on 15th August he was appointed to command the Middle East forces. At the same time he was relieved of responsibility for the forces in Persia and Iraq, which were formed into a separate Command which would be responsible for defending the Middle East block against the threat from the German armies in the Caucasus. He remained responsible for the defence of Palestine, Syria, Trans-Jordan and Cyprus, but the threat of a German advance through Anatolia was then considered remote as it was considered reasonably certain that, at the worst, Germany

would not present an ultimatum to Turkey till the spring of 1943. He was therefore free to concentrate all his attention on the threat to Egypt from the West.

Stabilization on El Alamein Position

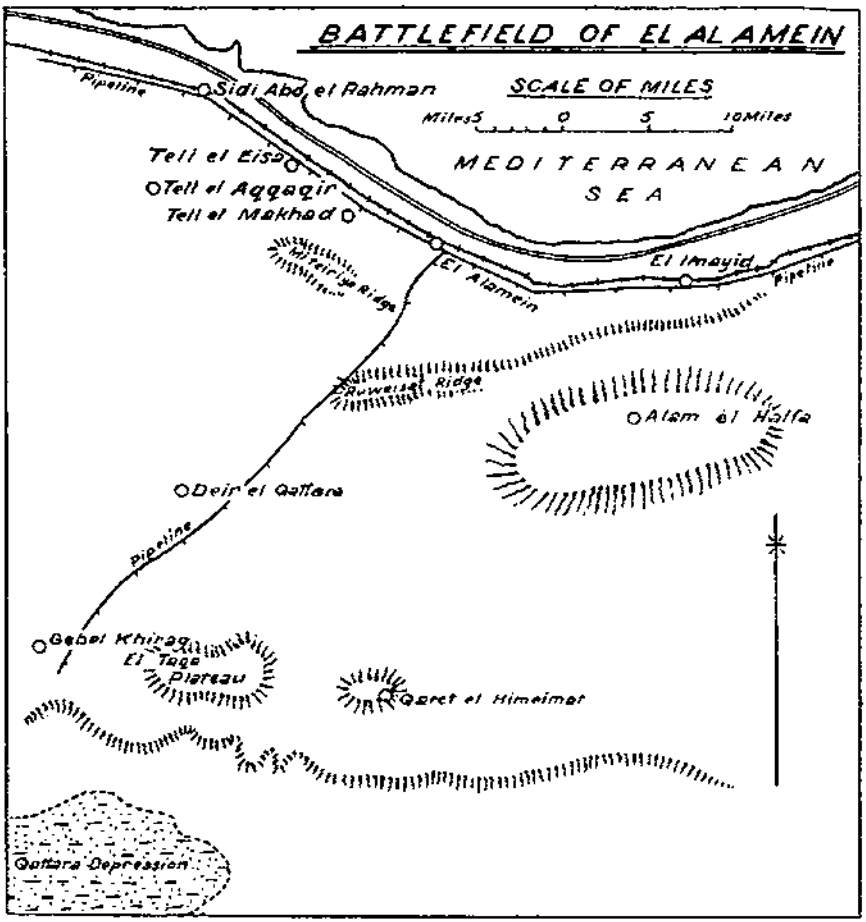
It will be remembered that General Auchinleck had himself taken control of the operations of Eighth Army in the Desert, but, on stabilization of the line on the El Alamein position, he had decided to place Lieut.-General Gott from XIII Corps in command of Eighth Army. Unfortunately before this officer could assume command, the aircraft in which he was flying was shot down, and he himself killed on the ground by machine gun fire from aircraft. His place was filled on 12th August by Lieut.-General Sir Bernard L. Montgomery.[1]

General Mongomery immediately started to reorganize the Army in preparation for a renewed offensive, while awaiting the arrival of reinforcements in formations and equipment. At the same time General Alexander, freed from responsibility for meeting an enemy advance from the Caucasus through Persia and Iraq, modified the plans for the defence of the Nile Delta. Responsibility for this was now centralized under Commander British Troops in Egypt, Headquarters X Corps being relieved so as to form an extra Corps Headquarters for Eighth Army. In general principle these plans remained unaltered, but the preparation of a defensive position, in front of the main line, designed to cover the water sources round Wadi Natrun was abandoned. Work was however to be continued on the outer defences of Alexandria and on improving communications between the Nile valley and the Red Sea. Orders were also given for certain areas round Alexandria, on the banks of the Rosetta Branch of the Nile and north of Cairo, to be flooded.

Reference has been made in previous chapters to the spasmodic efforts made to develop a defensive position about El Alamein on which Eighth Army now stood, and from which General Montgomery was to launch his great offensive battle. It will be convenient, therefore, to give here a description of the position, the work done on it from time to time, and the means by which the work was carried out as far as the engineers were concerned. So much attention has been given in historical records of the war to the final

[1]Field-Marshal Viscount Montgomery of Alamein, K.G., etc.

Map 13


BATTLEFIELD OF EL ALAMEIN
SCALE OF MILES
Miles 5 0 5 10 Miles
Pipeline
Sidi Abd el Rahman
Tell el Eisa
Tell el Aqqaqir
Tell el Makhad
MEDITERRANEAN SEA
El Imayid
Pipeline
El Alamein
Miteirya Ridge
Ruweisat Ridge
Alam el Halfa
Deir el Qattara
Pipeline
Gebel Khirag
El Taga Plateau
Qaret el Himeimat
Qattara Depression

offensive battle, that little account has been taken of the firm base which originally checked Rommel's victorious advance, and enabled General Montgomery to organize and launch his successful counter offensive.

As already explained, the position lay between the shores of the Mediterranean Sea on the north, and the Qattara Depression on the south. At its eastern end the latter approaches to within forty miles of the coast, and for the greater part of its depth the position occupied did not greatly exceed that distance in length. The bed of the Depression, which is bounded on its northern edge by cliffs about 600 feet high, consists of quick-sands and salt-marshes almost everywhere impassable even for a loaded camel. The flanks were therefore naturally secure, and the length of the position less than that found elsewhere in the Western Desert.

With the advance of the Axis forces to the Egyptian frontier in April, 1941, it was decided that a defensive position should be constructed in this favourable area. The details of the position were laid out by the Commander and Staff of 50th Division in consultation with C.E. B.T.E. (Brigadier G. Streeten). Lieut.-Colonel C. Topham[1] was appointed special C.R.E. to take charge of the engineer work. After an original plan had been modified, in August, 1941, work started on three defended localities extending across the belt of good going between the sea and the Depression. The principal of these was about El Alamein itself and was designed originally for occupation by a division. The other two, near Deir el Qattara and Gebel Khirag respectively, were each to be garrisoned by a brigade group. In each locality concrete pillbox protection was intended, and largely completed, for anti-tank guns, automatic weapons, O.P.s, etc. as well as earthwork fire trenches, the whole being surrounded by wire obstacles. Parts of the El Alamein "Box" were further protected by excavated and concrete anti-tank obstacles, and obstacles for the same purpose were provided for the two smaller localities by cutting escarpments by mechanical plant in the sides of the hills on which they were situated. Water storage for the garrisons was afforded by the reopening and repair of "birs", and the construction of many concrete tanks, all being served by pipelines and pumping stations from large underground reservoirs constructed in the neighbourhood of El Alamein railway station. The latter were mostly filled by water drawn from the Nile through the pipeline constructed along the line of the railway. Hospital and command

[1]Colonel C. Topham, O.B.E., M.C.

post accommodation was provided by excavation into the rock covered over with concrete and earth.

As a permanent nucleus of engineer labour 106th Army Troops Company was detailed, though engineers of formations were from time made available to assist. A large part of the work was let out to civil contract, and, though it was found difficult to retain labour in the area, the majority of the work was carried out in this way. In the early stages, the enemy being some hundreds of miles away, the work was given very low priority. Consequently great difficulty was experienced in obtaining transport and, in default of M.T., large numbers of donkey carts were hired for carrying stone. Compressors were also scarce which was a serious handicap as, besides dugouts, reservoirs, etc., many of the trenches had to be excavated in rock. At intervals X Corps, 2nd South African Division, 5th Indian Division, and 2nd New Zealand Division were made responsible for the layout, and their divisional engineers took part in the development; 654th and 738th Artisan Works Companies were also allotted later. As fortunes in the desert war fluctuated, so the interest in the work and the number of troops available rose and fell, but when, in June, 1942, during the retreat of Eighth Army from Gazala, XXX Corps took over direction of work, a great deal of the work had been completed. Some hundreds of pillboxes were finished, water reservoirs and pipelines in operation, hospitals and headquarters well advanced, and wire and anti-tank obstacles reasonably effective. Owing to the speed at which they could be laid and the danger they would cause to those working on the defences, few mines were laid round the localities, but an effort was made to tidy up, chart and mark the maze of existing minefields which were spread about over some 400 square miles in the neighbourhood.

The expansion in size of the Army during the previous months and the development of the tactics of armoured formations which had occurred as the result of experience in desert warfare, led to changes in the organization of the position. More especially greater depth was given by the preparation for defence of localities in rear which would act as pivots on which armoured counter-attack against enemy forces penetrating the forward defences could be based. The engineers of XXX Corps pressed on with the completion of the new and old defences, and laid large areas of new minefields. Eleven new airfields were constructed for use by the rapidly expanding air force.

In the fighting in June and July, some of the forward defences,

including those near Deir el Qattara and Gebel Khirag, were overrun by the enemy, only the most northerly about El Alamein remaining in our hands. Most serious of all was the fact that our line no longer extended right up to the Depression but was taken back to a point near a conspicuous peak—Qaret el Himeimat, leaving a gap of good going, but overlooked from Himeimat itself and the higher ground along the northern edge of the Depression. Between the two flanks, the country over which our defended line ran was a bewildering mixture of ridges and depressions with many patches of soft sand providing some of the worst going our forces ever encountered in the desert. At the northern end the sea shore was edged with salt marshes inland from which, in a narrow strip of less than two miles wide, the road and railway ran parallel to each other. Just south of the railway Eighth Army had, as a result of operations in July, pushed its original line westward to include two small ridges known as Tell el Eisa and Tell el Makhkhad, thus forming a salient. Twelve miles south of the sea coast rise the slopes of the Ruweisat ridge, a long, narrow elevation about 200 feet high. It runs generally east and west, turning slightly northwards at its western extremity. If captured by the enemy it would offer an avenue of reasonably firm going outflanking the position to the north. The enemy's principal attack on 2nd July had been directed to the capture of this feature of which he had succeeded in getting possession of the western extremity though Eighth Army retained hold of the remaining and higher part. From here to the south the line ran generally south by west over ground mainly flat but interrupted here and there by steep sided depressions. In rear of this portion of the front, south east of the Ruweisat Ridge, was a second and higher feature trending in a north-easterly direction, called the Alam el Halfa Ridge. A strong position for two brigades had been built on this ridge defended by wire and minefields and this commanded the country to the south; if the enemy, however, succeeded in occupying it, it would offer him another corridor of good going by which he could outflank the whole position to the north and drive direct on Alexandria. The front was covered by a huge triple minefield which extended from the coast almost to the Taqa plateau just north of the Depression, besides the minefields protecting the individual defended localities.

When the changes of command took place, in August, the northern area, down to and including the Ruweisat ridge, was held by XXX Corps, comprising 9th Australian, 1st South African and 5th Indian

Divisions with 23rd Armoured Brigade. XIII Corps in the southern sector consisted of 2nd New Zealand and 7th Armoured Divisions. In reserve, disposed for the defence of the Nile Delta, were four divisions which had not as yet seen action in the desert, 8th and 10th Armoured and 44th and 51st Infantry Divisions, as well as two veteran divisions refitting, 1st Armoured and 50th Infantry. Against this total of four armoured and seven infantry divisions, all of which were not immediately available, the Axis could dispose four armoured and eight infantry divisions, plus five independent regiments. These though nominally commanded by the Italian General Bastico, were in fact commanded by Field-Marshal Rommel. A noticeable feature of the equipment of both German and Italian formations was the high proportion of anti-tank guns, which were decentralized right down to infantry companies. This once more stresses the importance of armour, and hence of anti-tank protection, in this type of warfare, and explains the enormous amount of mine laying and lifting the Engineers were called upon to carry out.

Though at this period the initiative still lay with them, the Axis forces had also prepared an extensive defensive position to the west facing that of the British but some miles from it. This position was similarly covered with a great mass of minefields while in the space between the two positions lay many abandoned minefields belonging to the original British position or laid by one combatant or the other during the battles of June and July. The whole area was therefore a maze of minefields, intersecting, overlying and criss-crossing, some of which were charted, and as many more unknown. To reach each other each army had first of all to make gaps in their own protective fields, if sufficient gaps for the purpose had not been left, and then clear ways through the sea of intermediate fields, finally lifting those of their opponents' defences under the close observation and fire of the defenders.

Rommel Attacks. The Battle of Alam El Halfa

Both sides were anxious to strike first; Rommel before the Eighth Army had received sufficient reinforcements to give them superiority in the field, and Alexander, before Rommel could organize the maintenance of his troops in the forward area, dependent as he was on a long and vulnerable line of communications and an inadequate water supply. Rommel acted first. On 31st August, following two unsuccessful diversionary attacks against XXX Corps the night before, he started an attack against XIII Corps on the southern

flank of Eighth Army. This Corps had been reinforced and now included 7th and 10th Armoured Divisions, 2nd New Zealand and 44th Divisions, and two armoured brigades. The New Zealanders held the western face of the Corps front with 44th Division on their left, the two divisions being supported by the armoured brigades; 7th Armoured Division watched the southern flank, while 10th Armoured Division remained in hand.

It took Rommel six hours in darkness, in face of the fire of two artillery regiments and a motor battalion, to make two gaps in the outer minefield. Through these gaps two German Panzer Divisions penetrated but then did not progress at their usual speed because the Italian and German formations on their left flank were unable to get through the minefields in front of the New Zealanders. Owing probably to a false "going map", which had been "planted" on them by allowing the armoured car in which it was travelling to be captured, the German armour, instead of striking north-east against the British communications, advanced through heavy going northwards against the western end of the Alam el Halfa ridge, held by 44th Division and the two armoured brigades, where they were checked.

The work of the engineers holding the position at this time is well illustrated by the story of the doings of one sapper of 44th Division. Through the protective minefield in front of the position a number of gates were left to facilitate the movement of our patrols. On each gate was placed a piquet, usually composed of an infantry detachment of an N.C.O. and six privates with one sapper. Mines were stacked by the gap and on the alarm being given the infantry were to place the mines in the ready-made holes, after which the sapper would "arm" them. Such a gate existed on the front of 133rd Infantry Brigade of 44th Division. The piquet was provided by the Royal Sussex Regiment with Sapper Stansfield[1] of 210th Field Company. The holes for the mines were about 100 yards down the "lane" through the minefield on the forward slope, and the piquet was in position on the crest of the bluff.

On 31st August, a German tank, one of the force which had broken through to the south and turned northwards, was seen approaching. The piquet rushed forward to close the gap, the tank opening fire on it with machine-guns. Four were killed and one wounded and the sergeant and the other survivor tried to get the wounded man back to the position. What followed is narrated as

[1]Sapper K. Stansfield, D.C.M.

follows by the C.R.E. of the Division, Lieut.-Colonel J. M. Lambert:[1]

"Subsequent happenings were seen by a large number of infantrymen from their trenches on the bluff. It was generally agreed that shortly after Sapper Stansfield started his hundred yards walk towards the enemy, the tank's machine-gun must have jammed. It then started to shoot at him with its main armament using solid shot. Sapper Stansfield continued on his way and reached the place where the twelve mines were dumped. The range was not now much more than 200 yards. He picked up the mines one by one, armed them, and placed them in their holes across the lane. The tank meanwhile continued to pot at him. It failed to hit him—and he closed the gate.

"It is said by some of the onlookers that as soon as Sapper Stansfield had laid the mines, the tank stopped firing, and that he walked back up the slope in a sudden silence. This may have been due to a number of reasons: perhaps it was a tribute to a brave man."

("The Closing of Queen's Gate". *The Sapper*. November, 1951.)

During the next two days the German armour made repeated attacks but these were held by the artillery and armoured brigades. Rommel then changed his tactics and tried to entice the British armour into the open in a counter-attack. This he did not succeed in doing though, on 3rd September, the New Zealand Division made an attack southward in an attempt to close the gap which was only partially successful. On the 4th, the Germans made two attacks to drive back the New Zealanders with partial success. During the 4th and 5th, the German armour was assailed by our mobile armour from all directions, and by the evening of the 5th Rommel had withdrawn to the line of our outer minefields where he took up a defensive attitude.

During these operations one of the more important tasks of the R.E. was the destruction of damaged enemy tanks before they could be salvaged or repaired. To deal with tanks lying close to the position, patrols from the field companies of the divisions sallied out at night from the position, but the majority lying farther afield were dealt with by detachments from field troops working with the armoured brigades. While a troop of 2nd Field Squadron and R.E. units of 7th Armoured Division did a considerable amount of damage, the lion's share seems to have fallen to the independent

[1]Colonel J. M. Lambert, O.B.E.

20th Field Troop working with 2nd Armoured Brigade under orders of C.R.E. 10th Armoured Division. From reports which reached C.E. Eighth Army at least thirty tanks were given the *coup de grâce* by R.E. detachments. During the battle the R.E. with compressors were also employed to assist the infantry and artillery in digging defence works in the rocky soil of the ridge. They also laid and picked up tactical minefields during the course of the action.

Though as the result of the battle of Alam Halfa the enemy gained and held some ground on the western extremity of the high ground, the operation must be accounted as one of the decisive actions of the war. Rommel's effort to destroy or drive the British force back to the Delta failed. Never again was he to get so near the Nile. In the action he lost a large number of irreplacable tanks at a time when the British forces were daily receiving fresh reinforcements. Administratively he was in an extremely difficult position at the head of a tenuous line of communication several hundred miles in length: short of water and with insufficient petrol, two out of three tankers having been sunk in passage across the Mediterranean. A defensive attitude had been forced on him under circumstances which favoured an early offensive by the British Eighth Army.

Preparations for the Offensive

Preparations could now be pushed forward actively for the coming British offensive. Several of the formations with no desert battle experience were moved up from the Delta into reserve positions and there given training and experience in desert conditions. An important reinforcement arrived at Suez on 3rd September, in the shape of 300 of the new Sherman tanks from America with which it was possible to re-equip three of the armoured brigades. For the first time we had a tank which was equal in armour, armament and performance to the best tank in the Afrika Korps. On 12th September, the first demonstration of the prototype "Scorpion" or flail tank was given, and was so successful that their manufacture in local workshops was ordered.

The date of the offensive of Eighth Army was dictated not only by that at which the new reinforcements and equipment could be absorbed into the Army after the requisite training, but also by other considerations strategic and tactical. The date of the Allied landing in North West Africa had been provisionally fixed for 8th November, and it was important, in order to encourage friendly reactions by

the French in North Africa, that a victory should be achieved by this date. Such a victory would probably also have the effect of stiffening General Franco's objection to German threats to Gibraltar through Spain. From the tactical point of view, the operation must involve a series of infantry attacks against strong defences to gain possession of the enemy's minefields and the making of gaps through them in order to pass the armour through. For this a night assault was obviously demanded and, in order that the mines should be lifted quickly and accurately, good moonlight was necessary. There was a full moon on 24th October, so 23rd October was chosen as D day.

In the meantime, Rommel, who, as a result of the failure of his attack between 31st August and 5th September, now realized that he might have to fight a defensive battle, had greatly strengthened his position. In the north a second line of defended localities had been prepared behind his main minefields, this and the forward line being connected by new transverse minefields designed to lead our forces into areas suitable for counter-action by his armour and guns. The effect was of a belt, between five and eight thousand yards deep, thickly covered with mines and defended posts, stretching from the sea to Deir el Mireir, a deep depression lying south-west of the end of the Ruweisat ridge. Behind these again, a third line of defences, starting just east of Sidi Abd el Rahman, eight miles from our forward posts at Tell el Eisa, and running south for about seven and a half miles, was in course of preparation and was covered by further extensive minefields. On the southern flank there were two main lines based on the original British minefields and those of the first Axis position. His great weakness, as mentioned above, lay in his administrative position, and every effort was made, and with considerable success, to prevent an improvement in this respect. Both the Royal Navy and the R.A.F. concentrated on interference with shipping across the Mediterranean, while the R.A.F. directed considerable effort to disorganize the traffic on the main road from his ports along the coast, Benghazi, Derna, and Tobruk, to his forward area.

Eighth Army's Plan for the Attack

The fact that the Axis line of communications ran back along the coast to the ports behind his northern flank, influenced the British plan of attack. A successful and deep penetration on this flank would tend to isolate the Axis forces on the southern flank from their line of supply and main line of retreat for transport vehicles. As

General Alexander explains in his Dispatch on the operation: "The hostile front might be compared to a door, hinged at its northern end; to push at the free end might cause it to swing back some way before any serious damage was done, but a successful blow at the hinge would dislocate the whole front and throw the doorway wide open."

The plan for the battle was given the code name of "Lightfoot".

The attack in the north was to be made by XXX Corps, Commander Lieut.-General Sir O. Leese,[1] using, from north to south, 9th Australian, 51st (Highland), 2nd New Zealand, and 1st South African Divisions. A truly Commonwealth force. The first two were to drive due west on a line roughly parallel to and below the Tell el Eisa ridge to form a northern corridor, and the latter two were to attack south-westerly to secure the Miteiriya ridge, which was the key to the enemy position on this part of the front, and to establish the southern corridor through the defences. The 4th Indian Division, completing the Imperial aspect of the force, was to carry out a diversionary raid along the Ruweisat ridge. When XXX Corps had formed these two corridors through the full depth of the enemy defences, X Corps, Commander Lieut.-General Sir H. Lumsden,[2] with, from north to south, 1st and 10th Armoured Divisions, was to pass through and position itself on ground of its own choosing at the far end of the corridors. Then, protected by X Corps from the attentions of the enemy's armour, the infantry of XXX Corps would mop up the enemy's localities between the two corridors and to the flanks. Simultaneously XIII Corps, Commander Lieut.-General Sir B. G. Horrocks,[3] was to attack in the southern sector. This would take the form of two thrusts, one round the southern flank by 1st Free French Brigade directed against Qaret el Himeimat, and the other, north of Himeimat, by 44th Division supported by 7th Armoured Division; 50th Division was in reserve to this corps. If XIII Corps attack was successful, it was the intention that 4th Light Armoured Brigade should be launched round the southern flank directed on El Daba with the object of destroying the enemy's supply installations at that place and seizing the landing grounds. The mass of the artillery was to cover the attack of XXX Corps.

To endeavour to deceive the enemy as to our intentions and to make him think that the main attack would be delivered against his

[1]General Sir Oliver Leese, Bart., K.C.B., etc.
[2]Lieut.-General Sir H. Lumsden, K.B.E., etc., killed in action, 1944.
[3]Lieut.-General Sir Brian G. Horrocks, K.C.B., etc.

southern flank, very extensive deceptive measures were taken and in the preparation of these engineer units took a large share. Three weeks before the battle, dummy lorries were erected in the spots where guns would be brought into action and the latter were brought up later and concealed under the dummies. The necessary additional dumps in XXX Corps area were elaborately camouflaged, for which purpose the hummocky area near El Imayid was well adapted. The six necessary new tracks in this Corps area could not be concealed so their construction was postponed till the latest possible moment. In XIII Corps area the concentrations of artillery were first represented by dummy guns which were later replaced by real weapons in different positions. The most elaborate measures were taken to conceal the movements of X Corps. The two selected assembly areas were each filled by about 6th October, with approximately 2,000 vehicles. To these were added over 700 dummy vehicle bodies to be placed over the tanks of the three armoured brigades. The Corps moved from its training area to two staging areas on 19th October; these moves were carried out openly as training moves. From the staging areas to the assembly areas the moves were made mostly at night. As units moved out of the staging areas they were replaced by dummy tanks, some mobile and some static, dummy guns and transport and by over 2,000 real motor vehicles. A dummy pipeline was built stretching from the real pipeline down towards XIII Corps sector. This was made of old petrol tins, with dummy pumping stations and reservoirs; it was started on 27th September and progress was timed to suggest 5th November as the date of completion. Many other measures, such as movements of forces temporarily to false destinations, wireless activity, etc., in which engineers were not called on to take part, were also used. In the event, so carefully was the whole scheme planned and carried out that the deception was completely successful; the main direction of our thrust and the location of our armour were unknown to the enemy at the time the attack began. Indeed the Germans were convinced that the main attack would be a "left hook" from the southern flank, and accordingly placed most of their armour to meet it there. It was not till D plus 3 that they finally concentrated all their resources against our real attack.

Owing to the postponement of work on tracks for the deployment of the forces, in the last few days before the battle, an immense amount of work had to be done to complete them in time. In his diary of 23rd October, C.E. Eighth Army speaks of the magnificent

work done by his D.C.E. Roads, Colonel Shannon, S.A.E.C., in completing 120 miles of new tracks in this short space of time. Another major job carried out at the last moment was the clearance and marking of gaps through our own minefields and through many of those lying in no-man's-land, which was carried out by engineers of the leading divisions.

The Battle of El Alamein

(For Engineer Order of Battle see pages 392–395)

After a short and intense artillery bombardment, which reminded veterans of World War I of the great barrages of the Somme and Ypres, the assault was launched at 10 p.m. on 23rd October. In the northern (XXX Corps) sector the attack was completely successful on the flanks, but in the centre, where the northern corridor was to have been made, the attack was held up. X Corps was launched at 2 a.m. on 24th October, 1st Armoured Division on the right and 10th Armoured Division on the left. The R.E. of these two divisions were to make the necessary gaps in the enemy minefields. Each of these gaps was to consist of at least three lanes sixteen yards broad on a front of 1,000 to 1,500 yards. These lanes were to extend right through the enemy's minefields, of which it was expected that three or four would be met, each about 400 yards deep. The total depth to be cleared was estimated at about 6,000 yards. In the event, the minefields were usually found to be not more than 200 yards deep, but were ill defined and unmarked. There were also patches of mines laid on no particular pattern between the regular minefields, which complicated the work.

The allotment of R.E. units of X Corps for the operation was as follows:—

To 1st Armoured Division:—
Its own 1st and 7th Field Squadrons and 1st Field Park Squadron.
From 8th Armoured Division—9th Field Squadron.
From X Corps Troops—572nd Field Company.

To 10th Armoured Division:—
Its own 2nd and 3rd Field Squadrons and 141st Field Park Squadron.
From 8th Armoured Division—6th Field Squadron.
From X Corps Troops—571st and 573rd Field Companies.

After the initial operation units were to return to their own formations.

