



Lt Gen Sir Fenton J Aylmer VC KCB

HISTORY
OF THE
CORPS OF ROYAL ENGINEERS

VOLUME VII
CAMPAIGNS IN MESOPOTAMIA AND EAST AFRICA,
AND THE INTER-WAR PERIOD, 1919-38

CHATHAM
THE INSTITUTION OF ROYAL ENGINEERS

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**HISTORY OF THE
CORPS OF ROYAL ENGINEERS**

**VOLUME V
THE HOME FRONT, FRANCE, FLANDERS AND ITALY
IN THE FIRST WORLD WAR**

**VOLUME VI
GALLIPOLI, MACEDONIA, EGYPT AND PALESTINE**

**VOLUME VII
CAMPAIGNS IN MESOPOTAMIA AND EAST AFRICA, AND THE
INTER-WAR PERIOD, 1918 TO 1938**

Volumes V, VI and VII are published simultaneously.

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FOREWORD

It is now thirty-eight years since the last volume (Vol. III) of *The History of the Corps of Royal Engineers* was published. The first two volumes were written by Major-General W. Porter and covered the period from early times till 1886. Colonel Sir Charles Watson then continued the story up till 1912 in Volume III. After an interval of time certain episodes of history can be seen in better perspective and it may be found that there are gaps that should be filled. It was to fill such gaps in the period covered by Volume III that Brigadier-General W. Baker Brown wrote Volume IV, which is now being published. These four volumes thus take us up to the eve of the first World War. As soon as official data became available after that war it was obviously our duty to continue the history, and this has been done, the events occurring during the period from 1914 until about 1939 being now recorded in Volumes V, VI and VII.

As explained in the Preface, these have not been the work of one man, as were Volumes I to IV, but many officers have helped with the writing and compilation. Their efforts have, however, been collected and co-ordinated by one Editor—Major-General H. L. Pritchard, who has also himself written a considerable part of the work. I feel that every member of the Corps should be most grateful to him for his labours, especially as he has continued unremittingly during the last few years although suffering from very seriously failing eyesight. He and his team have certainly produced a great work, and his personal example of devotion to duty must be an inspiration to us all.

Mention must also be made of the work done by Major-General Sir Eustace Tickell in preparing the typescript for printing and in correcting all the proofs, and by Colonel F. C. Molesworth in compiling the index.

It is always difficult to decide how long after the event history should be written. A regimental historian must certainly wait until the official histories, founded on allied and enemy documents, have been published, but should not wait so long that the personal memories of those who took part in the events have faded. General

Pritchard followed this happy mean, but could not complete his task before the second World War intervened. The result was that a considerable time elapsed before publication became possible. This in no way detracts from the value of his work as a history to be read by members of the Corps and others in years to come. It is, however, in some ways unfortunate that these volumes were not available for study before we once again embarked upon a war involving engineering of very great magnitude and diversity. I feel sure that we as a Corps could have profited more fully from the many lessons of 1914-18, had we been able to study them in time in the clearly marshalled form that is now available in these volumes.

As to their use for future generations who may have to repeat these things yet once again, there are many parallels between the two great wars, and lessons can still be learnt by comparing them in many of their details. It is only by studying how things have changed that one can make any sort of estimate of their future trend. It is for this reason perhaps a pity that attention could not have been drawn in many places in this work to points of similarity or difference between the conditions of 1914-18 and those of a quarter of a century later. To have done so would have entailed much labour, and would, moreover, have still further delayed publication. This task is perhaps the duty of the author of later volumes.

To that ever dwindling body of sappers who took part in the events here recorded this history has a personal appeal; and to those who have since become, or are still to become, sappers this story of the deeds of their Corps in what was then the greatest war in history will certainly be of very great interest. It was a sapper war, and we entered it, through no fault of our own, both ill-prepared and under-manned, but, as these pages show, we achieved great things.

GUY C. WILLIAMS,
GENERAL,
CHIEF ROYAL ENGINEER.

1st January, 1951.

PREFACE

IN January, 1937, the Institution of Royal Engineers appointed an Editor to arrange for the continuation of the *History of the Corps of Royal Engineers* from the outbreak of the first World War on 4th August, 1914, to about the end of 1938, when preparations for the second World War were beginning.

The three volumes covering this period have been produced by team-work. The Editor advertised in the *R.E. Journal* for officers who would volunteer to write such portions of the history as they might select. He supplemented this advertisement by writing individually to many who had played prominent parts in certain events or in special types of work. The response to these appeals was most satisfactory, and as a result the history has been written by numerous authors. Some officers were good enough to act as sub-editors for a whole campaign or for definite portions of the history, finding the authors and compiling their work into a co-ordinated story. Others, invited by the Editor on account of the important part they had played in events, reviewed and commented upon the authors' and the Editor's productions. Amendments suggested by these commentators were usually accepted. The Editor asked some very senior officers to act as referees upon certain questions that he submitted to them. Several other officers undertook to search official historical records for information. The reader will notice variations in style, but there seems to be no necessity to apologize for this. The names of the 138 officers who have thus helped to produce Volumes V, VI and VII follow this preface in Volume V.

On 3rd September, 1939, the second World War broke out. By that date a considerable quantity of valuable information had been received by the Editor. Several officers had finished what they had undertaken to write, others had made good progress and hoped to complete shortly, while some had not succeeded in getting very far. The outbreak of war brought the production of these volumes to a standstill because practically everyone concerned, including the Editor, became involved in war work. The writing of history had to give way to the making of it. Moreover, all official historical records were hustled into air-raid shelters, and became inaccessible.

In 1943, the Editor was able to recommence the work of editing and compiling those papers that he had received, and some other officers resumed the work that they had promised. In 1945, after the conclusion of the war with Germany, the official records began to be brought back to London or to record offices, but, like many other evacuees, they were not in the condition in which they had left five years before. Their hasty evacuation had upset the filing systems, and the tracing of particular documents had become difficult. Time was required to re-establish order. In 1945, when the Editor tried to regain touch with some officers whose promised work had not yet been received, he found that there had been casualties among intending contributors. It is often said with truth that history should not be written too soon after the events concerned, but difficulties certainly arise if the work is postponed too long.

The Editor and authors have been helped by officers who have conscientiously searched through many cubic yards of war diaries, but, with some notable exceptions, the war diaries of the commanders of most R.E. units were, to put it mildly, thoroughly disappointing and of little value to an historian.

The history of the Corps in India has been written by Lieut.-Colonel E. W. C. Sandes, D.S.O., M.C., in two volumes, entitled *The Military Engineer in India*. He has followed these up by another one, published by the Institution of R.E. in 1948, entitled *The Indian Sappers and Miners*. In relating those events in which Sappers and Miners from India have played a great part in many theatres of war alongside the British R.E., we have utilized information from Lieut.-Colonel Sandes's volumes to co-ordinate the accounts of the great work of both British and Indian engineers. There remains much history of engineer work in India between 1914 and 1939 for which space could not be allotted in the present volumes, nor, so far as the Editor knows, has it been written elsewhere. It is to be hoped that this will be done in due course.

It was not until July, 1920, that the Royal Corps of Signals was created. Before that date signal units belonged to the Corps of Royal Engineers, and they expanded enormously during the war. The history of their work is being produced by the Royal Corps of Signals themselves and will not be found in the present volumes.

These volumes contain the history of World War I, written after that war and before World War II. In other words, there has been no attempt to compare the two wars, although editing was not completed until after the second.

We have attempted to write a history and not a technical treatise. We have, however, tried to explain the organization and systems of command and administration, and to bring out their merits or faults. We have also tried to show the effects of military operations on engineer work and vice versa.

A history of the Royal Engineers, who have carried out tasks of great diversity in war and peace in nearly every part of the British Empire and in many allied and enemy countries, cannot contain descriptions of every operation. Our object has been to emphasize the exceptional variety of the work demanded of the personnel and units of the Corps; and we hope we have succeeded in bringing out the complexity and the ubiquity of their activities. *Quo fas et gloria ducunt.*

THE EDITOR.

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THE CAMPAIGNS IN MESOPOTAMIA 1914-22

CHAPTER I

OPERATIONS IN MESOPOTAMIA UP TO JULY 1915

Introductory—The landing in November, 1914, and advance to Qurna—Battle of Shaiba, 12th April, 1915—Capture of Amara, June, 1915—Advance to Nasiriya, July, 1915.

(See Map 1)

INTRODUCTORY

FOR the strategy underlying the conception and development of the Mesopotamian campaign, the reader is recommended to consult the *Official History*. Turkey did not enter the Great War until the 31st October, 1914: but, in anticipation of her entry, the Indian Government had already dispatched a mixed brigade under Brig.-General Delamain to Bahrein, on the Persian Gulf, while the remainder of the 6th (Poona) Division was held ready to embark at Bombay in support of it. On the declaration of war, this original force was charged with:—

- (i) the protection of British interests at the head of the Persian Gulf,
- (ii) the support of Mohammerah, which involved the safeguarding of the Anglo-Persian Oil supply, and
- (iii) the carrying out of operations in Turkish Mesopotamia.

It was hoped, at the same time, that the presence of our troops in Persia and Mesopotamia would keep trouble as far removed as possible from the powder-barrel of Afghanistan and the north-west frontier of India: and it was realized that the possession of Baghdad would cover the main route from Turkey to Persia.

The administration of the campaign in Mesopotamia was, in the beginning, entirely the affair of the Government of India; but, as this did not produce altogether satisfactory results, the War Office assumed administrative control on the 18th July, 1916.

Mesopotamia is a country dependent upon the Tigris and Euphrates, with their tributaries and distributaries; but neither of these great rivers has the capacity to carry an army and its

supplies. Mesopotamian civilization is found close to its rivers, the rest of the country being sparsely inhabited by semi-settled or purely nomad Arabs. Thus, in the absence of roads and railways, the campaign followed the river routes, and nearly all the fighting was to force our way up the rivers, crossing and re-crossing them many times, often against opposition. The tortuous nature of the rivers, their annual floods overflowing hundreds of square miles and the inadequacy of native river-craft all added to the difficulty of operations, especially in Lower Mesopotamia. The original force, dispatched for limited objectives and operations and tied to the rivers for lack of land-transport, did wonders; but, in 1915, it was given a task quite beyond its capacity—hence disaster.

Throughout the campaign, the natural conditions and the climate of the country added enormously to our difficulties. From mid-March until September the heat was intense. Shade temperatures of 130° F. in Basra and over 120° F. in Baghdad were quite usual. Away from the rivers, drinking water in quantity sufficient for even the smallest column was almost unobtainable. In seasons of rain and flood, the marly desert soil was quickly churned up by any traffic into a peculiarly glutinous mud. After the floods came plagues of flies, of sand-flies and of mosquitoes. Small wonder, then, that in an ill-fed, ill-found and ill-sheltered army, operating in such a country, health suffered and numbers and striking power dwindled rapidly. The necessity for a radical reorganization of the force was obvious before the failure to relieve Kut in April, 1916. It was effected, mainly through the genius of Lieut.-General Sir Stanley Maude, during the autumn of that year.

To the military engineer, Southern Mesopotamia presented, in the beginning, an apparently hopeless problem. There was no local material available except the date-palm which is useless for structural purposes and is too heavy to float. There was no stone and hardly any fuel. The few mechanical installations in Basra were of little account. There was practically no wharf or road worthy of the name. The river craft certainly provided some material for floating bridges; but the smaller boats were deficient in buoyancy and strength while the larger ones could only be obtained at the expense of river transport.

If the reader is to understand the work of the Royal Engineer in Mesopotamia, it seems desirable to give him the foregoing sketch of the local conditions, under which most of that work was done.

The armistice with Turkey dated from 30th October, 1918, but

the Peace Treaty was not signed until 1924. During the intervening years, Mesopotamia was both technically and practically a "theatre of operations" and there was much employment for the engineer services, largely in connexion with expeditions beyond its frontiers and with the suppression of the Arab rebellion of 1920. The following chapters therefore carry the story of Mesopotamia on to the 1st October, 1922, when the command of the forces in the country was transferred to the Royal Air Force.* By that time the strength of Royal Engineers in the army of occupation had been reduced to the four British officers and three N.C.Os. of one company of Indian Sappers and Miners.

THE LANDING AND ADVANCE TO QURNA

On 31st October, 1914, the Government of India received from the Secretary of State a cable intimating Turkey's entry into the war. Thereupon, Brig.-General Delamain's mixed brigade from Bahrein was ordered to proceed in a combined naval and military force to Mesopotamia. On 6th November, Fao at the mouth of the Shatt-el-Arab was captured with little difficulty and, moving up the river, the British force then proceeded to establish itself opposite Abadan, the terminus of the Anglo-Persian oil pipe-line. On 15th November the enemy's advanced troops were attacked and defeated at Sahan, about three and a half miles west of the camp.

The only engineering unit in General Delamain's command was the 22nd Company, 3rd (Bombay) Sappers and Miners, under Captain E. K. Twiss; but, by the middle of November, reinforcements had arrived and among them was the 17th Company, 3rd S. & M. under Captain A. D. S. Arbuthnot.

On 17th November the whole force, now consisting of nearly two brigades of the 6th (Poona) Division, marched out towards Basra and in a four-hour battle drove the Turks from their trenches at Sahil. Both companies of sappers were in the firing line and both lost their commanders, Twiss being mortally and Arbuthnot seriously wounded. The latter survived to go to France and to return to Mesopotamia in January, 1916, only to be among the "missing, believed killed" at the Dujaila Redoubt, two months later. Lieutenant A. B. Matthews, who took over command from Twiss, received the M.C.

* From 1922 till 1943, the post of Chief Engineer Iraq Command was held by a Royal Engineer officer, working under the Air Ministry.

Four days were spent at Sahil, landing animals and stores, a most difficult operation. A hundred yards of very sticky mud lay between firm ground and the tidal waters of the Shatt, and palm trunks and leaves were the only materials available for causeways. Half an hour's traffic foundered any such road, and an hour or more was needed to make good. This difficulty was eased by the discovery that at night tides were much higher than by day and thereafter lighters were brought inshore after dark.

Basra was occupied on 22nd November and immediately there was an immense amount of work for the field companies. Roads were almost non-existent; innumerable creeks had to be bridged, water-supply schemes initiated, locations for troops made habitable. A hospital was fitted up in the palace of the Shaikh of Mohammerah. A field park was created and a start made with the employment of Arab labour.

The bulk of the Turkish force defeated at Sahil had retired to Qurna, forty miles up stream, at the confluence of the Tigris and the Euphrates (old channel). They were eventually dislodged from this strategic position by the 18th Brigade, accompanied by the 17th Company, S. & M. The left bank was first cleared of the enemy; but, in order to drive them out of Qurna on the right bank, it was necessary to cross the Tigris, here about 130 yards wide with a strong and very cold current. At a point about a mile north of Qurna, Havaladar Ghulam Nabi, with two sappers of the 17th Company, swam across carrying a log-line. Lieutenant M. G. C. Campbell of the same company followed with a wire cable, and within two hours, in spite of some opposition, a flying bridge was established and the infantry began to cross. By nightfall our troops were in a position to attack the town from the north; but this proved needless, as the Turks surrendered the next morning. Campbell was awarded the M.C.

Our strength, at this time approximately a division,* was not, however, sufficient to maintain the offensive, and the initiative passed to the Turks. They forthwith began to occupy the sand hills to the north of Qurna, while Arab auxiliaries regularly sniped our perimeter at night. An attack was made on the night 29th/30th January, 1915, but it was easily repulsed and, soon after this, rising floods rendered any further operations in this neighbourhood unlikely.

An attack on the oil pipe-line was more serious. With the help of the local Arabs, the enemy succeeded in breaching it and inflicted

* Commanded by General Sir Arthur Barrett, K.C.B.

something like a reverse on a small force sent out from Ahwaz to disperse them. They were, however, successfully held at bay in this quarter for many months by a detachment which included a section of the 22nd Company.

Meanwhile a force, which amounted ultimately to 12,000 Turks and 10,000 Arabs, was concentrating at Nukhaila on the New Euphrates. In order to interfere with its communications as much as possible, a flotilla, entitled the "Euphrates Blockade Force," was established by us. Lieutenant R. H. Dewing of the 12th Company, Q.V.O. Sappers and Miners, was appointed engineer officer and was mainly employed in blowing up captured *mahailahs* (country boats). The flotilla was successful in obliging the Turks to abandon Nukhaila as a port, and so to lengthen considerably their L. of C. Dewing was rewarded with the M.C.

THE BATTLE OF SHAIBA, 12TH APRIL, 1915

Early in December, 1914, a British detachment had been pushed out to Shaiba, nine miles west of Basra, and had been gradually increased to a strength of two brigades by the beginning of April, 1915, when an attack by the Turks was felt to be imminent. The communications of our force there were seriously impeded by the floods which, rising a month before their usual time, covered the desert between Basra and Shaiba. In Basra itself floods were causing an infinity of trouble. All the base depots were, at one time or another, under water. The only practicable remedy was to heighten and strengthen existing bunds, but earth for the purpose was hard to procure and transport for it very scarce.

In the first few months of 1915, three brigades additional to the original 6th Division landed and were formed into the 12th Division under Major-General Gorringe, late R.E., with Lieut.-Colonel T. C. Watson, V.C., as Engineer Commander. The engineer troops with this formation were the 12th Company, Q.V.O. Sappers and Miners under Captain S. Pemberton, and the Sirmur (Imperial Service) Sappers under Captain C. E. Colbeck. With the army troops was a searchlight section under Captain R. E. Stace, and a wreck party under Lieutenant O. Slater. The former unit provided two or three large lights to sweep the front at Qurna, and carried on a multiplicity of jobs at the base, such as lighting divisional headquarters and draining low-lying areas by pumps. Lights were also installed at Fao, in case of a naval raid on our shipping in the Shatt. The

function of the wreck party was to destroy the numerous steamers, which the Turks had sunk in navigable channels in the river. A bridging train of the K.G.O. S. & M., under Captain E. W. C. Sandes, was employed at this time on the maintenance and improvement of the Tigris bridge at Qurna.

None of these newly arrived units was present at Shaiba on 12th April, when the long-expected Turkish attack materialized. Here the engineers were represented by Colonel Evans as C.R.E., with Captain H. W. Tomlinson as his staff officer, and the 17th and 22nd Companies, S. & M., less one section. The Turks attacked our fortified perimeter, and were repulsed. The *Official History* records that "the brunt of the fighting had fallen on the 48th Pioneers and the 17th Company of Sappers and Miners, who had withstood the assault with conspicuous steadiness." On the following day the enemy attacked again, once more to be defeated.

It was plainly necessary to strike a hard blow at the Turks. On 15th April, therefore, Brigadier-General Melliss, temporarily in command, marched out against them and after a very stubborn battle, fought on a scorching day, utterly defeated them. Both sapper companies were employed as infantry. Again the 22nd Company lost its O.C., Captain E. C. Whiteley, whose name is perpetuated by the Whiteley bridge over the Ashar creek at Basra. Captain E. J. Loring, commanding the 17th Company, was wounded.

CAPTURE OF AMARA, JUNE, 1915

The next important task was to relieve our right wing. The operation was entrusted by Lieut.-General Nixon, the Army Commander, to Major-General Gorringe who, with the bulk of the 12th Division, in intensely hot weather successfully drove the Turks from the neighbourhood of Ahwaz towards Amara and severely punished their Arab allies. The 12th Company, Q.V.O. S. & M., distinguished itself at the crossing of the Karkha river, at that time in full flood with a 3-knot current and many eddies. The crossing was effected by means of two flying bridges, and a ferry made of improvised boats, constructed of $\frac{1}{2}$ -in. planking covered with service tarpaulins. After the crossing of the Karkha, Captain Pemberton had the task of blowing up towers in the captured town.

Preparations were now in hand for an advance from Qurna, an operation which was likely to be one of great difficulty. From the armoured conning tower of a 90-ft. observation tower, built by the

17th Company, the surrounding country appeared to consist of an almost unbroken sheet of water, with a few low hills to the north marking the Turkish position. Between them and Qurna the depth was between one and three feet, but deeper hidden channels rendered it impassable for infantry. Major-General Townshend, who had succeeded to the command of the 6th Division, decided to advance by boat across these miles of water. To this end, numbers of rafts for machine guns and of armoured *ballams* (country boats) for infantry were prepared at the cost of a vast amount of work in the shaping of steel plates with cold chisel and hammer. The attack, which took place on 31st May, was brilliantly successful and was followed up by a daring pursuit which did not end until Townshend with forty-one armed men achieved the capture of Amara and the Turkish battalion there. The engineer units taking part in the operations at Qurna were the 22nd Company and the Sirmur Sappers, the latter accompanying the *ballam* force and having the task of removing and destroying enemy mines. A flight of aeroplanes, the first to arrive in the country, took part in these operations, under Major P. W. L. Broke-Smith, R.E.

ADVANCE TO NASIRIYA, JULY, 1915

The capture of Nasiriya, whither the enemy defeated at Shaiba had fled, was now deemed necessary. This enterprise was entrusted to Major-General Gorringe, with a force of one brigade, to which was attached the 12th Company, S. & M., with Major A. F. Cumberlege as C.R.E. The first engineering operation was the demolition of a large irrigation dam on the Akaika branch of the Euphrates. It was about forty feet wide, strongly built of rammed earth with layers of reeds, and some sunken *muhailahs* as a foundation. Thirty-six hours' continuous work provided a passage for the first steamers. The advanced position of the Turks at and about the fork of the Euphrates near Suq-ash-Shuyukh was then taken, but it was plain that a larger force would be needed to drive them from their main position nearer Nasiriya. Time was pressing, as the Hammar lake was falling and our casualties from heatstroke and disease were already very heavy. The addition of two brigades, with the 17th Company, S. & M., raised the strength to 4,600 rifles only. With these on 24th July Gorringe made a determined attack, which resulted in the complete defeat of the Turks and the occupation of Nasiriyah.

In these operations, the 17th Company played a distinguished part. About 200 yards in front of the enemy's position on the right bank was a creek, reported unfordable. The company embarked on a steamer towing an armoured *muhaulah*, on which was material for two trestle bridges. In spite of severe artillery and rifle fire, the *muhaulah* was successfully placed in position to block and bridge the creek, whereupon the company, sheltered somewhat by the banks, erected the bridges. Our infantry then advanced over the creek and carried the trenches, most of them finding the creek fordable owing to the damming effect of the *muhaulah*. The company lost twenty-five out of the fifty-five forming the bridging party, including Loring, slightly, and Captain R. C. Lord, severely, wounded. It is pleasing to record that seven R.E. and attached officers received the M.C. for the Nasiriya operations.

CHAPTER II

TOWNSHEND'S TIGRIS CAMPAIGN

The advance from Amara—Capture of Kut, 29th September, 1915—
Advance to Ctesiphon—Withdrawal to Kut—The Kut defences—
Turkish attacks repulsed—The siege—Surrender of Kut, 29th
April, 1916.

(See Sketch I,* facing p. 32 and Map 1)

THE ADVANCE FROM AMARA

ON 7th June, 1915, Lieut.-Colonel U. W. Evans who had already received the C.B. for his services in the earlier operations was appointed G.S.O.1 of the 6th Division and, pending the arrival of Lieut.-Colonel F. A. Wilson, Major H. E. Winsloe acted as C.R.E. at Amara, with Captain H. W. Tomlinson as his staff officer. The 22nd Company, 3rd Sappers and Miners, under Captain M. G. G. Campbell, with Lieutenants A. B. Matthews, K. B. S. Crawford and W. O. Garrett, I.A.R.O., were engaged in a variety of duties. They built and wired blockhouses, prepared gun platforms on barges, erected a hangar, camouflaged a steamer and occasionally assisted the Bridging Train, 1st K.G.O. Sappers and Miners. The latter unit, under Captain E. W. C. Sandes, constructed a bridge of Arab boats across the Jahalla Creek (a branch of the Tigris) and so enabled the 12th Brigade to cross into Amara after marching from Ahwaz. Afterwards, the Bridging Train remodelled the Arab bridge over the main stream and prepared boats and material for an advance northwards. The Sirmur Sapper Company, under Captain C. E. Colbeck, was engaged during July, 1915, on miscellaneous work in Amara, and afterwards returned to Basra. On 20th August, the garrison was reinforced by the arrival from Nasiriya of the 17th Company, S. & M., under Captain E. J. Loring, with Captain C. M. G. Dunhill as Company Officer. Lieutenants

* Reproduced from *The Indian Sappers and Miners*, by Lieut.-Colonel E. W. C. Sandes, with the kind permission of the author.

A. T. East and W. R. Boyes, both of the I.A.R.O., joined the company at Amara.

As the weather was now cooler, a forward concentration of the 6th Indian Division for an advance on Kut Al Amara was begun with the occupation of Ali Gharbi by the 16th Brigade, accompanied by the right half of the 22nd Company, S. & M. The Bridging Train followed, and bridged the river at Ali Gharbi. When the remainder of General Townshend's force had passed through, this bridge was dismantled, towed up-stream and re-erected at Sannaiyat. On 26th September, Townshend advanced to Nukhailat to attack the Turkish position astride the Tigris at Es Sinn, below Kut. The enemy's trenches extended for several miles into the desert on either bank, those on the left bank being broken into three systems by large marshes. In rear was a bridge of boats, and the river was obstructed by a boom. While the Bridging Train moved up to Nukhailat and bridged the Tigris again at that place, the two field companies built observation towers, improved tracks and wired a bridgehead.

CAPTURE OF KUT, 29TH SEPTEMBER, 1915

The battle of Es Sinn (first battle of Kut) was fought on the left bank on 28th September, 1915, after a feint on the right bank on the 27th. Half the 17th Company was attached to the 18th Brigade in a holding attack near the river, while the 22nd Company marched with the 17th Brigade and other troops under General Delamain against the enemy's left front and left flank in the desert. Ably guided by Matthews, Delamain completed his task, though with the utmost difficulty. The precise location and area of the marshes was uncertain, and part of the attack went astray. The Turks counter-attacked, and then evacuated all their positions under cover of darkness. When Delamain reached the river behind the Turkish position on the morning of the 29th, his men had had little water and no food for twenty-six hours. Kut Al Amara was occupied on the same day, and the enemy were pursued by the 18th Brigade to Aziziya, a further sixty miles up stream. The ships carrying this brigade reached Aziziya on 5th October, the other brigades following within the next few days.

On arrival at Aziziya, the 17th and 22nd Companies made defences and communications and provided a flying bridge. A portion of the Bridging Train then appeared, and, with some assistance from the 22nd Company, built a footbridge, 280 yds. long, composed

of Wheatley bag rafts, Arab boats and trestles. On 17th October, with the arrival of eighteen pontoons, it was converted into a normal bridge for wheeled traffic. The halt at Aziziya was the easiest time that the Sappers had yet had in Mesopotamia. The climate was pleasant: the morale of the force excellent. The 6th Division had never been defeated. Every soldier looked forward to a triumphal entry into Baghdad.

ADVANCE TO CTESIPHON

The final advance began on 11th November. On the 16th the rafts of the Bridging Train were towed up stream by six launches, and a bridge was constructed before dusk with the help of a section of the 17th Company. On the following day the 17th Brigade and the remainder of the 17th Company crossed to the right bank, and on the 18th the bridge was dismantled. Immediately thereafter, an urgent message arrived that it was to be rebuilt and this was accomplished in darkness in three and a half hours. The length of this bridge was 250 yds.

On 19th November the entire force advanced to Zor, where the river was bridged once more. On the 20th, it reached Lajj, where a bridge was constructed on the 21st under most difficult conditions, for the left bank was twenty-five feet high and the current ran at five knots. During the advance from Aziziya to Lajj, the sapper companies were employed in preparing nullah crossings and in helping Sandes with his boat bridges when necessary.

Townshend launched his troops against the entrenched position at Ctesiphon, six miles from Lajj, on 22nd November, 1915, making a converging attack in four columns against the Turkish front and flank on the left bank. This portion of the position extended for about six miles and included fifteen redoubts connected by fire-trenches. In rear was a second line and, on the Diyala river, a third line. An Arab division was entrenched on the right bank; another Arab division and an Anatolian division held the front line on the left bank, and in reserve on this bank was a second Anatolian division. Guided by Matthews, three columns under Generals Melliss, Hamilton and Delamain had reached their allotted positions in the desert during the preceding night, and at dawn combined with the frontal attack of a fourth column under General Hoghton near the river. No sappers accompanied the Flying Column under Melliss on the extreme right; but the right half of the 22nd Company,

under Crawford, was attached to Column B under Hamilton, and the left half, under Campbell, was with Column A under Delamain, whose objective was "Vital Point," a powerful redoubt forming the key of the position. A portion of the 17th Company, under Loring, with Dunhill as Company Officer, was attached to Column C under Hoghton, the remainder of the unit being employed in guarding the heavy guns or helping the Bridging Train.

The Flying Column and Column B, directed against the left of the enemy's second line, failed to reach it; but Column A captured Vital Point in the front line, and Column C took Water Redoubt, farther to the south. Columns A and C then worked down the front line trenches and killed or captured those Turks and Arabs who held their ground. In these operations, the Sapper companies were used as infantry. Both Campbell and Loring were severely wounded, and Garrett, I.A.R.O., was killed. By the evening of the 22nd no R.E. officer who had served with either sapper company before the war remained with it. On the 23rd a powerful counter-attack was repulsed. On the 24th, however, owing to heavy casualties, Townshend concentrated his force at "High Wall," a position near the river which the sappers proceeded to fortify. Here, the 22nd Company was joined by Lieutenant H. S. Cheshire, I.A.R.O. After dark the Turks began to evacuate their second line and to retreat to the Diyala; but meeting large reinforcements, they turned about and reoccupied their positions. On the 25th Townshend decided to retire to Lajj, which he reached before dawn on the 26th. General Nixon, the Army Commander, who was present at Ctesiphon, had returned to Kut.

WITHDRAWAL TO KUT

Meanwhile, the Bridging Train at Lajj had had a strenuous time. Assisted by East and a party of the 17th Company, Sandes had just finished dismantling the bridge at 1 p.m. on the 22nd, in anticipation of an advance after the capture of Vital Point Redoubt, when he was ordered to re-erect it. This re-erection was completed by 8 p.m. On the afternoon of the 24th, the bridge was again dismantled and the rafts prepared for towing; but at 8 p.m. on the 25th, when Townshend had begun to retreat, orders arrived that the bridge should be reconstructed, a task which was finished before dawn on the 26th by the light of acetylene flares operated by the Searchlight Section, under Captain R. E. Stace. At 2 p.m. on the 27th, when a

general retirement on Aziziya had begun, Sandes received orders to dismantle the bridge and be gone within two hours, and this he accomplished by working at the double and cutting the anchor ropes. Delayed by the grounding of rafts and the general confusion of the shipping on the uncharted river, the leading tows of the Bridging Train did not reach Aziziya until 10 a.m. on the 28th, and when a bridge had been completed at that place, the men were utterly exhausted. They had worked continuously for thirty-six hours.

As the Turks were reported to be advancing, the 6th Division, preceded by the 30th Brigade and some cavalry under General Melliss, evacuated Aziziya on 29th November and marched to Umm-At-Tabul, ten miles down stream, while Melliss continued for another ten miles. The Bridging Train followed the main body to Umm-At-Tabul. Before daybreak on the 30th it was discovered that the enemy had camped close to the British force, so Townshend opened fire at dawn and deployed for attack, having meanwhile sent a message to recall Melliss. The sapper companies, less one section under Boyes with Melliss, were employed on road-making or escorting the guns and were not heavily engaged, but Dunhill, commanding the 17th Company, was killed. The command of that unit then devolved on Lieutenant H. M. Spink, I.A.R.O., until Boyes rejoined it. After punishing the enemy severely, Townshend broke off the action, and, reinforced by Melliss, began a series of forced marches southwards in the course of which he shook off the Turkish pursuit. The nights were bitterly cold, and the troops exhausted and hungry. The main body entered Kut on 3rd December, and the sapper companies went into bivouac north of the town.

Meanwhile, the Bridging Train had had a most adventurous voyage down the Tigris. It was without escort or pilots, out-distanced by the troops on land and the shipping on the river, and compelled often to run the gauntlet of Arab snipers. In a final brush with Arab cavalry, the last of its eighteen pontoons was lost, and it reached Kut with only twelve rafts of leaking Arab boats. There it obtained a few more boats, and thus was able to bridge the river near the Fort, down stream of the town on 5th December. The 6th Cavalry Brigade, with guns and transport, crossed this bridge on the 6th, and marched to join the forces assembling under General Aylmer. Luckily, the escape of the cavalry brigade from Kut drew no fire, for there was not a boat in reserve, and, immediately after the crossing, several boats foundered.

THE KUT DEFENCES

On their return from Ctesiphon, the engineers in Kut were reinforced by the arrival of Major J. S. Barker and Lieutenants K. D. Yearsley, R.E., and T. W. Abbott, I.A. Captain C. E. Colbeck, and Lieutenant F. Mayo were also in Kut with the Sirmur Sapper Company, who had come up recently from Basra, and was engaged in building the Fort and dismantling the Turkish bridge behind the Es Sinn position. Thus the complete cadre of R.E. officers for the defence of Kut comprised Lieut.-Colonel Wilson (C.R.E.), Majors Winsloe and Barker (Field Engineers), Captains Sandes, Stace, Tomlinson and Colbeck, and Lieutenants Yearsley, Matthews, Crawford, Greenwood (Wireless) and Abbott. These officers were assisted by Lieutenants Boyes, East, Cheshire and Spink, I.A.R.O., Lieutenant Mayo, Sirmur Sappers, and at his own request, by Captain W. H. Mathias, 128th Pioneers. Crawford was transferred from the 22nd Company to the command of the 17th Company, and Mathias served under Matthews, who commanded the 22nd Company. Stace was in charge of workshops established for the manufacture of hand and rifle grenades, periscopes, trench mortars and other siege equipment. He was assisted by C.S.M. Bellis and Sergeants Toleman and Baker, R.E. The workshops produced ingenious trench mortars, at first from wood and later from the cylinders of Gnome aeroplane engines.

Soon after Townshend's arrival, the infantry began to dig and wire a defensive position across the Kut loop of the Tigris from the Fort to a point about one mile up stream of the town. The position followed the alignment of some existing blockhouses and wire, designed for defence against Arabs. Under the supervision of Lieut.-Colonel Wilson and his field engineers, the system was gradually elaborated by a second line nearer to Kut, and afterwards by an intermediate or "middle" line and communication trenches. Woolpress Village, almost opposite Kut on the right bank, was occupied and fortified, and the left bank was piquetted within the defended area. Before Christmas, the whole position was well entrenched. The defensive line was divided into two sections. The Sirmur Sapper Company, stationed in the Fort, was responsible for the defences in the N.E. Section, held by the 17th Brigade. The 17th and 22nd Companies were posted north of the town in the vulnerable S.W. Section, held alternately by the 16th and 30th Brigades. The 18th Brigade was in and around Kut town, and found the garrison for Woolpress Village. The sapper companies were employed at first on digging, wiring, demolitions and the erection of pumps.

During the night of 6th/7th December, the Bridging Train, though much delayed by sniping, dismantled the Fort bridge across which the Cavalry Brigade had passed, and on the 7th, with the help of a section of the 17th Company, began the construction of another bridge nearer to Kut town. By the evening of the 8th a rickety structure was completed by using Arab boats from the old Turkish bridge down stream; but on the 9th the bridgehead was attacked and captured by the enemy, and it was decided that the bridge should be destroyed under cover of darkness. This exploit was carried out most gallantly by volunteers from the 22nd Company led by Matthews, and by a party of 2nd/7th Gurkhas under Lieutenant R. T. Sweet. A large charge of gun-cotton, with the fuse lighted, was laid on the bridge by Matthews within earshot of the Turks on the far bank. Some of the anchor ropes had already been cut, and as the Sappers and Gurkhas ran back unobserved, the remaining ropes were severed. The explosion broke the bridge into pieces, and the boats foundered gradually. Townshend was then completely isolated, for all the shipping, except the tug *Sumana*, two motor-boats and a few barges, had gone down stream with the Army Commander. Matthews and Sweet received the D.S.O., though recommended for the V.C., and the Sapper and Gurkha other ranks were also decorated. The Bridging Train, deprived of their bridge, became "Town Engineers." They were employed chiefly in making communications through Kut and preparing bridging material for future use. Between March and December, 1915, this small unit of Bengal Sappers had bridged the Tigris no less than seventeen times.

TURKISH ATTACKS REPULSED

Kut was subjected to several heavy bombardments during December, and the enemy sapped continually towards the defences and sometimes attacked them, though without success. After 13th December the principal sapper work was mining from the front line. Altogether, six mines were excavated and charged. There was also much trench digging, and on this and other work the 17th Company suffered heavy casualties in officers. On 17th December, Subadar Baryam Singh received a wound from which he died later in the siege. On the 18th, East was mortally wounded. On the 19th, Crawford was shot through both legs, and a jemadar was wounded and, as Boyes was in hospital with colitis, Cheshire

and one jemadar alone remained for duty. Yearsley was then posted to the company, and took command on the 24th.

On Christmas Eve a fierce assault on the Fort was made by thousands of Turks ; but their attempt to take Kut by storm failed, and our defences were afterwards elaborated and strengthened. The guns of the relief force at Shaikh Saad were heard on 7th January. Rain then began to fall, and the trenches and mines were flooded. The sapper companies and other troops fought the floods with some success, though on the 21st a large area was inundated and it became necessary to evacuate the front line in the N.W. Section. Within a few hours the Turks were also forced to leave their trenches. No further attempt was ever made to storm Kut. Khalil Pasha decided to reduce it by starvation. He enclosed it in an impenetrable ring of trenches and wire, and devoted his energies to blocking the advance of the Relief Force under General Aylmer. On 22nd January the floods began to subside, and the R.E. staff and sapper companies were employed in redesigning the trench system and raising breastworks where necessary. Rain continued to fall at intervals. Rations were reduced, and horsemeat was issued to the British troops. Before the end of the month, Major Winsloe was wounded and incapacitated for the remainder of the siege.

THE SIEGE OF KUT

After an aeroplane had bombed Kut on 13th February, the sapper companies improvised measures for anti-aircraft defence. These took the form of mounting machine-guns on barrels and slinging a field-gun on a vertical pole in a deep pit. They also prepared trench bridges for a sortie to co-operate with the relief force when it approached Kut, and the Bridging Train collected material for a flying bridge. Heavy gunfire was heard down stream on the 22nd. Sickness increased, and rations were further reduced.

Early in March, the river began to rise, and the sappers laboured night and day on flood embankments. On the 6th a heavy bombardment was heard down stream and on the 7th the commanders of the sapper companies were warned to be ready to construct flying bridges for transporting across the Tigris a force, under General Melliss, which was to co-operate with the relief troops. After dark, an ingenious floating mine was released from Woolpress Village by Stace, who hoped that it would be drawn down the Shatt Al Hai channel to destroy a Turkish bridge, but it grounded at the entrance

and exploded there. While the garrison stood to arms on the 8th, the relief force was repulsed at the Dujaila Redoubt in the Es Sinn position, and accordingly no co-operation was possible. Rain fell again, the struggle against inundation continued, and the bread ration for British troops was reduced to 10 oz. and later to 8 oz. On the 19th, after the enemy had disabled the tug *Sumana* by gunfire, the workshop staff succeeded in repairing her; but on the 30th, another shell pierced a main steam joint, and it seemed that the garrison of Woolpress Village was doomed. However, Stace managed to restore the *Sumana* to her ferrying duties by installing a duplicate joint, ordered by wireless from a sister ship down stream and dropped by aeroplane. By the end of the month, the sapper units were weakening rapidly. The men received a daily ration of 10 oz. of barley, ground in mills operated by Captain Winfield-Smith, R.F.C., but they still refused, as did the other Indian troops, to eat horseflesh.

SURRENDER OF KUT, 29TH APRIL, 1916

April, 1916, opened with storm and flood. On the 7th it was learned that the relief force, now under General Gorringe, had taken several positions and was confronting the enemy at Sannaiyat. The rank and file of the sapper companies in Kut had become so weak that they could only work a 90-minute relief. It was pitiful to see their attempts to dig. On the 10th, Townshend announced that Gorringe had failed to capture the Sannaiyat position on the left bank and appealed to the Indian troops to eat horseflesh. The appeal had its effect, for on the 13th almost all the men of the sapper units decided to comply. Other Indian units followed suit, though in many cases the decision came too late to save life. The sappers continued their fight against the floods, while the air trembled with the concussions of heavy gunfire as the relief force attacked and were counter-attacked at Bait Isa, far down-stream on the right bank. Although several British aeroplanes were now dropping food for the garrison, the amount was small, and consequently the bread ration was reduced to 4 oz. on 17th April. At this period the breastworks in Kut were tested to their limit by an exceptional flood.

On 23rd April came the news that Gorringe had been repulsed finally at Sannaiyat. The reserve and emergency rations were issued in Kut, and, after them, the small supply brought by air. A gallant

in Mesopotamia, outside invested Kut, was the 12th Company, Madras Sappers and Miners, and it was not available at the front because it had to be employed in improving the line of communication between Basra and Amara. The 13th Company arrived from India on 6th December but did not reach Ali Gharbi until the 19th as it was collecting bridging material. Consequently, on 6th January, 1916, when General Aylmer launched his available strength under Major-General G. J. Younghusband against the Turkish positions at Shaikh Saad, there was no engineer unit on the Tigris front. The 3rd and 4th Companies, Bengal S. & M., under Lieut.-Colonel G. A. J. Leslie, C.R.E. 7th Division, had both been sent up the Euphrates. The 20th and 21st Companies, Bombay S. & M., under Lieut.-Colonel Campbell Coffin, C.R.E. 3rd Division, had begun to march up-country and did not reach the Tigris front until 7th February. The 2nd Field Troop, Madras S. & M., also from France, was detained for work on the high-level Basra-Amara Road. Aylmer occupied the Shaikh Saad position on 9th January after a bitter struggle and the enemy withdrew to further positions up stream. At a cost of 4,000 casualties out of 18,000 effectives he had advanced only one-eighth of the distance to Kut. Nixon broke down under the strain, and ten days after Shaikh Saad he was relieved in the supreme command of General Sir Percy H. N. Lake.

GENERAL AYLMER CHECKED AT HANNA, JANUARY, 1916

Throughout January, 1916, the 13th Company performed marvels of improvised bridging. It removed a floating bridge of Arab *danaks* from Ali Gharbi, rebuilt it below Shaikh Saad on 7th January and again at Shaikh Saad itself after the enemy had retired. All was accomplished in gales of wind, bitter cold and storms of rain. On the 15th, after Younghusband had cleared the Turks from their next position at the Wadi influent, the company bridged the Wadi with the few available pontoons, and two days later, completed a 400-yd. boat bridge across the Tigris at Ora. Both were destroyed by gales. Townshend now signalled that his rations would be exhausted by 7th February, so Aylmer, with Lake's approval, renewed his attempt at relief. He had no bridge, little transport and supplies, and insufficient troops. The country was a sea of glutinous mud. He attacked the Hanna position on 21st January and failed disastrously; and after all, this sacrifice was made to no purpose for the next message from Townshend announced the

discovery of grain in Kut, which would enable the garrison to hold out for a further eighty-four days. So the battered Tigris Corps sat down at last to await reinforcements. These were to include the bulk of the 3rd Indian Division and also the 13th (British) Division from Egypt, the latter commanded by Major-General S. F. Maude. Under the direction of Colonel E. R. B. Stokes-Roberts, Chief Engineer, Tigris Corps, the 13th Company rebuilt the Ora bridge by 11th February and was joined soon afterwards by the 12th Company and a small bridging train of Bengal Sappers from India.

ABORTIVE ADVANCE TO DUJAILA REDOUBT, 8th MARCH

In the middle of February, 1916, the Imperial General Staff took over control of the campaign from Army Headquarters, India. Aylmer now planned to relieve Kut at one stroke if his strength permitted, by containing the Turks in their Hanna position on the left bank between the marshes and the Tigris while his striking force marched by night through the desert on the right bank to occupy the Dujaila Redoubt and then to cross the Shatt al Hai and co-operate with two brigades breaking out of Kut. But before the 13th Division had reached him, his hand was forced by Townshend who signalled on 4th March that he could not hold out beyond the end of the month. Accordingly, with Lake's approval, Aylmer struck at once. During the night of 7th/8th March a powerful force marched towards the Dujaila Redoubt which barred the way to the Hai. It was guided with the utmost precision by Captain K. Mason, R.E., and at dawn most of the 3rd Division under Major-General H. D'U. Keary was fronting the redoubt, which reconnaissance showed to be empty. Keary asked for permission to occupy it but was told to await artillery preparation. The guns opened fire, and the Turks promptly manned the trenches. Later, Keary was ordered to attack with one unsupported brigade. It entered the redoubt but was soon driven out and having failed to reach water on the Hai, Aylmer was forced to order a withdrawal on the 9th to the original position at Ora. The engineer units concerned in this unfortunate attempt were the 12th Company, Madras S. & M. and the 20th and 21st Companies, Bombay S. & M. The 13th Company, Madras S. & M., and the newly arrived 3rd Company, Bengal S. & M., were at or below Hanna. The 20th Company lost its gallant commander, Captain A. D. S. Arbuthnot, who was killed in the Dujaila Redoubt.

material was confined to a little scrub. The men worked in a welter of mud and water, with no relaxation, no comforts and little food. Except in the volume of fire, the scene resembled Flanders at its worst, with the added infliction that there was no relief in the front line.

REORGANIZATION AFTER THE FALL OF KUT

The fall of Kut removed the chief objective of the Tigris Corps. Reorganization then became the order of the day. The enemy on the right bank withdrew to the line of the Hai, and, on 20th May, the 3rd Indian Division advanced and occupied the Es Sinn position. Its C.R.E., Lieut.-Colonel Campbell Coffin, was invalided on 18th June and replaced by Lieut.-Colonel G. H. Stack. On 11th July, Lieut.-General Sir F. Stanley Maude succeeded General Gorringe in command of the Tigris Corps and on 28th August became Commander-in-Chief in Mesopotamia *vice* General Sir Percy Lake. The 13th Division was sent down to Amara, and with it the three field companies. While based on Amara the companies were employed on constructing part of the metre-gauge railway from Qurna. The state of these units may be judged by the fact that on 20th July the 88th Company could muster only seventy of all ranks. At Amara it received reinforcements and was built up gradually to a strength of over 300. The same policy was followed in all units for it was certain that, with the resumption of hostilities in the cold weather, no further reinforcements could be expected owing to lack of transport. The 13th Division was withdrawn chiefly because huddled accommodation was essential for British troops in the extreme heat, and the material required could not be moved up to the front in addition to rations and ammunition. The troops, moreover, were young and raw and needed training which they could not get in the forward areas. General Sir William Robertson, the C.I.G.S., had wished to withdraw the whole Tigris Corps to Amara, but India objected on political grounds, so it was agreed that a defensive line below Kut should still be held.

Another R.E. unit reached Mesopotamia during the summer of 1916. This was the 7th Field Troop, which landed in Basra on 26th August. Captain E. K. Squires, then S.O. to C.E. Tigris Force, was posted to command it. The 6th and 7th Indian Cavalry Brigades were already in the country and the 2nd Field Troop, Madras S. & M., had joined the 6th Brigade in February, so the 7th Field Troop, R.E., was attached to the 7th Brigade. The brigades

were organized to be self-contained as there was no intention at first to have any cavalry formation of a higher category. The 7th Field Troop had been formed on a nucleus provided by detaching a troop from one of the field squadrons serving with the Indian cavalry divisions in France. Each field troop was organized as a H.Q. and two half-troops, and although the two troops were attached to specific brigades, they were treated as divisional troops on all divisional operations when the brigades were combined later into a cavalry division under Major-General S. F. Crocker. No official steps were ever taken to form a field squadron; yet the two troops became known as such and Squires was addressed as "O.C. Field Squadron." In that capacity he often dealt with administrative matters which concerned both troops, but purely domestic administration was handled by the troops separately. Though the arrangement was peculiar, it worked satisfactorily.

For a time there was a serious shortage of engineer officers in Mesopotamia. In June, 1916, the deficiency had been twenty-five, of whom thirteen were required for the Tigris Corps, but by September the situation was better and the total amounted to 142. Lieut.-Colonel A. J. Wolff having been invalided, Major A. E. Coningham officiated as C.R.E., 13th Division, from June to August; then Captain W. H. Roberts officiated until the arrival of Lieut.-Colonel E. C. Tylden-Pattenson at the end of the year. Sickness was responsible for many changes in appointments—a natural result of the hardships of the campaign.

In October, 1916, the Tigris Corps was reorganized into the I Corps (3rd and 7th Indian Divisions) and the III Corps (13th British and 14th Indian Divisions), each with four engineer companies. The 14th Division, with Lieut.-Colonel E. C. Ogilvie as C.R.E., had been formed on the Tigris in June, and the 15th Division still earlier, but on the Euphrates. The engineers concentrated on bridging preparations. No. 2 (Mobile) Bridging Train, Bengal S. & M., was equipped with British-type pontoons, carried on 200 A.T. carts fitted with lengthened axles, the superstructure being loaded on fifty-six G.S. wagons. The unit thus became independent of river transport and it could build 500 yds. of medium bridge. Two non-mobile S. & M. Bridging Trains, Nos. 1 and 3, became available for work behind the front.

Additional R.E. field companies now arrived in Mesopotamia. These were the 1/3rd, 2/2nd and 3/1st Northumbrian units of the Territorial Force, which were renamed, in February 1917, the

448th, 450th and 451st Field Companies. Their C.R.E., Lieut.-Colonel W. V. Scudamore, was succeeded on 26th October by Lieut.-Colonel C. B. L. Greenstreet, and the latter, on 7th February, 1917, by Lieut.-Colonel J. F. Turner. The Northumbrian companies landed in Basra in the middle of October, 1916, and were attached to the 15th Division. On 30th November the 1/3rd Company reached Nasiriya on the Euphrates; the 3/1st arrived on 10th January, 1917, and the 2/2nd on 10th March. Thus, during the winter of 1916-17, the number of R.E. units in Mesopotamia was increased from four to seven; but they were still out-numbered by the S. & M. units which included ten field companies, a field troop and three bridging trains. The establishment of pioneers comprised a British battalion (8th Welch) and three Indian battalions.

By the end of 1916, General Maude was certainly well equipped for his offensive against Baghdad. His rail and road communications up the Tigris were much improved, his river transport augmented, and his supply situation fairly satisfactory. Also, he greatly out-numbered the enemy. Engineer materials, particularly for bridging, were still deficient owing to a delay of four months in complying with indents, but the situation contrasted most favourably with that in January, 1916, when General Aylmer began his ill-fated campaign almost destitute of materials and without a single company of Royal Engineers or Sappers and Miners at the front.

CHAPTER IV

THE BAGHDAD CAMPAIGN

General Maude advances against Kut, December, 1916—Capture of the Khudhaira and Dahra Bends, February, 1917—The Shumran crossing and fall of Kut—The Diyala crossing and fall of Baghdad, 11th March—Advance from Baghdad and the Adhaim crossing—Defence of Baghdad, Summer, 1917.

(See Sketches 1 and 2, facing pp. 32 and 70)*

GENERAL MAUDE ADVANCES AGAINST KUT, DECEMBER, 1916

IN December 1916, General Maude's striking force below Kut comprised the I Corps under Lieut.-General A. S. Cobbe and the III Corps under Lieut.-General W. R. Marshall. Both Corps commanders were experienced soldiers with excellent staffs, and the administration throughout was most efficient. The troops had benefited by further training, their rations had improved and their health was better. Opposed to Maude on the Tigris were the XIII and XVIII Turkish Corps under Halil Pasha. The strategical situation was promising; but Maude could not risk heavy casualties and accordingly he prepared for a methodical advance starting with the clearance of enemy concentrations from the right bank in the Khudhaira Bend below Kut, the Hai Salient opposite the town, and the Dahra Bend above it.

The Mesopotamia Expeditionary Force was now amply supplied with technical units, the Engineer Order of Battle being as follows:—

CAVALRY DIVISION	Major-General S. F. Crocker.
(formed later)	
" O.C., Field Squadron "	Captain E. K. Squires.
6th Cavalry Brigade	2nd Field Troop, Madras S. & M.
7th Cavalry Brigade	7th Field Troop, R.E.

* Reproduced from *The Indian Sappers and Miners*, by Lieut.-Colonel E. W. C. Sandes, with the kind permission of the author.

I CORPS	Lieut.-General A. S.-Cobbe.
Chief Engineer	Brigadier-General A. J. H. Swiney.
3rd Indian Division	C.R.E., Lieut.-Colonel G. H. Stack, with 18th, 20th and 21st Field Companies, Bombay S. & M. and 34th Sikh Pioneers.
7th Indian Division	C.R.E., Lieut.-Colonel G. A. J. Leslie, with 1st, 3rd and 4th Field Companies, Bengal S. & M. and 121st Pioneers.
III CORPS	Lieut.-General W. R. Marshall.
Chief Engineer	Brigadier-General E. P. Johnson.
13th Division	C.R.E., Lieut.-Colonel E. C. Tylden-Pattenson, with 71st, 72nd and 88th Field Companies, R.E. and 8th (Welch) Pioneers.
14th Indian Division	C.R.E., Lieut.-Colonel E. C. Ogilvie, with 12th, 13th and 15th Field Companies, Madras S. & M. and 128th Pioneers.
ARMY TROOPS	Nos. 1 and 2 Bridging Trains, Bengal S. & M., 64th Pioneers and several Labour Corps units.
L. OF C. TROOPS	Tehri-Garhwal Sapper Company and No. 3 Bridging Train, Bombay S. & M.
15TH INDIAN DIVISION (on the Euphrates)	C.R.E., Lieut.-Colonel C. B. L. Greenstreet, with 1/3rd Northumbrian Field Company, R.E. Malerkotla Sapper Company and 48th Pioneers, and with 3/1st and 2/2nd Northumbrian Field Companies, R.E., en route. (Later renamed 448th, 451st and 450th Field Companies.)

On 10th December, the I Corps was facing Sannaiyat on the left bank and holding a wide area on the right bank as far up stream as the Sinn Abtar and Dujaila redoubts in the Es Sinn position. The III Corps was assembled to the west of this position, and the 6th and 7th Cavalry Brigades were waiting at Arab Village below

Fallahiya. General Maude's first objective was the line of the Shatt al Hai, the seizure of which was entrusted to the cavalry and the 40th Infantry Brigade. This was carried out successfully after a night march on 13th/14th December, and at dawn the infantry were at Atab and the cavalry at Basrugiya, a few miles down stream. During their twenty-five-mile march from Arab Village, the cavalry were guided by Captains E. K. Squires and D. Mc. A. Hogg, the field troop commanders. "Squires deputed me to lead for the first twelve miles" writes Hogg. "Then he undertook the remainder himself on one long compass bearing while I and others checked him for direction and distance. We arrived exactly on the objective." The 88th Field Company, R.E., and No. 2 (Mobile) Bridging Train, Bengal S. & M., accompanied the 40th Brigade. Thus began Maude's great offensive leading eventually to the capture of Baghdad. On 14th December the III Corps advanced and by nightfall was in contact with the enemy's defences in the Khudhaira Bend and the Hai Salient. The cavalry reconnoitred up the Hai effluent towards Kut and in the direction of Shumran. Recognizing the threat to his bridge on the down-stream arm of the Shumran Bend, Halil Pasha dismantled it after dark and re-erected it beyond the bend.

CAPTURE OF THE KHUDHAIRA AND DAHRA BENDS

A pause now ensued while Maude consolidated his position. His engineer troops built six bridges across the Hai and began to extend a light railway from Sinn Abtar to Atab. While the I Corps assumed responsibility for the Tigris right bank up to Maqasis, the III Corps crept slowly up the Hai until its left was within two miles of the river bank opposite Kut. Two mobile columns were organized at Besouia, above Atab, as a striking force to act against Halil's communications up stream of Kut. The first was to move to the Husaini Bend, the next above Shumran, to attempt a crossing of the river, while the second covered the operation and shelled the enemy's bridge.

The Husaini Crossing was essayed on 20th December. No. 2 Bridging Train accompanied the main thrust, and Witts led a section to the river bank along an irrigation cutting while the infantry covered his advance. One pontoon was launched and manned, but the enemy was ready. Witts was wounded, and the casualties among other ranks were so severe that the attempt was abandoned and both columns returned to Besouia. The two field troops were with the screening cavalry.

Resorting to more deliberate methods, the first major operation was the clearance of the Khudhaira Bend from which the enemy could flood parts of our trench system on the right bank. This task was allotted to the 3rd Indian Division (I Corps) and was begun on 9th January, 1917, the engineer units concerned being the 18th and 20th Companies, Bombay S. & M. It occupied ten days of trench fighting and cost 1,639 casualties.* Meanwhile, the III Corps prepared to attack the Hai Salient. The 13th Division faced the eastern and southern faces, with the 14th Indian Division prolonging the line to the west. On 25th January the 13th Division advanced astride the Hai and made some progress on the east bank, and on the 26th the 14th Division moved a short distance up the west bank. The III Corps continued to gain ground slowly and, on 1st February, launched a general attack on both banks. The assault on the east bank having attained its objective, General Marshall transferred the 13th Division to the west bank to help the 14th Division which was held up. On 3rd February, the 14th Division renewed the assault and made some headway, though at heavy cost; but the Turks had also suffered so severely that they withdrew from the Hai Salient into the Dahra Bend to hold a line from Woolpress Village, opposite Kut, to the southern end of the Shumran Bend.

Operations against the enemy in the Dahra Bend began on 9th February. Woolpress Village fell on the following day and the Turks in the bend were soon hemmed in with no means of escape except by ferrying. After a severe struggle on the 12th, the III Corps prepared for the final assault on the right bank. This was delivered on 15th February, and before dawn on the 16th the Dahra Bend was in our possession. At last Maude was well placed to force a crossing of the Tigris. His chief concern was to mystify the enemy sufficiently to avoid heavy casualties.

Though the R.E. field companies had much hard and exacting work in the trench warfare ending with the occupation of the Dahra Bend, they were never used as infantry in the assault as the Sappers and Miners had been in earlier fighting. Captain H. B. W. Hughes† (O.C. 88th Company) records that the work was chiefly sapping and

* See article in *R.E. Journal*, September, 1937, by Lieut.-Colonel E. V. Binney, who describes the work of sappers and pioneers on what were almost siege operations.

† Later to be E.-in-C., Middle East Forces, 1940-4, Chief Engineer to General Eisenhower (Supreme Commander Allied Expeditionary Force, 1944) and E.-in-C. at the War Office, 1945.

taping trenches for night-digging by the infantry. Often the line advanced less than a hundred yards in twenty-four hours, and casualties were heavy because the ground was flat and open. Captain W. H. Roberts (O.C. 71st Company) had a similar experience. Eventually, when the 13th Division advanced by direct assault, the engineer units were split up into small parties to make and wire strong-points at junctions of trenches in the Turkish lines, an employment of technical troops which would be frowned upon in modern war. The 7th Field Troop, operating on the left flank with the cavalry, was engaged in improving tracks and ramping the steep sides of dry canals.

THE SHUMRAN CROSSING AND FALL OF KUT

The main operational task of the Royal Engineers and Sappers and Miners in the Baghdad Campaign was certainly the bridging of the Tigris and its tributaries. Three outstanding crossings were made under fire: at Shumran on the Tigris, a crossing which was mainly the concern of the Sappers and Miners; and later, on the Diyala and Adhaim tributaries, where the R.E. field companies played the leading part. The next most important engineer work at the front was road-making and ramping *nullahs*, and lastly water supply, filtration and chlorination. Naturally, the units had many other duties, but being of a normal nature they call for no special remark.

Before the Dahra Bend operations started, General Maude had ordered Witts to reconnoitre secretly for a possible crossing in motor lighters at the mouth of the Hai opposite Kut; but this scheme was abandoned, and after the Dahra Bend had been cleared, a spell of bad weather prevented any attempt at crossing higher up at Shumran. Meanwhile, the enemy was encouraged to believe that Kut was the selected spot. Rowers were trained in pontoons on the Hai, and a section of the 88th Company erected observation ladders near Woolpress Village and threw timber about to make as much noise as possible after dark, while at Shumran the enemy was rendered thoroughly accustomed to the sound of transport moving by night. Thus the stage was set for a great drama.