In the case of 1st Armoured Division all the R.E. units allotted were employed on clearance of minefields except 1st Field Squadron, under command of 2nd Armoured Brigade, which was given the task of tank "busting" and of clearing any minefields encountered after brigades had passed through the main enemy defensive minefields. Similarly with 10th Armoured Division all R.E. units were employed on clearance of lanes through minefields except 2nd and 6th Field Squadrons, under 8th and 24th Armoured Brigades respectively, who had similar tasks to 1st Field Squadron.

Both divisions tackled the problem of breaching the enemy minefields by forming a task force. In the case of 1st Armoured Division it included all arms except R.A., and was under an infantry commander with the C.R.E. as technical adviser. In 10th Armoured Division the force was commanded by the C.R.E. and contained no infantry or R.A.C. As a result of experience in the battle the former arrangement was considered preferable.

The task of clearing the lanes proceeded according to plan though delayed by the vastness of the minefields, and by pockets of enemy resistance which had not been cleared out by the attacking infantry. However at 6.30 a.m. the southern corridor, leading to the Meteiriya ridge, had been opened, and 9th Armoured Brigade, working with 2nd New Zealand Division, closely followed by 10th Armoured Division, passed through on to the eastern slopes of the ridge. In clearing a gap for 10th Armoured Division, 3rd Field Squadron, under their O.C. Major P. N. M. Moore, worked forward under heavy artillery and small arms fire. During darkness a truck was set on fire brightly illuminating the gap and the sappers working in it, who in consequence were exposed to even more accurate fire. Major Moore with a party managed to extinguish the flames and then continued the work of mine clearance. The gap completed, Major Moore informed the leading tank commander and then on foot led the armour through the lane.

A fresh attack by 51st Division with massed artillery support, at 3 p.m. the same afternoon, cleared the opposition from the northern corridor, and enabled the R.E. of 1st Armoured Division to clear a way through the minefields for their armour which was then able to deploy under cover of a night attack by 7th Motor Brigade.

As most of the damage to enemy tanks in the preliminary and early stages of the battle was caused by long range fire, and the

wrecks were covered by enemy fire, it was difficult for the R.E. detailed for the task of destroying them to gain access to the derelicts. Parties were, however, sent out whenever possible and 1st Field Squadron destroyed and marked over ninety tanks before the general advance began. On the night of 27th/28th, Major Moore of 3rd Field Squadron went out in a car to destroy an enemy gun. On alighting from the car he found himself confronted by a German corporal with a "Tommy" gun. Moore immediately sprang at him and seized the weapon. The German threw a grenade at him, but Moore shot him with his revolver, on which the other Germans at the position fled, enabling Moore to complete the destruction of the gun.

The first phase of the operation on XXX Corps front had thus been carried out, but twenty-four hours behind time table, chiefly owing to the density of the minefields. The operations of XIII Corps in the south met with limited success. Here 7th Armoured Division was to clear two lanes while 44th Division would add another 300 yards to the north. Each lane was to be duplicated later on.

7th Armoured Division had the use of "Scorpions" while the R.E. of 44th Division had to rely on spotting mines by sight. Consequently their methods of operation were different. In 7th Armoured Division each advanced guard was led by a pilot vehicle. As the position of the near edge of the minefield was not accurately known, these pilot vehicles, which were heavily sandbagged, drove forward till a mine was struck. Then a Scorpion was brought up, followed by detachments of 4th Field Squadron to act as detectors, lifters and markers, and started flailing. Actually the first mine encountered was an odd one 900 yards in front of the main belt. The extra distance involved caused casualties to the Scorpions from engine trouble and enemy fire and there was delay in bringing up spares. As a result of the consequent delay it was not possible to start clearing the second minefield, 2,000 yards ahead, as had been intended.

On the right a section of 11th Field Company under Lieutenant R. B. Hoskyn[1] had the assistance of three "snail" lorries of 211th Field Park Company. These "snails" had tanks full of Diesel oil over the rear wheels on to which the oil was allowed to drip. Diesel oil leaves an unmistakable mark on the desert which can be seen even on a moonless night. The Sappers on foot located a mine clear track through the minefield, and the "snails", following up, marked

[1]Captain R. B. Hoskyn, M.C.

the safe track for the infantry and, driving in echelon, "proved" the track. Thus we had the unusual sight of part of a field park company leading an army into battle. The section at once came under heavy fire and casualties were so great that Lieutenant Hoskyn realized that it was impossible to get a gap through at the point selected. He made a "freak" reconnaissance at another point and decided that a fresh attempt should be made with a small party which might escape the main attentions of the enemy. With one N.C.O. and a sapper he went forward and, still under heavy fire, started to clear a lane through the minefield. Though he and his companions were working in the middle of an intense fire fight, in which rival tanks were taking part, they eventually were successful and cleared a lane. Hoskyn then returned and informed the Commander of the leading carrier platoon who was thus able to lead the advance through the gap. Afterwards the Commander of the carrier platoon said, "To tell the truth there was so much mortaring and other stuff flying about that I did not think it was on to take the carriers through, but after Hoskyn's effort I had to." A bridgehead had now been formed beyond the first minefield, but it was too late to try to pierce the second that night.

Farther south 1st Free French Brigade with their own field company, after getting nearly to Himeimat, was counter-attacked and had to withdraw, thus leaving the area of gapping operations in full view of the enemy.

Next night, 24th/25th, the R.E. of 7th Armoured Division succeeded in clearing a way through the second minefield enabling infantry to move through. At first light the tanks started to go through. Some tanks missed the openings and blew up on the minefield. Those that got through came under heavy fire from anti-tank guns and some ran on scattered mines beyond. Lieut.-Colonel Withers, C.R.E. of the Division, in the supervising operations, got into a tank to pass through the gap. The tank was knocked out by enemy fire and he had to get out and run to another. Our tank losses were heavy and the attack was stopped. As it was clear that a way could only be forced through with heavy casualties, and as the Corps was clearly fulfilling one of its major purposes, that of retaining a large part of the enemy armour in the south away from the main assault of XXX Corps, it was decided that the attack should be pressed no further in this sector but that the Corps should continue to engage the enemy's attention by limited operations.

The attack had opened well. XXX Corps had made a breach

six miles wide which directly threatened the centre of the enemy's communications. X Corps had deployed in a position from which it could threaten to envelop the enemy's line or bring the weight of its 700 tanks and powerful artillery to bear in the event of the enemy counter-attack which it was hoped to provoke. XIII Corps was containing much of the enemy's armour away from the decisive point. The main task of the engineers of the Army, which was to make the necessary gaps to enable the armour to get to its dominant positions, was completed. Considering the extent and nature of the operation casualties in the minefield gapping units were not excessive, two officers being killed and eight wounded in this work in the whole Eighth Army in the first thirty-six hours. The casualties in other ranks are difficult to obtain on the same basis but it would seem that they were proportionate. This success, at comparatively light casualties, may be attributed to the excellence of the mine-lifting drill and the accuracy with which it was carried out.

General Montgomery now decided to extend the gap which he had made to the north only, and not in both directions as originally intended. On the night of the 25th/26th, 9th Australian Division attacked and widened the salient by about 2,000 yards to include the whole of the Tell el Eisa ridge. A diversionary attack by XIII Corps at the same time was not pressed in the face of determined enemy resistance. Having thus strengthened his advantageous position, Commander Eighth Army decided to pause to re-organize and to collect fresh reserves for the final effort. The enemy, who during these first operations had just as desired frittered away part of his armour in piecemeal counter-attacks, now realized what the British plan was and concentrated his armour to meet the main thrust and to defeat our forces before the threat could mature. On the 26th, 27th and 28th Rommel attempted to throw his armour against the flank of the British salient, but his attacks were either disorganized at the start by the action of the R.A.F. and the Artillery, or failed in front of the guns of the tanks and artillery waiting to receive them.

Eighth Army's new operation, "Supercharge", was launched on the night of 27th/28th October, when 9th Australian Division attacked in the north, the intention being that this attack should be followed up by a drive along the coast towards Sidi Abd el Rahman. Heavy resistance was encountered and only a limited success gained, the Australian sappers being faced with further great masses of minefields. But the attack had the result of drawing Axis reserves to

this area and General Montgomery decided to take advantage of the weakening of the enemy forces on the rest of XXX Corps front by a renewed drive from the head of the salient. On the night of the 30th, the Australians attacked again and, not only pinned that portion of the enemy forces on the north into a narrow corridor along the sea coast, but drew more of his armour to the area. The main attack was launched from the tip of the salient in the early hours of 2nd November; 151st and 152nd Infantry Brigades (of 50th and 51st Divisions) supported by 23rd Armoured Brigade, advanced in the centre, while the New Zealand 28th (Maori) Battalion and 133rd Infantry Brigade (44th Division) advanced to secure objectives covering the flanks. These attacks were successful in face of fierce resistance, and once more the sapper units had to clear gaps for the armour through the minefields. 9th Armoured Brigade, which was following up with the intention of driving straight on through the enemy final defences, was delayed by artillery fire and minefields which lay beyond the reach of previous reconnaissance, and was eventually stopped by anti-tank batteries and counter-attacked by tanks on the small rise at Tell el Aqqaqir just west of the Sidi Abd el Rahman track. Here occurred the largest clash of armoured formations in the whole battle while 9th Armoured Brigade fought to hold open the end of the salient to allow 1st Armoured Division to emerge. Grimly the Brigade held on assailed in front and both flanks by the enemy's Panzer divisions, while the Armoured Division hurried up through the gap in the minefields which its R.E. were toiling to widen. Eighty-seven of the Brigade's tanks were destroyed, but they took full toll of those of the enemy who was forced back slowly as the day wore on. The Axis losses were crippling, and the Afrika Korps would fight no more as a Corps on Egyptian soil. This was the decisive action of the battle and next morning, 3rd November, came signs that Rommel was withdrawing.

Thus ended the principal phase of the battle of El Alamein, undoubtedly one of the great decisive battles of the war, and one especially satisfying to the British Commonwealth peoples and forces after the many vicissitudes through which they had passed. Never again were their forces to suffer a major reverse during the war. The part of the engineers of the British and Commonwealth formations may not have been spectacular, but was an essential element in the victory. The thorough preparation of the defences and their completion with tracks, water and other administrative necessities

helped to provide the firm spring-board from which the attack was launched. The efficient and patient clearing of gaps through the huge minefields amidst the stresses and strains of the battle, enabled the armoured forces to break through the enemy defences and to rout his forces in the field. The destruction of disabled enemy tanks and guns prevented their salvage and repair for further use against the Allied troops. All these tasks, and many more, each comprising a number of small operations often carried out by quite small parties of Sappers, constituted an important share in the effort of Eighth Army in winning the decisive battle.

Pursuit by the British armour was at first prevented by a screen of Axis anti-tank guns across the Abd el Rahman track. This was attacked successfully in flank by 5th Indian Brigade, and X Corps, which now included all three armoured divisions, 1st, 7th and 10th, dashed forward to swing round Rommel's southern flank and cut his retreat. The Corps encountered another anti-tank screen covering Ghazal, but 2nd New Zealand Division with 9th Armoured and 4th Light Armoured Brigades swept on in a wide turning movement to the south direct on Fuka. Farther south XIII Corps pressed on rapidly for fifty miles till outpaced by the armoured pursuit on the right. R.E. destruction parties in Daimler scout cars, supported by armoured 15-cwt. trucks carrying reserve explosives, accompanied each armoured regiment. In the event the squadrons detailed for this purpose were not called on to any great extent, once the advance commenced, either to destroy tanks or to clear minefields.

Rommel's hope of being able to conduct an orderly withdrawal was gone, and he gave orders for the speediest withdrawal of his German troops, even if it meant abandoning the majority of his Italian allies on the field of battle. Many of these without transport awaited the chance of surrendering. Others, temporarily better off in this respect, set off as fast as the congested roads would allow to the west till their petrol ran out and they in turn had to await the victorious pursuit. Still others struggled westward through the desert until rounded up or lost in the waterless waste.

Thus on 4th November ended the decisive battle of El Alamein by which "the Hinge of Fate", as Winston Churchill puts it, at last swung in favour of the Allies. Rather less than one third of the original Axis force succeeded in making its escape. Enemy casualties were estimated at 10,000 killed and 15,000 wounded; over 30,000 prisoners were taken; 450 of the 600 enemy tanks were left on the battlefield, where many disabled had been destroyed by our

Sappers before they could be got away. Between 23rd and 28th October, the R.E. units of 1st Armoured Division alone accounted in this way for thirty-five tanks and twenty-six guns, while the "score" of Eighth Army Engineers up to 8th November was 192 tanks and 163 guns.

While in the battle the highlights of engineer work were the lifting of minefields and the destruction of guns and disabled tanks, in the pursuit many other vitally important tasks fell to the R.E. units and their brothers from the Commonwealth. As the advance proceeded, tracks had to be made, marked and lit for night use. With the intense traffic, dust became a serious menace to movement, and to deal with it two road construction companies with thirty water lorries, and all available plant, were detailed. Immediate steps were taken to repair and fill the water pipelines, and to provide temporary water supply by carriage in containers. Tall beacons were erected to help units to find their way and the edges of minefields were marked. Airfield construction units repaired landing grounds and cleared them of mines and obstructions.

At a conference held on 5th November, Eighth Army Commander spoke of the "magnificent work" of the engineers in clearing gaps through the minefields and thus permitting the advance of the armour. But the work had been a great strain on the personnel so employed and C.E. Eighth Army asked that they should be given a week's rest from this employment. This was arranged as far as circumstances permitted.

Some Engineer Aspects of the Battle

Before passing on to the events subsequent to the battle, it will be well to pause and consider some points of Engineer command and organization which are noteworthy in the accounts of the battle. In the first place engineer units of formations were nearly always kept under the direct command of their Cs.R.E., and on a few occasions larger groups were under the control of C.E.s. This led to greater efficiency and economy in engineer efforts, and is in contradistinction to the system generally in vogue earlier in this campaign where R.E. units tended to be farmed out to smaller formations and columns. This earlier policy had been dictated largely by the tendency throughout the whole Army to organize in small self contained columns so as to achieve greater mobility and freedom of action in the desert fighting. This more centralized control was rendered more

feasible, even in the conditions in the desert, by the fact that, by the time of the battle, wireless communication within engineer formations had been introduced where formerly there had been no internal means of communication except by motor-cycle dispatch rider. By this time a satisfactory wireless net had been established in most formations down to field squadrons and companies, and a special issue of short range sets was made to troops and platoons R.E. about a week before the battle. (See R.E. Signal organization in Chapter VIII, pages 183, 184.)

The lack of any armoured vehicle in engineer units, particularly those of armoured formations, had been keenly felt in the early stages of the campaign. The R.E. of 2nd Armoured Division brought with them on arrival in the Middle East eight Daimler scout cars which, in spite of their mechanical unreliability, proved invaluable. These scout cars became in time standard equipment of all field squadrons with armoured divisions. They proved especially useful for carrying demolition parties to blow up disabled enemy tanks during armoured battles, and also for reconnaissance. Before the arrival of the scout car, units had improvised vehicles for the same purpose by sandbagging "jeeps". These vehicles proved so popular that many units continued to use them, in preference to scout cars, after the arrival of the latter. Other field units R.E. provided themselves when they could with similar vehicles captured from the enemy. About a month before the battle, field squadrons of some armoured divisions were issued with White Scout cars which were more efficient than the old Daimlers, and, shortly after the battle, field companies in other divisions received an issue of these vehicles. (See also Chapter VIII, page 194)

Engineer Order of Battle, Eighth Army in Battle of El Alamein

(*Note.* The allotment of formations to Corps, and of engineer units to formations, altered constantly during the course of the battle. The details in the table below are taken from the War Diary of C.E. Eighth Army, dated 10th November, 1942, adjusted to agree with the composition of formations at the beginning of the Battle.)

Chief Engineer, Eighth Army, Brigadier F. H. Kisch.

X Corps. C.E. Brigadier P. A. Clauson.
1st Armoured Division. C.R.E. Lieut.-Colonel K. Mackay.

1st and 7th Field and 1st Field Park Squadrons.
10th Armoured Division. C.R.E. Lieut.-Colonel G. R. McMeekan.
2nd and 3rd Field and 141st Field Park Squadrons.
X Corps Troops. C.R.E. Lieut.-Colonel E. N. Bickford.
571st, 572nd and 573rd Field and 570th Field Park Companies.

XIII Corps. C.E. Brigadier C. de L. Gaussen.
7th Armoured Division. C.R.E. Lieut.-Colonel H. H. C. Withers.
4th and 21st Field and 143rd Field Park Squadrons.
44th Division. C.R.E. Lieut.-Colonel J. M. Lambert.
209th and 210th Field and 211th Field Park Companies, 11th Field Company detached with 131st Inf. Brigade to 7th Armoured Division.
50th Division. C.R.E. Lieut.-Colonel K. A. Lindsay.[1]
233rd Field and 235th Field Park Companies.
Two Free French Inf. Brigades with 2nd and 5th Free French Field Companies.
One Greek Inf. Brigade with 1st Greek Field Company and Stores Section.
XIII Corps Troops. C.R.E. Lieut.-Colonel N. A. Armitage.
577th and 578th Field and 576th Field Park Companies.

XXX Corps. C.E. Brigadier K. Ray, S.A.E.C.
51st Division. C.R.E. Lieut.-Colonel H. W. Giblin.[2]
274th, 275th and 276th Field and 239th Field Park Companies.
9th Australian Division. C.R.E. Lieut.-Colonel R. J. H. Risson, R.A.E., succeeded when wounded by Lieut.-Colonel A. S. Gehrman, R.A.E.
2/3rd, 2/7th and 2/13th Field and 24th Field Park Companies, R.A.E.
2nd New Zealand Division. C.R.E. Lieut.-Colonel F. M. H. Hanson, R.N.Z.E.
6th, 7th and 8th Field and 5th Field Park Companies, R.N.Z.E.
1st South African Division. C.R.E. Lieut.-Colonel Mill-Colman, S.A.E.C.
1st, 2nd, 3rd and 5th Field and 19th Field Park Companies, S.A.E.C.
4th Indian Division. C.R.E. Lieut.-Colonel J. H. Blundell.[3]
2nd, 4th and 12th Field and 11th Field Park Companies Sappers and Miners.

[1]Lieut.-Colonel K. A. Lindsay. [2]Colonel H. W. Giblin.
[3]Lieut.-Colonel J. H. Blundell, D.S.O., killed in action, 1943.

XXX Corps Troops. Under C.R.E. 1st South African Division.
11th and 13th Field and 22nd Field Park Companies, S.A.E.C.

Under Army Command.

8th Armoured Division. C.R.E. Lieut.-Colonel C. E. A. Browning.[1]
6th and 9th Field and 143rd Field Park Squadrons.
D.C.E. Roads. Colonel Shannon.
14 D.C.E. Colonel C. Topham.

Army Troops.

3 C.R.E. Lieut.-Colonel H. C. West.
62 C.R.E. Lieut.-Colonel B. M. Archibald.[2]
72 C.R.E. Lieut.-Colonel N. A. Armitage.
82 C.R.E. (Airfields). Lieut-Colonel M. R. M. Cubitt.[3]
9th Field Company S. and M.
295th Army Field Company.
566th and 588th Army Troops Companies.
25th, 27th and 31st Road Construction Companies, S.A.E.C.
4th and 5th Mobile Landing Ground Construction Parties.
21st New Zealand Mechanical Equipment Operating Company, R.N.Z.E.
Detachment 114th Mechanical Equipment Workshop and Park Company.
22nd South African Workshop and Park Company, S.A.E.C.
5th Boring Section.
36th South African Water Supply Company, S.A.E.C.
1st Camouflage Company.
85th Camouflage Company, S.A.E.C.
95th South African Bomb Disposal Company, S.A.E.C.

D. Director Survey. Colonel V. E. H. Sanceau.[4]

517th Field Survey Company.
13th Field Survey Depot.
46th Survey Company, S.A.E.C.

It is regretted that it is not possible to include a list of the many L. of C. and Transportation units and Headquarters which contributed so materially to the success of the Eighth Army.

[1]Brigadier C. E. A. Browning, M.C.
[2]Brigadier B. M. Archibald, C.B.E., D.S.O.
[3]Lieut.-Colonel M. R. M. Cubitt, M.B.E.
[4]Colonel V. E. H. Sanceau, O.B.E.

CHAPTER XV

THE ADVANCE FROM EL ALAMEIN TO TUNIS. NOVEMBER 1942–MAY 1943

The pursuit. Clearance of Cyrenaica—The Administrative problem and repair of ports—Invasion of Tripolitania—The advance resumed—Capture of Tripoli—Entrance into Tunisia. Junction with First Army—The Mareth Line—The crossing of the Wadi Akarit—Final operations in North Africa—Survey—The end of the campaign in the Western Desert.

(See Maps 14, 15 and 16 facing pages 404, 411 and 418 of this chapter and Map 19 facing page 472 of Chapter XVII)

The Pursuit. Clearance of Cyrenaica

The enemy withdrew from his delaying position near Ghazal during the night of 4th November, and on the 5th the pursuit proper began. This was taken up by X Corps, which included 1st, 7th and 10th Armoured, and 2nd New Zealand Divisions, the last named with 4th Light Armoured Brigade under command. XXX Corps, with 51st and 9th Australian Divisions, was kept in reserve and ordered to clear up the coastal area. The task of clearing the main battlefield was entrusted to XIII Corps, whose engineers had the unenviable task of sorting out the maze of minefields, lifting some and marking others. In spite of rearguard actions, in which the enemy lost almost all his remaining tanks, Daba was taken by mid-day on the 5th, and Bagush twenty-four hours later. Meanwhile our armoured cars were operating against the enemy's line of retreat with considerable success near Mersa Matruh. By the evening of the 6th, the main road had been cleared to within thirty miles of Mersa Matruh, and 1st Armoured Division, sweeping to the south, was well on its way to cut the road to the west of that place. But that night, light rain which had fallen during the afternoon, turned to a downpour. The desert became a morass in which tanks could move only very slowly and wheeled transport was completely bogged down. Indirect pursuit across the desert to the flank became impossible, and it became

necessary to follow up the tail of the enemy down the road with all the facilities this gave to the Axis rearguards of slowing the pace. These held Mersa Matruh on the evening of the 7th, and next morning the town was found to have been evacuated. At the same moment 2,000 miles farther west the first waves of the Allied forces invading North-West Africa were coming ashore on the beaches of Algeria.

In their withdrawal the Axis forces had done comparatively few demolitions but had concentrated their attentions on the destruction of the water supply. Much of the pipeline laid earlier by British engineers had been put out of action. The couplings on miles of pipe had been removed and the pipes themselves holed. Some of the latter work seems to have been done by German and Italian soldiers searching for water to drink. Machinery was smashed, reservoirs, tanks and aqueducts demolished; and all undestroyed water sources contaminated. The restoration of some water supply was therefore an urgent task, and several engineer units were put on to the job. Within forty-eight hours 570th Field Park Company had developed water production at Bagush to 200 tons a day using captured stores.

Along the road the pursuit swept on brushing away minor resistance at defiles such as the Halfaya Pass. The frontier was crossed once more on 10th November, and the leading troops entered Tobruk on the morning of the 13th.

The pursuit is graphically described by the historian of 9th Field Squadron as follows: "What an unforgettable experience that was. Two abreast and nose to tail the whole world seemed to be moving up. Every type of lorry, truck and car in the Army, the Navy, the Air Force, and even nursing sisters, were swaying and lurching up the uneven tarmac. In the opposite direction came another stream of vehicles, mostly full of prisoners. The scene was reminiscent of the Brighton road on an August Bank Holiday. Everybody was full of spirit; the great chase, that was to end in Germany itself, was on."

The administrative situation was now difficult, and the main body could not proceed farther till the port of Tobruk was opened. But it was essential to secure the landing grounds lying between Derna and Mechili so as to bring our fighter aircraft within range of the Jebel el Akdar and Benghazi to harass the enemy retreat and to interrupt his supply system. But there was an even more pressing reason for the capture of the coastal group of landing grounds. Only one convoy had sailed for Malta since the previous April owing to the impossibility of providing air protection, and that had lost

thirteen of the seventeen ships of which it was composed. Thus the garrison and population of the island were now on the verge of starvation. It was essential that a convoy should sail on 16th November, and that it should be afforded air protection. Small columns, supplied by stores landed at Mersa Matruh, Sollum, and Bardia, pushed on accompanied by two mobile airfield construction groups. Tmimi and Gazala landing grounds were captured on the 14th and that at Martuba on the 16th, and in each case, in spite of ploughing of the surface of the runways which were also sown with mines and obstructed, the landing grounds were rendered operational in forty-eight hours, and aircraft were able to operate from them to cover the passage of the convoy.

Little damage had been done by the enemy to the three ports above mentioned, though they were somewhat obstructed by shipping sunk by the R.A.F. They were however of minor capacity, and it was necessary to develop that at Tobruk as quickly as possible. Here again luckily the damage to the harbour was slight, the most serious trouble being the shortage of water for the large body of troops which was collecting in the neighbourhood. Fresh borings were immediately undertaken, and by good luck, an uncontaminated aqueduct, with a 1,500-gallon tank intact and with only the pumping set destroyed, was found in the neighbourhood and quickly brought into action. Such repairs as proved necessary to the various ports as they were reached were taken in hand, first by the engineers of formations, till such time as it was possible to bring up Works and Transportation units with their special equipment. The work was made more difficult by the presence of a large number of booby-traps left by the enemy. At Tobruk C.E. Eighth Army himself discovered what he described as "the father and mother of a booby-trap" in which the shifting of a petrol drum would have set off a large stock of 200 lb. R.A.F. bombs stacked in a passage of the main underground petrol store. The chief constructional work found necessary at Tobruk was the restoration of the bulk petrol storage, the tanks of which had been destroyed.

From the Egyptian frontier onwards the enemy had paid more attention to the destruction of the road, and many bridges and craters had been blown and mined, and called for the continuous attention of forward engineer units. In spite of all these difficulties, Benghazi was entered on 20th November, 21st Field Squadron having the honour of being the first engineer unit to enter the town.

Next day our mobile troops were in contact with the enemy at Agedabia, and then 22nd Armoured Brigade, having raced across 250 miles of desert, turned the enemy flank causing him to withdraw to El Agheila where contact was re-established on 25th November. Cyrenaica had once again been cleared of Axis forces.

The speed of the advance has been attributed very largely by General Alexander in his Dispatch to the efforts of the R.A.F., who continually harassed the enemy's retreat and at the same time prevented the enemy's aircraft from interfering with our pursuing columns. This successful action would not have been possible without the untiring efforts of the airfield construction groups and wings, R.E. and R.A.F. In no case recorded did these units fail in the advance to the Cyrenaican frontier to get a landing ground into action within forty-eight hours of the arrival of the first troops on the ground. By 26th November, airfields had been cleared and repaired at Msus, fighter wings were established, and our air superiority over the forward area assured.

The Administrative Problem and Repair of Ports

The administrative problem was now acute, and the development of communications, on which the future success of the campaign depended, became the major task of the engineers of the Eighth Army and Middle East Command. It has been pointed out several times in the course of the narrative of the campaigns, that maintenance of large forces in the Libyan Desert depended on the use of the larger ports. These were Alexandria, Tobruk, Benghazi and, looking ahead, Tripoli. The distance from Alexandria to Tobruk is some 500 miles, and Benghazi is a further 350 miles by road. Thence to Tripoli necessitates a further carry of 650 miles. Over such distances road traffic, even with a first-class road system, which was noticeably absent in North Africa, is not capable of maintaining large forces. A lorry carrying supplies from the Delta to the advanced troops about El Agheila and back would require nearly 50 per cent of its "pay load" for its own petrol.

We have seen that, immediately after its capture, work on the rehabilitation of Tobruk was started. This was pressed forward vigorously. The same thing now happened at Benghazi, at first engineer units of formations carried on till specialist and works units from L. of C. and the Transportation service could be brought up.

The arrival of these was delayed partly owing to the distance they had to travel, but also because the maintenance position in the forward area precluded the importation of any more units unless some of those already there should be sent back.

At Benghazi it was found that the port and town installations had been badly wrecked, partly by the Axis troops before their retreat and partly by bombing of the R.A.F. In the outer mole one large gap of sixty feet width had been blown by the enemy, besides heavy damage to all moles and jetties by allied bombing. The enemy had also blown craters, almost lip to lip, along all the main quays. All craft except one small dinghy had been sunk. The harbour was useless for unloading ships of any size, though lighters could be cleared in good weather. The main water supply, power house and sewage had all been wrecked. The latter was particularly troublesome as the main sewers of the town were below sea-level and, in the absence of pumps, sewage began to swirl into the streets. An extensive bulk oil and petrol supply had been installed by the Italians with a floating pipe-line to tankers in the harbour and four miles of pipe-line leading to two large reservoirs under bomb proofed roofs. The roofs had all been completely wrecked and it was only realized that under the heaped up debris the reservoirs still held petrol, when the D.C.E. noticed its smell. One can hardly imagine a more difficult problem that that which faced the field units, without special equipment in the first days. It was not till the end of November that a hastily organized Works C.R.E's. Headquarters under Lieut.-Colonel McMeekan arrived with an army troops company and a small Transportation element. Under such circumstances, improvisation was the order of the day. There was no time for a permanent repair of the mole, and no facilities for handling heavy weights or long piles. The gap in the mole was filled by throwing in the largest blocks of concrete which could be handled without any attempt to build a wall. Craters in the quay walls were patched with improvised revetment and rubble filling behind, and all the essential town services were patched up somehow. So successful were these efforts that by 5th December the port was discharging, in fine weather, 1,500 tons a day. On 4th December, General Montgomery, with his Chief Administrative Staff Officer, Major-General Sir B. Robertson, late R.E., whom we have seen in a similar position in the campaign in East Africa (Chapter X, page 250), held a conference on the spot with the local officers concerned including the C.R.E., Lieut.-Colonel McMeekan, and laid down a target of 3,000 tons a day to

be reached by the end of December to enable the advance into Tripolitania to be continued.

Intense efforts by all concerned enabled this target to be achieved, trains were running in the docks and on the local railway and sufficient water for troops was available though the town supply and the restoration of the sewage system took considerably longer. The successful closing of the breach in the outer mole was recognized by the following signal received by C.E. Eighth Army from the Naval Officer in Charge: "I have been asked by the C.-in-C., Mediterranean Station to convey to the Royal Engineers his congratulations on your work on the outer mole."

During the necessary pause while a forward base was being established at Benghazi, our forward troops being in contact with a strong enemy position on the frontier at El Agheila, work on improving communications forward and developing water supply was organized by corps areas. X Corps was responsible for all work in rear of Derna and XXX Corps beyond that point. Further to the rear, as the ports of Benghazi and Tobruk could not by themselves maintain the whole of the forces, work was being pressed ahead to improve the land routes from Egypt. Considerable damage had been done to the railway by the enemy who had also spread many mines and booby-traps to delay the work. In spite of this, and later damage caused by wash-outs after the heavy rain, work on restoration of the railway by railway construction companies was pushed ahead, so that railhead was opened at Cappuzzo on 21st November, and at Tobruk on 1st December. The last stages were assisted by the fact that the enemy, during his occupation of the railway, had extended the line to Tobruk Road, and although he had also destroyed this section, the formation remained. A necessary adjunct to the repair of the railway was the reinstatement of the water pipeline. For this ample provision in the form of stocks of new pipes had been collected forward before the offensive and the work was carried through quickly. It was aided in one respect by the fact that the Axis engineers had carried out many of the demolitions to the line at its highest points so that much of the pipe was full of water and less had to be pumped initially to fill the pipe. This mistake had not been made by Allied engineers in their earlier retreats. By 1st December, 3,000 tons of Nile water were being delivered daily twenty-five miles west of Mersa Matruh. The road also needed considerable attention. While the craters and other demolitions had been repaired quickly by forward engineer units to permit of the

rapid advance of the leading fighting troops, much more work was required to render and keep this single road fit for the heavy traffic entailed by the maintenance of the Army, and many engineer units of formations as well as road construction companies were engaged on the work.

Invasion of Tripolitania

As a result of all these efforts, to quote General Alexander, "within a very short time sufficient supplies were pouring into Cyrenaica to enable the air forces to continue uninterrupted their heavy attacks on enemy ports and shipping, to allow troops and reserves to be gathered in readiness for a further advance, and strong forces to be maintained in the forward area to ensure an impenetrable screen of observation." But even so it was the middle of December before General Montgomery was able to resume the advance. In preparation for this XXX Corps had relieved X Corps in the forward area, and it was hoped to continue the advance on the 16th. But on the night of the 12th Rommel began to withdraw, relying on mines, booby-traps and demolitions to hold up the pursuit. By these means, and by the temporary holding of a position covering an anti-tank ditch about twenty miles west of El Agheila, he was successful in slowing up the advance of the main body along the road. Then the New Zealand Division, which had moved by a long cross country route to the south, appeared on his line of withdrawal sixty miles west of El Agheila, and he was forced to break up his rearguards into small parties which got away through the gaps in the New Zealanders' deployment, losing a number of tanks and guns in the process.

Our forces were now in Tripolitania, and the nature of the country was changing. The desert was gradually being left behind and movement off the road was becoming more difficult and in many places impossible for wheels. With a full realization of this the enemy had destroyed almost every one of the bridges and culverts over the numerous wadis, and the debris of the demolitions and the wadis themselves were strewn thickly with mines. To speed the advance practically the whole of the engineer effort was concentrated on opening the road. In the preliminary work, carried out for the most part by field squadrons with the armoured divisions, efforts were concentrated on getting some form of communication through and on clearing of mines, landing grounds for the R.A.F. and harbour areas for the troops. In the El Agheila area alone seven R.E.

sections in one day cleared about 240 mines, exclusive of those cleared by other sections, from the railway and telegraph lines. In the seventy miles between El Agheila and Nofilia six and a half troop days were expended in making diversions round twenty craters and seven blown culverts all liberally strewn with mines, filling three craters, and removing five unfired charges. Following up the divisional engineers, corps troops and road construction companies made a more thorough job, filling in craters round which deviations had been made, and clearing mines off stretches of road which had been left marked by the divisional engineers. The former job was particularly dangerous as the debris round the craters was liberally sown with "S" (anti-personnel) mines which went off among the men and bulldozers working on filling the craters.

In the same area the water supply had been equally wrecked so that a well boring section had to be brought up and boreholes sunk while the wells were being repaired. For instance at Nofilia three boreholes were sunk to a depth of about 125 feet and each produced about 100 tons of water per diem.

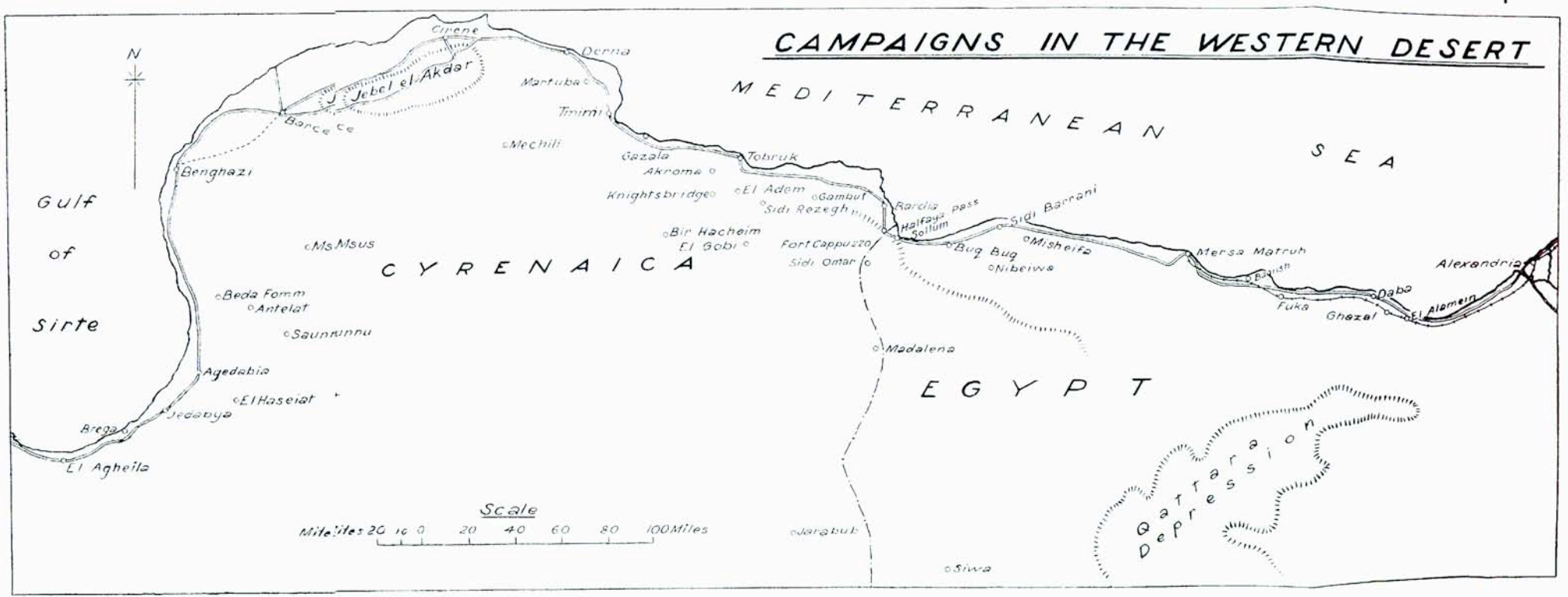
The rapid repair of airfields was of especial importance. Partly owing to the nature of the terrain, and partly to the fact that this country had not been fought over previously, there was a scarcity of existing landing grounds and of these the enemy had taken pains to prevent our early use. It was clear that in his denial schemes the enemy had given up any hope of an early return by his own troops, so the mines which were thickly sown were placed on no regular plan which made them more difficult to locate. He had also half buried in the runways 40-gallon drums attached to anti-lifting devices, and ploughed furrows 6 in. deep and 2 ft. 6 in. wide in curves all over the surface. An example of the work entailed may be given in the task of reinstating the airfield at Merduma West some miles west of Nofilia. Here 625 mines, about equally divided between anti-tank and anti-personnel, and sixty drums were removed by two sections of a field company in forty-eight hours. The work was complicated by the presence of a large number of dummy mines, consisting either of rows of disturbed earth or buried smoke candles to which the detectors reacted. Ploughing was not used on this particular field, and its efficacy varied with the nature of the soil, and the time which had elapsed between the completion of the work and the arrival of the repair party. For example ploughing of one field which was situated in a saltpan and reached in the rainy season was sufficient to deny its use for fourteen days; while at another,

ploughed in sandy soil with the furrows liberally sown with mines several days before the arrival of our troops, the furrows were completely drifted over by sand so that it was almost impossible to locate the mines by detectors. This landing ground was never used.

In recognition of the work of the engineers of Eighth Army in the restoration of landing grounds, the following message was received by Commander Eighth Army from A.O.C. Western Desert: "I would be grateful if you would transmit to formations concerned in clearing Marble Arch (an important ex-Axis airfield) our admiration and gratitude for the great work they did. The efficiency and acceptance of serious hazard involved was beyond all praise. We are encouraged to make doubly sure that the resultant air work over enemy territory is more than repayment." To this, in the spirit of comradeship which existed between all arms and services in the desert, the C.E. replied: "A.O.C.'s signal is being communicated to all engineer units in Eighth Army, by whom it will be deeply appreciated. May the A.O.C. please be assured that all ranks in the R.E. and sister Corps from the Dominions regard the clearing of captured landing grounds as one of the most worthwhile tasks they are called on to perform. They see their reward in the sky almost the moment the work is finished. We regret only that the nature of the task imposes some delay on the R.A.F. which we are doing our utmost to reduce to a minimum."

During the advance from El Alamein nineteen enemy airfields had so far been cleared of mines and reinstated and eight newly constructed.

By the end of the year Eighth Army advanced troops were in contact with a fairly strong position at Bouerat, some 200 odd miles east of Tripoli which was the next port of any magnitude through which the army might hope to be supplied. The Army was already 300 miles from the last port of any importance, Benghazi, which was now the advanced base. None of the small harbours on the Gulf of Sirte were of any size nor capable of any major extension, nevertheless each was carefully reconnoitred and used to the utmost extent. So it became necessary for the Army to halt while the necessary stocks of supplies, petrol, and ammunition were built up, and work on the roads became more intense than ever. Extra field units from X Corps and Benghazi were brought up to help XXX Corps, and the forward limit of responsibility of D.C.E. Roads was pushed well forward. But a more serious cause for delay was to arise. On 3rd January, a violent storm struck Benghazi and raged for two days.


CAMPAIGNS IN THE WESTERN DESERT
N
Cirene
Derna
Jebel el Akdar
Barce
Martuba
Tmimi
Mechili
Gazala
Tobruk
Akroma
Knightsbridge
El Adem
Gambut
Sidi Rezegh
Bardia
pass
Halfaya
Sollum
Sidi Barrani
Bir Hacheim
El Gobi
Fort Cappuzzo
Sidi Omar
Bug Bug
Misheifa
Nibeiwa
Mersa Matruh
Baggush
Fuka
Daba
Ghezal
El Alamein
Alexandria
Benghazi
Ms Msus
Beda Fomm
Antelat
Saunnunnu
Agedabia
El Haseiat
Jedabya
Brega
El Agheila
Gulf of Sirte
CYRENAICA
MEDITERRANEAN SEA
EGYPT
Maddalena
Jarabub
Siwa
Qattara Depression
Scale
Miles 20 10 0 20 40 60 80 100 Miles

The temporary filling in the breach in the mole was swept away and new breaches caused where Italian contractors had skimped the original work. Of the fifteen ships in the harbour only four escaped damage. Half were sunk and others driven ashore. Though the engineers toiled manfully to repair the damage, Benghazi was reduced to a fair weather port, and, though assisted by a reinforcement of "Z" craft which arrived to act as ship to shore lighters, at the first sign of storm all ships made out to sea.

But, in spite of all these efforts, the fact remained that Benghazi was now of little use as a base for further operations. General Montgomery, however, did not delay his advance and decided to rely on Tobruk and Egypt. To provide the necessary M.T. he "grounded" X Corps and other smaller formations and units and diverted their transport to the maintenance of the Army over the long desert L. of C.

The Advance Resumed

On 14th January, 1943, the advance led by XXX Corps was resumed, but only strong rearguards were found on the Bouerat position as the enemy, though unknown to the British High Command, had decided to withdraw into Tunisia and there to form a bridgehead. He was, therefore, fighting now chiefly for time to allow of the orderly withdrawal of his forces in Tripolitania, and the preparation of the defences of Tunisia. There was, however, some sharp fighting on and beyond the Bouerat position as the enemy retired in good order on to his next position at Homs. His demolition and mining activity had become if possible even more intense and in spite of the efforts of the engineers of XXX Corps the advance of the main bodies was considerably delayed.

Though the extent of the minefields at this stage of the advance may not have been so great as those which had been encountered at El Alamein, the promiscuous way in which they had been laid by the now rapidly retreating enemy made the task of clearance as difficult and equally dangerous, and many gallant actions were performed by units and members of the engineer units concerned. All methods of detection were employed, detectors, inspection of the ground and prodding. For speed of action bulldozers were used to clear unreconnoitred tracks and, amongst others, Lance-Corporal R. F. Milligan of 5th New Zealand Field Park Company with his bulldozer cleared tracks for his own and 7th Armoured Divisions at Sedada on 17th January and Beni Ulid on 19th, during

which work several mines blew up on the blade of his bulldozer but he kept it going and completed his job. From this it may be seen that the personnel of field park companies took their share in gallant action with the leading troops. The continuous employment on mine clearing and other causes had involved considerable casualties, and reinforcements had arrived in units not fully trained in the meticulous drill necessary. It was therefore found necessary to reopen, at Benghazi, the R.E. School of Mine Warfare which had been closed at the opening of the offensive in October. As an example of the drain on units, it was reported on 31st December, that 21st Field Squadron, which had only had two days' rest from mine lifting since 24th October and was now relieved, was ninety-two other ranks below establishment.

Capture and Repair of Tripoli

Beyond Homs, from their position west of which the enemy rearguards were hustled by a threat to their right flank, mountainous country was entered in which the road passed through ravines where the enemy were able to delay the pursuit with comparatively weak forces and where road demolitions proved very effective and troublesome to the engineers. The R.E. of 51st Division, which was leading the advance, carried out the first repairs followed by those of 50th Division. In rear XXX Corps Troops R.E. working under C.E. Eighth Army further improved the road. Between Bouerat and Misourata, sixty-eight demolitions and craters were dealt with, one involving the construction of a bridge of five spans each of 30 ft. Owing to the casualties caused by "S" mines in the demolitions, bulldozers were again in great demand. The whole Army Bridging Train, in spite of the traffic congestion, was brought up to deal with demolitions in the Homs area.

In spite of these obstacles, 51st Division emerged into the plain of Tripoli at Castelverde on 22nd January. On the same day a light armoured column, which had been sent to swing round the southern flank, forced the defile on the single road through Tarhouna and captured Castel Benito with its important airfield. On the 23rd the two columns entered Tripoli almost simultaneously, to find that the last of the enemy forces had left a few hours earlier. With the leading troops arrived Brigadier Kisch, C.E. Eighth Army, who was always to be found near the front. Next day the near-by airfield at Castel Benito had been repaired by 371st Army Field Company and taken into use by the R.A.F.

The Italian civil population, unlike that at Benghazi, had not been evacuated, and little damage had been done to the town and its essential services. Military establishments and the port had, however, been badly wrecked. The systematic destruction had been going on for some days and had been anxiously watched by our air reconnaissances, for on the degree in which the port could be used for supplying our troops depended the future rate of advance of the Army. The damage in the harbour was extensive both from the efforts of the enemy and from the earlier attentions of the R.A.F. Most of the quays and jetties had been badly damaged, the Spanish Quay having eighteen craters thirty to forty feet in diameter, cranes and mechanical plant had been wrecked and the road approaches and bridges blown up. But worst of all ships had been sunk in the entrance. Luckily the final blockship had been sunk by the Fleet Air Arm before it could be put in position to seal the harbour, the gap being filled with light craft only. The bulk petrol storage was found to be badly damaged but closer inspection proved that repairs could be carried out fairly quickly.

The problem facing the engineers therefore was gigantic, and all hands were rapidly put to work no matter what their normal avocations were. A Port Control Commission had been set up in advance of which the C.R.E. Works designate of the area was a member. This Commission settled priorities so that the work could be undertaken in an orderly manner. Field engineer units, being the first on the spot, started on the most urgent jobs and their places were taken on specialist work by Transportation and other units as these arrived. Clearance of sunken ships and other obstructions in the harbour was the responsibility of R. Navy, but as their first salvage ship to arrive had not all the necessary plant, R.E. units had to lend them a hand in the early stages. To enable some stores to be landed while awaiting the opening of the harbour, beach landing stages for the unloading of tank landing and "Z" craft were completed by R.E. units on the 26th, but were destroyed by a violent storm on the 27th, which also greatly impeded work on the harbour, and the project had to be abandoned; 552nd Army Troops and 571st Army Field Companies started work on repairing the Spanish Mole, and other units on the quays and approach roads, the first job being the clearing away of great masses of debris. In spite of the difficulties and the delay due to the storm, an entrance 45 ft. wide had been cleared by 30th January, but as this was only 16 ft. deep only small craft were able to enter and discharge at the partially repaired jetties. Among

the first to enter were some of the "Z" craft, designed and assembled by R.E. (See Chapter XVI, pages 434, 435), which owing to their shallow draft and ease of manoeuvre were ideal for the purpose. They had made the 670-mile trip from Benghazi under their own power manned by their Indian crews. The first cargo steamer was received on 3rd February, by which date a gap was available at the harbour mouth 80 ft. wide and 25 ft. deep. In the week ending 9th February, 11,000 tons were unloaded and by the end of March the capacity of the port had reached its target figure of 4,000 tons a day.

The repair of this port was an example of masterly improvisation, and the D.W. Middle East in a report on the work emphasizes that rapid harbour repairs involve field or L. of C. engineering technique rather than the more deliberate work which cannot be carried out in the time available. It is because such R.E. units are trained to improvise, and to obtain results quickly, that they must be considered more suitable for the part, at all events in the very early stages, than specialist units. No task is ordinarily encountered which requires more technical knowledge than is available to a Works C.R.E. and his staff. This is not to belittle the importance of specialist units for the completion of more permanent repairs and much valuable work was done by a small South African Harbour Construction unit which was brought up, under the orders of D.W., from Suez within a week of the capture of Tripoli. The engineer units employed had no special equipment except a diving suit with two divers. Cement mixers, stone crushers, two barges and a tug were all found in the area. There was some shortage of mechanical plant in the first few days but this want was soon supplied.

Within the town, as stated, the bulk petrol depot was found to be not so badly damaged as was at first feared, and it was got into action by the time the tankers were able to enter the port and deliver. The town water and power supplies, though not damaged, were in a bad state of repair and the civil authorities had to be given assistance to keep them going and to increase the output to meet the needs of the troops.

Entrance into Tunisia. Junction with First Army

In January, as Eighth Army was approaching Tripoli, a conference was held at Casablanca in Algeria which was attended by Mr. Winston Churchill, President Roosevelt, and the Combined

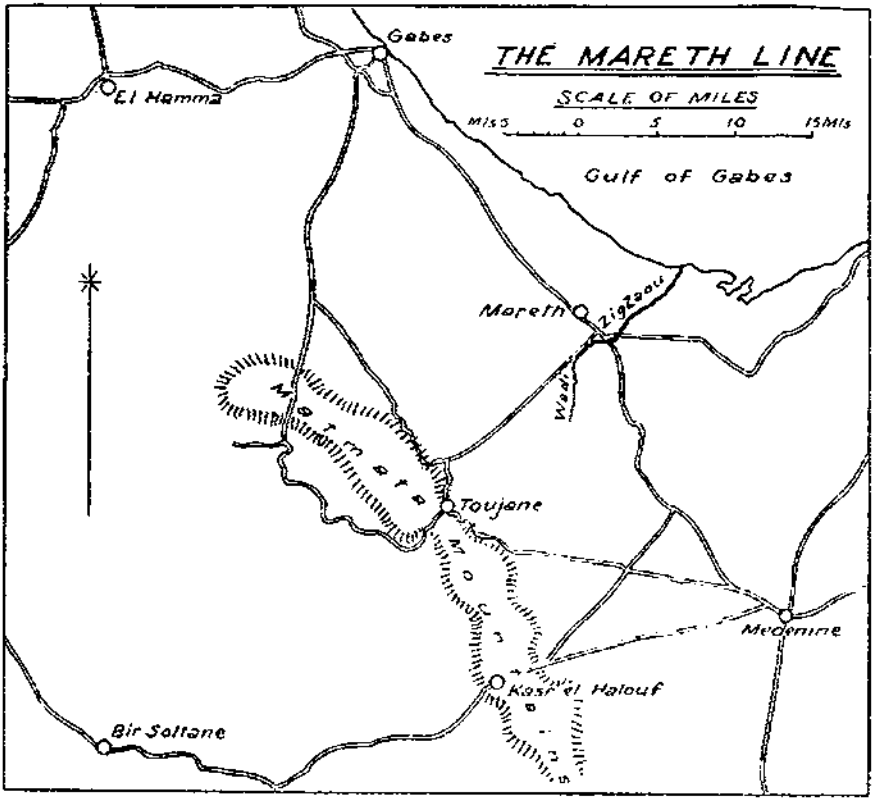
Chiefs of the Staff. At this it was decided that, when Eighth Army entered Tunisia, it should come under the orders of the American General Eisenhower,[1] Commander-in-Chief, Allied Expeditionary Force, an Army Group Headquarters (Eighteenth) should be set up to co-ordinate the action of all Allied forces engaged on the conquest of Tunisia, and that General Alexander should command this Group and at the same time become Deputy Commander-in-Chief to General Eisenhower. By the end of January, Tripolitania had been cleared of the enemy, and the new organization of command came into force. From henceforth Eighth Army would not act alone, but in co-operation with First Army now advancing on Tunis from the west. (See Chapter XVII.)

To cover this final advance it was necessary to repair all Axis made landing grounds in Tripolitania and even to provide some new ones. Indeed as a result of the very thorough obstructive measures taken by the enemy it was frequently found better to make new landing grounds than to try to repair old ones. The nature of the country in Tripolitania, and later even more so in mountainous Tunisia, did not lend itself so readily to the rapid production of airfields as did that in Cyrenaica. Therefore greater efforts were called for from the airfield construction groups and field units had to do even more of the work. Though priority was given to the operational needs of Eighth Army and its supporting air forces, fresh calls came for the production of more extensive airfields for American heavy bomber squadrons which were now arriving to operate from North Africa. To compete with the work of the Army under these conditions it became necessary to increase the mechanical plant for each airfield group with extra auto-patrols, scrapers and rollers. During this campaign responsibility for the construction and maintenance of airfields was divided between C.E. Airfields on the staff of E.-in-C. Middle East, and C.E. Eighth Army, the former being responsible for those in the G.H.Q. area and the latter for those in his Army area.

As Eighth Army moved forward G.H.Q., Middle East took over in turn the advanced bases at the ports, Tobruk, Benghazi and Tripoli. Here they further improved the port facilities and developed the base installations. In the dock areas arrangements were made for the supply of water to small craft, electric light and power; roads, dock offices, signal offices and A.A. gun sites were provided; and extensive systems laid out for the storage and distribution of

[1]General Dwight Eisenhower.