The Shumran crossing deserves a permanent place in military history. It was allotted to the III Corps. The I Corps was to pin down the enemy at Sannaiyat and guard the river line, and the cavalry to screen the movements on the right bank. The preparatory

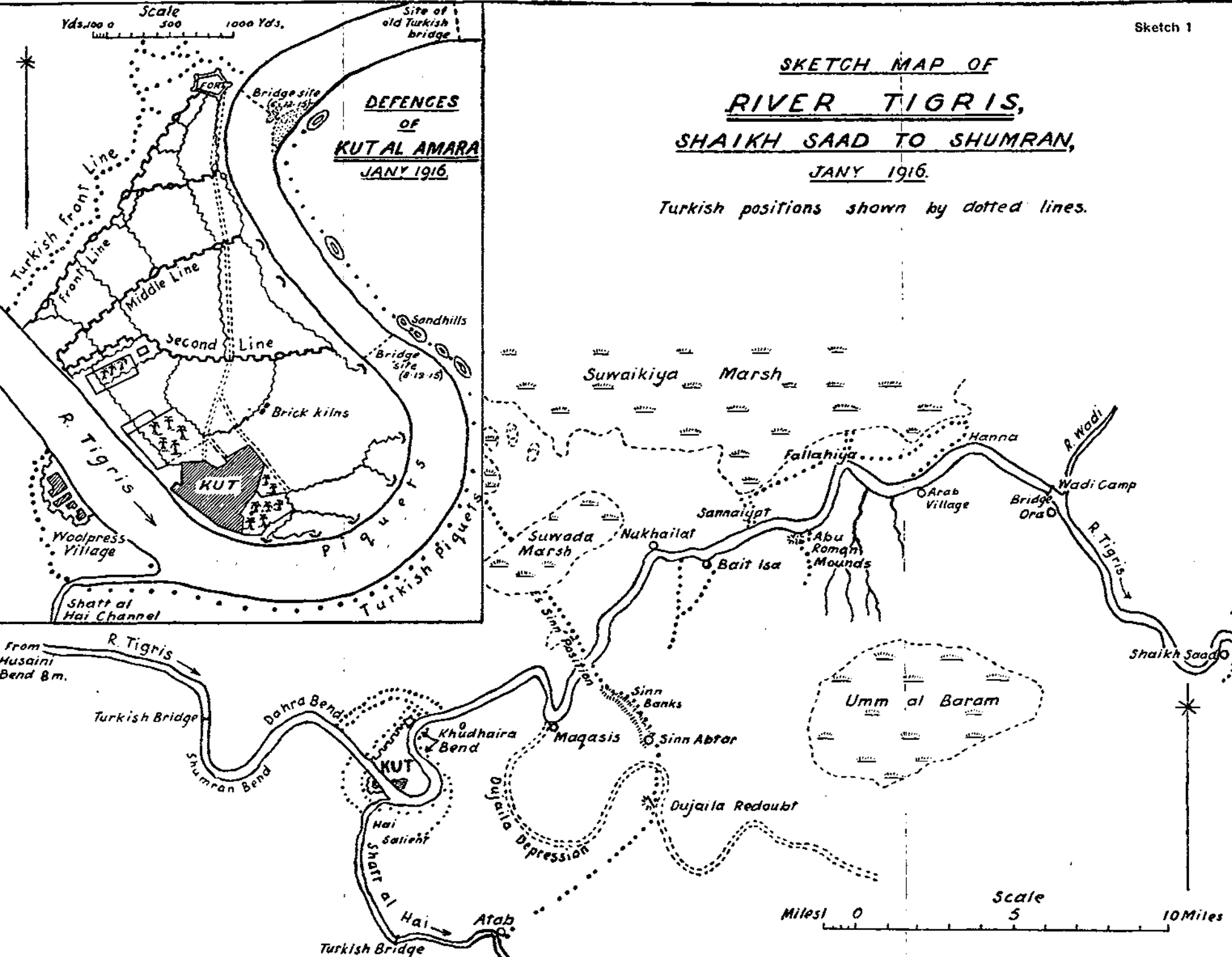
operations opened badly. On 17th February, the 7th Division assaulted the Sannaiyat position in heavy rain and was repulsed. Bad weather continued until the 21st, but on the 22nd some lines of trenches were captured at Sannaiyat. During the ensuing night, a raid by a detachment of the 3rd Division across the Tigris at Maqassis below Kut succeeded in attracting some of the enemy's reserves. A further, but less effective, diversion was caused by a feint by the 13th Division opposite Kut. On this occasion the 88th Company redoubled its efforts to make noises at Woolpress Village, but no pontoons were manned. All was now ready for the attempt at Shumran. The 14th Division was to cross the Tigris by a pontoon bridge at the apex of the bend, after covering troops had been ferried to the left bank and had established a bridgehead. Ferrying was to be directed by Major S. Pemberton (O.C. 12th Company, Madras S. & M.) and bridging by Captain F. V. B. Witts. During the night of 22nd/23rd February Witts' Bridging Train, escorted by a company of Welch Pioneers distributed throughout its length, marched towards the selected site and parked in a dry *nullah* bed about a mile from the river. The pioneers then moved forward to dig ramps through the high river bank for launching pontoons.

Ferrying was to be carried out at three sites down stream of the point selected for bridging, by battalions of the 37th Brigade with volunteer rowers drawn mostly from engineer units. Thirteen pontoons were allotted to each site, each with a crew of five and carrying ten infantrymen. Relief and reserve rowers were detailed. The routes to the ferries were marked with small heaps of earth. Wheel-axles were smothered in grease, and the strictest silence was enjoined on all ranks. The ferrying columns set out after dark on 22nd February; a hundred volunteer rowers from the 71st, 72nd and 88th Companies being detailed for No. 1 Ferry, that next below the bridge site. The columns halted some distance from the river and the ferrying pontoons were carried forward to the bank. At 1 a.m. all was quiet on both sides of the Tigris. There was no hint of the storm to come.

Ferrying began shortly before dawn on 23rd February, 1917. At first it was undetected by the enemy. Then heavy fire was opened on the pontoons of Nos. 2 and 3 Ferries. Many were sunk, and the small parties of Gurkhas who gained a footing on the left bank could do no more than hold on. At 8.30 a.m. it was decided to close No. 2 Ferry, and at 10 a.m., No. 3. Many gallant rowers of the 12th and 13th Saper companies had perished. There remained only No. 1 Ferry

SKETCH MAP OF
RIVER TIGRIS,
SHAIKH SAAD TO SHUMRAN,
JANY 1916.

Turkish positions shown by dotted lines.



where, fortunately, success had attended the efforts of the R.E. rowers. The 2nd Norfolk Regiment had been landed and had occupied a line some 500 yards from the bank without encountering serious resistance. Reinforcements continued to arrive by ferry and, against stiffening opposition, the Norfolks began to extend their bridgehead slowly down stream towards the hard-pressed Gurkhas.

We turn now to the bridging operations. The 71st Company, having been detailed to assist No. 2 (Mobile) Bridging Train, Roberts marched his unit to the bridging site before dawn. Witts and most of his sappers arrived there before 6 a.m. and an hour later, although no adequate bridgehead had yet been secured, orders came that bridge construction should commence forthwith to give moral support to the troops across the river. Accordingly, the pontoon carts and superstructure wagons came up at a gallop at wide intervals across the open plain, unloaded and galloped back. The losses were miraculously small because the Turkish gunners were concentrating their fire on a concealed line of approach. By 8.30 a.m. the shore transom of the bridge was in position. Progress was checked for a time by the difficulty of laying anchors from pontoons rowed against the rapid current, but Witts had foreseen this eventuality and had two small motor-boats ready. These lumbered forward on swaying wagons, each drawn by twelve bullocks and towering eleven feet in the air. They arrived undamaged and were quickly launched by the 71st Company through a cut in the bank. They were used not only for anchor-laying but also for ferrying. By 11.30 a.m., when the Norfolks had cleared the far bank, bridge construction was continuing almost unmolested, though by the necessarily slow method of "forming up," and at 4.30 p.m., after eight hours' work, a 295-yd. bridge was ready for traffic. It was a fine achievement. The 14th Division poured across until midnight, followed by the cavalry and the 13th Division, with whom marched the 72nd and 88th Companies. The 71st Company remained for two days at the bridge to assist the Bridging Train in its maintenance.

On 24th February, after a heavy attack by the 7th Division, the Turks at Sannaiyat abandoned their last trenches and withdrew up stream past Kut. In spite of stiff opposition, the II Corps broke out of the Shumran peninsula and surged forward on 25th February in a pursuit up the left bank. The Turkish retreat was converted into a rout by a naval bombardment on the following day, and on the 27th our cavalry occupied Aziziya (see Map 1).

THE DIYALA CROSSING AND FALL OF BAGHDAD

(See Sketch 2, facing p. 70)

Maude then halted to reorganize his scattered command and obtain permission to attempt the capture of Baghdad. On 5th March the III Corps advanced to Lajj, below Ctesiphon, while the Turkish 18th Corps took up an entrenched position along the Diyala tributary to bar the way to the capital. The III Corps immediately prepared to force a crossing of the Diyala on the left bank while the I Corps and cavalry crossed the Tigris by a bridge below the mouth of the Diyala and advanced up the right bank.

The Diyala crossing, though a small affair compared with Shumran, gave the field companies an opportunity to show their worth in the face of grim opposition. The stream was only 120 yards wide, but houses, trees and walled gardens on its high banks afforded cover to the enemy's machine-gunners and observation posts. The Turks were on the alert and it was evident that a crossing could be secured only by hard fighting. On 7th March, 1917, the advanced guard of the III Corps, consisting of the 38th Brigade (13th Division), with the 71st and 72nd Companies and the 8th Welch Pioneers, was a few miles south-east of Diyala Village. It fell to the 71st Company to share in the first attempt. Roberts writes "I had a number of pontoons with me. The Brigade Commander told us we were to cross the river that night well up stream of the site of a dismantled Turkish road-bridge. No proper reconnaissance had been possible and I had not even seen the river, but after much difficulty in moving our awkward pontoon wagons across country in the dark, we arrived at the selected spot."

Ramps were dug and a few pontoons carried to the water's edge; but when, crammed with infantry, they set out for the far bank in bright moonlight, they came under a murderous fire. All the occupants were killed or wounded and the pontoons lost. The attempt was renewed further up stream on the night of 8th/9th March, the R.E. unit concerned on this occasion being the 72nd Company. Again, heavy opposition was encountered. Three pontoons were lost, but a hundred men of the Loyal North Lancashire Regiment were landed on the far bank where they repelled all counter-attacks and, assisted by a heavy artillery barrage, gallantly held their isolated position. The third attempt, on 10th March, was completely successful. At 4 a.m., after an artillery bombardment, the 6th East Lancashires and 71st Company began to cross near the site of the North Lancashire exploit, and the 5th Wiltshires

and 88th Company higher up the river. There were few casualties for the Turks were already abandoning their trenches. The 88th Company had to fill in many *nullahs* during the approach march and the time spent in hauling the pontoons across unreconnoitred country nearly ruined the chances of an initial crossing before dawn. However, by a final dash, the river was reached in time, and at 10 a.m. the entire 38th Brigade was on the right bank. A detachment of No. 2 Bridging Train completed a pontoon bridge at Diyala Village at 11.30 a.m., and the remainder of the 13th Division crossed in pursuit of the enemy. The arrangements for the Diyala crossing are open to criticism. There was insufficient planning and reconnaissance, and this resulted in heavy casualties without a compensating saving of time. But the infantry fought magnificently, and the R.E. companies helped them materially in overcoming a formidable obstacle, stoutly defended.

On the night of 9th/10th March, while the 13th Division was engaged on the Diyala, the Turks abandoned a powerful position on the right bank of the Tigris where they had held up the 7th Division and part of the 3rd Division; and finally, during the following night, they withdrew beyond Baghdad. On 11th March, 1917, General Maude's victorious army entered the city. The goal of British policy had been attained.

ADVANCE FROM BAGHDAD AND THE ADHAIM CROSSING

Nevertheless, strategically, much remained to be done. The enemy was still in the field and the situation demanded that Maude should strike early in several directions—westward to the Euphrates, northward up the Tigris and north-eastward towards the Russians in Persia. His immediate aim was to overwhelm the Turkish XIII Corps on the Upper Diyala, in co-operation with the Russians, while he held the XVIII Corps on the Upper Tigris; but our allies would not debouch from Persia, and consequently, he was obliged to shoulder the whole burden. Caution was necessary. The Gallipoli campaign had failed, and Turkey was known to be preparing a *Yilderim* (thunder-bolt) army for the recapture of Baghdad. Deprived of Russian co-operation, Maude planned to contain the XIII Corps with his III Corps while he struck at the XVIII Corps, astride the Tigris, with his I Corps. The 7th Division defeated the XVIII Corps at Balad, on the right bank below Samarra, on 8th April, 1917, and detachments of the III Corps succeeded in forcing the XIII Corps to withdraw into the Jabal Hamrin, a bare range of

hills extending north-westwards between the upper reaches of the Diyala and the Tigris. A defensive position was then constructed on the Baghdad-Samarra railway near Balad.

The III Corps continued to advance up the Tigris and on 18th April forced a crossing of the Shatt al Adhaim tributary on the left bank. The Adhaim crossing was the third conspicuous engineering exploit in the campaign of 1917, the R.E. unit concerned being the 71st Company. The river, at the moment, was only 80 yds. wide, but the enemy was strongly entrenched on precipitous heights beyond it. The 38th Brigade (13th Division) was ordered to establish a bridgehead. Before dawn two battalions were ferried across some distance below the bridge site and, advancing northwards in conjunction with a frontal attack by another battalion, cleared the enemy from his positions overlooking the river. Roberts records that, from an engineering point of view, the Adhaim crossing was simple and straightforward. He had been able to reconnoitre the river bank on the previous night and, subject to certain limitations, was allowed to select the actual bridge site. The reconnoitring party came under fire, but the enemy did not seem to realize that this was the selected point. The 71st Company had been given a number of pontoons. These were used at first for ferrying and afterwards for bridging. For a time, bridge construction proceeded rapidly because the water was shallow, but subsequent progress was checked by quicksands. Roberts had chosen a site where it seemed that no trestles would be needed; but a falling water-level caused some of the pontoons to ground and necessitated their replacement by trestles which gave trouble in the treacherous river bed. The bridge was completed without serious opposition and before noon the 35th Brigade, preceded by a cavalry brigade, began to cross in support of the 38th. The cavalry converted the enemy's retreat into a rout. Some 1,200 prisoners were taken, but had it not been for the delay in bridging caused by the quicksands, the entire Turkish force might have been rounded up. No difficult situations developed as at Shumran and on the Diyala, but the Adhaim crossing presents a fine example of efficient R.E. work in a well planned operation.

DEFENCE OF BAGHDAD, SUMMER, 1917

After ejecting the enemy from Istabulat on 21st April, 1917, the I Corps occupied Samarra on the 24th. During the last week of April, the III Corps, driving the Turkish XIII Corps up the Adhaim, severely defeated it at Band-i-Adhaim on 30th April and forced it

to retire to Kirkuk. By the end of May, both Corps had selected their defensive positions for the ensuing hot weather, during which extensive military operations would hardly be possible. The I Corps, in open desert on the right bank of the Tigris, adopted the Flanders system of lines of deep, continuous fire trenches with dug-outs, communication trenches and rallying points. The III Corps east of the Tigris, in cultivated and undulating country, dotted with villages and palm-groves and intersected with irrigation cuts, favoured a more elastic system adapted to the ground. The extent of its defensive front to the north and north-east was so great that a continuous trench-system was impossible. The front was divided into divisional or brigade areas, each with a main defensive position from which covered approaches radiated forward to advanced posts. Obstacles were freely used. The infantry dug and wired, but the layout was undertaken by R.E. officers. Engineer materials and stores were deficient, particularly timber. The Engineer-in-Chief recorded in June that hutting material was still slow in reaching Baghdad because no less than thirty-two steamers had broken down. In August he complained that only 2,500 tons of engineer stores had arrived out of an allotment of 5,200 tons, and in September that his bridging equipment was almost exhausted and that for the past month no up-river tonnage whatever had been allotted to his stores. Under such handicaps it is creditable that the engineers were able to complete their defensive schemes and provide hutting accommodation for essential services behind the line.

There is nothing abnormal to record of the work of the 71st, 72nd and 88th Companies during the hot weather. Apart from planning defences and supervising infantry working parties, their chief responsibilities were water supply, small bridging, the occasional maintenance of large bridges and the improvement of communications. The 7th Field Troop performed similar duties with the cavalry. The III Corps re-entered Shahraban in August, and, driving the Turkish XIII Corps from the southern end of the Jabal Hamrin, occupied Qizil Ribat and the extension of the Jabal lying east of the Diyala. The Baghdad area was thus rendered secure from the north, and all that remained was to finish the war by a great offensive up both banks of the Tigris towards Mosul while adequate forces guarded against interference down the Euphrates. Turkey was now too much concerned with General Allenby's concentration of troops for the invasion of Palestine to be able to dispatch a *Yilderim* army to regain lost territory in Mesopotamia.

CHAPTER V

OPERATIONS ON THE EUPHRATES

Defence of Nasiriya—Capture of Ramadi, September, 1917—The advance to Hit—The capture of Khan Baghdadi, March, 1918.

(See Map 1)

DEFENCE OF NASIRIYA

ALTHOUGH the Lower Euphrates had little value as a line of communication in the conquest of Mesopotamia owing to the shallowness of its channel through the Hammar Lake, it was necessary to occupy it in order to guard the left flank of the main advance up the Tigris. From Qurna to the Hammar Lake, and beyond the lake to within a few miles of Nasiriya, an ill-defined channel runs through swamps, and navigation is slow and difficult, particularly during the flood season. Afterwards, the course is easier to follow, though the adjacent country is inundated in the spring. Above Samawa, the river flows in two branches, the Hilla and Hindiya, from the great Hindiya Barrage below Musaiyib. Up stream from the barrage as far as Falluja, though wide, it is navigable only by vessels of very shallow draught. On the whole it may be said that the Euphrates hindered rather than helped the main operations up the Tigris. It introduced an element of uncertainty. The Muntafik and other Arab tribes along its route were generally hostile in their attitude; and even after Nasiriya had been occupied by the 12th Indian Division under General Gorringe in July, 1915, there was always the possibility that Turkish reinforcements might be floated down stream to interrupt the Tigris line of communication and raise the Arab tribes against us.

At the end of 1915, Nasiriya was held only by the 12th Infantry Brigade under Brigadier-General H. T. Brooking. Beyond it, the Turks were in full control. General Townshend was besieged in Kut, and the Tigris Corps had yet to capture Shaikh Saad. The policy on the Euphrates front was to maintain an active defence. No reinforcements were available and shipping was scarce. General

Nixon had recommended in August that a railway should be constructed from Basra to Nasiriya, but sanction was accorded only when the fall of Kut appeared imminent and everything was in the melting-pot. Thus it happened that, even after Nixon's failure at Ctesiphon, the garrison of Nasiriya was still supplied only by small river craft moving slowly and precariously through swampy channels. The railway was not completed until the end of 1916.

An unfortunate incident occurred on the Shatt al Hai in February, 1916, when a mixed detachment of 1,600 men under Brigadier-General E. C. Tidswell (34th Brigade) was demonstrating against hostile Arabs from Shatra. On 7th February, Tidswell was ordered to withdraw and, harassed by the tribesmen, retired through a supporting force sent from Nasiriya. The Indian troops of this force became disorganized under the determined attacks of 5,000 Arabs, and Tidswell suffered 373 casualties in extricating the combined detachments. General Brooking afterwards restored British prestige by punitive operations from Nasiriya against several villages; but the Arabs from Shatra and the marshes farther south continued to show hostility, and some minor expeditions, involving river gun-boats, were undertaken. Although the Nasiriya garrison now consisted of the 12th and part of the 34th Brigades, there was no engineer unit on the Euphrates other than one section of the 12th Company, Madras S. & M., stationed at Suq ash Shuyukh, some twenty miles below.

During the spring of 1916, the Euphrates front was strengthened by the formation of the 15th Indian Division from the 12th, 34th and 42nd Brigades. The command was given to Major-General H. T. Brooking, an ex-pioneer officer and a most capable and resourceful leader who realized fully the gravity of the Arab danger on the Euphrates and lost no time in securing his position on the lower reaches of the river. Nasiriya was garrisoned by the 12th and 42nd Brigades, with the 34th Brigade in support at Khamisiya and Akaika near Suq ash Shuyukh. The engineer units were the 4th Company, Bengal S. & M., the Malerkotla Sapper Company and the 48th Pioneers, under Lieut.-Colonel W. V. Scudamore, C.R.E. 15th Division. Their work consisted mainly of hutting, flood-control and water supply, but they also built observation towers, improved communications and provided bullet-proof protection for gun-boats. They learnt their hutting from the Marsh Arabs, whose reed huts were fairly weather-proof and afforded good protection from heat. Flood-control presented serious problems. The Euphrates often

overflowed at points far above Nasiriya, and pouring inland, threatened the defended area with inundation. When military labour could not cope with the situation, the local Arabs and their women-folk, much to their disgust, were pressed into service to meet the emergency. Water was a more dangerous foe than the Turk, for an enemy offensive down the Euphrates during the summer of 1916 was improbable. There were no signs of any preparations near Nasiriya, and it was known that the Turks were hated by the Shiah populations of the holy cities of Karbala and Najaf. Brooking had sufficient strength to control any subversive elements of the Muntafik confederation of tribes and could easily suppress the degenerate Marsh Arabs. The conditions of life were better than on the Tigris front for the troops were comfortably housed and well supplied, but they suffered severely from the intolerably damp heat and prevalent malaria.

Early in September, 1916, when the floods were subsiding, Arab bands started hostilities on the left bank near Nasiriya, culminating on 9th September in a determined attack on a small mixed force by the inhabitants of an adjacent village. On 11th September Brooking employed two columns to deal with the insurgents. Three hours of close fighting followed. We lost 196 men but inflicted more than 1,000 casualties on the Arabs and taught them a salutary lesson. The 4th Company, Bengal S. & M., and half the Malerkotla Sapper Company, were concerned in this operation, during which they demolished a number of Arab homesteads in a style learnt on the N.W. Frontier of India.

At the end of 1916, when Lieut.-Colonel C. B. L. Greenstreet was C.R.E., a Royal Engineer unit appeared for the first time on the Euphrates front. This was the 1/3rd Northumbrian Field Company, a Territorial formation. It reached Nasiriya on 30th November and was soon to be followed by the 3/1st and 2/2nd Companies. These units were renamed the 448th, 451st and 450th Field Companies, R.E., respectively. After the arrival of the 1/3rd Company, the 4th Company, Bengal S. & M., was released to rejoin the 7th Division for the offensive on the Tigris. In February, 1917, Greenstreet was succeeded by Lieut.-Colonel J. F. Turner as C.R.E. 15th Division. Two months later, after General Maude had captured Baghdad, the division was transferred to the Tigris front with the exception of the 12th Brigade, the field companies, and the 48th Pioneers. Nasiriya and other points on the Lower Euphrates were then far from the scene of battle and small garrisons were sufficient

for their protection from Arab raiders. Subsequently, the river was occupied gradually up to Hilla and bridged in several places by engineer units.

CAPTURE OF RAMADI, SEPTEMBER, 1917

Soon after the occupation of Baghdad, General Maude dispatched a brigade of the 1st Corps towards the Euphrates at Falluja above which the Turks had cut the dam at the mouth of the Sakhlawiya Canal in order to inundate the country west of Baghdad and interfere with our railway construction. No resistance was encountered, and Falluja and the mouth of the canal were seized on 18th March, 1917. As Falluja lies within thirty miles of Baghdad, its occupation was essential in the scheme for guarding the capital against a Turkish *Yilderim* army that might advance down the Euphrates. The enemy was already establishing depots of supplies and ammunition at Ramadi, Hit, Khan Baghdadi and Ana higher up the river. In June, Maude began to contemplate reconstructing the Sakhlawiya Dam and decided that, to cover the working parties, he must occupy Dhibban and, if possible, Ramadi. The task was entrusted to the 7th Brigade and other troops under Colonel C. L. Haldane. They reached Dhibban on 10th July; but an attempt on Ramadi on the 12th failed at a cost of nearly 600 casualties, due mostly to the extreme heat.

By the middle of September, 1917, the 15th Division had practically completed its concentration in the Baghdad area, and with it the 448th, 450th and 451st Field Companies. The time had come for a second attempt on Ramadi. The 15th Division, the 6th Cavalry Brigade; and the 50th Brigade Group at Falluja were chosen for the operation. On 26th September, General Brooking assembled his force at Madhij, some fifteen miles below Ramadi, and the 12th and 42nd Brigades started their advance after dark. Communication across the Euphrates at Falluja had been improved by the construction of a pontoon bridge by a detachment of No. 1 Bridging Train, Bengal S. & M., to reinforce an existing boat-bridge. The field companies had much road-repair work to do in the forward areas on the right bank. Brooking ordered the 6th Cavalry Brigade to cross a dam at the mouth of a canal leading southwards from below Ramadi and then to move westwards to cut the enemy's line of retreat up the river bank and attack his rear, while the 42nd Brigade seized some commanding heights and the 12th Brigade

the Aleppo road. The mobile column was then launched in pursuit of the remnants of the Turkish force which had escaped before the road was closed, and covering seventy miles in forty-eight hours, brought the total of prisoners to more than 5,000. Zest was added to this chase by the prospect of rescuing two British officers, Lieut.-Colonel J. E. Tennant, R.F.C., and Major P. C. S. Hobart,* R.E., who had been shot down while on an aerial reconnaissance near Khan Baghdadi on 25th March. At Ana it was learned on the 28th that the captives had recently left for Aleppo on camels, but they were overhauled and rescued, some thirty-two miles farther on, by armoured cars.

This dramatic episode concluded the offensive operations on the Euphrates. Withdrawing his advanced forces from Ana, after destroying many dumps of ammunition and stores, General Brooking concentrated the 15th Division at Khan Baghdadi with a brigade group at Haditha, thirty miles up stream. As at Ramadi, surprise had been an important element in his success. The Euphrates front was now absolutely secure, for the bulk of the enemy had been killed, dispersed or captured and his forward depots demolished.

During the summer of 1918, the field companies on the Euphrates were employed chiefly on water-supply, road-making, bridging and hutting. No. 2 Bridging Train, Bengal S. & M., bridged the river at several places and on one occasion caused much consternation among the enemy when mistaken for a column of artillery on the march. Occasional violent storms occurred, in one of which, a 300-yd. pontoon bridge was swamped and swept away. All three companies remained on the Euphrates until September, 1918, when the 448th and 450th were attached to the I Corps on the Tigris. The 15th Division held the river line from Hilla northwards until replaced by the 17th Division in March, 1919, when it was disbanded and the R.E. units were sent to India for demobilization. It left a splendid record behind it, for although rarely in the limelight, it formed a sure and certain guard to General Marshall's left flank in the final overthrow of the Turkish forces in Mesopotamia.

* For his subsequent career see pages 231 and 232.

CHAPTER VI

OPERATIONS IN NORTHERN MESOPOTAMIA

Advance to the Jabal Hamrin, Autumn, 1917—Capture of Kirkuk, April, 1918—Advance to the Little Zab, October, 1918—Turkish surrender at Mosul.

(See Sketch 2, facing p. 70)

ADVANCE TO THE JABAL HAMRIN, AUTUMN, 1917

FROM the summer of 1917 there was little change in the strategic situation in Mesopotamia until the final offensive up the Tigris in the autumn of 1918. No help could be expected from Russia, whose troops in the Caucasus and Persia were melting away. Attention in the Middle East was focused on Palestine. At Kifri and Kirkuk, at Tikrit on the Tigris and at Hit on the Euphrates, the Turkish 6th Army lay inert, its reinforcements diverted to oppose General Allenby.

Early in October, 1917, the III Indian Corps under Lieut.-General Sir William R. Marshall faced the Turkish XIII Corps north and north-east of Baghdad. The 14th Indian Division (Major-General Sir R. G. Egerton) held a line from Shahraban along the left bank of the Diyala as far south as Windiya, westward of which the 13th Division (Major-General Sir Walter de S. Cayley) extended the line to a point on the Tigris near Sindiya. As the weather was now cooler and a light railway had been laid to Shahraban, General Maude decided to occupy the portion of the Jabal Hamrin east of the Diyala in order to gain control of the headworks of the canals fed by that river. This task was entrusted to the III Corps. Marshall's plan was to drive the Turks from their advanced position about Delli Abbas, west of the river, and then to hold them in front while his main attack developed against their left flank. His striking force was organized in three groups, the right and centre under Major-General Egerton, and the left, with which were the 71st and 88th Field Companies, under Major-General Cayley. The operations went according to plan. On 18th October, the Left Group occupied

new 17th and 18th Divisions. As it was agreed that the policy in Mesopotamia should be restricted to an active defence, attention was concentrated on Persian commitments, operations above Hit, and a blockade of Najaf (ninety miles south of Baghdad), where a political officer had been murdered. Floods on the Tigris and Diyala kept the engineer units busy on the maintenance and reconstruction of many bridges. However, from 24th to 29th April, the 71st and 88th Companies and the 7th Field Troop were engaged in operations by the III Corps under General Egerton, who was given the task of clearing the Turks out of all the country between the Diyala and Little Zab Rivers. Corps Headquarters and the 13th Division (C.R.E. Lieut.-Colonel E. C. Tylden-Pattenson) operated across the Jabal Hamrin, about ten miles north of the Diyala, to Tuz Khurmatli, where the Turks, retiring from Kifri under pressure of the 14th Division (C.R.E., Lieut.-Colonel H. S. Gaskell) were heavily defeated and lost 1,200 prisoners, all their guns, and most of their transport. The 14th Division established itself at Kifri and on the line of communication to Tuz Khurmatli, while Egerton and the 13th Division pushed on to Kirkuk, meeting with little opposition *en route*. The 6th Cavalry Brigade had some fighting when operating beyond Kirkuk almost to Altun Kopri. Corps Headquarters and the 13th Division occupied Kirkuk for about three weeks, the line of communication being switched to the Adhaim route; but as the distance was soon found to be excessive, Kirkuk was evacuated and Egerton withdrew to Tuz Khurmatli and Kifri before going into summer quarters. The engineer units in the Kifri area, in addition to their normal work, were employed in collecting oil from wells, mining coal, and destroying Turkish ammunition. The successful operations towards Kirkuk ensured adequate protection for the Persian line of communication through Khaniqin, Qasr-i-Shirin and Kerman-shah to Hamadan and beyond.

The importance of bridging during the first half of 1918 may be judged from a perusal of the Engineer-in-Chief's Diary, where the following entries appear: "India can supply only 73 out of 800 rolled steel beams ordered for steel pontoon bridges"; "Adhaim (piled) and Akab (pontoon) bridges carried away"; "C.E. I Corps making light suspension bridges over Adhaim"; "Captain Witts experimenting with British and Indian baulks"; "Adhaim suspension bridge being erected by Malerkotla Sappers"; "Stormy weather. Musiyeh bridge damaged"; "Heavy pontoon bridges at Sadiya and Dhibban required to carry tractors and heavy

artillery"; "New bridge at Nasiriya"; "Samarra and Hit pontoon bridges damaged"; "Baghdad South Bridge broken twice by flood"; "Heavy bridge at Narin Kopri (south of Qara Tepe) to be put in hand at once"; "Dizful* Bridge"; "New Hilla bridge opened for lorries up to 8 tons"; "Sar-i-Mil bridge requires strengthening"; "Adhaim silting up. Bridge removed"; "New Baghdad South Bridge." Month by month, until the end of the war, the Diary has entries about bridging, a fact which is scarcely surprising in view of the undeveloped state of the road and rail communications. The engineer units carried out a vast amount of road-bridging, sometimes with date palms when no better timber was available. The friable nature of the soil necessitated the use of wire-netting on all roads intended for motor traffic. As there was now an ample supply of matting, *bullies* and corrugated iron, the units were employed frequently on camp construction. In addition, during the summer, the 71st and 88th Companies and some Sapper and Miner units built bridges and made tunnels on the light railway line from north of Shahraban, through the Diyala gorge (between Ruz and Qizil Ribat).

ADVANCE TO THE LITTLE ZAB, OCTOBER, 1918

From an operational point of view the summer of 1918 was uneventful. New forward positions were prepared by the engineers and infantry, but activity was directed chiefly towards the reorganization of rearward areas, the setting up a civil administration and the development of local resources. In order to cover the extension of the railway beyond Samarra, Tikrit was reoccupied by the I Corps on 12th July, and railhead reached that place on 18th August. By the end of September, General Marshall was ready to resume the offensive. The main part of the Turkish Sixth Army was then holding a long-prepared position of great natural strength astride the Tigris at the Fat-ha gorge, with another, fifteen miles in rear, at the confluence of the Little Zab tributary. The offensive up the Tigris was entrusted to the I Corps and attached troops, including the 7th and 11th Cavalry Brigades, but a small column from the III Corps covered the right flank. This column, commanded by Brigadier-General A. C. Lewin, was to advance on the line Tauq-Kirkuk-Altun Kopri to prevent the enemy beyond Kirkuk from moving down the Little Zab. The 17th Division was

* 130 miles north of Basra.

centred on Tikrit and the 18th Division on Samarra, with a brigade at the Tigris-Adhaim junction. It was decided that the railway should be extended northwards as rapidly as possible since the Tikrit railhead was thirty-five miles from the Fat-ha position. As regards the III Corps, the 13th Division, west of the Diyala, had a brigade group in the Qara Tepe-Kifri-Tuz Khurmatli area and another about Delli Abbas. The 14th Division, east of the Diyala with headquarters at Mirjana, had one brigade farther up the Persian Road and another at Shahraban. The third brigade, and a brigade of the 13th Division, had gone to the Caspian with Major-General W. M. Thomson. The independent 15th Division guarded the Euphrates front north of Hit.

General Cobbe, wishing to avoid a direct attack with the I Corps on the twelve-mile length of the Fat-ha position, decided to turn the enemy's left, secure a crossing over the Little Zab and drive the enemy across to the Tigris right bank, where he might be able to cut off and destroy the entire Turkish force covering Mosul. An 18th Division Group, under Major-General H. D. Fanshawe, was to operate up the Tigris left bank, to assist the main thrust by a 17th Division Group, under Major-General G. A. J. Leslie, late R.E., on the right bank. With the 18th Division were the 2nd, 6th* and 8th Companies, Bengal S. & M., and with the 17th Division the Malerkotla and Tehri-Garhwal Sapper Companies. The 448th and 450th Field Companies formed part of the Corps Reserve at Tikrit. The 7th Field Troop was with the 7th Cavalry Brigade, under Brigadier-General C. E. G. Norton, which was attached to the 18th Division, and special missions were accorded to the 11th Cavalry Brigade, under Brigadier-General R. A. Cassels, and a light armoured motor brigade. With the exception of a section of the 71st Company detailed for Lewin's column on the extreme right, the 71st and 88th Companies took no part in the operations as they were attached to the 13th Division. The 72nd Company had already gone to Persia.

The operations began on 23rd October, 1918, when Lewin's column entered Taza Khurmatli and marched towards Kirkuk. Columns of the 18th Division advanced along the Jabal Hamrin against slight opposition and seized the Ain Nukhaila Pass, while No. 2 Bridging Train, Bengal S. & M., bridged the Tigris some twenty miles below Fat-ha. On the morning of the 24th, the 18th Division occupied the Fat-ha position on the left bank without a fight, and

* The 6th Company had replaced the 5th Company which had been transferred to the Persian L. of C.

the 17th Division marched unopposed into the right bank defences. By tamely evacuating this powerful line the enemy escaped possible encirclement and destruction. Moreover, during their retreat they were able to destroy the roads on both banks of the river in the Fat-ha gorge, thus delaying our advance and throwing an enormous amount of work on our engineer units. The right-bank road was so badly damaged that for a time it was impassable for the pack transport of the 17th Division. Every available sapper and pioneer was hurried forward for repair work, and by noon the left-bank road was fit for guns, but the right-bank road was still blocked. During the afternoon a length of three miles on the right bank was cleared sufficiently for carts to be man-handled along it, but it was easier to organize pack transport. The soil on both banks consisted of gypsum which disintegrated so rapidly into fine dust that a roadway, if opened, could be maintained only by unceasing shovelling. The demolitions gave the enemy time to reorganize in their next prepared position at Humr where the Little Zab enters the Tigris. The construction of a pontoon bridge by No. 2 Bridging Train at the Fat-ha gorge eased some of the difficulties of supply and communication across the Tigris, but the 17th Division was still severely handicapped in its advance up the right bank because its heavy artillery could not use the road on that side.

Lewin entered Kirkuk on 25th October, the Turks opposing him having withdrawn to Altun Kopri. Norton, with the 7th Cavalry Brigade, reached the Little Zab some five miles from the Tigris, and Cassels, with the 11th Cavalry Brigade, struck the river farther up stream. This threat caused the enemy to shorten their position along the Little Zab, and they began to vacate their trenches and cross the Tigris by a bridge to their right-bank positions covering Humr and running thence northwards for some miles. The Humr position was of great natural strength and held by 7,000 men with forty-two guns. Cobbe planned that a column under Fanshawe, including the 7th Cavalry Brigade and part of No. 2 Bridging Train, should advance before daylight on 26th October along the Tigris left bank direct on Sharqat, while the 11th Cavalry Brigade forded the Tigris above that place to intercept the enemy's retreat. The 17th Division was to press forward on the right bank. Fanshawe crossed the Little Zab at 11 a.m. by a bridge provided by No. 2 Bridging Train. Meanwhile, the 7th Cavalry Brigade screened from the enemy the wider movement of the 11th which, by 1 p.m., was nearing the Tigris opposite Huwaish. The L.A.M. Brigade, operating

wide on the right bank was already astride the Mosul Road, south of Huwaish. By 5 p.m., part of the 11th Cavalry Brigade had crossed the Tigris by a difficult ford at Hadraniya, thirteen miles above Sharqat, and had moved southward to Huwaish, where Cassels prepared to resist attack from south or north. The result of the operations of all columns was that, on the night of 26th/27th October, the enemy on the right bank evacuated the Humr position and retired towards Sharqat.

TURKISH SURRENDER AT MOSUL

On the morning of 27th October, Cobbe ordered the 18th Division to advance up the left bank, and Fanshawe detailed a column under Brigadier-General G. A. F. Sanders, late R.E., consisting of the 53rd Infantry Brigade with some cavalry and artillery, to push on rapidly to a point opposite Sharqat to prevent the enemy from crossing the Tigris and to assist the 11th Cavalry Brigade by reinforcement across the river and by artillery fire. Sanders acted with great promptitude, and by his energetic handling of the 53rd Brigade and attached artillery secured the 11th Cavalry Brigade in its somewhat isolated position astride the enemy's only possible line of retreat. Marching throughout the night, he reached the Tigris opposite Huwaish at 5.30 a.m. on the 28th and immediately sent forward a Gurkha battalion and some pontoons to the site of a primitive flying bridge, operated by the 5th Field Troop, Bengal S. & M., which Cassels had managed to establish below the Hadraniya ford. Thereafter, ferrying proceeded more rapidly and the Gurkhas reinforced the 11th Cavalry Brigade. Sanders's guns also came into action. The 7th Cavalry Brigade arrived at 4.15 p.m. after a forced march of forty-five miles, and crossing by the Hadraniya ford, took up a position to guard Cassels from the north. Meanwhile, the 17th Division had advanced slowly through difficult country towards the enemy entrenched three miles south of Sharqat. The Turks were now in a critical situation. Cassels' force lay across their line of retreat northwards, the 18th Division barred any escape eastwards, and to the west lay a waterless desert.

On 28th October, the 17th Division drove the enemy from the Sharqat position and, during the following night, marched towards the final Turkish position about three miles south of Huwaish. The enemy tried to break through Cassels' lines to the north and failed. Leslie also failed on the 29th when he launched the 17th Division

against the Huwaish trenches. Yet, at daybreak on 30th October, 1918, the end came suddenly with the surrender of the entire Turkish Tigris Group under Ismail Hakki Bey comprising 11,000 men with fifty-one guns. A mixed column under Fanshawe, including the two cavalry brigades and half the 8th Company, Bengal S. & M., was then dispatched towards Mosul, where, on 1st November, Ali Ihsan Pasha and the remainder of the Turkish Sixth Army surrendered after news had arrived of an armistice signed on the previous day.

It will be seen that, with the exception of the 7th Field Troop and one section of the 71st Company, the R.E. units took no part in the final offensive, though the 448th and 450th Companies worked at Tikrit on the lines of communication. The bulk of the engineering during the advance fell to Bengal S. & M. units commanded by R.E. officers. No. 2 Bridging Train, under Captain F. V. B. Witts, bridged the Tigris at several places and established a two-mile crossing of the Little Zab involving three bridges. The 2nd Company, under Captain F. G. Drew, not only laboured in the Fat-ha gorge but supplied an escort to a Ford van convoy dispatched to Cassels when he was operating far up the Little Zab. Captain E. G. Gidley-Kitchin, with the 5th Field Troop, helped Cassels materially in maintaining the essential flying bridge below Hadraniya. Other units were employed, day and night, in repairing roads, ramping *nullahs* and arranging water supplies. Though they had little fighting, they certainly paved the way to speedy victory.

After the armistice, there was much work to be done in improving and realigning the road to Mosul, and the 8th Company, stationed there, had to demolish and cleanse large areas of the city to make them fit for occupation by our troops. The 2nd Company moved up the Little Zab towards Altun Kopri where two brick-arch bridges over branches of the river had been destroyed by the Turks. These were replaced by Inglis bridges of 84 and 72-ft. span—a slow process as the stores took six weeks to reach the sites from railhead at Baiji. The company worked in the Altun Kopri area until May, 1919.

All the R.E. field units in Mesopotamia were withdrawn in February and March, 1919. The 448th, 450th and 451st Companies were sent to India when the 15th Division on the Euphrates was disbanded, and replaced by the 17th Division (C.R.E., Lieut.-Colonel H. N. North). The 7th Field Troop and 71st and 88th Companies went to the same destination. The 72nd Company, after many

curious experiences in Persia, the Caucasus and Trans-Caspia (described in the next chapter), voyaged across the Black Sea and demobilized on the Gulf of Ismid, near Constantinople. The units sent to India were accommodated on arrival in large demobilization camps at Deolali, soon to be converted into mobilization camps for raising composite units for service in the 3rd Afghan War. Three such units were formed rapidly from the R.E. personnel from Mesopotamia and were called Nos. 1, 2 and 3 Special Field Companies, R.E. They were the first units of the Corps to serve in India since the 4th, 11th, 21st and 23rd Companies arrived during the Indian Mutiny. However, they saw no active service, and after the end of the Afghan War they were demobilized and the personnel returned to England. They had proved in Mesopotamia that, under war conditions, the Territorial can soon become as efficient as the regular soldier.

CHAPTER VII

PERSIAN AND POST-WAR IRAQ OPERATIONS

Necessity for the Persian L. of C.—Work on the Persian Road—Adventures of the 72nd Field Company—The rising in Southern Kurdistan, 1919—The Mosul Bridge—The Arab rebellion, 1920—Army employment of R.E. officers in Mesopotamia.

(See Sketch 2, facing p. 70 and Map 1)

NECESSITY FOR THE PERSIAN L. OF C.

THE gradual development of the Persian Line of Communication followed in the wake of the Dunsterville Mission to the Caspian early in 1918. It was undertaken for the maintenance of the considerable forces required in Persia to protect our right flank in Mesopotamia after the collapse of Russia and to check Turco-German infiltration. The Russians had improved, to some extent, the 230-mile length between the Mesopotamian border and Hamadan, but the road was still difficult for motor traffic in the summer and almost impassable in winter. In February, Major-General Dunsterville and his staff reached Hamadan with the utmost difficulty in a convoy of Ford cars and vans and continued thence for another 267 miles to Enzeli on the Caspian; but there they were stopped by the pro-Bolshevik *Jangalis* under Kuchik Khan, and having no troops in support, Dunsterville returned to Hamadan. His subsequent experiences on the Caspian are recorded in *The Adventures of Dunsterforce*. They culminated in the gallant defence of Baku by 1,100 British troops of the 39th Brigade (13th Division) against a powerful Turkish force, during which, on 26th August, Major B. J. Haslam, the only R.E. officer present,* was killed while wiring the front. Baku, evacuated on 14th September, remained in Turkish hands until its reoccupation by part of "Norperforce" under Major-General W. M. Thomson on 17th November. These events, and others in Persia, explain the urgent necessity for the development of the Persian Road in 1918.

* At Hamadan, however, was Captain George Eve, R.E., who had joined the Mission there on 23rd April. He was an Anglo-Russian mining engineer from South America.

WORK ON THE PERSIAN ROAD

Apart from Russian advances and retreats, extensive movement along the Persian route began in the autumn of 1917 when some 40,000 Assyrian refugees called *Jelus*, flying before a Turkish advance from the Tabriz region, poured through Bijar to Hamadan and were evacuated down the line to a large tented village at Baquba which was organized and administered by Brigadier-General H. H. Austin, late R.E. The maintenance of this centre entailed much engineer work and depleted the reserves of supplies built up laboriously for the troops. Also, the migration of the hordes of refugees down the line prevented, for the time being, all protective troop movements into Persia.

In February, 1918, the nearest troops to the Persian border were detachments of the 14th Indian Division, then under Major-General Thomson, whose headquarters were at Qizil Ribat. Most of the technical units of this division (12th, 13th and 15th Companies, Madras S. & M. and 128th Pioneers under Lieut.-Colonel H. S. Gaskell as C.R.E.) were detailed to improve the route as far as the top of the Pai Taq Pass, some fifty miles from Khaniqin. Part of the road in this pass had to be entirely realigned and regraded. The summit and the narrow valley to Sar-i-Mil, ten miles beyond, was under snow till March, and thence to Karind the valley, though wider, was completely waterlogged in winter because of the black-cotton soil. By the beginning of April, the 12th and 15th Companies and 128th Pioneers, assisted by Persian and Kurdish labour, had completed a light motor road as far as Sar-i-Mil. Gaskell then pushed forward these units, together with the 5th and 52nd Companies, Bengal S. & M., and 48th Pioneers, which had now joined him, to work on the road as far as Kangavar, sixty miles beyond Kermanshah, at the same time transferring his headquarters to Sar-i-Mil. An immense amount of road-work was accomplished between the frontier at Qasr-i-Shirin and Kermanshah, but by far the most difficult section was the Pai Taq Pass. In September, 1918, as regular motor traffic was then operating as far as Hamadan, Gaskell moved his headquarters to Kermanshah and all technical troops were transferred to the Persian Line of Communication. After the armistice, the 61st and 65th Companies, Madras S. & M., relieved the 12th and 15th Companies; and the 17th (Garhwali) Labour Corps, a Madras Labour Corps, the 7th Porter Corps and finally the 7th Company, Bengal S. & M., were sent up to assist.

The road across the plateau between Harunabad and Kermanshah was very hilly and climbed several passes. Numerous diversions were needed to avoid bad soil. Beyond Kermanshah, in mountainous country, the obstacles were still more formidable. The road followed roughly the line of a Persian track leading through Bisitun and Kangavar to Asadabad, surmounting *en route* the Girdaneh Pass (5,600 ft.). An arched bridge at Bisitun, blown up by the Turks, was repaired successfully by the Sappers and Miners. Beyond Asadabad, a long diversion was made southwards to avoid a steep climb to the Asadabad Pass (7,200 ft.). Major B. J. Haslam had improved the track over the pass, and Lieut.-Colonel E. de L. Young, his successor as C.R.E., Dunsterforce, had continued the work, but the road was liable to become blocked with snow and hence a diversion seventy-five miles in length was considered justifiable to afford an easy winter route for motor traffic until the more direct route could be dealt with satisfactorily. The latter was completed in 1919. Being required to provide, in nine months, a passable road from railhead at Qizil Ribat to Hamadan, a distance of 264 miles, Gaskell was obliged to concentrate on the worst portions, where dozens of small bridges and culverts were needed, though no major bridging. In addition, he had to provide hutted accommodation, hospitals and water supplies for the L. of C. troops. Work continued throughout the winter of 1918-19 in cold and snow, and metalling commenced early in 1919 when the maintenance of the Russian road from Hamadan to the Caspian was added to the responsibilities of the C.R.E. Persian L. of C.

ADVENTURES OF 72ND FIELD COMPANY

Although the improvement of the Qizil Ribat-Hamadan Road was almost entirely a Sapper and Miner affair, one Royal Engineer unit helped to complete the project. This was the 72nd Field Company, under Major E. U. Grimshaw, which accompanied the 39th Brigade to Persia in July, 1918, in support of the Dunsterville Mission. The unit was lent to the Persian L. of C., and being required for work in the Hamadan region, was spared participation in the Baku fiasco. One section worked for a time on the road at the northern end of the Asadabad Pass and met the full force of an epidemic of influenza which swept the country. Another was on detachment at Bijar to the west. The headquarters were located in Hamadan, where the company concentrated in September to

prepare an aerodrome and build a large hangar with local timber, brick panelling, Belfast trusses and a canvas-covered roof. The aerodrome was rarely used, but it made an excellent sports ground for the Armistice celebrations.

The subsequent adventures of the 72nd Company beyond Hamadan deserve some mention. In December, 1918, the unit was ordered to Baku after the reoccupation of that port. It proceeded by motor transport through Kasvin, Manjil and Resht to Enzeli and thence by ship to Baku, where it had the usual round of R.E. work until August, 1919. A section under Lieutenant R. H. Perry was sent across the Caspian to Krasnovodsk to help the "White" Russians against the Bolsheviks, since the "Whites" had no engineers. After working on a defensive line at Krasnovodsk, it moved eastwards along the Trans-Caspian Railway to the Askhabad region where the "Whites" had been defeated and required assistance in destroying railway bridges as they retired. This was a most peculiar war, fought entirely along the railway line.* Each side lived in cattle trucks and attacked or defended with armoured trains. As the undisciplined "Whites" retreated westwards, Perry's detachment demolished the bridges. In September, 1919, the detachment rejoined the 72nd Company in Baku and the unit proceeded to Batoum, and finally to Constantinople for demobilization. By that time its composition was probably unique, for it had Russian drivers, Turkish cooks and Greek and Armenian tradesmen. Rarely has any R.E. unit wandered farther afield.

Reverting to the Persian Road to Hamadan, it may be remarked that, early in 1920, orders were received to prepare a hot-weather standing camp at Karind for hundreds of families of British troops in Mesopotamia and another for a battalion of British infantry to guard them. A summer headquarters camp for the Commander-in-Chief's Staff was required also at Sar-i-Mil. These schemes involved water supplies, cookhouses, hospitals and other arrangements which demanded much engineer labour. They were undertaken shortly before the Arab Rebellion and not only added to our responsibilities at a critical period but interfered appreciably with the proper maintenance of the Persian line supplying "Norperforce" under Major-General H. F. Bateman-Champain in the Kasvin area. The only engineer unit in that area was the 19th Company, Bombay S. & M., whose work has been described fully in the R.E.

* *Operations in Trans-Caspia*, by Colonel J. K. Tod, C.M.G., published in *The Army Quarterly*, Vol. XVI, 1928, pp. 280-303.

Journal.* Its O.C., Major C. F. Stoehr, was also C.R.E. Norperforce. In December, 1920, Lieut.-Colonel H. S. Gaskell handed over charge of the engineer activities on the Persian line of communication to Major W. J. W. Noble, and four months later Norperforce was withdrawn. All R.E. field units had already left Mesopotamia and Persia.

THE RISING IN SOUTHERN KURDISTAN, 1919

Although hostilities against the Turks ceased on 31st October, 1918, Mesopotamia remained a theatre of warfare almost until a peace treaty was ratified in 1924. At the end of April, 1919, when Lieut.-General Sir George MacMunn became Commander-in-Chief, the occupying forces comprised the 17th Indian Division, under Major-General G. A. J. Leslie, late R.E., with headquarters at Baghdad, and the 18th Indian Division, under Major-General Theodore Fraser, late R.E., with headquarters at Mosul. Troops equivalent to two brigades, under Brigadier-General H. F. Bateman-Champain, were in North-West Persia, and a number of units were guarding or maintaining the Persian line of communication.

The Engineer-in-Chief at this period was Brigadier-General W. Ewbank.† The engineer units of the 17th Division were the 9th, 61st and 65th Companies, Madras S. & M. (C.R.E. Lieut.-Colonel H. N. North), and those of the 18th Division the 2nd, 6th and 8th Companies, Bengal S. & M. (C.R.E. Lieut.-Colonel J. F. Turner). The 85th Company, Bengal S. & M., was also in the country, and the 2nd Field Troop, Madras S. & M., and 5th Field Troop, Bengal S. & M., were attached to the cavalry. Other troops included Nos. 1 and 2 Bridging Trains, Bengal S. & M.‡ Almost half the total

* *Snow and Flood in North-west Persia and Engineer Work with Norperforce, 1919-20*, by Major C. F. Stoehr, R.E., appearing in the *R.E. Journal*, Vol. XXXVI, 1922, pp. 230-5 and Vol. XXXVIII, 1924, pp. 255-66.

† Brigadier-General Ewbank succeeded Major-General Rimington as E.-in-C. on 1st February, 1919, and held the appointment until 15th November, 1919, when he was followed by Major-General E. H. de V. Atkinson.

‡ No. 1 Bridging Train left Mesopotamia in May, 1919; but No. 2 remained until May, 1921 under Captain W. S. Wotherspoon, R.E., who had succeeded Major Witts in December, 1918. The bridging trains were no longer corps troops as the corps organization had been abolished in March, 1919.

engineer strength at General MacMunn's disposal was in Persia,* but with seven field companies and other units available in Mesopotamia the engineer establishment seemed adequate, provided that the country remained reasonably quiet. Unfortunately, Mesopotamia did not remain quiet. Political agitators were at work, and their activities resulted finally in widespread rebellion. No British R.E. field units were concerned in the post-Armistice operations for they had been transferred to India or elsewhere for demobilization.

Trouble started in May, 1919, with a rising in Southern Kurdistan under Shaikh Mahmud of Sulaimaniya who schemed to set up an independent State. Mahmud struck when the nearest British garrison, under Lieut.-Colonel A. H. Bridges at Kirkuk, was at a minimum, and on 22nd May he was joined by the South Kurdistan Militia who had interned their British officers. The political officers in Sulaimaniya were imprisoned, and a rumour spread that they had been murdered. General Fraser immediately dispatched from Kirkuk a small mobile column under Colonel Bridges whose instructions were to reconnoitre up to the Bazian Pass, twelve miles east of Chemchemical, but no farther. Unfortunately, Bridges exceeded his instructions and advanced to the Tasluja Pass, twelve miles from Sulaimaniya. His column was followed by a marching column which included the 2nd Company, Bengal S. & M. While the marching column was at Chemchemical on 23rd May, news came that Bridges had been severely defeated at the Tasluja Pass, and shortly afterwards the remnants of his mobile column rode into Chemchemical. Helped by reinforcements from the 55th Brigade at Baiji, the 2nd Company constructed a perimeter camp where their O.C., Captain F. G. Drew, was in command of the troops for two days pending the arrival of a replacement for Bridges who had been recalled. The sapper company, being the only complete unit at Chemchemical, marched out daily to piquet the hills in the direction of Kirkuk, whence relief was expected, and a mounted detachment, improvised by Drew, proved most useful. A convoy from Kirkuk was ambushed and destroyed by the Kurds on the 29th while attempting to reach Chemchemical. Later, however, the 55th Brigade, under Brigadier-General G. M. Morris, occupied Kara Anjir, half-way between Kirkuk and Chemchemical. A force under Brigadier-General G. A. F. Sanders, late R.E. (G.O.C.; L. of C.),

* 12th and 13th Companys, Madras S. & M., 5th and 52nd Companies, Bengal S. & M., and 19th Company, Bombay S. & M.

won through to the besieged garrison at Chemchamal early in June and undertook punitive operations in the neighbourhood.

General Fraser was now directed to assemble at Kirkuk a "South Kurdistan Force" (usually called "Fraserforce") consisting of two infantry brigades with cavalry and armoured cars, for an advance on Sulaimaniya. While troops under Sanders guarded the lines of communication, a mixed striking force of brigade strength under Morris, including the 2nd Company, was to thrust at Sulaimaniya. The Kurds held two strong lines of defence, the first of which was at the narrow Bazian Pass, twelve miles east of Chemchamal. At dawn on 18th June, Fraser, who was with the striking force, attacked the Bazian defences and gained all his objectives without serious loss. The cavalry then entered Sulaimaniya and released the political officers. Mahmud was captured and imprisoned until 1922 when he was allowed to return to his old haunts. During the march to Sulaimaniya, which the main body reached on 20th June, the 2nd Company had much strenuous work in bridging or ramping *nullahs*. Shortly afterwards, contact was established at Halebja with a column under Lieut.-Colonel J. Body marching up the Diyala from Qizil Ribat. The 13th Company, Madras S. & M., was with this column, and although only on pack transport, carried material for crossing the Upper Diyala. The sappers made bundles of dried reeds and enclosed them in tarpaulins, thus forming "sausages" which were grouped into rafts for a flying bridge. Fraserforce remained in Sulaimaniya until October, 1919, when it returned to Kirkuk after building a fortified post on the Bazian Pass.

In June, 1919, rebellion spread to the Kurdish tribes north and north-east of the Mosul *vilayet*, but it was subdued promptly by Major-General R. A. Cassels who was acting as G.O.C., 18th Division in the absence of General Fraser. Thereafter, Mesopotamia seemed quiet; but appearances were deceptive, for propaganda from Syria was at work and on 13th December, some insurgents occupied Dair ez Zaur on the Upper Euphrates. However, despite a threatening situation, the engineer units continued their normal employment of road, railway, bridge and camp construction under the direction of Major-General E. H. de V. Atkinson, late R.E., who, as Engineer-in-Chief, had recently assumed charge of all military and civil works in Mesopotamia.

On 24th March, 1920, Lieut.-General Sir Aylmer Haldane arrived as Commander-in-Chief in replacement of Lieut.-General Sir George MacMunn. With a combatant force of less than 35,000 men, Haldane

was called upon to maintain order from the Persian Gulf to Mosul, guard 14,000 Turkish prisoners-of-war, keep open the Persian Road to Norperforce, and provide for the safety of 1,000 British women and children in the Karind camp. The prospect was not alluring, and with the outbreak of the Arab Rebellion it became alarming.

THE MOSUL BRIDGE

Before dealing with the military operations undertaken in 1920 against Arab insurgents on the Euphrates it may be well to describe briefly a notable feat of engineering initiated at Mosul at the end of 1919 by Lieut.-Colonel J. F. Turner, C.R.E. 18th Division, and completed after conditions had returned to normal. This was the construction of a floating bridge across the Tigris of such original design that, until its success was proved, it was known as "Turner's Folly." The existing Arab bridge was quite unsuitable for heavy motor traffic and a pontoon bridge was needed to enable the 18th Division to maintain control over the trans-Tigris tribes and keep in touch with its outposts. At the point selected for the new bridge, the river was 524 feet wide at low level and 710 feet in flood, with not only a rise and fall of 30 feet but a maximum flood speed said to approach 25 knots, thus clearly ruling out any thought of upstream anchors. Called upon to span this veritable Niagara, Turner designed a structure in the form of a suspension bridge laid on its side, the force of the current supplying the load on the cables.

The Mosul Bridge was capable of carrying loaded armoured cars, and including the trestled ends, was 815 ft. in length. Three horizontal catenary cables were provided, each composed of seven 3-in. wire ropes. These were led to massive concrete shore anchorages and were supported on twenty-four decked-in floats, shaped like boats and built with wooden planking. The catenary farthest up stream anchored the floats and rested normally on bowsprits projecting from them. The other two rested on the sterns, and from them wire cables were taken down stream to the bridge pontoons. The latter were wooden boats, made of 1-in. planking, caulked with cotton waste, covered with canvas, and painted with crude oil. They were formed in pairs into rafts connected by wooden Warren girders which carried the roadway. Footways were provided outside the girders. All materials had to be transported in lorries along eighty miles of desert track from railhead at Sharqat, and the only timber available was inferior jarrah.

Preliminary work on the bridge was started early in 1920, the floats, cables and superstructure being made in Mosul by the 2nd and 8th Companies, Bengal S. & M., and the pontoons by the 6th Company. The concrete anchorages at the site were built by contract. On 24th September, after the Arab Rebellion, construction was begun by the 6th Company, assisted by a works company and Arab labour; and on 14th February, 1921, the Mosul Bridge was opened to traffic. It proved an outstanding success, though expensive in upkeep. Subsequently it was purchased by the Mosul Municipality, and though poorly maintained, remained in use until washed away by a severe flood in 1928, after which the Arabs reverted to their old boat-bridge until the latter was replaced by a modern steel-girder structure.

THE ARAB REBELLION, 1920

The multiple causes of the Arab Rebellion do not concern this narrative. The conflagration started on 4th June, 1920, at Tel Afar, a desert town some forty miles west of Mosul, where a band of 200 *Sherifians* from Aleppo incited the inhabitants not only to murder the local political officer and the crews of two armoured cars that had been sent to communicate with him, but to advance against Mosul. This outbreak was extinguished quickly by troops from Mosul. Tel Afar was occupied and fortified and became a strong *point d'appui* for subsequent desert operations. The outbreak of rebellion in Southern Mesopotamia had its repercussions in the north, but Arab concentrations in the Mosul *vilayet* were frustrated by the constant employment of small mobile columns radiating in all directions from Mosul. These columns had many engagements. They punished disaffected Arabs severely and discouraged them from attempting any major operation. This system was so successful that General Fraser was able to spare nearly two brigades from his own theatre of operations and to abolish for six weeks his line of communication with Baghdad. He continued to maintain excellent control in the Mosul *vilayet* after protesting against a proposal made on 14th July that he should vacate the area. The rebel bands gained no success along the Upper Tigris. The Kurdish tribes around Kifri gave some trouble, and a section of the 64th Company, Madras S. & M., was besieged for twelve days in Tuz Khurmatli. However, ground and air action restored order. The 2nd, 6th and 8th Companies, Bengal S. & M., shared in these activities before returning to their work on the Mosul Bridge.

For the close defence of Mosul City, a modification of the block-house system adopted at Baghdad was considered adequate. Only some half-dozen blockhouses were provided, but these were sited so as to command the main approaches and the obstacles which had been created between them. This reduced the amount of construction work demanded of the engineers and minimized the number of troops locked up in immobile defence; but the system was never tested because, after Tel Afar, no Arabs showed any inclination to attack Mosul. Incidentally, it facilitated the examination of persons leaving or entering the city.

Communications throughout Mesopotamia were still very defective. Metalled roads were non-existent outside the largest towns, and the country tracks were impassable after heavy rain. Transit by steamer up the Euphrates was uncertain and very limited, and up the Tigris a journey from Basra to Baghdad might take fifteen days unless completed by using the metre-gauge railway from Kut. The recently completed metre-gauge line* connecting the two cities by way of Nasiriya, Samawa, Diwaniya and Hilla was frequently washed away by floods, and in fine weather the journey occupied two days. Thus, even if he had had the necessary strength, General Haldane could not reinforce rapidly any threatened point. Actually, when the Arab Rebellion took him by surprise, he had only 4,200 British and 30,000 Indian troops to hold the entire country, and his mobile force available for operations on the Middle Euphrates amounted to no more than 500 British and 3,000 Indians.