Map 15



aviation and M.T. petrol and for fuel oil and dieseline for the Royal Navy. The bulk storage and distribution of petrol was a large job involving, as it did, the repair of existing tanks and the provision of others, a considerable system of pipelines to depots and filling points besides floating pipelines to tanker berths. With these were further required pumps and engine houses. Storage at Tobruk for 6,200 tons was completed by December 1942; at Benghazi the figure rose from 5,200 tons in January, to 10,400 tons in March. At Tripoli a much larger installation was built giving 11,500 tons in February and double that amount by June 1943. Depot and workshops accommodation on a very large scale was constructed and provided with rail and road connexions. At Tripoli these spread for over

twelve miles along the coast and up to six miles inland, besides some outlying installations at some distance from the main group.

The Mareth Line

At the end of January, on emerging from Tripolitania into Tunisia, Eighth Army halted to enable the administrative position, which had become very difficult before Tripoli had been captured, to be improved. This was especially necessary as the Army was now approaching the strong Mareth defensive line. This position had been prepared by the French before the war to stop any invasion of Tunisia from Tripoli, and a great deal of work had lately been put into it by the Axis forces. The original line bore certain resemblances to the Maginot Line in France though the individual works were not nearly so elaborate, and, being constructed later than the Maginot defences, incorporated more recent ideas in fortification. It ran for a total length of about twenty-two miles on a course roughly north-east to south-west just south of the small town of Mareth, from which it took its name. One flank rested on the sea and the other on the steep-sided Matmata mountains. At the north-east end the Wadi Zig-Zaou ran in front of the line, and, artificially scarped, made a first-class anti-tank obstacle. The defences themselves consisted of a system of interconnected strong points, partly underground, with structures and shelters of reinforced concrete. The fire from these localities covered strong belts of wire obstacles and extensive minefields. The Matmata mountains, at the western end, were almost impassable for wheeled traffic and the one poor road which crossed them was blocked at the pass of Ksar el Hallouf. The desert west of the mountains was considered by the French as completely impassable to any significant force; the going was very difficult and there was very little water.

On 21st February, in order to relieve the pressure on the American troops on the left of First Army who were being attacked by Rommel in the neighbourhood of Casserine (see pages 461, 462), General Alexander ordered Eighth Army to move forward. By the 23rd, by which date the crisis of the battle at Kasserine was passed, Eighth Army was not fully in touch with the advanced troops of the enemy holding the Mareth lines and, as the need for a diversion was no longer urgent and the administrative position was not yet as satisfactory as could be wished, it was decided not to press the advance. Further it was evident that Rommel was now preparing an attack

against Eighth Army's left flank from the direction of the Matmata Mountains. This was launched on 6th March, and, though the attack was pressed home four times during the day, was repelled by the anti-tank fire of our troops without practically any assistance from our armour. The enemy lost fifty-two tanks, which represented about one-third of his total armoured strength on his southern front. This was Rommel's last battle in Africa, for a few days after he handed over his command to General von Arnim and returned to Germany. He had been ill for some time and had indeed been absent undergoing treatment in Germany when Eighth Army's attack at El Alamein had been launched, returning only on the third day of the battle.

Plans were now well advanced for the final offensive by First and Eighth Armies to destroy the enemy forces in Tunisia. The attack by Eighth Army was timed for 20th March, to be preceded by preliminary operations by II U.S. Corps against Gafsa on the 16th, and the clearance of the enemy outpost positions in front of the main Mareth Line starting on the same day. Both these operations were successful. Eighth Army's plan for the main attack was that XXX Corps should attack frontally, while a temporarily formed New Zealand Corps, consisting of 2nd New Zealand Division, 8th Armoured Brigade, and a force of French troops with a troop of 6th Field Squadron attached under General Leclerc, should move wide to the west, through the desert west of the Matmata Mountains, to swing round the right flank of the enemy's position. The experience of our Long Range Desert Groups in previous fighting had showed that such a move was possible in spite of the view held by the French that the country west of the mountains was impassable by any but small bodies of troops. When XXX Corps had penetrated the position, X Corps, with 1st and 7th Armoured Divisions, should pass through and drive northwards.

The attack by XXX Corps, with 50th Division leading, was launched according to plan at 10.30 p.m. on 20th March. It has been mentioned above that the Wadi Zig-Zaou, which ran across the front of the enemy position, formed an efficient anti-tank, and even anti-personnel, obstacle. It was about 200 feet broad and had steep, almost unclimbable, banks twenty feet high. There was little water in it but quantities of mud. In preparation for the assault, the R.E. of the Division, under their C.R.E., Lieut.-Colonel C. E. A. Browning, had made quantities of fascines and ladders, armed with which infantry and Sappers advanced "as though at the storm of

Badajoz". The infantry stormed successfully three or four strong points and formed a bridgehead. The R.E., under a storm of fire, for the enemy's artillery had the range accurately and their machine-guns enfiladed the Wadi, carried forward their fascines and started to build causeways for tanks and vehicles. Casualties were extremely heavy, but in spite of these they managed to build one causeway for track vehicles but were unable to improve it to take wheeled transport. Further, in the deep mud, the first light tanks crossing damaged the causeway so badly that heavier tanks were unable to follow.

On the night of 21st/22nd, heavy rain brought the wadi down in spate and further damaged the crossing. To assist the shattered and weary R.E. of 50th Division, who had continued to work on the causeway, on the 22nd the Sappers and Miners of 4th Indian Division (less one field company) were placed under orders of 50th Division. During the afternoon the enemy counter-attacked strongly and considerably reduced the bridgehead. When work started in the evening to build two new causeways, conditions could hardly have been worse. The enemy were on the offensive and at very close range. The wadi was an inferno of fire. The rising moon silhouetted the men working on the east bank. Transport blocked the approaches. Led by their C.R.E., Lieut.-Colonel J. H. Blundell, and the two company commanders, 4th and 12th Field Companies S. and M. plunged into the wadi bed and worked feverishly with fascines and wire mesh to build the causeways. Lieut.-Colonel Blundell was everywhere encouraging his men and pointing out, though the peak of his cap had been shot off, that if a man of his height, well over six feet, was unhurt, others would be too. When an infantry officer asked help for some of his men who had been blown up in a minefield, Blundell and a sapper with a detector went to the rescue. While doing so the sapper was hit and Blundell carried him to safety.

At 3.30 a.m., the enemy put down a heavy barrage in preparation for a further counter-attack. Under this the causeways were finished and Blundell withdrew his men but not before he had given orders that no one was to hurry away so as not to alarm other troops in the area. He himself went last stopping to talk to infantry groups while his men waited for him. Many units bore witness to the heartening effect of the coolness of the Sappers.

The position in the bridgehead was however untenable and before dawn the troops which had crossed were withdrawn.

As in the meantime New Zealand Corps was making progress

through the desert to the West, General Montgomery decided not to press his frontal attack with XXX Corps but to reinforce his left. He accordingly sent X Corps Headquarters with 1st Armoured Division to join the New Zealanders, and directed 4th Indian Division, under XXX Corps, to thrust into the mountains to the west of the Mareth line in order to open the road from Medenine to Bir Soltane via Ksar el Hallouf as a shorter line of supply for X Corps. It was then to advance along the spine of the Matmata Mountains to cut the Mareth–Gabes road. The Sappers and Miners of 4th Indian Division had a hard task to clear the road through the mountains for the Division. The enemy had cratered and demolished the road fairly thoroughly and deviations were generally impracticable to make. In one place in the Hallouf pass, the column was held up for eight hours while 4th Field Company with a bull-dozer and two compressors worked feverishly to clear a road through. The scene was graphically described in a B.B.C. dispatch as follows: "The machines were gingerly taken down the narrow trail, watched anxiously by officers on the heights above, and as the bulldozer filled the hole and the compressors' drills cut away the overhang, swarms of men, directed by the sappers, brought up stone from the bottom of the ravine to rebuild the retaining wall. Slowly a new road grew, both here and farther down the gorge." Thus 4th Indian Division descended into the plain and linked up with X Corps, which, after heavy fighting about El Hamma, entered Gabes on 29th March. Here it was joined shortly by advanced troops of 51st Division of XXX Corps, the enemy having withdrawn from the rest of the Mareth line.

Meanwhile the engineers in rear had been toiling to open and repair water supply and to maintain the roads. The latter which had not been built for such heavy traffic, collapsed at times under the weight of tanks on their transporters. Early in March the complete break up of the road through Medenine caused considerable anxiety, but by great efforts, chiefly by S.A.E.C. units, the road was patched, and ultimately properly repaired, and the operations of the Army were not delayed on its account.

The Crossing of the Wadi Akarit

After his defeat on the Mareth line, and threatened on his right flank by the advance of II U.S. Corps from Gafsa, General Messe, who was now in command of the Axis troops, with General von

Arnim as his Deputy, withdrew to a new position in the neck of land between the sea at Gabes and the depression of the Chott el Fedjadj. In front of this position, which was from twelve to fifteen miles in extent, ran the Wadi Akarit, a steep sided obstacle which had been extended and improved to form an anti-tank ditch to cover the whole front of the position. The position, which was naturally strong, had been considerably developed by the Axis troops. Two roads to the north passed through it on either side of a mountainous ridge, that by the sea coast led to Sfax, the other farther inland towards Gafsa. At each end of the ridge were peaks dominating the roads, and between these there was a low col crossed by some rough tracks.

The attack on the position was launched by XXX Corps on 6th April, with 51st Division (C.R.E., Lieut.-Colonel H. H. C. Sugden[1]) on the right, 50th Division in the centre, and 4th Indian Division on the left. General Messe had sent most of his armour well away to his right apparently because of the threats by II U.S. Corps from Gafsa and 1st Armoured Division at Maknassy. The divisional engineers of all three British divisions had the task of making gaps in the minefields covering the position and making crossings over the anti-tank obstacle. This they did under heavy fire. Lieut.-Colonel Blundell, C.R.E. 4th Indian Division, whose gallant conduct in the assault on the Mareth Line has been described above, being killed by a shell with three of his officers when supervising the work of his units.

Here also Eighth Army as a whole and the R.E. in particular suffered a grievous loss when the C.E., Brigadier F. Kisch, was killed by one of the mines he had done so much to defeat in developing the technique of mine warfare. Kisch, who had come back to the Corps from the Reserve of Officers at the beginning of the war, had been C.E. British Troops in Egypt, and then of Eighth Army since its formation, earning the respect and confidence of its Commander and all ranks. Always in the forefront, and determined to see things for himself, he and his unorthodox clothing had become a legendary and beloved figure in the Army. A C.E. of one of the Corps who served with him throughout the campaign wrote thus: "The skill of a Chief Engineer lies not so much in technical brilliance (though Kisch had this to the full), as in correct and timely military appreciation and its reactions on engineer commitments, before he is given any orders. Only thus can he hope to make adequate arrangements to keep pace with operations. It was in this, combined with his

[1]Brigadier H. H. C. Sugden, C.B.E., D.S.O.

enthusiasm and perseverance, that Fred Kisch excelled. He deservedly became a well known and popular figure throughout Eighth Army." The same mine also killed Colonel Shannon, South African D.C.E. (Roads), whose work had contributed so greatly to the rapid advance of the Army across North Africa.

The battle lasted only a day but the fighting was described by General Montgomery as "heavier and more savage than any we have had since Alamein"; 51st Division gained its original objective but was driven off by a counter-attack; 50th Division was seriously delayed by resistance on the line of the wadi; but 4th Indian Division on the left was completely successful and in a few hours was through the enemy's defences and threatening the flank of those to their right. Through this gap X Corps was passed but was counter-attacked and held by enemy armour till nightfall, when the Axis troops withdrew to the north. Next day patrols of First and Eighth Armies made contact. The net had closed.

Final Operation in North Africa

General Alexander having decided that the final thrust to break up the Axis forces should be carried out by First Army, Eighth Army thereafter, apart from one more attack on an Axis position near Enfidaville, was restricted to exerting steady pressure against the enemy's southern front in mountainous country. The story of the final destruction of the German and Italian forces in Tunisia therefore belongs properly to that of the advance of the Allied Force, of which First British Army formed the bulk, from the west. It is accordingly told in Chapter XVII dealing with that campaign.

Anxiety for the maintenance of the main roads by which the Army was maintained in its advance beyond Tripoli has been mentioned above. There was no railway west of Tripoli barring a 95 cm. track to Zarzis which it was considered could not be developed with profit except for communication between the docks and the depots in the neighbourhood of the town. The value of even the smallest port along the coast had therefore to be investigated. Zarzis and Gabes were found to be of little use and only small quantities of urgent stores were delivered by L.C.T.s without engineer assistance of importance. Sfax, which was occupied on 10th April, was found to be blocked except for L.C.T.s, but a passage was cleared for small ships and within five days as much as 1,500 tons was being unloaded per diem. To this figure "Z" craft contri-

buted a considerable quota, as they were specially suited for such work.

Survey

After the retreat of Eighth Army in July, 1942, the main body of 514th Field Survey Company was withdrawn from the Army to work under G.H.Q., Middle East, on tracks and beacons behind the position at El Alamein, one section with 46th S. African Survey Company being principally employed on the plotting of enemy battery positions. New editions of the maps covering the position and that of the enemy were prepared and issued.

In anticipation of a renewed advance 517th Field Survey Company was attached to Eighth Army and undertook work in the rear while 46th S.A. Survey Company covered that in the forward area. As the Army advanced into Tripolitania the demand for new and special maps was so great that 517th Company was also moved forward. In fresh country, of which accurate maps were not available, and in default of the capture of better enemy maps, the two units were hard pressed. This demand increased considerably when the Army entered Tunisia, and, through lack of better material, large scale maps had to be produced by enlargement of the existing French maps amended from material provided from aerial photographs.

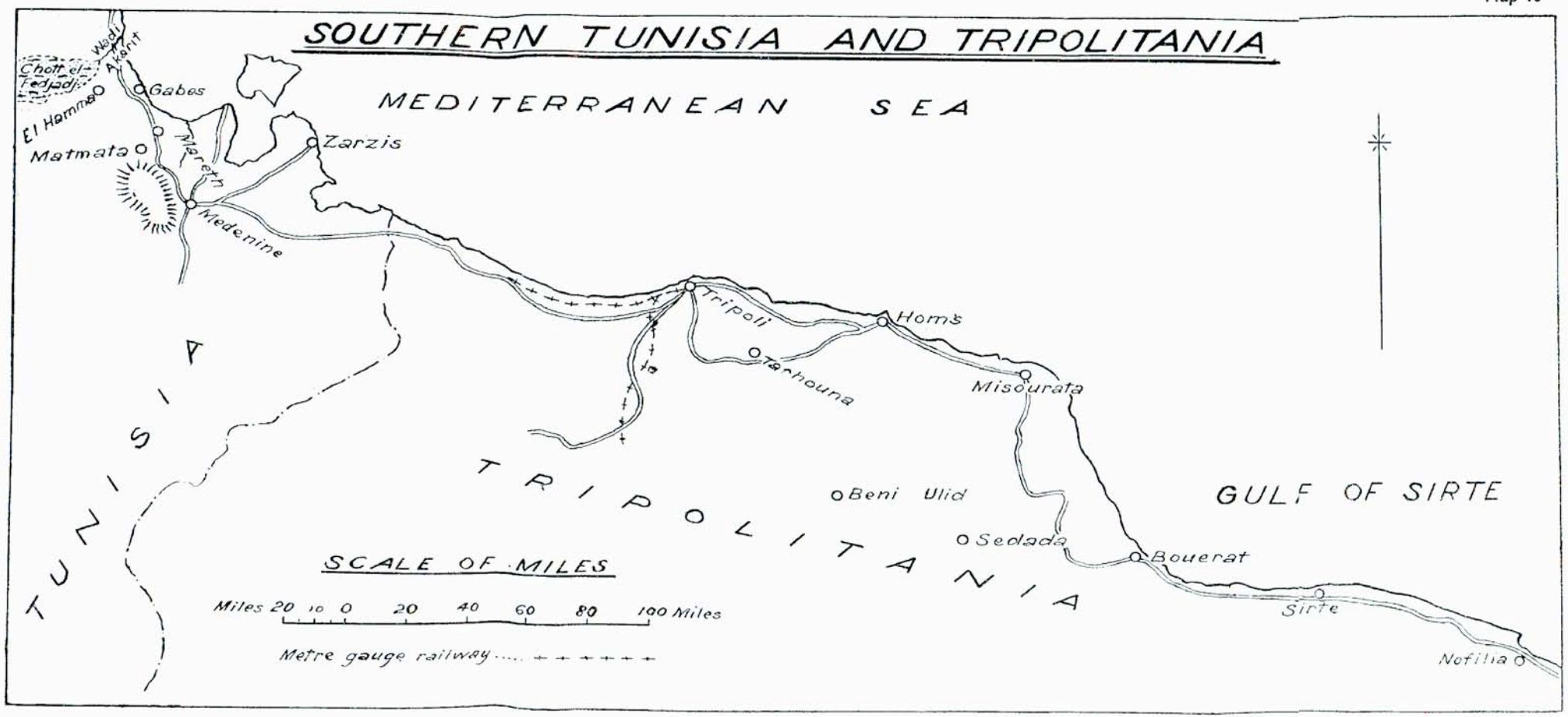
At this time the demands on the G.H.Q. production units, 13th, 514th, and a drawing section of 19th Field Survey Companies, rose to record heights. In May, the output was two million maps, which figure was doubled in June.

The End of the Campaigns in the Western Desert

And so, after many vicissitudes, the struggle carried on under such strange conditions by Eighth Army and its predecessor, Western Desert Force, was eventually crowned with complete victory. The fighting in the Desert had at times been intense and at all times exacting. In the early days the British troops, outnumbered and ill equipped, had not only held but defeated the superior Axis forces opposed to them, and it was largely the calls for troops and equipment for other theatres which prevented them holding the advantages gained. When eventually a force superior in numbers and equipment had been built up, backed as it was by an extensive and efficient base organization, which will be described in the next chapter, nothing could stop its victorious advance. The 1,400 miles from El Alamein to Tunis were covered in six months, in spite of the

determined resistance of a well equipped and energetically commanded enemy.

In all this fighting, in good days and evil, the Royal Engineers, with their sister Corps from the Dominions and dependencies, had taken their full share, and indeed made possible the movement of the large forces engaged, and their subsistence in this inhospitable land. There may not have been the imposing bridging, the armoured assault on beach defences, or even the extensive railway development seen in other theatres, but the unspectacular work of the individual sapper, sweeping or grubbing for mines, squeezing the last drop of water out of the arid desert, taking on at short notice unaccustomed jobs at ports, or even supervising the work of unskilled natives in the workshops of the base, all paid their share in the earning of a hard-won victory.


SOUTHERN TUNISIA AND TRIPOLITANIA
MEDITERRANEAN SEA
Chott el Fedjadj
Wadi Akarit
Gabes
El Hamma
Matmata
Mareth
Zarzis
Medenine
TUNISIA
TRIPOLITANIA
Tripoli
Homs
Tarhouna
Misourata
Beni Ulid
Sedada
Bouerat
Sirte
Notilia
GULF OF SIRTE
SCALE OF MILES
Miles 20 10 0 20 40 60 80 100 Miles
Metre gauge railway

CHAPTER XVI

THE MIDDLE EAST BASE

Situation at outbreak of war—The Needham Committee—Tel-el-Kebir depots—Tura caves—Roads—Airfields—Ports and docks—Railways—Inland water transport—Engineer stores—Local production—Transportation stores—Water supply—Engineer effort in the Middle East Theatre.

(See Maps 17 and 18 facing pages 423 and 442 in this chapter)

WHILE the tide of battle had flowed backwards and forwards across the desert with ever increasing forces engaged, and the British armies had fought in East Africa, Eritrea, Greece, Syria, and the islands of the Mediterranean, a great maintenance organization had been built up in the Middle East to supply all their needs. The engineer part in the development of this great organization taken as a whole represented one of the major tasks with which the Corps was faced, and solved with wonderful success, in the whole war.

SITUATION AT OUTBREAK OF WAR

When war broke out in September, 1939, the total number of troops in the whole area was barely 10,000, and their maintenance organizations were on a commensurate scale. Further, as in accordance with the Treaty with Egypt the troops were in the near future to move from the Delta to an area on the Suez Canal, major development of permanent installations in Egypt proper were in abeyance and work had not started on new establishments in the Canal Zone. There was, therefore, a very small nucleus on which to maintain the much larger forces which, even under the circumstances then obtaining, were likely to arrive in the area. For example the provision for engineer stores and workshops amounted to little over 100,000 square feet of covered space. The R.E. personnel available to carry out any expansion was also meagre, amounting to not more than fifty R.E. officers, including those with the Treaty Building Committee, and the Engineering School of the Egyptian Army.

Even existing stores were not fully stocked and R.E. units were not up to establishment. There were Chief Engineers in Egypt (Brigadier E. F. Tickell) and Palestine (Brigadier G. Streeten) with Cs.R.E. (Works) at Abbassia and Moascar besides the Cs.R.E. of the two weak divisions in Palestine who also looked after works in their areas of responsibilities. Transportation was represented at the time by a small Movements Control Section on the staff of British Troops in Egypt (B.T.E.). Immediately on the outbreak of war a few officers to form a transportation staff were obtained locally and one of these was appointed A.D.Tn.

No large scale plans for war were in existence, but on the engineer side an engineer base stores depot and a workshop had been earmarked in the War Office mobilization scheme for dispatch to Egypt when formed. These actually arrived early in 1940 and were located at Abbassia. Pending their arrival some of the personnel of the Treaty Building Committee were used to form a headquarters stores organization.

The Needham Committee

The first major step in development was the setting up of the Needham Committee, so called after its Chairman, Major-General Needham, to plan for the establishing of a base in the Middle East for a force of fifteen divisions with corps and G.H.Q. troops, the total strength being estimated at 296,694. Brigadier Tickell, lately C.E. B.T.E. and now Director of Works Middle East Command, was next senior member of this committee whose report, issued on 24th October, 1939, formed the basis on which the development of the Middle East base was executed; though, as will be seen, the premises on which the work was done varied considerably as time went on. In the report was a key plan for the installations necessary to maintain the given force with 150 days' reserves, and a list of stores and units necessary to carry out the project was appended. The list of R.E. stores considered necessary included:—

15 miles of Decauville track.
614,076 sq. ft. of standard shedding 36 ft. 6 in. span.
150 miles of water piping.
18 electrical generating sets, each 150 kVA.

This list would appear to be ludicrously small under such circumstances, but, realizing the heavy calls then being made on the Home Country, the Director of Works omitted all items which he thought

might be obtained locally or from other sources such as India. Two army troops companies, two electrical and mechanical companies, and twenty-one additional works officers were asked for. The works necessary included:—

85 miles of road.
140 miles of railway.
2 bridges.
Cold storage for 18,200 tons.

On the assumption that all these could be made available, it was estimated that the work, if started on 1st December, 1939, could be completed in thirteen months, i.e., by the end of 1940.

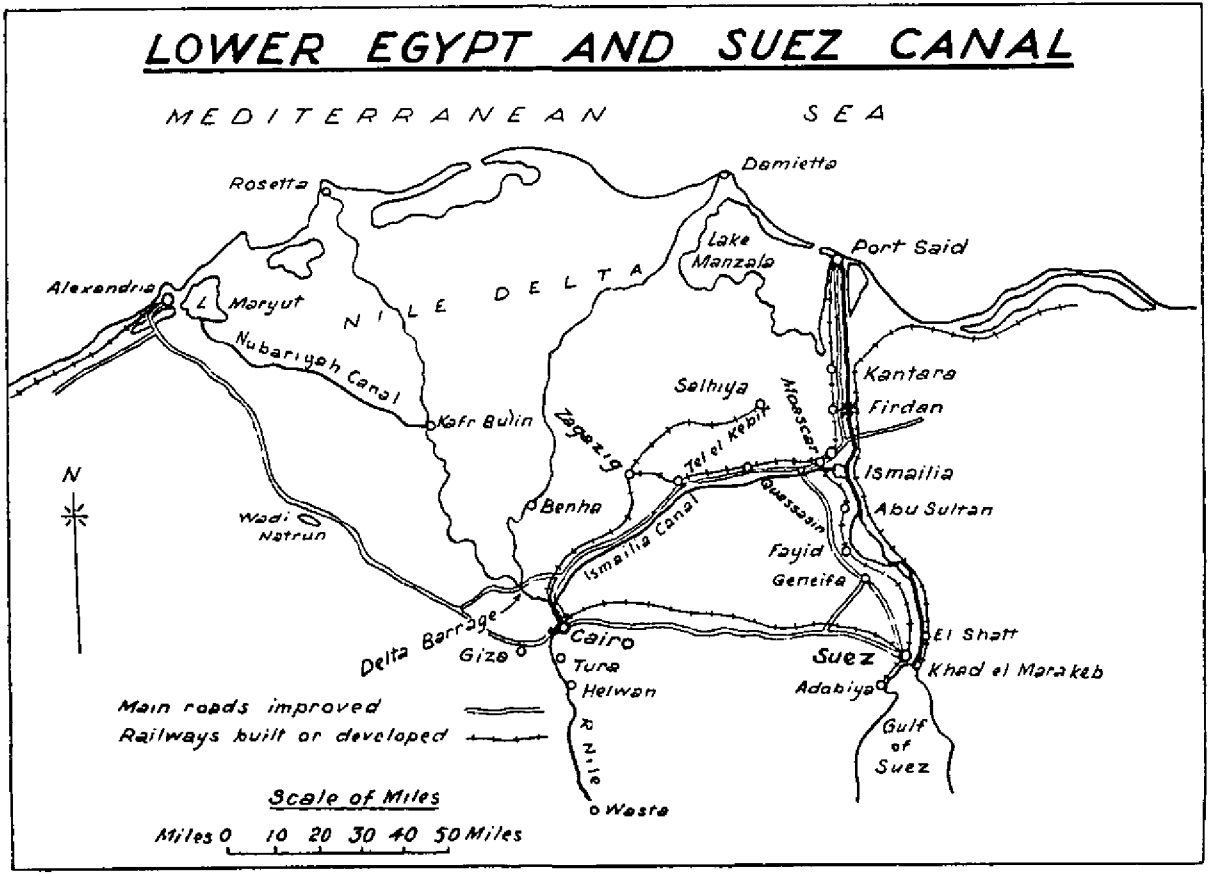
The Committee recommended the establishment of two bases, one in the Alexandria area, and one near the Suez Canal. The former was not proceeded with owing to the entry of Italy into the war in June, 1940, and its place was taken by bases in Palestine and the Sudan.

The implementation of the report of the Committee, and the presentation of consequent requirements to the War Office were largely in the hands of an ex-officer of the Corps, Major-General N. W. Napier-Clavering, who was at the time D.A. and Q.M.G. at G.H.Q., Middle East.