The Tel Afar incident in the north was followed, on 30th June, 1920, by a rising at Rumaitha, south of Diwaniya on the Hilla branch of the Euphrates, where the garrison was besieged and the railway cut. On 4th July, Samawa was also isolated. A small force under Brigadier-General F. E. Coningham, including the 61st Company, Madras S. & M., was dispatched southwards by rail from Baghdad through Hilla to Diwaniya and succeeded in evacuating the Rumaitha garrison on 20th July; but the general situation was extremely serious since widespread rebellion might occur anywhere and our meagre forces were scattered over an area larger than Great Britain.

During July and August, Haldane called repeatedly for reinforcements amounting in all to more than two divisions. In June the engineer units in Mesopotamia were the 9th, 61st, 64th and 67th

* This line had been laid during 1919, and was converted from metre gauge to standard gauge in January, 1920. *Vide* Chapter X.

Companies, Madras S. & M. (17th Division) and the 2nd, 6th and 8th Companies, Bengal S. & M. (18th Division).^{*} The 8th Field Troop, Madras S. & M.,[†] was with the 7th Cavalry Brigade, and No. 2 Bridging Train, Bengal S. & M., was on the Euphrates. Engineer reinforcements arriving in August comprised the 11th, 63rd and 69th Companies, Madras S. & M. (C.R.E., Lieut.-Colonel E. J. Loring). These were allotted to a new 6th Indian Division forming on the Euphrates under Major-General G. N. Cory. The 26th and 28th Railway Companies, S. & M., also made their appearance. These reinforcements came, however, after the crisis had passed. The burden of the field engineering operations in the areas chiefly affected fell almost entirely on the Madras Sappers who, with the assistance of pioneer battalions and Arab labour, were employed under arduous conditions in building blockhouses along railways, providing and operating flying bridges, improving roads, demolishing villages, arranging water supplies and constructing defences round important bases.

On 20th July, while Coningham was rescuing the Rumaitha garrison, a rebellious tribe seized Kifl, beyond which we had a garrison at Kufa to keep watch on fanatical elements in the holy city of Najaf. The task of retaking Kifl was entrusted to a small mixed column from Hilla composed chiefly of the 2nd Battalion, the Manchester Regiment. On 24th July, in extreme heat, the column was heavily attacked near Kifl and obliged to withdraw after suffering severe casualties. This disaster brought to a head the trouble brewing on the Middle Euphrates and an extension to the Baghdad area seemed probable. Accordingly, the capital was encircled by a formidable wire obstacle and forty blockhouses on a sixteen-mile perimeter, a project which was supervised by Brigadier-General G. A. F. Sanders, late R.E., and executed by the 9th Company, infantry working parties and Arab labour under Lieut.-Colonel A. B. Carey, R.E.

The disaster to the Manchester column was followed by a withdrawal from Diwaniya. While the 61st Company repaired bridges, Coningham began his retreat along the railway on 30th July but did not reach Hilla until 9th August because long stretches of track had been destroyed. Operations were then planned for the recovery

^{*} The 19th Company, Bombay S. & M., 7th and 52nd Companies, Bengal S. & M., and 65th Company, Madras S. & M., were in Persia.

[†] The 8th Field Troop had replaced the 2nd Field Troop in April, 1920. The 5th Field Troop, Bengal S. & M., had left in February, 1920.

of the Hindiya Barrage and for the defence and repair of the Baghdad-Hilla railway. A mixed brigade under Brigadier-General H. A. Walker left Hilla on 10th August for Musaiyib, above the Barrage, followed by a smaller force including the 61st and half the 67th Companies. Walker recovered the Hindiya Barrage on 13th August and could then control the water supply to, and consequently the conduct of, the fanatical inhabitants of Karbala and Najaf. A special organization under Brigadier-General G. A. F. Sanders, working from both ends, was repairing and "blockhousing" the remainder of the Baghdad-Hilla railway, the 9th Company operating southwards and half the 67th Company northwards. Three hundred blockhouses were finished by 19th August. Similar work followed on the lines leading from Baghdad to Baquba and Kut, and Hilla itself was given a girdle of thirty-two blockhouses. The rebels, however, were now in possession of 200 miles of railway between Hilla and Samawa.

Unrest had spread, meanwhile, to the areas north and north-east of Baghdad, and rebel gangs attacked the railway north of Qizil Ribat. In the middle of August, Colonel J. H. F. Lakin, O.C. Persian L. of C., organized a small mixed force under Lieut.-Colonel H. S. Gaskell, R.E., to restore order, the engineer unit being the 65th Company, Madras S. & M. Gaskell occupied Khaniqin and, marching southwards along the railway, relieved a besieged post north of Qizil Ribat on 24th August. Two sections of the 65th Company were attacked on the following day while building a post to cover a railway bridge, but Gaskell, mounting a locomotive, broke through the insurgents under heavy fire and brought back reinforcements sufficient to drive the enemy away. By the 27th, the line was repaired as far southwards as Qizil Ribat. Operations on a larger scale, in which the 9th Company and No. 2 Bridging Train took part, followed from Baquba. After the reoccupation of Shahraban on 8th September, and the completion of all repairs, railway communication to the Persian border was restored and the British families at Karind were evacuated to India.

The tribes along the Euphrates near Baghdad remained quiet until 12th August, 1920, when the murder of a political officer, Lieut.-Colonel G. E. Leachman, was the signal for a series of outbreaks above Falluja. On the 15th, a river convoy, escorted by a section of the 67th Company, Madras S. & M., was ambushed and captured below Ramadi, and afterwards the Baghdad-Falluja railway was cut. Communication was reopened by Brigadier-

General Sanders and on 3rd September the 11th Company, Madras S. & M., began to repair and "blockhouse" the line. No less than 173 blockhouses were also built along the Baghdad-Kut line.

Operations could now be undertaken for the relief of the small garrison of Kufa on the Lower Euphrates, besieged since 21st July. A 55th Brigade column under Brigadier-General Walker, including the 61st and 67th Companies, and a 53rd Brigade column under Brigadier-General Sanders, including the 9th Company, advanced from Hilla on 6th October, the first to relieve Kufa and the second to threaten Karbala. Both operations were successful.* The rebels set fire to a boat-bridge, but half the 9th Company, under Major E. Bradney, advanced across it with some infantry and extinguished the flames.

Disturbances in the River Area of the Lower Euphrates had begun in June, 1920. Railway communication below Samawa was interrupted repeatedly during the ensuing months, and on 3rd September an armoured train was derailed and captured. Attempts at reinforcement failed, and Samawa was invested. Major-General E. H. de V. Atkinson, the Engineer-in-Chief, was selected by General Haldane to undertake the relief, with Brigadier-General F. E. Coningham in charge of the military operations. On 1st October, with a column of all arms including the 69th Company, Madras S. & M., Coningham marched from Nasiriya and Atkinson then assumed command of the expedition. The subsequent advance along the railway was accompanied by four trains—one armoured, two carrying water, and the fourth with blockhouse materials—and by 4th October "Atcol" had reached Darraji where the line had been torn up for half a mile. Samawa was relieved on the 14th. Blockhouse construction along the railway proceeded rapidly, the 63rd Company from Kut having joined the 69th Company. In all, the two companies built 250 blockhouses, mostly of sandbags and gabions. The usual type was circular and twenty feet in diameter roofed with a 160-lb. tent and surrounded by a wire apron. Each was provided with a 400-gallon water tank.

The relief of Samawa was the last military undertaking of any importance during the Arab Rebellion. On 19th October, Major-General G. N. Cory took command of the new 6th Indian Division on the Lower Euphrates, and Major-General G. A. F. Sanders replaced another Royal Engineer, Major-General G. A. J. Leslie, in command of the 17th Indian Division at Baghdad. Punitive

* Kufa was relieved on 17th October, 1920.

expeditions, disarmament and the collection of fines became the order of the day. The 9th Company destroyed the houses of prominent rebels in Karbala, and the 67th Company in Najaf and Kufa. Much gun-cotton was required at Najaf as some of the houses had several tiers of underground passages and rooms. During November, 1920, the 63rd and 69th Companies and the 26th Railway Company marched northwards from Samawa with a 6th Division column to meet a 17th Division column moving southwards from Hilla. They built pontoon and flying bridges across the Euphrates and repaired railway bridges.

After some rebels round Diwaniya had been subdued, organized resistance ceased, but small columns continued to traverse doubtful areas and were accompanied usually by sapper detachments. The final embers of the rebellion were extinguished at Suq ash Shuyukh below Nasiriya in February, 1921, after seven months of marching and fighting.

The close of military operations was followed by a general exodus, leaving only sufficient troops to hold the country. The 2nd and 8th Companies left Mosul for India at the end of January, 1921, the 61st Company in March, and the 9th and 12th Companies in April. The 64th and 67th Companies, the 26th and 28th Railway Companies, the 8th Field Troop and No. 2 Bridging Train left in May, and the 6th, 11th and 13th Companies in June. The only field engineer units then remaining under Brigadier-General A. B. Carey as Engineer-in-Chief* were the 7th (Bengal) Company and the 63rd and 69th (Madras) Companies. The 7th and 69th Companies departed in the following spring; but the 63rd Company, being allocated "permanently" to Mesopotamia, was not withdrawn until 1923 when the situation had altered completely.

Many grandiose, and sometimes ill-considered, schemes for new works were launched in 1921-22, notably a project for a road across the desert from Baiji to Mosul to by-pass Sharqat. Nevertheless, much sound work was done in the forward areas on communications, bridges, water supply and housing, and the engineers helped to solve the supply problem by introducing the use of oil-fuel for cooking. Until the 11th Company left for India it was employed with the 63rd Company under the Works Directorate on the new Hinaidi Cantonment south of Baghdad; and after it had gone, the 63rd Company completed the building of eight large hangars for

* Brigadier-General Carey had succeeded Major-General Atkinson as Engineer-in-Chief at the end of 1920.

the Royal Air Force by July, 1922. In January, 1923, the 63rd Company was transferred to Mosul, and during April, before returning to India, took part in the operations of Air Vice-Marshal Sir John Salmond against the ubiquitous Shaikh Mahmud in Kurdistan.

Reviewing as a whole the engineer work in Mesopotamia from 1919 to 1923, it appears that the field units were employed mostly on their normal duties. They were never used as infantry in the attack, as in 1914-15, when every rifle was needed in the firing line. They were handicapped by extremes of climate, difficulties of transport and shortage of materials, but by clever improvisation they overcame all obstacles. The Sappers and Miners, officered mostly by Royal Engineers, contributed not only to the success of our arms but to the peaceful development of the country under King Feisul after serious fighting had ended.

ARMY EMPLOYMENT OF R.E. OFFICERS IN MESOPOTAMIA

The foregoing chapters, recording the work of the Corps in the Mesopotamian Campaigns, would be incomplete without some mention of the extent to which R.E. officers were employed in the command of troops and in staff appointments.

Lieut.-General Sir Fenton J. Aylmer was the first G.O.C., Tigris Corps, and he was succeeded in March, 1916, by Lieut.-General Sir George F. Goringe.

Five R.E. officers commanded divisions. Of these, Goringe, with the 12th Indian Division, drove the Turks from Nasiriya and the Lower Euphrates early in 1915, Major-General G. A. J. Leslie, with the 17th Indian Division took a leading part in the battle of Sharqat in October, 1918, and Major-General G. A. F. Sanders, who succeeded Leslie in command of that division in 1920, conducted the very difficult operation of disarming and pacifying the rebel Arabs on the Middle Euphrates towards the end of that year. Leslie officiated as G.O.C.-in-C. from January to March, 1920, as did Major-General T. Fraser from January to April, 1921. Fraser (G.O.C. 14th Division, 1918-19, and 18th Indian Division, 1919-21) commanded the South Kurdistan Field Force in 1919 and became G.O.C. the Forces in Iraq in 1922. Sanders acted as G.O.C. the L. of C., South Kurdistan Field Force.

Three R.E. officers held brigade commands—Brigadier-Generals U. W. Evans, Leslie and Sanders. Brigadier-General H. H. Austin

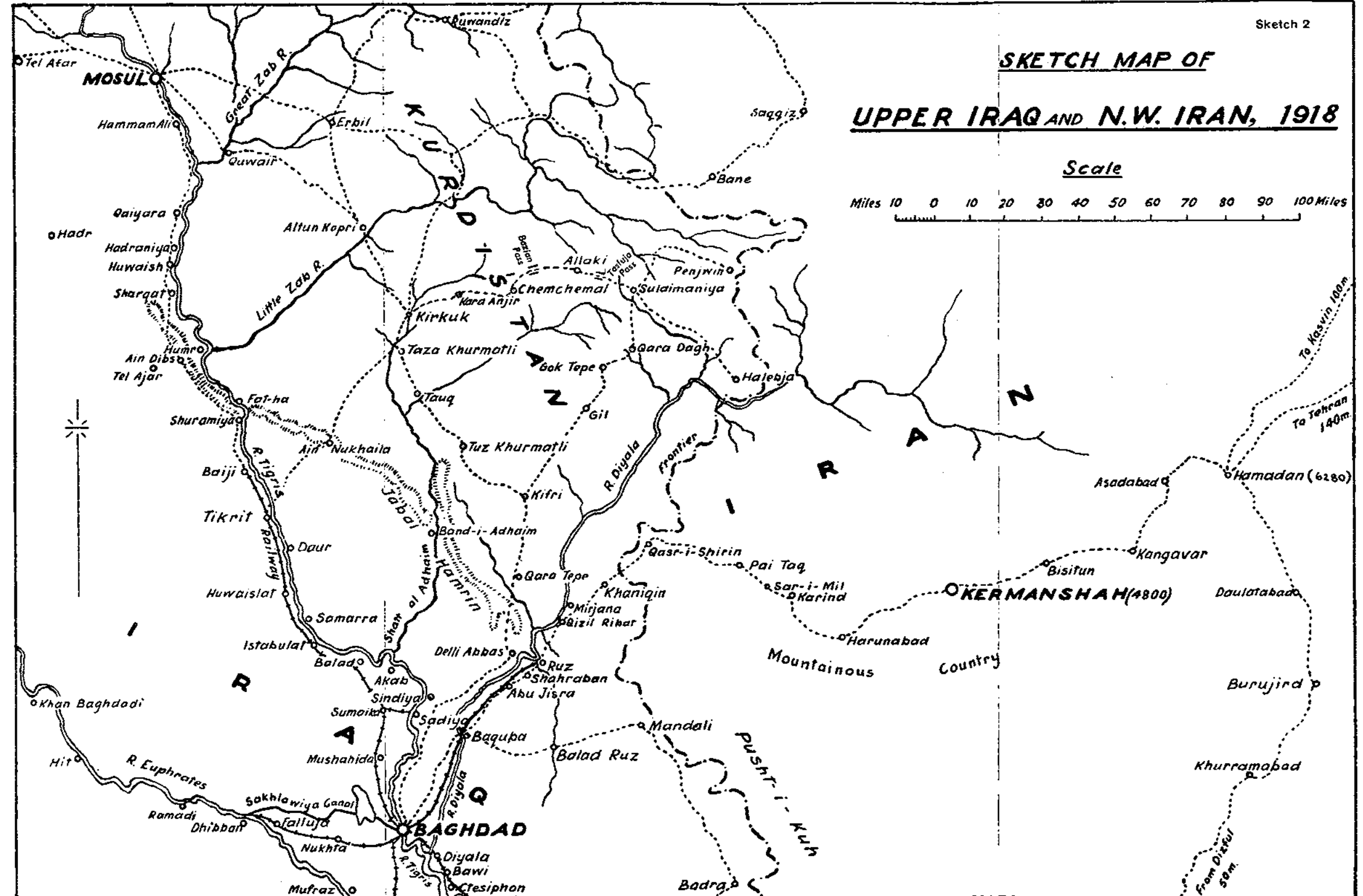
commanded the troops on the Tigris L. of C. in 1916, and then became the first Commandant of the large camp for *Jelu* (Assyrian) refugees, established at Baquba on the Diyala River.

On the Staff, Gorringe was chief Staff Officer of the Tigris Corps during February and March, 1916. Fraser was B.G.G.S., 3rd Indian Corps from 1916 to 1918. He also officiated as C.G.S. at G.H.Q. for three months in 1918. Three R.E. officers held 1st grade staff appointments and three were brigade majors or D.A.Q.M.Gs. Brigadier-General W. H. Beach was Director of Intelligence at G.H.Q. throughout the war, and Brigadier-General G. R. Frith was Deputy Adjutant-General in 1920-1.

SKETCH MAP OF UPPER IRAQ AND N.W. IRAN, 1918

Scale

Miles 10 0 10 20 30 40 50 60 70 80 90 100 Miles



CHAPTER VIII

ENGINEER ORGANIZATION AND WORKS IN MESOPOTAMIA

Introduction—Engineer organization—The Engineer Field Park—
The Works Directorate—Flood protection—Roads and bridges—
Hutting—Hospitals—Electrical and Mechanical work—Miscellaneous works.

(See Maps 1 and 2)

INTRODUCTION

AFTER the occupation of Basra on 21st November, 1914, the Sappers and Miners and Engineer Establishment of the 6th Indian Division were able, for a period, to carry out the works necessary for the whole force; but it soon became apparent that a special Works Establishment was required. Application was, therefore, made to Army Headquarters India with the result that, on 24th March, 1915, the following reinforcements disembarked at Basra: an Assistant Director of Works with one subaltern as his Deputy Assistant, and a works company, consisting of three British officers, two British upper subordinates, six Indian sub-overseers, and three Indian clerks. There were no artificers.

From this modest beginning the Works Directorate steadily increased until at the conclusion of the campaign it comprised some 240 British officers and over 19,000 enlisted men, including works companies and labour corps, in addition to several thousands of Arabs and others who were administered by the Director of Local Labour. The Works Directorate undertook all engineering works for the force outside the areas in occupation of the field armies except those which devolved on other Directorates such as railways. It included an engineer field park for the supply of all engineer stores, furniture and necessities and was responsible for roads and buildings (including hutting, hospitals, billets, aerodromes and sanitary works); piers and wharves; flood protection, reclamation and irrigation; defence works; armour-plating and decking of

river craft; electrical and mechanical works (including electric lights and fans, water-supply systems, ice manufacture and refrigeration); and later, the maintenance and renewal of agricultural machinery throughout the country. As the years passed, the Works Directorate was relieved of some of these tasks by the creation of new Directorates, but in these cases it may be said that the essential and more urgent needs had already been supplied by the Works Directorate.

The physical conditions of Mesopotamia are fully described in the *Official History* of the Campaign (Vol. I, pp. 6-15) and some reference to them has been made in the introductory pages of this record. One consequence of these conditions was that works were necessarily confined almost entirely to the neighbourhood of towns situated on the rivers Tigris and Euphrates or, in the case of road-work, to their banks. The country produced no timber fit for construction, and there was no stone suitable for building or road metalling south of Baghdad. Some brick kilns existed, but the output was small owing to scarcity of fuel. Practically the only materials produced by the country which could be used for building were grass mats and reeds. Hence all stores had to be imported in competition with other heavy demands on shipping. Such roads as existed were unmetalled and for the greater part without bridges. Most of the buildings in the country were indifferent structures of sun-dried brick without verandahs. In the larger towns some of the houses were comparatively well built and double-storied, but the total absence of any sanitary system usually rendered them unsuitable for the billeting of troops. Sanitation was rendered difficult by the presence of water near the surface of the ground.

A feature of great importance was the rise of the two rivers, which begins at the end of March. The greatest flood occurs between 21st and 28th May, when the river at Basra may rise to ten feet above low winter level. Date gardens exist on the banks in the vicinity of the larger towns, and are almost continuous from Basra to Qurna, and are flooded annually to a depth of several feet. Extensive inundations are caused by the Tigris between Kut and Amara, and by the Euphrates above and around Nasiriya. The whole country below Baghdad alternates between inundation and drought. The two rivers provide practically the sole sources of water supply between Basra and Baghdad.

ENGINEER ORGANIZATION

In November, 1914, the 6th (Poona) Division was provided with the normal engineer establishment, namely a C.R.E., Lieut.-Colonel U. W. Evans, with his adjutant and office establishment, two companies of Sappers and Miners, a field engineer (major) and two assistant field engineers. Before long the following army units were posted to the division: an engineer field park and a searchlight section. All engineer units were under the C.R.E. both for discipline and administration. In April, 1915, the 12th Indian Division joined Force D and the II Indian Corps was formed. Brigadier-General J. P. Brewin was appointed Chief Engineer of the Force, but was invalided in July, and was succeeded on 3rd August by J. C. Rimington, who remained as Chief Engineer and subsequently as Engineer-in-Chief of the Force until after the Armistice. His brigade major, H. N. North, did not join till January, 1916. The Sirmur Imperial Service Company was one of the two S. & M. Companies of the 12th Division, and the corps engineer units included a bridging train and a printing and litho. section of Sappers and Miners.

In January and February, 1916, the Force was augmented by the arrival of the 3rd and 7th Indian Divisions from France. In November, 1916, these were formed into the I Indian Corps, and the 13th (British) and 14th Indian Divisions, which had then arrived, into the III Indian Corps. In addition the 15th Indian Division and the 6th Indian and 7th (British) Cavalry Brigades were present. The former II Indian Corps had disappeared, having been partly captured at Kut and the remainder reconstituted. The Chief Engineer was promoted to Major-General and Engineer-in-Chief, and a Chief Engineer was appointed to each of the two corps, with a brigade major.

At this time the number of field companies with each division was increased from two to three. Those with the 13th and 15th Divisions were field companies of the British Territorial Force, the remainder were Sappers and Miners. There was a British field troop with the 7th Cavalry Brigade and a Sapper and Miner field troop with the 6th Cavalry Brigade. Corps engineer units consisted of one printing and litho. section and one section searchlight company with each corps. Army units comprised Nos. 1 and 2 (Mobile) Bridging Trains, one printing and one litho. section, and two companies Imperial Service Sappers and Miners (Malerkotla and Tehri Garhwal). Later two Weldon bridging sections, one field searchlight company, and another printing section were added.

In January, 1917, Colonel W. Ewbank was appointed Deputy Engineer-in-Chief. Later an assistant field engineer (electrical and mechanical) was allotted to each corps.

All R.E. officers (in R.E. employment) and engineer units of the field armies and on the L. of C. were under the orders of the Engineer-in-Chief as regards technical supervision, distribution and personnel. The Works Directorate was also under his control for technical matters and personnel, but the other directorates of an engineering nature, namely the Railway, the I.W.T. and the Irrigation, were under the direct orders of the Army Commander, as were the Survey Establishments under Colonel Ryder, and the Labour Directorate. The Director of Works was the engineer advisor of the I.G.C. until, in 1917, he was appointed engineer advisor of the Army Commander, in addition to the Engineer-in-Chief.

After the Armistice it was decided, in December, 1918, that the Engineer Service in Mesopotamia should be mainly a civil one. Its head was Chief Engineer of the Army of Occupation and also Secretary to Government. In the latter capacity he was under the orders of the Iraqi Minister of Public Works. He was also made an Adviser to the Council of State. The first holder of the post, from 1919 to 1921, was Major-General Sir Edwin H. de V. Atkinson. The Service comprised the following separate departments: Roads and Buildings, Railways, Irrigation, E. & M. and Posts and Telegraphs.

THE ENGINEER FIELD PARK

No. 5 Engineer Field Park was the first "works" unit to arrive on the scene. In peace, six such parks existed in India, each intended to serve a division of all arms. Stores for each of them were kept on Ordnance charge; stationery and books being with the Military Works Service. There was no personnel. The quantities of stores represented in most cases only a few days' consumption, and the C.R.E., Lieut.-Colonel U. W. Evans, who was aware of this, had had the foresight, early in November, 1914, to order the purchase of a large quantity of additional engineer stores, which were obtained and forwarded by the A.C.R.E. Bombay.

The assistant field engineer in charge of the park was Captain F. C. Molesworth and the remaining personnel consisted of two British and two Indian N.C.Os., twelve Indian artificers, twelve *khalasis* (superior coolies) and one Indian clerk. Captain Molesworth

arrived at Basra in time to meet the first consignment of stores on 27th November, but his British personnel did not arrive till early in December, and his Indian personnel not till 26th January, 1915, with the remainder of the stores.

The park had to be established on the river bank. The only site available was a plot south of the Turkish commodore's house (R.E.H.Q.), and some 200 yards long by perhaps 70 yards wide, on which the telegraphs, the wireless, the park and part of the Ordnance all had to find accommodation. Consequently little more than an acre was allotted to the park, and before long every square inch was stacked high with material. Senior inspecting officers criticized the congestion which was both extreme and obvious, but not the fault of the A.F.E. The filling of the swamps in rear was taken in hand early, with earth brought by boat, but it could not keep pace with the demand for space. The entire plot was liable to be submerged in floods, and early in the year the timber yard was two feet deep in water. At first only one pier, of the flimsiest construction, existed on the park area, but it served to land an incredible amount of stores before it gave way. By that time a longer and better pier had been built and was later extended to reach a specially decked barge anchored in the stream, so that by 1916 steamers loaded with timber could discharge direct. In 1917 a second pier with a steel-pontoon head was built. A brick office with a mud on corrugated-iron roof, workshops, stores, godowns, magazines, section offices and other buildings were constructed or adapted by park labour. These were continually added to and improved, until by the end of the campaign the workshops of the base park alone covered nearly 36,000 square feet, mostly of steel sheds, and contained machinery valued at 2½ lakhs. By that time the area occupied had been extended to fifty-two acres.

At first local Arab labour was employed for unloading and stacking, and skilled labour for the workshops was engaged locally. In 1916, seventy-two men of the Porter corps were allotted, and in 1917 the entire IX Labour Corps were set aside permanently to work in the base park. Further personnel had to be obtained from India, and the strength of British Warrant and N.C.Os. was doubled by May, 1915, and continued to increase. In October, 1916, the 47th Base Park Company with three officers and about eighty British O.Rs. arrived from England, with Major M. O'C. Tandy in command. The final establishment of the park was over twenty-five officers and some 750 enlisted men, British and Indian,

exclusive of labour corps. In June, 1916, Captain F. C. Molesworth was invalided and was succeeded by Major E. A. Tandy, who handed over charge to Lieut.-Colonel M. O'C. Tandy as A.D.W. Park in July, 1918.

Consignments of stores were sent up river on steamers or on barges tied thereto. Branch field parks were established in 1915 at Qurna, Ahwaz and Amara; in 1916 at Ali Gharbi for the Tigris Corps, and at Maqil; and in 1917 at Baghdad, where there were extensive workshops. Several forward dumps for the field armies were established. The A.C.R.E. Bombay continued to dispatch stores throughout. Consignments of timber alone reached 4,900 tons per month.

A vast variety of articles was made up in the park, notably furniture, ice chests, coffins, punkahs, chesses and trusses. Pontoons were repaired and *mahailas* fitted as hospital barges. In 1915, trench mortars and hand grenades of McClintock pattern were manufactured, and Indian regiments were instructed in bomb-throwing.

THE WORKS DIRECTORATE

The Works Directorate was divided into three sections—Roads and Buildings, Electrical and Mechanical, and the Engineer Field Park. The Roads and Buildings Section was organized on the pattern of the Military Works Services of India. The basic unit was the charge of the A.D.W. who, with his office staff, prepared the designs, made the payments and kept the accounts. Under him were the sub-divisions, up to a maximum of five, each held by a works officer or upper subordinate. As the work extended, A.D.Ws.' charges were frequently held by D.A.D.Ws. and many lower subordinates were employed, mostly Indian sub-overseers. The E. & M. Section was divided into departments, such as Electricity, Water Supply, Workshops, Refrigeration and Machinery. The Engineer Field Park was divided into sections such as Receipt of Stores, Issue of Stores, Timber, Workshops, Hardware and Accounts.

At the beginning one A.D.W., Major A. F. Cumberlege, was in charge of the Works Directorate. He was promoted to D.D.W. in June, 1915, and on being invalided was succeeded in October by Lieut.-Colonel A. J. H. Swiney. On 20th April, 1916, the latter handed over to Lieut.-Colonel E. R. B. Stokes-Roberts, who on 9th August, 1916, was promoted to Director of Works with the rank of Brigadier-General. By the middle of 1917 expansion had been

so great that there were three D.D.Ws. (Colonels E. C. Ogilvie, C. B. L. Greenstreet, and H. L. Pearson) and thirteen A.D.Ws. Brigadier-General Stokes-Roberts wore himself out by his incessant labours, and died at Baghdad on 22nd November, 1917. He was a man of outstanding capacity, and the out-turn of works under his direction enormously increased. Colonel D. K. Edgar was his capable right-hand man. The next Director of Works was Brigadier-General C. H. Roe, who remained until January, 1919.

In November, 1918, the approximate number of officers employed on works was : Roads and Buildings, 90 ; E. & M., 65 ; Park, 25 ; Labour Corps, 60. Total, 240. At first, officers posted to the Works Directorate came from the Engineering Services or private firms of India. After the middle of 1916 they came mostly from Britain. Many of these were men of the very first class, but owing to want of experience of eastern methods and languages, it was usually some time before they could pull their full weight, and there was always a great strain on the R.E. officers holding responsible positions. The officers and subordinates worked devotedly ; there was never any intermission from continuous pressure, conditions were difficult, honours and rewards were few, but their achievements were remarkable.

Sickness and casualties among all ranks, British and Indian, were high owing to the severity of the climate. During June, 1916, 25 per cent of the works company was on the sick list. In May, 1917, officers and British subordinates of the Works Directorate were ordered to carry umbrellas in uniform when out of doors as a protection from the sun. However, great benefit was derived from the leave to India each summer.

At the commencement there was one works company with a strength of fourteen. The majority of works officers, all upper and lower subordinates, and all artificers brought from India were posted to this unit till its strength rose to 2,000, when a second was formed in August, 1916. By June, 1918, there were six such companies, each with an authorized strength of fifty-one British, including ten officers, and 1,254 Indians, mostly carpenters, masons, blacksmiths and painters. The officers, subordinates and mechanics of the E. & M. Section were borne on the strength of a Composite Company E. & M. which had 335 British and nearly 1,700 Indian all ranks. In addition there was the 300th E. & M. Company, of which the strength was about 290, all British, including six officers. This company arrived from England in March, 1917.

At first work was carried out by local contractors, two or three of whom proved very efficient, by local labour or by artificers of the works company, but it was found that these methods were insufficient for the pace of construction required, and labour corps from overseas were asked for.

In January, 1916, the II Labour Corps, under Captain E. de L. Young, R.E., arrived, followed shortly by the I Labour Corps. These were far the best labour corps which served with the Force. They were Punjabis, enlisted to serve in the presence of the enemy, and were capable of any skilled or unskilled work. They were followed at intervals by labour corps from other parts of India, from Egypt and from Mauritius. Some were capable, some could do little more than dig, but all were useful. In 1917, thirteen labour corps were employed on works and many others by other directorates and by the field armies. The strength of each labour corps was about 1,000, including a varying number of skilled artisans, and seven British officers.

From the first local labour was organized, not under any directorate but under the G.O.C. concerned, in order to prevent the various directorates from competing for men. At Basra in 1915 labour was organized for hire and payment under two infantry officers, whose continual efforts were required to obtain the proper out-turn from the local Arabs. In 1917, a Controller of Local Labour was established to run all local labour throughout the country, but it was not until 1918 that the overseas labour corps were placed under his orders. He was then appointed Director of Labour, with direct access to the Army Commander.

FLOOD PROTECTION

The Shatt al Arab at Basra began to rise in March and by 1st April, 1915, the tents of the British General Hospital had been flooded to a depth of a foot twice in twenty-four hours. Many camps and areas for stores throughout the base were also submerged, and the British cemetery, which was in constant use, remained entirely under water. It was necessary to raise protective clay bunds round all these areas, or to fill them by bringing earth in native boats. Pumping was also employed. The floods subsided in July, but in the interval the troops had endured great hardship.

In subsequent years more effective measures were taken. The Euphrates runs six miles north of Makina Camp (just north of

Basra) and the whole area between may be inundated. There was under the Turkish régime a bund some ten miles long, extending from the Shatt al Arab to the Shaiba ridge, but it was in a neglected condition and breached in several places. It was decided to increase this flood-bank, known as the Shaiba bund, to its full section and also to raise above flood level the road from Basra to Zobair, thus enclosing a safe area of forty-five square miles to accommodate all camping grounds at the base. The height of the Shaiba bund was made up to $6\frac{1}{2}$ ft., designed to be $3\frac{1}{2}$ ft. above flood level, and the section was some 175 square feet, the exposed face being sloped 1 in 5 and protected for a distance of six miles by a revetment of corrugated iron sheets backed with mats and sandbags.

In September, 1916, a Reclamation Section was recruited in India, and forty miles of track, ten locomotives and 850 trucks were obtained. A light railway was laid along the top of the entire Shaiba bund, spoil earth was brought ten miles from the Euphrates bed and very large areas at the base were raised above flood level.

In March, 1917, a large portion of the Reclamation Section with light railway equipment moved up to Baghdad. Here a bund about twelve miles long, and from four to eleven feet high, was constructed from the city walls to the Diyala river, to divert flood water coming from the east and north.

In nearly all the outstations below Baghdad the floods caused continuous anxiety until the end of the war. In February, 1918, an Irrigation Directorate was established, but it did not take over the protective works for some months, by which time nearly all the urgent requirements had been completed by the Works Directorate.

ROADS AND BRIDGES

In the Basra area much work was required to improve the existing roads. They were widened, straightened and shaped, and many new roads were made. Many bridges were constructed over the tidal creeks to carry 5-ton lorries. For fully eighteen months all the roads remained unmetalled, and gangs of Arabs were constantly maintained to water and dress the surface in dry weather, and to cover them with palm branches and to patch them in wet. After rain they became quagmires and impassable by lorries.

In January, 1916, to meet the growing needs of heavy traffic, the Army Commander ordered that 14,000 tons of road metal should be sent from India for the construction of one main metalled thorough-

fare some seven miles long, from the river front area through Makina Camp to Maqil. At the same time two 6-ton steam rollers, and ten miles of 2-ft. tramline with four petrol tractors for distributing the stone were ordered. The metal was hard Bombay trap, but $4\frac{1}{2}$ in. of metal on a 9-in. soling would not make a water-bound road on Mesopotamian mud. It was found by experiment that the best result was given by laying the metal dry in layers up to four inches thick and then grouting with a mixture of $1\frac{1}{2}$ parts of sand to 1 of cement, all interstices being filled. This produced faster progress than mixing concrete in the ordinary fashion. The thickness of the concrete varied from four to eight inches according to the stability of the underlying surface, the metal was 12 ft. wide with $1\frac{1}{2}$ in. of camber, and the width of the road was 24 ft. between ditches.

Additional stone was required and, after investigation, a quarry party of 250 men of the V Labour Corps under an officer were sent in February, 1917, to Kharaq Island in the Persian Gulf, thirty miles north-west of Bushire, where there were large quantities of suitable limestone. Tramlines were laid for one and a half miles from a new jetty to the quarries, a camp was erected with a wireless station and a fleet of over 170 native craft for sea transport was arranged. Trucks from quarry to wharf were pulled by pairs of mules. The maximum export in one month was 3,100 tons and in all about 28,000 tons were brought to Basra. A large quantity of good sandstone was found at Kuwait on the Persian Gulf, but the difficulties of transport were too great. Limestone brought from Ahwaz by Arabs was also used. At the end of 1917 quarries were started at Jebal Sinam, twenty-four miles south-west of Basra, served by metre-gauge railway to the base.

The seven miles of concrete road, as projected, were completed during 1917. A duplicate road between Makina and Maqil was then made. In all there were some forty miles of roads at the base, of which nearly one quarter were of concrete. At L. of C. stations all the roads remained unmetalled.

During 1916 all the bridges at the base were made strong enough to carry 9-ton lorries. Some were built on piles with a lifting bay to allow river craft to pass. Some were made with lattice girders of spans up to sixty-five feet, and some of troughing on steel joists.

In the Baghdad area about 140 miles of road had to be maintained. Only a small proportion of these were metalled, the stone being brought from Balad in empty trucks returning along the Samarra

railway, but some of the earth roads were covered with gravel or brick and stood well in rain. It was found that unmetalled roads kept in fair condition if systematically watered in dry weather, but were very bad in wet. Many of the streets in Baghdad had to be remade. Two bridges across the Tigris were built at Baghdad, one in the city, and the other to the south.

The Tigris road was also maintained and partly remade, eventually reaching from Basra to Baghdad, a distance of over 400 miles. It was first ordered in November, 1915, to be made as far as Amara, by military labour; and materials for six bridges to span creeks, canals and the Tigris at Qala Salih were prepared and sent up by the Works Directorate, who also constructed a bridge over the southern branch of the Euphrates, 200 yds. long, at Kurmat Ali, six miles north of Basra. This was a floating bridge on ten steel cylindrical pontoons that originally supported the discharge pipe of a dredger. They were laid end to end athwart the stream and the bridge was ready in five days. In September, 1916, it was replaced by a bridge of lattice girders of 30-ft. span, to take a load of 11 tons, supported on piers of steel pontoons in pairs. In April, 1917, this bridge was removed and re-erected at Baghdad. It was intended that the Tigris road should be raised above flood level, but this could not be done. The only secure portion was between Kut and Baghdad, where the road was protected by 140 miles of bunds along the entire left banks of the Tigris and Diyala rivers.

HUTTING

There were soon urgent demands for hutting at Basra on account of the approach of the hot weather. Camps for all troops and formations, and shelters for horses and mules were erected, chiefly on the Makina plain, but also at Maqil and other suitable sites. All along the river front were billets adapted as offices and stores, including Army and L. of C. Headquarters and offices for Posts and Telegraphs, Supply, Ordnance and other services. All these required improvements, quarters for personnel and subsidiary buildings. The British Base Depot was in the Turkish Barracks and the Indian Base Depot in the Turkish Naval Barracks.

In general the type of hut adopted consisted of a braced framework of sawn timber some ten feet high to the eaves. The roofs consisted of layers of mats with bundles of reeds laid between them or (when available) of corrugated-iron sheets, covered with one to

four inches of earth, resting on poles supported by trusses of sawn timber. The walls were of double matting, with doors of light timber framework panelled with matting. The floor areas allowed were: officers, 150 sq. ft.; British other ranks, 48 sq. ft.; Indian other ranks, 35 sq. ft. Verandahs were provided for British troops.

Incinerators of sun-dried or burnt brick, in which the sanitary matter was burnt as far as possible, were provided for all camps. Movable latrines were obtained from India by the thousand.

In January, 1916, when large reinforcements were expected, it was decided to provide new accommodation for some 15,000 troops. This was practically completed by September, 1916, in the Makina camping area, which contained lines for a division, a cavalry brigade, No. 1 Rest Camp for 3,000 men, lines for labour corps and a veterinary hospital for 450 horses. Steel buildings to house a British battalion were also erected. They were later allotted to the 3rd Echelon containing thirty-five officers and 500 clerks.

Maqil was selected as the site for Supply and Ordnance depots and here 1,800-ft. run of 60-ft. and 1,140-ft. run of 30-ft. steel shedding were eventually erected: also imposing double storied blocks of quarters for Ordnance officers and W.Os., a prisoner-of-war camp, and rest camps. In 1917 an ammunition depot occupying three quarters of a square mile, of twenty-four steel sheds each 100 ft. by 25 ft., was built and wired in. There were also erected a large officers' club, a wireless station, a dairy farm, and on the east bank an aerodrome, a depot for 800 convalescent horses and a second prisoner-of-war camp.

Much hutting was carried out on the L. of C. especially at Amara, Qurna and Kut, where extensive lines for troops were built. At Amara an aerodrome, school of musketry with rifle range, two remount depots, an officers' club, and a large grass farm were provided. Other places where hutting was done were Ahwaz, Ezra's Tomb, Ali Gharbi (grass farm), Shaikh Saad and Nasiriya. The great arch at Ctesiphon was repaired.

Very extensive hutting and building were carried out in the Baghdad area. Much of the work consisted in the remodelling of existing buildings for quarters, offices, and depots for men, animals and stores. New building included a remount depot, a large dairy and grass farm, club-house for polo and football, heavy workshops for mechanical transport and Ordnance, and some temporary hangars for which an ingenious method was adopted of hanging the canvas

roofing from a series of catenaries of strong wire hung from pairs of very high built-up poles.

In May, 1918, the Works Directorate was made responsible for all building (except technical buildings) of all other directorates outside field army areas. The pressure of work continued to the last, and in 1918 minor works were numbered by the hundred. The Engineer-in-Chief complained of the excessive demands, and on Armistice Day G.H.Q. ordered the discontinuance of many major and minor works then in hand. In advanced areas new works were undertaken in Hilla, Hit, Ramadi, and elsewhere. At Baquba a camp for 6,000 refugees was begun and then finished by the refugees themselves.

HOSPITALS

The British general hospital was established in the Shaikh of Mohammerah's palace on the right bank of the river north of Ashar Creek, and Indian general hospitals in other large buildings in his grounds. Many additional blocks for wards, subsidiary buildings, stores, nursing sisters' quarters, and operating theatres were built. Soon additional hutted hospitals at Makina and elsewhere were put in hand. In July, 1916, it was decided that the hospital accommodation must be brought up to 14,000 beds, of which a large proportion was located at Amara which was drier and healthier than the base. During 1917 this increase was completed, ten hospitals, British and Indian, being built at Amara and twelve at Basra, of which one had 1,800 beds. Large British and Indian convalescent depots were established at Mohammerah. Hospitals were built at most of the L. of C. stations.

As a rule hospital huts had two roofs with an air space between them, the upper roof being of corrugated iron sheets covered with clay up to four inches thick. They had boarded floors and walls of boards or louvres with an air space, fly proofed, two feet above floor level. There was forty square feet per patient, with an average height in the wards of fourteen feet. A hutted hospital of timber and patent roofing for 1,040 British patients was sent out from England via Salonika, but it required much alteration before it was tolerable in hot weather. This included raising and doubling the roofs and the addition of verandahs.

As the climate of Baghdad is much drier and healthier than that of places farther down the river, it was decided to retain there as many as possible of the sick and wounded. Altogether eleven

hospitals and four convalescent depots were completed, providing a total of 9,608 beds, of which about 2,800 were at the advanced base at Hinaidi. Rather more than half the beds were for British patients. As far as possible existing buildings were altered and adapted. No. 23 British and No. 31 Indian Stationary Hospital were placed in the Turkish infantry and cavalry barracks respectively, fine and substantial buildings with lofty rooms and thick walls. Another large hospital was located in a long range of private dwelling houses, doors being knocked through and considerable reconstruction carried out. New hospitals were provided in single storied buildings of sun-dried brick. Corrugated iron carrying about four inches of mud was used for roofing in lieu of reeds which, used in thatch one foot thick (as at Amara) gave an equally sunproof and much lighter roof. Great overhang was given at the eaves. Subsidiary buildings and those required for medical staffs, orderlies and nurses were provided.

ELECTRICAL AND MECHANICAL WORK

During 1915 all E. & M. work was done by the Searchlight Section. In August part of this section went forward and was eventually captured with its C.O., Captain R.E. Stace, at Kut. The remainder of the section stopped at the base, and there erected five small sets which provided lights and fans in the British hospital, G.H.Q. Building (The British Consulate), L. of C., Headquarters, some other offices, and Ashar Barracks. The erection of an ice plant was begun in October.

The only piped water supply which existed in Basra was provided by a small engine and pump on the river bank supplying a line to the Turkish Barracks at Ashar, which was adapted for the British Base Depot. In general, during 1915 the water supply was carried out by the troops themselves, drinking water being fetched in boats from the middle of the river, chlorinated and distributed in water carts, or A.T. carts carrying barrels, to the camps, where 400-gallon or other steel tanks were set up on frames and provided with taps.

Before the end of 1915 electric light and fans had been ordered from India for 7,000 hospital beds and a proportion of offices and recreation rooms, and in February, 1916, the Army Commander ordered the formation of an Electrical and Mechanical Section. At the end of July, 1916, India was informed that installations for

7,000 additional hospital beds were required. The section was first under direct control of the Engineer-in-Chief, but after a few months it was placed under the Director of Works. The personnel of the Searchlight Section was transferred to it, and recruits were sent from India or transferred from British troops with the force.

It was decided to provide piped water supplies for camps and hospitals throughout the base and L. of C., the water being obtained from the rivers by power pumping. During 1916 these were completed, 20,000 ft. of 6-in. and smaller piping being laid at Makina Camp and 10,000 ft. at Maqil. Pumping stations were set up to serve various areas at the base. The suction pipes were either taken 200 feet into the river or into steel lighters used as settling tanks. Distribution reservoirs consisted of steel tanks on cribwork towers up to 24 feet high. Standpipes and taps were provided in the lines, and taps were installed in hospital bathrooms. In some cases the water was treated by automatic suction chlorinators attached to the pumps: in others the water in the reservoirs was chlorinated by the medical authorities. Devices for cooling water were adopted. By early 1917, piped supplies for 200,000 troops were completed at Basra. Similar piped water supplies were provided at Amara, Qurna and Shaikh Saad. Pumping plants on barges were also prepared and sent to the Tigris Corps.

In August, 1917, seventeen stationary filtration plants and four floating plants for the field army were received from the War Office. This enormous quantity of apparatus required the labours of 400 men continuously over several weeks for unloading alone from the ships. It was several months before the first plant was running at Maqil, but they were all gradually erected at various places. They were capable of dealing with a total of 1,980,000 gallons daily. A special staff for working them came out from England, and joined the E. & M. Section.

New generating sets for electricity were erected—three at the front, two in the Ashar area and three at the Robat Creek. An installation was also set up at Amara. During the hot weather of 1916 the main requirements in lights and fans for the first 7,000 hospital beds and some offices had been met. Hitherto *punkahs* had been used.

To meet the needs of 7,000 additional hospital beds and other extensions, it was decided that an oil-fired central power station should be erected at Basra, on a site near the Ashar creek. The station was designed to include an ice factory, an ice store to hold

250 tons, and a well-equipped workshop. The plant immediately available from India for the station consisted of two complete steam-driven alternators, each of 130 kilowatts at 3,000 volts, and two 120-kw., 440-volt continuous current dynamos, both sets being complete with Babcock & Wilcox boilers and the greater part of the accessories. Most unfortunately the ship carrying a large proportion of this plant was lost, with the result that replacements, put in hand immediately by the War Office, did not arrive till 1917. Two 250-kw. continuous current dynamos, a 200-kw. alternator, and 150-kw. rotary converter had been ordered from England in the first instance, and the final capacity of the central power station was 1,230 kilowatts. It commenced taking the load in March, 1917, meeting all local requirements and releasing small plants for re-erection up river. Supply was carried on 440 volts, 3 wires, three sub-stations being provided at Maqil, Makina and East Bank to convert high-tension alternating current to continuous.

Several ice plants had been received from India, but they had been so imperfect when bought by the S. & T. Corps that in 1916 it was possible only to erect plants delivering 3 tons of ice daily at Basra, and 2 tons at Amara, and three 1-ton plants on barges for the Tigris Corps, and two small plants for out-stations. But in 1917 the central ice factory at Basra was completed to supply twenty tons daily, and three floating 4-ton ice plants were supplied to the Tigris front. Out-stations were well provided for.

Major J. S. Pitkeathly took charge of the E. & M. Section as A.D.W. in July, 1916. In November, 1917 he became D.D.W. with two A.D.Ws. and an Inspector of Machinery.

On the occupation of Baghdad in March, 1917, the only power plants for lights and fans available there were of defective quality. The British drivers worked manfully, employing every device to keep the machinery running. Soon more sets arrived from the base. A central power station of 750 kw. with a cold storage room was designed for the Baghdad area including the Advanced Base at Hinaidi, and in August machinery weighing 1,200 tons arrived for it. All requirements were met, including electric lighting of the wharves.

By midsummer 23 tons of ice a day were manufactured in the Baghdad area, and by August 1 million gallons of drinking water were distributed there daily, the large Turkish water supply having been improved, provided with sedimentation tanks, and supplemented by additional pumping stations and distribution systems.

In 1917, fifteen refrigeration barges were received from England for the carriage of frozen meat, seven others having been sunk on the voyage. For navigation these barges were under the I.W.T. but the storage and refrigeration were under the E. & M. Section, so that all cold storage remained under one control. They were assembled and insulated at Basra. They were equipped with a brine cooling plant with two cold rooms fore and aft the engine room. They were worked so successfully by Captain Kenneth Lightfoot that no cargo was ever lost.

In June, 1917, the E. & M. Section received orders to take over the erection and working of all machinery required by the Agricultural Development Adviser for baling, crushing and milling carried out by cultivators throughout the country; also the repair of pumps and engines of cultivators, assistance in working them and repair of ploughs. Three special workshops were set up, and 200 engines and pumps for sale were obtained from India.

The achievements of the E. & M. Section were impressive. They erected electric power installations at Basra, Baghdad and sixteen other places. Every stationary hospital ward, office, officer's quarter and British barrack was provided with lights and fans. They made large permanent water supplies at Basra and Baghdad and twelve semi-permanent supplies at various posts on the L. of C. and they erected and maintained installations capable of delivering $7\frac{1}{2}$ million gallons per hour for irrigating government dairy and grass farms. They erected fifty-three ice-making plants (i.e., in every area where British troops were stationed) with an aggregate output of 140 tons of ice per day, in addition to their responsibilities for cold storage and agricultural work.

MISCELLANEOUS WORKS

The first A.D.W. brought out instructions from Army Headquarters India that estimates must be prepared for all works costing more than Rs. 500 and works costing over Rs. 5,000 required the sanction of the G.O.C. concerned. It was found that this procedure could not be adhered to. Many officers were not trained to prepare estimates, and under the extreme pressure officers were unable to debit costs of labour and materials to the multiplicity of jobs. Nevertheless, throughout 1915 and 1916, estimates continued to be prepared and sanctioned, but usually in merely a "lump sum" form, and the Accounts officers were very accommodating in

granting credits to A.D.Ws. on monthly forecasts. Allocations of payments to general heads of work were accepted. During 1916 the monthly expenditure of the D.D.W. at the base averaged £40,000, excluding the value of materials issued from the park. In 1917 it was finally settled that the D.D.Ws. should send to the Financial Adviser lists of works put in hand at each station and the sanctioning authority. No estimates were required except in the cases of works carried out for the Navy or the civil authorities. This was a great concession and saving of labour.

The timber used for hutting was imported in large quantities from Singapore, where woods such as panak and seraia are suitable for the field, being easily worked and of moderate price. Rough poles (*ballies*) were obtained from Zanzibar. Bitumen from the beds at Hit was used extensively for water-proofing roofs of houses and billets, lining mud troughs, repairing pontoons, and for hospital floors, where a mixture with 10 per cent of lime was found very satisfactory. Engineer stores, and tools other than those in the Ordnance Vocabulary, were issued to all formations by the Engineer Field Park.

In 1918 new oil-fired brick kilns were built at both Basra and Baghdad, and produced bricks much superior to the Arab bricks in large quantities, meeting all army and civilian requirements.

Perimeter defences were constructed by the Works Directorate at Basra, Amara and Ahwaz. A line of concrete blockhouses was built to protect the Basra-Nasiriya railway. Extensive armouring of steamers and barges and construction of gun platforms on river craft, were carried out in the earlier part of the campaign. Superstructure for bridging trains was made and pontoons kept in repair.

CHAPTER IX

BASRA HARBOUR AND THE RIVER TRAFFIC

Growth of the I.T.W.—Works carried out by the I.W.T.—River traffic.

(See Maps 1 and 2)

GROWTH OF THE I.W.T.

DURING the first fifteen months of the campaign in Mesopotamia all transport arrangements afloat, including the working of the port of Basra, were in the hands of the Royal Indian Marine, under the direction of Commander Hamilton, R.I.M. and, later, of Captain W. B. Huddleston, R.I.M., as Marine Transport Officer. On 8th September, 1916, the War Office ordered the organization of port work and river transport to be transferred to the Royal Engineers. This order was, however, modified, with the result that Basra harbour and all river work below it remained under the Royal Indian Marine establishment, then directed by Brigadier-General Sir George Buchanan, while river traffic above Basra came under the Directorate of Inland Water Transport, a Royal Engineer service.

The development of the port of Basra was only part of the development of the base of the Mesopotamia Expeditionary Force, described in the previous chapter, but it presented some special problems for the Royal Engineers which may be briefly referred to here.

Basra, a town of 30,000 inhabitants, is situated on the Shatt-El-Arab seventy miles (by water) above its mouth at Fao and forty-five miles below the junction of the Tigris and Euphrates (old channel) at Qurna,* the highest point which can be reached by small ocean-going steamers. At Basra, the Shatt-El-Arab was 1,000 yards wide and from three to five fathoms deep. Between Basra and Maqil, three miles up stream, the river was wide enough and deep enough to accommodate an ocean fleet, limited in draught, however, to twenty-seven feet at high-water on the bar at Fao. In the years

* One of the traditional sites of the Garden of Eden.

before the war, there were seldom more than two or three steamers in port at the same time. There was no accommodation in the shape of wharves, sheds, warehouses, cranes or moorings, because none was needed. There were a few small landing-jetties for motor launches, but there was no through-communication along the front.

At the beginning, the Marine Transport Officer, with a quite insufficient establishment, turned to the Sappers and Miners of the 6th Indian Division for help in providing the necessary works on shore and, in the midst of a thousand other demands, they did what they could with their very limited resources. When a base field park was established, it became possible to do more and, later, when the Works Directorate came into existence, the output became considerable. During 1914-15, the most pressing demands were for the provision of additional piers and landing-stages for the unloading of ocean steamers and the loading-up of river craft. Some of the piers were extended to reach specially decked barges anchored far out in the stream. Mat sheds for storage purposes were also provided, Arab tracks were widened and shaped and many bridges were constructed over the innumerable irrigation creeks. In January, 1916, when it was decided to extend the port of Basra to Maqil, it became necessary to provide immediate flood protection for a large area there, to raise a broad wharf, to redeem several low-lying areas and to construct additional landing-places where ships could lie alongside.

In the following September, as already recorded, river traffic was separated from port traffic. Colonel W. H. Grey* was appointed by the War Office as Director I.W.T., and assumed control forthwith. His first task was to reorganize his service into departments and to appoint Assistant Directors dealing with personnel, transport, dockyards, works at the base, up-river construction, native craft, marine engineering and stores, vessel- and barge-building, etc. Colonel R. H. W. Hughes was appointed Deputy Director in September, 1916, and, when Brigadier-General Grey was recalled to Europe in May, 1917, succeeded him as Director.

From the outset, Grey found it necessary to make his directorate

* Colonel Grey was appointed a Brigadier-General soon after becoming Director I.W.T. Colonel Hughes received similar rank when he succeeded Grey. Sir George Buchanan had received the rank of Brigadier-General when appointed "Director-General of the Port Administration and River Conservancy." These officers all possessed wide pre-war experience of port and river conservancy and traffic.

a self-contained unit. This meant building his own barracks and offices, which brought some relief to the heavily burdened Works Directorate, and arranging for stores and equipment by direct communication with the War Office and the Indian Government. He also introduced a system of accounts under which all works were costed and the work of the constructing-engineers, dockyards, workshops and ships were all accounted for on a commercial basis, books being kept by a chartered accountant. In addition, the ordinary accounts required by the Indian Government were also kept.

The complete story of the development and achievements of the I.W.T. has been told elsewhere.* Here, it is possible only to record certain statistics, which indicate the scale of its expansion and the vastness of its responsibilities.

At the end of 1916, its personnel included 224 officers, 212 British O.Rs. and 6,735 men of eastern race. The revised establishment of 1918 provided for a sixfold increase to 799 officers, 3,337 British O.Rs. and 38,832 men of eastern race. There were practically no regular soldiers in the formation. The officer cadres were immediately strengthened by the inclusion of many civilian experts from England and, to a much less degree, from India and elsewhere. The re-organization owed much to the earlier investigations and reports of Sir George Buchanan, who had been appointed Director-General of Port Administration and River Conservancy by the Indian Government early in 1916.

WORKS CARRIED OUT BY THE I.W.T.

The works carried out by the I.W.T. at Basra included the erection and staffing of a large dockyard capable of doing all the repairs necessary for the fleet, the building of slipways of which the greatest was capable of handling vessels up to 1,000 tons, the excavation by hand-labour of a large wet basin with 12½ acres of water-area and 6,000 ft. of frontage, and the erection of two 1,000-ton oil tanks of reinforced concrete. In addition, there were constructed at Bushire three wharves 100 ft. long with 50-ft. T-heads and at Kuwait a wharf 350 ft. long. A pipe-line was also provided at Abadan for loading oil tanks; and here too, in January, 1918, the work of the tinning sheds was taken over, as the Anglo-Persian Oil Company was unable to cope with the increased demand for

* *Vide* Brigadier-General Hughes's *The I.W.T. in Mesopotamia*.

cased oils. Up river, also, the Construction Department of the I.W.T. had to meet heavy calls. Workshops were opened at Ezra's Tomb, Kut and Baghdad, and those at Amara and Nasiriya were greatly enlarged. There were also two floating workshops, one on the Tigris and a smaller one on the Euphrates above Nasiriya. In 1918 Dhibban (then railhead) on the Euphrates was developed as a most important transshipping station and a floating repair-shop was stationed there; while in connexion with the collection of the harvest, kerosene storage-tanks were erected at Hilla, Kufa, Diwaniya, Kifl and many other places to supply the needs of cultivators.

In the summer of 1917 the I.W.T. took over the maintenance of the Tigris roads and all bridges on the Tigris L. of C. and, later on, the bridges on the Diyala, the Euphrates and the Tigris (above Baghdad). The most important bridges constructed by the I.W.T. were the MacMunn Bridge at Amara and the Maude Bridge at Baghdad, which was capable of carrying 15-ton vehicles. Both were mechanically operated and could be opened for passage of a ship and closed again in five minutes.

RIVER TRAFFIC

The *raison d'être* of the I.W.T., however, was the transport of men and material from Basra to Baghdad and to all intermediate posts on the rivers. This entailed the maintenance of an ever-growing fleet of river craft and, in addition, a new system of river-conservancy, pilotage and buoyage.

The peculiar character of the two great rivers of Mesopotamia make both their navigation and their conservancy exceptionally difficult. In the summer, owing to the melting of the snow in their highland sources, they come down in high flood and are then barely kept within their banks by the maintenance of bunds whose efficiency deteriorated very much during the early years of the campaign. At this period they are both liable to change their channels and to form sand-banks which only become apparent in the low-water season. The course of the Tigris was known to be unusually tortuous; but little was known of the capacity or peculiarities of either river or of their tributaries and distributaries. River survey and river conservancy were almost non-existent.

A department of River Conservancy was, therefore, one of the first to be established. Later, this department was also made

responsible for irrigation, the importance of which may be deduced from the fact that the Tigris from Baghdad to Basra (500 miles) is drained off by innumerable canals, large and small. Irrigation responsibilities on the Euphrates were also considerable.

The system of pilotage introduced was one whereby sections of the rivers were under their own pilotage officers who were responsible for buoying and placing marks so that the numerous moving sand-banks could be avoided. This was a great improvement upon the old system of placing Arab pilots on board each vessel and trusting to their knowledge of the river for safe running. It also enabled a staging-system to be established, whereby steamers could be used up to the maximum draught permitted by the depth of each section of the river, while the barges were of uniform $4\frac{1}{2}$ -ft. draught and could be towed anywhere. Many beliefs regarding the depth and speed of the rivers were proved inaccurate by proper survey.

In connexion with river conservancy, which never relaxed, it is to be noted that in March, 1918, surveys and preparations were commenced with a view to completing the navigable cut across the Hamar Lake. In all, about twenty-four miles had to be dredged to a depth of eight feet. Of this, six and a half miles had been partly dredged in 1916/17 under the direction of Sir George Buchanan who had three suction dredgers brought from Burma for the purpose but his scheme had been temporarily abandoned. This work was eventually completed in February, 1919, when over $7\frac{1}{2}$ million cubic yards of spoil had been excavated and deposited to form a bank on the south side of the channel.

In December, 1915, in addition to native boats, the river fleet had consisted of 13 paddle-steamers, 3 stern-wheelers, 9 tugs, 3 screw-boats and 47 barges, all in bad condition. By March, 1917, it had grown to 245 self-propelled vessels, 315 barges and 187 motor-boats; and, by November, 1918, to 446 self-propelled vessels, 774 barges and 414 motor-boats. Early in 1918, sixteen "Fly-boats" were taken over from the Royal Navy and four of these were retained as gun-boats, Royal Artillery gunners being attached to the I.W.T. to replace naval ratings.

Vessels ordered in England were generally sent out under their own steam and, amongst others, three of the old so-called "Penny Steamers" from the Thames were sent out with R.E. crews under the R.E. flag and gave very good service in Mesopotamia as tugs. The War Office also introduced a towage-service from England, via the Mediterranean, vessels all being manned by R.E. units. When

the first vessel arrived at Gibraltar, manned by soldiers and flying the Corps flag, it caused quite a sensation.

Barges were generally sent out in plates and angles and were put together at Basra ; but others were entirely built and equipped locally, including the special barges for filtered drinking water and the refrigerating craft.*

Among the less obvious activities of the I.W.T. may be mentioned the institution, in April, 1918, of a small Fisheries, Sub-Department with headquarters at Fao. A specially-fitted ice making barge, with cold-storage accommodation was stationed there, with a staff of two officers, eleven British O.Rs. and nineteen Indians. Operations lasted three months and 133 tons of fish were dispatched to Basra.

In July, 1918, under instructions from the War Office, four officers and four O.Rs. were dispatched to North Persia to assist in selecting and arming vessels for service on the Caspian Sea. Orders were, however, modified and these duties were transferred to the Royal Navy ; but control of merchant-shipping, port-administration and all repair work were deputed to the I.W.T. detachment, which was considerably reinforced for this purpose. After the cessation of hostilities, it was transferred to the Mediterranean Command.