The War Office directive consequent on the receipt of the report of the Committee was not received till January, 1940, and was on a more modest scale than that envisaged in the terms of reference of the Committee. It allowed for only nine divisions of a total strength of 225,000 and reserves for only ninety days in place of the original 150. The total cost of the works services on the new basis was estimated at £921,000 with the immediate construction cost of £291,000. Sanction for expenditure of the latter amount was not received till April, 1940, when work was at once started.

The Middle East Base "officially" came into being on 3rd May, 1940, and a week later the War Office ordered that reserves should be increased to the original figure of 150 days. To meet this, Middle East Command requested authority to proceed with the full construction programme in accordance with the Needham Report. In reply the War Office authorized the execution of certain services, but withheld general authority to carry out the full plan for the time being. The plan was not fully authorized till the end of August, 1940. By this time much of the work had been completed and the money spent in anticipation of authority.

Map 17


LOWER EGYPT AND SUEZ CANAL
MEDITERRANEAN SEA
Rosetta
Damietta
Lake Manzala
Port Said
Alexandria
L Maryut
NILE DELTA
Nubariyah Canal
Kafr Bulin
Zagazig
Selhiya
Mahsama
Kantara
Firdan
Tel el Kebir
Ismailia
Abu Sultan
Benha
Wadi Natrun
Ismailia Canal
Fayid
Geneifa
Delta Barrage
Cairo
Giza
Turra
Helwan
Suez
El Shatt
Khed el Marakeb
Adabiya
Gulf of Suez
N
Main roads improved
Railways built or developed
R. Nile
Wasta
Scale of Miles
Miles 0 10 20 30 40 50 Miles

Tel-el-Kebir Depots

Some details of a few of the major groups of depots and of the problems involved in their construction will be of interest. At Tel-el-Kebir there was eventually the largest group of depots in the Middle East. The site was an ideal one, and had been used in 1914–18. It was easily accessible to normal gauge railway, had a gravel soil, and being surrounded by cultivation was fairly free from dust. It was within horse transport range of the Sweet Water Canal. Labour was available in the near-by villages, though this proved a not unmixed blessing as it proved impossible to stop pilfering on a prodigeous scale. Work was started in April, 1940, on a comparatively modest scale and on a design intended for the maintenance of the nine division scale. This provided for the construction of a R.A.S.C. (M.T.) depot and a R.A.O.C. depot, together with hutted accommodation for personnel. To these was added almost immediately an Ordnance workshop of 174,000 square feet. Contracts for the work on the camps and storehouses were let to a firm of French contractors, a special Garrison Engineer being appointed to take charge of the work. The same firm was also granted the contract for a wharf on the Sweet Water Canal.

Planning for the expansion to fifteen divisions led to reconnaissances for additional camps for personnel near by, and this proved to be the first stage in the build up of the vast area of camps for 100,000 men at Tahag and Quassassin. Hutted construction for personnel had walls of plaster on matting and corrugated iron roofs. Slit trenches were provided in lieu of splinterproofs. Almost daily extra requirements were formulated, and, in November, 1940, the Director of Works had to point out that in order to achieve a more rapid completion the standard of accommodation would have to be drastically curtailed. In future amenity hutting would have to be the exception, most stores must be kept in the open, and the sanctioning of small services by local commanders prohibited.

In an expansion of 240,000 square feet to the Base Ordnance Depot a type of reinforced concrete construction, known as "Stonehenge", was used for the first time, though ultimately its employment was widely extended. The object was to give rapid construction with the minimum use of timber and skilled labour. For the framework of the building two standard and extremely simple reinforced concrete units were employed, a column and a slightly inclined beam. Column bases were grouted in monolithic with the concrete floors.

Beams were secured to columns by grouting in dowels, purlins were of wood, roofing of corrugated iron, and box gutters of timber. Though several marks and modifications were introduced as the result of experience the principles of design remained the same.

By May, 1941, about 90 per cent of the 2½ million square feet of covered accommodation at Tel-el-Kebir then authorized had been completed, together with an extensive water supply system, electric power installation, and an extensive road and rail programme. In June of that year the area was bombed, the total damage being estimated at £20, but shortly after the whole place was camouflage painted. By June, 1943, when the campaigns in North Africa came to a victorious conclusion, the whole work had been finished except for the completion of the electric power station. The total covered accommodation provided amounted to 3¼ million square feet of which nearly 1 million was in Stonehenge construction. Accommodation was provided for 4,500 personnel in huts and for nearly double that number in tents. There were 38 miles of roads, and 21 miles of single track railway. The water system supplied 450,000 gallons daily. In the course of the work

16 million burnt bricks,
12 million mud bricks,
37,000 tons of cement,
277,500 tons of gravel

were used, the total weight of these being 421,200 tons.

In a foreword to a report on the construction of the depot area at Tel-el-Kebir, the Engineer-in-Chief, Middle East Force, made the following points which will be of interest to officers of the Corps faced with a similar task:—

1. The War Office refused permission for stores to be aquired in advance of authorization of construction, the contention being that depots could be built more quickly than stores to fill them could be moved to the Middle East. This did not prove to be the case.
2. The rate of progress in construction was governed by the rate of delivery of stores, and never by the lack of ability to build.
3. During construction there was a constant demand for increases caused by the ever-increasing demands and complexity of mechanized warfare.
4. Large changes in layout were caused by the transfer of work-

shops to the newly formed Corps of R.E.M.E., and also by the fact that the Australian forces required separate installations.

Though the depots at Tel-el-Kebir formed the largest group, they were but a fraction of the whole. Other extensive areas of storage and workshops, with their services and complementary accommodation for troops, were developed at Tura (described below), along the Suez Canal from Firdan nearly to Suez, in the Sudan, in the Berkaa valley in Southern Syria, in the Haifa area, and in Southern Palestine, while the peace time accommodation at Cairo and Alexandria was increased. In all the total of about 23 million square feet authorized by the War Office was far exceeded.

Tura Caves

A highly interesting development resulted from the decision to exploit the accommodation provided by the Tura Caves. These consist of galleries cut out of the face of the 400 foot high escarpment which runs north and south about a mile east of the Nile valley, and about fifteen miles south of Cairo. They were in all probability the source of the stone used for the building of the Pyramids in about 3700 B.C. Plaques and cartouches were found which are believed to date from that time. In one cave a large block of stone weighing about twenty tons was uncovered, the dimensions of which approximated to those of the base stones used in the construction of the great Pyramid of Cheops.

It was plain that the original caves were cut out by a highly civilized people. The span between the dividing walls was never greater than twenty-five feet, the safe span for limestone of this composition. Unfortunately a later civilization with less knowledge had attacked the dividing walls, and increased the spans far beyond those safe for this type of stone. Consequently falls had occurred in subsequent centuries.

And so, after a lapse of 5,600 years, efficient engineers once more took the caves in hand. As found, the entrances were almost blocked with debris, and they had been explored only by holiday makers in search of adventure. Inside they consisted of large domed areas stretching about seventy to ninety feet from the entrances with galleries or "fingers" beyond extending far into the hillside, though use was made only of the first 800 to 1,000 feet. In the domed entrance chambers, where the safe span had been exceeded, the width extended to some seventy or ninety feet. Here the roofs were

dangerous and the clearance of the falls which had already occurred involved much heavy labour, and even blasting to break up the largest stones which had fallen. Work on the first cave, to be used as an ammunition store, started in February, 1940. This, called "Zero Cave", was found when cleared to consist of a domed entrance extending to about seventy feet from the entrance and about seventy feet wide, and six galleries, of width somewhat under twenty-five feet, running back from sixty to 250 feet in the heart of the rock. The solid rock cover varied from 150 feet to 200 feet, thus affording complete protection from the heaviest bombs, while the proximity of the Nile made transport simple. The walls were straight and plumb, and the ceilings of the galleries were smooth and horizontal. After clearance a slab of plain concrete was laid on the floor, Decauville track was laid down, the cave wired for lighting, and a generating set installed. In this way first-class storage accommodation of 11,700 square feet was provided in five months, and the R.A.O.C. took possession in June, 1940.

So successful was this venture that demands were immediately received from other services for similar accommodation, and work on a second cave started in September, 1940, to be followed in quick succession by the exploitation of others and the general development of the Tura area. Further accommodation for R.A.O.C. as well as for R.A.S.C., Signals and for a Survey map printing plant was provided, and other caves were developed by the R.A.F. and the Egyptian Air Force. The caves were specially suitable for the storage of delicate signal equipment in view of the complete dryness and even, cool temperature. Water supply and drainage were installed, and an extensive road system developed. Railway sidings, with a link from the Cairo–Helwan Railway, were laid down, and a lighter quay built on the Nile. The electrical generating plant was increased to a capacity of 750 kilowatts. In all the scheme cost approximately £1½ million and provided a total floor space of just under 2 million square feet.

Roads

Besides the very large programme of road and railway construction in the depots already mentioned, very large extensions to the communication system within the base area were carried out, apart from the major task of maintaining the existing routes in good condition under the greatly increased military traffic. The construction and maintenance of roads in Egypt was the responsibility of the

Roads and Bridges Department of the Egyptian Ministry of Communications, and, under the terms of the Anglo-Egyptian Treaty of 1936, the British War Department was interested in the proper maintenance of roads, and in particular those specifically mentioned in the Treaty, which were known as Treaty roads. The principal of these were:—

Port Said–Suez
Ismailia–Cairo
Geneifa link
Cairo–Suez
Cairo–Alexandria via the Desert
Alexandria–Mersa Matruh
Ismailia–El Auja (Sinai road)

When war broke out none of these Treaty roads, except that from Cairo to Alexandria, was actually completed, but broadly speaking, they were finished and maintained by the Egyptian Government in a reasonable condition throughout the war, with of course every assistance from the British Army who provided plant and transport, and a regular supply of bitumen.

In Palestine the Directorate of Public Works was the authority responsible for road work. As early as May, 1939, a comprehensive road programme for the next five years had been submitted by Headquarters, British Forces in Palestine and Trans-Jordan, to the Palestine Government, the proposed expenditure being just over £¼ million. This programme had been drawn up with the object of constructing good arterial communications, and of improving those in existence to give all weather access to certain districts. The Beisan–Jericho road had been given priority in the first year's work. On the outbreak of war the programme was restricted to roads of strategic importance and these were put in hand, that connecting up with the Egyptian road at Auja being completed from Beersheba shortly after the opening of hostilities. The construction of the great strategic road from Haifa to Baghdad has already been described (Chapter IX, pages 226, 227). The formation of this was well advanced by September, 1939, but the surfacing was only just being started. The road was not finally finished until 1943, but it was usable as traffic could move off the road over the desert where it had not been completed.

In the Sudan, the Public Works Directorate was similarly responsible for the construction and maintenance of roads.

From the outbreak of war there was, therefore, in the Base area a number of organizations charged with the construction and maintenance of roads, and it was exceptional for work on existing roads there to be carried out by engineer units, or even under direct R.E. supervision.

Airfields

Closely connected with work on roads was the construction of airfields, for many units, particularly road construction companies, were suitable for employment on either type of work. It will be remembered that a Deputy Chief Engineer, Airfields, was appointed to the staff of E.-in-C. Middle East in June, 1941. This officer was responsible for the organization of airfield construction and maintenance both in the base area and with the armies in the field. The division of responsibility for airfield construction and maintenance was that the R.A.F. were charged with the maintenance of existing airfields, and the construction of new ones, in the Delta east of the Cairo–Alexandria road, and also of peacetime fields in Palestine, Iraq and the Sudan. The Army were responsible for those outside these areas and in the early stages helped with the construction of new fields in R.A.F. areas till the latter service was in a position to undertake the extra work. The Army provided the R.A.F. with cement and bitumen for the airfields they were constructing.

Airfields built in the base area designed for the use of heavy bombers and heavy transport aircraft were of more solid construction and were more highly equipped than were those in the theatre of operations. The work generally was carried out by airfield construction units assisted by local civilian labour. The work in such country presented no special problems, except that, as in the forward areas, dust and sand were ever present enemies. In June, 1943, the Air Ministry Works Department, which had been steadily building up its organization, began progressively to take over the responsibility for the maintenance of airfields.

Ports and Docks

Depending, as did Middle East Force, on sea transport for the importation of troops and stores; the development of docks in accordance with the strategic situation, and their operation at the maximum efficiency was of supreme importance. At the beginning of the war, Egypt possessed three principal ports; Alexandria, which

dealt with the bulk of exports and imports; Port Said, which was designed mainly for transhipment traffic, and Suez, which dealt only with the comparatively small Red Sea traffic. Apart from one section of the wharves at Alexandria, mechanical handling equipment was non-existent, and the majority of berths were not rail served, as plenty of cheap labour was available. With the virtual closing of the Mediterranean after the fall of France and the declaration of war by Italy in June, 1940, ships could normally only reach Alexandria and Port Said via the Suez Canal. This waterway was itself under constant threat of obstruction by enemy bombing, and was indeed closed on occasions for several days while mines, dropped by enemy aircraft, were swept from the channel. It was, therefore, obvious that the port of Suez would have to be expanded rapidly and as much use as possible made of the small ports on the Red Sea littoral.

Although, heretofore, port construction and repair, and the installation of port facilities had been the responsibilities of the Transportation Directorate in the field, and were in all cases sponsored and co-ordinated by the Director of Transportation at the War Office, all such work in the Middle East was carried out by the Director of Works. D.Tn. Middle East was, however, responsible, in conjunction with the Movements Staff, for approving all port development layouts as well as any necessary railway construction. The officer representing D.W. at any port was, therefore, responsible for practically all engineer work, whether in the docks or in the town. This system of control was to obtain later in the campaigns in Sicily and Italy, but not in other theatres. Its introduction is, therefore, specially interesting, as, at the moment of writing, its acceptance in future organization seems to be likely.

Responsibility for the inception of proposals for port development, therefore, fell on D.W. who, in August, 1940, started work on an initial scheme under which the number of deep water berths at Suez was to be increased to eight, and a number of lighter wharves constructed at the port and in the neighbourhood, as well as along the Canal. The railway facilities at Port Said and Alexandria were also to be somewhat improved. Larger scale development south of the Canal became urgent in February, 1941, when the Canal had to be closed to traffic for twenty-one days for the clearance of mines. A party of consulting engineers was flown out from the United Kingdom to advise on improvements and the final scheme agreed on was designed to raise the capacity of the ports in the neighbourhood

of Suez from 3,000 tons a day to between 8,000 and 10,000 tons by the end of 1942, increasing to 12,000 tons during the first half of 1943.

The work planned originally by D.W. was continued, and, by the autumn of 1941, a large programme of lighterage wharves was well under way at Kantara, Firdan, Abu Sultan, Fanara, and Fayid, in the Canal Zone, as well as at Suez and its neighbourhood at El Shatt and Ataka, and for I.W.T. at Tura, Quassassin and other points. These lighterage and I.W.T. wharves eventually totalled about five miles in length and were provided with extensive stacking space. This form of port paid ample dividends in the special conditions obtaining in the area of calm weather, small tide range and ample unskilled labour. Work also started on the construction of deep water berths, four at Marakeb opposite Suez, four at Adabiya Bay south of Suez, and four at Safaga farther to the south. Few of these deep-water wharves were completed by the time of the victorious advance westward through the Western Desert in the winter of 1942–43 when the rate of arrival of imports reached its peak. With the opening of the Mediterranean, as a result of the clearance of the North African coast, the programme was reviewed and work on some of the deep-water quays was shut down, and attention was given to the improvement of the docks at Alexandria chiefly by the installation of extra cranes and improvement of the railway facilities.

The development at Safaga is illustrative of the work entailed at these subsidiary ports. Safaga was in peacetime a small phosphate port on the Red Sea about 250 miles south of Suez. It was served almost entirely by sea transport, only poor roads, little more than tracks, connecting it with Qena, about fifty miles distant as the crow flies, on the Nile and the Egyptian State Railway from Cairo to Aswan. A short stretch of metre gauge railway connected it to the near-by phosphate mine. It had a sheltered anchorage, and a small jetty alongside which a fair sized freighter could berth. Two lighterage wharves were constructed, 800 and 600 feet long respectively, and a deep-water quay 2,000 feet long, to berth four freighters with a maximum draught of 28 feet. As it was necessary to import railway locomotives before the deep-water quay could be used it was also found necessary to build a special loco pier. Accommodation for troops, depots and base installations were provided, the latter including an electric power station, water supply with storage for 3,000 tons, and two distillation plants. Also a cold store, a petrol tin factory and tin filling plant, R.E. and M.T. stores and workshops,

and a road and metre gauge railway were built to connect the port with the Nile and railway at Qena, at which place loading berths for feluccas and railway yards and depots had to be constructed. The work was carried out partly by contractors, and also by direct labour under British and South African Works and Transportation staffs, the Egyptian State Railways, and last, but by no means least, 19th New Zealand Army Troops Company R.N.Z.E. who formed the nucleus of the whole labour force.

Such a bald account can give little idea of the problems solved and the difficulties surmounted. The organization, feeding and housing of a mass of unskilled labour drawn from distant villages in a desert and unproductive region; the dilatoriness of Egyptian Governmental organizations; the washing away of roads, railway and pipelines in an unexpected rain storm; the sinking by enemy aircraft of the very powerful and only available dredger; the maintenance of the vital phosphate shipments combined with the import of constructional stores, to mention only a few of the many vicissitudes eventually conquered. In fact a typical example of the work of the Royal Engineers in many campaigns in undeveloped lands.

Though not to be measured in importance with most of the developments here recorded, the building of a lighterage port at Aqaba, at the head of the gulf of that name, is worthy of special mention in view of the unpromising conditions at the site, and the fact that the work was carried out by Sappers drawn from different parts of the Commonwealth assisted by local labour. No contractors were available. The intention was to use Aqaba as a subsidiary port to feed depots in Palestine, the stores to be transported thither by road to Ma'an on the Hedjaz Railway, or to such a point as could be reached by a spur taken from that railway. In fact this proved to be as far as Nagb Ashtar, fifty miles from Aqaba. The building of this road, which for twenty miles lay along the bed of a wadi, and therefore liable to frequent wash-outs, and later had to climb by hairpin bends up an escarpment, was a noteworthy job in itself. Although Hiram built ships here for Solomon to fetch gold from Ophir, there was little sign of the previous existence of a port when the construction parties started to arrive, except one small jetty only accessible to small boats and the wreck of a jetty built for Lawrence in 1917–18, and a small native village. The Gulf of Aqaba, unlike that of Suez, is very deep with steeply shelving shores, and is liable to sudden storms. In addition to the port, and road and railway works, the project involved accommodation for the constructional troops, dock

operating personnel, etc. both at Aqaba and at railhead at Nagb Ashtar. Aqaba is surrounded by at least 100 miles of desert in every direction, and the only natural resources were stone for aggregate, sand, and suitable brick earth for making sun dried bricks. Practically all stores had therefore to be imported, almost entirely by sea till the road-rail link with Ma'an had been completed. It was intended, as well as facilities for the discharge of lighters, to build two deep water berths, but these were not completed. A lighter basin, as well as two more temporary lighter wharves and the road-rail link to Palestine, was in use by 1943.

The engineer and "attendant" troops employed on the work were as cosmopolitan a crowd as it is likely to meet anywhere. Besides the British staff of C.R.E. Works (Lieut.-Colonel E. L. Botting[1]) and British Signals personnel, the following were included, 7th Artisan Works Company I.E., a section each of 19th Army Troops Company and 21st Mechanical Equipment Company R.N.Z.E., a detachment of a Mauritian Dock Operating Company R.E., a detachment of a Railway Construction Company R.A.E., the R.A.S.C. being represented at first by an M.T. Company of Palestinian Jews which were later relieved by Cypriots, the whole being guarded by Arab Legion Police, not to mention the local Arab labour which were employed on the work and many of whom were accommodated in camps.

It was clear at this time that the nine division plan would be entirely inadequate and Middle East Command on its own responsibility started planning in detail for the fifteen divisions as envisaged in the Needham Committee's report, and carrying out work at the maximum speed allowable with the resources available, the chief controlling factor being the rate at which stores could be moved from the depots and docks to the sites of the work. After many changes in policy, dictated by the altering world strategic situation, a maximum target figure of provision for twenty divisions, of which the majority were to be taken at a strength of 35,000, was decided on in January, 1942, and work continued to proceed at the maximum speed as before.

The changing local situation, and the recurring threat to the safety of the Nile Delta, also led to changes in the siting of the depots. More attention was directed to development of installations in Palestine and the Sudan, though the bulk of the work was still centred in Egypt, particularly in the Canal Zone. A "safety zone" inside

[1]Lieut.-Colonel E. L. Botting.

which all future development should take place was laid down, and was bounded on the north by an east-west line through Acre, and on the west by the eastern edge of the Nile delta.

RAILWAYS

As may be imagined the development of this great base area entailed programmes of railway extension both within the various depots and dock area, connecting up the various parts of the base, and the base area with the various operational theatres. Generally speaking the construction of track and sidings within the depots and dock areas and their connexion with existing broad gauge lines, was carried out in their respective territories by the Egyptian State Railway, the Palestine Railway, and the Sudan Railway, under the instructions of the D.Tn. Middle East (Brigadier C. A. Langley to 1941, and Brigadier J. A. Bell[1] from that date). These organizations also carried out the greater part of the work necessary to increase the capacity of main lines to take the increased traffic, and to serve newly developed or enlarged ports. The single line from Suez to Ismailia was doubled and large marshalling yards were built at both Suez and Nefeisha Junction. This doubling was extended to Firdan, where a single track swing bridge was built over the Suez Canal to join the Palestine Railway at Kantara East. With the construction of the new ports at Marakeb and El Shatt, opposite Suez, a railway to serve them was laid on the east side of the Canal from Kantara. Other branches were also extended from Suez to satellite ports at Ataka and Adabiya Bay. None of these works except the Firdan bridge presented any major engineering problems. This bridge consisted of a single swing span of 100 feet resting on steel screw pile piers, with short approach spans on either side.

To connect up with the Sudan and the overland "backdoor" route to the Middle East, to be described later (Volume IX, Chapter XVIII, page 531), the Sudan Railway extended its track northward from Wadi Halfa to Farras, so as to reduce the length of the gap with the Egyptian Railway at Shellal and so cut down the period of the year when water conditions interfered with river traffic. As mentioned above, as an alternative feeder to the Nile valley route, a metre gauge railway was built from Safaga, the small port on the Red Sea, to Qena, on the banks of the Nile in Upper Egypt, at

[1]Brigadier J. A. Bell.

which point traffic could be transferred either to the Egyptian Railway standard gauge system or to Nile craft.

While the operation of this largely increased network of railways was carried out almost entirely by the staffs of the local railway organizations, in times of stress railway operating troops had to give some assistance particularly as regards control of empty wagons. A considerable amount of rolling stock had to be imported and military railway workshop personnel carried out extensive work in the erection of this material. A good deal of work was also done in aiding the Egyptian State Railways to convert some of their locomotives to oilburning in view of the shortage of coal. A railway workshop company was established at Suez, where, besides the above work, much was done in reconditioning locomotives for Palestine and Persia.

Inland Water Transport

Reference has been made to the use of river craft on the Nile. Control and operation of this service, and also the provision, manning and maintenance of craft of all types for clearance of cargo from ship to shore in ports, was in the hands of the Inland Water Transport section of the Corps. The I.W.T. service started in a small way in 1940, primarily for the purpose of accelerating turn round of craft carrying military stores between ports and depots. Its activities increased rapidly until the small H.Q. staff at Cairo controlled the operation of practically all power craft, tugs and dumb barges on the Nile and in the Delta. In the ports many of the lighters were supplied by the same service. Civilian resources were used to a maximum and excellent results were achieved with only a small expenditure of military effort.

In addition to acquiring craft by hire or requisitioning, the I.W.T. organization constructed a number of craft, both for use on the Nile and canals and for harbour lighterage. These included concrete pontoons for Alexandria, and concrete lighters and self-propelled river craft for the more sheltered waters of the Canal ports. But probably the most interesting success in this respect was the construction of "Z" craft. These craft, the design of which was initiated in the office of D.W. Middle East for the carriage of personnel, vehicles and cargo, and capable when unladen of making sea voyages, were much used in the ports and, as we have seen, in operations along the north coast of Libya and Tripolitania as the various ports were cleared of the enemy. The craft were fabricated in India

and assembled in an I.W.T. yard on the island of Chevalier in Lake Timsah. The first keel was laid in August, 1941, and forty-four were constructed in the first batch which was completed in June, 1942. A second batch of forty-four was constructed during 1943. Thereafter, the clearance of North Africa making their use no longer necessary, the process was reversed and the craft were sent back to India for use in the Burma campaign. A special type, called "ZZ", was made for the Royal Navy for minesweeping. All metal parts of these below fifteen inches above water level had to be non-ferrous. Thirty of these were built.

Other shipbuilding works included:—

One hospital and forty-five cargo-carrying caiques used for medical aid and food distribution to Greek islands when liberated.

The assembly of 200 ramped landing craft shipped in segments from Canada and U.S.A.

The conversion of five 10,000-ton liberty ships for trooping.

One hundred barges for I.W.T. service, and four 100-ton pontoons.

Engineer Stores

To provide for this enormous output of engineer work, and for the engineer needs of the various dependent theatres, a large stores organization had to be built up. At the outbreak of war the existing engineer stores and workshop, which was situated at Abbasia and was rail served, consisted of only 35,000 square feet. This was immediately expanded to 122,500 square feet and made capable of handling 15,000 tons. In March, 1940, the construction of two new depots was started. One of these, situated on the banks of the Tewfik Canal at the Barrage so as to be served by water as well as by rail and road, was designed for a holding of 50,000 tons and provided with a Goliath crane capable of lifting 10 tons to a height of 20 ft. The other was at Suez with holding accommodation for 80,000 tons. This with a total area of 175 acres had 140,000 sq. ft. of covered storage and 94,000 sq. ft. for a sawmill as the principal item to be held was timber. Other small stores were established at Alexandria, Fanara, and Tel-el-Kebir. One of the reasons for this multiplicity and dispersion of engineer stores was that it enabled the D.W. to accept delivery of stores by the means most easy for the Movements staff to arrange at the moment. In this way the R.E. avoided many of the hold ups in delivery owing to congestion of transport routes and facilities which occurred from time to time.

With the acceptance of the fifteen division plan, some of the smaller depots were expanded and others built. That at Fanara on the shore of the Great Bitter Lake, was increased to a holding of 100,000 tons with an area 330 acres and 176,000 sq. ft. of covered storage and workshops. It was provided with a docking space of 150 ft. from which nine miles of standard and light gauge railway track served the depot direct from the quay. The depot at Alexandria (Wardian) grew to 20 acres and could hold 60,000 tons. Two new depots were built in Palestine; one at Beit Nabala, in Southern Palestine, for 100,000 tons held in 320 acres; the other, at Qiryat Motzkin near Haifa, designed for 100,000 tons often held as much as 150,000 tons.

As a final expansion to meet the needs of twenty divisions, a depot for 70,000 tons was established at Quassassin, thirty miles west of Ismailia, in 230 acres. For the whole, at an early stage, a transit depot was set up at Port Said to accept stores which were unloaded more quickly than they could be cleared by available transport.

To serve the needs of the Ninth Army during the Syrian campaign (see Chapter XI, pages 289–292) three depots were established at Chakka, Majdaloun, and Zaatar, the last with a sub-depot at Dora. A transit depot was located at Tripoli. The requirements of the forces in the Western Desert were supplemented from an expense store for 60,000 tons at Burg el Arab, the majority of the stores being railed direct from the various depots to railhead. No depots were built in the Sudan where stores for the Eritrean campaign and the forces in the Sudan were dealt with in dumps at Port Said, Khartoum and Massawa.

As a measure of the volume of work carried out by the engineer stores organization, it can be recorded that between December, 1941, and December, 1942, imports of engineer stores totalled 591,900 tons, of which 116,600 came from the United Kingdom, 162,000 from U.S.A., and the balance 213,300 tons from the Eastern Group (see Chapter VII, pages 179, 180). The stocks of stores at the end of this period amounted to nearly 500,000 tons. Nor did the end of the campaigns in North Africa lead to a diminution in activity, for, though many of the stores for the Sicilian and Italian campaigns were shipped direct to those theatres from the U.K. and U.S.A., the Middle East remained the main base for all theatres in the Mediterranean and Western Asiatic areas. In November, 1944, the weight of stores shipped was nearly 50 per cent greater than at the period of intense activity in September, 1943, though the import figures had

fallen by about 30 per cent. In October, 1944, the numbers of personnel employed in the base engineer installations amounted to 5,500 military engineer personnel (4,000 R.E.) and 75,000 civilians and prisoners of war.

Local Production

Owing to the closing of the Mediterranean on the entry of Italy into the war and the consequent delay and restriction of shipping owing to the long sea route by the Cape, it became necessary at an early stage to supplement the supply of imported stores by local production as far as possible. This soon became a major part of the activities of the engineers in the base area, under a special C.R.E. (Production), Lieut.-Colonel N. A. Blandford-Newson.[1] These locally produced stores were not confined to those which are a normal R.E. responsiblity, those for other services including anti-tank mines and water and petrol containers. Mention has already been made of the two marks of Egyptian Pattern anti-tank mines (Chapter XIII, page 367). Thirteen million of these were produced in R.E. controlled workshops in Egypt, the cases being produced by primitive presses similar to those used to produce petrol containers as described below.

The petrol containers made locally under R.A.S.C. auspices, to supplement the meagre supply of similar cans from the U.K., proved to be quite unsuited to the rough handling and transport conditions of the desert campaign, and their inadequacy was further demonstrated when the first of the corresponding German containers, or "Jerricans", was captured. Specimens of these were flown home to the War Office (F.W.5) who made the most careful and thorough investigation with manufacturers, and in due course the necessary details of production methods and supplies of plant and tools were sent to the Middle East. But such procedure involved inevitable delays which may be judged by the fact that, while the first "Jerrican" was flown home early in 1941, and the first plants for their manufacture were available in America in the autumn of 1942; it was not till August, 1943, that, the plant having arrived in Egypt and been erected, the first locally made Jerricans became available. But the R.E. in the Middle East in the meantime had not sat idle. Every press, however antiquated and primitive, was got going with locally made dies, with steel plate mostly imported

[1]Brigadier N. A. Blandford-Newson, O.B.E.

from India, and in factories set up in obscure civilian workshops. In many cases the presses were hand operated, four bars being inserted into the head each manned by two native workmen who ran round the machine and, when sufficient pace had been got up, swung laughing round on the handles till they were shot off, still laughing loudly, in all directions as the die ran home. The cans were then welded by almost equally unskilled native labour, with an ingenious but effective, but equally primitive method of inspection of the finished articles. In this way between four and five million efficient Jerricans had been produced before any production came from the imported plant.

Well established cement industries existed in Egypt and Palestine, and, as sand and aggregate were readily available, concrete work was the mainstay of all building programmes. The control of cement was taken over early in the war by the D.W.; oil fuel was substituted for coal in the manufacture, and a monthly output of 82,000 tons was achieved, almost the whole of which was used by the military. From this can be gauged some measure of the tremendous size of the building programme. The cement so used represents about 15,000 tons of concrete (about half hand-mixed) a day. This is a figure almost incredible to experienced engineers, and becomes more staggering when it is realized that this rate of output was maintained for over three years.

Most of the metal tradesmen and all the building foremen in Egypt were Italians, and their loss, when Italy declared war and they were interned, was keenly felt, and threw a considerable extra load on the R.E. supervisory personnel.

Timber was always scarce, and the monthly demand averaged 15,000 tons. There is no timber in Egypt. In the early stages of the war as much as possible was collected from Balkan countries but this supply ceased when the sea transport in the Eastern Mediterranean became threatened. Attempts to draw supplies from India were not very profitable. The Indian timber industry, based as it is to a large extent on the forests of the foothills of the Himalayas where transport is difficult, is chiefly directed to the production of timber of not greater than sleeper length. The output of that country was therefore more useful to the Transportation than the Works Service. Supplies from Kenya and Burma were interfered with by shipping difficulties, even before the war with Japan cut off the supplies from the latter country entirely. The forests of Cyprus were exploited till the Government of the Colony had to call a halt.

Early in 1942, it was decided to investigate the possibility of drawing supplies from the forests of Lebanon. The Lebanese Government were co-operative and lent a forestry representative. These forests were all of soft wood, fir and pine, the types most needed. In spite of the difficulties of the terrain and the unfriendliness of the local tribes, 150,000 tons were obtained in four years. Roads had to be built in virgin territory, and country previously inaccessible to any form of transport other than mules was opened up. Much valuable work was done in this development by 112th Workshops and Park Company R.E. To prepare this timber and to meet the large demands for joinery, large sawmills and woodworking shops were established at Suez, Fanara, and Beit Nabala in Palestine and also at Haifa.

Transportation Stores

The provision, handling, and issue of stores for the Transportation Directorate posed an equally great problem. There was at the outbreak of the war, and indeed till the end of 1940, no Transportation Stores organization in the Middle East, nor were the local railway organizations designed or stocked to meet the enormous expansion that the war demanded. Before this time a few orders had been placed, mainly in India, as a result of which a small quantity began to arrive early in 1941. With the formation of a proper Transportation Directorate late in 1940, an effort was made to forecast requirements and place orders. But at this time little was known of the nature or extent of the campaigns which were to follow, and the terms of reference of the Needham Committee gave little help except as regards the extent of the depots to be established, but nothing as to the operational requirements. Further the nature of the countries in which campaigns were eventually fought varied so greatly, and some conditions, particularly in Syria and Persia, were such that an estimate based on normal conditions was bound to be far short of the mark. In fact, the two-year plan forecast first prepared turned out to be totally inadequate, and commitments were met only because D.W. was able to help with the supply of steel and R.E. stores such as plant and shovels. This willing co-operation between various branches of the Corps was a noticeable factor in the history of the campaigns in this area, and indeed in all engineer relations throughout the war.

As the war progressed and plans became more settled, the position began to improve. But the unavoidable time-lag between the

submission of demands and the receipt of stores caused difficulties at times. During 1942 the bulk of permanent way material received in the theatre was being sent from the ship's side direct to the construction railheads in the Western Desert, or on the Haifa–Beirut–Tripoli railway, and stocks were being used as fast as they were being received. The civilian railways were experiencing similar difficulties in obtaining stores and it was agreed that they should receive assistance from army sources for work directly connected with the war effort. This led to the setting up of a special Stores Accounting Section.

The main Transportation Stores Depot and Workshop in the Middle East was at Suez. Construction started in November, 1940, and was completed by April, 1941. Sub-depots were formed at other Egyptian ports. With the extension of the Middle East Base to the Levant, the necessity arose for another depot to serve this area, and a second main stores depot was established at Essib in Palestine. Later, when construction started on the Haifa-Tripoli Railway, sub-depots were set up at Beirut and Tripoli. Depots for I.W.T. stores were established at Bulak and Alexandria.

At the beginning of 1941, the manufacture of certain items of dock gear was started at Alexandria. Early in 1942, it was agreed that all cargo handling gear in Middle East ports was to be pooled, and thereafter gear for the loading and unloading of cargoes, both civilian and military, was to be provided by the Army, irrespective of which organization carried out the work. This led to a large increase in the demands for gear, and arrangements were made for considerable quantities to be made by local native tradesmen in the Stores Depot at Alexandria. Use was made of locally reconditioned cordage and discarded steel wire rope obtained from salvage. The manufacture of this cargo handling gear proceeded so well that, by the end of the war, supplies were being sent, not only to Mediterranean and Persian Gulf ports, but also to India and the Far East.

Water Supply

All these developments involved extensive arrangements for the improvement of water supply. This was particularly the case in the Alexandria area, where, not only had a largely increased population due to the erection of military camps and depots in the neighbourhood thrown a heavy load on the already hard pressed town supply, but part of the needs of the troops and railway in the Western Desert had also to be met from the same source. The total output required

in consequence for all purposes in this area amounted to approximately 100,000 tons a day. In peace time Alexandria depended chiefly for its water supply on a number of canals fed from the Delta Barrage on the Nile, from which the water was pumped by several pumping stations. As these canals usually flowed between banks and were raised above the level of the surrounding country they were vulnerable to bombing. It was, therefore, considered necessary to provide a month's storage of three million gallons. Two schemes were put in hand, the first being the flooding of an area at Kalaa recently reclaimed from the salt water Lake Maryut, the second the filling with fresh water of the seaplane base which was being constructed near the Nouzha Airfield. As the latter was only in the early stages of construction and could not be put in use for many months, the Kalaa scheme was of urgent importance. As it involved the flooding of cultivated land, the Egyptian Government were loath to give permission for its construction. However they agreed that all the work should be carried out, but actual flooding should not take place till the military situation demanded.

The Kalaa scheme was formulated in June, 1941, and was completed in June, 1942, at which time the Axis forces were facing El Alamein seventy miles away. After anxious debate a decision was postponed, and the victory in November relieved the situation and flooding never took place. Meanwhile preparations for filling the seaplane base, when ready, with fresh water, were pressed ahead. The work in each case was carried out by the Egyptian Government to plans prepared by Royal Engineers. Besides these major, largely insurance, schemes for water supply, the needs of the large numbers of troops and establishments in the base area required the provision of a considerable number of important systems. In the Canal Zone particularly, many filter and pumping plants, each with an output of one million or a half million gallons per day, and which drew water from the Sweet Water Canal, were erected. These were of local pattern and very efficient with automatic chlorination.

In June, 1943, just before the Sicily landings, about half a million men, besides those on ships including the two huge "Queen" liners, had to be provided for at a rate of forty gallons a day, the equivalent of supply to a large city.

Engineer Effort in the Middle East Theatre

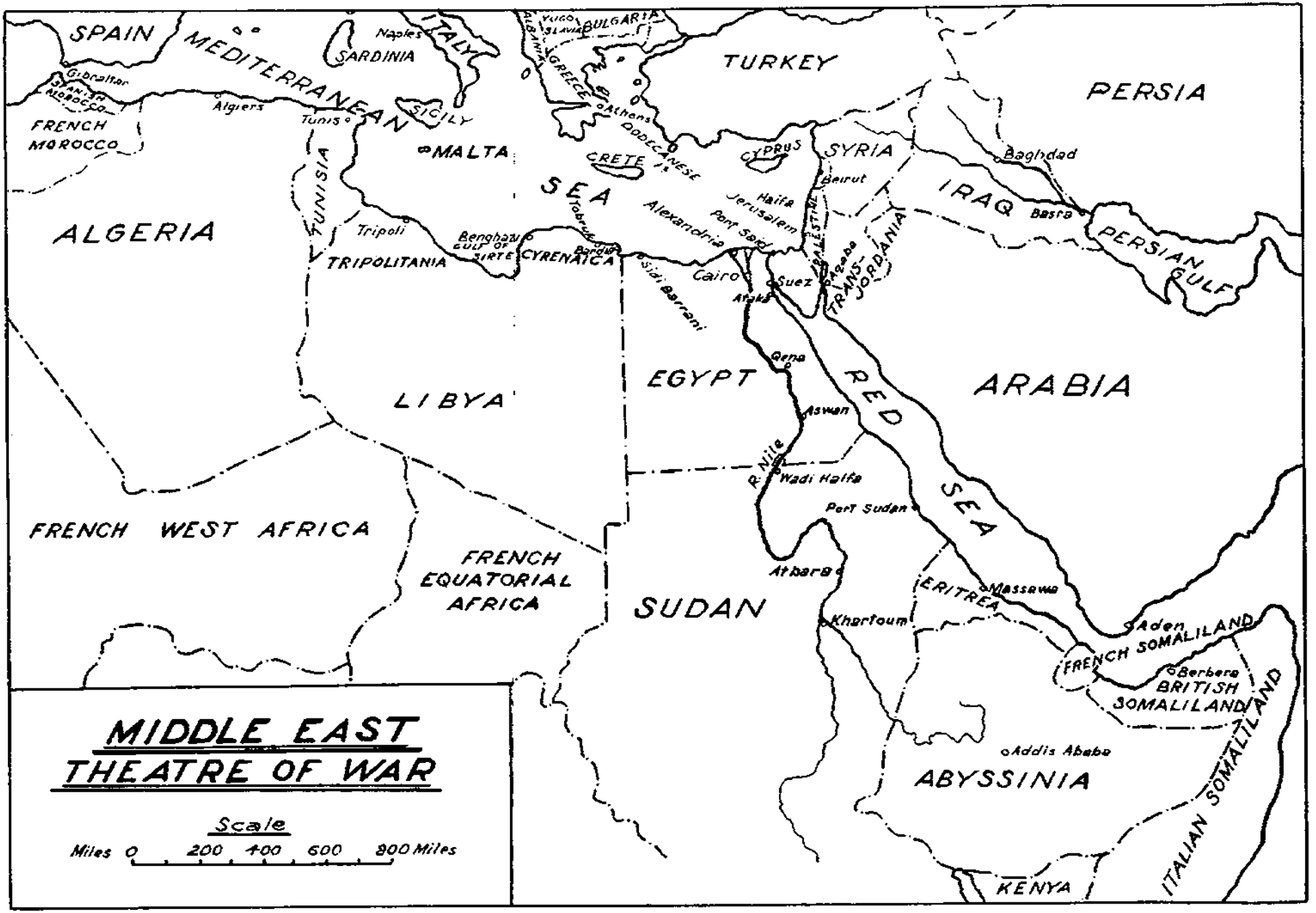
In the last eight chapters we have tried to give some account of the doings of the Royal Engineers and their brethren from other

countries of the Commonwealth in the various campaigns and areas of activity in the Middle East. The narrative is far from complete and unavoidably omits much work of distinction and interest. But enough has been said to indicate the very large part these Corps took in the successful operations, so widely scattered round the shores of the Mediterranean Sea. In the active operations, though mine-warfare might seem to dominate R.E. activity in the Desert, enough has been told to show the great variety of work so well carried out by field units, at times including tasks usually associated with units of the L. of C. or Transportation. The tasks of the latter two departments of the Corps have been shown to have been on a scale and of a variety seldom encountered in the past history of the R.E.

At times, particularly in early days when numbers, plant and stores were scarce, the work was noticeably difficult, and it speaks much for the ingenuity and initiative of all ranks that such results were achieved, and the operations of the various armies were unimpeded for lack of engineer support. As has been said much of the essential work was unspectacular, but for all that it did not fail to win the admiration and gratitude of other arms and services.

In the theatre of war where changes in officers holding senior appointments were rather more than usually commonplace, it is noticeable that few changes occurred in the holders of senior engineer posts. This and the efficiency of the R.E. officers in control led to team work of the highest order. From his appointment as Engineer-in-Chief, when the office was instituted in 1940, Major-General H. B. W. Hughes remained in chief control till the end of operations in North Africa. Major-General E. F. Tickell, who was already on the spot at the outbreak of war as C.E. Egypt, remained at his post as Director of Works for the same period. In charge of Transportation, only one change occurred during the same period, Brigadier C. A. Langley as Director General of Transportation being replaced in 1941, on transfer elsewhere, by Brigadier J. A. Bell as Director of Transportation. Similarly as Director of Survey at G.H.Q., Colonel, later Brigadier R. Ll. Brown,[1] saw the work of his service through from his appointment in 1940, to the victorious entry of our forces into Tunis. Finally mention must again be made of Brigadier F. H. Kisch, who, from D.C.E. Egypt in the earliest days of the war, succeeded Brigadier H. P. W. Hutson as Chief Engineer of Eighth Army in the Desert on the change of the designation of that formation from that of the Western Desert Force, when Brigadier

[1]Brigadier R. Ll. Brown, C.B.E.


SPAIN
MEDITERRANEAN
Naples
SARDINIA
ITALY
Gibraltar
SPANISH MOROCCO
Algiers
Tunis
SICILY
FRENCH MOROCCO
MALTA
TUNISIA
ALGERIA
Tripoli
TRIPOLITANIA
Benghazi
GULF OF SIRTE
CYRENAICA
Tobruk
Bardia
Sidi Barrani
LIBYA
YUGO SLAVIA
BULGARIA
ALBANIA
GREECE
Athens
DODECANESE
CRETE
TURKEY
CYPRUS
SYRIA
Beirut
Haifa
Jerusalem
Port Said
Alexandria
SEA
Cairo
Suez
Aqaba
PALESTINE
TRANS-JORDANIA
IRAQ
Baghdad
Basra
PERSIA
PERSIAN GULF
EGYPT
Qena
Aswan
R. Nile
Wadi Halfa
RED SEA
ARABIA
Port Sudan
Atbara
Khartoum
SUDAN
FRENCH WEST AFRICA
FRENCH EQUATORIAL AFRICA
ERITREA
Massawa
Aden
FRENCH SOMALILAND
Berbera
BRITISH SOMALILAND
Addis Ababa
ABYSSINIA
ITALIAN SOMALILAND
KENYA
MIDDLE EAST
THEATRE OF WAR
Scale
Miles 0 200 400 600 800 Miles

Hutson went to Greece, and remained in the post until his unfortunate death near the end of operations at the Wadi Akarit.

Though the war moved away from the Middle East, much remained to be done. Egypt still remained as a principal base for operations in Italy and Greece, and for the many problems of rehabilitation and control in the surrounding countries. Major-General Tickell, and Major-General B. E. C. Dixon in turn as E.-in-C. Middle East after the departure of Major-General Hughes, had almost as many problems to solve in "peace" as had their predecessor during the period of intense operations.

CHAPTER XVII

NORTH-WEST AFRICA

Planning—The landings—Airborne operations—The advance towards Tunis—The advance checked—Situation in January, 1943—Axis attacks—Operations preliminary to final offensive—Opening of final offensive—The capture of Tunis and Axis forces surrender—Work at Base and on L. of C.—Survey.

(See Map 19 facing page 472 in this chapter)

THE desirability of sending a force to occupy North-West Africa had been recognized from an early date. Such action, combined with the retention of Gibraltar, would keep open the entrance to the Mediterranean Sea from the west and so make it possible to maintain our fleet in those waters. It would also act as a threat to the rear of enemy forces in Tripolitania and Cyrenaica who were engaged with our forces based on Egypt. As, however, any such expedition might be actively opposed by the Vichy French forces in Morocco and Tunisia it was not for some time possible to contemplate such a new commitment. The entry of the U.S.A. into the war in December, 1941, however, completely altered the situation and plans for an Anglo-American expedition were immediately discussed. Not only did the belligerency of the U.S.A. mean that the necessary forces would be available, but also, since that country had maintained friendly relations with the Vichy French Government, it was hoped that a landing by American forces would not be opposed by French troops in the area.

PLANNING

The launching of an expedition was approved by the two Governments in July, 1942, and planning was taken in hand immediately. A compromise as to the relative parts to be taken by the forces of the two nations was arrived at. While it was felt that British troops with their more recent operational experience should take a leading part in the early stages of the campaign, it was thought that troops of the United States would be more likely to find local support.

Accordingly, an American officer, Lieut.-General Eisenhower, was appointed Commander-in-Chief, Africa Force Headquarters (A.F.H.Q.), with a British officer, Lieut.-General K. A. N. Anderson,[1] as Commander of the Eastern Task Force on which the burden of the initial fighting would fall. It was further planned that American troops should participate largely in the assault phase including the Eastern landing. The senior engineer officer, known as "The Engineer", at A.F.H.Q. was an American officer, Brigadier-General D. A. Davidson, with a British officer, Brigadier F. C. W. Fosbery,[2] as his Deputy.

The operation, known by the code word "Torch", was the first overseas landing on a large scale, in which opposition might be encountered, to be undertaken in the war. There was, therefore, little previous experience to go on, and much to be learnt from the experience gained.

Planning for the British share was started in London in August, 1942, under the direction of Headquarters First Army, in direct collaboration with the War Office. General Eisenhower's Allied Force Headquarters (A.F.H.Q.) was not to take over till a later stage. From the engineer point of view planning commenced in E.-in-C.'s office at the War Office, it being the first time that organization was available for the purpose, having been set up only in the previous year. More detailed planning was carried out in England by the staff of C.E. First Army, Brigadier N. A. Coxwell-Rogers.

One of the major unknowns, as has been indicated above, was the attitude of the French local forces, on which depended the degree of opposition to landing and the rate at which the subsequent advance might be expected to proceed. To engineer planning these factors were of vital importance. If serious opposition to landing were encountered stores and equipment for landing personnel, vehicles and stores, and for getting them rapidly across the beaches were an urgent necessity, while the mobility of engineer units in this first phase would not be so vital. On the other hand, if there was no opposition and existing harbours and quays could be used, the engineer resources to ensure mobility and rapid advance inland would be required early, and the mobility of field engineer units would take a more prominent place.

[1]General Sir Kenneth Anderson, K.C.B., etc.
[2]Brigadier F. C. W. Fosbery.

Shortage of shipping, and the uncertainty as to the rate of unloading stores, limited severely what could be carried in the early flights. The compromise solution decided upon was to include the engineer stores necessary for the immediate development of two forward ports, Philippeville and Bone, in the third convoy, the faster part of which was due to arrive on D+14 day, and to include only reconnaissance parties for initial development with the assault formations. The convoys were each organized in two parts, one fast and one slow, and the engineer units had three scales of transport, and hence of equipment—assault, light and normal. The various echelons necessary to build up units on these scales were carried in different parts of the convoys. Engineer units depend on their transport not only for moving personnel, but also to carry vital equipment. On an assault scale units could carry equipment only sufficient to enable them to undertake a very limited variety of functions. For example, on the scales used in this operation, divisional engineers with a normal War Establishment of 174 vehicles, had on assault scale only seventy-five vehicles, and on light scale 120.

In the initial plans it had been proposed to land at Bone and Philippeville as well as farther west at Algiers and Casa Blanca. But later it was decided to land only in the area of the last named ports, as it was feared that landing on such a wide front would lead to excessive dispersion of the small force that could be landed quickly. Also it was considered to be too great a risk to venture without air cover into ports which German bombers based in Tunisia could reach. All assaulting British troops were directed to the neighbourhood of Algiers, the Americans taking on all those farther west. Even in the Algiers area, in accordance with the hope of placating the French troops, a considerable proportion of the landing troops were American.

The planning as far as Survey was concerned was much complicated by the difference in control of Survey in the two Allied armies. In the American service Survey formed a part of the Intelligence section of the department of the Chief Engineer. On the staff which arrived with General Eisenhower in August, 1942, with his planning staff, Survey was represented by one officer assisted by a single technical sergeant. In anticipation of a campaign in North Africa, the Geographical Section at the War Office, had, in the ordinary course of procedure, arranged for supplies of maps of the area to be prepared, and Survey planning was conducted by the American

Officer, partly with G.S., G.S., and partly with D.D. Survey, First British Army, Colonel R. P. Wheeler.[1] To help matters, a British officer, Colonel E. B. Elkington,[2] was appointed for survey duties at A.F.H.Q., and he was given a small staff to assist him. With this organization for co-ordination, planning for the British part of the operation was carried out at Headquarters of First Army in London under Colonel Wheeler with a small staff for assembly of bulk stocks of maps at Swindon. For security reasons both these staffs were kept as small as possible. By an agreement between the two War Departments, spheres of cartographic responsibility had been laid down and as North Africa lay within the British sphere all matters concerning map design, grids, etc., were a British responsibility and the War Office made themselves responsible for the supply of maps to British and American forces sailing from the United Kingdom, and for furnishing everything necessary for the reproduction of maps in the U.S.A. for forces proceeding direct from that country.

The Landings

After a direct voyage from England, three assault landings were made in the neighbourhood of Algiers on 8th November, 1942, one entirely American, one American with British administrative and supporting troops (including 564th Field Company of V Corps Troops R.E., and a detachment from 5th Mechanical Equipment Section), and one British. This last was carried out by 11th Infantry Brigade Group of 78th Division, C.R.E. Lieut.-Colonel E. M. Blake,[3] which included 237th Field Company and was supported by 751st Field Company of V Corps Troops R.E., and another detachment of 5th Mechanical Equipment Section. The Corps Troops Field Companies and the Mechanical Equipment detachments in each case formed part of the "Beach Bricks" which were to work on and organize the beaches where it was found that the ports could not be used for the landings.

A proportion of 14th Airfield Construction Group also landed with the assault with the task of developing Maison Blanche and Blida airfields. Actually at this point no opposition was encountered on the beaches and, while a unit of the French Foreign Legion was found ready to counter-attack at Blida airfield, the matter was amicably

[1]Brigadier R. P. Wheeler.
[2]Colonel E. B. Elkington.
[3]Lieut.-Colonel E. M. Blake, killed in action, 1944.

settled by an officer of D.C.E Airfields staff over a glass of wine with the French Commander.

Airborne Operations

As it was of the utmost importance to seize forward airfields to enable our fighter aircraft to intercept German bombers from Tunisia interfering with the landing and to cover an early advance, it was decided to carry out airborne operations for the purpose, 1st Parachute Brigade with 1st Parachute Squadron R.E. (Major S. L. Dorman) being detailed. One of the features of the plan was that the parachute jumps would have to be made from Dakota (American) aircraft and not from those on which 1st Airborne Division had been trained. A new jumping technique was needed. Four men (not sappers) were killed on the first practise jump. It is worth recording that this had no effect whatever on morale. The R.E. contributed to the acquisition of the new technique by building mock-up Dakotas from which the soldiers could practise their jumping drill.

The outline plan for the airborne troops was as follows: 3rd Parachute Battalion, with "C" Troop 1st Parachute Squadron (Captain A. Hewitt, R.E.[1]) under command, was to fly from England, via Gibraltar, to North Africa where they would jump. The remainder of the Brigade Group was to go by sea to Algiers where they would be used as opportunity offered.