Brigadier-General Hughes was absent from Mesopotamia from the 4th May to the 25th September, 1918. During his absence, Colonel J. C. Ward, D.S.O., officiated as Director. Later on, this officer became Director of the Port of Basra, directly responsible to the I.G.C.

In August, 1919, most of the War Directorates, e.g., Works, Irrigation, Railways, Port, Telegraphs, etc., had become quasi-civil ; but the I.W.T. continued to operate and was kept going for many more months by its military personnel. At that date, its strength had only fallen to 325 officers, 766 British O.Rs., 597 civilians and 25,148 men of eastern races (including 2,378 local labour). It was still delivering 900 tons per day from Basra to Kut and 500 tons from Basra to Baghdad. Its buoyage department was still at full strength.

During the Arab rebellion in 1920 its depleted resources were highly tried. After the reduction of the military garrison in 1921, however, the necessity for an organization on even such a reduced scale no longer existed and, eventually, it passed entirely under the control of the civil authorities.

* Brigadier-General Hughes gives an exhaustive list and description of every type of vessel used, in his book *The I.W.T. in Mesopotamia*.

In all theatres of British operations during the war, the I.W.T. (R.E.) services were charged with vast responsibilities; but in no theatre were these responsibilities of so varied and so novel a character as in Mesopotamia. The best testimonial to the efficiency with which the most important of them were discharged even at the time of greatest trial is contained in Lieut.-General Sir Stanley Maude's dispatch on the Capture of Baghdad: "The newly-formed I.W.T. Directorate had first to form its ranks and then develop its organization and provide for its many requirements; but the personnel, making light of these very real obstacles to rapid progress, worked unceasingly with the result that, day and night, an endless chain of river craft passed up and down the river, thereby ensuring the maintenance of the troops at the front."

CHAPTER X

RAILWAYS IN MESOPOTAMIA

Railway construction during the war—Organization—Railways after the Armistice—The Basra-Baghdad line—Post-war organization.

(See Map 1)

RAILWAY CONSTRUCTION DURING THE WAR

BEFORE the war, Mesopotamia possessed no railway system. A section of the Berlin-Basra standard-gauge railway was in operation between Samarra and Baghdad and a Turkish built (2 ft. 6 in.) line connected Baghdad with Mufraz on the Euphrates; but neither of these was of any use to our Expeditionary Force until after the occupation of Baghdad in March, 1917. The whole of the material and personnel required for railway construction and practically the whole of the necessary rolling stock had to be imported by us.

Prior to 1916, a 2-ft. light line had been laid by the Director of Works to connect Maqil with the port of Basra and to serve our local camps and depots; but the Government of India had decided against any other railway construction in Mesopotamia. This decision was reversed when the War Office took over control in February of that year, and four months later work was begun on a metre-gauge line from Basra to Nasiriya. The metre-gauge was the only one for which an adequate stock could be supplied at that time.

In June, 1916, Mr. J. H. White of the Indian State Railways, who had been appointed Director by the Government of India, arrived at Basra with the first consignments of material. The War Office, however, had decided that the Director should be an officer with experience in the working of railways under war conditions. Accordingly, Colonel G. Lubbock, R.E., was appointed Director *vice* Mr. White in August, 1916, and took up his duties at the end of September.

The line to Nasiriya (133 miles) was completed in December, 1916. Meanwhile, as 2-ft. 6-in. gauge material had become available, it was decided to lay this from Qurna to Amara (70 miles) along

the right bank of the Tigris in spite of pessimistic forecasts of danger from floods. By the end of November, however, when this line was finished, it had already become apparent that the very narrow gauge could not meet the needs of the force, and as India could supply the material, it was decided to convert the Qurna-Amara line to metre gauge. Conversion began on 1st February, 1917, and was completed on 24th April, the narrow gauge being kept running by adopting a four-rail track with the metre gauge laid outside on the same sleepers. While operations were in progress against Kut, a 2-ft. 6-in. line was built from Shaikh Saad, the river base, to the Hai river (36 miles) during the latter part of 1916.

When Baghdad was occupied in March, 1917, the C.-in-C. decided that a line should be built from Kut to Baghdad (105 miles), the distance by river being 200 miles. This line was started on 20th May, 1917, reaching the supply depot at Hinaidi near Baghdad on 25th July. For the first fifty-six days the rate of plate-laying averaged 1.76 miles per day, no mean feat in the hottest months of a Mesopotamian summer.

As no fresh material was available at the moment for extensions beyond Baghdad, the narrow-gauge material dismantled from the Qurna-Amara and Shaikh Saad lines was brought to Baghdad and laid thence up the Diyala, reaching Baquba in July, 1917, and Shahraban (60 miles) in October.

In the autumn of 1917 the construction of standard-gauge lines connecting Baghdad with the Euphrates was begun, rolling stock being sent from England. The first of these reached Dhibban in February, 1918 (44 miles), the second reached Hilla (165 miles) in May, 1918. In the spring of 1918, as more material arrived from India, the Baghdad-Shahraban line was replaced by a metre-gauge line laid independently, and some of the material thus released was laid from Hilla to Kifl on the Euphrates (18 miles) to assist in bringing in grain to Baghdad.

On 5th June, 1918, the extension of the German-built standard-gauge line from Samarra was begun, reaching Tikrit (32 miles) on 18th August, and a further extension was begun on 9th October, reaching Sharqat via Shuraimiya (58 miles) after the Armistice. The gap between Basra and Qurna (41 miles) was completed with a metre-gauge line in the course of 1917, and a line from Zubair station near Basra was built to tap a stone quarry at Jabal Sinam (24 miles) in order to provide road metal for Basra.

In 1918 the Shahraban line was extended to Qizil Ribat and to

a point near Khaniqin. The extension involved two short tunnels and several rock cuttings through the gorge of the Diyala, and at the time of the Armistice it had only reached Qizil Ribat (19 miles).

With the exception of the Qizil Ribat extension all lines were built over flat or slightly undulating country, involving little or no earthwork. All bridges and flood openings were on timber trestles and piles, except a floating bridge on steel pontoons, carrying the metre-gauge over a branch of the Euphrates near Basra. The total length of all the lines enumerated, including the light lines in the port of Basra, was approximately 830 miles.

ORGANIZATION

Besides the Director and Deputy Director (Colonel R. Oakes) only five regular R.E. officers were employed in the Directorate, the remainder being temporary R.E., Indian Army reserve of officers and civil engineers from India gazetted to no branch of the service, but given "relative" army rank according to their position.

The Government of India undertook and carried on throughout the war the supply of personnel of all ranks for which they initiated and maintained a large recruiting organization in India. No attempt was made to organize the operating personnel into military formations, the normal organization of civil railways being followed in the main.

For construction, work companies* about 500 strong were formed. Eight such companies were employed, supplemented during part of 1917-18 by British and Indian technical troops (R.E., S. & M. and Pioneers), and to a small extent by Arab labour in the Basra *vilayet*. For bridge work, survey, etc., special skilled units were formed, varying according to the needs of each work.

In 1916-17, service in Mesopotamia was not popular in India and the rank and file could only be recruited on short nine-month contracts. As conditions improved contracts were gradually lengthened to eighteen months and two years. Arrivals and de-

* Establishment of a construction company :—

Technical officers	2
Administration and medical officers	2
Supervising staff	6
Clerk and time keepers	4
Artisans (carpenters, smiths, etc.)	12
Gangers and platelayers	210
Labour foremen and labourers	312

partures often exceeded 3,000 a month. These were dealt with at a special railway base depot where the men's documents and pay records were kept.

The clothing, rationing and sanitary supervision throughout the Directorate was found to throw so much work on the technical officers, of whom there was a scarcity, that a separate department of the railway was formed for these administrative duties, officered by non-technical personnel. A Railway Transport Department was formed, in accordance with F.S.R., as the channel of communication between the army and the technical railway officers.

The war establishment of the Directorate as authorized in 1918 is given below ; actual strength did not exceed ninety per cent of establishment at the Armistice.

Establishment of the Railways, 1918

	Officers	Other Ranks
Direction and Management	23	256
Pay and accounts	11	223
Stores	9	2,540
New Construction	56	8,753
Engineering maintenance	25	7,261
Loco. Dept.	19	5,825
Traffic Dept.	14	3,214
Administrative (non-technical)	14	609
Railway Transport Dept.	19	149
Railway Depot and Records	3	71
Total	193	28,901

It will be noted that the proportion of officers is high, compared with peace-time standards. This was due largely to the constant changes of personnel recruited on short contracts, and the lack of a permanent and experienced subordinate supervising staff. Moreover, practically no work could be done by contract, and liberal supervision by officers was necessary in order to obtain efficient results from the labour.

ROLLING STOCK AND PLANT

From first to last, all plant, permanent way and rolling stock were supplied from Indian railways, with the exception of 12

standard-gauge locomotives and 100 wagons sent out from England. At the Armistice the total rolling stock included 38 locomotives and 156 wagons of standard gauge, 164 locomotives and 4,171 wagons of metre gauge, besides 3 complete ambulance trains.

At the Armistice the traffic carried on the whole system was approximately 4 million ton-miles of goods and 5 million passenger-miles per week.

RAILWAYS AFTER THE ARMISTICE

Operations being still in progress in Persia, work on the line beyond Qizil Ribat was carried on without interruption after the Armistice, reaching the Persian frontier near Qasr-i-Shirin, forty-six miles from Qizil Ribat, at the end of May, 1919. It had been the intention of H.M.'s Government in 1919 to carry on this line into Persia, with a view to supporting operations on the Caspian Sea, and a survey party organized from the Railway Directorate actually surveyed a possible route as far as Hamadan early in 1919, but this project never materialized.

During the hot weather of 1919 the Diyala was bridged above Qizil Ribat with a timber pile and trestle bridge, and a branch line built, approximately forty miles long, reaching Kifri in the autumn. It was anticipated that grain and other supplies would be obtainable from this area. The bridge carrying the line over the Diyala at Baquba during 1917-18 was of timber trestles 28 ft. high on piles, the maximum height (rail level to river bed) being over fifty feet. During the winter floods of 1917, its foundations were nearly scoured out, and were the cause of considerable anxiety owing to the importance of this bridge to our communications with Persia. India was able to supply cement and old broad-gauge girders, and it was decided to replace it with a permanent bridge on concrete piers founded on concrete wells, with two spans of 75 ft. and four of 100 ft. each. This, the first bridge of a permanent nature to be built in Mesopotamia, was begun in May, 1918, opened for traffic in March, 1919, and named "Marshall Bridge."

THE BASRA-BAGHDAD LINE

In 1918, approval was given by H.M.'s Government for the completion of the direct Basra-Baghdad line by joining up the then existing railheads at Nasiriya and Hilla, 160 miles apart, and

surveys for the line were carried out. The Government of India, however, found themselves unable to supply the necessary track and rolling stock owing to the many demands of the war, and the project had to be deferred. It was begun again in January, 1919, on an alignment that had not been adequately surveyed, with the result that many miles of freshly completed embankment just above Samawa were carried away in the spring floods, and a new alignment had to be adopted which proved satisfactory. Timber bridges were constructed over the Hilla branch of the Euphrates and over the main channel of the Euphrates just above Samawa. The Baghdad-Hilla line was converted from standard to metre gauge early in 1920, a simple matter taking only three or four days, and the whole line Basra to Baghdad was opened for traffic in January, 1920.

Its existence as a going concern was short-lived. The Arab rebellion broke out in June, 1920, and in the course of the operations the whole section south of Hilla was gradually abandoned. The damage done to the permanent-way bridges and rolling stock was extensive and many of the railway employees on this section lost their lives. The Arab method of destroying the track was simple and effective. Fish plates were removed from a pair of rail joints and camels were harnessed to the loose end of the track, which was then hauled out at right angles to the line. Thereby, the rails for a length of a hundred yards or more were bent beyond possibility of repair. The sleepers were removed to serve as roofing material or firewood in Arab villages.

Samawa was saved by the local garrison which held out near by; but all other bridges were burnt down to water level, and some rolling stock was burnt or otherwise destroyed at Samawa and other stations. Three locomotives and about 120 wagons were isolated at Diwaniya in the early stages of the rebellion. These were all connected up into one train and brought back to Baghdad with the troops that relieved Diwaniya, not without some delay and risk to the relieving force. The line had been cut in several places between Diwaniya and Hilla and, to get the train through, rails and sleepers had to be taken up behind the train, carried the length of the train (nearly a mile) and laid ahead. Oil fuel for the locomotives only just held out to reach Hilla. In fact, at the end, one locomotive was pulling the other two and the train.

Over a hundred miles of sleepers and fifty miles of rails and a hundred wagons were obtained from India to make good the des-

truction by the Arabs, and the line was gradually restored and the bridges rebuilt as the forces advanced in the autumn and winter of 1920-1.

On the north-eastern section between Baghdad and the Persian border the railway sustained only minor damage to a few bridges which were all of masonry, but several small timber bridges on the Kifri branch were burnt. Other sections sustained no damage, and by the spring of 1921 the whole system was again in working order, though somewhat disorganized by the experiences of the previous nine months.

POST-WAR ORGANIZATION

In March, 1920, the railways were transferred from the Army to the Civil Government, which took over the whole of the existing staff; and the Regular R.E. officers gradually returned to their military duties during 1920-1. Although the internal organization and working of the system remained unchanged, all traffic, military, civil, government and private, was, after the transfer, accounted for and charged on a commercial basis. The troubles of 1920 and the high cost of labour and materials resulted inevitably in a loss on the working of the railways in the first year or two of civil control, a loss which was included in the general expenses of the war and its aftermath.

CHAPTER XI

SURVEY IN MESOPOTAMIA

Organization—Use of air-photography—Minor surveys—Conclusion.
(See Map 1)

ORGANIZATION

IN 1914 few maps of Mesopotamia existed, and those available were on so small a scale, so inaccurate and so wanting in detail that they were of little value for military purposes. Yet, the original Expeditionary Force was not provided with any personnel or equipment for accurate surveying.

In January, 1915, at General Nixon's request, a small party under Colonel Pirrie, Indian Army, arrived in Basra to carry out a large-scale survey of that city and its environs. Nine months later, the Basra survey party included two R.E. officers, Major H. H. Turner and Captain W. E. Perry, three provincial officers and twelve surveyors. From this small beginning the survey establishment had risen by 1917 to twenty-eight officers and eighty-two other ranks, and remained at that strength until some time after the Armistice. The appointment of a Deputy-Director of Surveys in Mesopotamia was not authorized until early in 1917. Colonel Pirrie was the first incumbent. When he proceeded on leave in May, 1918, he was succeeded by Colonel C. H. D. Ryder. In February, 1919, Ryder was invalided and Major C. P. Gunter then acted as Deputy Director until Colonel Pirrie's return in April of that year.

During the years 1914-16 operations had to be planned mainly on reconnaissance sketches and reports produced by selected officers under the orders of the chief Intelligence Staff Officer, Colonel W. H. Beach, late R.E. Thus, in March, 1916, the night march to the Dujaila Redoubt was planned on the reconnaissances of Captain K. Mason, R.E., who guided the column so successfully.

Surveying in Mesopotamia was not, however, a Royal Engineer service. It was provided by The Survey of India, a civil department mainly recruited from all ranks of the Indian Army and from civil

sources, but employing many R.E. officers in its higher grades. Its operations in Mesopotamia spread far beyond the frontiers of that country, embracing parts of Syria, Kurdistan and Persia. A complete account of these operations is to be found in Vol. XX of the Records of the Survey of India—*The War Records of 1914-1920*.

The most important work in Mesopotamia comprised a regular topographical survey based on triangulation in Greenwich terms, which was eventually connected with the Russian surveys in the north and the Egyptian surveys in the west. This topographical survey followed the armies in the field and operated over the country as it was freed from enemy occupation. It included town surveys on scales as large as 48 in. to the mile and precise levelling operations. Before the Royal Flying Corps was able to co-operate with the survey, reconnaissance and sketch maps were made with difficulty for the immediate use of the fighting front, but as air co-operation gradually became effective, and in order to provide the army with maps of enemy-occupied areas, which were all unsurveyed, a Map-Compilation Section was formed and accompanied the forward troops. This Map Compilation Section was commanded by Major C. P. Gunter, under the G.S.O.1 Intelligence. In November, 1916, it became a complete Photo-Litho Section by the addition of an Air-Photo Section from Egypt, a full-sized printing machine and several hand-presses, manned by trained machine-printers and litho-draughtsmen recruited from the New Army troops in India.

USE OF AIR-PHOTOGRAPHY

The advent of photography from aeroplanes enabled all Operation and Position maps to be compiled entirely from air-photographs provided by the R.F.C. This is historically of interest as it was probably the earliest instance of maps of this kind being compiled without the aid of ground survey. The open and flat nature of the country where military operations took place enabled the compilers to produce accurate and up-to-date maps for the use of the troops for every action from the autumn of 1916 onwards, and there was a general feeling at the time that these maps were of great help in defeating the enemy.

While these main operations were being carried out, opportunities for the display of personal initiative and sometimes of great courage were provided by expeditions undertaken by survey detachments varying in strength from three officers and six other ranks to indivi-

duals working on their own. In May, 1918, when preparations were in hand for the advance on Kifri, an operation-map was urgently required, but there was no opportunity for air-photography. Major G. A. Beazeley, however, had invented a method of sketch-surveying from an aeroplane on a board with a sun azimuth dial. He undertook the sketch map in front of Kifri, completed it in the morning, and sent it to the Map Compilation Section by air the same day. Copies were printed and flown to the troops next morning in time for the advance and capture of Kifri that day. On a later occasion, while carrying out a similar task in front of Kirkuk, Major Beazeley's plane was shot down and he was captured by the enemy.

An unusual method of fixing points for air-photographs in enemy-country beyond the reach of our triangulation was evolved by Major Gunter with the Artillery. From four observation posts, very accurately fixed, observations to identical 6-in. Howitzer shell-bursts on impact in the enemy position were made simultaneously. An air observer registered the position of each hit on a large-scale trench-map compiled from air-photographs. The observed angles were then plotted and those marked "O.K." by the observer were accepted as correct and their co-ordinates used for adjusting the photo-strips.

MINOR SURVEYS

Before the war, when the country was under Turkish rule, Sir William Willcocks had prepared maps and plans for irrigation purposes in the Tigris and Euphrates valleys, but in 1917 many of his bench-marks could not be located, and the Irrigation Directorate found that some new precise levelling was necessary. Colonel G. P. Lenox-Conygham, late R.E., of the Survey of India, visited Mesopotamia early in 1918 and arranged for the necessary work. Two levelling detachments arrived in October, 1918, and completed their work that winter, one in the Euphrates valley and the other on the Tigris.

In the winter of 1918/19, Captain C. G. Lewis, with two other ranks, carried out a rapid triangulation and survey of the Euphrates valley. After completing his work for the detailed survey, he effected a connexion between the Mesopotamian and Egyptian surveys at Aleppo. By the skilful use of motor transport he was able to complete the last 200 miles of triangulation and survey in sixteen days. Subsequently, in the Syrian desert, Captain K. Mason was instrumental in opening up the desert route from the Euphrates

to Damascus, through Palmyra. A route-sketch was carried across the desert by means of a motor traverse.

After the Armistice British Political Officers were installed in central and southern Kurdistan in order to take over the administration of the country. This gave an opportunity for a survey officer to enter a very inaccurately mapped area and resulted in a satisfactory sketch-map by Captain K. Mason, covering 2,400 square miles of most difficult and war-devastated territory. It was in the borderland of Kurdistan and Azerbaijan that an Indian Survey officer was able to combine some valuable reconnaissance survey with his political mission, and this proved of great value to the South Kurdistan Field Force in June, 1919.

In Western Persia, a detachment commanded by Captain W. E. Perry worked with the Russians for eight months in 1917; and, during 1918-20, detachments under Major E. T. Rich carried out surveys of a varied character in north-west Persia and connected our triangulation with the Russian network emanating from the Caucasus. Surveys were also carried out in the Pusht-i-Kuh, north-east of Bushire, for the Anglo-Persian Oil Company and the resulting maps were made over to them.

CONCLUSION

All these surveys were based on Mesopotamia, and during the period of hostilities the area of topographical survey covered about 120,000 square miles, besides large areas of reconnaissance and sketch surveys. The area of mapping done by the Map Compilation Section comprised 2,200 square miles from air-photographs and 131,000 square miles from ground surveys.

The Arab rebellion in 1920 put a stop temporarily to all survey operations in Mesopotamia, and after it was quelled only a few officers and surveyors of the Survey of India remained in the country to fill in gaps left in the topographical maps. Practically all surveys were soon afterwards taken over by the local civil administration.

MISCELLANEOUS THEATRES, 1914-18

CHAPTER XII

THE EAST AFRICAN CAMPAIGN

The initial situation—Troops arrive from India—The minor operations of 1914-15—Arrival of General Smuts and more troops, 1916—General Smuts's campaign of 1916—Reorganization during spring, 1917—Railway work—Work on the L. of C.—The final phase—Survey in East and West Africa.

(See Sketch 3, facing p. 128)*

THE INITIAL SITUATION

IMAGINE a country three times the size of Germany, mostly covered by dense bush, with no roads and only two railways, and either sweltering under a tropical sun or swept by torrential rain which makes the friable soil impassable to wheeled traffic ; a country with occasional wide and swampy rivers interspersed with arid areas where water is often more precious than gold ; in which man rots with malaria and suffers torments from insect pests ; in which animals die wholesale from the ravages of the *tse-tse* fly ; where crocodiles and lions seize unwary porters, giraffes destroy telegraph lines, elephants damage tracks, hippopotami attack boats, rhinoceroses charge troops on the march, and bees put whole battalions to flight. Such was German East Africa in 1914-18. So dense was the bush that a man twenty yards from his fellows might feel himself alone in Africa. On one occasion, a British column pursuing a German force passed it unawares and did not discover the mistake until its rear-guard was attacked by the German advanced guard. Field wireless communication was non-existent. Our columns groped blindly for the elusive, mobile and well-organized enemy and faced his concealed machine-guns. The war became a long process of attrition and extermination. There was little glory to be won and much hardship to be endured. In fact, to most of the world, the East African campaign was just another "side-show," badly reported and consequently almost unknown. It was allotted only such troops

* Reproduced from *The Indian Sappers and Miners*, by Lieut.-Colonel E. W. C. Sandes, with the kind permission of the author.

as could not be better employed elsewhere ; and although, through the gallant fighting, stoical endurance and hard marching of those troops, victory was attained in the end, it presents, in retrospect, a sombre picture.

During four years of hostilities, less than three dozen R.E. officers served in East Africa, and no R.E. field units whatever, but this small cadre worthily upheld the high traditions of the Corps. Not until 1918 did a few subsidiary R.E. formations reach the country in the shape of No. 358 Base Park Company, Nos. 391 and 392 Road Construction Companies and No. 6 Topographical Section, so it is clear that the Home Establishment took little part in the campaign. The onus fell originally on India, and India could not support it. Most of the junior R.E. officers on the Indian Establishment had been sent to France in the autumn of 1914, and others to Mesopotamia, leaving a mere trickle for East Africa. Even the regular Sapper and Miner companies proceeding to Mesopotamia were officered largely from the Indian Army Reserve of young civilian engineers with a brief military training. Had not South Africa come to the rescue in 1916 with troops of all arms, German East Africa might never have been cleared of the enemy and would accordingly have provided, throughout the war, convenient sea-bases from which hostile warships could have raided our lines of communication across the Indian Ocean.

In August, 1914, British East Africa and Uganda were totally unprepared for war. In the former, the only regular unit was the 3rd Battalion, King's African Rifles, based on Nairobi, though a small force of armed police was maintained for internal security. In the latter, the 4th Battalion was based on Entebbe on Lake Victoria. Only eleven companies in all were available for the active defence of the huge Protectorates. The 1st Battalion was far away in Nyasaland, and the 2nd Battalion no longer existed.* Some help was expected from hurriedly raised volunteer units of local Europeans, and from a corps of Arabs, but these formations had no technical troops or artillery and few machine-guns. Against this meagre array were pitted fourteen African *askari* companies, officered by Germans, self-contained, mobile units, each with its own

* The 2nd Battalion, K.A.R., had unfortunately been disbanded in 1911. Many of the men had then enlisted in the German forces and fought against us during the war. Afterwards, they were allowed to re-enlist in the K.A.R., and in 1928, some were wearing both the African General Service Medal and the Iron Cross !

supply and transport organization of porters, and well equipped with machine-guns, though lacking artillery. The *askaris* had been carefully trained in bush warfare. They were brave, hardy and accustomed to living on the country, and at their head was Colonel von Lettow-Vorbeck, a capable soldier with recent experience of bush fighting in German South-West Africa.

Two railways formed the principal arteries of traffic in German East Africa—the Northern Railway from the port of Tanga to Moshi, near Mount Kilimanjaro, and the Central Railway from Dar-es-Salaam, through Morogoro and Tabora, to Lake Tanganyika. To the north, in British East Africa, the Uganda Railway from Mombasa, via Nairobi, to Lake Victoria was our main line of communication. These lines were of paramount importance because, during the rainy season, normally from April till the end of June, most of the country became impassable except by rail. The absence of roads, the loose nature of the belts of black cotton soil, the scarcity of water in the dry season and the floods during the rains, made engineering a prominent, and sometimes decisive, feature in the military operations. Engineers, however, were as scarce as diamonds, as also were engineer troops, and whole brigades of infantry had to be employed for weeks at a time on road-making. Von Lettow's experienced *askaris* and porters needed no roads; but the British and Indian troops, using motor transport, had to make them as best they could under strange and difficult conditions.

TROOPS ARRIVE FROM INDIA

The first reinforcement from India landed in Mombasa on 1st September, 1914—a single battalion of Punjab Infantry forming part of an Indian Expeditionary Force "C," of brigade strength, under Brigadier-General J. M. Stewart. The unit was hurried up country to guard the vital Uganda Railway, and was followed, early in October, by the remainder of the force, comprising two battalions of Imperial Service infantry (Indian States' troops), an Indian mountain battery, a British volunteer battery with obsolete field guns, and a railway volunteer machine-gun battery with equally ancient weapons. Such was the puny force which, with eleven K.A.R. companies, was expected to guard 250,000 square miles of British territory and 600 miles of railway lying parallel to, and often only fifty miles from, the German frontier. However, at the end of October, the dangerous situation was eased to some

extent by the arrival of an Indian infantry brigade under Brigadier-General R. Wapshare, in addition to an Imperial Service brigade, under Brigadier-General M. J. Tighe, and another mountain battery. Tighe's command fortunately included the 61st Madras Pioneers, and among the divisional troops allotted to I.E.F. "C" were the Faridkot State Imperial Service Sapper Company, a small bridging train of Bombay Sappers and Miners, and, most important of all, two regular railway construction companies of Sappers and Miners, each of which included an operating detachment of reservists from the Indian State Railways, and a party of about 300 officers and tradesmen drawn from Indian railways. With the Faridkot Sappers, as Special Service Officer, was Major B. W. Mainprize. Captain E. D. Tillard commanded the Bridging Train, and Majors C. F. Anderson and C. W. Wilkinson, the 25th and 26th Railway Companies. Other Royal Engineers with the railway organization were Captains L. N. Malan, C. S. M. Watson and E. St. G. Kirke, and Lieutenants H. L. Woodhouse, J. R. Roberts and R.E. Gordon.* Major R. L. McClintock arrived with No. 4 Engineer Field Park, Madras-S. & M. On the staff of Major-General A. E. Aitken, now in command of the whole force, renamed I.E.F. "B," were Lieut.-Colonel S. H. Sheppard as G.S.O.I, Lieut.-Colonel C. B. Collins as C.R.E., Major G. Lubbock as D.A.D. Railways under Sir William Johns as Director, and Captain H. C. Hawtrey as A.D. Signals. These were the first Royal Engineers, apart from survey officers, to reach the theatre of war.

THE MINOR OPERATIONS OF 1914-15

General Aitken had only one regular British battalion, and a few of his regular Indian battalions had seen any active service. Also, he had no field artillery and few machine guns, and his Indian States' infantry was only partially trained. On 4th November, 1914, he failed in a landing at Tanga; but owing largely to the excellent arrangements made by his G.S.O.I (Sheppard), the troops were re-embarked and returned to Mombasa. As in the dark days in Mesopotamia, the War Office now assumed control of all operations. Wapshare, who relieved Aitken in the supreme command, had to devote his energies for several months to the defence of British

* The railway staff was reinforced later by Lieutenants J. H. Morris, D. D. Crawford, P. J. R. Watkins, N. N. C. B. Little, A. Minnis and R. Higby, R.E., and by many officers of the Indian Army Reserve.

territory while his troops recovered from the reverse at Tanga. He had at his disposal a force of almost divisional strength. But where were the three field companies which should have been his minimum engineer establishment for operations in a savage and difficult country? They were represented by a single unit of Indian State troops, below strength and not trained to the standard of regular Sappers and Miners. His Bridging Train was a mere cadre of thirty men; skilled workers, but requiring assistance for rapid bridging.

On 8th November, 1914, I.E.F. "B" began to move inland from Mombasa, some reinforcements being sent to Nairobi, where Stewart had made a demonstration towards Longido. The Faridkot Sappers were railed to Voi, about sixty miles from the sea, and the 25th and 26th Railway Companies moved up the Uganda Railway for protection duties. Meanwhile, the Germans had followed up their success at Tanga by thrusting northwards towards Mombasa. In January, 1915, they were driven from Gazi; but they still held Jasin on the frontier. Only at Taveta, south-east of Kilimanjaro, did they maintain a foothold on British territory, and we countered by occupying their island of Mafia, south of Dar-es-Salaam. The situation throughout 1915 was virtually a stalemate. Major-General Tighe, who relieved General Wapshare in April, had to be content with defending the 900 miles of frontier and improving his communications; but nevertheless, with a view to the ultimate invasion of German East Africa, he began to build a branch railway line from Voi, through Maktau, towards enemy-occupied Taveta, to link up with the German Northern Railway at New Moshi when the area had been cleared of hostile forces.*

* The following are the chief sources of information for the military and engineering operations described in this narrative: *Military Operations, East Africa, Vol. I, Aug. 1914-Sept. 1916* (Lieut.-Colonel C. Hordern); *My Reminiscences of East Africa* (General von Lettow-Vorbeck); *General Smuts' Campaign in East Africa* (Brigadier-General J. H. V. Crowe); *A Short History of the Services rendered by the Imperial Service Troops during the Great War* (Major-General Sir Harry Watson); *A Brief History of the Bombay Sappers and Miners*; *The Empire at War, Vol. IV, Africa* (Sir Charles Lucas); *The East African Force, 1915-19* (Brigadier-General C. P. Fendall); *The Times History of the War: The Campaign in German East Africa*; articles by Captain H. L. Woodhouse and Brigadier-General S. H. Sheppard in *The Journal of the United Service Institution of India*, 1917 and 1919; articles by Brigadier-General R. T. Ridgway and Colonel G. M. Orr in *The Army Quarterly*, 1922, 1925 and 1926; articles by Brigadier-General S. H. Sheppard, Captain H. L. Woodhouse and Lieut.-Colonel W. E. Britten

In March, 1915, as a preliminary to the railway extension, the Faridkot Sappers and 61st Pioneers, with African labour gangs, connected Voi with Maktau by a motor road and made another through dense bush from Tsavo to Mzima. Papyrus reeds in transverse layers provided a tough surface, and for "corduroying" it was sometimes necessary to use ebony scantlings in the absence of cheaper material. Tillard was now with the Faridkot Company, having handed over charge of the Bridging Train to Lieutenant (ex-Sergeant) W. Smeet. The unfortunate Bridging Train could make no floating bridges of any size because its pontoons had been requisitioned by the Royal Navy; but it was allowed to retain its collapsible Berthon boats, and these proved most useful in ferrying operations on the Rufiji River in 1917 after the boats had been carried through the bush for many miles on the heads of sturdy African porters. Deprived of their pontoons, the thirty Bombay sappers of the Bridging Train were employed on ordinary field company duties, such as trestle bridging and road maintenance.

At Voi, the Faridkot Sappers, under Tillard, built a fine suspension bridge of 100-ft. span, designed to carry heavy lorries. They had plenty of timber for the roadway and for a long trestled approach on one bank, but otherwise the only materials available were wire nails and wire and old mine-winding cable from South Africa. Being quite inexperienced in such work, they took six weeks to complete it, though a regular unit might perhaps have done the job in as many days; but such delays are unavoidable in a hastily improvised expedition. The Faridkot Sappers were enthusiastic workers and did as well as could be expected under novel conditions. In June, they took part in a successful raid on Bukoba on Lake Victoria, where they destroyed a German wireless station. Tillard was told that as the telefunken system differed from our own, he need not trouble to bring back with him any of the captured equipment. However, he brought two boxes of spare parts, and on arrival was met by an agitated signals officer who said he could have used everything available from Bukoba! Perhaps the German

in *The R.E. Journal*, 1919, 1923 and 1935, and by Lieut.-Colonel R. L. McClintock ("Batouri") in *Blackwood's Magazine*, 1918; extracts from War Diaries and Dispatches, 1914-18; and notes by Major-General S. H. Sheppard, Brigadier-General J. A. Dealy, Colonels H. L. Woodhouse, C. W. Wilkinson and L. N. Malan, and Lieut.-Colonel E. D. Tillard. See also *The Indian Sappers and Miners* by Lieut.-Colonel E. W. C. Sandes, Chapter XX.

equipment might have been adapted for field wireless. If so, it would have made a valuable addition to the cable communication maintained with the utmost difficulty by the brigade signal sections.

Undoubtedly, the most important engineer field units in East Africa during the first half, at least, of the campaign were the railway companies. Almost every movement of our scattered forces, and sometimes their very existence, depended on them. Animal transport was obliterated by the *tse-tse* fly; motor transport was interrupted in the rainy season, and porter transport was desperately slow and wasteful, for in twenty days a porter consumed the weight of his load. There remained the railways, which the Germans did their utmost to destroy, by mining and bridge demolition, as they retired. The 25th and 26th Railway Companies were each organized originally in two branches, a "Regular" branch of some 200 men with elementary military training, and a "Traffic and Loco." branch with none whatever. On arrival in East Africa, the latter joined the Traffic Department of the Uganda Railway. The "Regulars" proceeded to guard bridges and patrol the line, and for six weeks, Lieut.-Colonel C. W. Wilkinson, who commanded only 400 men, was responsible for the safety of 400 miles of line. The units were afterwards given ox-transport and worked for a time as field companies on preparing a road to Longido. In April, 1915, they began to lay a metre-gauge line from Voi to Maktau for a distance of thirty-seven miles through dense thorn jungle infested with the *tse-tse* fly, in which unpleasant task they were assisted by the 61st Pioneers and labour gangs who cleared the bush in advance. Although a variety of material had to be used, they brought railhead to Maktau in June. Two months later, the railway companies returned to the main line and Captain Kirke was sent back to India to recruit for two additional companies, the 27th and 28th. Regarding the Voi-Maktau branch, Wapshare had reported that in his opinion it was an absolute necessity if the invasion of German East Africa was to be seriously considered, for only by the aid of a railway could sufficient troops be brought within striking distance of the Taveta border. The line was now open; but if the invasion succeeded, the railway companies would have also to repair and maintain any captured German lines, and hence the importance of raising additional companies.

Royal Engineer officers in East Africa were concerned not only in staff duties and field and railway engineering but also in surveying and army signalling. The former is dealt with at the end of this chapter.

Signalling in the East-African field was taken in hand seriously in April, 1915, when Captain H. C. Hawtrey raised a local Signal Section for the raid on Bukoba, to replace two brigade sections of the original landing force which had returned to India. In July, Hawtrey was reinforced by two additional sections from India and formed a unit called "Z" Divisional Signal Company, Sappers and Miners, staffed by officers of the Indian Army. This unit rendered excellent service in many operations until it was disbanded in June, 1917. Transmission was by visual signalling or cable. The personnel were absorbed eventually into other units of the Indian Signal Service, which became in December, 1925, the Indian Signal Corps.

ARRIVAL OF GENERAL SMUTS AND MORE TROOPS, 1916

The operational deadlock of 1915 was followed by great activity in 1916 when, through the arrival of reinforcements from South Africa and India and the achievements of the railway companies, it became possible to assume the offensive on a large scale. Lieut.-General J. C. Smuts landed from South Africa on 19th February as Commander-in-Chief and reported that he was ready to carry out the occupation of the Kilimanjaro area before the rainy season. The strategic situation was then as follows. North-west of Mount Kilimanjaro, we were based mainly on Longido, and south-east of it, on the new Voi-Maktau branch railway, which we hoped to extend to Taveta, the key to the whole front. The enemy at Taveta blocked the best route for invasion, and they had an advanced position at Salaita, which they had maintained against a South African assault on 12th February. Against von Lettow's 6,000 men with sixteen guns in the Kilimanjaro area, Smuts could muster, as his striking force, 18,000 men with fifty-seven guns, 9,000 men being absorbed in guarding his line of communication. The Germans held a marked advantage in machine-guns, having one to every hundred men. Smuts's force was organized in two divisions, the 1st East African Division under Major-General Stewart, and the 2nd East African Division under Major-General Tighe, each with only one half-company of Faridkot Sappers for all skilled field engineering duties. The 61st Madras Pioneers were in the Force Reserve. In addition, there was a flanking force of two brigades of South African troops commanded by Brigadier-General J. L. Van Deventer, newly arrived from the Union. This force had no engineer troops whatever.

Brigadier-General J. A. Dealy was the Chief Engineer, and Lieut.-Colonels C. B. Collins and R. L. McClintock the Cs.R.E., 1st and 2nd Divisions respectively.* Brigadier-General S. H. Sheppard, previously G.S.O.I, now commanded the 2nd East African Brigade of the 1st Division.

During the preliminaries to a forward concentration, the railway companies had advanced their railhead from Maktau to within three miles of Salaita, and arrangements had been made to mass troops at Mbuyuni. The chief obstacle was lack of water. Lieut.-Colonel Collins, however, succeeded in laying some miles of 2½-in. pipe from hills near Voi, thus providing the troops with 40,000 gallons daily, the balance of 60,000 gallons being supplied by railway and storage tanks. Thus an adequate concentration, preparatory to attack, was made possible through the efforts of the engineer troops and labour gangs under the direction of R.E. officers.

GENERAL SMUTS'S CAMPAIGN OF 1916

General Smuts began his advance on 6th March, 1916. After sharp fighting, south of Kilimanjaro, against Brigadier-General W. Malleson's 1st E.A. Brigade, and against Brigadier-General S. H. Sheppard's 2nd E.A. Brigade (reinforced by the 2nd S.A. Brigade) on a tributary of the Pangani River, von Lettow withdrew on 22nd March across the river near Kahe, and Smuts called a halt. On 12th March, Major B. W. Mainprize was killed while bravely leading an assault. He had left the Faridkots and was acting as Brigade-Major to Malleson. The principal operations during the heavy fighting between 18th and 21st March at Kahe were entrusted to Sheppard's two brigades and attached troops. Sheppard, acting as G.O.C. 1st Division, reached but could not capture the enemy positions; but meanwhile, and unknown to him owing to the dense bush, Van Deventer's column had occupied Kahe Station on the Northern Railway. This relieved a tense situation and forced von Lettow to withdraw across the Pangani. "The rapidity of our advance and the distance to which it was carried," wrote Smuts, "must inevitably have caused a breakdown in the transport had

* The numbering of the divisions was soon reversed. In April, 1916, Lieut.-Colonel McClintock handed over charge as C.R.E. 1st (late 2nd) Division to Lieut.-Colonel A. A. McHarg, who had come from the Survey of India in October, 1914. McHarg held the post until September, 1917.

it not been for the unremitting exertions of the railway engineers who carried forward the railway from east of Salaita to Taveta and the Latima Nek at an average rate of a mile a day including surveying, heavy bush cutting and the bridging of the Lumi River."

By 22nd March, 1916, Smuts had cleared the enemy from the Kilimanjaro-Arusha area and stood firmly on the Northern Railway, poised for an advance down it to the coast. Yet he could not move until the railway companies had linked the Uganda and Northern lines, for his supplies must come from Uganda. He devoted the interval to solving problems of local transport and supply, and to reorganizing his command into the 1st Division (Major-General A. R. Hoskins), 2nd Division (Major-General J. L. Van Deventer), and 3rd Division (Major-General C. J. Brits). The hulk of his heterogeneous force now hailed from the Union, but it included also British and Indian troops, King's African Rifles, East African European settlers of all friendly nations, and native levies from many tribes. The babel of languages made co-operation difficult.

The invasion of German East Africa followed two main lines of advance towards the Central Railway connecting Dar-es-Salaam with the interior. The western approach was from Arusha, through Kondoa Irangi, to Dodoma; the eastern led down the Pangani River, and through Handeni, to Morogoro. Von Lettow's main body held positions south of Kilimanjaro. Smuts's first important move was to send a force under Van Deventer towards Kondoa at the beginning of April, thus causing von Lettow to withdraw most of his troops south-westwards to guard the centre of the German Protectorate. Van Deventer occupied Kondoa on 17th April, but could advance no farther. On 9th May, he repelled a violent counter-attack. This action was important, for it made von Lettow realize that his strategy in future must be purely defensive.

On 18th May, Smuts began his march down the Pangani in three columns astride the Northern Railway, and later, swinging southwards through Handeni, reached the Nguru Mountains at the end of June. He manœuvred the enemy most skilfully out of many carefully prepared positions. Von Lettow now transferred his main body eastwards to oppose Smuts, whereupon Van Deventer resumed his thrust southwards and cut the Central Railway at Kilimatindi and Dodoma. Thus, at the end of July, von Lettow found himself separated from his detachments fighting Belgian and British forces in the Tabora region. The process of carving up the German forces had begun. Van Deventer next moved eastwards along the Central

Railway to rejoin Smuts, who had launched a drive southwards in four columns through the Nguru Mountains. On 13th August, however, when Smuts was near Turiani and Van Deventer at Mpwapwa, Von Lettow was already in rapid retreat, making apparently for Morogoro or Kilosa. Smuts followed to Morogoro, only to find it unoccupied, for von Lettow had retired into the Uluguru Mountains and was marching on Kisaki, where he hoped to replenish his supplies.

By the end of August, 1916, Smuts's forces had outrun their communications and were becoming exhausted. Nevertheless, they were urged forward so as to afford the enemy no respite. Intricate operations followed in the Uluguru Mountains. Major-General Brits, with two S.A. mounted brigades under Brigadier-Generals B. G. L. Enslin and A. H. M. Nussey, pursued the enemy along the western flank and part of his force arrived near Kisaki on 5th September. Meanwhile, on the eastern flank, Major-General Hoskins, with two E.A. infantry brigades, under Brigadier-Generals S. H. Sheppard and J. A. Hannington, had been advancing against strong opposition, and was still forty miles from Kisaki when Brits attacked that place on 7th September. A wide turning movement by Enslin failed, and on the 8th, Nussey was held up. Von Lettow then evacuated Kisaki and retreated southwards, followed by Hannington. Fighting continued on the 10th and 11th. The German commander manoeuvred to cover his line of retirement to Kibambawe, on the Rufiji River, where supplies awaited him. His strategy now tended to be based, more and more, in the locations of his supply depots.

Regarding the Uluguru operations, Smuts remarks that on the eastern slopes the enemy fought rearguard actions daily in broken country covered with high bush. The bridging of the Ruvu River took several days, and for some distance beyond the site, the roadway made by the Germans skirted the faces of precipitous rocks on a wooden gallery supported by piles. This being incapable of carrying heavy lorries, the technical troops had to blast away the mountain-side and construct a proper motor road. Bridging and road-making were undertaken also by the infantry. South of the Ruvu River the road passed first through swamps and then over a mountain spur with a precipitous southern face. Through this spur, and down the face, the technical troops and most of Sheppard's infantry cut a passage in solid rock—a notable feat of engineering which occupied several weeks.

The valuable port of Dar-es-Salaam had been taken without

difficulty on 4th September, and on the 19th, Belgian forces from the interior reached the Central Railway at Tabora. Brigadier-General E. Northey, advancing from the Nyasaland-Rhodesia border with 3,000 men, was then at Iringa. Portugal had entered the war, and her troops had crossed the Rovuma River; but they had been driven back into Portuguese East Africa with the loss of valuable arms and supplies which helped von Lettow to continue the struggle. Nevertheless, in six months the Allies had conquered the greater part of German East Africa. With Smuts to the north, the Belgians and Northey to the west, and the sea to the east, von Lettow's dwindling forces had only one line of escape—to the south into Portuguese territory. Yet the enemy had considerable freedom of movement, for the remnant of German East Africa still open to him was larger than Great Britain. Smuts considered that the time had come to occupy effectively the entire German coastline south of Dar-es-Salaam, and before the end of September, 1916, he took Kilwa, Kiswere, Lindi, Mikindani and some minor ports. Kilwa then replaced Dar-es-Salaam as the main sea-base. He now proceeded to suspend active operations and reorganize his exhausted troops. He disbanded the 3rd Division under Brits and sent most of the other South African troops home to recuperate. Until the end of the year, conditions on the Mgeta River front, north of the Rufiji, approximated to trench warfare, with Sheppard's 1st E.A. Brigade in the front line, and the 2nd E.A. Brigade, now under Brigadier-General H. de C. O'Grady, in reserve.

The general offensive was resumed in the New Year, the objectives being the seizure of a crossing over the Rufiji and the encirclement and annihilation of the opposing forces. To effect the former, Smuts detached Sheppard's brigade to make a wide detour and establish a bridgehead above Kibambawe, while the front was held by a Nigerian brigade under Brigadier-General F. H. G. Cunliffe. After clearing the enemy from a position on 1st January, 1917, Sheppard reached the Rufiji near Kibambawe on the 5th. The enemy had already crossed and were strongly entrenched on the right bank; also, they had removed the entire roadway of the Kibambawe bridge. However, between the 5th and 15th, under cover of darkness, Sheppard's brigade crossed the Rufiji, three men at a time, in seven small Berthon boats of the Bridging Train. They had been brought up by porters. Another brigade having already crossed farther down stream, von Lettow fell back to the south-west, pursued by the Nigerians. The crossing of the Rufiji was the last major operation

conducted by General Smuts, for on 20th January, 1917, he handed over command to General Hoskins and sailed for England to attend an Imperial Conference. His campaign in 1916 had entailed heavy casualties through sickness, as well as in battle, but he had attained most of his objectives and had reduced the enemy's strength to 1,100 Europeans and 7,300 *askaris*, with twenty guns and seventy-three machine-guns.

REORGANIZATION DURING SPRING, 1917

Torrents of rain, on 25th January, put an end to further military operations. In the Mgeta and Rufiji valleys, roads over which motor transport had run continuously for some weeks, became passable only by porters, wading in water above their waists, and occasionally carried off by crocodiles. The site of a ford over the Ruaha River between Dodoma and Iringa could be reached only by traversing swamps six miles wide on either bank and six feet deep, and patrols moved in boats over the vast lake that had been the Rufiji valley. Sickness spread among the troops who could not withdraw to higher ground as this would mean abandoning hardly won territory to the enemy. General Hoskins had an unenviable task. The 3rd Division having gone to South Africa, and the 2nd Division being under orders to follow, he had to carry on as best he could with reinforcements from West Africa and India and some additional K.A.R. battalions. He was too weak to take the offensive, even had the weather permitted, and accordingly, in February, 1917, he abolished the divisional organization and re-formed his command into mobile columns in order that, during May, when the ground should have dried, concerted forward movements might be made from Lindi, Kilwa, the Rufiji, Iringa and Songea to encircle and annihilate the roving bands of the enemy. War on a large scale ceased with the departure of Smuts, but hardships increased. "The endless work entailed in the upkeep of the various lines of communication," wrote Hoskins, "and the improvement of landing facilities at Kilwa and Lindi, made heavy demands on the limited body of technical troops at my disposal. Reinforcements could not keep pace with the wastage, and though the various units of engineers, technical troops and Road Corps were suffering severely from the general unhealthiness of the season, I was unable to withdraw them to give them the rest which they had so well earned."

Only the fittest survived the rigours of the climate, and among

these was Brigadier-General (temporary Major-General) S. H. Sheppard. Arriving with I.E.F. "B" in 1914, he served continuously in East Africa until the end of 1918. From 22nd September, 1914, to 31st January, 1916, he was G.S.O.1 to the Expeditionary Force. From 1st February to 18th March, 1916, he commanded the 2nd E.A. Brigade, and afterwards acted as G.O.C. 1st E.A. Division from 19th to 31st March, during which he fought the action at Soko Nassai on 21st March. From 1st April, 1916, to 19th January, 1917, he commanded the 1st E.A. Brigade, including actions at Bwiko (31st May), Mkalafno (9th June), Lukigura (24th June), Wami River (17th August), Mgeta River (1st January, 1917) and the Rufiji crossing (5th to 15th January, 1917). Finally, from 20th January, 1917, to the conclusion of hostilities in December, 1918, he was Brigadier-General, General Staff (Chief of Staff), first under a British commander, General Hoskins, and later under the South African leader, General Van Deventer. Sheppard, a champion racquets player, was blessed with an iron constitution which even the African climate could not undermine. His boundless energy and enthusiasm, and his knowledge of engineering, were of the greatest value when he commanded troops in the field; and his tact, while Chief of Staff, secured, as Van Deventer himself remarked, the closest co-operation between all branches and thus helped to ensure early victory.

RAILWAY WORK

The success attained in 1916 was due largely to the labours of the Sapper and Miner railway companies, in restoring rapidly the damaged Northern and Central lines. Before Smuts's advance down the Pangani in May, the 25th and 26th Companies had prolonged the link-line from the Uganda Railway as far as Salaita and Taveta, and they finally joined it to the Northern Railway at Kahe. The line traversed virgin forest and crossed many swampy tracts in which it had to be floated on timber mattresses. An additional railway unit, the 27th Company, had been formed in March under Captain R. E. Gordon; and in May, Captain E. St. G. Kirke arrived from India with yet another, the 28th Company. The four companies were then grouped into a Railway Battalion under Lieut.-Colonel C. W. Wilkinson, and with other engineer formations, including South and East African units, they followed Smuts down the Northern Railway. The enemy had demolished almost all the bridges and culverts, and consequently much crib and trestle work was

required. The battalion halted at Mombo, where Smuts had diverged southwards from the railway. In July, near Korogwe, the 25th and 26th Companies under Wilkinson acted as infantry in a column sent against enemy raiders and charged and captured a position with the bayonet, fortunately suffering few casualties, as reinforcements were scarce. Work proceeded so rapidly on the Northern Railway that, by 19th August, through communication was established with Tanga, which had been occupied on 7th July.

The Railway Battalion was then transferred to the captured German Central Railway. The 25th and 28th Companies sailed from Tanga to Dar-es-Salaam, and the 26th and 27th Companies, to which some South African Pioneers under Major J. H. Dobson were attached, landed at Bagamoyo, whence they reached Ruvu Station on 10th September by forced marches. The 26th Company worked down the line towards Dar-es-Salaam, and the 27th westwards towards Mikese and Morogoro; and while the 28th Company repaired wharves and sidings in Dar-es-Salaam, the 25th operated up the line to meet the 26th. A service of Ford lorries or vans, mounted on railway axles and dragging trailers, was maintained while repairs were in progress—an ingenious device attributed by General Smuts to the inventive capacity of the South African Pioneers serving under Van Deventer. A tractor, with trailer, could carry up to fifteen tons of supplies, and Van Deventer was able, accordingly, to supply his 2nd Division by rail during an advance of 120 miles from Dodoma to Kilosa and to thrust later towards the Ruaha River. When Morogoro had been occupied, the same system was adopted over that section of the Central Railway, so that from 6th October, 1916, the line was open for tractor traffic for about 300 miles from Dar-es-Salaam to Dodoma. Normal traffic with locomotives was opened between Dar-es-Salaam and Morogoro on 17th November, and extended to Dodoma by the end of the year. The Central Railway then replaced the Uganda Railway as the main line of communication with the interior.

The railway sappers had now completed their *magnum opus*, but much still remained to be done. In January, 1917, Lieut.-Colonel L. N. Malan took over command of the battalion from Lieut.-Colonel Wilkinson and the four companies afterwards worked for some months on bridging in the coastal region of the Central Railway and on building a branch line from Dodoma; but when the theatre of operations shifted farther south in June, the units were transferred to Kilwa and Lindi to build light tramways for the supply of our

forces advancing towards the Portuguese frontier. Local plantations provided the permanent way, and traction was arranged by mounting Ford vans on tramway axles. Sixty miles of line were laid from Kilwa, and a further fifteen miles had been completed from Lindi when the enemy was driven southwards. The railway sappers, however, were decimated by sickness in this unhealthy coastal strip, and it was decided that they should return to India as soon as their services could be spared. The 25th Company left East Africa in February, 1918, and the 26th and 27th Companies in April after extending the Lindi tramway to a length of sixty miles. The last to leave was the 28th Company, which sailed from Lindi in September. Before the Railway Battalion was abolished in 1921, its units rendered good service in Palestine, Syria and Anatolia, and in the Third Afghan War. In East Africa, it had done wonders under most trying conditions, and though only the men of the original 25th and 26th Companies, and others attached from Indian railways, had any pre-war experience of construction, it had developed, under Royal Engineer leadership, into an efficient formation of specialists.

WORK ON THE L. OF C.

We turn now to the employment of R.E. officers in East Africa otherwise than with Indian field units, railway companies or survey parties or on the staff. It is difficult to unravel the history of the East African Works Directorate because the available records are incomplete and overburdened with detail, and most of the officers who made them have since died. Major F. P. Rundle was sent to East Africa from India in May, 1915, for works duties, and Captain F. Cooper (R.E. Services) was posted, late in that year, as Inspector of Works; but no Works Directorate seems to have been formed until Brigadier-General J. A. Dealy arrived in February, 1916, as B.G., R.E., later called Chief Engineer. In 1914, Dealy had gone to works employment in France from the Military Works Services in India, and on arrival in East Africa, he realized at once that a proper works organization was needed to cope with the engineering demands at the sea bases and to assist the few engineer field units on the ever lengthening lines of communication. Taking over charge from Lieut.-Colonel C. B. Collins, who had been C.R.E., I.E.F. "B," since the original landing in 1914, he was ably supported by Lieut.-Colonel Rundle as A.D.W., Lines of Communication; and in July, 1917, four months after Dealy had been invalided, Rundle

was promoted to Chief Engineer. Normally, the appointment would have gone to Collins, who had become D.D.W. under Dealy in October, 1916, but it is sad to record that Collins had died of cerebral malaria at Mikese on 1st March, 1917. Another addition to the Works Directorate in 1917 was Lieut.-Colonel R. L. McClintock, who became A.D.W., L. of C., in April. McClintock had brought No. 4 Engineer Field Park, Madras S. & M., to East Africa in 1914, and had served in 1916 as C.R.E. 1st (later 2nd) E.A. Division and C.R.E. with various columns. He held the post of A.D.W. until his return to the Madras Sappers at Bangalore in 1919. Yet another A.D.W., L. of C., was Lieut.-Colonel R. H. West, posted in July, 1917, and invalided in January, 1918. The last to arrive during the war was Major H. N. Kempthorne, who was A.D.W. from November, 1918. The casualties show that, with the exception of Rundle and McClintock, no Royal Engineer could stand for long the strain of works service in East Africa in 1914-18. The directorate was always under-staffed, and consequently no leave could be granted. The coastal climate was enervating and unhealthy, the responsibilities heavy, and the hours very long.

The disjointed nature of the records tells its own tale, but in November, 1918, Lieut.-Colonel F. P. Rundle produced a useful summary of the work performed by the technical units throughout the campaign. The work was done mainly by Indian sapper and pioneer units, East and South African engineer units, road construction companies and road corps, but was supervised by the Chief Engineer and his A.Ds.W. Between 1914 and 1918, these formations and African labour gangs built or repaired 3,421 miles of road, 52 miles of tramway, 11 flying bridges over large rivers, and 9 marine piers at the ports. They erected buildings covering an area of 1 million square feet, including hospital accommodation for 3,570 beds and subsidiary buildings to hold 24,000 beds; also, high-level water tankage to a total capacity of 53,000 gallons and low-level tankage of 275,000 gallons, in addition to 2,388 feet of water-troughing. They laid 60 miles of piping, erected 133 power-driven and 153 hand-operated pumps, ran 31 power-pumping stations, deepened 118 wells, and sank 37 bore-holes from 80 to 320 feet deep. The list is impressive, for it omits the work done by the Railway Battalion in the course of field operations.

The exploits of the South African engineer formations, some of which came to East Africa in 1916 and remained till late in 1918, deserve brief mention:- Allusion has been made to the fine achieve-

ments of the S.A. Pioneer Battalion under Major J. H. Dobson on the Central Railway. These were matched by those of the 1st and 2nd S.A. Engineer Troops, raised in Johannesburg, the 1st, 2nd, 3rd and 4th S.A. Railway Companies, and the S.A. Water Supply Corps and S.A. Labour Corps. Most of their work was on the lines of communication, and the Water Supply Corps laboured chiefly at the sea-ports, but much road-work and bridging were done by the two engineer troops in connexion with actual field operations. When General Northey was conducting operations from Iringa and Songea in 1916 with forces amounting to only 3,000 men, he required no less than 400,000 porters to supply his scattered columns. The colossal task was eased when light motor-vans arrived and roads were made to carry them. These roads were built by Major Colin Clark, in command of a detachment of South African Engineers who completed 450 miles in six months, including a stretch of thirty-five miles where the roadway rose to 8,000 feet above sea-level. Thus South Africa took a considerable share in overcoming the engineering difficulties of the campaign, just as British East Africa gave what assistance it could in the form of a Pioneer Company and a Railway Pioneer Corps, raised locally in 1914-15.

THE FINAL PHASE

On 29th May, 1917, Lieut.-General Sir J. L. Van Deventer took over the supreme command from Major-General A. R. Hoskins, with Major-General S. H. Sheppard as his Chief of Staff. Reorganization of the force had been completed, and the heavy rain which had prevented earlier movement had ceased. The enemy was grouped in two main bodies, one of 4,000 men under von Lettow himself about Kilwa and Lindi in the coastal region, and the other, of 2,000 men, under Colonel Tafel, far inland at Mahenge. A detachment had invaded Portuguese East Africa, and another was moving northwards having crossed the Central Railway east of Tabora. Van Deventer prepared at once to resume the offensive.

He realized that a war of attrition was commencing, and that the quickest way to end it was to kill or capture Germans. Accordingly, all columns were told to engage the enemy, wherever found, and force him to fight. The general design was to squeeze the enemy gradually southwards, applying pressure from farther and farther down the coast as new ports were opened. The advance began in the Kilwa area on 5th July, and in the Lindi region on 2nd

August. Von Lettow fell back to Narungombe, where he gave battle before resuming his retreat. On 15th October, near Mtama on the Lukuledi River, he was completely defeated in a battle which lasted four days and cost us 2,700 casualties, or more than half our strength. This struggle, however, was decisive. The remnants of von Lettow's command retreated to the Makonde Plateau, Tafel surrendered on the Ruvuma, and German sovereignty in East Africa became virtually extinct.

Nevertheless, von Lettow was able to carry on a form of guerilla warfare for more than a year by withdrawing in November, 1917, across the Ruvuma River and capturing Portuguese munitions and supplies at Ngomano and elsewhere. His force of fifteen companies still amounted to 2,300 men with two guns and thirty-five machine-guns, and it was evident that it would be no easy task to catch him in Portuguese East Africa, an unmapped country as large as France, with few roads and only thirty miles of railway. Van Deventer decided to launch a combined movement of converging columns, being careful at the same time to guard against the possibility that Von Lettow might break back into German East Africa, which, incidentally, is what finally happened. For his part, von Lettow was determined to compel us to keep large forces in the field in order to guard our lengthening communications. We countered by adopting first Porto Amelia, and finally Mozambique, as sea bases. The opening of Porto Amelia forced the Germans to leave the Medo-Mesa district and to move farther inland. After fighting at Maketa and Nanungo, von Lettow retired to Malema and appeared to be heading for the Zambezi River. Then suddenly he swung round, and after devious manoeuvres, moved northwards in August, 1918, towards the Ruvuma, crossing that river successfully in September, though almost intercepted by converging forces. When he surrendered at Abercorn in Rhodesia on 25th November, 1918, he had only 155 Europeans and 1,165 *askaris*, with one gun and thirty-eight machine-guns. Thus ended a unique campaign. Never before had military operations on a large scale, with modern weapons, taken place within a few degrees of the equator, and rarely had there been such a long and strenuous pursuit of a beaten enemy.

The final phase was marked by the employment, for the first time, of a regular unit of the Indian Sappers and Miners. This was the 14th Field Company of the Madras Corps, under Captain W. E. Britten, assisted by three officers of the Indian Army Reserve. Reaching Dar-es-Salaam on 4th February, 1918, the unit sailed in

March to Porto Amelia, whence it marched seventy miles to join a column known as "Pamforce." Its work consisted mainly in preparing a track for light motor-transport behind the advancing troops, including timber bridging where necessary. During May alone, the company built 474 ft. of bridge, laid 2,430 ft. of corduroy roadway and cut 6 miles of new track through dense bush. After von Lettow had vanished to the far north, it marched back to Porto Amelia and embarked, early in October, for India, having completed 320 miles of motor road and bridged three large rivers in a period of six months, during which the men had covered 1,100 miles on foot.

Viewing the East African campaign as a whole, we see that in military operations in the field the Corps of Royal Engineers was represented only by a few officers holding staff appointments, commanding engineer units, or serving as Cs.R.E. of divisions or in the Works Directorate or signals or survey organizations. Captain B. W. Mainprize of the Faridkot Sappers, and Major L. N. F. I. King of the Survey Department, held staff appointments for a time, but the only commander of a fighting force of all arms was Major-General S. H. Sheppard, who bore, from first to last, the heat and burden of the day and upheld most worthily the fine traditions of his Corps.