The battalion group took off from England on the evening of 9th November, and after touching down at Gibraltar, landed at Maison Blanche airfield, which had been occupied by the assaulting troops, on 11th November. At 8.30 a.m. on 12th November, it took off again and jumped over its objective, the airfield at Bone. The dropping zone was hard, and the aircraft are thought to have flown too low for safety. Captain Hewitt afterwards said that he seemed "to step from the aircraft on to the runway". He was concussed for three days and one sapper sprained his ankle. Otherwise there were no casualties, and, in conjunction with a Marine Commando which at the same time landed from the sea, the airfield was seized and held for a week till relieved.

Meanwhile the rest of the Brigade Group had arrived by sea. On 16th November, 1st Battalion with "A" Troop 1st Parachute

[1]Captain A. Hewitt, missing, 1943.

Squadron (Captain P. G. Geary[1]) flew from the airfield at Maison Blanche and jumped at Souk el Arba. Their mission was to rally the French in the neighbourhood to the Allied cause. From Souk el Arba they moved on foot via Beja to Medjez el Bab where they made junction with French forces. The Battalion Commander and a liaison officer visited the French general, an old man of 70, who laughed at the handful of British in the vast continent of Africa opposing the "invincible" Germans. However, at this precise moment, some German armoured cars fell into an ambush laid by the battalion on the edge of the town, thereby convincing the French that the Germans were not invincible. From then till 6th December, the battalion group operated independently against the enemy. During this time the R.E. Troop lost 50 per cent of its personnel killed, including Captain Geary and two other officers, in an unfortunate occurrence. A raid was being made on an Italian camp. The work of the R.E. was to lay Hawkins mines on the Italian line of retreat. They carried the mines in sandbags on their backs. A loud explosion was heard from the direction in which they had gone and all the detachment were afterwards found dead. There were no survivors, but it is believed that someone fell back on to his bag full of mines while crossing a "wadi", and that the mines, which were armed in readiness, exploded. The action of the third troop with the remaining battalion belongs to subsequent operations, and will be related in due course.

With the same object of seizing forward airfields, 36th Infantry Brigade Group including 256th Field Company, and with 228th Field Company and a detachment of 22nd Mechanical Equipment Section in support, landed at Bougie on 9th November, to capture the airfield at Djidjelli. Unfortunately the landing of the battalion destined for the airfield was delayed by a heavy swell and it was not able to reach Djidjelli, and so allow our fighters to operate, till the 13th. In the meantime German aircraft sank several ships in Bougie harbour.

The Advance Towards Tunis

The landings having been accomplished with little opposition, it was now desired to press on eastwards as rapidly as possible, and to endeavour to capture Tunis before the enemy could bring in troops and organize its defence.

[1]Captain P. G. Geary, killed in action, 1942.

The distance from Algiers to Tunis is 560 miles, and the country in between is extremely mountainous, and crossed by only two roads, not designed for heavy traffic, and an inefficient railway. No stores were available locally, and the Army was entirely dependent on what it brought overseas with it in the way of transport, equipment, fuel, supplies, etc. These circumstances, combined with the limitations to the build up of the force caused by shortage of shipping, and the long "turn round" of the latter due to the length of the sea voyage, militated against a rapid advance of anything but a comparatively small force. In fact, though the Press and B.B.C. reported at the time that First Army was advancing "in massive strength", only two brigade groups of 78th Division, 11th and 36th, accompanied by 17th/21st Lancers Regimental Group of 6th Armoured Division, were available to move under Commander 78th Division. The Engineers of the force, commanded by C.R.E. 78th Division, consisted of 256th and 237th Field Companies and 281st Field Park Company of the Division, C.R.E. V Corps Troops (Lieut.-Colonel K. H. Osborne[1]) with 564th Field Company, a troop of 5th Field Squadron, two Bailey Platoons of 105th Corps Bridge Company R.A.S.C., and 751st Field Company, this last unit being intended for the initial development of the port of Bone.

As far east as Bone no serious engineer work was encountered, as the roads had not been damaged and were able to stand up to the comparatively light traffic of the force with its light scale of transport. In consequence the advance went at astonishing speed, and 281st Field Park Company, a type of unit not normally associated with extreme mobility, covered the 400 odd miles to Bone in twenty-nine hours. Indeed their speed on the mountain road was so great that two of the trailers carrying angledozers, after several attempts to overrun their prime movers, overturned. They were eventually righted and rejoined their unit.

Meanwhile, at and around the ports of embarkation, engineer units of both nations were employed in getting stores ashore and temporary depots established. The ports and railways were found in good order and the off-loading of ships proceeded rapidly. Indeed one of the first jobs of the port operating units was to fence in the harbour in order to control the flood of officers of all services and arms who crowded in, each clamouring for the immediate unloading of a particular cargo in which he was interested. It may be imagined that under such circumstances the lot of the Movements Control

[1]Lieut.-Colonel K. H. Osborne, D.S.O., O.B.E., M.C., T.D.

Staff was "not a happy one". Some account of their experiences has been given in Chapter VIII.

In spite of the fact that the carriers and motor transport of 36th Infantry Brigade had so far been unable to land, the forward troops pressed on towards Tunis. From Bone the advance continued on two axes, the coast road through La Calle and Djebel Abiod towards Mateur, and the inland road by Souk Ahras–Souk el Arba–Beja–Medjez el Bab towards Tunis. The first serious engineer task encountered was the maintenance of the inland route from Souk Ahras to Souk el Arba. Lieut.-Colonel Osborne of V Corps Troops with 564th Field Company was dropped to undertake this and, as a result of a reconnaissance by C.E. First Army, other engineer units were hurried forward to assist. This was but a fairweather foretaste of the enormous road maintenance problem which was to face the R.E. of the Army in the months to come. On 18th November, the leading battalion of 36th Brigade had reached Djebel Abiod where it repulsed an attack by enemy tanks and armoured cars; 11th Brigade Group, now in the lead owing to its superior provision in transport, was at the same time operating east of Djebel Abiod and encountered the first demolition on the Djebel near Mateur. This was dealt with by 256th Field Company using S.B.G. equipment, later replaced by a Bailey bridge which earned the doubtful distinction, four weeks later, of being the first Bailey bridge to be demolished by the Germans.

The enemy strength at this time was estimated at 500 to 1,000 fighting personnel in the area of Tunis and 4,000 at Bizerta, with some tanks in each case. In addition a number of German aircraft had been flown in, and the enemy had occupied Mateur and pushed out west and south-west.

On 17th November, the majority of the balance of the leading formations having come up, orders were issued for 78th Division (still less one brigade group), after completing its forward concentration in the area centred on Souk el Arba, to advance on Tunis and destroy the Axis forces. The Commander of the French troops, who had adhered to the Allied cause on 10th November, undertook to cover to the best of his ability the right flank of this advance.

In a preliminary operation, 36th Brigade got forward to Jefna, where it found the enemy in a strong position which it was unable to force. The French and British elements in the neighbourhood of Medjez el Bab were hard pressed and it was decided to postpone any general advance till the build up of forces and supplies

was sufficient to give it a reasonable chance of reaching Tunis. In consequence R.E. units of the Army had their first experience of laying defensive minefields.

In preparation for the advance the R.E. units in the forward area were also mostly concerned with improving the roads. Most of these were narrow, ten to fifteen feet wide, waterbound, and tortuous, through mountainous country. They had been neglected since 1940, and cut to pieces by movement in the advance and subsequent maintenance traffic in wet weather. The bridges were mostly suitable only for one-way traffic and for Class 12 loads.

On 25th November, 78th Division and the Armoured Regimental Group, reinforced by light tanks from the U.S.A. 1st Armoured Division, having completed their concentration, the advance was resumed; 11th Brigade took Medjez el Bab and crossed the River Medjerda. Here the bridge had been destroyed, and 237th Field Company put across a 100 ft. Bailey bridge, the first of its type to be built in contact with the enemy. Owing to limitation in transport only barely sufficient equipment was available to build the bridge with no spares. The convoy approaching the site was set on fire by air attack, but all the equipment was rescued and the bridge was completed in twelve hours. On the 28th, this force arrived at the outskirts of Djedeida, the nearest point to Tunis that was reached until the final stage of the campaign.

At the same time 17th/21st Lancers Group, with 1st Parachute Battalion and a battalion of U.S. Light tanks, moved into the plain south of Mateur, the R.E. units accompanying the force being hard put to it to keep the roads open for supplies as the rains had commenced.

The 2nd Parachute Battalion with "B" Troop 8th Parachute Squadron R.E. (Captain A. L. D. Vernon), now came into action. They had remained at Maison Blanche when the rest of the Brigade Group had flown away for their jumps. Their orders were to jump at Pont du Fahs, destroy the enemy aircraft on the airfield at that place, and then proceed to Depienne and Oudna, repeating the process at each place. They were then to march north-west to join 78th Division's attack. Just before taking off on the 29th November, news was received that the Germans had evacuated Pont du Fahs and Depienne. No previous reconnaissance was possible, so it was left to the Commanding Officer to choose a dropping zone from the leading aircraft.

The aircraft flew high over the mountains. It was very cold, and

many of the men were airsick. At 2.30 p.m. the drop over Pont du Fahs began. Men and equipment were scattered far and wide. It was evening before the force formed up and marched towards Oudna. Transport, consisting of mulecarts, mules, and decrepit motor-cars, was requisitioned in Depienne, and a night march, over very rough going in bitter cold, was made. By the afternoon of the 30th the Germans had been driven from the airfield at Oudna, and the battalion established in the town. That evening the Germans assembled considerable forces with tanks and attacked. At the same time news was received that the attack by 78th Division had been postponed. The Battalion Group was surrounded, and the prospect of making contact with other Allied troops was bleak. They were only fifteen miles from Tunis and forty miles from the nearest British troops at Medjez el Bab. For five days they withdrew through the mountains, being harried by Germans in armoured vehicles and aircraft. Throughout this time the R.E. acted as infantry. They were heavily laden with technical equipment and were hard put to it to fight and march in consequence. But nothing was abandoned until the Commanding Officer of the Battalion ordered some of the technical equipment to be jettisoned. On 4th December they joined the troops at Medjez el Bab.

The Advance Checked

It was now evident that the enemy intended to stand and fight along the entire front. The Axis forces on the spot had, during November, been reinforced by a number of German units including extra tanks and aircraft. They now totalled about 15,500 fighting troops and 130 tanks, and other reinforcements were arriving almost daily by air and sea, though many of the sea transports were sunk by Allied air and naval forces. It was, therefore, obvious that it would not be possible to take Tunis, or indeed to advance further, till more troops and equipment could be landed and got forward, and, in view of the exposed position of 78th Division, it was decided to withdraw to about Oued Zarga and all road and rail bridges east of that place were prepared for demolition. As the withdrawal was carried out the railway bridges were destroyed, but as it was not found necessary to retreat beyond Medjez el Bab the charges were withdrawn from the road bridges.

During the period spent on the forward line and during the withdrawal there was some hard fighting in which enemy air superiority

played an important part. Axis aircraft were able to operate from several airfields in the neighbourhood of Tunis, while those of the Allies were still operating from that at Bone. There were no existing airfields between the latter and those held by the enemy, and the terrain was most unsuitable for their construction, being either mountainous or on unstable soil. A possible site was found at Souk el Arba but it was on clayey loam, and the winter rains had commenced. Various methods of producing a runway were tried by 14th Airfield Construction Group, and eventually an only partially successful method was evolved by laying Sommerfeld track on bamboo rushes. This airfield was therefore very unreliable.

With the arrival of more troops, V Corps (Commander Lieut.-General C. Allfrey,[1] C.E. Brigadier M. R. Caldwell[2]) took over command in the forward area in the first week in December, but even the addition of V Corps Troops, R.E. to the R.E. of formations on the spot was not sufficient to cope with the heavy work on roads posed by the advent of the rains coupled with greatly increased traffic. The work, besides incessant repairs to roads and maintenance, involved the construction of a number of bridges and piped causeways. Owing to the slow arrival of engineer units in the theatre a number of units which would normally at this stage have been employed at the bases were brought up. Indeed the layout of R.E. units at this time, early in December a month after the first landing, is interesting.

The 78th Division was still short of one of its field companies (214th), the remainder of its divisional units being with it in the forward area. With the regimental group of 6th Armoured Division were only two troops of 5th Field Squadron and a detachment of 144th Field Park Squadron. C.R.E. V Corps Troops R.E. with two of his field companies (564th and 751st), was fully committed in the forward area of the Corps. Working on communications about Souk Ahras was C.R.E. 2 G.H.Q. Troops R.E. (Lieut.-Colonel E. H. T. Gayer[3]) with two of his own field companies (228th and 229th), 103rd Army Troops Company, and 5th Mechanical Equipment Section. At the advanced base at Bone was C.R.E. First Army Troops (Lieut.-Colonel L. E. A. Gwynne[4]) with his 587th Field Company, two advanced park sections of 109th Workshops and Park Company,

[1]Lieut.-General Sir Charles Allfrey, K.B.E., etc.
[2]Brigadier M. R. Caldwell, C.B.E., killed on service, 1944.
[3]Colonel E. H. T. Gayer, C.B.E.
[4]Colonel L. E. A. Gwynne, C.B.E., T.D.

and 39th Mechanical Equipment Section. Work in the Philippeville area was being done by 586th Field Company (First Army Troops), 110th Army Troops Company, two more advanced park sections of 109th Company, 13th Mechanical Equipment and 162nd Bomb Disposal Sections. None of the field units was on more than light scales of transport and some were still only on an assault scale. At Bougie were 212th Army Troops and 700th Artisan Works Companies with detachments of 594th Workshops and Park Company, and 22nd Mechanical Equipment and 159th Bomb Disposal Sections. On the L. of C. at Constantine was 264th Field Company of 2 G.H.Q. Troops, while at the main base at Algiers a number of units and parts of others were being employed as they arrived; 14th Airfield Construction Group was busy on airfields at Souk el Arba and Bone and was also assisting on the roads, while the first detachment of 3rd Airfield Construction Group had just arrived to work on the airfield at Philippeville.

It will thus be seen that the units of the Corps were scattered far and wide, presenting a difficult problem of control and co-ordination to C.E. First Army.

At this period, owing to the shortage of airfields in the forward area from which British fighter aircraft could operate, the ports and bases suffered severely at times from the attention of enemy bombers. During one of the raids on Souk Ahras an ammunition train was set on fire. A patrol of 229th Field Company under Lieutenant Burrows[1] reached the train when one ammunition wagon was already burning, and succeeded in pushing to safety five other trucks. One of these had begun to burn by the time it had been uncoupled and pushed away, but the party, which had by this time been joined by other members of the company and of 103rd Army Troops Company, eventually extinguished the fire and saved the contents of the truck by means of a chain of "tin hats" from a broken water main. The whole work was done in close proximity to the other burning wagons of exploding ammunition. At Bone, the Area C.R.E. (Lieut.-Colonel F. D. Ogden[2]) and C.R.E. First Army Troops spent several nights directing the rescue of personnel trapped in bombed buildings, and the O.C. No. 2 Docks Group was wounded in a raid on the harbour.

In V Corps area, as noted above, the chief work was on the maintenance and improvement of roads. This included a number

[1]Major J. M. H. Burrows, T.D.
[2]Lieut.-Colonel F. D. Ogden.

of crossings over rivers and wadis, the most important of which was a 160-ft. triple-double Bailey bridge at Souk el Khemis with 700 yards of approach road involving considerable cutting through high banks. The actual bridge was built by 564th Field Company, with 586th and 751st Field Companies working on the approaches, in just over four days. This bridge was on the main route forward, and after it had been opened C.E. V Corps watched with pride the stream of vehicles passing across. Suddenly, to the extreme and freely expressed disgust of the Chief Engineer, the flow ceased. After an interval the next vehicle appeared, moving slowly—a small Arab donkey cart. The donkey made good progress as far as the ramp, where he sat down and expressed his intention of going no farther, presumably having no confidence in a bridge placarded as it was with notices that it was fit to take loads of 30 tons. The combined efforts of Military Police and a large number of senior R.E. officers eventually persuaded him that all was well, and the traffic proceeded. The bridge was inevitably christened "Balaam".

As has been mentioned above, the railways had been found undamaged. It was, therefore, at once clear that the principal job of the railway operating units would be to assist the civilian authorities to work their lines to capacity. The British operating troops accompanying the Army comprised a Railway Operating Group Headquarters, with 154th and 182nd Railway Operating Companies, and 2nd and 5th Railway Mobile Workshops. Towards the end of November, detachments of these units, having familiarized themselves with local civilian practice, went forward to operate the narrow gauge routes Bone–La Calle and Ouled Rahmoun–Tebessa where trouble was being experienced chiefly through enemy air attacks on locomotives.

Efforts were further directed to increase the capacity of lines from Algiers to the east and, in spite of shortage of locomotives, it was possible to work five train paths a day for purely operational work.

The railway construction units, No. 1 Construction and Maintenance Group Headquarters, 150th, 160th, and 161st Railway Construction Companies, with bridging sections, 863rd Mechanical Equipment Company (Tn.), and a Railway Signal Company R.C.S., were chiefly concerned at this time with the development of rail served depots.

A fresh attempt by V Corps to drive through to Tunis was started on 23rd December, but was brought to an almost immediate stop by torrential and sustained rain which reduced the ground to a

quagmire. It was accordingly decided not to make further attempts to break through on V Corps front till the rainy season was over. Instead General Eisenhower decided to stage an attack in the south against Sfax with U.S. II Corps which was assembling in the Tebessa area, but this offensive in its turn had to be cancelled.

While 78th Division was making its thrust to attempt to capture Tunis, French forces were beginning to take the field on the side of the Allies in Southern Tunisia. They were joined by an American Parachute Regiment under Colonel Raff which dropped at Youk les Bains in mid November, the combined force being known as the Tunisian Task Force. Having no engineers, Colonel Raff asked for British assistance. This came in the form of two sections of 228th Field Company. This small party of Sappers found themselves confronted with many and varied tasks. Starting with an extensive reconnaissance for engineer materials they passed on to minelaying, airfield construction, and organizing classes of instruction for American personnel in minelaying and lifting and elementary demolitions. When contact was made with the enemy they were engaged on mine detection and lifting, and on patrolling deep into the enemy's lines and carrying out demolitions on key road and railway bridges in enemy territory. On return to their company the following commendation was received by O.C. 228th Field Company from Colonel Raff: "The section of Engineers of your unit under the command of Lieutenant Roworth[1] is hereby commended for the excellent and outstanding work done while attached to this force. At all times no task was too difficult, no enemy too dangerous, for them to push ahead of the infantry in performance of their duties. The unit is a credit not only to its immediate organization but to the whole British Army as well."

A development at this time was the inauguration of a First Army School with an Engineer Wing for the teaching of all arms the technique of laying and lifting mines and of elementary demolitions. In February, 1943, was added a Mine Warfare Wing of which Major M. H. Partridge[2] from 258th Field Park Company was appointed Chief Instructor. He was assisted by instructors lent by Eighth Army in view of their vast experience in the subject. By the end of April, 556 officers and other ranks had passed through of whom 146 were American, thirty-two French, and the remainder British. Though not opened till April, 1943, when 18th Army Group Battle

[1]Major T. I. Roworth, D.S.O., M.B.E.
[2]Major M. H. Partridge.

School was started, the Bridging School must be mentioned. This was intended chiefly for the instruction of personnel of Eighth Army in the use of Bailey bridge equipment with which they had had little opportunity to gain experience. In this case, the staff was drawn from R.E. of First Army who had had more practice in the use of the equipment.

Situation in January, 1943

The general situation in January, 1943, was V Corps on the left facing Tunis, the forward troops being mostly those of 78th Division, with 6th Armoured Division (C.R.E., Lieut.-Colonel B. C. Davey,[1] 5th and 8th Field Squadrons and 146th Field Park Squadron) on the right protecting the flank about Bou Arada. Holding the mountainous country in the centre around Pichon was an International force under the title of French XIX Corps. While on the extreme right stretching down to Gafsa was U.S. II Corps.

The immediate policy of V Corps at this time was:—

(*a*) To contain the enemy by constant pressure, to prepare for a future offensive, and to be prepared to advance if the enemy moved his troops southwards.
(*b*) To help the French on the right flank, they being short of equipment, and of engineer and administrative troops.
(*c*) To push on with the construction of airfields to enable the R.A.F. to support operations.

This policy, with the extension of the front and the wet weather, meant a great deal of work for the R.E. This fell into two broad categories:—

(*a*) Long term work in preparation for future offensive operations. Under this heading fell preparations along the L. of C. and in the forward areas to improve the communications and prepare for the movement of heavy Churchill tanks both on transporters (a class 70 load) and on their own tracks. The development of all weather airfields had also to be pressed ahead.
(*b*) Work arising from the immediate tactical situation. This included mine laying and lifting, tank destruction and other engineer tasks normal to a period of active operations, as well as frequent spells of employment as infantry.

[1]Brigadier B. C. Davey, C.B.E.

The handling of stores for all this work was complicated by the loss at sea of much of 585th Army Field Park Company, and it was impossible to run both an Army and V Corps dump till the losses had been made good.

The General Staff First Army selected six routes forward of the line Souk Ahras–Bone, all of which were to take Churchill tanks on their transporters. All were ready by 15th February. At this time there was practically no experience in the field in dealing with these heavy loads, or the classification of bridges to take them. Much study and experiment had, therefore, to be devoted to the problem. As a result many existing bridges had to be strengthened or replaced, or new bridges built. Where none of these courses was possible, a specification for diversions in the form of Irish bridges, with limiting gradients and curves, was worked out and circulated.

As a start, two class 70 Bailey bridges of spans of 110 and 50 ft. respectively were undertaken, and such was the shortage of engineer units that, for the purpose, two field companies had to be employed who had only just landed and were still without vehicles. That this was necessary two and a half months after the original landing demonstrates the shortage of engineer potential which may occur in the early stages of an overseas expedition. In other cases existing bridges were strengthened by the insertion of piers of tubular scaffolding and the addition of sleepers to the decking. But usually diversions were employed, one case involving the removal of 10,000 cubic yards of soil, and others required some 2,000 tons of stone and 200 tons of cement for the Irish bridges.

Particular trouble was caused by the replacement of a bridge over the River Tessa near Teboursouk. The span of 130 ft. was too great to take Class 70 loads according to the tables issued with the bridge, which it must be remembered was a new type of equipment at the time. Calculations made on the spot showed that a triple-triple bridge should take the load. This was referred to the Experimental Bridging Establishment in England by telegram, and a confirmation received in a few days. In view of possible difficulties about headroom, it was decided to add the third storey below the roadway, though this involved leaving out two panels of this storey at each end. Work was started on 4th January, 1943, by 8th Field Squadron assisted by four sections of Pioneers, on the long 600-yard macadamized approach. A double-double bridge was built clear of the gap and launched on 7th and 8th January. On 14th/15th January the bridge was converted to triple-triple the third, and underneath,

storey having to be dragged into position by tackles from the river bed and finally fixed by chord bolts. The bridge was opened for traffic on 17th January by Brigadier-General D. A. Davidson, the American Chief Engineer at Allied Force Headquarters, which by this time had arrived at Algiers and taken over supreme command from First Army.

Apart from the passage of gaps, much work was necessary on the roads themselves, easing gradients to a maximum of 1 in 12, widening and improving the road surface, and reducing excessive curves. Quarries were reopened and worked, one at Chetou, an old Roman city, producing coloured marble said to have been at one time reserved for the palaces of Roman Emperors. The Royal Engineers considered themselves worthy successors to this privilege.

Much assistance was given by the local Ponts et Chaussées and Travaux Publiques organizations, more especially in the collection of native labour. More Bailey and other bridges followed and, by the middle of February, the Churchill tanks, on arrival, were able to reach their concentration area about Le Kef with little difficulty. As the last transporter went through successfully C.R.E. First Army Troops, who was in charge of the work, heaved a sigh of relief and returned to his office to answer a telephone call from a troubled voice which demanded attention to a leaky tap.

The answer to the problem of all weather airfields in this country of mountains and valleys, which rapidly became sodden after rain, was the discovery of a number of outcrops of sand in the Medjerda valley between Souk el Arba and Souk el Khemis. During January, three such airfields were completed by 14th Airfield Construction Group, being quickly followed by one at Le Kef. These all consisted of Sommerfeld track runways, 30 yards wide, laid on sand. Runways varied in length from 1,000 to 1,500 yards, and were completed with perimeter, taxi tracks and dispersal points. They were found to be fully operable after several days of heavy rain. The sites were found owing to information from a farmer who mentioned that certain fields dried rapidly after rain. At the same time 3rd Airfield Construction Group completed a number of airfields near Bone, Philippeville, and Jemappes.

The British and American systems for the control of work on airfields differed. While in the field the British Army was responsible for construction and maintenance, these duties in the U.S. forces were entrusted to the Engineer Branch of the U.S. Air Force. In this campaign this divergence of responsibility caused little trouble.

All work in the Army area for the Tactical Air Force supporting operations was carried out under the general direction of C.E. First Army through his D.C.E. Airfields, Colonel A. G. Wyatt.[1] The airfields for bomber aircraft in the rear areas, which were mostly American, were provided and maintained by the U.S. Air Force.

For both road work and the construction of air strips the demand for the supply of mechanical equipment increased daily and, though fresh units (135th and 137th Mechanical Equipment Companies) disembarked and were hurried forward, supply never equalled demand.

Throughout these operations, the units of 1st Parachute Brigade took part in the fighting as infantry, and 2nd Parachute Squadron R.E. was engaged on all the normal employments of a field engineer unit. Being on a very low scale of transport it had to "scrounge" what vehicles it could get locally to enable it to move, and carry tools and materials.

Axis Attacks

With the Allied offensive halted, the enemy, during the first two and a half months of 1943, kept up a series of attacks most of which were held. The most serious of these was made against U.S. II Corps about Sidi Bou Zid on 14th February. Having taken Sbeitla on the 18th, he broke through the Kasserine Pass on the 20th, and sent his armoured forces northwards towards Thala, and westwards towards Tebessa, overrunning among other troops 19th U.S. Engineer Regiment which was acting in an infantry role. The 26th British Armoured Brigade was sent to the assistance of II U.S. Corps and 229th Field Company was ordered to join it. On arrival the company was ordered to lay mines in front of the position held by 2nd/5th Leicesters. The reconnaissance party went forward to make contact with the Leicesters, and, finding considerable traffic congestion in Thala, arranged for carriers from the battalion to meet the company. Meanwhile, enemy tanks had passed unrecognized through the forward posts and made a block across the road which was encountered by No. 3 Section. Half the section were captured, the rest escaped through the hills and eventually rejoined the unit of which the O.C., Major F. E. Ladly,[2] also had a narrow escape from an unexpected meeting with enemy tanks.