SURVEY IN EAST AND WEST AFRICA

Of the many officers and men engaged in survey work in Africa at the outbreak of the war all returned at once to other Corps duties except Major L. N. F. I. King in Kenya and Captain P. J. Mackesy on the West Coast. The three minor campaigns, the East Coast, the Cameroons, and Togoland, showed similar geographical conditions. The countries concerned were known to few, there were no reliable maps and the problems of survey resolved themselves into reconnaissance and route sketching on the one hand and into the gradual improvement of the original maps on the other. There were very few occasions when any more accurate data were required for the direction of fire. It is interesting to note that reconnaissance and hasty route sketching, hitherto entrusted mainly to officers, was done by N.C.Os. from the Ordnance Survey.

In East Africa Major L. N. F. I. King, who had been in charge of the Kenya Survey Department, remained to effect a junction, if possible, between the Kenya triangulation and those of the German survey of the northern highlands of Tanganyika, and of the Boundary

Commissions which had demarcated the Kenya-German East Africa Frontier. The junction of triangulations once established, Major King was employed as Assistant Field Engineer on the lines of communication. The existing German 1/300,000 map of German East Africa was "squared" and printed by the Geographical Section. A South African topographical section began reconnaissance and compass sketching, but suffered from inexperience and even more from disease. From July, 1916, it may be said to have ceased work. At that moment No. 6 Topographical Section arrived from England and disembarked at Mombasa, under the command of Captain E. K. Boileau. The section was, however, split up almost immediately in order to provide reconnaissance staffs for the three divisional columns. As there were no fixed points to which to refer, and as movement was rapid, no regular mapping could be done. The men of the section were, however, able to keep their columns "placed" on the 1/300,000 map, and every now and again, as at Morogoro, Dar-es-Salaam, Kilwa and Lindi, more ambitious area sketches were made. A very useful part of the reconnaissance work was the sketching of the *tse-tse* fly belts as a warning to transport columns. On 18th October, 1917, Captain Boileau was killed by a sniper whilst reconnoitring on Nakade Ridge.

In 1918 the necessary sketching, compilation of rough maps, and printing (mainly sun printing) was found to be beyond the power of the small numbers available. Application was made to the Indian Government, and again the Survey of India stepped in sending a party of six skilled plane tablers under Lieutenant A. J. A. Drake, who took over command of No. 6 Topo. Section. The next stages of the campaign were in Portuguese East Africa for which no even reasonably reliable map existed. The section continued to provide route maps, and to act as topographical guides.

In October, 1918, both No. 6 Topo. Section and the Indian Detachment were recalled and embarked at Dar-es-Salaam for England and India respectively.

On the west coast the outbreak of war found survey parties active in demarcating frontiers and mapping mining concessions. The rank and file knew the country, and in particular its frontier regions, as well as, if not better than, any other British officials. They were used at once as guides and route sketchers. One example of their work may be given. Corporal William O'Connor had been at work in the northern territories of the Gold Coast, and had also been mapping the Gold Coast-Togoland boundary. On the outbreak of

war Captain Mackesy, appointed reconnaissance officer to the Togoland Field Force, dispatched O'Connor (a good horseman) to find the French Field Force, then assembling in Timbuctoo, and to guide it either through British territory or direct into Togoland as occasion might demand. This mission he carried out with judgement and success, earning thereby the D.C.M. Meanwhile the officers of the various survey parties were sent home or employed in the Western African Expeditionary Force, on signal, railway or works services. The rank and file were recalled from their reconnaissance duties to form the Works Department at Duala under Major Clough. Throughout the campaign, however, their special abilities proved useful. Thus Major Clough combined the correction and sun printing of such maps as existed with his other duties, whilst many of the rank and file were used as guides to parties on road and railway work. In March, 1916, the West African campaign at an end, officers and men were ordered home.

Persia now realized that Great Britain was her only friend, but was herself too weak to make any serious resistance, so that the danger of Turkish and German penetration to Afghanistan increased considerably. Russia had withdrawn her portion of the East Persian cordon and it became incumbent on the Indian Government to take it over right up to the frontier of Trans-Caspia. Moreover a cordon to trap merely the enemy agents would no longer suffice; it might now become necessary to send a considerable force to East Persia and the Trans-Caspia. As a start in that direction a military mission under Major-General Sir Wilfred Malleson was dispatched by the Indian Government to Meshed early in 1918. The establishment of a cordon of detachments, and the maintenance of their supply and rapid intercommunication in East Persia was a formidable task, but the difficulties were far greater when it became necessary to convert the system into a line of communication capable of maintaining a considerable force, especially without the help of Russia.

In 1917 the Quetta-Nuski railway was extended 120 miles to Dalbaudin, thence to Mirjawa on the Perso-Baluch frontier and finally to Duzdab. When Russia collapsed the head of the British Indian cordon, which hitherto had been 300 miles from Robat, had to be pushed on for more than 300 miles to Askhabad, making a total of approximately 630 miles from the railhead at Duzdab, with a great scarcity of water and grazing. In addition there was a loop road, 225 miles long, connecting Seistan with the Duzdab-Meshed road.

The country presented great natural difficulties. East Persia consists of two highland blocks north and south of one another, superimposed on an elevated plateau, and the Seistan depression which is a fertile area surrounded by an inhospitable wilderness. Dividing the two highland blocks is a tongue of the Central Persian desert. The highest parts reach 10,000 feet, and the passes are between 7,000 and 8,000 feet. The temperature varies between forty degrees of frost and tropical heat up to 120 degrees in the shade. From May to August a furious wind blows continuously day and night. Such are the difficulties that nature opposed to the establishment of a line of communications about 630 miles in length beyond railhead.

ORGANIZATION

The task of creating, organizing, administering and defending this great L. of C. was confided by the Indian Government to

CHAPTER XIII

THE EAST PERSIAN CORDON

Necessity for the Cordon—Organization—Technical details.

NECESSITY FOR THE CORDON

THROUGHOUT the Great War the attitude of Persia was a matter of anxious concern to the Indian Government. Frequent Russian encroachments, pressure along her northern frontier and peaceful but dangerous penetration into her territories had engendered Persian hostility, and, therefore, a tendency to side with Germany and Turkey in their struggle with Russia. But, sandwiched between strong Russian forces in the north and the British control of the sea and her southern coast, Persia found it necessary to walk warily and to avoid committing herself openly until the friends of her choice should be in a position to support her. It was a desire to cut the connexion between Persia and Turkey at Baghdad that had caused the Indian Government's continuous advocacy of an advance to that strategic place. But our enemies, Germany and Turkey, were unceasingly working to exploit the Persian situation to their advantage by sending skilful and energetic agents into that country, and what was still more threatening, into Afghanistan. Habibullah the Amir of Afghanistan was fortunately convinced of the power of the British Empire and rightly gauged that the interests of his country would be best served by a strict neutrality. In this attitude he had practically no support from the leading men of Afghanistan, which was therefore a powder barrel that might be ignited either by a shot at Habibullah, or in spite of him by the machinations of Turkish and German agents, particularly the latter. In these circumstances the Indian and Russian governments arranged jointly to spread a cordon or net just inside the East Persian frontier along its whole length where it marched with Afghanistan up to Russian Trans-Caspia, for the purpose of intercepting the enemy's agents and preventing them from travelling to and from the Afghan powder barrel.

In December, 1917, the armistice between Russia and the Central Powers changed the whole situation. The Bolshevik government, no longer our ally, was just as threatening to Persia as its predecessors, but on the other hand ceased to oppose a Turkish advance, which was obviously not the approach of an ally but a conquering invasion.

Brigadier-General W. E. R. Dickson, late R.E., with the instructions that it was required at once, if not sooner, and in fact troops began to use it almost immediately. The resources in staff, personnel and material, placed at General Dickson's disposal at the outset were diminutive, and were very sparingly increased as time went on. The demand was for bricks without straw. The three most urgent matters were, the improvement or construction of a road, the calculation of amount, nature and distribution of transport, the division of the line into sections and the organization and distribution of personnel. In brief, the road making problem was to make and maintain about 850 miles of roads in difficult country to carry light military transport on pneumatic tyres. It was required at once, and people to do it were woefully scarce.

It must be mentioned here, however, that much good work had already been done on the roads by Brigadier G. A. Dale, I.A., who commanded the Cordon from the time of the Russian collapse until handing over to Dickson early in 1918. Major W. P. Pakenham Walsh, R.E., was the A.D. Works during this period.

Brigadier-General Dickson has written a very interesting book entitled *East Persia, a backwater of the Great War*, in which he describes and explains how he and the energetic and resourceful people who worked with him established and operated a successful L. of C. in a wonderfully short space of time. Here it is only possible to give the reader a glimpse of the difficulties encountered, the methods adopted to surmount them and the personnel including some Royal Engineers who accomplished the task under Dickson's guidance. In four months, by November, 1918, the 480 miles of road from railhead to Meshed were made fit for light military transport.

When he arrived on the scene of his labours with a very small staff, including Captain W. J. Good, formerly a member of the Calcutta Port Commission, Dickson consulted the British Consuls, Major Prideaux and Mr. R. J. Gould, I.C.S., to ascertain the resources in personnel and material available for making a start. The Consuls had recently raised Corps of Persian Levies officered by British officers from the 106th Hazara Pioneers experienced in road-making. They had some of their Indian officers and N.C.Os., also with much experience of road-making. These levies were placed at Dickson's disposal and the 107th Pioneers also soon arrived to help. With these, Major Lang, Commandant of the Levy Corps, did valuable work. Captain Stubbs, R.E., who had been commissioned from the

Indian Public Works Department, had preceded Dickson to East Persia. He was working with remarkable energy and with practically no trained assistants on the northern section. He collected his supervising staff and his labour locally, and used local miners and local powder for blasting. He had a genius for discovering latent talent among the population.

R.E. officers and a welcome detachment of Sappers and Miners soon arrived. The L. of C. was organized into sections, in each of which a Section Engineer was responsible for all engineer work, road-making, hutting, water supply and defences. On the uninhabited southern sections, the work was done by the 24th Company, Sappers and Miners, 107th Pioneers, and 104th Indian Labour Company; in the centre section, by local Persian gangs of coolies supervised by officers of the Seistan Levy Corps and in the northern section as already described by Captain Stubbs.

The Assistant Directors of Works (all R.E. officers) were Lieut.-Colonels W. P. Pakenham-Walsh, J. A. Græme and L. E. Hopkins. The Deputy Assistant Director of Works was Major M. A. H. Scott, and other R.E. officers employed were Captain A. Prain and Lieutenant Patterson of the 3rd Sappers and Miners, and Lieutenants P. A. Bourdillon, C. F. A. Bird and T. J. P. Price of the Military Works Services, and Lieutenant M. A. Scott.

TECHNICAL DETAILS

Troops garrisoning the L. of C. and those passing up the line together with the convoys, were accommodated in a series of defensible localities which involved considerable work on their perimeters. The chief difficulty was the entire lack, except in the northern area, of any form of material for hutting, nor could the available transport undertake to import timber. Consequently, the local practice of using domed mud roofs was followed, the East Persian masons being experts in this specialized work.

Between the hilly ranges a difficulty, peculiar to the region, was produced by the gales of wind which caused the sand to travel from place to place, often submerging the road in the course of a single night. Expedients to deal with this were, either to raise the road above the surrounding level so as to be swept clear by the wind, or to coat the surface with a mat of twisted shrubs on which the sand did not always lie. In the southern section the camel

convoys, treading down the earth formation of the road, gave it a hard smooth surface unaffected by rain, and admirable for the passage of light lorries with pneumatic tyres. In mountain passes much rock blasting had to be done. Owing to the difficulty of transporting materials, no bridging of any importance could be carried out. The banks of nullahs were merely ramped down, and the beds cleared of boulders.

Water was obtained from Persian wells for the defended posts, and from springs for camel watering on the roads. In some places boreholes were drilled. In the southern section water was sometimes strongly impregnated with salts and had to be treated to make it potable without distressing consequences.

THE INTER-WAR PERIOD, 1919-39

CHAPTER XIV

THE AFTERMATH OF WORLD WAR I

Introduction—Royal Engineers in the Caucasus, 1919—The Irish Rebellion, 1918-22—The Versailles Peace Conference—Survey in North Russia—Survey after the Armistice—The R.E. War Memorial.

INTRODUCTION

WHEN more than six volcanoes cease activity after four years of continuous eruption, there is sure to follow a period during which some rumblings and heavings alarm the local inhabitants. So it was when the armistices with Bulgaria, Turkey, Austria and Germany had terminated the first World War, and there then ensued a period of some years when minor operations were continued in many parts of the world. The Bolshevik government of Russia had made a separate peace with Germany at Brest-Litovsk in 1917, but only to find herself involved in an internecine counter-revolutionary war. The Czar himself had been a loyal ally of Britain and France, and would never have made a separate peace with Germany. Britain, therefore, felt compelled to support the counter-revolutionaries in their struggle against Bolshevik governments; British forces containing R.E. units found themselves based on Murmansk fighting southwards. British officers found themselves commanding volunteer German forces supporting the German populations of Lithuania, Estonia and Latvia in the maintenance of their independence against the Bolsheviks. Weygand, the French general, found himself advising Marshall Pilsudski, commanding the Polish Forces, engaged in hurling back the Bolshevik army from the gates of Warsaw. Based on the Crimea, British Military Missions were helping General Denikin to fight northwards towards Moscow, and Major-General Cowie and Brigadier-General Alan Brough, both R.E. officers, were with the Railway Mission helping this force. British troops were landed at Vladivostock, and penetrated deep into Siberia, supporting Admiral Koltchak's forces fighting to the east of Moscow, and sappers under Brigadier-General Jack helped him to work the Trans-Siberian Railway.

The British Salonika Army, now based on Constantinople and

renamed The Army of the Black Sea, crossed that sea and landed at Batum, whence its forces proceeded by rail to Baku on the Caspian, and were joined by the famous Dunsterforce* that had come up through Persia from Mesopotamia. Here again, we hear of several R.E. units and officers on missions. The Army of the Black Sea had also taken over the Turkish railways of Asia Minor and Thrace, and Brigadier-General G. D. Rhodes became Director of Railways, assisted by a number of R.E. officers and units. Britain made the mistake of supporting Greece in an attempted conquest of Turkish Asia Minor. The prostrate and beaten Turkish Empire aroused itself to another effort headed by Mustapha Kemal, drove the Greeks into the sea at Smyrna and then turned to face the war-weary and demobilized forces of Great Britain that were still occupying, in far too weak numbers, Constantinople and the shores of the Bosphorus and the Dardanelles. We were within an ace of another war between Great Britain and Turkey. Again, the Chief Engineer, Brigadier-General A. G. Stevenson, found himself building piers on the Gallipoli Peninsula and at Chanak on the southern shore of the Dardanelles. Mustapha Kemal, although momentarily and locally stronger than ourselves, realized that Britain, even in her war-weary state, could not be flouted for long. Both sides saw the desirability of opening negotiations, which reached a peaceful and honourable conclusion. In Mesopotamia we have already told the story of operations, continuing till 1924, in which the R.E. played a very prominent part.

In India, the Afghans crossed the border in 1919 and started the Third Afghan War, which at once set the whole frontier ablaze and necessitated very large scale operations with the employment of more than six divisions.† The Afghans gave in after a few months, but operations in Waziristan continued for several years. Major-General J. R. E. Charles, late R.E., commanded the Waziristan Force in 1923.

In Europe the victors of the Great War had overthrown the governments of vast territories and were heirs to the chaos that followed, intensified as it was, by the policy of "self-determination." At Versailles there was a great tidying up of the debris of war in many lands, and the Engineers were required to provide numerous reports to help those engaged in making what was hoped would be

* See pp. 55-9.

† For further details see *The Indian Sappers and Miners* by Lieut.-Colonel E. W. C. Sandes.

a lasting peace. British troops found themselves in occupation for varying periods of many parts of Europe, on the Rhine, in Silesia and in the late Austro-Hungarian Empire, under conditions which were those neither of war nor peace.

Nearer home, in fact, at our back door, in Southern Ireland, very serious rebellion broke out. The British had to deal with some very perplexing situations in the handling of which the army was called upon to play a principal part.

We can only deal briefly with a few of these events.

ROYAL ENGINEERS IN THE CAUCASUS, 1919

After the Armistice the Allies occupied Constantinople, but soon had to dispatch the 27th Division to Batum to force the Turks to carry out the evacuation of the Caucasus. The situation there was chaotic. The White Russians under General Denikin, with whom we had a military mission, were hostile to the newly formed republics of Georgia, Azerbaijan and Armenia, who were themselves at daggers drawn, there were warlike Tartars and still some German remnants, while Bolshevik agitators were active everywhere. The many problems were not simplified by the presence of French, Italian and American Missions. The country was wild, mountainous and devoid of roads. There was thus plenty of work for the rapidly dwindling sapper units and also for Major-General W. H. Beach, late R.E., the British Chief Intelligence Officer in this medley of nations and hotbed of intrigue.

The 27th Division landed at the end of December, 1918 at Batum and the 39th Brigade from Persia at Baku, the Caspian Sea being controlled by a Royal Naval detachment in captured ships. The engineer units with the 27th Division were the 17th, 99th, 500th and 501st (Wessex) Field Companies, while the 39th Brigade had the 72nd Company. A railway company was reported to be on its way, but turned out on arrival to be a workshop company. With the help of local resources, they managed to provide accommodation for the troops, offices, depots, workshops and hospitals, to carry out railway demolitions in order to keep the Bolsheviks at bay and among other activities they mounted a 6-in. naval gun on the shores of the Caspian. Their principal work, however, was the resuscitation of the remnants of the railway system which alone provided any means of movement in the area.

The D.G. Transportation, South Russia, was Major-General H. C. Cowie, late R.E., from the Indian Railways, with a deputy in

charge of the Caucasus railways, Colonel Brough,* who had come with six officers and eleven other ranks from Baghdad, via Kerman-shah and Enzeli. Brough found that part of the 72nd Company, under an officer with locomotive experience, had made a start with railway traffic, but the amount of damage to rolling-stock was appalling and the newly formed republics were squabbling for what remained. He succeeded, however, after much delay and obstruction in persuading them to pool their resources and to work the railway system as one, under his management. He gradually increased his staff to forty officers by collecting local men with some experience. Rates of payment for past and future railway transport were at last agreed and slowly the traffic was worked up to five trains daily each way.

The pumping of oil from Baku to Batum was essential for the running of the railway and, indeed, for every other enterprise in the country. The Russian staff were still available and gave every assistance, though they had not been paid for months, but disputes between the local republics complicated the distribution of oil and there were continual strikes of the employees of the various nations, often on the point of war with one another. These troubles all fell upon Brough, but a reserve of oil was gradually built up and reservoirs filled. The Transportation Directorate was also in charge of the docks and harbour at Batum with all their accessories, including pipe-lines and oil supply. Major Herschel of the South African Railways handled this work most successfully.

An orderly administration was gradually built up throughout these distracted territories and our forces withdrew, finally embarking at Batum in October, 1919.

THE IRISH REBELLION, 1918-22

The Irish question, which had caused such a dangerous situation in 1914, had been patriotically shelved on the outbreak of war and many Irishmen, though never subject to conscription, had fought gallantly against the Germans. On Good Friday, 1916, however, open rebellion broke out in Dublin. A temporary peace was patched up but a second rising occurred at Easter, 1918, and

* See his article in the *R.E. Journal*, 1938, which includes a lively picture of the almost Gilbertian political situation and of his experiences, including his winter journey in Ford cars through the Persian mountains.

this was followed by widespread incidents of ever-increasing frequency and violence until by the end of 1919 the country was in a state of turmoil. Large numbers of troops were sent from England, and, in fact, by April, 1920, the Home garrisons had been reduced to mere skeletons. The troops were soon no longer used merely in aid of civil power, but for rounding up rebels. In spite of all attempts to find some sort of settlement the situation deteriorated until there was virtually a state of war attended with almost daily outrages followed by organized reprisals.

A peculiarly brutal incident among the many which occurred at this time was the murder in cold blood of Brevet Lieut.-Colonel N. M. Smythe, R.E., an officer of outstanding character, who during distinguished service in France had been wounded three times and lost an arm. While serving in Ireland in 1920, he was appointed to be one of the Military Commissioners, who it had been decided should act with the local magistrates. He went to London for instructions and on his return was billeted in Cork at the Union Club, but at about 9 p.m. a party of rebels entered his room and shot him dead.

The Irish troubles involved much work for the Royal Engineers. Wanton damage to roads and bridges had to be repaired; protection afforded to troops and often to the police in barracks and billets; and many difficult and dangerous tasks had to be carried out in connexion with the demolition of houses as acts of reprisal for murders and other outrages.

A major problem was the accommodation of the ever-increasing numbers. Hutted camps had been built during the war, but these had to be supplemented by the taking over of very many buildings, including even the old walled barracks built during the troubles of the eighteenth century and long since vacated. The work involved in reconditioning and in alterations was enormous and could not have been carried out without the co-operation of certain contractors. Supervision of the work was, however, very difficult as it was almost impossible to move about the country and never with safety. Railways were out of the question so that all journeys had to be made by road with escort and even then successful ambushes were very common. Long journeys, for instance, by the Chief Engineer when inspecting, often involved going by sea sometimes via England. All sapper units were provided with motor trucks and without them could have done nothing.

During the spring of 1921 the murders of individual officers

became so frequent that orders were issued that they should never move in parties of less than five. Many officers including at least one sapper disappeared entirely and were never traced. Organized offensive operations with the 6th Division and cavalry were then ordered, but a truce was called in July, 1921, and hostilities were finally brought to an end by the granting of dominion status to Southern Ireland in December. This, however, was not to be the end of bloodshed, for there promptly ensued a civil war between the Irish themselves, involving greater casualties than those of the rebellion. With this war we are not, however, concerned.

Brigadier-General W. Baker Brown had been appointed Chief Engineer in Ireland in August, 1918, when he took over from Brigadier-General A. Grant. He was relieved in February, 1921, by Brigadier-General G. Walker, who finally closed his office in Dublin on 16th December, 1922. After a period as Chief Engineer Eastern Command, he held the post of Commandant S.M.E. and Inspector of R.E. from 1927 till 1931.

THE VERSAILLES PEACE CONFERENCE

After the Armistice it was soon realized that transportation questions were of great importance, not only in the immediate rehabilitation of Europe, but in the planning of any peaceful settlement of world affairs. Brigadier-General Mance, late R.E., was chosen to accompany the British Delegation to the Peace Conference at Versailles, in order to advise on these questions. The Policy Section of the Railway and Road Directorate under Lieut.-Colonel Woodhouse, R.E., was expanded and set to work to collect relevant information. Many memoranda were prepared and a series of maps produced dealing with the possible new frontiers from the point of view of transportation. Mance not only acted as Transportation Adviser to the British Delegation but was one of the British Members of the Ports, Waterways and Railways Commission, on which he was entrusted with the British negotiations. He was assisted by Colonel A. M. Henniker and Captain J. P. S. Greig on the Peace Conference side, and by Colonel G. A. P. Maxwell and Major N. Thornton (of the L.N.W. Railway) on the Supreme Economic Council side.

When it was found that the Peace Conference was being hampered by a multiplicity of practical questions connected with relief and the re-establishment of normal conditions in Europe, these matters

were handed over to the Supreme Economic Council, of the Communications Section of which General Mance was appointed President. In order to assist the various countries in the physical re-establishment of their railways, and to supervise international traffic at a time when the ownership of rolling stock had not yet been determined, International Railway Missions were sent to each country by the Supreme Economic Council. Brigadier-General F. D. Hammond was head of the very successful mission to Poland, and was succeeded by Colonel J. K. Robertson (Indian State Railways). British military railway officers were stationed at Vienna, Trieste, Prague, Belgrade and Bucharest, and for some time relief trains from Trieste were accompanied by British military detachments to ensure the return of the rolling stock. At some frontiers greater flexibility in the exchange of rolling stock was rendered possible by the agreed supervision by British officers. The duties of the Communications Section included the making of a census of European rolling stock and the reopening of traffic in the Danube.

Captain C. E. Jordan Bell (formerly employed on the construction of the Baro-Kano Railway) performed valuable service at Belgrade in connexion with the provisional reconstruction of the bridge over the Save at Belgrade—a vital link in European communications.

At a later stage Brigadier-General Hammond was Director of Communications, with Colonel Robertson as Comptroller of Railways, in the High Commission for the Government of Upper Silesia during the period of the plebiscite.

Early in 1920 most of the remaining functions of the Communications Section of the Supreme Economic Council were transferred to the Provisional Communications and Transit Committee of the League of Nations of which Brigadier-General Mance became Vice-President. The labours of this Committee led to the Barcelona Conference on Communications and Transit in 1921, at which General Mance was Technical Adviser to the British Delegation.

SURVEY IN NORTH RUSSIA

On the formation of the expeditionary force destined for the North Russia Front, three N.C.Os. were selected from the 19th Survey Company and embarked in June, 1918, to undertake mapping and survey work, but from first to last no regular officer was posted.

The maps available were the Russian 10-verst series, very uneven

in accuracy and at too small a scale to be of much tactical value. Two Ellam duplicators and three sets of drawing instruments completed the outfit. Naturally the force was confronted with possible opposition from coast batteries and local garrisons, and the voyage was occupied in producing such maps as could be compiled, and in the transliteration of place names. On disembarkation plans for defence, for billeting and for future advance were put in hand. Sergeant-Major Wilde, who was in command, presently discovered local plans from the railway, forestry and river navigation offices, and in doing so found both instruments and Russian surveyors who were incorporated in the force. Whilst Sergeant-Major Wilde and Sergeant Matheison trained and led the three mapping sections thus formed, Sergeant Bristow took over the main map office. The work included production of maps of defended localities at 6 in. and 2 in. to the mile, minor triangulations with beacon poles frozen into holes in ice or snow, the measurement of bases on frozen rivers, and many compass routes to connect, and to advance, the various columns and outposts.

SURVEY AFTER THE ARMISTICE

The Armistice was followed by the recall of Colonel E. M. Jack, who had served continuously as the head of Geographical Services on the Western Front since the outbreak of war. Rejoining the Geographical Section on 1st January, 1919, he relieved, in 1920, Colonel Sir Coote Hedley, who had led the Section for nine years. Lieut.-Colonel MacLeod with the 4th Field Survey Company proceeded to Cologne. In 1919, Lieut.-Colonel C. S. Reid brought what remained of the field survey battalions to Larkhill, Salisbury Plain, where till demobilization, they helped to form the new Artillery Survey Company.

The Ordnance Survey remained under Colonel Sir Charles Close, but suffered severely under the findings of the various Committees on National Expenditure. The pre-war standard of revision had to be abandoned, and although large building programmes were beginning, the large scale plans were allowed to deteriorate. On the signing of the treaty with Southern Ireland, maps, printing plates, machinery and buildings worth more than £ $\frac{1}{4}$ million and about 250 employees were transferred to the new government. Cordial relations remain but the Survey of Eire is thus no longer a Corps activity.

The Geographical Section under Major O. E. Wynne provided maps and a printing section for the treaty negotiations at Versailles. Their work was of the greatest importance in the preliminary delimitation of post-treaty boundaries. The following Royal Engineers were employed as Boundary Commissioners consequent on the Treaties of Versailles, St. Germain, Trianon, Sèvres, Neuilly and Lausanne :—

<i>Commissioner</i>	<i>Boundary</i>
Colonel E. Agar	Denmark-Germany.
Lieut.-Colonel G. F. A. Whitlock	Belgium-Germany.
Lieut.-Colonel R. A. Boger	Poland-Germany.
Lieut.-Colonel D. Cree	Poland-Germany and Hungary-Yugoslavia.
Major P. K. Boulnois	Danzig Free State-Poland.
Lieut.-Colonel T. T. Behrens	Austria-Italy.
Lieut.-Colonel A. H. Craven	Austria-Yugoslavia and Hungary.
Lieut.-Colonel W. L. de M. Carey	Czechoslovakia-Austria, Hungary and Poland.
Lieut.-Colonel F. Giles	Yugoslavia-Albania and Bulgaria.
Lieut.-Colonel A. B. Clough	Albania-Greece.
Lieut.-Colonel T. T. Grove	Demilitarized Zone of the Straits.
Colonel E. G. Wace	Saar Valley.
Colonel S. F. Newcombe	French Syria-Palestine.

THE R.E. WAR MEMORIAL

On 19th July, 1922, H.R.H. The Duke of Connaught unveiled at Chatham the Memorial to the Royal Engineers who had fallen in the war. The memorial was completely draped with union jacks, which were released electrically to flutter down, revealing the snow white 70-ft. obelisk.

As there had been difficulties in connexion with the choice of a suitable site in London, it had been decided to erect the Memorial at Chatham between the two arches commemorating the Crimean and South African campaigns. The design was chosen as the result of an open competition assessed by Sir Reginald Blomfield, R.A., who selected the design of Messrs. Hutton and Taylor, F.F.R.I.B.A., from among the several hundred submitted. The sculptor was Mr.

Alexander Proudfoot, A.R.S.A. In addition to the erection of this lasting and tangible memorial, a large sum was invested to provide assistance in the education of deserving children of Royal Engineer officers and other ranks.

As a memorial to Field-Marshal Earl Kitchener—the greatest of the 18,000 Royal Engineers who gave their lives during the war—the plinth of the obelisk at Chatham bore the simple but impressive inscription—*Kitchener, 1850-1916*. Moreover, it was decided that the piece of plate in the Headquarter Mess to commemorate the war should take the form of a silver statuette of Earl Kitchener to match the existing one of Field-Marshal Sir John Burgoyne. These are replicas, about two feet high of the statues standing in the Horse Guards and Waterloo Place.

A beautifully bound and engrossed Roll of Honour was deposited in a special niche in the Chapel that had been built in St. Paul's Cathedral as a national memorial to Earl Kitchener, together with Rolls of Honour of Dominion, Indian and other Corps of Engineers. The frontispiece was painted by Mr. Solomon J. Solomon, R.A., who had served in the Royal Engineers during the war.

CHAPTER XV

CHANGES IN R.E. ORGANIZATION

Introduction—The Rawlinson Committee—Reduction in percentage of tradesmen—Surveyors of Works, R.E.

INTRODUCTION

WHEN the fighting ceased in November, 1918, the British people and their Parliament did what they have done after every previous war in their history. They hastened to demobilize and to break up their military machine and their war industry. It had taken two years at least to build it up, and not until two years after the outbreak of war, had they been able to strike a really big offensive blow to help their Allies. During those two years they had been continuously exposed to the risk of national annihilation. One would have thought that such a warning against unpreparedness for war would never have been forgotten, yet we find that by 1920 Britain had achieved almost total disarmament. The Government of that day, and of many subsequent years, laid down a principle for the guidance of their fighting forces that "there could be no big war for ten years." At the end of every year the Government renewed this same limit and not till the end of 1934 was the instruction cancelled. It was not until the spring of 1939 that full rein was given to the fighting services to develop their fighting efficiency, and again two years of miraculous improvisation were required before they could deliver a really big offensive at El Alamein.

The R.E. in common with the rest of the army were, of course, affected by this ruling principle, and had to struggle to preserve the germs that might be capable of expansion if time were given for that purpose.

THE RAWLINSON COMMITTEE, 1919

Very soon after the end of the war, and as soon as the armies had been demobilized, the War Office appointed several committees to make recommendations in regard to the future organization of

the Army and of the various principal branches of it. One of these committees was convened under the presidency of General Sir Henry Rawlinson to report on the future organization of the Royal Engineers and the methods of carrying out the engineer work required by the Army in peace and war. Its members were :—

President

General Sir Henry S. Rawlinson, G.C.B., G.C.V.O., K.C.M.G., G.O.C.
Fourth Army.

Members

Major-General E. H. de V. Atkinson, C.B., C.M.G., C.I.E., late R.E.
Chief Engineer, First Army.

Mr. B. M. Draper, Works Finance Branch, War Office.

Sir Brodie Henderson, K.C.M.G., C.B., Deputy Director-General of
Transportation, B.E.F., France.

Major-General Sir Richard P. Lee, K.C.B., C.M.G., late R.E., General
Officer Commanding 18th Division.

Mr. C. L. Morgan, C.B.E., Member of Council, Institution of Civil
Engineers.

Major-General H. F. Thuillier, C.B., C.M.G., late R.E., General Officer
Commanding, 23rd Division.

Associate Members

Brigadier-General C. H. Foot, C.B., C.M.G., Chief Engineer, Australian
Corps.

Major-General W. B. Lindsay, C.B., C.M.G., D.S.O., Chief Engineer,
Canadian Corps.

Secretary

Lieut.-Colonel E. E. B. Mackintosh, D.S.O., Royal Engineers.

Assistant Secretary

Major H. R. Pownall, D.S.O., M.C., Royal Field Artillery.

The terms of reference which were exceedingly wide and covered every activity of the Corps in war and peace were divided into the following heads :—

Functions of the Corps of Royal Engineers.—What services were to be included in the sphere of activity of the Corps.

Organization of the Corps of Royal Engineers.—How the Corps should be organized so as to carry out the functions laid down for it.

Works.—The organization of the Corps for the carrying out of the Works Services of the Army, in addition to its primary rôle as a combatant branch.

Recruitment and Training.—The cadet training, entry and subsequent training and employment of officers, and the recruitment and training of the other ranks.

Administrative Questions affecting the Corps.—Consideration of the pay and rates of promotion of all ranks, the seconding of officers employed on other than Corps duties, admission to Staff College.

Relations with Civil Engineering.—How provision for expansion of the Corps on mobilization from civilian sources, and for obtaining the best technical advice on large engineering questions in war can best be effected.

The Committee began its sittings in March, 1919, and continued them daily for about four months. Altogether ninety-two witnesses were examined, mostly R.E. officers, but also a number of staff officers and some leading civil engineers, while eighteen others submitted written evidence. The Committee went into the subjects under reference very thoroughly and submitted a most exhaustive report, containing a hundred recommendations, of which the most important were the following :—

That those services which require personnel with the technical knowledge and training necessary in the ordinary engineering professions in civil life should be organized in a single Corps of Royal Engineers.

That all Transportation Services should be Royal Engineers.

That, unless stronger arguments could be adduced than those brought before the Committee for separating the Signal Service into an independent corps, no change in the existing system by which they were part of the Corps of Royal Engineers should be made.

That sound ranging, flash spotting and calibration should be taken over by the Royal Artillery.

That all searchlight units should continue to be Royal Engineers.

That engineer and pioneer units in a division should be amalgamated and, as Royal Engineers, should be under one command.

That divisional engineers should be organized in three double field companies.

That a headquarter company of special skilled men should be included in the establishment of divisional engineers.

That the proportion of engineers (excluding signals) to infantry in a division should be one to six.

That the skilled tradesmen in a field company should be between twenty-five and thirty per cent of the company dismounted strength.

That the whole bridging equipment of field companies should be massed at divisional headquarters.

That all engineer work of a force in the field should be co-ordinated and controlled by a single Engineer-in-Chief, who should be the

adviser to the General Staff in regard to engineer work in connexion with operations, and to the Quartermaster-General in regard to engineer work in connexion with lines of communications and bases.

That at the War Office a Directorate of Military Engineering should be created, definitely charged with the duties of advice to the General Staff on all engineering matters in connexion with overseas operations, and of preparing in advance for the probable requirements in engineer personnel and material for those operations. Also with studying the developments of engineering in all its branches at home and abroad with a view to their employment in the service of the Army.

That the Directorate of Military Engineering above referred to and the existing Directorate of Fortifications and Works should be conjoined under an Engineer-in-Chief.

That quantity surveyors should in future be civilians.

That Woolwich and Sandhurst should be amalgamated into a single college.

That a number of commissions in the Royal Engineers should be given yearly to students from universities and engineering institutions.

That Royal Engineer officers should undergo their courses in constructional, mechanical and electrical engineering at Cambridge University.

That Royal Engineer officers should not lose their Corps pay while students at the Staff College.

That young and suitable non-commissioned officers, Royal Engineers, should be given the chance of commissions in the infantry.

That opportunities should be opened to Military Foremen of Works for commissions in the Corps.

It was unfortunate that very little attention was given by the Army Council to the proceedings of this Committee and very few of its recommendations were taken up. The fact is that it was assembled prematurely. Other committees had been assembled at the same time but, as the Government had not come to any decision on the general strength of the army to be maintained or on the tasks it would be required to carry out in peace or war, there was no solid foundation on which individual committees could build up their recommendations. The strong drive for retrenchment of expenditure on the fighting services which set in very soon afterwards, and the consequent drastic reduction of the Army, had the effect of making many of the proposals of these committees nugatory. Of those of the Rawlinson Committee several were, in fact, decided in a sense contrary to the Committee's recommenda-

tions, for instance, the Signal Service was made into a separate Corps,* the divisional engineers were not organized in double field companies, the quantity surveyors were afterwards organized on a military and not a civilian basis, and the proposal to amalgamate Woolwich and Sandhurst was definitely rejected by the Army Council, at any rate for many years.

The Committee's proposal for the appointment at G.H.Q. in war of a single Engineer-in-Chief was followed in the organization prescribed in *Engineer Training 1937*, which provided for a Director of Engineer Services to be the senior engineer adviser at G.H.Q. on all major engineer questions on the General staff side and also to be the adviser of the Quartermaster-General on all engineering questions in connexion with the lines of communication and bases. He was also to exercise executive control, through the Director of Works and Director of Engineer Stores, of all works and stores services in connexion with the latter. There was also to be an engineer officer, graded as G.S.O.1 to be the adviser of the General Staff on engineer questions, but to work in touch with the D.G.E.S., the latter being definitely the senior engineer adviser and having the right of direct access to all the Principal Staff Officers, including the Chief of Staff.

In regard to the Committee's proposal to establish at the War Office a Directorate of Military Engineering charged with giving advice to the General Staff on all engineer matters in connexion with overseas operations, and to study and prepare for them in advance, and the conjunction of this directorate with the existing Directorate of Fortifications and Works under a single Engineer-in-Chief, no steps were taken until well into World War II. The Commandant, School of Military Engineering, Chatham, was charged, in addition to his other duties, with those of Inspector of Royal Engineers, and, as such, inspected and reported on all R.E. units and advised the General Staff in regard to their equipment, organization and training.

Of the other recommendations of the Committee the following were carried out at various times during the subsequent twenty years :—

The sending of all junior officers to Cambridge University for their courses in engineering subjects. This was the first, and for a long time the only one, of the Committee's proposals to be carried out. Its

* See Appendix. VI.

execution was due to the urgent necessity for putting through these courses some 400 officers who had been commissioned during the war, and the impossibility of doing so at the S.M.E. in a reasonable time. The War Office agreed later to continue this system for all future officer entrants to the Corps.*

Commissions in the Corps to be given yearly to students from the universities.

R.E. officers to retain their Corps pay while students at the Staff College.

A headquarter company, mainly of tradesmen, called a Field Park Company, to be included in the War Establishment of divisional engineers.

The bridging equipment of field companies, consisting of folding-boat sets and small box-girder bridges, to be carried with the field park company of the divisional engineers, and the pontoon and trestle equipment by a bridge company, R.A.S.C. in rear.

Young and suitable non-commissioned officers of the R.E. to be given the chance of commissions in the infantry as Y Cadets at Sandhurst. Many gained such commissions.

Opportunities to be given to Military Foremen of Works for commissions in the Corps as Surveyors of Works. Again many received such commissions.

It is of interest also to note that the Rawlinson Committee recommended that a uniform rate of time promotion should be introduced for the Army as a whole, and that this reform was brought about by Mr. Hore Belisha, Secretary of State for War, in 1938.

REDUCTION IN PERCENTAGE OF TRADESMEN

In 1919 an alteration was made in a fundamental principle concerned with the manning of R.E. units. Up to about the year 1912, only skilled tradesmen (artisans) were enlisted in the Royal Engineers, and they were paid Engineer Pay at varying rates, according to their skill. It was tacitly understood that unskilled labour units would be raised in war-time to work alongside the skilled sappers. About 1912, however, there occurred a shortage of skilled recruits, and a small infringement of the above principle became unavoidable. In every R.E. unit, permission was given to fill the vacancies with non-tradesmen, who were classified as Pioneers and drew a lower rate of pay. It was considered that they could be

* See pp. 156-62.

employed as cooks, and for other duties which did not require the special skill of an artisan. In 1919 it became practically impossible to recruit any skilled tradesmen, as those who had been demobilized were drawing high rates of pay in civil life, and most of the pre-war survivors had completed their voluntary engagement or were soon about to do so. The post-war Army required a much higher proportion of skilled artisans in many other Corps and regiments. The R.A.S.C. were now almost completely mechanized; artillery and even cavalry were talking of mechanization, the R.A.O.C. and the R.A.S.C. had already to provide large workshops for the repair of vehicles of all kinds, and the R.A.F. was now an independent force, competing in the open market for skilled tradesmen. The apprenticeship system in civil life had ceased to maintain the numbers of civilian artisans and there had been heavy casualties among them in the war. There was a great demand for their services in civil life, they could command high wages and saw practically no inducement to enlist in the Army.

The Army Council realized that they would have to start their own organization for enlisting and training boys from the age of 15, as apprenticed tradesmen to fill the units of the R.E., R.A.S.C. and R.A.O.C. who could not operate without skilled men. But the Treasury, seeking economy, was tempted to exploit the principle of introducing a higher proportion of pioneers at cheaper rates of pay into every technical unit, and in the R.E. this proportion increased very considerably.

At the same time, the very necessary and important step was taken to establish an Army School for Apprenticed Tradesmen on a three year course, between the ages of 15 and 18, on the Beachley peninsula, between the rivers Severn and Wye. The R.E. Electric Lighting Schools at Gosport and Plymouth were also given an establishment of apprenticed tradesmen to train and at the Chatham depot there was an establishment for training boys. The R.A.O.C. and the R.A.S.C. also had schools at their depots, but the school at Beachley was to be the main supply of skilled men for all three corps. It was contemplated that its establishment should be 900. The boys were engaged at the age of 15 for three years, and were under contract to enlist at the age of 18.

The school opened with a first batch of 200 in February, 1923, and proved to be very attractive to parents. Here was an offer of free voluntary secondary education at a boarding school, not only in normal educational subjects, but also in a skilled trade.

Each boy was to be paid pocket money at the rate of five shillings per week and was to be clothed in uniform, fed and accommodated. Such was the competition for entry that it was possible to establish a competitive examination, so that boys who already possessed a good standard of education were obtained. At the age of eighteen they were enlisted for seven years with the colours in R.E., R.A.S.C. or R.A.O.C. and five years in the Reserve.

The strength of the school gradually grew to about 800 and, with the other schools at the depots, the output became sufficient to fill within a few years the establishments of the units to which the boys were posted. Moreover, conditions of unemployment in civil life, which had begun to arise in the late 1920s, were now making it possible to attract skilled men to enlist voluntarily, and, in fact, many had to do so at pioneer rates of pay until a vacancy occurred for them on the reduced establishment of tradesmen. This situation was not, however, met by reducing the proportion of pioneers in skilled units, but by limiting the number of boys accepted for training. This policy had, of course, the effect of providing fewer tradesmen on the Reserve, and has materially changed the make-up of the Corps and the method of employment of its units, in that they now contain a high proportion of unskilled men and, therefore, cannot be diluted to the former extent by the allocation of easily raised labour units to suit the work in hand.

SURVEYORS OF WORKS, R.E.

Prior to 1904 the Army organization for the execution of works consisted of an Engineer branch, composed of Royal Engineer officers, warrant and non-commissioned officers, and a District Surveyors branch, composed of civilians. In this it followed the usual practice of other Government Departments which deal with works and of the civil engineering and architectural professions. In these the practice is to employ quantity surveyors with functions distinct from those of the engineers or architects. In order to understand the changes of organization affecting the Surveyors in the Works service of the Army it is necessary to note what the distinctions are between the functions of engineers and surveyors..

The functions of the Engineer branch are :—

Preparation of designs and specifications, and decision on the material, workmanship and mode of execution. Inspection of

materials and supervision of the execution of the work. Responsibility for financial control and economy in design and execution.

The functions of the Quantity Surveyors branch are :—

Preparation of detailed estimates and bills of quantities. Technical examination and check of contractors' tenders and priced bills of quantities. Measurements of contract work, technical examinations of bills and of contractors' claims for extras, etc.

For various causes of old standing, the District Surveyors had come to be employed to a considerable degree on the duties of the Engineer branch and the distinction between the duties of the Engineer and the Quantity Surveyor had become obscured. This resulted in some dissatisfaction among the civilian District Surveyors, who felt it an injustice that they should perform the functions of the Engineer while receiving a lower status and lower rates of pay. They also met with difficulties in carrying out their duties in barracks, where their civilian status sometimes prevented their receiving the consideration which they felt to be their due.

In 1904, a change was made in the organization for the execution of works services. A new department, entirely civilian in composition, under a civilian Director of Barrack Construction, was created for the design and construction of all new barracks and hospitals. The Royal Engineers, under the Director of Fortifications and Works, were made responsible only for fortifications, ordnance buildings, camps and rifle ranges, and for the maintenance of all barracks. It was intended that the then existing body of civilian District Surveyors should be taken over by the Director of Barrack Construction, but that official found he did not require them since the organization of his department was of a very centralized nature. The Director of Fortifications and Works had therefore to retain a body of District Surveyors too large for his requirements. Partly to meet this situation and also with the intention of improving their status and pay, District Surveyors were organized in 1908 into a military corps as "Staff for Royal Engineer Services" and given commissions. Their liability for Engineer duties was definitely recognized and they were called "Inspectors of Works" instead of District Surveyors. Provision was also made for their employment as Division Officers in order to supplement the supply of R.E. officers, which presently became inadequate owing to increased

military training duties, and to the gradual re-transfer to the D.F.W. of all hospital and some new barrack services. At the same time (1908) all new recruitment to the newly formed Staff for Royal Engineer Services was stopped and it was decided to let this corps die out as its members individually reached the limiting ages for retirement.

By this change in organization the distinction between the functions of engineers and quantity surveyors was altogether swept away. The employment of the Inspectors of Works on the proper duties of quantity Surveyors was maintained only in the offices of Chief Engineers with the result that the Division Officers R.E., on whom the responsibility lay for the correctness of quantities, measurements and bills, were expected to exercise this responsibility without technical assistance. This, however, they could not efficiently do since the duties of the quantity surveyor require a specialized and long training which the R.E. officer does not get and cannot get without detriment to his military and engineering efficiency. The unfortunate effects of this confusion of functions were brought to notice by the Read Committee of 1911 on the Triennial Contract System and also by the Rawlinson Committee of 1919 on Engineer Organization.

By 1919 the D.F.W. had again become responsible for all new construction as well as for maintenance, since the civilian Director of Barrack Construction and his department had been abolished during the war. The employment of Inspectors of Works as Division Officers ceased and they reverted to their proper duties as Surveyors. But those still remaining were insufficient to fill the necessary appointments at home. To make up the number required temporary Inspectors of Works were engaged, mainly from officers who had held temporary commissions in the war. This arrangement, however, could not be satisfactory as a permanency, especially when it was found to be very difficult to fill the Inspectors of Works posts abroad, since the temporary officers could not be ordered abroad against their will. As the numbers of the original Staff for R.E. Services dwindled this difference became acute.

In 1923, a War Office Committee was appointed to consider the question of recruiting future entrants for the duties of quantity surveyors and proposed the following scheme :—

- (a) For purposes of pay, pension, allowances and promotion, the new class should have the status of quartermaster.

- (b) They should be known as Surveyors of Works, R.E., with the rank of Lieutenant, Captain or Major, according to their length of commissioned service, with selection to the rank of Lieut.-Colonel, and should wear R.E. uniform.
- (c) In order to be eligible for appointment, candidates should be required to have passed an examination to be held by the Surveyors' Institution, approximately equivalent to that laid down for a "Professional Associate" of that Institution ("P.A.S.I.").
- (d) The maximum age of entry should be 36; candidates to have five years service as a Military Foreman of Works, to be recommended for promotion, and to be in possession of a 1st Class Army School Certificate of Education.

In 1926, this scheme was implemented, and worked satisfactorily for many years. A number of temporary Inspectors of Works who were serving at that time were granted permanent commissions, but with this exception all vacancies were filled from the ranks of Royal Engineers who had passed the Surveyors' Institution Examination.

The scheme undoubtedly proved to be a bright attraction to recruiting for the Royal Engineers, opening as it did to every recruit the possibility of a commission within a certain number of years and gradual promotion to the rank of Lieut.-Colonel, and providing instruction and practice in the work of a technical profession valuable in civil life after leaving the army.

CHAPTER XVI

TRAINING OF R.E. OFFICERS

Post-war supplementary courses, 1919-25—Junior officers' courses, 1926-39—Achievements of R.E. officers at Cambridge, 1919-39—R.E. officers and the Staff College—Attachment of R.E. officers to engineering firms.

POST-WAR SUPPLEMENTARY COURSES, 1919-25

At the beginning of 1919 there were in the Corps over 400 junior officers who, during the course of the war, had received permanent commissions as second-lieutenants in the R.E., after a training of six months only at the R.M.A., Woolwich. Owing to the urgent need for subalterns these officers had been given only a short course of instruction in field engineering and military subjects at the S.M.E. before being posted to units at the theatre of war. It was, therefore, necessary to complete their training in the technical subjects of the profession of the Royal Engineer, viz., constructional engineering, survey, electricity, workshop machinery, etc. Arrangements were at once made to form classes for putting them through these courses at the S.M.E. For this purpose they had to be collected from wherever they were serving and brought to Chatham. They were chosen as far as possible by seniority, beginning with those who had received their commissions in July, 1913. The first class, of twenty-five officers, was formed at the S.M.E. on 31st January, 1919, and was known as No. 1 Supplementary Class: No. 2 assembled in May, 1919, and No. 3 in August of the same year. It was, however, obvious that many years would be required to pass more than 400 officers through these courses, and it was, therefore, imperative to find some method of quickening up the process.

During the summer of 1919 a War Office Committee,* of which Lord Rawlinson was the President, was held for the purpose of making recommendations on Engineer Organization. The terms of reference of this Committee included the question of the training

* See pp. 145-150.

and entry of young officers into the Corps, and the length and scope of their training courses. The recommendation of the Committee in regard to the training in engineering subjects was that in future all R.E. officers should receive their training in constructional, electrical and mechanical engineering at Cambridge University, and that they should undergo at Chatham the necessary courses in fortification and survey, and a practical workshops course in electrical and mechanical engineering, as well as their military training. The reasons given by the Committee for this recommendation were that engineering science and practice were advancing by leaps and bounds, and that their influence on future military operations would be most intimate and intense. They considered that the time given to engineering subjects should be increased. To provide at Chatham for the increased importance of these subjects it would be necessary to expand the S.M.E., to amplify and extend the courses in constructional, electrical, and mechanical engineering, and to provide an equipment and teaching staff of the first order, equal to those found in the best civil engineering institutions. The difficulties and expense of such a scheme would be considerably greater than those of sending the officers to Cambridge. The latter course also would, the Committee pointed out, have the advantage of obtaining the best and most highly trained teachers and that of broadening the outlook of the officers and giving them opportunities of mixing with their civil comrades.

When the difficulty in providing at Chatham supplementary courses for the officers commissioned during the war became pressing, the attention of the War Office authorities naturally turned to the above recommendation of the Rawlinson Committee. Although the recommendation referred to officers newly commissioned from Woolwich, it was decided to ask the University authorities whether they could help to meet the temporary and urgent need of the Corps by providing similar training for the Supplementary Classes.

Soon after Major-General H. F. Thuillier took up the appointment of Commandant, S.M.E., in November, 1919, he was directed to get into touch with the Cambridge University authorities and see if they would be good enough to allow fifty officers at a time to undergo an engineering course lasting one year. This necessitated rather lengthy and delicate negotiations. The ordinary university course for the engineering tripos (known as the mechanical science tripos) lasts three years, and to cover the subject in a one-year

course necessitated much condensation of the teaching and some additional staff to conduct the course. It was very fortunate for the Corps that the professor in charge of the University Engineering School was Professor C. E. Inglis, O.B.E., F.R.S., who had served in the Corps during the war and was the designer of the well-known and much used Inglis Bridge. He was a strong supporter of the idea of giving young R.E. officers their training at Cambridge, and was most helpful in arranging for a course to suit the special requirements of the Supplementary Class officers. There remained the question of getting the various colleges to agree to accept the officers as resident undergraduates. This entailed interviews with the Heads of all the colleges, some of whom were at first rather difficult to interest in the proposal. The negotiations were carried out with much tact and diplomacy by Major J. A. McQueen, the Brigade Major at the S.M.E., with the valuable support of Professor Inglis, and eventually the consent of all of them was secured.

The War Office agreed to pay all the University and college tuition and other obligatory fees and expenses, the officers themselves, who continued to receive regimental and engineer pay and allowances, being required to pay for their board and lodging. The University appointed two tutors for the purpose of assisting in the tuition and generally supervising the work of the officers, while the War Office agreed to appoint a senior R.E. officer to reside at Cambridge for the purpose of liaison with the University authorities. The first officer to be appointed for this purpose was Brevet Lieut.-Colonel G. H. Addison, and the tact and efficiency with which he performed these duties had the effect of overcoming any lingering objections to the intrusion of the military element into the University.

The first batch of fifty officers (Nos. 5 and 6 Supplementary Classes) went up to Cambridge in October, 1920, and others followed, two classes at a time, at yearly intervals, till all those who had been commissioned between July, 1913, and September, 1918, inclusive, had been through courses either at the S.M.E. or at Cambridge, the last two classes finishing the University course in June, 1925.

The one-year course for Supplementary Class officers was necessarily insufficient to permit of their taking the University tripos examination, but the authorities arranged for an examination at the end of the course, on the results of which the officers were graded in three classes, which might be regarded as indicating the classes they would have taken in the tripos had they undergone

the complete tripos course. They also gave facilities for any officer who wished to take the tripos, and to receive the B.A. degree on passing, to do so by remaining up at the University for an additional year with the leave of the War Office, but at his own expense. A few officers did so, and passed the tripos with Honours.

In addition to these courses at Cambridge, the Supplementary Classes had to undergo at Chatham short courses in field works and bridging, survey, and practical workshop courses in steam, internal combustion and electrical machinery. Advantage was taken of the long vacation in summer to do the outdoor courses, and the others were done on leaving Cambridge.

Lieut.-Colonel G. H. Addison was asked to give an opinion whether the tripos course was suitable for young R.E. officers, or whether it would be beyond their capacity. He considered that the only certain way of testing this was to make a personal trial of it himself, so he went through the whole course and at the end of two years succeeded in passing the examination with Honours in the Second Class—a very notable achievement for a man of 46, who had no special mathematical ability and whose life since leaving school had been spent in the normal employment of the engineer officer. His successor, Brevet Lieut.-Colonel B. L. Eddis, followed suit later and performed the same feat at a slightly younger age. Subsequent incumbents, Majors R. S. Rait Kerr, E. F. Tickell and F. W. Hards, were not so energetic.

JUNIOR OFFICERS' COURSES, 1926-39

The preceding paragraphs have shown that the idea of giving young R.E. officers their education in engineering subjects at Cambridge University was first propounded by the Rawlinson Committee on Engineer Organization in 1919, but that it was first tried out in connexion with the training of the Supplementary Classes. While these classes were going on the question of what permanent arrangements should be made for providing training in engineering subjects to the young officers on first appointment from Woolwich was fully investigated and discussed. The reasons given by the Rawlinson Committee for their recommendation that they should receive it at Cambridge were very convincing, but financial and other considerations naturally had to receive the most careful attention.

When the satisfactory effects of the training of the Supplementary

Classes at Cambridge became apparent, General Thuillier, therefore, began consultations with the University authorities to ascertain whether they would, when the Supplementary Classes came to an end, take two classes a year of junior officers as a permanent arrangement. No difficulties were raised from the University side, the excellent impression made on the authorities by the Supplementary Classes making them very willing to continue the association of the Royal Engineers with the University. For the juniors it was proposed that they should do the full tripos course and take the examination at the end. To allow of this the University agreed that the period of the cadets' course at Woolwich should count as equivalent to the first year at the University, so that by doing two academic years (six terms) of residence the R.E. officers would be eligible to take the tripos examination and qualify for the B.A. degree. Considerable difficulty, however, arose in fitting the University terms with the training required at Chatham in subjects not covered by the University course, without greatly extending the length of the time the officers were to be under instruction. It will be realized that the longer the officers' training period lasts and the longer they are thereby kept from undertaking their Corps duties, the greater is the expense to the State.

The subjects, not covered by the University, and in which it was necessary for them to undergo courses at Chatham (with the length of time required for each were) as follows :—

Military duties, on first joining	...	10 weeks
Field works and bridging	15 weeks
Survey	12 weeks

Further courses necessary were :—

Construction	8 weeks
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This was to cover the special applications of constructional engineering to military purposes, e.g., War Department design and practice in regard to barracks, hutted camps, water supplies, roads, drainage, etc., also the practice of the various building trades.

Workshops	8 weeks
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This consisted of practical demonstrations of the various mechanical trades employed in the Royal Engineers, and in the layout and organization of workshops and machinery used for army purposes.

Electricity 3 weeks

This similarly dealt with the usual practice in wiring and lighting military buildings, etc., firing charges electrically, and with the types of electrical plant, searchlights, etc., normally used in the Army.

Military duties (refresher course before
finally leaving) 3 weeks

Desirable in view of the period spent at the University away from military practice and influences.

To fit in all these courses without unduly extending the total period of instruction it was proposed to utilize the greater part of the University long vacation in the summer. This was bound to have the effect of greatly increasing the difficulty of getting First Class Honours, since practically all civil aspirants for the First Class do special voluntary courses during the long vacations. This, however, was a less important objection than that of prolonging the total period. By this means it was possible, though with difficulty, to fit in the six University terms and all the additional Chatham courses into a total period of two years and nine months, or nine months longer than the usual course for officers who were given all their training at the S.M.E. When it was considered that as long ago as 1865 the duration of the S.M.E. courses had been two years, and that in the interval the whole range of engineering science had been enormously extended and its application to military operations had vastly increased in importance, an extension of nine months could hardly be considered excessive.

Early in 1923 a War Office Committee was appointed, under the chairmanship of Viscount Haldane, to inquire into the system of entering officers for the combatant branches of the army, the length of time spent at the cadet colleges, and the character and scope of the general and professional education given there and immediately after commissioning. General Thuillier was invited to put before this committee his scheme for the training of R.E. officers partly at Chatham and partly at Cambridge. The committee examined the proposals with care, spending two days at Cambridge for the purpose. In their report they recommended that in future the training of R.E. officers after leaving Woolwich should be partly at Chatham and partly at Cambridge and they embodied General Thuillier's proposals in their report. The committee, which made a large

number of recommendations regarding the entrance into, and education at, Woolwich and Sandhurst, also recommended the reduction of the Woolwich and Sandhurst courses from two years (four terms) to one and a half years (three terms), and that R.A. cadets should complete their training by a course at Larkhill.

The recommendation of the Cambridge scheme by so strong a body was no doubt the main factor in inducing the War Office to accept it, though discussions on the financial aspect caused long delays and it was not till 1925 that it was finally approved. After certain interim arrangements, the first complete batches went from the R.M.A. to Cambridge in October, 1926, and by the date of the outbreak of war, in 1939, practically all R.E. junior captains and subalterns had Honours degrees in engineering, and more than half the Corps had been to the University.

ACHIEVEMENTS OF R.E. OFFICERS AT CAMBRIDGE, 1919-39

All R.E. officers who went to Cambridge were in every respect full members of the University, and their status was exactly the same as that of the ordinary undergraduate. They were subject to University discipline, and went through the ceremony of matriculation soon after arrival. The Supplementary Classes went for one year only, a few being allowed to stay for a second year at their own expense in order to obtain degrees. Junior officers went for two years, and did the second and third years' work for the Mechanical Science Tripos, it being assumed that they had already done the equivalent of the first year's work. They had the privilege of taking a degree after only two years' residence, as opposed to the statutory three years required of the ordinary undergraduate. From two to eight officers were at each college, living the life of the ordinary undergraduate and taking full part in all college activities. Most colleges wished to have young men of as many different types as possible, and were glad to get a few sappers, on the grounds that they were in certain respects different from the other undergraduates and formed one more ingredient to be thrown into the melting pot. It is, however, very pleasant to be able to record that this was not the only reason why colleges welcomed sappers. In the files in the R.E. Office at Cambridge were numerous appreciative letters from Masters, Tutors and other college authorities. The greatest achievement, therefore, of the Supplementary and Junior officers at Cam-

bridge was the excellent reputation that they won for themselves and for the Corps.

As regards purely academic distinction, it should be remembered that the J.O. was handicapped as compared with other undergraduates. He missed the first year's work at Cambridge, including the Long Vacation Term, and also went to Chatham during the long vacation between his first and second years. Most normal tripos candidates worked very hard during the Long Vacation Terms. It should also be remembered that about half the undergraduates at Cambridge are scholars selected from every kind of school. In other words, sappers were competing with many of the best young brains in the country.

As a result of all the above factors, though very few failed to obtain Honours and a satisfactory proportion obtained Seconds, the percentage of Firsts was below that obtained by ordinary undergraduates, who, in effect, had thirty-two months available for work, as against the sappers' (say) eighteen, i.e., sixteen months at Cambridge, plus 400-odd hours at the R.M.A.

The results of the Mechanical Sciences Tripos from 1928 to 1939 were :—

Year	Honours Degrees			Ordinary Degrees	Total
	Firsts	Seconds	Thirds		
1928	—	1	4	5	10
1929	4	5	9	—	18
1930	3	8	14	—	25
1931	4	7	13	3	27
1932	3	12	14	1	30
1933	3	18	7	3	31
1934	2	10	12	1	25
1935	—	6	19	1	26
1936	1	13	29	—	43
1937	2	10	20	2	34
1938	1	12	18	4	35
1939	3	9	24	4	40
Totals	26	111	183	24	344

The following officers obtained First Class Honours :—

- 1922.—E. A. Barclay-Smith and R. D. Davies.*
- 1923.—E. M. E. Coghlan and R. D. Keane.
- 1924.—P. R. Antrobus (Rex Moir Prize for best marks in the Tripos),
E. A. L. Gueterbock and W. D. A. Williams.
- 1925.—S. W. Joslin and N. A. M. Swettenham.
- 1926.—E. L. Botting.
- 1927.—W. F. Anderson, J. C. R. Fitzgerald-Lombard, C. R. Price
and J. S. A. Salt.
- 1929.—B. S. Armitage, F. M. Hill, M. C. Perceval (Archibald Denny
Prize—Structures) and W. B. Sallitt.
- 1930.—B. M. Archibald, R. P. Buchanan and R. W. Ewbank.
- 1931.—C. A. Biddle, H. E. C. de Chassiron, C. L. Richardson and
W. H. C. Travers.
- 1932.—D. C. Merry, E. H. Thompson and J. P. Waller.
- 1933.—D. E. Holbrook, A. P. Lavies and J. G. McKendrick.
- 1934.—J. P. B. Flowerdew and H. A. T. Jarrett-Kerr (with two
distinctions).
- 1936.—R. L. White.
- 1937.—J. D. Edgar (with distinction) and E. M. Hall.
- 1938.—J. E. L. Carter (Ricardo Prize—Thermo-dynamics).
- 1939.—A. J. D. Halliday (Ricardo Prize), P. M. Ronaldson and D.
Ross.

As regards athletic achievements, Sappers did remarkably well at Cambridge. The great majority represented their colleges at one game at least, while in the smaller colleges it was often the case that the three or four Sappers were in almost every college team. Quite a number became captains of college teams and there was at least one president of a college boat club. Such distinctions were difficult to attain as the captain of a game is normally a third-year man.

A large number of officers took up rowing, and many rowed in their college First Boats. A surprisingly high percentage stroked their crews. This fact was in 1937 discussed at a college High Table, and it is gratifying to record that it was considered to be due to qualities of character, such as judgement, determination, an independent outlook and powers of leadership, while no one suggested a possible mechanical regularity attained through drill!

* Later a senior lecturer at Cambridge, Ph.D. and Fellow of Christ's College.

When the Supplementary Classes first went to Cambridge, few officers obtained Blues at any of the major games, as they had only recently returned from the war and it is in any case difficult to obtain a Blue in one year. Right from the very beginning, however, there were always a few officers representing the University, and in the later Supplementary Classes this number increased, the Corps making its presence felt especially on the hockey field. Several Supplementary Class officers played Rugger for the University, but it was not until the arrival of the J.Os. that any Blues were awarded. Between the two world wars sappers represented Cambridge at many other games, notably boxing, athletics, tennis and ice hockey, but never at cricket or rowing for which they could not have afforded the necessary time.

The following Blues and half-Blues were obtained, though this list may be incomplete as the records are not of easy access:—

Rugby Football.—F. W. Simpson, J. M. Griffith, W. M. Inglis and J. R. Rawlence.

Hockey.—H. B. Harrison, O. L. Roberts, N. E. V. Patterson and J. P. Thorp.

Boxing.—T. Wright, F. M. Hill, T. Burrowes, J. J. D. Groves and N. C. G-A. Charteris.

Athletics.—E. W. Denison, D. W. Price, J. J. D. Groves and A. J. Fitzgerald.

Tennis.—H. T. S. King, C. R. D. Tuckey, D. I. Burnett and G. O. M. Jameson.

Squash.—D. I. Burnett.

Golf.—W. H. H. Aitken and P. G. Hatch.

Badminton.—W. T. Calvert, R. T. L. Rogers and R. A. P. Wehner.

Jui-jitsu.—R. P. Griffin.

Fencing.—C. H. Barnett, R. Montague Jones, T. W. Nash, A. C. Lewis and H. E. B. Frederickson.

Polo.—B. C. Davey.

Billiards.—T. H. Sweeny and T. E. Longfield.

Rifle-Shooting.—A. J. R. Wishart would have been selected, but was declared ineligible, being a professional!

Swimming.—J. M. Calvert and W. A. Vinycomb.

In addition to the above, numerous officers from the R.M.C., Kingston, represented the University at lacrosse and ice hockey, and P. J. A. Wrenford was in the University ski-ing team. R. L. Brown and R. H. Walker, many years apart, each rowed in a Jesus

1st May boat that was Head of the River, Walker being stroke of his boat. O. L. Roberts was elected a Quidnunc.

R.E. OFFICERS AND THE STAFF COLLEGE

When, as a result of our experiences in the Crimea, it was decided in 1857 to institute a Staff College and to inaugurate systematic staff training, it is evident that the character of the instruction to be given was modelled on the qualifications of Royal Engineer officers. Readers of Major Godwin-Austen's *The Staff and Staff College* will note the scientific bias of the course originally prescribed and of the tests for entrance. Strategic and tactical theory and military administration received little attention. This conception of the making of a Staff Officer was to persist for a long time. It was shaken when Henderson's writings and lectures popularized the study of the art of war, and the lessons of the South African War threw further doubts on its validity; but it was not completely abandoned till the Great War had shown us that technical work should be left to the technician and that the functions of the staff were of an entirely different character.

The original misconception was, no doubt, mainly due to ignorance, though the importance of the engineer rôle in the Crimea had its influence. It may also be claimed that, during the pre-Crimean period when higher training in the Army was at a discount, the standard of education of the Royal Engineers and their wider range of experience attracted attention and brought them into prominence. Often they acted as advisers to their commanders on matters which lay outside the scope of their technical duties, matters which to-day would be the special concern of the General Staff. This, in turn, broadened their outlook on military problems and brought them into touch with other branches of the Service, thus adding to their qualifications for command and staff employment. So much was this the case that, although in the original order of 1857 instituting the Staff College only five places were allotted to the two Ordnance Corps out of a total establishment of thirty students, a further order in 1861 laid down that R.E. officers would not be admitted to the College but would be eligible for staff employment without going through the course. This latter order was withdrawn, however, in 1870 and five out of twenty places were allotted annually to R.A. and R.E. officers.

The Staff College opened in 1858, being at first housed in the

Sandhurst building till its permanent home was ready in 1862. Among the first students was Sir Robert Grant, afterwards to become a notable Inspector-General of Fortifications and Engineers. It cannot be said that the institution was hailed with enthusiasm by the Army, partly owing to the prevailing belief in the instincts and training of the "practical" soldier and partly to the nature of the course. It did, however, attract some of the best men, who realized how much continental armies owed to systematic staff training and organization, but it also admitted some whose chief object was to escape regimental duty. Not till the South African War had opened our eyes to the defects in our army, and growing tension in Europe had made army reform a matter of urgency, did competition for entrance become keen. Haldane's institution of a General Staff and of formations with peace-time staffs that would continue to operate in war provided a stimulus which had been lacking when staffs and commanders, often owing their selection to personal influence, replaced in war those who had conducted training in peace. Synchronously with Haldane's reforms at home came Kitchener's reorganization of the Army in India, and it was due to his insistence in the face of much opposition that, in 1905, the Quetta Staff College came into being. This step not only widened the scope of staff training but did much to ensure the spread of a common doctrine throughout the armies of the Empire.

Although the Corps exercised so great an influence on staff training in its initial stages, Haldane's reforms and the institution of a General Staff tended rather to divorce the Corps from the staff than to maintain the connexion. Except for one additional place and an occasional nomination provided by Quetta, the restrictions on entrance of sappers to the Staff College were continued. Financially a staff career presented few attractions to the R.E. officer, for he sacrificed Corps pay while at the Staff College and staff appointments offered no better pay than regimental service. Moreover, there was a tendency to restrict his service on the staff to a specific class of appointment. It was commonly held that his training and experience fitted him rather for the Administrative Staff and that he should only be eligible for General Staff appointments at the War Office, on the staffs of fortresses or for specifically regimental staff appointments. The effect of this perhaps plausible theory tended to exclude the R.E. officer from General Staff appointments with the Field Army and to deprive him of opportunities of holding high commands in it. However plausible the theory, it

was shattered by the Great War which saw R.E. officers employed in large numbers in all branches of the General Staff and in command of troops. The war, in fact, established the view that while technical services should be left to technicians there was no reason why many technicians should not be eligible for a wide range of appointments. After the war this view held the field and R.E. officers on their merits held all positions on the staff and in command for which officers of other arms were eligible ; only those appointments, such as artillery and Tank Corps appointments, which were definitely of a technical nature were reserved to the arm to which they applied.

The natural result of the experiences of the war and of the more broadminded policy pursued afterwards, was to increase greatly competition in the Corps to enter the Staff College as the recognized road to higher command. Competition might have been even keener but for the fact that, owing to the restriction on the number of R.E. students, officers of the Corps realized that in practice they were competing with each other in what was nominally an examination open to the whole army. It frequently happened that officers who passed high on the list found themselves excluded and their places taken by officers of other arms. Why, if entrance to the staff was in the main to be decided by examination results, should the number of R.E. entrants be restricted? That was a much debated question, and with some amounted to a grievance.

The answer to it was twofold. In the first place it was decided from the outset that the staff should be representative of all arms of the Service. Allotment of places was accordingly made to the various arms proportionate to their numerical strength. This, as a rough and ready means of attaining the object, was probably a wise arrangement, especially when the examination tests were favourable to candidates from the scientific arms. The second reason was that officers educated to carry out technical duties should not in unlimited numbers be diverted to another purpose. Where, as in the Corps, seconding was not enforced this reason had particular weight. Those who admitted the justice of imposing some (though perhaps less rigorous) restrictions on R.E. entrance held that if all restrictions were abolished R.E. officers' proved competence as examinees would secure them entrance and lead to a large increase in the number of R.E. candidates, thus bringing about a difficult situation. In spite of such arguments, the Army Council, in their desire to secure the best brains of the Army on the staff, abolished in the years 1927-28 all restrictions on R.A. and

R.E. entrants. The result was much as many had anticipated. In 1927, out of 31 places allotted to British Service officers, 11 were secured by R.A. and 7 by R.E. officers. In 1928, out of 27 places, 8 were filled by R.A. and 7 by R.E. In the following year, as a result of the difficulties experienced by the A.A.G.(R.E.) in filling regimental appointments, restriction on R.E. entrance was again imposed and four places only were allotted, but in this year 14 out of 24 unallotted places were secured by R.A. officers.

As a consequence of these experiences a new system was devised which aimed at securing that all who gained entrance by competition should have shown in examination a proficiency above the average. Under this system a definite number of competitive places were allotted annually in Army orders to each arm in proportion to strength, but with the proviso that no officer who passed lower than 50th on the list would be eligible for a competitive vacancy. This proviso resulted in certain arms failing to fill their allotment. The vacancies unfilled in such cases were added to the nomination vacancies allotted proportionately to the various arms. This system, however, did not apply to Quetta which catered mainly for the Indian Army.

It was still a little galling for a man who, though he had passed high, found himself excluded by restrictions; but it was some satisfaction to him to know that if he had passed in the top fifty he had in all probability excluded someone of another arm, thus adding to the number of nomination vacancies and thereby slightly increasing his chance of obtaining a nomination. In any case he would not have the annoying experience of finding himself automatically replaced by someone with no qualifications except that of obtaining marks much lower than he himself had gained, as sometimes occurred under the former practice. It was worth remembering too, that position on the list was a factor carrying some weight in allotting nominations.

On the whole, after the war, the Corps had no cause to complain of insufficient representation on the staff. The importance of the engineer arm had also been recognized at the Staff Colleges by the appointment of a specialist R.E. instructor. Both Staff Colleges, for the first time, had R.E. Commandants—Major-General C. W. Gwynn at Camberley, 1926–30, and Major-General G. C. Williams at Quetta, 1934–37. Moreover, in addition to the R.E. specialist instructor, other places on the instructional staff were filled by R.E. officers.

At the War Office and in the Commands the same broad-minded policy was followed, seats on the Army Council, General Staff Directorships (including that of Director of Military Training), Division and Brigade Commands were held by officers of the Corps during the inter-war period. The appointment of sappers as infantry Brigade Majors was an indication that the same policy was likely to be continued when the supply of officers who had proved their general competence in war was exhausted. The appointment of an infantry General Staff Officer as Instructor in Tactics at the S.M.E. brought the young R.E. officer in touch with the point of view of other arms at the outset of his career, and gave him a sound grounding in tactics which stood him in good stead at the Staff College, and added to his qualifications for staff employment.

ATTACHMENT OF R.E. OFFICERS TO ENGINEERING FIRMS

As long ago as 1885, it had been realized that, owing to the growing importance of mechanical matters in war, a certain number of R.E. officers should be trained in civil engineering workshops. An officer—Lieutenant W. R. Stewart—had therefore been sent to Messrs. Armstrong's Works, and thereafter the practice had been continued more or less regularly. In 1938, for instance, both the D.F.W., Major-General D. S. Collins, and the Director of Mechanization, Major-General A. E. Davidson, were among those who had attended such courses as subalterns. Some officers were attached to civil railway companies, usually in the workshops, before being posted to R.E. railway units, and later in their service many of these held very important posts in civil railways in various parts of the world.

This practice was continued during the inter-war period and in the case of railway officers it had the effect of building up a reserve of trained officers for posts in the Transportation Directorate and in the Movements Branch of the Staff. It was, however, extended by arranging for certain senior subalterns and junior captains to work for a time as actual employees of consulting engineers or large contractors on important engineering works. Many firms gave every facility to the officers sent to them to acquire knowledge and experience, and the fact that they applied for additional officers is evidence that they obtained full value from their services. A

few typical cases of these attachments will illustrate the value of the experience acquired.

In 1933, Lieutenant W. S. Francis joined Messrs. Gibson & Pauling for work on the construction of the Gebel Aulia dam, thirty miles south of Khartoum.* The length of this dam was to be about three miles of which about one-third was to be of masonry containing a large lock and sixty large sluices. The greatest height was to be about sixty-five feet, the dam impounding water for about 200 miles up stream. The work was to include a railway from Khartoum, a power-station, powerful pumping plant and accommodation buildings. Francis arrived to find the only assistant engineer had been invalided home and the Chief Engineer accordingly placed him in charge of the dam itself, subsidiary works being in the hands of Syrian and other engineers. The first task was to set out the work *ab initio*. Other engineers then began to arrive but Francis still remained in charge of the ever-growing excavation. During the three years that he spent on this project he was for considerable periods in charge of the masonry work and, in association with the steelwork engineers, was later in charge of the construction of the lock and sluices.

In 1934, Captains W. H. Waring and A. G. H. Brousson were employed by Messrs. Dorman Long on the building of the Storstrom bridge in Denmark. It was to carry a road and railway for about two miles between two islands on fifty steel spans. There was to be 80 ft. clear above water in the navigation channel and extensive embankments at both ends. Waring and Brousson after two months at the works spent a further two months as assistants to the engineers on the site.

In 1934, Captain S. K. Seagrim was associated with Messrs. Dodd & Watson in the £6 million scheme to dispose of sewage in west Middlesex at a maximum rate of 4 million gallons a day. The scheme included 360 acres of tankage and over sixty miles of 13 ft. diameter sewers including much tunnelling. Seagrim was on this work for four months during which he was assistant to several of the resident engineers and spent some time at the head office and in the estimating branch.

In 1935, Lieutenant H. P. Drayson was employed by Sir Alexander Gibb & Partners as an assistant engineer on the Galloway Water hydro-electric scheme, which was to feed about 100,000 kilowatts

* See his article in *The R.E. Journal*, 1935.

into the grid of south-west Scotland. The works included reinforced concrete power stations, mass concrete dams and the installation of the plant. Drayson supervised the construction of a power station, a large aqueduct and a 13-ft. diameter steel pipe-line with a very large surge-tower. He was employed for nine months. He had previously spent four months with Messrs. Holloway Brothers on the demolition of Chelsea Bridge, where he assisted with the construction of much temporary work including coffer dams.

Some of the other officers employed in this way during the inter-war period were : Captain S. A. Stewart with Sir Alexander Gibb & Partners on the Kincardine-on-Forth bridge ; Captain E. Waring with Messrs. Mark & Hallcrow on the Lochaber waterworks scheme ; Captain J. H. D. Bennett with Sir Alexander Gibb & Partners on the Galloway power scheme ; and Captain L. O. W. Wooldridge with Messrs. John Mowlem on the new graving dock at Southampton.

CHAPTER XVII

THE ROYAL ENGINEER BOARD

Constitution of the R.E. Board—Bridging—Demolitions and mines—
Mechanical equipment—Water supply equipment—Camouflage—
Searchlights—Acoustics and sound locators—Signals and radar.

CONSTITUTION OF THE R.E. BOARD

As indicated in Volume IV of this History, the R.E. Committee was not revived after the war, but, on the representation of the D.F.W., Major-General Sir William Liddell, it was replaced at the end of 1919 by a more executive body known as the Royal Engineer Board. In the short interim period, a Central Engineering Board had dealt with current matters. The R.E. Board consisted of a president, senior members each with assistants, a permanent secretary, and a small clerical staff; the president, members and their assistants were posted as normal service appointments, while a selected retired officer filled the post of secretary.* The responsibilities of the Board were wider than those of its predecessor and this made it essential for the work to be allotted to three separate committees, whose responsibilities were broadly: "A" Committee, field engineer equipment; "B" Committee, air defence; and "C" Committee, signals matters. Each of these committees was controlled by one of the three senior members, but their meetings were attended by the complete board. Later, "D" and "E" Committees were formed to deal with radar and camouflage. Each of the main committees was served by its own experimental establishment with appropriate scientific and technical staff and facilities for design and development up to the stage of the production of prototypes. The birth of the R.E. Board practically coincided with the formation of the Royal Corps of Signals but this did not affect the organization and it was not until the early 1930s that the Board's title was changed to Royal Engineer and Signals Board.

The general policy of the Board was a matter for the Director

* In 1929 replaced by that of Vice-President and filled by a serving officer.

of Staff Duties, but the technical aspects concerned the D.F.W., the Commandant S.M.E., the Director of Artillery and others for matters affecting their responsibilities. A major reorganization of the War Office in 1927 brought the control of the Board into the hands of the Master General of Ordnance and his technical weapons directorate under the Director of Artillery, who was also responsible for its administration. By 1933 the Director of Mechanization (Major-General A. Brough, late R.E., later succeeded by Major-General A. E. Davidson, also late R.E.) had taken over the direction and administration of the Board. In 1939, it came under the Ministry of Supply with the transfer of the M.G.Os. department to that new Ministry. This eventually led to the replacement of military control by civilian scientific control, and with it came the break up of the Board into its separate components, but the engineer equipment side retained much of its military character and was thus perhaps the true successor of the Royal Engineer Board.

The R.E. and ex-R.E. officers who served on the Board were :—

President.—Colonels A. G. Stevenson, 1920, H. G. K. Wait, 1923, G. R. Pridham, 1927, R. Oakes, 1929, G. F. B. Goldney, 1931, F. J. C. Wyatt, 1935, and Colonel (later Brigadier) A. P. Sayer, 1937–40.

Permanent Secretary.—Major E. O. Henrici, 1919 and Lieut.-Colonel J. G. Fleming, 1920–9.

Vice-President.—Lieut.-Colonels A. P. Sayer, 1929, R. S. Rait-Kerr, 1933 and F. E. Fowle, 1936–40.

" A " Committee.—Colonels H. C. K. Wait, R. A. Gillam, Lieut.-Colonel C. R. Johnson, Colonels G. H. Addison, O. G. Brandon and F. E. Fowle.

" B " Committee.—Lieut.-Colonels F. W. Robertson, 1919, A. E. Davidson, 1920, Major A. D. Carden, 1921, Lieut.-Colonel F. W. Robertson, 1922, Majors A. B. Ogle, 1925, A. D. Carden, 1926, Colonels H. L. Bingay, 1929, F. J. C. Wyatt, 1933, C. E. Colbeck, 1935 and H. N. Fordham, 1938.

" C " Committee.—Colonels A. C. Fuller, J. P. G. Worledge and R. Elsdale.

" D " Committee.—Colonel C. E. Colbeck, 1937.

" E " Committee.—Colonel F. J. C. Wyatt, 1939.

" A " Committee dealt with bridging, demolitions and engineer field unit equipment, thus covering the majority of the technical needs of the Corps. It was not, however, directly concerned with

permanent construction or railway work, but, unlike its predecessor—the R.E. Committee—it did deal with semi-permanent bridges in addition to mobile equipment. In the development of mechanical equipment it shared responsibility with "B" Committee. It was served by the Experimental Bridging Company, R.E., under Major G. le Q. Martel who continued in charge for a time after the unit had been converted to a civilian establishment called the Experimental Bridging Establishment (E.B.E.) at Christchurch. The other R.E. officers who held the appointment of Military Superintendent, E.B.E. were: Major A. V. T. Wakely, Captain R. D. Davies, Majors J. H. B. Doyle, S. G. Galpin and S. A. Stewart. The period between the two wars was one of continuous but not always progressive change in engineer requirements, involving much new development. This of course reflected changes in the Army, its transport, speed of movement, composition, weapons, tactical doctrine and the nature of contemplated operations. Increased bridge-loadings demanded the development of special design technique, the employment of new materials and new methods of construction using mechanical aids. Changes in civil bridge construction, especially the use of reinforced concrete, produced serious demolition problems. Undoubtedly this period was one of great interest and saw a most definite advance in the quality, quantity and variety of engineer field equipment.

"B" Committee dealt with anti-aircraft and coast-defence searchlights; sound location and sound ranging; E. & M. equipment and water supply. It was served by the Air Defence Experimental Establishment (A.D.E.E.) at Biggin Hill, which replaced in 1922-3 the Searchlight Experimental Establishment of the London Electrical Engineers at Teddington. The acoustics section, under Dr. W. S. Tucker, joined from the S.E.E. Woolwich in 1925. The R.E. officers who had the appointment of Superintendent, A.D.E.E. were—Majors C. Sylvester Evans, T. A., F. J. C. Wyatt, J. D. Inglis, B. B. Edwards, R. G. Lamb, W. H. G. Costello and finally, in 1936, Evans again as Military Commandant (Colonel).

"C" Committee dealt with signals matters and replaced the Signals Service Committee which had been formed in 1917. It was served by the Signals Experimental Establishment (S.E.E.) on Woolwich Common, later moved to Christchurch and named the Signals Research and Development Establishment (S.R.D.E.). The R.E. and ex-R.E. officers who had charge of the S.E.E. were—Lieut.-Colonels L. F. Blandy, A. G. T. Cusins, K. E. Edgeworth and

Majors C. J. Aston, J. S. Yule, D. C. Carter and D. Arcedeckne-Butler. The achievements of "C" Committee in wireless telegraphy, radio-telephony and radar produced revolutionary results in World War II, but not being the direct concern of the Royal Engineers must only be dealt with briefly.

"D" Committee was formed in 1937 to take over work on army radar from "C" Committee. It was served by a group of scientists and technicians under Dr. E. T. Paris, attached to the Air Ministry establishment at Bawdsey.

"E" Committee was formed in 1939 to take over work on camouflage from "A" Committee.

BRIDGING

The limited mobile bridging equipment of the army had always been supplemented by improvised expedients, which even before 1914 had begun to undergo changes to meet increasing loads. Sticks and string were being replaced by nailed, dogged or bolted timber-work and steel joists were being used in increasing numbers. The war had seen considerable advances in semi-permanent girder construction, the use of piles, etc., but none of these methods were suited to mobile operations, such as were now being contemplated. The requirements of the General Staff during the inter-war period were for rapidly placed bridging to carry the whole gamut of military loads from single men to the heaviest armoured vehicles, including semi-permanent bridges to replace field equipment. A bridge classification was agreed upon, based on a medium class of bridge to carry the divisional transport, and a light class for a brigade group, with a heavy class for corps and army loads including tanks. The medium class rose gradually from a maximum axle-load of $5\frac{1}{2}$ tons in 1924 to one of 9 tons in 1930, and the heavy class from a vehicle of 18 tons in 1924 to 26 tons in 1938. The E.B.E. carried out detailed tests of the load effect of all types of army and R.A.F. vehicles, and eventually of civil vehicles destined for requisition. A scheme for marking their load classification on vehicles was evolved, the classes at the end of 1938 being 3, 5, 9, 12 and 18-ton axles or their equivalents for tracked vehicles, with a maximum vehicle weight of 26 tons.

Pontoon Equipment.—The first major development undertaken by the Board started at the end of 1920 and aimed at the replacement of the outdated bi-partite pontoon equipment by a new type

capable of dealing with all divisional loads including lorries. All-steel construction was at first proposed as providing for rapid production in emergency and reduced maintenance of peace-held stocks, but a type of sewn plywood called Consuta was eventually adopted as it gave a saving in weight of 500 lb. and stood up to all tests. A scow-shaped bow was developed as a result of towing trials with models and also at full scale. The length of the decked-in pontoons was just over twenty-one feet, and by 1924 they had passed all tests. The rest of the stores to complete the equipment included nickel-chrome steel roadbearers, mild steel saddles and trestles and 9 by 3-in. Oregon pine decking. In 1928 an improved trestle was designed, using box-section legs and transom of high tensile steel, and capable of carrying all loads including super-heavy. Various modifications were introduced before 1939, including means of restricting articulation under the heaviest loads so as to spread the effect over adjoining piers, and long landing-bays to reduce the use of trestles. The equipment catered for all medium, heavy and super-heavy classes by varying the grouping of the pontoons and roadbearers. Although available with the Field Force in 1939, it was never used operationally, but many of its features were incorporated in the Bailey pontoon bridge that played so large a part in World War II.

Folding Boat Equipment.—In 1928 to meet the need for a 5-ton light pontoon equipment a new type of folding boat was developed. The first system provided for a two-boat end-loading tracked raft of 3-tons capacity, or two-boat decked rafts of $4\frac{1}{2}$ tons capacity, gunnel loaded and capable of being formed into a bridge. Subsequent designs with restricted articulation eventually produced the standard 9-ton capacity divisional floating bridge equipment which was used throughout the 1939 war including the crossing of the Rhine.

Infantry Assault Bridge Equipment.—Starting in 1920, tests were conducted with very many materials for floating assault bridges, and by 1923 canvas floats filled with kapok had proved their efficiency. They could in emergency be connected up to form a bridge for pack transport, and were to be held in engineer parks for issue when required.

The Large Box Girder.—One lesson taught by the 1914-18 war was the need for rapidly erected girder bridges to deal with gaps for which floating equipment was unsuited. Several types of heavy semi-permanent girder bridges had, of course, been employed in that war, but their design had been primarily based on civil practice,

though perhaps the Inglis bridge had envisaged to some extent the needs of military conditions. The first proposal for a military girder bridge was submitted to the Board in 1920 by Major Martel who produced a design for a novel type of "deck" bridge adaptable to varying spans and loadings, the chesses being carried directly by two, three or four self-stable girders, 4 ft. by 2 ft. 6 in. in section. The girders were made of "boxes," 8 ft. long, connected by steel pins passing through male and female lugs. Hornbeam end-sections reduced the need for ramping the approaches. The 4-ft. depth of the girder was exceptionally small and though uneconomical for ordinary purposes had the outweighing advantages of adaptability, rapid erection and simplicity. Moreover, the elimination of cross girders gave a total weight far less than that of existing types of "through" bridge. The bridge was adopted in 1925, and called the Large Box Girder, though the name Martel Girder remained in general use. In 1931, tenders were called from a number of leading firms for the redesign of the bridge to a new general specification, but no design submitted could approach that of the E.B.E. which included the use of high-tensile steel and welding in place of riveted joints. The bridge was adopted in 1938 and the final type could carry class 24 loads over 130-ft. spans.

The Small Box Girder.—In 1927, designs were commenced for a 60-ft. light girder bridge to carry medium (9-ton) loads. It was finally of the Martel type, with two welded high-tensile steel girders each made of four box-sections, the end ones being tapered to form horn-beams. The sections were joined by "link-pin" or "dog" connectors of special steel. Erection, using a long launching nose, was extremely rapid. Using four girders the bridge would carry heavy loads. This was the first use of welding for high-carbon steel girder work, and involved much research into the design of the joints and welding technique—research which made possible the Bailey bridge at a later date. In 1936 the bridge was redesigned to carry 12 tons, and was used for special assault purposes (e.g., launched from an A.V.R.E.) in World War II.

Semi-Permanent Bridges.—The type eventually adopted was the Hamilton, which was simple and adaptable; it had only nine different mild steel members and the bolts were limited to 1 and 1½ in. diameter. The girders were of the Warren type providing a "through" bridge, and the members could be doubled, trebled or quadrupled for increasing load capacity. In single truss form it could carry heavy loads over 70-ft. spans and when doubled over

140 ft ; 200-ft. spans could be dealt with by further additions to the trusses. The bridge was also adopted by the Ministry of Transport to provide replacement of bomb-damaged civil bridges and by the Crown Agents for the Colonies. The Everall bridge, built from components that broke down into camel loads, was adopted for India.

Miscellaneous Bridging Devices.—Many experiments were carried out with different rapid methods of providing crossings for tanks and armoured cars. Major Martel produced a scheme for pushing forward a 70-ft. Inglis bridge on idle tracks by means of a tank, and various systems were proposed by which a tank could both carry and launch under fire a short-span bridge. Attempts to float the tank itself were not successful except for light tanks, and proposals for driving submerged on the river bed, or above water on timber structures called "stepping stones," were also found to be impracticable. Experiments were revived in 1937 and produced the "Scissors" bridge—a 30-ft. track span for 14-ton tanks. It was carried folded on the roof and could be launched without exposure. For armoured cars some nice design work resulted in several simple types of track spans, capable of being handled and placed by their crews across gaps of up to twenty-seven feet. Each track consisted of two easily-joined sections of pressed steel troughing, designed to centre the wheels of the car or lorry if the steering were left free.

The design and selection of the many accessories required for bridging operations involved much careful research. Light folding dinghies and assault boats were developed for river reconnaissance and initial crossings ; motor-boats and out-board motors were adapted for raft handling, anchor laying and other purposes ; while for girder bridges, heavy jacks, launching gear, anchorages, bank-seats, piers, etc., all involved careful design and experiment. Perhaps the most simple and useful of these accessories were the skeleton steel bridging cubes, which had originated in India. They could be bolted together to form bank-seats, footings or piers of considerable height and were specially useful for repairs to damaged bridges. In their final form they were 2 ft. square and 6 ft. long with a safe strength of 20 tons.

DEMOLITIONS AND MINES

War experience had indicated the probable future use of demolitions on a very large scale, and much experiment was therefore

carried out with all types of commercially-produced explosives and accessories. In 1931, a new type was evolved, known as Plastic H.E., easily produced, very stable and easily handled in its plastic form. It had been designed for bore-hole work but was found to be superior to gun-cotton for cutting charges, and in bore-holes would cut reinforcing bars and concrete in one operation. Difficulties in boring holes in reinforced concrete led to the initiation of trials with shaped charges which produced such effective results in World War II. As the result of extended trials, the Mackie pattern exploder weighing 10½ lb. was adopted in 1936 as the service pattern.

From 1919 onwards anti-tank mines were continuously under investigation. The E.B.E. eventually developed a mine which would operate under pressure on any part of the cover and meet other requirements. It was adopted in 1934. Soon afterwards anti-tank mines became the concern of the Ordnance Committee. The problem of location of mines was hardly touched until troubles in Palestine in 1932 called for some means of detecting charges buried in roads. The S.E.E. improvised a form of induction device, carried on the end of a light pole projecting from the front of the vehicle, to indicate the presence of iron or steel in the road—the forerunner of subsequent mine detectors.

In 1937 an Experimental Demolition Establishment was formed at Bovington where a trial-ground was available for full-scale experiments.

MECHANICAL EQUIPMENT

Trials of heavy trench diggers were continued in 1919 but were closed down in 1923, without finding a suitable type. In the early 1930s with a view to starting recognition of the value of earth shifting by mechanical plant, the Board provided some standard ¾-yd. excavators also equipped for drag-line and crane work, but little more resulted until after war was declared. A R.E. tank was under experiment in 1919 but it was not acceptable to the General Staff, and the idea was not revived until the war produced the armoured assault vehicles, R.E. The 1919 prototype R.E. tank was, however, retained and driven at the E.B.E. throughout the inter-war period and was the last survivor of the 1914-18 tanks. It was not only a load carrier but provided a unique heavy mobile test load, often for this purpose carrying on its top several lighter brethren. A mole drainer, drawn by tank or tractor, was pursued for

many years in conjunction with signals cable layers but it was eventually abandoned in 1935.

Compressors mounted on two-wheeled trailers were introduced as the result of field trials in 1933, but with the advent of the light truck in field units, the compressor was mounted in a truck which carried all its tools, etc., so that it could operate independently with ample cross-country performance. Its primary duties were bore-hole work, road breaking, etc., but other appliances were added in the form of pneumatic saws, pumps, etc., and the compressor became the general power unit for field companies.

Many electric generating sets were developed for field use, including a field park company 5-kilowatt lighting set for divisional headquarters, a $7\frac{1}{2}$ -kilowatt set for workshop lorries and a 24-kilowatt set for anti-aircraft searchlights.

From 1921, efforts were made to find a commercial pattern of power pile-driver suited to army needs. The McKiernan-Terry steam and air driven types were tested and included in the R.E. War Vocabulary of Stores. In 1930 a new type of self-contained internal combustion pile-driver was tested; a 440-lb. model being found satisfactory for forward field work and a specially produced $\frac{1}{2}$ -ton model for railway work.

Power tools were tested and selected for field park, army troops and E. & M. companies, who all required electrically driven lathes, grinders, drills, circular saws, etc., and electric and oxy-acetylene welding gear. For the E. & M. and A.T. companies, workshop lorries provided the generating plant and transported the machines which, by means of a lorry gantry crane, were lowered for operation around the lorry under side covers. The development of suitable plant, restricted in size and weight by the lorry limits, was not an easy matter. Mobile derrick lorries were under trial for several years and eventually a derrick lorry with a 2-ton crane and hauling gear was adopted for field park companies.

WATER SUPPLY EQUIPMENT

In 1934, after many trials, a satisfactory mobile boring rig was accepted, which could drill to 600 ft., from 13 in. to 6 in. diameter. Submersible electrically driven pumps were developed for deep well bores. For shallow wells (down to 100 feet and rarely 200 feet) various power pumping sets were adopted for field unit

equipment. These included electric drive, petrol engine with direct drive and air-lifts worked from field unit compressors.

In 1933, the development of flexible shafting eased many pumping problems, and with it the need for water elevators for field units disappeared. Two sizes of this drive were adopted—13mm. and 17.5 mm. They were armoured and braided with phosphor-bronze in lengths of 15ft., with special couplers. The large size could transmit power 100 ft. down a well, so as to lift 1,600 gallons an hour against a total head of 200 ft.

Numbers of pumping sets were developed for both field-unit and rear-area use. The final field-unit pattern consisted of an eight-horse-power two-cylinder air-cooled engine connected by flexible drive to light single-stage centrifugal pumps that could be coupled either in series or parallel according to the head required. A small set, consisting of a Villiers engine direct coupled to a 2-in. Homelite pump was also provided for field units.

As the result of careful trials, Victaulic joints were adopted as standard for forward pipe-lines.

A mobile water purification set was introduced in 1938, having been developed in co-operation with the R.A.M.C. College.

One other item of water supply equipment must be mentioned which was effective yet simple; this was the self-supporting canvas water tank developed from the "Sportapool."

CAMOUFLAGE

By 1921, all work on camouflage had been put in abeyance, but it was revived in 1937, and in 1939 came under the control of a new "E" Committee, under Colonel Wyatt. Though field camouflage had been the main concern, increasing attention had been paid to large static schemes for vital defences and establishments. An important development was the use of steel wool which gave effective concealment at both long and short ranges, and was much used by both the army and R.A.F.

SEARCHLIGHTS

Developments during the war and up to 1920 had produced a standard type of 120-cm. searchlight projector with a paraboloid reflector and a special lamp designed for higher (later classed as medium) current density with forced ventilation and reduced

obscuration by the negative carbon. For the control of the projector a "long arm" had been designed by which one man could both traverse and elevate the beam on directions given verbally by observers at some little distance away. To supplement visual observation, acoustic aid had been provided in the form of an early pattern of sound locator using pairs of trumpets spaced at 18 in. for bearing and for elevation. In skilled hands this combination could point to the general direction of a target and follow it when once found but the initial pick-up of the target continued to present the greatest difficulty until radar eventually solved the problem. A General Staff directive in 1921 required an instrument "that would enable a searchlight to illuminate an audible but unseen target without search" and later in 1933 that the "equipment should be based on the assumption that its proper functioning should be independent of the skill of the operator"—an ideal that even in the later days of radar was hardly achieved. These two requirements—accurate location and co-ordinated remote control—were priority investigations for the A.D.E.E. in the inter-war years.

By 1924, the 90-cm. mobile projector for field units had been produced, and improvements were added up to a year or two before the second world war. High current-density working became the standard practice for anti-aircraft work and was also applied to coast defence searchlights; research was continuous on carbons, and reflectors of both glass and metal. A rhodium plated metallic mirror was introduced as service equipment shortly before the 1939 war, but some glass reflectors still remained in use. The 120-cm. projector remained in service, but consideration of a new pattern of 150 cm. was started in 1925. Development was slow owing to financial stringency but after a long series of trials supply was started just before the war. In later years, with the subsequent advent of accurate radar control, this projector with its clean narrow beam and good cloud penetration, produced a very effective equipment.

ACOUSTICS AND SOUND LOCATORS

Sound locators were developed considerably during this period, research on acoustics leading to improved practical design. A major advance was made by the development of locators with paraboloid sound collectors, specially designed to accept the sound of aircraft and to reduce the effect of extraneous local noise. They also enabled direct remote control of the projector to be effected

by the movement of the locator. Given well-trained listeners, the equipment was capable of very fine results with its automatic course-finding sight and accurate following. Certainly no other nation produced a locator of such high potential performance, but, with the increasing speed of aircraft, acoustic methods suffered an ever-increasing handicap due to the lag of sound.

Until radar became effective, attempts were made to overcome the initial pick-up difficulties by a variety of other methods—spread, split or rotating beams, mosaic reflectors, “Wobblers,” etc. All were investigated but, depending as they all did upon visibility, they could be considered no more than expedients until the problem of accurate location had been solved.

The co-ordinated movement of the projector in continuous agreement with that of the locating device, was also the subject for intensive investigation; direct linkage became possible with the later sound locators, but could not be applied to the portable types. The A.D.E.E. developed an automatic remote control of an impulse type, with step-by-step co-ordination, which in trials proved more suitable than the naval type, using a variable speed hydraulic gear with mag-slip co-ordination. This control was in use when the war started but a type more suited to the higher aircraft speeds had by then been developed to replace it.

With the growing menace of air attack one of the major problems of the defence of this country was to provide the means of distant detection and early warning of the approach of aircraft. Some elementary work had been done on distant detection by sound and the pursuit of this method was allocated to the R.E. Board as a priority investigation on behalf of the three services. It involved basic research in the long distant travel of sound under different conditions, and the close analysis of the composite sound produced by aircraft. The physical laboratories of many of the Universities helped in this work by listening in to the test firings of 16-in. guns in the Isle of Grain. From the results much information was obtained on the reflection of sound by the upper atmosphere and the skip distances of little or no audibility.

A system of acoustical appliances was planned along our most threatened coast-line. This aimed at initial detection by concrete sound mirrors—sections of a sphere 200 ft. long and 30 ft. high, and accurate tracking of the approach by bowl shaped mirrors, 30 ft. in diameter.

Gun sound ranging had been used during the war when static

conditions had permitted the employment of long bases for the microphones and extensive communications to the recording stations. When research on this subject was transferred to the R.E. Board in 1930, a number of scientists who had assisted in its tactical development joined the A.D.E.E. staff and the Gun Sound Ranging Research Section then under R.A. control was also transferred. Work was materially assisted by the general research on acoustics, which helped to produce Dr. Tucker's hot-wire microphone, tuned to the characteristics of the sound emitted by gun fire. Methods were developed for more rapid installation under mobile conditions, demanding shorter bases, more rapid recording and a radio link to replace cables. The use of sound ranging in mountainous country was investigated at extended trials in North Wales.

An acoustic proximity fuse was produced for the Air Ministry. It was successfully demonstrated and approved, but was not used in the war.

SIGNALS AND RADAR

With the formation of the Royal Corps of Signals in 1920 the development of communications equipment ceased to be the direct concern of the Royal Engineers, but as it comprised nearly one-third of the activities of the R.E. Board, some mention must be made of its achievements. Work began in 1921 on a planned series of wireless sets, varying in power from one for working from brigade to battalion up to a high-powered set for linking London to G.H.Q. overseas. In 1927-8 the needs of mechanized formations were dealt with. In 1929 work on a new series of sets was started. These had higher performance and used R/T as well as W/T with crystal frequency control. This series, with later additions, equipped our armies in 1939. Other signals work included research in the grinding of crystals, direction finding, interception, high-speed and chemical recording, security transmission and cyphers and finally the early stages of army radar.

Range and direction finding by the use of high frequency radio waves was initiated in 1935 under the Air Ministry, but this highly secret work was brought to the notice of the R.E. Board through the contacts of its signals member, Colonel Worlledge (late R.C.S. and R.E.). The Director of Mechanization, General Brough, was immediately informed of its possibilities for use with anti-aircraft guns and searchlights. As a result Dr. E. F. Paris of the A.D.E.E. with some assistants was attached early in 1936 to the Air Ministry

establishment at Bawdsey. Their work was controlled by Colonel C. E. Colbeck, late R.E., who in 1937 took charge of a separate "D" Committee of the R.E. Board dealing exclusively with radar, as it was eventually called. Development proceeded apace and before war was declared the first sets for use by anti-aircraft artillery had been issued, and a better set was in production. Another experimental set showed good performance in locating and tracking both shipping and low flying aircraft especially mine layers, and could be developed for use by coastal artillery. The great potentialities of radar for army uses had in fact been clearly demonstrated and the foundations laid for subsequent developments.

CHAPTER XVIII

FORTIFICATIONS AND WORKS, 1919-39

Housing the post-war army—Improvements in barracks—The naval base at Singapore—Works Services for the R.A.F.—Reconstruction after the Quetta earthquake.

HOUSING THE POST-WAR ARMY

GOVERNMENT policy regarding the size, organization and location of the army necessarily remained indeterminate for some years after the Armistice. There were high hopes that the millennium was arriving, and that the League of Nations would enable us to reduce our forces to vanishing point; that point was nearly reached, but not the millennium. There was a violent reaction from the lavish outpouring of money on the army, and every penny was now grudged for a force whose future existence was in doubt. There was therefore great delay in obtaining rulings on policy, except the statements that there was little money and that there would be no big war for years, a policy which was not reversed till 1934.

The army that returned from the war was very different in organization from the army that left its barracks in 1914. Two new Corps, the Royal Signals and the Royal Tank Corps, had emerged and were to continue. Although the Machine-Gun Corps, created in the war, ceased to exist as a separate organization, the numbers and importance of M.G. detachments would be permanently increased and a special school to develop their training and doctrine was required. For this purpose sacrilegious hands were laid on the Cavalry School at Netheravon, which the R.E. were required to convert to this very different purpose, while the cavalry were told to squeeze their school into the Equitation School at Weedon, a hunting paradise hitherto exclusively reserved for the Gunners, and one R.E. officer who, on his return from hunting, attended to their barrack accommodation. Gunners and cavalry at Weedon now concentrated on the sapper to demand more accommodation. The treaty with the Irish Free State caused us to abandon barracks

that had housed a whole division which now sought a home elsewhere. There were of course many lesser changes all requiring a revision of accommodation. Last but not least, more money than could be spared was required to make good arrears of maintenance.

During the war numerous hutted camps had been constructed all over the country, and the public demanded to know at once whether the Government intended to retain and purchase the sites; and, if not, how soon they would be reinstated completely to their pre-war condition. In the absence of a clear-cut government policy about army matters, the fate of several hutted camps remained in doubt, but for the large majority orders were given to the R.E. to complete reinstatement with the least possible delay.

The war had killed off large numbers of skilled building artisans, and the apprentice system for training up the next generation had been in abeyance. The fortunate survivors were able to demand high wages, but were far too few to compete with the housing demands of the whole population. The manufacture of building materials, other than those required for war purposes, had almost ceased. Under these circumstances, it is not surprising that building costs for four or five years after the war were exactly three times the pre-war rates. Consequently, the sums doled out to the army for building and repairs would only produce one third of the amount of work that we were accustomed to expect. From about 1924, building costs slowly dropped till they reached a satisfactory level in 1935, but then tended to rise again. The situation at home, created by the foregoing difficulties, would have been quite impossible had the whole regular army returned to barracks immediately. Fortunately, it was very busy abroad for some years and came back piecemeal.

The absence of definite rulings on permanent policy, the shortage and high cost of building labour and materials and the unwillingness of the Government to provide money, made it necessary to adopt many building expedients that we should have preferred to avoid. Great use was made of existing war huts, improved to make them more habitable. Every war leaves the army a legacy of huts. Huts dating from the South African, and even a few from the Peninsular and Crimean wars, were still doing duty. Some concrete huts of various types had been erected in the Great War, but of these, many, notably at Catterick, were of exceedingly light construction. The meagre supply of bricks was used to surround them with a wall $4\frac{1}{2}$ in. thick, leaving an air-space between the old and new walls.

This and other improvements gave them a life of another ten to fifteen years.

In 1924, the Government at last agreed to the establishment of a permanent cantonment at Catterick to replace a portion of the accommodation abandoned in Ireland. Provision of funds, however, was limited to £1,150,000, so the scheme had to be drastically cut and building expedients adopted to provide the accommodation which was by then becoming exceedingly urgent. Catterick was built to house most of the 5th Division and the new Royal Corps of Signals Depot and Training Centre. The Signals units at Aldershot were given new barracks on the site known as Smallshot; accommodation was also provided for them on Salisbury Plain and at Colchester. The Tank Corps was housed in a war hutted camp at Bovington, much improved by adaptation and considerable additions.

In 1926, it was realized that it was essential to provide for the eventual collapse of the reconditioned huts. Although Army Estimates were still being cut down, it was decided that a quarter of a million pounds must be provided annually to replace huts of the Peninsular, Crimean, South African, and Great War architectural periods by permanent buildings of really satisfactory modern type. With building prices now falling it was calculated that thirty years would probably complete the programme!

From 1927 onwards, mechanization of the army increased rapidly. While this was in the experimental stage, garages were provided in temporary structures or by conversion of stables, but the fluctuating establishments of experimental units made it difficult to ascertain the scales of accommodation required. Large central mechanical workshops were required by the R.A.O.C. and provided at Aldershot, Tidworth, Catterick and Colchester. A big war-time munition factory at Chilwell, near Nottingham, had fortunately escaped disposal and was adapted and enlarged to serve as a central R.A.O.C. depot. An aerodrome at Feltham was converted for use as a mobilization depot and workshops for the motor transport of the R.A.S.C. In 1931 and 1932, the financial crisis caused a slowing down in improvements to barracks.

In 1933, it was realized that our defended naval bases throughout the world could no longer remain in the denuded condition to which they had been reduced by the policy of "no big war for ten years." In 1935, there was a possibility that that period might be reduced to ten minutes. Increased accommodation and defences overseas

became a very urgent matter, throwing a considerable strain on the works service. The work done at Singapore is described later in this chapter.

IMPROVEMENTS IN BARRACKS

In spite of the financial and building difficulties of post-war years, the Army Council determined to effect considerable improvements in the scale of accommodation and amenities in barracks. The first demand was for the abolition of the age-old custom of the men feeding in their barrack-rooms, the food being carried for some distance across the open from a cook-house, and placed congealed before the soldier. Separate dining-huts attached to existing cook-houses were at first provided. These were quickly followed by permanent dining-establishments specially designed and built complete with modern cooking installations, hot plates and wash-up rooms with mechanical washers. The next great improvement was the replacement of gas by electric light. If the scale of lighting was somewhat below the desired standard, it was an enormous advance on what had gone before. One of the greatest improvements affecting the comfort of the soldier was the inclusion within the barrack block, or in an annexe, of washbasins and W.Cs., previously at a distance.

The provision of playing fields for troops had formerly been a matter for regimental initiative and funds. It was wonderful how much had been provided under this system, but in 1921, the War Office definitely assumed responsibility for providing recreation grounds as part of their works programme, and a suitable scale of provision was laid down.

Regimental institutes and N.C.Os' messes were much improved and enlarged. Hot and cold shower baths and slipper baths were provided for the men. Great improvements were carried out in the married quarters of other ranks. Quarters which contained only one bedroom almost ceased to be built, and the normal type now had two bedrooms, but was so designed that the number could be changed to one or three as required. Sanitary annexes were included in all married quarters so that the dreadful system of a communal W.C. at some distance disappeared. Baths and hot water supply were also provided. Large numbers of the new quarters were built at all stations.

Accommodation for married officers was put on an entirely new footing. Before the war only the commanding officer and the quartermaster were given married quarters in barracks; all other

married officers had to make what arrangements they could, often at great expense. The national shortage of housing after the war frequently made it impossible for an officer's family to join him, so in 1922 the War Office decided to play their part in reducing both the national housing shortage and the inconvenience to officers, by providing married quarters in or near barracks for roughly one third of the establishment of officers. The high cost of building caused the accommodation provided in the quarters to be somewhat limited, but it was a great improvement on none at all.

The urge to carry out this large programme at speed, and during a time of great shortage of money and materials, had caused the question of the most suitable and agreeable form of architectural design to receive but scant consideration; but in 1929, when administration was becoming more normal and Major H. E. Moore took over the design branch at the War Office, careful attention began to be paid to the appearance of new buildings, and happy results were soon very noticeable. It was found that a simple Georgian treatment was generally appropriate, correct proportions and a proper choice of materials being relied upon to give the desired architectural effect. The reprinting in 1933 of the *Handbook of Design and Construction* and the compilation of a series of attractive standard designs enabled real progress to be made in stimulating a desire for architectural quality in army buildings. Less frequent became the combination of red brick, blue slates and red ridge tiles, which at one time threatened to become the hallmark of barrack construction. Asbestos cement slates were forbidden on permanent buildings, and sandfaced tiles surmounting multi-coloured brickwork became the order of the day, while encouragement was given to the improvement of existing structures by the planting of non-injurious creepers.

Meantime steady pressure was being maintained by the Synopsis Committee at the War Office to bring living conditions of all ranks into line with contemporary civilian standards.* The economy campaign of 1931-33 caused a temporary set-back in all proposals for such improvements, but by 1934 it began to be realized that, unless these were again taken in hand, recruiting would be adversely affected. In 1936 came the Sandhurst Block in which a central dining-room was incorporated in the same building as the living quarters, baths were included in the sanitary annexes, and other

* See articles by Mr. A. Lloyd Spencer, A.R.I.B.A., in *The R.E. Journal* of December, 1937, *et seq.*

luxuries were added such as wardrobes, equipment cleaning rooms, suitcase stores, drying rooms, and hot water to lavatory basins. Sitting rooms also made their appearance next to the barrack rooms at the expense of N.C.Os' bunks which were promoted to the sergeants' mess.

About this time steps were taken to introduce central heating throughout the barracks, steam or hot water being circulated from a central boiler-house. Successful efforts were made to improve the design and quality of fittings generally, cooking appliances, particularly, being modernized by the introduction of steam cooking for larger installations, and heat storage ranges for messes and officers' quarters. Steady improvement in accommodation in sergeants' messes and in the corporals' rooms of regimental institutes accompanied these developments, while the married families benefited by the provision of recognized children's playgrounds and greater recreational facilities in the army children's schools.

Several interesting campaigns were waged to improve the conditions under which officers were housed, basins in bedrooms were at first strongly resisted, but they were generally authorized in 1935. An effort to provide a more liberal scale of built-in furniture was defeated by the fact that this would entail loss of furniture allowance. Garages (on a rental basis) and dressing rooms were incorporated in junior officers' quarters in 1936, and a second bathroom in C.Os' quarters was approved at about the same time.

The year 1936 thus saw the beginning of a vast building programme, undertaken in circumstances of extreme difficulty. Building designs were in a state of flux. The organization of the army was in process of radical revision and no one was qualified to indicate with certainty the size or nature of the units for which accommodation should be provided. Moreover, junior R.E. officers were practically unobtainable and many retired officers had to be recalled to assist. The programme was well under way when events in 1939 caused all efforts to be diverted to the reprovision of huts for the occupation of the British Army during the next few generations.

THE NAVAL BASE AT SINGAPORE

The following article was written in 1938, but in view of the capture of Singapore and the whole of Malaya by the Japanese in 1942, some editorial comment, now in 1946, is desirable. Let the article stand as it was written prior to the second world war. The subse-

quent history of Singapore and Malaya will doubtless be dealt with in the next volume of Corps History.

Hitherto no official analysis and explanation of the fall of Singapore has been published, but doubtless material for searching examination is being collected for the historian. The editor of this volume cannot be expected to anticipate the verdict of history, and without access to the mass of relevant facts it would be foolhardy to try to analyse the causes of the great and unique disaster, but it seems permissible for him to suggest that the future historian may consider the following facts.

Between the years 1927 and 1937, when the construction of the fortress of Singapore was being conceived, started, interrupted and then restarted and completed, the strength of the Japanese army and navy was far below what it was when the second world war broke out in 1939 and still farther below Japanese strength in January, 1942.

At the beginning of 1937 unconquered China and French Indo-China stood between Japan and Malaya; American naval strength had not been crippled at Pearl Harbour; Europe was at peace and the whole strength of the British Empire was deemed to be available for sending help to Malaya if we were at war with Japan.

It was not forgotten that history has shown that coastal fortresses, when captured, have usually fallen from the land side. That, however, does not mean that guns specially designed for sinking ships should be capable of all-round traverse. Other and more suitable artillery must be provided for repelling attacks from the land.

Briefly, the scale and type of attack to be expected in the 1920s, and even up to 1937, was far below that which it was possible for the Japanese to deliver in 1942, and it obviously was not envisaged that the resources of the British Empire would be so tied up in Europe and Africa that they would be unable to give adequate reinforcement to Malaya.

The construction and defence of overseas fortresses to defend naval bases had been one of the most important rôles of the army for some centuries, but it was a long time since the army had undertaken the complete remodelling and extension of the defences of a naval base of such importance as the one at Singapore.

Before the Great War of 1914 it was considered, and the events

of that war proved the correctness of the appreciation, that the scale of attack to be expected at Singapore would not exceed that delivered by a few raiding cruisers. The defences were constructed accordingly and proved a sufficient deterrent to cause the German cruiser *Emden* to avoid the place and no other hostile vessel was ever in a position to visit it. Soon after the war, on 16th June, 1921, the British Government decided to establish a first-class naval base at Singapore for the repair of the largest battleships. New Zealand, the Federated Malay States and the Sultan of Johore showed their interest in this scheme by generous contributions to its cost. Such a first-class base had to be well defended against a first-class attack.

The construction and defence of an overseas fortress is a matter requiring the close co-operation of all three services. The task of the army likewise requires co-ordination of the work by all its arms, departments and services, but the bulk of such work falls upon the Royal Artillery and the Royal Engineers, working, as they always have, in the closest liaison. Much consideration had, therefore, to be given by many people of many services and departments before a project of such complexity and importance could reach the stage of construction.

There was a preliminary stage when proposals and tentative plans submitted by the Malaya Command were considered at Home, and during this period coast-defence experiments were still progressing. It was not, therefore, until 1927 that the War Office appointed a commission of specially selected officers to study the proposals on the site and to make recommendations.

Some of the six years' delay between the decision of 1921 to proceed with such a scheme and the departure of this commission is due to the fact that a Labour government came into power in 1924 and suspended work, but in November, 1924, a Conservative government replaced the Labour government and again took up the scheme. A similar interruption due to change of government was to occur again in 1929, and it was not until October, 1932, that a decision to resume work was announced and became effective in April, 1933. Much of the delay was also due to a technical controversy, continuing for some years, upon whether such a base could be entirely defended from the air supplemented by guns of comparatively small calibre. The cheapness of such a doctrine offered a great temptation, and it was not until May, 1932, that a cabinet committee decided that the heavy gun emplaced on land was just as necessary as it had always been for coast defence. As events turned out all these delays, so

exasperating to those interested in the work, were very beneficial to the final result. Experiments in coast-defence work and sound appreciation of many factors governing the problem continued to supply knowledge and modify the plans. Such a complicated scheme in such an unusual locality would have suffered considerably by being rushed.

The Commission sent out by the War Office arrived at Singapore on 10th April, 1927, and consisted of:—

Major-General Sir Webb Gillman, late R.A. and afterwards
Master General of the Ordnance,
Colonel L. N. Malan, who was to be Chief Engineer in charge of
construction,
Lieut.-Colonel R. F. Lock, R.A., Secretary of the Ordnance
Committee.

Their report with many accompanying plans was very complete, and formed the basis of the scheme as finally constructed, though there were, of course, later modifications.

Singapore is within two degrees of the equator. It rains on about 180 days in the year and occasionally there are long and tropical downpours. In 1926 continuous rains caused the rivers of Malaya to rise sixty feet, washing away complete railway trains and flooding the whole country. The damp Malayan climate, although apparently not altogether unpleasant, undoubtedly makes an insidious sapping attack on the vigour and energy of the white man. The natural condition of the country is thick luxuriant jungle, and any clearing if not maintained quickly relapses. Malaria is prevalent except where it has been dealt with by drainage, etc., and all work has to be preceded by efficient anti-malarial measures. The defence scheme required the opening up of large areas of this primeval jungle, where the pioneers of this work, although within a few miles of a large and luxurious city, lived under conditions of great discomfort and difficulty in improvised accommodation, which they often found themselves sharing with poisonous snakes and always with mosquitoes.

The island of Singapore and the mainland of the Johore State behind it, to which it is connected by a causeway across the intervening arm of the sea, are, in shape, curiously like the Isle of Wight, the Solent and the neighbouring south coast of England, but there are additional islands up to a square mile in area that also had to be taken into consideration in planning the defence scheme, and vessels

to keep up sea communication had to be provided for the garrison and those constructing the defences. The whole Peninsula of Malaya, about 500 miles long, was within the G.O.C.'s command. While this added to his responsibilities and anxieties, it provided some resources for the defence of the fortress of Singapore, notably some very fine and keen volunteer units recruited from the British community and from Eurasians, Malays and Chinese.

The report of the Gillman Commission was immediately followed by preparatory work carried out by the Chief Engineer, who had been a member of the Commission, and by the middle of 1930, when all work in hand had been finished off and closed down in accordance with the instructions received in July, 1929, the following progress had been made.* All anti-malarial work had been completed. Two piers and a wharf for landing stores had been built and connected to the necessary sites, one by broad-gauge railway that would carry the largest crane in the world, made by Messrs. Ransome & Rapier for mounting guns, another by a 2-ft. gauge line to other sites. There was also a dock, specially designed to receive a steel barge for carrying heavy guns. This barge was designed locally by a firm of naval architects to follow the procedure used for some years at Woolwich. Roads had been made, sites cleared ready for a cantonment and a power station constructed. A temporary water supply, at first a matter of some difficulty in spite of the heavy rainfall, had been arranged. Two large three-storeyed barrack blocks and married quarters for seven officers and twenty-four other ranks with recreation grounds were finished and one new battery with its accessories was practically complete. A number of type designs for buildings suitable to the climate and to locally available building materials had been made. For these it was fortunate that the R.E. Staff included men with architectural ability and vision, talents that were also exercised in suitable tree planting and landscape gardening, in a climate where everything grows profusely, to improve the appearance of the cantonment.

With the general layout and scope of the whole project settled, with communications to all parts of the work made, with survey, site clearing, anti-malarial work and communications completed and with some accommodation ready for military working parties, the project was in a condition to be rapidly resumed as soon as

* For the story of the early portion of this work see *The R.E. Journal* of September, 1929.

permission might be received. Although such permission was not given till October, 1932, much preparatory work in anticipation had also been done at the War Office, and a trial emplacement for a heavy gun had been designed, built and tested at Shoeburyness.

In January, 1933, the establishment of a Chief Engineer with a second C.R.E. was revived, and in April, 1933, Colonel A. C. Dobson, with fourteen more R.E. officers and thirty-six other ranks arrived in Singapore. In July, 1933, orders were received to accelerate the programme so as to complete it in three and a half years instead of the original five years, and a considerable increase was made in the proposed garrison.

Time was required to get out detailed contracts, and for contractors to collect workmen and stores, with the result that only £49,000 had been spent up to the end of March, 1934. However, during the year 1934/5 work to the value of £450,000 was completed, rising to £524,000 during 1935/6. From 1933 to 1937 the total expenditure was £1½ million, the average works staff during this period being thirty-one officers and seventy-one warrant and N.C.Os. The 2-ft. railway, run by the 41st Company carried 4,000 tons of stores per month and succeeded in transporting an enormous package, 11 ft. high and weighing 17 tons, a task which had been declined by every contractor.

There were three separate cantonments, and also Supply and Ordnance depots, each with workshops, but there was continuous uncertainty concerning the actual number and strength of the units to be accommodated. Moreover, they often arrived earlier than planned and much temporary housing had to be built. There was a Combined Services hospital of 400 beds, many separate power stations and large changes were required in the existing headquarters offices. Good recreation grounds, tennis courts and ample tree planting were, of course, included.

It is here that one would like to describe the extremely varied and scattered defence works and the problems that arose in constructing the batteries, searchlight emplacements, observation and command posts and magazines, some of which were on difficult sites with very deep foundations, but such matters are not for publication.* The very large crane already mentioned was used

* Detailed reports giving much technical information were made by Colonels Malan, Dobson and Cave-Browne. These were deposited in safe custody at the War Office and no doubt will become available for study in due course.

for the heaviest guns but the others were handled with a locally designed and constructed gantry.