[1]Brigadier A. G. Wyatt, C.B.E.
[2]Lieut.-Colonel F. E. Ladly, M.B.E., E.R.D.

With the help of 26th Armoured Brigade the enemy's thrust was stopped and he began to withdraw, but his advance had uncovered the right flank of V Corps. The 1st Guards Brigade was manning the gap leading into the Corps area about Shiba and a composite R.E. Force, composed of 230th, 561st and 587th Field Companies under command of Lieut.-Colonel E. H. T. Gayer, C.R.E. 2 G.H.Q. Troops R.E., was sent up to assist, and arrived to find 6th Armoured Division (C.R.E. Lieut.-Colonel B. C. Davey) taking over responsibility for the defence. The two Cs.R.E. pooled their resources and started intensive minelaying; 8,000 mines were laid during the night of 17th/18th February, and a further 7,000 in the next two nights. A great deal of this work was done under fire from enemy tanks, Sergeant Cooper of 230th Field Company rescuing the wounded after a jeep carrying fused mines had been blown up. Here again the enemy's thrust was stopped.

During the earlier stages of this operation about Thala a troop of 8th Field Squadron earned special praise from the Commander 26th Armoured Brigade by putting in a night attack, providing protection for guns, occupying and holding an important hill feature, and destroying seven German tanks—all in the course of twenty-four hours and "in addition to their normal tasks".

The Germans in their withdrawal from what was, apparently, an unexpectedly successful reconnaissance in force rapidly exploited, demonstrated the rate at which a road could be mined and booby-trapped. On 24th February, one sub-section of 229th Field Company in six-and-a-half hours cleared 100 Tellermines and a number of booby-traps of various kinds from two and a half miles of road. As the advance proceeded, the work was taken over by two troops of 8th Field Squadron who picked up 350 mines in ten miles, 75 per cent of which were booby-trapped with pull mechanisms.

With the situation restored the Allies continued to build up their forces as fresh formations, British and American, arrived in the country including 46th Division (C.R.E. Lieut.-Colonel J. C. Walkey,[1] with 270th, 271st, and 272nd Field Companies and 273rd Field Park Company).

At this period the approach to within co-operational distance of the Eighth and First Armies led to the setting up of 18th Army Group Headquarters under General Alexander as described in Chapter XV. To his staff Brigadier B. K. Young was appointed Brigadier R.E. with the duty of co-ordinating engineer work and

[1]Brigadier J. C. Walkey, C.B.E.

resources throughout the Army Group. A certain amount of regrouping of forces took place so as to get the formations of each Ally together in preparation for the next operations.

But the enemy did not remain passive. For another month he kept up probing attacks all along the front, and R.E. units in the forward areas, as well as their normal duties of minelaying and assistance in defence works, frequently had to assume the role of infantry. For five days O.C. 564th Field Company commanded a mixed force composed of his own company, six sections of Pioneers, some forty Arab bridge guards under French officers and N.C.O.s, and a 25-pounder gun which was charged with the defence of El Aroussa. This place was used at night as a harbour for armoured forces operating in the neighbourhood, and for part of the time formed the defence of a divisional headquarters. 271st Field Company of 46th division destroyed ten disabled German tanks in three nights, and other companies of the Division accounted for others, including some of the latest "Tiger" tanks. The presence of the first of these new tanks had been reported by an officer's patrol of 1st Parachute Squadron a week before they were encountered in battle.

In counter-attacks by 3rd Parachute Battalion to regain an important feature across the River Nefsa between 21st and 24th March, 270th Field Company built a Kapok bridge under heavy fire, and also used folding boats to ferry stores, including sandbags, across the river. It also assisted the parachute troops to build breastworks and to consolidate their position; 1st Parachute Squadron took a hand in offensive fighting. While the Parachute Brigade was in the Bou Arada area, strong German attacks were made simultaneously on all battalion fronts. "A" Troop (Captain S. George[1]) was working with 1st Battalion when a detachment of Germans, ahead of the main attack, over-ran a hill occupied by a platoon of a neighbouring battalion. "A" Troop was ordered to retake the position. This it did, going up the hill in fine style, killing or capturing all the Germans and taking a machine gun into the bargain. It then held the position for several hours under heavy shell fire until relieved by the infantry. One officer and three sappers were killed and three wounded.

Meanwhile work in preparation for the ultimate Allied offensive was going forward. Certain divisional attacks to secure ground suitable for launching the general advance were to be undertaken, and for these, as for the general offensive, communications and

[1]Captain S. George, M.C.

forward tracks were improved, and engineer reconnaissances carried out.

Five fairweather airfields, to supplement the all-weather fields already constructed, were developed in the Souk el Khemis and Le Sers areas with strips 400 yards wide, graded and rolled, but with no Sommerfeld track or other artificial surfacing material. Such a programme, with that on roads, put a severe strain on the limited resources in mechanical equipment, and all engineer workshops were put on the task of producing improvised rollers.

Operations Preliminary to Final Offensive

The first of the preliminary operations took place on 28th March, when 46th Division with other troops attacked to re-take Sedjenane. This involved a cross-country advance and the consequent use of mule tracks for part of the force. Besides the preparation of these tracks, the R.E. extended M.T. roadhead forward as far as possible. In the attack it was clear that the enemy was taken by surprise, as there was not nearly the same use of minefields as had been encountered after the recent withdrawal of the enemy armour near Kasserine. The enemy, however, completely destroyed various bridges and piped causeways which our engineers had made in the original advance, and rebridging operations were much hampered by the attentions of enemy dive bombers. Consequently most of the work had to be done by night. In one case a large crater had been blown in a hillside road and, after various other methods of repair had been tried, the gap was filled by blowing the gap above the road into the crater and levelling off the track by hand. Twelve miles of neglected track between Sedjenane and Cap Serrat was made fit for intermittent light traffic, it being required by the R.A.F. for access to their airfield at the latter place.

On 7th April, 78th Division in its attack to clear the ground north of the Oued Zarga–Medjez el Bab road encountered very extensive minefields and booby-traps. In the first forty-eight hours the Divisional R.E. cleared 1,000 mines of all sorts some with complications, built two S.B.G. bridges and constructed a ford. Thereafter there was much work on roads to enable Churchill tanks to get forward. In one case a wadi was crossed by a bridge-cum-culvert which had as its basis 40-gallon oil drums, sandbags, cornbags and other material found in the hill villages. To reduce the length of mule carry the roads were pushed forward close behind the advanc-

ing troops and sappers and angle dozers were under continual close observation and frequent mortar fire from the enemy who were usually in occupation of hills overlooking the areas where R.E. units were working. It is considered by the Chief Engineer that their construction under such conditions was one of the finest engineer achievements in the whole campaign.

IX Corps (Commander Lieut.-General J. Crocker,[1] C.E. Brigadier A. D. Campbell[2]) had taken its place in the last week in March on the right of V Corps, and for the preparatory work each corps had, besides its own divisional and corps troops R.E., a G.H.Q. field company and a mechanical equipment detachment. V Corps had also detachments of 854th Quarrying Company.

The arrival of IX Corps Troops R.E. (C.R.E. Lieut.-Colonel J. V. C. Moberley[3]) was delayed as the personnel ship carrying 558th Field Company was sunk, and the Company came ashore short of weapons and personal equipment, while the vehicles of 242nd and 255th Field Companies were delayed in an M.T. ship which failed to join the convoy. It was only by means of cannibalization, bribery in the form of entertainment of senior staff officers and every other known artifice, that Lieut.-Colonel Moberley brought 558th Field Company and 258th Field Park Company up to the Corps area by the middle of March, while the other two companies (242nd and 255th) arrived for the subsequent battle. The units not normally belonging to the Corps were left behind to maintain communications when the advance started. First Army Troops R.E., and 2 G.H.Q. Troops R.E., with certain mechanical equipment and bomb disposal detachments, were available for work in the Army area.

Early in April, 1943, Brigadier B. K. Young succeeded Brigadier-General Davidson as C.E., A.F.H.Q., his place as Deputy C.E. being filled by an American, Colonel Elliot, jointly with Colonel Fosbery.

Opening of Final Offensive

It will be remembered (Chapter XV) that, at the end of January, Eighth Army had entered Tunisia and on 20th March broke through the Mareth Line. After that operation direct

[1]General Sir John Crocker, G.C.B., etc.
[2]Major-General A. D. Campbell, C.B., C.B.E., D.S.O., M.C.
[3]Colonel J. V. C. Moberley, D.S.O., O.B.E.

co-operation between the two Armies became possible and, during the battle at Mareth, II U.S. Corps had engaged the attention of the enemy armour by a thrust towards Gafsa. On that occasion no British Engineers were involved from First Army. Now on 6th April, Eighth Army was to attack the Axis position on the Wadi Akarit, and, to endeavour to cut off the enemy line of retreat, IX Corps was ordered to attack through Sbiba towards Kairouan.

For this attack 128th Infantry Brigade Group and 6th and 34th (U.S.) Armoured Divisions were allotted, the necessary engineers, beyond those of 6th Armoured Division, being supplied by 751st and 586th Field Companies from V Corps Troops and First Army Troops R.E. respectively. The move to the concentration area involved crossing the area held by XIX French Corps and, this formation being short of engineers, the R.E. units with IX Corps were responsible for the improvement and maintenance of the approach roads. That for 128th Brigade was little more than a sand track and with other necessary tracks amounted to some 150 miles. This work fell on 586th Field Company which had to be helped by Engineers of II U.S. Corps.

On 8th April, 128th Brigade captured Pichon, the operation involving two crossings of the Oued Marguellil and considerable mine clearance. A coincident attack by 84th (U.S.) Division on the right failed to make progress. On 10th April, 6th Armoured Division advanced towards Kairouan and patrols reached that town the same day though too late to cut the enemy's line of retreat. But 2,000 prisoners had been taken and the net round the Axis forces had closed considerably. In the final stages of the advance a 90-ft. Class 70 Bailey bridge and a 48-ft. S.B.G. bridge were built by 751st Field Company. Owing to the speed of movement, water became an important engineer commitment and fourteen water points were set up in six days.

For the offensive the main armoured thrust was to be put in by IX Corps between Bou Arada and Goubellat. It was necessary in preparation for this to render twenty miles of hill tracks fit for heavy traffic. It was estimated that it would take three field companies liberally supplied with mechanical equipment and transport ten days to complete this work. In spite of the fact that all the work was carried out in "no man's land", and that to ensure surprise as much of it as possible was delayed until the last moment, the task was completed in a week by 558th, 579th and 272nd Field Companies assisted by 6th Armoured Division R.E.

The attack of First Army was to be made in close co-operation with that of Eighth Army in the neighbourhood of Enfidaville. The action of Eighth Army has been described in Chapter XV, and will be mentioned here only in so far as it directly affected the operations of First Army. The two armies were now in such close contact that formations could be switched from one to the other. In consequence, as the main attack was to be launched by First Army, several formations were sent from Eighth Army to strengthen the blow. As will be seen a considerable regrouping of formations within First Army also took place. Though II U.S. Corps, which also was to take part in the operation, remained under the command of Eighteenth Army Group (General Alexander), its role in the attack was laid down by Commander First Army who issued orders to it direct. The division of the Army into three national sectors (British, French, and American) restricted the full freedom of reserves which would have been possible in a homogeneous army.

The general plan of First Army was that V Corps should attack from the Medjez el Bab area on the morning of 22nd April, and break into the enemy's main defensive position. IX Corps, attacking a few hours before V Corps and on its right, was to capture the high ground west of Sebkret and then push its armour through across the Goubellat plain, in the hope that by speed of movement it might get through the hills to the east, swing north towards Massicault and in that area engage and destroy the enemy's armoured reserves and act against the rear of the defenders opposite V Corps. II U.S. Corps on the north to advance eastwards covering the left flank of V Corps and then to advance on Bizerta by the Sedjenane–Jefna and Oued Sedjenane valleys. French XIX Corps to advance on the extreme right on Pont du Fahs as soon as the attack by IX Corps had softened up the resistance on the French front. Eighth Army was attacking two days earlier at Enfidaville in order to draw off reserves from the front of First Army.

In spite of spoiling attacks by Axis forces on the night of 21st/22nd April, in the course of which some R.E. units did some extensive tank "busting", the attack was launched punctually on the 22nd. The infantry attack on IX Corps front, carried out by 46th Division, was completely successful and its two armoured divisions (1st from Eighth Army, and 6th) were pushed through. However, on a line east and north of Sebret el Kourzia they ran into a strong line of anti-tank guns and their advance was checked. Their efforts to find a gap in the defences added another 100 miles of sand track to

IX Corps road maintenance commitments. There was also considerable shortage of water in the area and the Corps R.E. had to put up nineteen water points. As the mission of the armour had failed, the Army Commander withdrew 6th Armoured and 46th Division into Army reserve, with the intention of using them on the front of V Corps if the attack of the latter went well.

V Corps advanced with 1st (C.R.E. Lieut.-Colonel F. H. Foster[1]) and 78th Divisions leading.

In ten days' bitter fighting the Corps advanced to a depth of about six miles and captured most of the enemy's main position facing Medjez. In these operations, in which the control of the majority of R.E. units was centralized in the hands of the C.E. of the Corps, the engineers were employed on normal duties of clearing mines, booby-traps and demolition charges, and of making and maintaining roads. At the crossing of the Oued Hamar an officer of 7th Field Company withdrew the demolition charges on one of two bridges under heavy fire. A party from 225th Field Company then went to remove the road blocks on this bridge, but these had apparently been booby-trapped, for during work the bridge blew up killing all the party, though the bridge itself was still usable by light traffic. The demolition charges were then removed from the other bridge, and thereafter the road blocks were successfully removed from it though thirty-seven booby-traps were found connected to them. The work on this bridge took eight hours.

Behind the Corps, R.E. units of the Army were busy developing and maintaining forward routes, while 14th Airfield Construction Group got parties forward and by 30th April had an airfield in operation near Medjez el Bab.

Though German opposition had been determined and progress slow on V Corps front, space had been gained to the east of the River Medjerda to deploy armoured troops, so, with the object of switching the bulk of the armour to this sector, two more bridges were built across the river.

II U.S. Corps on the left and XIX French Corps on the right meanwhile had made satisfactory progress at first till they in turn were held up by strong enemy positions.

The Capture of Tunis, and Axis Forces Surrender

On 30th April, General Alexander, in view of the difficult country opposite Eighth Army, decided to reinforce First Army for the final

[1]Lieut.-Colonel F. H. Foster, D.S.O., O.B.E., T.D.

attack by 7th Armoured, and 4th Indian Divisions, and 201st Guards Brigade. The regrouping was completed by 5th May, preparatory to the opening of the offensive at dawn next morning.

The main attack was to be launched by IX Corps on its previous front, 4th British (C.R.E. Lieut.-Colonel P. F. Foley) and 4th Indian (C.R.E. Lieut.-Colonel J. A. Cameron[1]) Divisions to break the crust, after which 6th and 7th Armoured Divisions were to move through with the object of seizing the high ground immediately west of Tunis and thus breaching the inner defences of the town. V Corps was to protect the left flank of IX Corps, while II U.S. Corps continued its attacks with the object of taking Bizerta. XIX French Corps to capture an important mountain massif on its own front; 1st Armoured Division was held in Army reserve.

The chief job of the Engineers in preparation for the attack was the preparation of routes forward, especially for the armour of IX Corps. Speed was essential and control was delegated to the Chief Engineers of V and IX Corps between whom the closest co-operation was necessary. Within Corps engineer resources were centralized under the C.E.s, while C.R.E. 2 G.H.Q. Troops R.E. took over responsibility for the work on roads in rear of the Corps areas. All was completed in time including the clearance of gaps through enemy minefields as far forward as possible. On 4th May, the Germans put in one of their usual spoiling attacks with armour, this time on 1st Division front, and were repulsed, 23rd Field Company destroying nine enemy tanks.

The attack went entirely according to plan. Launched on 6th May, on the 7th, British and American forces entered Tunis and Bizerta respectively, and proceeded to mop up the German forces between these two towns and in the Cap Bon peninsula. On 12th May, General von Arnim, Commander-in-Chief of the Army Group Afrika, surrendered with his staff. The victory was complete. A quarter of a million prisoners were taken, of whom half were Germans, with immense booty.

As few minefields were encountered in the final battles, there was not much call on the immediate services of R.E. units, though five Bailey bridges were erected under fairly peaceful conditions. Immediately after the capture of Tunis, however, much had to be done in the clearance of mines and booby-traps, in erecting water points, and in putting up cages for the masses of prisoners, many of

[1]Lieut.-Colonel J. A. Cameron.

whom were driving round the country in their own transport seeking somewhere to be locked up.

A pleasant little story is told of appreciation by other arms of the work of the R.E. at this time. Just before the final surrender of the enemy forces the C.O. of the Queen's Bays paraded a party of Sappers of 1st Field Squadron which had been under his command, the two units having been closely associated during the whole final campaign of Eighth Army. He inspected them, thanked each in turn for the work he had done since El Alamein, after which each sapper received a bottle of beer. There is no need to stress that beer was in shorter supply than any other liquid in North Africa.

Work at Base and on L. of C.

Since the early days of the landing, when much of the work had to be done by engineer units of formations owing to the slow arrival of base and L. of C. units due to shipping difficulties, little has been said about the work in the base areas. Shortage of manpower and stores severely limited the rate and extent of progress, and it is really remarkable how much was carried out in time to be of value in the short six months campaign.

To take ultimate charge of works a Director of Works (Brigadier A. C. Baillie[1]) with a staff arrived with the G.H.Q. increment originally attached to First Army staff. Until A.F.H.Q. took over control, in January, 1943, control was in the hands of Chief Engineer First Army. From that date, at which his whole staff had arrived, D.W. assumed his proper functions. A great handicap to orderly development was the late schedule of arrival of the Engineer Base Stores Depot. Though Field Park Companies, and later 109th Workshops and Park Company, did what they could, the stores on arrival were dumped in disorderly heaps at the sides of the roads leading from the docks, and took a lot of sorting out when personnel became available to do so.

Personnel camps were of three types, staging, transit, and permanent, and accommodation was provided in each of these classes for a total of 40,000, 54,000, and 59,000 respectively. Living accommodation was in all cases tented, and for other buildings Nissen huts, with the corrugated iron shielded from the sun by African grass mats, were standard. Hospital accommodation for 180,000, besides convalescent camps for 8,000 patients, was provided.

[1]Brigadier A. C. Baillie, O.B.E., M.C.

Nearly 2 million square feet of hutting was built for workshops and depots besides that obtained by requisitioning and adapting existing buildings. An unforeseen demand arose at the moment of victory. Accommodation had been provided in prisoner of war camps for 110,000, but ¼ million were captured and emergency measures had to be adopted. For rapid fencing Sommerfeld track was found to be a successful improvisation.

The Transportation staff had been built up during the planning stage in London under D.Tn., Brigadier R. F. O'D. Gage,[1] but only a small party arrived till the advent of A.F.H.Q. when much of the early work carried out in conjunction with French civil railway officials had been launched. On arrival D.Tn. became subordinate to the American Director General of Military Railway Service (D.G.M.R.) and served as his Deputy as well as D.Tn. to British forces. British railway branches were integrated with the corresponding American branches—each branch being put under an American head—and the various routes were allocated to British and American units for operation. This arrangement was inconvenient to the British because it meant that railway policy on the British lines would no longer be a British responsibility. Owing to the differences in the organization and administrative methods of the two armies there were many difficulties to be overcome. But by goodwill on both sides the system worked with reasonable efficiency. The chief work of the railway construction units was in the development of rail facilities at the ports and in the base depots, and, owing to the rapid seizure by our forces of the country well up to the Tunisian border and a lack of damage from air bombing, little repair work was necessary. At the ports, the dock facilities and lighterage being found in working order and manned under French control, the work of the docks operating and construction units calls for no comment.

Survey

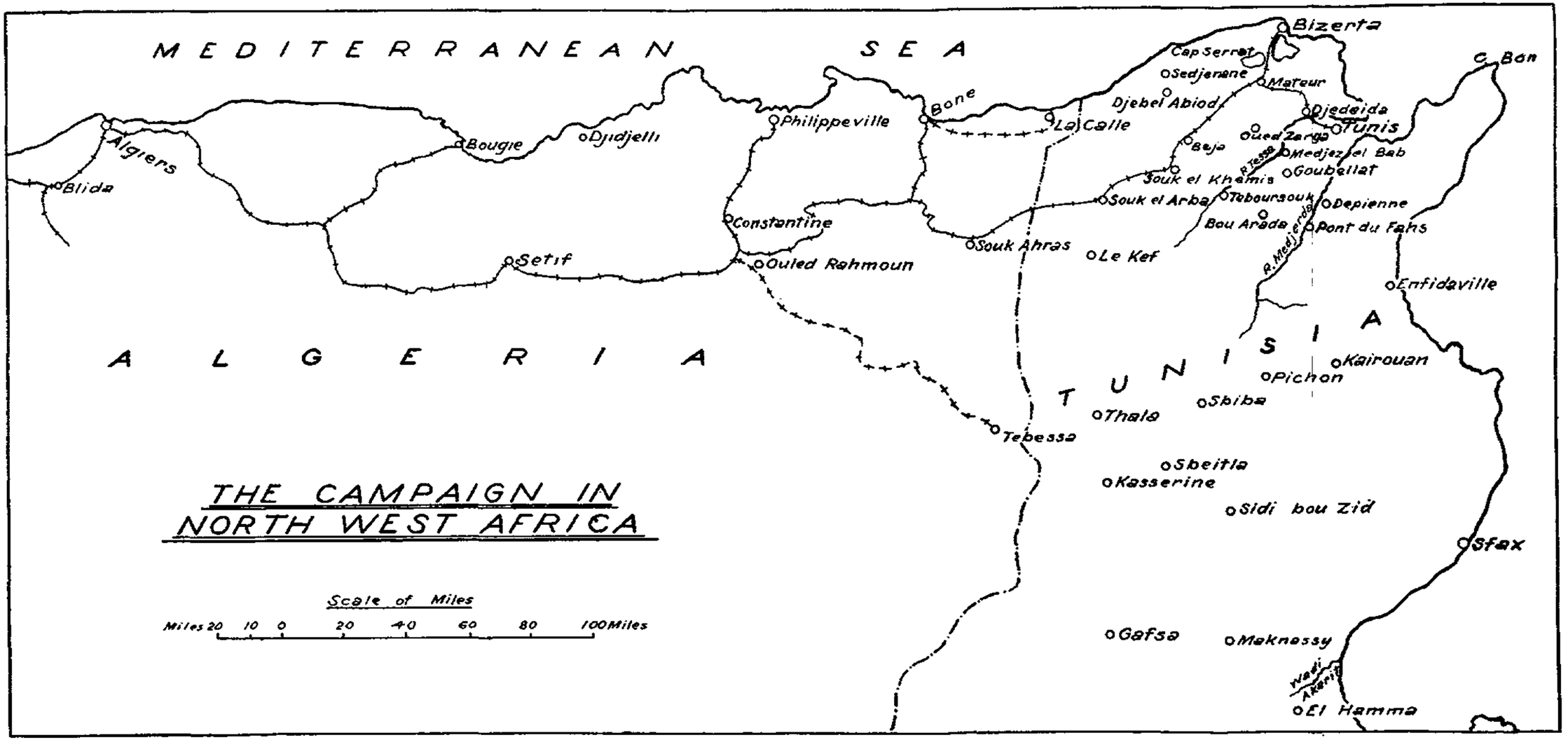
A small party of R.E. Survey officers landed with the assault with the special task of making contact with the French Service Géographique at Algiers, and of endeavouring to prevent the destruction of basic material. This party was followed in the second convoy by Colonel Wheeler, D.D. Survey First Army, and half the Directorate, one section of 518th Field Survey Company and 12th Field

[1]Brigadier R. F. O'D. Gage, C.B.E., M.C.

Survey Depot; 516th Field Survey Company was at the last moment held back till a later convoy and did not arrive till February. Colonel Elkington, as British Director of Survey A.F.H.Q., did not sail till 9th December and, his ship being torpedoed, he was lucky to arrive at Oran on 21st December. Thus 518th Company was the sole unit for field survey with the First Army and its sections were necessarily widely dispersed; 12th Field Survey Depot set up its main depot at Algiers and as the advance continued established a forward depot at Bone.

In February, 1943, when 18th Army Group was formed, Colonel Wheeler was appointed D.D. Survey to the new Headquarters, being replaced in First Army by Colonel S. G. Hudson.[1] 516th Company arrived about the same time and moved to the forward area, and 12th Field Survey Depot moved forward to Constantine with an advanced map depot at Souk Ahras, being relieved in Algiers by the newly arrived 7th Field Survey Depot. Nos. 11 and 12 Map Reproduction Sections also arrived in March.

[1]Colonel S. G. Hudson, C.B.E.


MEDITERRANEAN SEA
ALGERIA
TUNISIA
Bizerta
Cap Serrat
Sedjenane
Mateur
C. Bon
Djebel Abiod
Djedeida
Tunis
La Calle
Bone
Philippeville
Bougie
Djidjelli
Algiers
Blida
Beja
Oued Zarga
Medjez el Bab
R. Tessa
Souk el Khemis
Goubellat
Tebboursouk
Souk el Arba
Depienne
Bou Arada
Pont du Fahs
R. Medjerda
Souk Ahras
Le Kef
Constantine
Setif
Ouled Rahmoun
Enfidaville
Kairouan
Pichon
Sbiba
Thala
Tebessa
Sbeitla
Kasserine
Sidi bou Zid
Sfax
Gafsa
Meknassy
Wadi Akarit
El Hamma
THE CAMPAIGN IN NORTH WEST AFRICA
Scale of Miles
Miles 20 10 0 20 40 60 80 100 Miles

INDEX TO VOLUME VIII.

NOTES

1. The index for clarity has been divided into three sections:

   I. General.
   II. Royal Engineer Units and Formations.
   III. Units of Engineer Corps of Commonwealth Countries.

2. In some items of Section I, and in most of Sections II and III, the following abbreviations are used to indicate reference to action in the principal theatres of war.

EA.	East Africa and Eritrea.
F.	France and Belgium, 1939–40.
G.	Greece and Crete.
L.	Levant, including Turkey, Syria, Palestine and Aegean Island.
ME.	Middle East, general, referring to activities of Middle East Command and particularly to Egypt and Sudan, other than operations in the Western Desert. Also Gibraltar and Malta.
N.	Norway.
NWA.	North-West Africa.
PI.	Persia and Iraq.
WD.	Western Desert.

Reference to activities in the United Kingdom and in minor theatres of war are not specially indicated.

I. GENERAL

II. R.E. UNITS AND FORMATIONS

III. UNITS OF ENGINEER CORPS OF COMMONWEALTH COUNTRIES