In addition to the work at Singapore, a hill station was constructed on the plateau known as Cameron's Highlands, 400 miles to the north. This was at an elevation of 5,000 ft. and afforded an excellent site for a change of air camp for all three Services. It was in effect the first attempt to produce a proper hill station in Malaya.

The estimate, in 1933, for what was known as "The First Stage" was £1,150,000. In 1937, the estimate for the whole scheme had grown to £2,711,000 and by August, 1938, it approached £4,000,000. Except for batteries, magazines and a few special buildings all designs were prepared locally. For the batteries and magazines, the War Office supplied bills of quantities, but neither the available time nor local staff allowed for the preparation of quantities for other work, most of which was carried out by lump sum contracts, based on plans and specifications. For defence works tenders were called for from four British firms, but in other cases Chinese firms were also invited to quote. There were about eight of these, who did good work and at a remarkable speed. Two sets of barracks for two battalions were designed and built in just over twelve months.

The main coast defence scheme was practically complete when tested by the large-scale combined manœuvres of all three Services in February, 1938.

From 1915 onwards the post of G.O.C., Malaya was nearly always held by an ex-Gunner or ex-Sapper Major-General. They were as follow: Sir Dudley H. Ridout, late R.E., 1915; Sir John S. Fowler, late R.E., 1921;* Sir Neil Malcolm, late A. & S. Highrs., 1921; Sir Theodore Fraser, late R.E., 1924; Sir Cazinir C. van Straubenzee, late R.A., 1927; H. L. Pritchard, late R.E., 1929; Sir Leopald C. L. Oldfield, late R.A., 1931; E. O. Lewin, late R.A., 1934 and W. G. S. Dobbie, late R.E., 1936.

The Chief Engineers, Malaya, during the construction period were: Colonels L. N. Malan, 1927; R. F. A. Butterworth, 1930; A. C. Dobson, 1933 and W. Cave-Browne, 1935.

The Cs.R.E. were: Lieut.-Colonels R. L. B. Thompson, 1921; D. Forster, 1924 and W. H. Kelly, 1926. After 1929, there were two Cs.R.E.—Singapore and Changi.† The former were: Lieut.-Colonels H. F. B. S. Moore, 1929; F. G. Hyland, 1931; G. Streeten, 1934

* G.O.C. British Forces in China, 1921-4.

† In abeyance from 1930 till 1933.

and B. D. Peake, 1938; and the latter A. T. Shakespear, 1929; J. R. Roberts, 1933; and J. C. P. Tosh, 1937.

The number of fortress units rose steadily as the defences progressed and the Fortress R.E. in 1938, consisted of Fortress Headquarters with the 30th and 34th Companies (Anti-Aircraft) and 35th and 41st Companies (Coast Defence). The 36th Company was at Penang.

WORKS SERVICES FOR THE R.A.F.

The Royal Air Force came into existence on 1st April, 1918, when the Royal Flying Corps and the Royal Naval Air Service were merged to form a new fighting service. For several years prior to this the works requirements of the R.F.C. had been met by R.E. staffs and units under Brigadier Sir Edward Raban, late R.E., D.D.F.W. (Aviation) at the War Office. Similarly R.N.A.S. requirements had been met by the Admiralty works organization, which included a uniformed body, the Air Construction Corps. Those who had dealt with the R.F.C. and R.N.A.S. were gradually merged to form the R.A.F. Works Department under Sir John Hunter, an ex-contractor, who held the post of Administrator of Works and Buildings, Air Board. The Air Construction Corps was reconstituted in the R.A.F., renamed the Air Construction Service (A.C.S.) and supplemented by commissioning civilian engineers, many of whom had been temporary R.E. officers.

At the end of 1919, soon after Major-General Sir Andrew Stuart, late R.E., had become Director of Works and Buildings, Air Ministry, post-war economy led to the disbandment of the A.C.S., and in spite of the wishes of the Chief of Air Staff, sanction was refused to build up any reserve to replace it in emergency.

Soon after this, when the Royal Air Force assumed responsibility for Iraq, a regular R.E. officer was appointed as Chief Engineer, Iraq Command, working under the Air Ministry Works Department. This post was continuously so held until taken over by an Air ministry Works officer on the reorganization which followed the rebellion in Iraq in 1943. Another R.E. officer, Lieut.-Colonel J. F. Turner, was attached as C.R.E., and later Chief Engineer, to R.A.F. Headquarters in India, to act as liaison officer between the R.A.F. and the Military Works Department. The most important connection, however, between the R.A.F. Works Department and the Corps was maintained by the fact that, throughout the years of peace, the post of Director of Works and Buildings at the Air

Ministry was held by a succession of ex-R.E. officers. They were : Major-General Sir Andrew Stuart, 1919 ; Major-General Sir William A. Liddell, 1924 ; Brigadier H. Biddulph, 1928 and Colonel Sir John F. Turner, 1931, who was succeeded by his Deputy Director, Sir Ernest Holloway in 1939.

Although the R.A.F. works services in peace were thus virtually divorced from the army, it was always realized that this could not be so in war. In order to ensure that available labour, transport and materials were under one control, the army had always accepted liability for R.A.F. works in forward areas in the field. The responsibility in base areas remained undefined and was not covered except by the civilian personnel of the R.A.F. who happened to be serving, but without reserves, at existing stations at home and abroad. Work required at a newly formed operational base was not covered at all.

As tension grew during the late 1930s it became vital to solve the problem, but most of the obvious solutions were impracticable. There were insuperable difficulties in re-forming the A.C.S. ; the intense shortage of R.E. officers made it impossible to train a sufficient number of them in the many special R.A.F. requirements ; the limited numbers of civil engineers in the R.A.F. works service had no experience of war conditions, demanding the power of rapid improvisation and other characteristics that take long to learn.

As the result of conferences between the D.F.W., War Office and the D.W. Air Ministry, it was decided to train some of the best R.A.F. Works staff as reserve R.E. officers and to allocate two R.E. companies for R.A.F. work behind the forward areas. It was realized that these units would not be immediately available, but it was hoped that existing permanent airfields would be used for some time. This scheme could not be said to have produced a complete answer to this difficult problem which perhaps will never be solved to the satisfaction of all concerned.

RECONSTRUCTION AFTER THE QUETTA EARTHQUAKE

The town of Quetta was completely destroyed by earthquake on 31st May, 1935. Needless to say, the local Sapper and Miner units did invaluable work during the period immediately afterwards.* The question of reconstruction was promptly considered by the

* See article by Lieutenant B. M. Archibald in *The R.E. Journal* of December, 1936.

Government of India, who decided that the Military Engineer Services should be given the task of rebuilding not only the army cantonments but also the lines occupied by the civil administration. Lieut.-Colonel C. J. S. King was placed in charge as C.R.E. and found himself largely responsible for the task of replanning the city.*

It had been decided that all new buildings should be made earthquake-proof† and also built so as to resist the very wide local extremes of temperature. The production of entirely new designs to meet these often conflicting requirements presented a big problem. The railway was extended to the sites of the work and a large number of lorries and items of mechanical plant was obtained. These were particularly necessary as about 1½ million tons of debris had to be disposed of, some of it being used to build the labour camps for 18,000 men. The first contracts, totalling nearly a million pounds, were let in May, 1936, several of them being of a novel type to permit of tendering before complete sets of drawings and specifications were ready. These contracts were followed by others, but owing to the very great local difficulties only £½ million was spent during the first year. The engineer staff was soon increased to a Deputy Chief Engineer with two Cs.R.E. as it was intended to build at the rate of about £1 million per annum for six years. Financial stringency, however, soon reduced this programme and work was not completed until after the war.

The tasks confronting the R.E. officers engaged on this large project were extremely interesting and included what was perhaps the first use by the army of modern earth-moving plant on a fairly large scale. Among the officers employed on the reconstruction of Quetta were the following: Colonel C. J. S. King, Lieut.-Colonels E. M. Pert and W. D. M. Christie, Captains N. Boddington and W. D. H. Beyts and Lieutenants B. M. Archibald and A. P. Lavies.

* See his article in *The R.E. Journal* of September, 1937.

† It was specified that buildings should be capable of resisting the force produced by a horizontal acceleration of 4 ft. per sec. per sec., i.e., a horizontal force of one-eighth their weight.

CHAPTER XIX

SEARCHLIGHTS, 1919-39

Coast defence electric lights—Regular A.A. searchlights—Territorial A.A. searchlights—Schools—Air defence of overseas ports—The Abyssinian crisis—The 1st Anti-aircraft division, T.A.—Further expansion—Transfer to the Royal Artillery—Miscellaneous activities of searchlights.

COAST DEFENCE ELECTRIC LIGHTS

DURING the war years all coast defence searchlights at home and some abroad had been manned by units of the auxiliary forces. During the post-war reorganization they were taken over once more by twenty regular fortress companies,* containing forty-six officers and more than 1,000 other ranks.

On the rebirth of the Territorial Army in 1920, eighteen fortress units† were included, having an aggregate strength of 151 officers and more than 2,300 other ranks, of which about half were for duty with searchlights. The war had produced little change in the work of fortress units, and their plant was not modernized until at least a decade later.

In 1932 full responsibility for coast defence at home, except in South Ireland, was handed over to the T.A. and all regular U.K. fortress companies were disbanded except the 45th at Gosport, redesignated the 4th Fortress Company, its duties being mainly

* The fortress companies were: 3rd, Dover; 4th, Gosport; 15th, Gibraltar (renamed 1st Fortress Company in 1925); 16th, Tyne, Tee and Humber; 22nd, Gosport; 24th, Malta; 27th, Bermuda; 30th, Plymouth; 33rd, South Ireland; 34th, Channel Islands; 35th, Pembroke, Cardiff and Liverpool; 36th, Sierra Leone; 39th, Sheerness; 40th, Hong Kong; 41st, Singapore; 43rd, Mauritius; 44th, Jamaica; 45th, Portsmouth and Weymouth and 49th, Forth, Clyde and Tay. Many of these were disbanded between 1927 and 1938.

† The Lancashire, Tyne Electrical, North Riding, Hampshire, Devonshire, City of Aberdeen, Sussex, Glamorgan, Renfrewshire, City of Edinburgh, Cinque Ports, Kent, East Riding, Carmarthenshire, City of Dundee, Essex, Cornwall and Dorsetshire (Fortress) R.E., T.A.

instructional and experimental. The T.A. fortress units were re-organized, works sections and in most cases anti-aircraft searchlights being added, and the Suffolk (Fortress) R.E. was created for the defences at Felixstowe. The various units of the Tyne Electrical Engineers, on reorganization, regained their old name.

REGULAR ANTI-AIRCRAFT SEARCHLIGHTS

While the initial reconstruction of coast defence units was progressing, the great organization of anti-aircraft searchlights, that had grown up during the war, was being as rapidly and as thoroughly reduced. The last remnants of Nos. 3 and 17 A.A. Companies moved to Blackdown at the end of 1920 to form the nucleus of the 1st Anti-Aircraft Searchlight Battalion, R.E., which took its place in the newly created 1st Air Defence Brigade. This new regular unit, destined to become the largest on the peace establishment of the Corps, did not at first present a very imposing spectacle on parade, having a total strength of three N.C.Os. and four sappers under the command of a lieutenant, R.F.A. It was more than a year before it welcomed its first R.E. commanding officer—Lieut.-Colonel G. C. E. Elliott, and nearly two years before it received substantial reinforcement. In the meantime two temporary searchlight units, containing both regular and T.A., had been formed for service with the forces then resisting the Irish rebellion. They were equipped with 60-cm. searchlights on lorries, and were intended for escorting patrols and for illuminating streets when raids were being carried out. The lorries mounted machine-guns, were partially armoured and had wire netting covers to exclude hand grenades. They also carried 10-in. spotlights and handlamps on long leads to help in the search of houses and cellars. After the Treaty of December, 1921, the remnants of these units joined the battalion at Blackdown.

TERRITORIAL ANTI-AIRCRAFT SEARCHLIGHTS

In February, 1919, a conference presided over by the Right Hon. Winston Churchill, then Secretary of State for both War and Air, recommended that the intricate organization of Home Air Defence should be kept alive in peace, just as is the Royal Navy, and that it should be the responsibility of the Air Ministry. Successive later proposals, however, reduced by 1920 the establishment of the searchlights considered necessary to exactly nil. In 1923, the Govern-

ment embarked once more upon a scheme for building up an effective air defence. The ground troops, which were to be increased year by year, included Territorial anti-aircraft units at war establishment—a new departure in peace organization. National economy, however, deprived these excellent resolutions of much of their effect, for after the initial creation of the first of the new formations, no further expansion took place for many years, and, in fact, the searchlight units were soon to be limited to 75 per cent of their war establishment.

For the defence of London, two air defence brigades, T.A., were approved in 1923 and included two, later numbered the 26th and 27th Anti-Aircraft Battalions,* R.E. (London Electrical Engineers), each to contain thirty-two officers and 852 other ranks. These were followed by the formation of eleven companies† primarily intended to co-operate with the artillery. All Territorial Army anti-aircraft units were later incorporated in a formation known eventually as Air Defence Formations, T.A., on whose headquarters, from 1925, was a Chief Engineer, Colonel J. P. Moir, succeeded by Colonels T. T. Grove in 1929 and A. B. Ogle in 1933-5.

SCHOOLS

The two pre-war electric light schools at Gosport and Plymouth had been replaced towards the end of the war by the A.A. Searchlight and Sound Location School at Ryde and the School of Electric Lighting (S.E.L.) at Stokes Bay, Gosport. The latter dealt mainly with technical and coast defence matters. The former was revived in 1921 and moved to Perham Down, Salisbury Plain, to form part of a new R.A. and R.E. Anti-Aircraft School under Colonel M. St. L. Simon, late R.E. The next year the school moved to Biggin Hill to become the School of Anti-Aircraft Defence (S.A.A.D.) with an R.A. and R.E. wing, each under a Chief Instructor.

We have seen on pages 175 and 183 that there was an Air Defence Experimental Establishment (A.D.E.E.) under the R.E. Board. This moved in 1923 to Biggin Hill where it worked in company with the School.

* Redesignated A.A. Searchlight Battalions in 1930. They comprised the 301st to 306th Companies.

† The 307th (Tyne), 309th to 312th (Essex), 313th and 314th (Kent), 315th, 316th and 318th (Surrey), and 317th (Middlesex) A.A. Searchlight Companies, R.E.

the 1st and 2nd Anti-Aircraft Groups, while the 1st A.A. Searchlight Battalion had been named the 1st Anti-Aircraft Battalion, R.E. and a 2nd Battalion was being formed. These two battalions continued until well into 1937 to furnish the very large drafts for overseas and the immense number of instructors for the Territorial Army units that were then being formed.

THE 1ST ANTI-AIRCRAFT DIVISION, T.A.

In 1934, a Government Committee under Air Chief Marshal Sir Robert Brooke-Popham had reviewed the air defences of Great Britain, and as a consequence an Anti-Aircraft Division, T.A., was formed in December, 1935, with headquarters at Uxbridge to replace the existing A.A. Formations, T.A. The division included nine brigades of artillery and eleven anti-aircraft battalions, R.E., organized on a geographical basis into four unequal Anti-Aircraft Groups, T.A. Each battalion had an establishment of forty-two officers and about 1,300 other ranks, organized in four companies. The division had no Chief Engineer, but an Instructor-in-Searchlights was attached to headquarters.

This reorganization not only absorbed all existing units (except the company on the Tyne) but involved the raising of new ones and the conversion of certain infantry battalions of the Territorial Army to the anti-aircraft rôle.* Five battalions were thus converted to searchlight units, their personnel being transferred to the R.E. They, however, retained their former titles and were allowed much latitude in choice of badges, buttons, etc. Any initial resentment at this enforced change of loyalty to a new branch of the Service soon wore off and all units displayed their traditional enthusiasm as efficient components of the Corps.

* The A.A. Battalions, R.E. in the 1st A.A. Division were :—

- 26th (London) A.A. Group.*—26th and 27th (London) L.E.E.
27th (Home Counties) A.A. Group.—30th (Surrey), 31st (City of London Rifles), 34th (The Queen's Own Royal West Kent) and 35th (First Surrey Rifles).
28th (Thames and Medway) A.A. Group.—29th (Kent) and 32nd (7th City of London).
29th (East Anglian) A.A. Group.—28th (Essex), 33rd (St. Pancras) and 36th (Middlesex).

The companies were numbered 301 to 346.

AIR DEFENCE OF OVERSEAS PORTS

In 1933, consideration was at last given to the dangers of air attack upon defended ports overseas and in January, 1934, the first anti-aircraft searchlight unit ever to leave the U.K. in time of peace—a section of seventy all ranks—left to join the 40th Fortress Company at Hong Kong. The training of further drafts for posting abroad was then urgently taken in hand by both the A.A. Battalion at Blackdown and the S.E.L. at Gosport. By the end of 1934 it had been decided that Malta, Hong Kong, Singapore and Gibraltar should all have anti-aircraft searchlight companies in addition to fortress companies, under a Headquarters, Fortress Engineers. The companies were to be named the 16th, 22nd, 30th and 31st respectively, but before the scheme could be fully implemented, urgent operational calls for searchlight personnel arose.

THE ABYSSINIAN CRISIS

In consequence of the Italian invasion of Abyssinia in 1935, increases in the British defences of the Mediterranean and Middle East were essential, especially air defences. During a period of ten weeks in the autumn, the A.A. Battalion was called upon to send units of varying strengths to Malta, Alexandria, Aden and Port Sudan. With additional drafts later, this practically used up the whole battalion. The units at Alexandria were allotted to two composite air defence brigades, one for the defence of the port and the other for a possible temporary naval base to replace Malta. The temporary base was to be defended mainly by Royal Marines and thus the searchlight company was the first R.E. unit to serve in a naval organization and under officers of the Royal Navy.

In December, 1935, the majority of this unit was lent by the Navy for the air defence of the force on the Western Desert of Egypt. They sailed to Fuka and marched the remaining fifty miles to Mersa Matruh. In April, 1936, they were relieved by the other company in Alexandria, and in July this company was moved urgently to Palestine—a rail journey of thirty-five hours—to assist in the restoration of order in that country.

In the autumn, the various detachments were released, some going to Singapore to form the new 30th Company and the remainder returning to Blackdown, where certain changes had occurred during their eleven months' absence. The Air-Defence Brigade had become

FURTHER EXPANSION

At the end of 1936, the 2nd A.A. Division was formed in order to extend the defences northwards. It also required eleven A.A. battalions. Of these the 37th was formed from a company of the Tyne Electrical Engineers and the others (38th to 47th) by further conversions from infantry.*

Even these immense expansions did not represent finality, and, by April, 1938, four more battalions had been formed: the 48th (Hampshire) from the Hampshire (Fortress) R.E. for Portsmouth, the 49th (West Yorkshire Regt.) and 50th (Northamptonshire Regt.) to augment the 31st and 32nd A.A. Groups, and the 51st (Scottish) Battalion to extend the defences still farther northward. Later in the year the 58th Battalion was formed in north London and was destined to be the last A.A. battalion R.E. to come into existence. There were many minor changes all involving increases in establishment, not the least being the necessity to send a company of twenty-four lights to Egypt under the terms of the 1936 Treaty.

TRANSFER TO THE ROYAL ARTILLERY

This very large expansion presented many difficulties, not the least being the provision of Adjutants and Permanent Staff Instructors for the multitudinous new Territorial Army units. The numbers of searchlight personnel in the Corps were rapidly outstripping those engaged on more legitimate engineering. The shortage of officers was becoming really serious and regular field companies were in several cases reduced to little more than cadres. Moreover, there was a danger that men who had served their time in A.A. units would not be suitably trained to join field units if called up from the reserve on mobilization. At the same time it was becoming

* The A.A. Battalions of the 2nd A.A. Division T.A. were:—

30th (Northumbrian) A.A. Group.—37th (Tyne) T.E.E., and 47th (Durham L.I.).

31st (North Midland) A.A. Group.—43rd (5th Duke of Wellington's Regt.) and 46th (The Lincolnshire Regt.).

32nd (South Midland) A.A. Group.—40th (The Sherwood Foresters), 42nd (The Robin Hoods), 44th (The Leicestershire Regt.) and 45th (The Royal Warwickshire Regt.).

33rd (Western) A.A. Group.—38th (The King's Regt.), 39th (The Lancashire Fusiliers) and 41st (5th North Staffordshire Regt.).

The companies were numbered 307, 308, and 348 to 389.

clear that improvements in equipment had made it no longer necessary for searchlight units to be officered by trained engineers and manned with a high proportion of tradesmen. In the past it had at times been suggested that coast defence lights should logically be manned by the regiment whose guns they served. How much more cogent was this argument in the case of air defence with its complicated systems of control and co-operation? These and other contentions eventually prevailed, and on 31st March, 1938, His Majesty was graciously pleased to approve of the gradual transfer of responsibility for Anti-Aircraft and Coast Defence Electric Lights duties from the Corps of Royal Engineers (Regular Army) to the Royal Regiment of Artillery.

This decision was to involve in due course the disbandment of certain R.E. units and their replacement by R.A., and the reorganization of fortress units. It was not long before it was to apply to the Territorial Army as well. In this way, after an interval of thirty years, searchlights were thus following Submarine Mining, and passing from the Corps, who had bred and nurtured them. Here would our story end were it not for the fact that other powerful forces were at work. The year 1938 was one of great anxiety and of consequent turbulent expansion in our defences. It was no time to carry through this great change in haste, and a considerable period was to elapse before the Royal Artillery could train sufficient personnel to take over with safety their new duties.

In the interval, reorganization and expansion continued. Fortress anti-aircraft companies were placed, like all other air defence units, under the central control of the A.O.C.-in-C., Fighter Command, R.A.F. Units of the two A.A. Divisions were withdrawn from the control of Army Commands and the 1st Anti-Aircraft Corps (later, A.A. Command) with headquarters at Stanmore came into being. There were many minor changes. The Orkney (Fortress) R.E. was created for the defence of Scapa Flow, the Antrim (Fortress) R.E. having already appeared in Belfast; the handing over of the South Irish Coast Defences to the Government of Eire was more than offset by the necessity to send the re-formed 39th Company to Freetown and the 45th to Haifa. Moreover, the growing fortress of Singapore now required a fourth company, the 36th, to augment the 30th, 34th and 35th already there.

The organization so rapidly built up at Home was to be tested in no uncertain manner when events in Germany compelled the embodiment of all Territorial A.A. and coast defence units on 26th

September, 1938. This great rehearsal brought out some shortcomings but proved that the men could join their units, often a hundred miles away, within the few hours allowable for air defence mobilization.

During the winter, expansion continued unabated, though it now affected the Regiment and not the Corps. The A.A. Divisions were increased to five and many new searchlight regiments, R.A., were formed from Territorial battalions. By the end of 1938, there were 50,000 officers and men in the British Army, borne on the establishments of searchlight units or employed on searchlight duties, and of these some 30,000 were still Royal Engineers. Such then was the development of the searchlight service in the twenty years following the Armistice.

Many R.E. officers held responsible posts in command and on the staff in the mixed formations of the A.A. organization, and retained their appointments after the Royal Artillery had taken over the searchlights and during the ensuing war. Lieut.-General (later Sir Maurice) Grove-White, when G.O.C., II A.A. Corps, found himself in command of more than 100,000 gunners, attached services and A.T.S. women, scattered over the whole of the central half of England and Wales. Among the senior appointments held were the following: Lieut.-General M. F. Grove-White, 2nd A.A. Division, 1938-40, II A.A. Corps, 1940-2; Major-General F. G. Hyland, 31st (North Midland) A.A. Group, 1936-9, 6th A.A. Division, 1939-42; Major-General A. M. Cameron, 39th A.A. Brigade, 1942-3, 47th A.A. Brigade, 1943, 6th A.A. Division, 1943-4; Major-General S. Lamplugh, 32nd A.A. Brigade, 1943-4, 71st A.A. Brigade, 1944, Major-General, General Staff, H.Q., A.A. Command, 1944-5; Brigadier A. B. Ogle, 27th (Home Counties) A.A. Group, 1935-41; Brigadier J. C. Wickham, 32nd (South Midland) A.A. Brigade, 1936-41; Brigadier K. D. Yearsley, 43rd A.A. Group, 1938-41, 57th A.A. Brigade, 1941-2; Brigadier D. W. Nicholson, T.A., 40th A.A. Brigade, 1938-41, 54th A.A. Brigade, 1941-2; L. E. C. M. Perowne, 69th A.A. Brigade, 1942-3, 37th A.A. Brigade, 1943-4.

MISCELLANEOUS ACTIVITIES OF SEARCHLIGHTS

Our tale would be incomplete were it to ignore those humbler, but no less useful, purposes to which the searchlight was applied in these two decades. Thus, the anti-aircraft searchlight sections that accompanied the Second Army to the Rhine in November,

1918, were to be found assisting in the control by night of river traffic and smuggling on the Rhine. In March, 1920, a coast defence searchlight was serving with "Norperforce" at Enzeli harbour on the Caspian Sea, and from June until December this detachment operated armoured searchlight trains from Baghdad during the Arab rebellion. In 1925 and 1926, searchlights were used by the Engineer Troops of the Sudan Defence Force to prevent the use of waterholes at night by the insurgents in the Nuba Mountains. Again, in 1927, this force employed them on a river steamer in the suppression of the Nuer rebellion. In 1936, the searchlights of 1st A.A. Battalion played an important rôle in quelling the Arab Strike in Palestine. The searchlights were mounted to illuminate long stretches of railway and pipe-line, to assist our patrols in combating the extensive sabotage. Other searchlights were installed on the roofs of the towns and used in conjunction with guns and machine-guns to prevent sniping into the camps. All the lights came frequently under fire but one only was hit.

A more pacific employment of searchlights, which was probably better known to the public and without which no account of this branch of the activities of the Royal Engineers could be closed, was in connexion with searchlight tattoos. The greatest of these was that held annually on the Rushmoor Arena at Aldershot. To this spectacle hundreds of thousands of people came every year from all over the world, and up till 1935 the illumination was always provided by searchlights manned by the 1st A.A. Battalion from Blackdown. Territorial Army searchlight personnel illuminated the Tattoo at Wembley during the British Empire Exhibition of 1924-5, and subsequently at the Northern Command Tattoos at Leeds, York and elsewhere. Tattoos at almost every British military station at home and abroad have been lit by R.E. searchlights.

Peacefully engaged then in these charitable endeavours, let us take leave of another, and numerically perhaps the greatest, offspring from the Corps of Royal Engineers, which, following in the footsteps of its elder brothers, is gone forth for ever from the scientific nursery of the British Army.

CHAPTER XX

SURVEY, 1919-39

Post-war organization—The Ordnance Survey—The Geographical Section General Staff—Colonial surveys—Boundary Commissions.

POST-WAR ORGANIZATION

IN the reorganization after the war, the survey companies were absorbed into a survey battalion with a peace establishment of nine officers and 456 other ranks, whose training was confined to survey matters. War Establishments were laid down for units to accompany formation headquarters and for various types of section, containing appropriate craftsmen, to be detailed to meet the special circumstances of a campaign.

During the war, survey for the artillery had been carried out by engineer units, who, as we have seen in previous volumes of this History, had developed the technique of fixing guns and targets and this had made possible the very efficient predicted shooting of 1918. After the war it was decided that the Royal Artillery should become responsible for gun-fixing and the provision of artillery boards, while the Corps retained its duties of providing the common triangulation. The Artillery Survey Company thus came into being.

During early post-war years survey questions arose on manœuvres and exercises, and commanders were anxious to find out how the necessary co-operation between Regiment and Corps would work. Unfortunately the combination of an admirably mapped country and an almost universal lack of visibility during autumnal exercises, made field-work highly artificial. Nevertheless, in 1929, a R.E. Survey Company was approved, on peace establishments and pay, but acting under the orders of the Director General of the Ordnance Survey.

In the Geographical Section an important addition had to be made to the establishment. The Royal Air Force had its own cartographic problems, and required the utmost help that maps could give to its pilots. British official surveys had long been so

organized that everything above the sea-level datum was carried out by the Ordnance Survey at home, or organized overseas by the Geographical Section, whilst everything below that datum was dealt with by the Hydrographic Department of the Admiralty. In 1919, an inter-service committee decided that this division of labour should be maintained, and the responsibilities of the Geographical Section, already embracing all such departments of State as had geographical problems overseas, were extended to cover map supply for the Royal Air Force. Two officers, paid for by the R.A.F., were accordingly added to its establishment.

THE ORDNANCE SURVEY

From time to time during the last 150 years the national survey has been given new yet inevitable duties. Rejected by the Army, reluctantly enough, as the terms of reference grew, the Ordnance Survey fell into the hands of one department of State after another, and in 1891, came under the Ministry of Agriculture and Fisheries, but in the absence of any department directly and wholly responsible for applied science it was difficult for anyone to understand that surveys were part of the price of progress. After the war changes of the countryside proceeded with gathering momentum, and the Ordnance Survey steadily lost ground. Representations were not lacking, and, at last, in 1935, an inter-departmental committee was called together to consider the position. It was clear that it would require a generation to recapture a moderate efficiency.

Perhaps the most interesting novelty was the choice in 1925 of a projection to make it possible eventually to publish all the large 1/2,500 plans in one continuous series instead of in county blocks.

The Directors-General in the post-war period were: Colonel Sir Charles Close, Brigadiers E. M. Jack, 1922, H. S. L. Winterbotham, 1930, and M. N. MacLeod, 1935.

THE GEOGRAPHICAL SECTION GENERAL STAFF

The war left a number of new subjects to introduce into the normal routine. It became more than ever necessary to watch the growth of foreign geodetic and other surveys and to collect data concerning them. Much new map compilation was required in order to incorporate war surveys and treaty alterations and to provide good reference maps for the study of overseas problems. Two new series

covering Asia and Africa were produced. The importance of survey from air photographs led to the institution of an inter-service Air Survey Committee, with representatives of the Admiralty, War Office, Air Ministry, Ordnance Survey and National Physical Laboratory, and later with a permanent research officer and secretary, Lieutenant M. Hotine. Survey progress is largely bound up with advances in instrumental design and manufacture, the lead in which (though not in finish or reliability) had fallen from 1890 onwards into German hands. In 1926, the Geographical Section called a conclave of the Ordnance Survey, the Hydrographic Branch and the principal manufacturers to examine and test British and foreign theodolites on Dartmoor. This resulted in the manufacture of the famous "Tavistock" model by Messrs. Cooke, Troughton & Simms. Very close touch was maintained with Colonial Survey Departments who had been of such importance and assistance during the war.

During the inter-war period there were, of course, occasions of operational activity. The first arose in 1922, with the collapse of the Greek Forces in Asia Minor and the imminence of a Turkish invasion of Europe. A survey platoon was included in the force then sent to the Near East. The General Strike of 1926 meant another period of stress. Immediately afterwards signs of an impending conflict in China set the Geographical Section hard at work on maps of its more important areas and cities; they were ready just in time, and were copied and used by the Americans, French and Japanese.

The Geographical Section after the war was under Colonels E. M. Jack, 1920, H. S. L. Winterbotham, 1922, M. N. MacLeod, 1929 and P. K. Boulnois, 1935.

COLONIAL SURVEYS

Practical survey training in the Colonies was continued throughout the inter-war period. In 1924, with the growing importance of Singapore as a naval base, a Colonial Survey Section was sent out to survey the State of Johore and finished by 1934 an excellent series at the scale of 1/25,000. Also in 1924 a second Colonial Survey Section undertook the topographical survey of Trinidad and Tobago at 1/50,000, and another Colonial Survey Section was dispatched to Nigeria in 1926. In the mapping of our African West Coast colonies Royal Engineer officers have taken a leading part. The comparative excellence of the surveys is due mainly to the late General Sir

Gordon Guggisberg, who was Surveyor General in both the Gold Coast and Nigeria before he became Governor of the former. After the war at least twenty-three R.E. officers were employed in the surveys of these colonies and in Sierra Leone. The work, largely survey, of the Temporary Roads Department of the Gold Coast is described in Chapter XXIV.

In 1924, the survey of Hong Kong and Kowloon was in arrears. The good 1/20,000 series now covering it was the first example of a continuous air-photo survey by the Geographical Section. Photographs taken by the Naval Air Service and based on a new triangulation made it just possible to compile the new map. A similar remapping of Malta and Gozo was made at 2 in. to the mile. Between 1930 and 1934 triangulations, with longitudes fixed from wireless time signals, were carried out in the Suez Canal Zone, Aden and its hinter-land, the Jordan valley, and the lava belts and southern boundary of Trans-Jordania. A similar, though not identical, style of surveying was used for the mapping of the desert fringes of Iraq, the process consisting largely of long traverses amplified by air photographs. In 1934, a new triangulation was made of Mauritius, the original survey of which had been the very first work of the Colonial Survey Section. Of all the useful work of the Geographical Section during this period perhaps none exceeded the continuation of the great arc of precise African triangulation along the 30th east meridian from Port Elizabeth to Cairo.

BOUNDARY COMMISSIONS

The demarcation of Imperial and other boundaries is perhaps the most responsible and instructive of the survey activities of the Corps. After the war, the boundaries of the mandated territories were generally demarcated by Colonial Survey Departments. Such for example were those of the Gold Coast-Togoland, Nigeria-Camerouns, Tanganyika-Congo, and Transjordania-Iraq-Syria. The Sudan-French Equatorial Africa boundary was demarcated under the orders of Colonel Pearson, Surveyor General of the Sudan, assisted by Colonel Boulnois. In the Iraq-Turkey Boundary Commission Colonel Lewis took a similarly prominent part. The boundary commissions in which Royal Engineer officers acted as Chief Commissioners are given below. All have been described in the Royal Geographical Society's Journal.

Congo-Zambesi, 1922-3, Colonels Cree, A. B. Clough and E. R. L. Peake.

Kenya-Italian Somaliland, 1925-7, Lieut.-Colonel L. N. F. I. King.

British and Italian Somaliland, 1929-30, Lieut.-Colonel J. H. Stafford.

British Somaliland-Ethiopia, and *British and French Somalilands*, 1932-4, Lieut.-Colonel E. H. M. Clifford.

British Guiana-Brazil, 1936-7, Major J. F. Phipps.

CHAPTER XXI

MECHANIZATION IN THE ARMY

Early pioneers of mechanization—The South African War—The period 1902-14—Mechanization during the first World War—The inter-war period—Mechanical engineers for the army—Mechanization of R.E. units—R.E. and the Royal Tank Corps.

EARLY PIONEERS OF MECHANIZATION

MECHANIZATION in the army, like so many other military changes, has been dependent in the main upon civilian scientific and mechanical progress. From time immemorial, ships, roads, vehicles and animal transport have been diverted and adapted from civil uses, and more recently, railways, telegraphs, mechanical transport, aviation and many other facilities produced by science have been made to serve the needs of war ; but that is not to say that no credit should go to the military profession. In time of peace the army often takes up new ideas at a very crude and embryonic stage, finances and aids the inventor and places orders with civil firms, without which their products could never be launched upon the commercial market. Moreover, military men themselves have often been among the actual inventors and investigators. In war this process is far more marked. Money is spent lavishly on research and experiment, risks are taken that could never be countenanced in peace and the moment a new or better type appears its forerunners are ruthlessly scrapped. An invention may thus run through several editions in a year, making progress that would require a generation in time of peace ; of this, aviation is an outstanding example. Some may see no disadvantage in delay but none can deny the acceleration that war produces.

Consequently, in describing the mechanization of the army and the work done for it by the Corps we must start with a compressed synopsis of progress in the mechanical world. Both soldiers and civilians had to wait for the internal combustion engine to make economical and practical the transport of themselves and their goods at speed upon the roads, and soldiers had to wait for the low pressure tyre and for the metallurgical advances that made possible

the multi-wheel drive, before their ability to leave the roads could justify the scrapping of horse transport. The milestones in this mechanical progress were:—

- 1789—Watt was granted a patent for a steam engine with a separate condenser.
- 1801—Trevithick produced his steam road locomotive.
- 1826—Sir Goldsworthy Gurney began to make and run steam coaches between Gloucester and Cheltenham.
- 1829—Robert Stevenson built the first practical locomotive.
- 1845—Thompson invented and patented the pneumatic tyre.
- 1857—Messrs. Fowler of Leeds made the first traction-engine.
- 1857—Boydell's traction-engines began to rouse interest in the War Department.
- 1865—Parliament paralysed progress by enacting that every mechanical vehicle travelling by road should be preceded by a man on foot carrying a red flag.
- 1865—The bicycle was invented.
- 1876—The Otto cycle internal combustion engine was invented.
- 1884—The earliest Daimler motor-car engine was made.
- 1893—The Diesel engine patent appeared.
- 1896—The repeal of the Red Flag Act.
- 1898—The Royal Automobile Club arranged trials of motor vehicles.
- 1902—Commercial lorries, steam and petrol, were in their infancy.

We shall now trace the various stages by which the engineers of the army seized upon these civil inventions in order to make use of them for their own purposes, and later for those of the army as a whole.

In 1833, we find Colonel C. W. Pasley, Commandant of the R.E. Establishment at Chatham, a member of the committee reporting upon Gurney's steam coaches.

In 1868 the R.E. purchased from Messrs, Aveling & Porter of Rochester a traction-engine, described as "Steam Sapper No. 1." It was named *The Prince Arthur* after the Duke of Connaught, who had recently received his first commission in the R.E.

In 1871, Major-General J. Lintorn Simmons, late R.E., Governor of the R.M.A. Woolwich, was appointed President of a War Office committee to inquire into the merits of various traction-engines. Steam Sapper No. 2 was purchased and was employed on manœuvres to such effect that five more machines were ordered, two of them,

driven by sappers, for pulling heavy guns at Shoeburyness. In India, rubber tyred traction engines in the service of the Post Office were being run by Lieutenant Crompton, K.R.R.C., later Colonel, R.E., T.A.*

In 1873, Major R. Home, C.R.E. of the force sent to Ashanti under Sir Garnet Wolseley, included a steam sapper and saw bench among the plant he took with him. As there was not a mile of road in West Africa outside the coastal towns, it was hardly the best terrain for British mechanical transport to make its début in war, but the steam sapper was found very useful for sawing timber.

In 1877, steam sappers were used for bringing up siege trains and stores during the siege manœuvres at Chatham, and from then onwards the mechanical transport of heavy guns was the constant subject of investigation in co-operation with the R.A.

In 1883, Major Templer,† drew the attention of the army to the value of Fowler traction-engines. In this year, and perhaps earlier, certain R.E. officers began to be sent to civilian firms for training in their workshops.

In 1884, workshops were started at the S.M.E., Chatham, for the mechanical instruction of R.E. other ranks. Since 1870 this had been taking place at Woolwich Arsenal.

In 1886, a new branch was established under the Inspector-General of Fortifications and Works, the officer in charge being known, until 1917, by the curious title of Inspector of Iron Structures (I.I.S.).‡ Fortunately he never limited himself to inspecting such

* Crompton became a very distinguished mechanical and electrical engineer and was President of the Institution of Automobile Engineers, 1906-8. He was first a Volunteer and later a Territorial, R.E., becoming the C.O. and finally the Hon. Colonel of the London Electrical Engineers, R.E.

† Major, later Colonel, Templer, a very notable man, was at the time in the 7th (Volunteer) Battalion, K.R.R.C. He had been authorized to establish a balloon and hydrogen factory at Chatham, transferred in 1892 to Aldershot where its superintendent worked in close collaboration with the Balloon Company, R.E. He was not only an enthusiast for military ballooning, but a fine mechanical engineer and a pioneer in experiments with rubber tyres. He had a long and close connexion with the Corps.

‡ Among the holders of this appointment were Colonel Inglis, Majors English and Bate, Captains J. d'E. Johnstone, C. H. Nugent, 1899, T. H. Cochrane, 1905, A. G. Stevenson, 1909 and R. Oakes, 1913. Oakes's work has been described in Vol. V of this History.

structures, but conceived it to be his duty not only to arrange all mechanical contracts connected with army works but also to co-operate in many branches of research, especially for the provision of mechanical transport for the R.E. and for the rest of the army. Thus we have both the I.I.S. and the Assistant Instructor at the S.M.E. Workshops both working a close liaison with the R.E. Committee on research and the testing of numerous types of mechanical plant and vehicles.

In 1893, and again from 1895 to 1898, steam sappers and hired traction-engines driven by sappers were used on manoeuvres.

In 1897, the R.E. Committee purchased the army's first steam lorry, and from then onwards, numerous tests and trials took place in the contest between the lorry and the horsed wagon. In these tests, Nugent, the I.I.S., and his Staff Captain, R. K. Bagnall-Wild* were to be very prominent right up to 1910. At this time, Captain Gaynor, Assistant Instructor in Workshops, 1893-8, and from 1895 Advisor to the War Office on steam road transport, was on every committee and at every trial of M.T. He was most unfortunately killed in a riding accident soon after joining the Staff College and it almost seemed that the horse had taken his revenge for Gaynor's constant efforts to eliminate him from army transport. His successor at Chatham, Captain F. E. Harward, also did much mechanical research for the army. He was unfortunately killed when sent to start motor transport in Somaliland.

THE SOUTH AFRICAN WAR

The campaign in South Africa was no exception to the rule that every war stimulates the development and application of science to the military art. It was in this war that Lieut.-Colonel E. P. C. Girouard, Director of Railways, caused heavy guns to be mounted on railway trucks, and armoured trains with R.E. crews and sometimes R.E. commanders played an important part under the general command of Major H. C. Nanton, R.E. Moreover, it was in this war that mechanical transport was first employed.

Colonel Templer had been appointed Director of Steam Road Transport with the specially raised 45th Company, R.E., under Captain G. P. Scholfield and one subaltern, E. Barnardiston. The

* In 1917, Brigadier-General R. K. Bagnall-Wild was elected President of the Institution of Automobile Engineers.

traction-engines and trucks with spare parts and workshop equipment reached South Africa at the end of 1899. One shipload had been sunk at Las Palmas, but, whereas the engines were recovered and did their work, the horses in the same ship remained drowned. At the end of 1900, Colonel Templar had to return and Scholfield became Director S.R.T. His workshops and stores at Cape Town were by then in charge of F.E. Harward from the S.M.E. Workshops, and about a year later I. J. Conner from the I.I.S. office joined.* The S.R.T. though mainly used in depots and towns, was sometimes allotted to columns, but rarely with success, because its proper use was not understood. It occasionally hauled heavy guns out of difficulties.

Mobile searchlights drawn by mechanical transport also began their career in South Africa, manned by a very efficient detachment† of the London Electrical Engineers under the redoubtable Colonel Crompton with Captain Lindsay Lloyd as his Adjutant.

The time was not ripe for the reliable and established boiler and steam engine to be ousted for traction purposes by the infant internal combustion engine, but a petrol-driven vehicle was in fact introduced (for the first time) to war by Captain R. S. Walker, R.E. His searchlight company had taken over from the London Electrical Engineers and the lights were deployed in a blockhouse line. He decided to use his automobile to carry out a night inspection, but was soon greeted by a furious fusillade. Dismounting and approaching the blockhouse on foot and then on his hands and knees, which was prudent as he was 6 ft. 6 in. tall, he inquired during a lull in the firing whether they had not been warned of his arrival by car. "Yes" was the reply, "but we did not believe *that* story." As early as 1901 he was preaching that the petrol engine had solved the problem of army transport and of flight in the air, and he reported officially that searchlights should be both carried and supplied with current by the engines of petrol-driven vehicles. By his death on the Western Front the army lost a very promising and far-seeing mechanical engineer.

* By 1st June, 1902, on the declaration of peace, the S.R.T. had grown to 10 officers, 326 R.E. other ranks, 156 civilians, and 238 natives, with 46 steam tractors (41 built by Fowler of Leeds) and 2 steam lorries, drawing 250 trucks.

† The subalterns of this searchlight unit were Lieutenants D. S. Collins (D.F.W. from 1935 and Q.M.G.B. from 1939), C. B. Harvey, A. E. Davidson (Director of Mechanization from 1936) and W. H. E. Forsyth.

THE PERIOD 1902 TO 1914

The success of the S.R.T. in South Africa caused the Inspector of Fortifications and Works, General Sir Richard Harrison, to propose that a committee should be established to study and develop M.T. in the army. The Mechanical Transport Committee (M.T.C.),* which came into being in 1900, contained three subcommittees to deal with the R.A., R.E., and A.S.C. aspects, it being considered that the time had come for the army's transport corps to turn its attention to the possibilities of M.T. The R.A. had, of course, been working in collaboration with the R.E. for some time.

As the result of the deliberations of the M.T.C., the War Office in 1902 made the far-reaching decision that M.T. was not to be confined to technical uses but was to become army transport operated by the A.S.C. It was an entirely new form of activity for a Corps organized and equipped solely on an animal transport basis, and they naturally turned to the R.E. for help in assuming their new responsibilities, which were in fact not entirely transferred until 1910.†

In 1901, 1903 and 1909, on the initiation of the M.T.C., trials were held among civilian firms to obtain suitable types of army vehicles. It is not surprising that these trials were unsuccessful for, on the best civilian technical advice, the army had decided that petrol was too inflammable for use in war. Not till 1912 was this ban removed, when by good fortune the London General

* R.E. members of the M.T.C. included Colonel Crompton, Major Nugent, the I.I.S., *ex officio* and very active in arranging trials and experiments, Colonel T. R. Main and Captains C. H. Prentice and G. B. Roberts. The successive secretaries of the M.T.C. were all R.E. officers—Major Lindsay Lloyd, 1900; Captain Bagnall-Wild, 1906 and Captain A. E. Davidson, 1910-14.

† The stages by which the M.T. Branch of the A.S.C. came into being were as follows: In 1902, one section was formed at Aldershot under R.E. tutelage, but the R.E. ran the M.T. on manoeuvres the following year; in 1903 and 1904, two companies began training at Chatham using the S.M.E. workshops, their instructor, Major M. R. Kennedy, and certain other R.E. personnel being transferred to the A.S.C.; in 1905, M.T. units with steam traction engines first appeared in Establishments; in 1909, A.S.C. officers began training in civilian workshops; in 1910, the A.S.C. M.T. personnel strength was only 600 and experimental work was still under the I.I.S., pending the development of an A.S.C. technical nucleus at Aldershot.

Omnibus Company* had evolved a chassis which was not only suitable for London passenger transport, but also proved very useful for army purposes.

When war broke out in 1914, the 2nd-line transport of the army was entirely on a lorry basis, except for a few workshops drawn by steam tractors. A few years before, the R.E. had handed over complete control to the A.S.C., who themselves, however, owned only twenty petrol-driven vehicles. The 1,000 lorries (3-ton and 30-cwt. with solid rubber tyres) which accompanied the B.E.F. were drawn from civilian sources and subsequent replacements came mainly from America.

Meanwhile the R.A. subcommittee of the M.T.C., assisted by R.E. officers, had been experimenting with mechanized gun-traction. In 1902, Fowler traction-engines had moved a Volunteer 4.7-in. battery fifty miles in one day. By 1912, a Hornsby oil-driven tractor had passed all its trials, and Holt tractors from America were also recommended. Unfortunately the General Staff were doubtful whether heavy artillery would be required in the field and we therefore entered the war in 1914 without a single gun tractor, although both the French and the Austrians each had more than a hundred, equipped with four-wheel drive.

Likewise we had no armoured-car units. Maxim and Vickers had tried, though unsuccessfully, to mount Maxim guns on motors as early as 1896 and 1898, but the car of 1914 still had too little strength and horse-power to carry armour.

MECHANIZATION DURING THE FIRST WORLD WAR

During the first world war the R.E. had no responsibility for the development of army mechanical transport, as this had been completely assumed by the A.S.C., but Major Lindsay Lloyd, R.E., who had retired a few years before the war, rejoined on mobilization and became an important member of the Directorate of Supplies and Transport at the War Office.

When the war caught India without any previously prepared organization for military mechanical transport, they had the good fortune to find Lieut.-Colonel C. H. H. Nugent, R.E., at Army

* The manager of the L.G.O.C. was Major Dumble, formerly adjutant of the London Electrical Engineers. His assistant was Captain Fishbourne, R.E., and under their management the company acquired a virtual monopoly of London motor buses.

Headquarters. He was, therefore, given the extremely difficult task, in 1914, of improvising forthwith the mechanical transport and armoured cars of the Indian Army, not only in India but in the theatres of war in which they were operating.* He succeeded in rapidly creating and working an efficient M.T. organization. After two years, some A.S.C., M.T. Companies arrived in India and Nugent handed over the whole organization to the Director of Supplies and Transport.

The very prominent part played during the war by the R.E. in the creation of the Tank Corps has been described in Volume V of this History, and the story is continued later in the present chapter.

THE INTER-WAR PERIOD

After the war, R.E. officers were constantly associated with the experiments and trials of vehicles of all kinds for the mechanization of the army. They also held key positions at the War Office in the branches concerned with this work. In 1927, the Directorate of Mechanization was formed under the M.G.O. at the War Office. The first Director was a Royal Artillery officer, Major-General S. C. Peck, but many R.E. officers filled important posts in his Directorate. A little later the War Office created a Mechanical Warfare Board. The technical section of this supervisory Board was located at Woolwich under Colonel A. E. Davidson and became in 1934 the Mechanization Board. In 1935, Colonel Davidson was elected President of the Institute of Mechanical Engineers, and in 1936 he succeeded Major-General A. Brough, late R.E., who had been Director of Mechanization at the War Office since 1932. In 1938 Colonel G. Le Q. Martel, late R.E., was appointed Assistant Director of Mechanization and in the same year Deputy Director with the rank of Brigadier.

In 1932 Lieut.-General Sir Ronald Charles became the first Royal Engineer to hold the post of M.G.O. on the Army Council and in 1935 was succeeded by Lieut.-General Sir Hugh Elles, late R.E.

During the years 1929 to 1932, Major R. A. Bagnold, F.R.S., late

* He was assisted by Major G. H. Willis, Captains E. N. Manley, A. H. C. Trench, B. Burgess, G. Nottidge, A. H. Morse, and Lieutenant F. E. Buller—all R.E.—and some R.E. N.C.Os., with officers and British other ranks recruited from the Indian Army Reserve and Territorial Units in India, and with enlisted Anglo-Indians and Indians.

R.E., and son of a Royal Engineer, on his own initiative carried out valuable and extensive explorations by motor vehicle in the deserts of Egypt, Sinai, Palestine and Transjordan—sometimes accompanied by Captain V. F. Craig, R.E., and Lieutenant E. Bader, R.E.—for the purpose of obtaining experience concerning water consumption, reduced tyre pressures, soft going and many other factors affecting vehicle design, performance and equipment for such journeys. Navigation and rapid survey methods were also evolved. A remarkable feature of the 6,000-mile journey of 1932 was that the programme made out before starting was adhered to within one day. He was awarded the gold medal of the Royal Geographical Society in 1935, and his work was of great value to the desert operations of 1939-43.* In 1929, Colonel A. E. Davidson was sent by the War Office to Egypt and to India to establish liaison with the Indian Army on the subject of mechanization. He returned by road via Persia, Iraq and Transjordan and recommended that experimental mechanical convoys be sent on an exploring tour to gain experience as to type, designs and travelling procedure. As a result, a mechanical convoy in 1932 travelled 5,600 miles in the Sudan. Lieutenant H. P. Drayson, R.E., was the navigator of this and of another convoy in 1933.† Other explorations of R.E. officers by car were made by Lieutenant A. W. G. Dobbie,‡ Major R. S. Horner from Baluchistan to England and Lieutenant W. F. Anderson.§ In 1934-5 Captain H. P. Drayson acted as navigator to Captain Kellett's experimental convoys through various European and Asiatic countries to India.

After the war the army strove unceasingly to improve the cross-country capacity of M.T. because until a satisfactory standard was attained it was not practical to scrap animal wheeled transport. In 1923-4 the Sahara Desert was crossed by a six-wheel pneumatic-tired Renault car and in 1926-7, following this experiment, the R.A.S.C. evolved the army six-wheel lorry. In 1930, an even more important discovery was the great capability of the large low-pressure tyre. These were landmarks in the search for cross-country performances.

* See his book *Libyan Sands* and articles in *The Geographical Journal*. He had perfected the sun compass, the radiator condenser, the sand-mat and sand-channel, all of which became articles of equipment.

† See *R.E. Journal* of March, 1934.

‡ See *R.E. Journal* of September, 1934.

§ See *R.E. Journal* of March, 1935.

MECHANICAL ENGINEERS FOR THE ARMY

The organization dealing with mechanization has not yet been discussed except to mention that many important posts were held by R.E. officers. The matter was, however, one of paramount importance to the Corps, for the work was mainly in the sphere of the mechanical engineer, and it was natural that the R.E. should consider very closely their position in this important and rapidly expanding branch of engineering in the army.

During the war it had been found necessary to employ a special body of engineers to deal with the mechanical engineering side of the Tank Corps, and suggestions had been then made that, in view of the rapid growth of mechanization, the army of the future would need a great body of mechanical engineers to deal with both the repair and provision of armament and all mechanical vehicles. Lord Weir, as President of a committee in 1923, put forward similar suggestions and gave it as his opinion that R.E. officers should be employed on this work, making it clear that a properly constituted body of mechanical engineers would be needed. In 1924, this important proposal was fully discussed in the War Office, affecting as it did very vitally the responsibilities of the Master-General of Ordnance and of the Quartermaster-General, and above all the future capacity of the army to develop and operate mechanically.

The whole question of the functions, organization and training of the Corps of Royal Engineers had to be reconsidered in connexion with this fundamental proposal of Lord Weir's Committee. The main questions were :—

- (a) Should the R.E. be responsible for those administrative duties, then dealt with under both the M.G.O. and Q.M.G., concerning the design and provision of vehicles, weapons and technical equipment of all kinds—in fact, of munitions ?
- (b) Should the R.E. take over all mechanical workshops and be the sole source of supply of mechanical engineers and artisans ?

As regards the first question, it was agreed that the R.E. should continue to find selected officers with particular mechanical aptitude for the administrative duties defined above, but that it was important that selected officers of "user" branches of the army, who likewise showed aptitude for this work, should help to staff the administrative posts.

The second question presented a much more thorny problem as it required radical re-examination of the functions, organization and training of the Corps. Was it necessary that this mechanical work should be done entirely by specialists relieved of all normal R.E. military and general engineering responsibilities? The Corps had always found it advantageous to avoid complete specialization in any particular branch of engineering, although an appreciable percentage of officers and other ranks developed into specialists by the accident of almost continuous employment in work for which they showed particular aptitude. Did this new proposal now require the Corps to depart from this fundamental principle, or could they undertake this mechanical work for the army without being compelled to form a specialist branch? Volumes might be written to discuss these questions but the historian must here be content to record results only.

The Army Council decided not to place this responsibility on the Corps of R.E., but no serious effort was made to form a separate body of mechanical engineers. When Field-Marshal Lord Milne became C.I.G.S. in 1926 he revived the whole question and appointed a committee, over which he himself presided. As a result it was decided to make changes in the distribution of duties between the M.G.O. and Q.M.G., transferring the R.A.O.C. Directorate from Q.M.G. to M.G.O., and the D.F.W. from M.G.O. to Q.M.G. The responsibility for repairing M.T. vehicles was left with the R.A.S.C. under the Q.M.G., but design and production was to be under the M.G.O. Again no serious attempt was made to raise a body of mechanical engineers.* It was, however, decided that the administrative branches dealing with munition supply should be staffed by regimental officers who had completed a course at the Military College of Science at Woolwich.

The above organization was in existence from 1929 until the rearmament programme was initiated in 1936. In 1937, Admiral Brown was appointed Director-General of Munitions Production at the War Office, with Lieut-General M. G. Taylor, late R.E., as Deputy M.G.O. The new D.G.M.P. was impressed by the lack of a

* The numbers of mechanical engineers in the R.A.S.C. and of O.M.Es. in the R.A.O.C. did, however, begin to increase after this committee had given their recommendations. The R.A.O.C. remained responsible for maintenance of weapons and fighting vehicles, including tanks, responsibility for which they had taken over from the R.E. soon after the war.

properly constituted body of mechanical engineers in the army, and formed the opinion that the Corps of Royal Engineers should father this body. A committee, of which General Venning was Chairman, was formed in June, 1938, to consider this subject, but no further change in the organization of mechanical engineers in the army had been made before this controversial problem was subjected to the supreme test of war in September, 1939. As a result, the Corps of Royal Electrical and Mechanical Engineers (R.E.M.E.) was constituted in 1941, in time to prove their great value in the critical battles of 1942 and subsequently.

MECHANIZATION OF R.E. UNITS

The successful use of mechanical vehicles by searchlight units in South Africa encouraged the mechanical enthusiasts on the R.E. subcommittee of the M.T.C. in May, 1901, to make the sweeping recommendation that steam tractors or lorries should be used by the following R.E. units: the Pontoon Troop, Field Company, Field Park, Railway Company, Telegraph Division, Searchlight Unit and Balloon Section, requiring some ninety vehicles per army corps. Only the Field Troop, Survey Section and Balloon Depot were to retain horse transport. This optimistic proposal was of course far in advance of the mechanical developments of the day, for M.T. at that time was tied to roads or very hard ground and would have been useless for such units as field companies or those of the Telegraph Division. Nevertheless, this proposal certainly showed courage and no small power of prophecy.

In 1911, an East Anglian Territorial field company, under Captain (later Colonel) F. Wilson designed and made a motor tool cart,* that had considerable cross-country capacity. On manoeuvres in 1912, it so demonstrated the increase in power bestowed by mobility that the R.E. Board soon recommended its adoption in place of the horsed tool cart. The estimated cost, £60,000, was, however, considered unthinkable for such a hazardous experiment.

When the R.E. went to war in 1914 their mechanical transport consisted of a few petrol-electric searchlight lorries and still fewer light trucks with signal units.† Their many years of effort had done

* See *R.E. Journal*, March, 1938.

† There were also the traction-engines at Chatham and a reserve of civilian dispatch riders (with their own motor cycles) formed in 1910 and organized by Captain E. G. Wace, R.E., under the D.M.T., War Office.

much for the army, but virtually nothing for themselves, and not even were they allowed the use of any of the A.S.C. mechanical transport except for short and uncertain periods. We must try to remember, however, that the lorry of 1914, with its narrow solid rubber tyres, was hardly a substitute for the tried and versatile four-horsed tool cart, and that no other unit in the army had anything but horsed *first-line* transport.

During the war, considerable advances were made. Following the anti-aircraft searchlight units; pontoon parks, army troops and E. & M. companies were given motor transport—mainly 3-ton lorries. Even the field squadrons, started, as early as November, 1914, virtually to discard the use (but unfortunately for them not the watering, feeding and grooming) of their horses and employed borrowed lorries for moving men and stores to the work. In the mountains of Macedonia field companies during the final advance supplemented and sometimes replaced their pack transport by motor vehicles. Three completely mechanized R.E. battalions for work with tanks were about to take the field on Armistice Day, 1918, and at that time the Director of Roads was using 700 steam lorries on the Western Front.

After the war there was little or no advance in the mechanization of R.E. units for many years, and in fact, in personnel, equipment, tools and transport, the field company of 1931 was almost identical with that of forty years before. Mechanization of the R.E. had to proceed *pari passu* with that of other arms and, money being very short, there was of course a strong disinclination to commit the army to a type of vehicle, as yet by no means perfect, at a time of continuous improvement in design.

By 1927, the advent of the six-wheeled lorry had entirely changed the outlook, and a mechanized force had been formed containing a mechanized field company. This unit, in conjunction with the Experimental Bridging Establishment and under the direction of the R.E. Board, was destined to try out, and often to initiate, many ideas that were to benefit all other field units when they in their turn discarded horses for motor transport. The mechanized 17th Field Company, under Major Martel and later Brevet Lieut.-Colonel N. T. Fitzpatrick, became, in fact, the trial ground for the majority of proposed equipment,* field unit establishments and loading tables. Similar work for army troops and E. & M. companies was carried out at Chatham.

* Changes in equipment have been described in Chapter XVII.

By 1931, it was possible for the Army Council to order the parade of a division mobilized on the latest (mechanized) war establishments. Those for divisional engineers had been delayed and were only received just in time to enable the Sappers, after all their work for mechanization, to parade as modern units and not in a form dating from before the days of the first petrol engine.*

In 1932, funds were at last allotted for the gradual conversion of R.E. units to mechanized establishments and this conversion was complete in 1937.† There had been much controversy upon such questions as the proportion of the personnel to be given accommodation in the unit vehicles, and the quantities of bridging equipment to be carried within the division, but fortunately parsimonious counsels did not prevail, and the units that went to war in 1939 were granted that additional power that comes from real mobility.

R.E. AND THE ROYAL TANK CORPS

Mention has been made of the special Royal Engineer units that were formed late in 1918 to carry out all normal R.E. duties for the Tank Corps in the field. During the war, the Tank Corps had employed special tanks for such tasks as the removal of barbed wire obstacles, the laying of bridges under fire and cable burying with a mole drainer. These are normal R.E. tasks, but the Tank Corps had found difficulties in the organization and training of crews for what to them was a specialist rôle. It, therefore, became apparent that a R.E. unit, using their own specialist tanks, would be needed to carry out these duties.

It was first necessary to obtain a suitable type of specialist tank that could carry out as many of these tasks as possible. A new design was, therefore, prepared and constructed at Christchurch in 1919 and became known as the R.E. tank.‡ Briefly, the tank had a short stiff derrick in front worked by an hydraulic ram, and could perform the following operations—carry and lay under fire a 21-ft. bridge to carry 35 tons; propel a heavy steel roller in front of the tracks for detonating, without damage, the anti-tank mines of that period; push a 70-ft. heavy bridge, mounted on idle tracks,

* The divisional engineers had at first actually been ordered to parade as the only units on a horse-transport basis.

† It was just over a century since the Commandant at Chatham had reported on the first practical mechanized road vehicles.

‡ See *R.E. Journal*, October, 1920.

and launch it under fire ; perform other specialist duties such as the clearing of barbed wire obstacles with grapnels, the firing of demolition charges suspended from the derrick in front, etc. Great changes in policy, however, took place at this time. The army was to be trained and equipped for mobile operations, and thus the heavy war-time tanks designed for trench fighting became obsolete. The prototype heavy R.E. tank, however, was destined to survive and to outlive all its brethren, but only in the humble rôle of acting as a very heavy mobile load for testing bridges at Christchurch.

After the war, the Tank Corps Training Centre was established at Bovington with Major-General Sir Hugh Elles as Commandant until 1923, when he became the first Inspector of the Royal Tank Corps at the War Office. It was soon decided that the R.A.O.C. should take over tank repairs and the special engineer officers in the Royal Tank Corps were abolished, though Lieut.-Colonel G. C. Gowlland, R.E., remained in charge of the workshops at Bovington until 1922.

In 1921, the Royal Tank Corps was equipped with the first post-war tank, made by Messrs. Vickers. It was far lighter and more mobile than the war tank, but was still a large and expensive machine. On several occasions suggestions had been made that there would be many advantages in using a larger number of smaller machines for an attack on a defensive position. As no official action had been taken on these proposals, Major G. le Q. Martel designed and constructed with his own hands a small lightly-armoured tank, driven comparatively easily by only one man, who could also fire a machine-gun to the front or flanks. Demonstrations with this machine raised considerable interest but it was decided that two men would be better than one. A number of machines were then built by Messrs. Morris Commercial to take two men with an armament of one light automatic. This action led Mr. Carden (later Sir John) to revive a type of small unarmoured machine to which he had given some thought. He had many discussions with Major Martel, and his later models, which differed considerably from his first ideas, became very useful vehicles. This form of small machine eventually bifurcated into two types—the machine-gun carrier and the light tank.

In 1926, it was decided, as we saw in the previous section, to form a mechanized force on Salisbury Plain, consisting of a medium tank battalion, supported by a field artillery brigade and a machine-gun battalion carried in cross-country lorries. A number of the small

machines referred to above were added to carry a reconnaissance unit. It was then decided that the 17th Field Company, commanded by Major Martel, should be mechanized and co-operate with this force. It will be seen that a large part of the force was unarmoured and the field company was to be unarmoured also. Much of the work was that of a normal field company though for the first time entirely mechanized. Some attempts were made, however, to revive the ideas of the special R.E. units working with tanks, which had been tried during and immediately after the war.

While the mechanized force was being formed, a great display of mechanical vehicles was given to the Dominion Premiers in the autumn of 1926, and, as part of the demonstration, the 17th Company was ordered to provide a display of passing tanks rapidly over river obstacles. In addition to the use of the normal pontoon equipment, three other methods were demonstrated. First of all, tanks were passed over a stream, 50-ft. wide and 5-ft. deep, by the use of light timber "stepping stones." By this method the first tank was passed across in just under one minute from the arrival of the sappers at the site. Next the tanks were passed over an improvised 60-ft. light box-girder bridge which was launched across the river and completed in seventeen minutes. Lastly, a bridge designed by Major H. H. Bateman was placed across a 28-ft. river without exposing the crew, and tanks were passing over within two minutes. This bridging display occupied less than half an hour and showed the river obstacles would not necessarily be a serious handicap in future tank operations.

In 1928, the name of the mechanized force was changed to the Experimental Armoured Force and it was intended to assume for the purpose of trials that it was entirely armoured. This was ahead of practical possibilities and the following year the force was disbanded. A little later it revived in a different form as the Tank Brigade. In this form the whole force was armoured except for the transport, but no steps were taken to introduce an armoured R.E. unit into the brigade. It was not, in fact, until comparatively late in the second world war that vastly increased tank production made possible the formation of armoured assault engineers.

Major-General Sir John Capper and later both Major-General Sir Ernest Swinton and General Sir Hugh Elles became Colonels Commandant of the Royal Tank Corps. In 1934, Brigadier P. C. S. Hobart, late R.E., who had joined the Royal Tank Corps after the war, became Inspector of the Royal Tank Corps at the War Office.

In 1937, he was appointed to command the Tank Brigade. Brigadier Hobart had been an ardent enthusiast for mechanized warfare from the start, and much of the progress made in establishing armoured forces for mobile fighting was due to his initiative and drive. He became Director of Military Training in 1938 and towards the end of that year was ordered to Egypt to form and train what was destined to be the famous 7th Armoured Division.

CHAPTER XXII

OPERATIONS DURING THE INTER-WAR PERIOD

R.E. with the Shanghai Defence Force, 1927—The Abyssinian crisis, 1935—Disturbances in Palestine, 1929 and 1936.

R.E. WITH THE SHANGHAI DEFENCE FORCE, 1927

EARLY in 1927 the Chinese civil war, which had been endemic since the fall of the Empire in 1911, assumed a distinctly anti-foreign tinge, causing serious alarm for the safety of British lives and property in the Treaty Ports. The British Government therefore decided to dispatch a military force to Shanghai where most of British interests were concentrated. The Shanghai Defence Force was about the size of a division and was composed of an Indian brigade and two brigades from England, with additional units to make up a self-contained command. The sole engineer troops* consisted of No. 10 Field Company, Q.V.O. Madras Sappers and Miners, under Captain G. R. Gilpin. The C.R.E., Lieut.-Colonel E. A. H. James, was also allotted a very small staff of R.E. officers and other ranks to carry out works duties, which were expected to be mainly concerned with the provision in Shanghai of accommodation for the troops and their stores. The first troops to arrive were the Indian Brigade with No. 10 Field Company, which disembarked on 17th February, 1927.

Of the two areas under foreign jurisdiction in Shanghai the French defended their own Settlement, while the International Settlement was the responsibility of the British, except for small areas allotted to Italian sailors and Japanese. The length of the British perimeter was about fifteen miles. On the two flanks it was in quite open cultivated country, but in the centre ran through the streets of a very thickly populated area with no visible sign to mark the boundary between the International Settlement and the Chinese city adjoining it. One side of a busy street was often in the Settlement while the

* There was also a litho-printing section and postal section, both of which did excellent work.

densely packed houses on the other were in purely Chinese territory. The system of defence was based on section posts, with lines of fire crossing the front, and so sited that they could not be brushed aside. They were generally connected by wire entanglements and were supplemented when time permitted by a second line of posts to control areas in rear.

Immediately on its arrival, the British force manned the perimeter and allowed no armed Chinese soldiery to enter. A state of emergency was declared on 21st March when the opposing Chinese armies engaged one another on the outskirts of the Settlement and there was an attempt on the part of the combatants to force their way in. This noisy period, which formed the climax in the affairs of the Defence Force, was soon followed by increasing quiet, till at the beginning of July conditions had improved so much that a gradual reduction of the force was begun.

The two main problems with which the Royal Engineers were concerned were the defence of the Settlement against armed aggression and the accommodation of the force inside.* The responsibilities allotted to the engineers in the Defence Scheme included the design and the supervision of the construction of all defences and the provision and distribution of all the materials required. As much of the country was waterlogged, posts had to be constructed with breastworks for which all kinds of materials were employed. Sand-bags, reinforced concrete, bamboo hurdles and steel plates had their uses, but perhaps the simplest and best results were obtained from road metal held between sheets of corrugated iron. As there were about a hundred defended posts, it will be easily appreciated that the work done by the Sappers and Miners, especially in the early days, under constant pressure and often in bitterly cold and wet weather was extremely arduous; but at work or play, for drill, discipline or smart turn-out, No. 10 Field Company was unbeatable.

Next in importance came the task of accommodating nearly 17,000 men together with the provision of a host of accessory buildings such as offices, stores, bakeries, workshops and hospitals.

The Defence Force had been dispatched at very short notice, which inevitably resulted in troops arriving before adequate preparations could be made to receive them, but much had been done by local effort before the arrival of any troops at all. The Commander-in-Chief of the China Station in conjunction with H.B.M.

* See articles in *The R.E. Journal* of 1928.

Consul-General had arranged for a Billeting Committee to be formed from leading civilian residents under whose auspices the construction of a large hutted camp and four smaller ones had been begun. These were only partially completed on the date of arrival of the troops, who had perforce to be kept on board ship for a few days before being crowded into the unfinished camps or into such empty buildings as could be made suitable for billets.

Such was the general situation when the C.R.E. of the force and his very small advanced party* made their appearance on 28th February. With such a small staff and in complete ignorance of local conditions, the C.R.E. obviously could not take over immediate control of the work then in the hands of the Billeting Committee, and the general policy he adopted was to allow the Billeting Committee to finish their hutted camps and to try to meet the immediate requirements of the troops in billets, while gradually setting up an organization for dealing with the large amount of additional work that would obviously be required.

Alarming stories of the hot weather were forthcoming from responsible local residents, and it was evident that all the camps already being built would have to be reconstructed if they were to be fit for occupation in the summer months. Consequently, for the additional camps, a standard hut had to be produced to fit the expected weather conditions. Two main types were devised—one, a hut, 70ft. by 20 ft., used chiefly for barrack rooms, the other, one of 35-ft. span, used for dining rooms, kitchens and canteens. Two thousand five hundred very satisfactory oscillating fans were purchased in Japan at a cost just half of that asked by European firms.

The clash of opposing Chinese forces on the outskirts of the Settlement on 21st March—just as the R.E. organization for the provision of suitable accommodation was getting into running order—was the cause of some minor difficulties. Troops, under tactical necessity, entered many houses in the vicinity of the defence line, and this naturally led to large bills for compensation and damages which were difficult to check. Moreover, many of these billets had no lighting, cooking, water or sanitary arrangements, and the provision of these largely increased the imperative work in hand. A general strike of all Chinese workmen was called, but luckily did not last very long. In view of the possibility of a future stoppage,

* Lieutenant V. Dykes and four other ranks; increased later by the arrival of Major F. V. B. Witts, and Lieutenants J. E. C. McCandlish, N. Wilson and E. S. de Brett.

it was decided to raise the nucleus of a works company composed of exiled White Russians, of whom there were many in Shanghai at the time. This was done by Captain N. C. D. Brownjohn,* who was a Russian interpreter and was kindly spared by the Chief Engineer, Hong Kong. The men, headed by an ex-Russian engineer officer of the Tsarist Army, were employed for many months,

With the arrival of summer, work grew lighter and difficulties began to fade away. By July—five months after the arrival of the first troops—the 17,000 men belonging to seventy different units had all been adequately housed in either huts or converted buildings. The 269 huts ordered by the Billeting Committee had been completed, all with considerable alterations and additions, and 286 standard huts with nearly 200 subsidiary buildings had been constructed in addition to nine tented camps with generous accessories. The hired and converted buildings were a strangely mixed collection and included blocks of flats, schools, offices, shops, warehouses, factories, dance halls, and private houses. There was also a theatre, hotel, Turkish bath, riding school, amusement palace, race course grandstand, police station, fire station and gaol. The British hospital was in a new school and a new block of flats and the Indian hospital in a piano factory.

This amount of work could not have been done without the ever-ready help of the Commissioner of Public Works and his staff, and certainly not without the untiring efforts of the junior R.E. officers who worked sixteen hours a day for months on end. The extreme speed and energy of the Chinese contractors and their workmen were a revelation to new-comers to the country, but perhaps the most potent factor, among those that made it possible for an inadequate staff to spend economically nearly a third of a million pounds in a few months and to have the bills all checked and paid a few months later, was the fact that the C.R.E. and his officers were given a free hand to do their best under difficult circumstances without interference from outside.

THE ABYSSINIAN CRISIS

When Italy invaded Abyssinia in 1935 a British force was sent in the autumn to Alexandria, and this necessitated the very rapid

* He became Vice C.I.G.S. in 1950.

provision of accommodation for a brigade group in the outskirts of the town and the conversion of a requisitioned hotel into a hospital. The force contained 6-in. guns and searchlights which were erected for the defence of the harbour. In December most of the force with troops from Cairo, including the 2nd Field Company, moved to Mersa Matruh with outposts at Sollum. The main engineer problem was the supply of water, which was obtained from shallow wells and by opening up the old Roman aqueducts, destined to play such an important rôle in World War II. The force contained two companies of searchlights from the 1st A.A. Battalion, one for the defence of Alexandria and the other to form part of the Mobile Naval Base designed to replace Malta. The latter company moved with the other troops to Matruh. It was later relieved by the other, who proceeded the following July to Palestine and was used for illuminating stretches of railway and pipe-line to assist in preventing sabotage.

DISTURBANCES IN PALESTINE, 1929 AND 1936

There had been considerable anti-Jewish feeling on the part of the Palestine Arabs, who complained that they were being dispossessed of their land by the Jews in order to establish farming colonies for the numerous immigrants from Europe. In 1929 these feelings reached a point at which the Arabs began to take violent action.

There was at this time no army garrison in the country, the only support for the civil power being provided by some R.A.F. units including a few armoured cars. In August the situation became so threatening that troops from the Cairo Brigade, under Brigadier W. G. S. Dobbie, (later Lieut.-General Sir William G. S. Dobbie, G.C.M.G., K.C.B., D.S.O., LL. D, late R.E.), were sent to provide immediate assistance. One battalion was moved by air and two others with ancillary troops, including one section of the 42nd Field Company, followed by train. The Arab attacks were directed almost entirely against the Jews and did not interfere with road, rail and telegraph communications. The troops were thus able to use their mobility to the full and within three weeks of their arrival normal conditions were restored. Brigadier Dobbie, who had been put in command of all forces, was then able to hand back control to the A.O.C. and to return to Cairo. The army units were sent back to Egypt with the exception of a battalion at Jerusalem which had two companies detached at Haifa.

This was the situation in 1936, when the Arabs made a further

and far more serious effort to counter the Jewish infiltration. The Mufti of Jerusalem, Haj Amin el Husseini, organized a general strike designed to paralyse the civil government, while Arab bands attacked Jewish settlements, disrupted all forms of communication and damaged the pipe-line to the Haifa oil refinery. To meet this situation, the 5th Division, less artillery, was moved from Egypt, and early in September it was decided to send in addition the 1st Division from Aldershot and to form a corps headquarters, under Lieut.-General Sir John Dill, to take charge of all troops in Palestine. Colonel N. W. Napier-Clavering was appointed Chief Engineer and ordered to sail at six days' notice. He was to co-ordinate the engineering activities of the Army, the R.A.F. Works Service and to some extent the Palestine P.W.D. Each of the two divisions had a C.R.E. with two field companies but there was no army works organization. It was laid down that the peace-time system of accounting should be maintained.

On arrival at Haifa it was found that the strike was in full swing, the roads were impassable except by escorted columns, the railways were liable to interruption by sabotage and the Arabs were making murderous attacks on Jewish colonies throughout the country. The members of the corps headquarters from England moved by rail to Lydda and thence by car to Jerusalem, where they joined those already working. It was a shock to find that communications (except by air) with the base at Haifa hardly existed and in fact the Chief Engineer's office stores did not arrive for more than a week. Even then they were found to be war mobilization stores containing little of any use for the peace system which had to be followed. In these circumstances some initial confusion was inevitable. Stores, in particular, arrived with inadequate personnel to handle them and accounting never really recovered from the initial set-back.

The engineer problems fell into three main categories. First there was the work required to keep open the railway and roads which were constantly mined and ambushed; secondly there was the task of providing immediate accommodation for the large number of troops; and thirdly the longer term problem of building hutted camps before the winter for those who could not be billeted. The repair of damaged roads was undertaken by the field companies, who also carried out many other tasks to assist the infantry in dealing with the guerrilla bands. One of the deterrents designed to discourage the Arabs was the destruction by explosives of houses in

which arms had been found or to which active guerrillas had been tracked. This gave much practice in the calculation of the charges necessary to destroy individual stone houses without damage to those near by. Stone for the railways and roads was quarried by the Government using convict labour. The 42nd Field Company undertook the running of the main quarry and the defence of the convict barracks against frequent night attacks. The 8th Railway Company helped not only to repair and keep open the railway but also for a time and with naval help to man trains and the pilot trolleys which preceded them. When the country had been partially pacified and the hostile Arabs driven into the hills the company undertook the reopening of the metre-gauge railway from Haifa to Jenin, Massoudieh, Nablus and Tulkarm.

The provision of accommodation proved to be very difficult. There were only barracks, each for a half battalion, at Jerusalem and Haifa, with a small hospital at Sarafand. Camps and billets were provided for the remaining troops but these involved much work in building cookhouses, ablution facilities, etc. The autumn rains in Palestine are very heavy and much of the soil becomes a quagmire so that it was important to produce hutted accommodation without delay. The siting of the hutted camps depended to some extent upon the rather unsuitable road system, much of which passed through the hills and was very vulnerable. The civil government had, however, started a road along the coastal plain from Lydda through Tulkarm to Haifa, with a branch from Tulkarm to the coast at Nathaniya. It was, therefore, decided to build huts for two battalions at Sarafand and for one at Nathaniya. The accommodation at Jerusalem and Haifa was also to be increased to hold one battalion at each place. Hutted camps were also to be built for one or two companies at certain strategic points such as Nablus, Jenin, Tulkarm and Tiberias. The work was to be carried out by contract under R.E. supervision. All materials had to be imported and neighbouring countries were combed to supplement supplies from home. Much was received from Egypt, including the huts erected at Mersa Matruh during the Abyssinian crisis. The dismantling and shipment of these huts caused such damage that an enormous amount of work was necessary before they were finally re-erected in Palestine. There did not seem to be the slightest prospect of completing the accommodation before the rains began, and this would not have been done but for two unforeseen happenings. The rains were a month late and the collapse of the Arab strike

combined with the quelling of the guerrillas made it possible to return the first division to England early in October, thus halving the problem. In the result only one battalion was in tents when the weather broke and it moved into huts a fortnight later.

On the departure of the corps headquarters, engineer work in Palestine was taken over by a C.R.E., Lieut.-Colonel C. C. Phipps, with a small establishment. He later handed over to Lieut.-Colonel J. D. Inglis. Early in 1937 it was decided to construct a road from Haifa to Baghdad, and a special staff, under Major R. Briggs, was provided to carry out this large work with direct labour. His estimate of £550,000 caused considerable discussion and it was late in 1938 before work started. The road was finally completed, by Major N. C. Hammond, during World War II, but was passable when hostilities began and was used for many vital moves during the war.

CHAPTER XXIII

EXTRA-REGIMENTAL EMPLOYMENT

Military attachés—Inspecting Officers of Railways—Colonial Office appointments—Palestine Public Works Department, 1920-3—Railways in Tropical Africa, 1919-39—Roads in the Gold Coast.

MILITARY ATTACHÉS

THE following R.E. officers held the appointment of Military Attaché to one of His Majesty's Embassies or Legations at Foreign Courts :—

Lieut.-Colonel C. B. Thomson	Bucharest	1915
Major H. G. Gandy, D.S.O., O.B.E.	Lisbon	1919
Brevet Lieut.-Colonel F. S. G. Piggott, D.S.O.	Tokyo	1921
Colonel F. L. N. Giles, D.S.O., O.B.E.	Belgrade	1925
Colonel J. J. H. Nation, C.V.O., D.S.O.	Rome	1927
Colonel R. E. M. Russell, C.B.E., D.S.O.	Santiago	1927
Lieut.-Colonel K. J. Martin, D.S.O.	Warsaw	1928
Major W. H. Oxley, M.C.	Belgrade	1929
Colonel G. G. Waterhouse, M.C.	Paris	1931
Colonel E. A. H. James	Tokyo	1932
Colonel R. G. W. H. Stone, D.S.O., M.C.	Rome	1935
Lieut.-Colonel J. T. Godfrey	Warsaw	1935
Major-General F. S. G. Piggott, C.B., D.S.O.	Tokyo	1936

The following officers held the appointment of Assistant Military Attaché :—

Major K. J. Martin, D.S.O.	Paris	1927
Captain J. T. Godfrey	Washington	1928
Major R. A. Hay	Berlin	1934
Captain B. C. Davey	Rome	1935

Lieut.-Colonel C. B. Thomson was later created Lord Thomson of Cardington and, when Secretary of State for Air, met his death in the disaster to the airship R.101 in 1930.

INSPECTING OFFICERS OF RAILWAYS

The Government has exercised since 1840 technical supervision over the railways, tramways and trolley vehicle undertakings of Great Britain (and Ireland up to 1921) by means of an Inspectorate, formerly under the Board of Trade but since 1919 under the Ministry of Transport. Officers of the R.E., without break, have formed the Inspection Staff as under :—

Board of Trade

Lieut.Colonel Sir J. M. Frederick Smith*	1840-1841
Lieut.-Colonel R. Thomson	1840
Captain S. C. Melhuish	1840
Major-General Sir C. W. Pasley*	1842-1846
Captain J. Coddington	1844-1847
General Sir J. Lintorn A. Simmons	1847-1862
Lieut.-Colonel Geo. Wynne	1847-1858
Captain R. M. Laffan	1847-1852
Captain D. Galton	1850-1857
Captain H. W. Tyler	1853-1876
Colonel W. Yolland	1856-1884
Captain G. Ross	1858-1861
Colonel F. H. Rich	1861-1891
Major-General C. S. Hutchinson	1867-1895
Colonel Sir Francis Marindin	1877-1899
Lieut.-Colonel Sir H. Arthur Yorke†	1891-1913
Lieut.-Colonel G. W. Addison	1894-1899
Lieut.-Colonel R. G. Von Donop†	1899-1916
Colonel Sir John W. Pringle†	1900-1929
Lieut.-Colonel E. Druitt	1900-1918
Lieut.-Colonel G. L. Hall	1919-1927

Ministry of Transport

Lieut.-Colonel A. H. L. Mount†	1920
Colonel A. H. C. Trench	1927
Lieut.-Colonel E. P. Anderson	1929-1934
Lieut.-Colonel E. Woodhouse	1930
Major G. R. S. Wilson	1935

* Inspector General of Railways.

† Chief Inspecting Officer of Railways.

The Inspecting Officers are responsible to the Minister of Transport for all technical advice upon railway, tramway and trolley vehicle matters. Their duties consist primarily in the inspection, from the safety aspect, with the full authority of legislation, of new works on railways carrying passenger traffic, and of all new tramway and trolley vehicle equipment. They are also responsible for holding Inquiries, and advising, upon all accidents to the public and to employees in connexion with these three transport services; on occasions, they act as Assessors at Coroners' Inquests.

Inquiries into railway accidents were held from 1840 onwards under the general powers contained in the Acts of 1840 and 1842 for "regulating the railways." In 1871, specific powers were granted to order an Inquiry, or, if the circumstances justified such action, to set up a Court of Inquiry which should have the same powers as a Court of Summary Jurisdiction. Generally the former procedure has been found sufficient for the purpose, and the Inspecting Officers have conducted their Inquiries in a manner that seems to them best suited to the circumstances of the case. There is no obligation upon undertakings to comply with recommendations when criticisms are raised on methods of operation, maintenance, etc.; but each accident report is required by law to be made public, and, in practice the advantages of the procedure and the lack of bias in the recommendations are such that an Inspecting Officer's suggestions are always fully considered and generally adopted. The Chief Inspecting Officer also submits an Annual Report to the Minister, who presents it to Parliament.

In addition to their statutory duties mentioned above, the Inspecting Officers in the past twenty-five years have sat on numerous departmental and other committees dealing with such varied subjects as the safety of railway employees, bridge stresses, permanent way and signalling, electrification of railways, automatic train control, wireless in traffic operation, British Standard Specifications, etc.

COLONIAL OFFICE APPOINTMENTS

Following in the steps of their predecessors, R.E. officers continued to provide Governors for Colonies and also a permanent Under-Secretary of State at the Colonial Office from 1925 to 1933, namely, Brigadier-General Sir Samuel Wilson. Another Royal Engineer, Sir Montague F. Ommaney had filled the same post from 1900 to 1906.

approved, and gradually recruited during 1921-3 by transfers from the former staff, local engagements and appointments from home.

In its early days the P.W.D. suffered from lack of staff, plant and materials and was somewhat overwhelmed by a flood of urgent demands, especially as it was without suitable accommodation and had no regulations to guide its procedure. Gradually, however, as staff was obtained and the system that had been evolved became better understood within and without the department, the control and execution of works began to run more smoothly. Headquarters P.W.D. and its M.T. workshops were at Jerusalem, with a District Engineer and Assistant District Engineer in each Governor's district. Within the limits of the annual Public Works budget, the department dealt with new and maintenance services for Governors of Districts and Heads of Administrative Departments. It was also responsible for all government mechanical transport, possessed its own fleet of road rollers and for a time maintained a small bus service for the use of junior officials at Jerusalem. Technical questions connected with the Rutenberg Concession for the generation of electricity from the Jordan were referred to it for examination.

The following were the most important undertakings in the early days of the P.W.D. : The repair, extension and maintenance of the metalled roads of the country ; the increase of water supply for Jerusalem by the installation of pumping plant at Solomon's Pools ; and the dredging and removal of obstructions from Haifa Quay. Other work undertaken was concerned with accommodation for officials and their families, sanitation, offices, stores, customs houses, police and gendarmerie buildings, magistrates' courts, post offices, prisons, hospitals and village water supplies.

There was a qualified architect on the staff, which included Christians, Jews and Arabs, who, within the department, all worked together harmoniously. Good work was also done by Christian, Jewish and Arab contractors. In addition to the Director, the following R.E. officers served with the Department : Brevet-Major H. S. Briggs, Assistant Director, E. & M. ; Major H. F. B. S. Moore, District Engineer ; and Lieutenant (Q.M.) T. Smith (retired), Assistant District Engineer.

RAILWAYS IN TROPICAL AFRICA, 1919-39

For many years before 1914 the Corps had been associated with the construction and operation of railways in Africa. Their achieve-

Colonel Sir Percy Girouard was Governor of Northern Nigeria from 1907 to 1909 and then of Kenya, until 1912.

Lieut.-Colonel Sir John R. Chancellor was Governor of Mauritius from 1911 to 1916, when he moved to be Governor of Trinidad until 1921. In 1923, he was appointed the first Governor of Southern Rhodesia on the termination of the administration of that territory by the British South Africa Company. In 1928, he moved yet again and held the post of High Commissioner for Palestine and Transjordan until 1931.

Brigadier-General Sir F. Gordon Guggisberg was Governor of the Gold Coast, from 1919 to 1927 and Governor from 1928 to 1929 of British Guiana, where he died in 1930. He caused to be constructed the harbour of Takoradi, allowing ocean-going steamers for the first time to come alongside their berths and dispense with the use of surf-boats. He was also responsible for great advances in the survey and in the construction of roads to be described at the end of this chapter.

Major Sir John E. Clauson was Lieut.-Governor of Malta and High Commissioner and C.-in-C. of Cyprus from 1911 till his death in the island in 1918.

Major Sir Maurice Cameron succeeded Sir Montague Ommaney in 1895 in the important post of Crown Agent for the Colonies in London. He was followed later by another Royal Engineer, Lieut.-Colonel J. G. Fleming.

We find R.E. officers in charge of Colonial Public Works Departments. Colonel S. D'A. (afterwards Sir Sydney) Crookshank held that post in Nigeria from 1923 to 1924, and Lieut.-Colonel R. L. Lees a similar appointment in the Gold Coast, while Major-General P. G. (afterwards Sir Philip) Grant was the founder of the Palestine P.W.D. His work is described in the next section.

PALESTINE PUBLIC WORKS DEPARTMENT, 1920-3

In the summer of 1920, when Military Control in Palestine was replaced by a civil administration, Sir Herbert Samuel became the first High Commissioner under the Mandate and Major-General P. G. Grant was appointed Director of Public Works in his Administration. Reaching Jerusalem at the close of 1920, General Grant reconnoitred the country, ascertained the probable kind and quantity of work to be done and then submitted his proposals for an establishment of staff for the new P.W.D. This establishment was

ments in Egypt and the Sudan have been recounted in previous volumes of this History* ; they had been closely connected with the construction of the Uganda Railway, and, in fact, the first arrival at Nairobi had been a sapper sergeant ; and in West Africa, they had played no small part in the extension of the line running northwards from Port Harcourt. When Sir Percy Girouard, late R.E., was Governor of Nigeria, he had arranged for a detachment of three R.E. officers and thirty other ranks to be employed upon the extension of that line for 350 miles from Baro (400 miles inland) to Kano in the extreme north of the Colony. This detachment, using raw native labour, and often working in intense heat, laid nearly 150 miles of line at phenomenal speed, on one day constructing more than six miles of track and laying out material for another seven—a world record. The detachment returned at the end of 1911. The three officers were Captain H. O. Mance and Lieutenants F. D. Hammond and G. A. P. Maxwell. We have already seen, on pages 140 and 141, how Mance's railway experience, continued from 1914 to 1918 on the Western Front, was used by the Government during the peace negotiations, but he and his two subalterns were soon destined to renew their associations with the railways of Africa as we shall see presently.

The association of the Corps with these railways was continued during the war with the construction, in 1915-16, of the line from Voi to Taveta for the opening of the East African Campaign.† After the Armistice, however, this association was extended in no small degree.

Kenya and Uganda.—At the end of 1920 Brigadier-General Sir Godfrey D. Rhodes left his work in Asia Minor‡ and became Chief Engineer of the Kenya and Uganda Railway, then called the Uganda Railway. This ran from Kilindini to Lake Victoria, across which there was a marine service, extended by short lines to Kampala and Lake Kioga. The system at the time suffered from lack of both maintenance and funds. Signs of coming prosperity in East Africa, however, led to the expenditure of over £10 million during the five years preceding 1928, on which date Sir Godfrey became General Manager. The developments included extensions, increasing the track mileage from under 700 to more than 1,600 miles, the building

* See also *The Royal Engineers in Egypt and the Sudan*, by Lieut.-Colonel E. W. C. Sandes.

† See Chapter XII.

‡ See Chapter XIV, p. 136.

ballasted, more and heavier sleepers were put in the track and bridges were strengthened to take 20-ton axle loads.

Nigeria.—In 1928, Lieutenants J. F. Lees and R. E. Bagnall-Wild were employed as Assistant Engineers under the Survey Department of the Nigerian Railway. Lees was employed on the re-laying of the Ibadan-Offa section and then on a proposed Odo-Oba-Akure line through the dense bush of the cocoa area. Bagnall Wild also worked on this line and then with the Route Selection Survey for a proposed line to Lake Chad.*

Official Reports on East and West African Railways.—Brigadier-General F. D. Hammond was nominated by the Secretary of State for the Colonies in 1920 to report in great detail upon the Uganda Railway. Similar reports were called for during the next three years upon the railways of Tanganyika, Gold Coast, Sierra Leone and Nigeria. After retiring in 1925, he was commissioned by the Southern Rhodesian Government to inquire into the very complicated finances of the Rhodesia Railways. As the result of yet another report, in the production of which he was assisted by Major E. O. A. Newcombe, R.E., a new company, the Nyasaland Railways was formed. Aided by Government capital, the existing line was extended by 1935 to Lake Nyasa, including the bridge over the Lower Zambesi, $2\frac{1}{2}$ miles long. Hammond became a director on the Boards of the Nyasaland and Rhodesia Railways and the Central Africa, Trans-Zambesia, Mashonaland and Beira Railway Companies.

Brigadier-General Sir H. Osborne Mance was requested by the Colonial Office to report in 1936 upon the co-ordination of transport—road, rail, waterways and air—in Kenya, Uganda and Tanganyika. This report was of great value to the Governments concerned in framing subsequent legislation on this difficult matter.

ROADS IN THE GOLD COAST

(See Map 3, at end)

The prosperity which came to the Gold Coast during the years following the Armistice enabled the Governor, Sir Gordon Guggisberg, late R.E., to initiate a programme for the improvement of the colony's roads which were in a somewhat primitive state, that is to say that virtually none existed. Captain R. Ll. Brown, R.E., and Lieutenant G. C. Rogerson, R.A., began surveys in 1924, and the following year saw the start of the Temporary Roads Department

* See his account in *The R.E. Journal* of December, 1936.

of a modern port at Kilindini and the incorporation of the marine services on Lake Albert and also extensive road services.

Tanganyika.—Colonel G. A. P. Maxwell was General Manager of the Tanganyika Railways from 1920 till 1935. Little had been done since the termination of the East African campaign to restaff the railway, to make good the ravages of war or to account for past and budget for future expenditure. It was three years before it was possible to consider new construction for which loans were obtained from the Home Government. By the end of 1935, some £3 million had been spent on additions and improvements and some £5 million on new work. The system originally consisted of the two lines, Tanga to Moshi, 220 miles and Dar es Salaam to Kigoma, 780 miles (see Sketch 3). New lines were constructed from Moshi to Arusha, 54 miles; Tabora to Mwanza, on Lake Victoria, 235 miles; and a line northwards from Manyoni, 93 miles. A service of two ships was inaugurated on Lake Tanganyika to open up the Abercorn district of Northern Rhodesia. The General Manager was also responsible for ports, harbours, coastal lighting and buoyage.

From 1930 till 1932, Captain D. J. M. Murray and Lieutenants C. G. B. Greaves and C. E. M. Herbert were appointed Assistant Engineers under the Tanganyika Railways. They were employed on the survey and estimates for a projected line running south from Kilosa for a hundred miles. It was intended to assist native development but might perhaps eventually connect with Northern Rhodesia and the South.

Rhodesia.—From 1919 till 1929, Colonel C. F. Birney was General Manager of the Rhodesian Railways, a system over 2,500 miles in length and comprising seven companies which were operated as one concern. During his first three years—a period of rising prices, shortage of materials and unsettled labour conditions—the main problem was that of recovering from the effects of the war. The next seven years presented a very different task—that of keeping pace with rapid expansion and growing traffic due principally to base-metal mining in the Rhodesias and the Congo. During the decade of his tenure the ton-mileage rose from 458 to 1,104 million and the gross earnings from under £2 to nearly £5½ million. Extensive programmes of improvement were undertaken during the period to convert what was essentially a colonial pioneer railway into an efficient instrument carrying heavy traffic. During this period over £10 million were spent on capital works. Train loads were increased by the elimination of curves and gradients, the main line was stone

(T.R.D.).* The staff of this new department was never to become very swollen and consisted, during its eight years of existence, of two or three R.E. officers, about four N.C.Os. and a civilian clerk.

The small sapper party was confronted with the task of surveying, mostly in dense tropical forest or high elephant-grass country, the routes for hundreds of miles of new roads and then of arranging for their construction. For this purpose they developed a new survey technique with a $4\frac{1}{2}$ -in. compass and chain, preceded by a cutting party and followed by levellers. From this preliminary line, supplemented by frequent cross-sections, a map was produced from which the first location of the road could be chosen.

The roads were of gravel, but the curves, gradients and formation were laid out with care so that they could be used later for a better surface. The bridges were of reinforced concrete or masonry, with a few steel-girder spans up to a hundred feet. They were designed to carry:—on top, steam rollers crowded at a check; and below, the raging floods of tropical Africa. Most of the work was done by local Italian contractors but at one period, as a relief measure in anticipation of a locust famine, large parties of direct labour were employed, mainly on a long embankment across a swamp, involving 120,000 cu. yds. of earthwork.

By the time that the T.R.D. was disbanded owing to financial difficulties in the Colony during the world economic crisis in 1931, it had constructed 360 miles of road and surveyed a further 420 miles. Its few officers and N.C.Os. had certainly left their mark on the Gold Coast and the fruits of their labours remain as a permanent profit to the Colony, (*see map 3, in pocket at end*).

The R.E. officers who served in the T.R.D., for tours varying from one to four years, were, in the order of their arrival: Captain R. Ll. Brown, Lieutenants H. C. Bogle, R. P. Wheeler, W. H. Stratton, H. A. Macdonald, A. R. Logan and Captain F. K. Stranack. Brown most unfortunately suffered a serious gun accident in 1926 when in the bush and, although his sergeant moved him seventy-five miles to hospital in twelve hours, he lost his arm.†

* The adjective in its title was intended to refer to the life of the organization and not of its achievements. For a detailed description of the adventures of the T.R.D. see a series of amusing articles in *The R.E. Journal* of 1932.

† He became Director-General of Ordnance Survey in 1949, and the same year Stratton was appointed Commandant of the Joint Service Staff College.

CHAPTER XXIV

CORPS INSTITUTIONS

The Royal Engineers Band—The R.E. Old Comrades' Association.

THE ROYAL ENGINEERS BAND

FEW will now remember our famous Bandmaster Mr. Sawerthal, who with his cousin the Bandmaster of the R.A. Band raised the reputation of the two bands to a very high pinnacle in the musical world and among the public at large.

Those who followed him have worthily maintained his success, and at the time of writing (1938) the Band has a particularly fine reputation. Mr. Sawerthal retired in 1890 and was succeeded by Mr. J. Sommer, a German, whose father had been an Army Bandmaster. He received a commission in 1899 and the M.V.O. in 1901, and for some years was one of the examiners at Kneller Hall. On his retirement in 1905, Mr. Neville Flux was appointed. He composed a great variety of music and was elected F.R.A.M. in 1910. In 1919, he received his commission as Lieutenant with the title of Director of Music and was promoted Captain in 1927—the first Bandmaster of the Corps to reach that rank. He retired in 1932 and was succeeded by Lieutenant D. W. Jones, L.R.A.M., A.R.C.M., p.s.m., followed by Lieutenant A. Young, A.R.C.M., p.s.m. in 1944, and who was promoted Major in 1950.

The uniform of the R.E. Band has undergone many changes during the last seventy years, the most noteworthy being :—

In 1873, the white tunic and red trousers gave place to the gold-braided scarlet tunic and blue trousers.

In 1917, the forage cap was introduced.

In 1913, the blue greatcoat was replaced by khaki.

In 1916, khaki clothing was introduced for ordinary wear, but red was still worn for church parades, etc.

In 1921, a cheaper form of red tunic worn with white belt was introduced, but only lasted until 1929.

In 1924, the wearing of red was limited to concerts, etc.

In 1937, just before the Coronation of H.M. King George VI, the R.E. busby replaced the bearskin and the blue greatcoat was reintroduced.

On the outbreak of war in 1914, the Band was used to augment the training staff at the Depot. Many bandsmen volunteered for active service but were not permitted to go. In December, 1916, the Band left for a tour in France, mainly in the forward areas, and in three months gave 175 concerts, many of them under highly adverse conditions. This tour was very much appreciated, both by members of the Corps in France and also by the French themselves. During the absence of the Band on this tour, their duties at Chatham were carried out by a voluntary brass band formed at Detling in 1916. In the early part of 1919 the band again went abroad, carrying out a ten-week tour of France, Belgium and the Rhineland.

The present band is able to give either orchestral or military band concerts. On the same day it may perform as a military band on a ceremonial parade, and in the evening produce a first-class orchestra. A dance band, formed in 1929, is now an integral part of the organization.

Until recently the enlistment of an adult musician was a rare occurrence, the establishment being maintained by the recruitment of boys of 14 who passed into the ranks as musicians on reaching 18. These boys, many of them sons of members of the Corps, received their early musical training entirely in the band, instruction being carried out by the more expert bandsmen. Selected musicians were from time to time sent for more advanced instruction at Kneller Hall. Of late years, however, recruitment by this means has failed to keep pace with the wastage and recourse has recently been had to improved propaganda and advertising for adult musicians. The result promises to be satisfactory. The strength of the band on 1st January, 1938, was forty-seven musicians and five boys under training against an establishment of fifty-four musicians and six boys.

The band used to give two concerts in London, usually in November and March, which allowed officers, especially retired officers and those of the T.A. and S.R., and their families and guests to hear the band to the best advantage, a form of entertainment much appreciated by musical friends. In recent years efforts have been made to ensure that those serving at stations other than Chatham shall enjoy the Band. At Aldershot, Longmoor, Blackdown, Salisbury

Plain, Catterick and Gosport, for example, the Band is annually a great feature during entertainment periods. It must be a satisfaction to R.E. officers, scattered in small numbers throughout the world and unable to return hospitality with Corps functions, to know that the Corps with the assistance of the R.E. Band is maintaining hospitality at home.

Among the Band's many noteworthy performances in the last fifty years may be mentioned that given at the State Ball at Buckingham Palace during the 1897 Diamond Jubilee celebrations, and at the Garden Party at Buckingham Palace in 1934. Broadcast performances have been given in Kingsway Hall on several occasions and once in Canterbury Cathedral.

In 1929, in common with other military bands, all the instruments were altered from sharp to flat pitch to conform to the normal pitch for orchestral concerts. In the case of reeds this meant the purchase of new instruments, an expensive item since all band instruments are the private property of the officers of the Corps. The cost of the alterations amounted to approximately £850.

ROYAL ENGINEERS OLD COMRADES' ASSOCIATION

The events leading to the formation of the R.E.O.C.A. are described in Volume IV, Chapter XVII. The inaugural Meeting of the Association, at which General Sir Harry Prendergast presided, was held in the Royal United Services Institution, Whitehall, on 12th October, 1912.

The following R.E. officers have held the office of President of the Association :—

General Sir Harry Prendergast, V.C., G.C.B., 1912.

F.M. Lord Kitchener of Khartoum, K.G., 1913.

General Sir Richard Harrison, G.C.B., C.M.G., 1916.

Lieut.-General Sir Ronald Maxwell, K.C.B., K.C.M.G., 1923.

Lieut.-General Sir Aylmer Hunter-Weston, K.C.B., D.S.O., 1924.

General Sir George Kirkpatrick, K.C.B., K.C.S.I., 1935.

Lieut.-General Sir Ronald Charles, K.C.B., C.M.G., D.S.O., 1936.

His Majesty King George V graciously consented to become Patron of the Association in 1918, and H.R.H. The Duke of Connaught and Strathearn, K.G., honoured the Association by becoming its Vice-Patron in 1927.

The Association consists of a Headquarters in London and a

number of Branches. Branches are administered by a President, Chairman, Treasurer, Secretary and a Committee elected by their members. They may be formed in any town or district by the consent of the Headquarters Committee on receipt of an application signed by not less than twenty members or potential members.

From the date of its inception until 1932 the Association was administered by a Headquarters Committee, called the Central Committee, consisting of a Chairman, Vice-Chairman, Honorary Treasurer (the A.D.F.W., War Office), the I.G.R.E., the Officer i/c R.E. Records, and an indefinite number of elected members of the Corps (both serving and retired) residing, or serving, at stations within easy reach of London.

In order to obtain a more representative body of members on this committee, Major-General R. N. Harvey, the then Chairman, introduced a scheme in 1932 whereby all Branches situated within a radius of seventy-five miles of London were represented. The two main factors considered in this reorganization were that the Committee should be as small as possible and that the cost to Association Funds for travelling expenses of members attending the meetings should not be unduly heavy. There were some thirty branches concerned, so in view of these factors it was recommended that where several Branches were located within reasonable distance of one another they should be grouped together for representation, whilst others should have independent representation on the Committee. This newly constituted Committee consisted of some twenty members (eight officer and ex-officio members and twelve elected members from Branches and groups of Branches) and met quarterly instead of monthly as heretofore. In order that the financial and other urgent business of the Association should be attended to as expeditiously as possible a General Purposes Committee, meeting monthly and consisting of the Chairman, Vice-Chairman, Hon. Treasurer and three members of the Central Committee, was elected. This scheme of reorganization was unanimously approved in July, 1932.

From the formation of the Association until 1934 the procedure was that, in addition to the meetings of the Central Committee, the Association also held an Annual General Meeting in London on the same day as that on which the annual functions took place. To this meeting it was obligatory to submit for confirmation such alterations in matters of organization and administration as might be recommended by the Central Committee. The meeting was free

to all members of the Association and any member was entitled to vote. This procedure, which had sufficed in the early days of the Association, proved less satisfactory as the number of Branches and membership increased. Furthermore the holding of the meeting on the same day as the other functions gave little time in which to consider and discuss the items on the agenda. Consequently, in 1934, the Central Committee decided to recommend to the Annual General Meeting that an Annual Conference of Branch Delegates be introduced in its place. This recommendation received unanimous approval and an organized Annual Conference, to which each Branch is entitled to send one delegate, is now held annually in May in substitution for the Annual General Meeting. Following these reorganizations the status of the Chairman of the Central Committee, was changed that of Chairman of the Association.

The following officers have filled the office of Chairman of the Central Committee (latterly Chairman, R.E.O.C.A.) since October, 1912 :—

Colonel B. R. Ward, 1912.

Colonel F. S. Leslie, 1913.

Major-General Sir George Scott-Moncrieff, K.C.B., K.C.M.G., C.I.E., 1917.

Major-General Sir Andrew Stuart, K.C.M.G., C.B., 1924.

Major-General R. N. Harvey, C.B., C.M.G., D.S.O., 1930.

Major-General W. H. Beach, C.B., C.M.G., D.S.O., 1936.

Mr. J. McB. Robbins, ex-Q.M.S., R.E., was appointed Secretary in October, 1912. It was largely due to his personality, zeal and drive, especially at the critical period after the start, that the Association quickly found its feet and continued to increase and prosper rapidly. His zeal never flagged during the twenty-two years he was in office until his death in February, 1934. He was succeeded as General Secretary by ex-R.Q.M.S. J. G. Walker, who had for three years held the appointment of Assistant Secretary under Mr. Robbins.

At the time of the formation of the Association its objects were purely social, but in 1914 it was suggested by the A.A.G., R.E. that the R.E. Labour Bureau, which was being administered for him by the Officer i/c R.E. Records, should be transferred to the R.E. Old Comrades' Association. This was done and the name of the Bureau was changed to the R.E. Civil Employment Registry. The finding of employment for R.E.O.C.A. members thus became a

definite object of the Association under the supervision of the Central Committee.

The objects of the Association are now defined as follows :—

(a) To foster *esprit de corps* and a spirit of comradeship amongst all ranks of the Corps of Royal Engineers, serving and retired; and to encourage and facilitate their rendering of service to one another.

(b) To assist in finding employment for members.

(c) To give pecuniary assistance to members, and to bring to the notice of appropriate organizations the cases of members or of their widows or their orphans deserving assistance.

(d) To obviate the burial of members by Poor Law Authorities.

(e) To render advice to members, their widows or dependants regarding claims for pensions, Workmen's Compensation, National Health and Unemployment Insurances, and in connexion with businesses and agreements.

The following Headquarter or General annual functions are held—normally on a Saturday afternoon and evening in October :—

Cenotaph Ceremony—Parade of members at the Cenotaph in Whitehall where a wreath is placed on behalf of the Association.

Lord Kitchener Memorial Service—A short undenominational Service at the Kitchener Statue on the Horse Guards Parade, and the placing of a wreath.

The placing of a wreath of Flanders Poppies at the Corps Cross in the Field of Remembrance at Westminster Abbey on Remembrance Day.

Annual Reunion and Dinner, in London.

Similar functions are held by Branches throughout the United Kingdom and Empire, together with varied social activities, including concerts, dances and inter-branch visits for games, etc.

Membership was originally confined to Regular Royal Engineers, but since 1918 has been open to all who have served or are still serving in any branch of the Corps of Royal Engineers, including Auxiliary Units, and Dominion and Colonial Engineers of British nationality.

The rates of annual subscription are—officers 5s., other ranks 2s. and boys 1s. Other ranks subscriptions are remitted after twenty-one years continuous membership. Life subscriptions are—officers £5, other ranks 30s. and recruits 20s. In 1941 the Association had a membership of about 150,000 and an invested capital of about £54,000.

CHAPTER XXV

CORPS GAMES AND SPORTS

Introduction—Cricket—Rugby football—Association football—Hockey—Yachting and rowing—Foxhunting—Drag hunt—Polo—Brake Club—Show jumping—Beagling—Lawn tennis—Rackets—Squash rackets—Golf—Billiards—Athletics—Boxing—Fencing—Swimming—Flying—Results of R.A. v. R.E. matches.

INTRODUCTION

VOLUME IV of the Corps History gives some details of activities of the Royal Engineers in sport and games up to 1912 and in Volume I on page 6 there is a reference to a statement by the late Sir George Trevelyan, Bart., writing in 1876 the life of Lord Macaulay, to the effect that the R.E. "for years together could turn out the best football eleven in the United Kingdom," and also to the cricket match against I Zingari on 20th and 21st August, 1875, in which "against good bowling and excellent fielding . . . eight wickets of the R.E. fell for an average of ninety runs a wicket." We here begin in the year 1912, but to show that the Corps already had a reputation for sports and games, we recall from the past a few outstanding events, some of which have been recorded in Volume IV.

In 1875, the Corps Officers' Association Football XI won the F.A. Cup. On two previous occasions they had been runners-up, and three years later they were again in the final. Later, when officers were gradually adopting Rugby as their game at the expense of Association, the other ranks of the Corps carried on the tradition and we find the Depot Battalion XI winners of the F.A. Amateur Cup, thrée times winners of the Army Cup, and twice runners-up, during the period 1902 to 1908. It is difficult to select one example from many fine performances by the Corps at cricket, but perhaps their victory over the M.C.C. by one wicket in 1911, on the stroke of time, after their opponents had declared their second innings closed at 502 for 9, is worthy of special mention. Several Corps players—J. Fellowes, H. N. Dumbleton, L. B. Friend, W. C. Hedley,

and H. W. Renny-Tailyour—played for the Gentlemen of England ; and Renny-Tailyour had the further, almost unique, distinction of having played both Association and Rugby Football for Scotland. The Corps won the Army Rackets Doubles Championship in 1895, and produced one of the finest individual players of his day, S. H. Sheppard, who was three times winner of the Army Singles, and the only serving officer to win the Amateur Singles Championship of England. In 1909 and 1910 the Corps Rowing VIII reached the semi-finals of the Thames Cup at Henley Regatta, and as a compliment to one of the best crews the Corps has produced, stroke (C. E. P. Sankey), and two members of the crew (P. K. Boulnois and A. E. Grasett) were elected to Leander Club.

The inter-war period saw revolutionary changes in standards, habits and values in almost every walk of life, not excepting the sphere of sport. The youth of this period contained as keen and as fine performers in athletics and sports as their predecessors, but circumstances deflected many of their energies into different channels. These changes were manifested in a waning of the old enthusiasm for cricket, with a corresponding rise in the popularity of lawn tennis ; in the eclipse of Association by Rugby as an officer's game ; in the decline of rackets and the rise of squash ; in the foundation of an Officers' Flying Club ; in the participation by an R.E. officer in the Monte Carlo Motor Rally ; and in the extended interest in athletics, hockey, golf, sailing, ski-ing and other activities, largely at the expense of those associated with the horse. Causes are not far to seek. Cricket made heavy demands upon leisure time, particularly at the week-end which, with the advent of the motor-car, an officer could enjoy away from his station. The standards of skill demanded of the first class "soccer" footballer effectively excluded amateur clubs and, with rare exceptions, amateur players from participation in the highest class of the game. As a result, its prestige declined in the public schools, where increasing numbers transferred their allegiance to the Rugby code. A resulting falling off in the number of good players turned out by Woolwich and Sandhurst led to an inevitable decline of the game, so far as officers were concerned. Rackets was gradually ousted by squash, and the cause was unquestionably the inability or disinclination of officers to face the relatively heavy cost, when they could get their exercise in a squash court at one tenth of the price. Finally, much though it may be deplored, the encroachment of machines into every department of modern life rendered mounted sports increasingly

artificial ; and although polo, hunting, etc., remained very active, they were kept so, for the most part, by comparatively few devotees, who delighted and excelled in overcoming the ever-increasing difficulties.

In the short review which follows it has only been possible to deal, in the main, with "representative" Corps games. Local activities have here and there been mentioned but lack of space precludes their treatment in any detail. No survey would however be complete without some reference to the achievements of the Royal Engineers overseas. In India, Gibraltar, Egypt, Hong Kong, and Singapore, representatives established and maintained a fine tradition for sport, be it polo, hunting, racing, cricket, pig sticking, ski-ing, hockey, mountaineering or shooting ; and, speaking generally, in any station which can muster a sufficient number of fit sappers, it is still safe to assume that the Corps will be represented, and well represented, in any team tournament which may take place—and stand as good a chance as any of annexing the trophy.

CRICKET

In 1919 the Corps made a start on its post-war cricket activities with the renewal of seven fixtures—against Aldershot Command, Free Foresters, Royal Artillery, Band of Brothers, the Staff College, the Household Brigade and Mote Park. Of these, two were won, three lost, including the Gunner match, and two drawn. In the following year three more old opponents, the Yorkshire Gentlemen, Oxford Harlequins and the M.C.C. were added to the list and a new fixture against the Incogniti arranged. Annual matches were also started against the Royal Corps of Signals in 1921, against the Royal Navy in 1924 and the Royal Marines the following year. The fixtures against Aldershot Command, Incogniti, Mote Park, M.C.C. and Yorkshire Gentlemen were, for a variety of reasons discontinued and replaced by one-day matches with Beckenham and the Yellowhammers. Generally in an average year the Corps played nine two-day and four one-day matches. A summary of results shows that between 1919 and 1939 we played 247 matches, of which 67 were won, 63 lost and 117 drawn. The large number of drawn games rather indicates that our batting generally was stronger than our bowling but it must not be forgotten that a large proportion of the matches were played at Chatham on the perfect wickets prepared there by Mercer.

Against the Gunners we started this era badly by losing four out of the first five matches and it was not until 1924 that we recorded our first win at Lord's. This victory was made possible by a sporting declaration by the Gunners who left us an hour and fifty minutes to make 187; thanks to Bryan (90 not out) and Hancock (79) we did this with seven minutes to spare. As Hancock made 89 in the first innings and took four wickets, he played a large part in our success. Later results proved very even as we won in 1926 and 1929 and the Gunners in 1933, 1935 and 1938.

The Oxford Harlequin matches were noted for the large scores made on numerous occasions by both sides, but it was not until 1938 that we recorded our first and only win. In contrast to the Harlequins, the Free Foresters and I Zingari proved easier meat, as we recorded in these matches fourteen wins against only five defeats. The Band of Brothers, as befits the leading Kent Club, have proved themselves evenly matched with the Corps both on the field and during Guest Nights. On the field we have both won on four occasions with the remaining thirteen matches being drawn.

As is only right and proper we started off well against the Royal Corps of Signals with four victories in the first six matches and it was not until 1931 that we first had our colours lowered; after that we just held our own as we also did against the Navy, Marines and Staff College. During this period we were twice visited by touring sides from overseas; in 1921 by the Gentlemen of Philadelphia and in 1936 by Mr. Matthew's Canadian XI. Regretfully we have to admit that we were beaten by the Americans and could only draw with the Canadians!

Passing on to personalities we find that we started off in 1919 with a strong nucleus of pre-war cricketers amongst whom were F. J. C. Wyatt, still a very dangerous bowler, B. L. Eddis, a good all rounder and still amazingly quick at cover point. E. St. G. Kirke who made 4,000 runs as a field officer, R. S. Rait-Kerr later to become Secretary of the M.C.C., R. N. Bocquet and V. E. Purcell. Among the new-comers were G. F. D'A. McCarthy, a fine forcing bat who retired all too early. N. A. Coxwell Rogers, a good medium-pace bowler and more than useful bat, and H. M. Whitcombe, a fast left-hand opening bowler. In 1921 W. J. Vezey appeared on the scene and made 60, 114 not out, and 154 in his first three innings for the Corps; unfortunately he did not quite live up to this form in the future.

In 1922 L. F. Hancock started his long and strenuous career

which only ended with his death in France in 1944. He was a fine all rounder, full of enthusiasm and novel ideas for getting the better of his opponents. In his first year at Corps Cricket he took 54 wickets for an average of 19.9; which is the only occasion between the wars that fifty wickets were taken by an individual in one season.

G. J. Bryan, who had made a hundred in his first match for Kent in 1920, arrived from the Shop in 1923. A fine forcing bat and, until he hurt his arm, a useful bowler, he played a leading part in Corps Cricket, although his appearances were not as frequent as they might have been owing to his playing for the Combined Services, the Army and Kent. In the twelve seasons during which he was in England he scored 5,194 runs, including twenty-three centuries, with an average of 74.2 and took 134 wickets for an average of 19. In 1933 in the course of eight Corps matches he scored 1,028 runs for an average of 102.8—a feat which has not been approached by any Corps cricketer since the days of Renny-Tailyour. He also made 229 for the Combined Services *v.* the South Africans in 1924.

1923 also saw the advent of D. C. E. Grose, a fine wicket-keeper and opening bat, who later played for the Army, and E. S. de Brett, a very useful all rounder; W. H. H. Aitken, a slow leg-break bowler and very powerful hitter also started to come into prominence at this time and these three rendered yeoman service to the Corps in later years. Two years later another fine bat, R. N. Foster, appeared and heralded his arrival by scoring a century in each of his first two matches.

In 1926 two rather more mature players began to appear regularly for the Corps—O. L. Roberts and A. Minnis. Roberts was a first-class wicket-keeper and forcing bat, who only just failed to get a Blue at Cambridge; in 1932 he made 203 against I.Z. in his only appearance for the Corps that year. Minnis was a clever slow left-hand bowler and was one of our most consistent bowlers for many years, besides playing for the Army; those who played with him will never forget his “quick turning technique” which must have gained him many wickets. In 1929 he astounded everybody except himself and dumbfounded the critics of his batting prowess by coming second in the Corps batting averages with an average of 42.3.

In 1927 L. T. Grove appeared on the scene and quickly proved himself to be one of the best bats in the Corps and the Army; unfortunately after two years he went to India and thus only played

for six seasons in all before being killed in an air crash in Canada in 1942. During his short career for the Corps he made 2,860 runs with an average of 52.

In 1930 A. C. Shortt first began to make his mark in Corps cricket as a fast bowler and from then onwards, in spite of a clicking knee, was our opening bowler when available; he was also a far better bat than most fast bowlers. It was during this season that a noteworthy batting record was made when double centuries were scored in two consecutive matches—228 by Ross Kellett against B.B. and 230 by W. D. Swan against the Royal Marines; this was all the more remarkable as only three double centuries were scored for the Corps between 1919 and 1939.

1930 also saw the first appearance of two more Corps stalwarts, F. W. Simpson, a fine opening bat and useful slow bowler, who was later to play for the Army, and L. J. Harris, a dangerous fast-medium bowler and attacking bat.

J. R. Rawlence had already played for Hampshire before he was commissioned in 1936, a very good bat, who however, seemed to lack confidence and who never really did himself justice, when playing for the Corps or the Army. Lance-Corporal Storey appeared in 1938 as a most dangerous bowler, who might have gone a long way if it had not been for the war; as it was, in two seasons he took 72 wickets for an average of 14.

RUGBY FOOTBALL

For some years before 1914, an officers' team at Chatham—the S.M.E. Rugby Football Club—had provided opportunities for regular play in first-class football. The side was a strong one and the list of fixtures included such redoubtable opponents as Rosslyn Park, the Old Blues, U.S. Portsmouth and Old Merchant Taylors. The home ground was inside the cricket enclosure, and the three successful seasons before the war culminated in the winning of the Kent County Cup. In 1914, the U.S. (Chatham) Club was founded, but the S.M.E. had prior call upon the services of players. During the war a local R.E., Chatham, side played regularly from 1916 to 1918, but Corps matches, in common with other games, were suspended until after the Armistice.

In the autumn of 1919, a regular Corps side appeared, with fixtures against Blackheath, The Harlequins, Richmond and, for the first time since 1889, the Royal Artillery. The S.M.E. and the U.S.

(Chatham) sides were also revived, the latter being given preference over the S.M.E., whose fixtures were generally on Wednesdays, with the U.S. matches on Saturdays. At about this time the U.S. team contained fourteen sappers and one Royal Marine officer. All really good Royal Navy players appeared to be stationed elsewhere. In spite of this, the intention was to convince the leading south of England clubs that U.S. (Chatham) was a first-class side and worthy of fixtures with them. The S.M.E. XV, in spite of its many good players, could not also maintain its status as a first-class side, and was dissolved, but first succeeded in winning back the Kent County Cup, which had been lost in 1919. In 1922, the present U.S. ground was opened, and for the next six or seven years, while the Supplementary and Y.O. Classes could be counted upon, the U.S. Club flourished and ran both a 1st and an "A" XV. With the beginning of the Y.O. Cambridge Courses, however, the fortunes of the club began to decline, and after one or two seasons as an almost entirely naval side it was dissolved in 1933.

After 1922, the representative Corps matches were limited to those against service sides—the R.A., R.M.A., R.N.C., R.C.S. and R.T.C., to which the Cambridge LX Club was added later. In 1927, a very popular annual match was inaugurated at Woolwich between the R.E., Y.Os. and the R.A., "Why Owes." The Corps sides were usually strong and of the nineteen matches played against the gunners ten were won and two drawn. Against all the other service sides the R.E. won well over half the games played. Home matches took place on the Great Lines, where the ground sloped from side to side, a change from the Shop ground, which sloped from end to end; but these sloping grounds were not conducive to an improvement in the standard of play.

In addition to Corps and other matches, a number of players were called on for Army Trials before Christmas, Army Matches after Christmas and County Matches throughout the season. They consequently found that it was far easier to keep in training than to obtain the necessary leave from S.M.E. courses. There was no coaching, no lectures on football tactics, and all expenses except for Corps matches were borne by the players. No special arrangements were made for meals, and many were the hard "away" matches fought and won on a packet of mess sandwiches.

For the Army Cup Tournament, eleven R.E. Command, Station and Unit sides were constituted as "units," and entered with varying degrees of success. An R.E. unit reached the final four times,

the Training Battalion being runners-up in 1922, 1930 and 1931, and R.E., Aldershot in 1927.

Among the well remembered personalities in R.E. Rugby were G. Thorp and G. D. De'Ath, who, though no longer playing, were the heart and soul of the U.S. (Chatham) and S.M.E. sides. R. M. Scobie at centre three-quarter, had played for Scotland in 1913 while still a cadet, and, so tradition says, was the only one of the Scottish backs to cover himself with glory in their defeat by Wales in 1914. R. K. Millar, in 1924, played for Scotland v. Ireland and for the Combined Services v. the All Blacks, and achieved the honour of being included in a set of cigarette cards entitled "Famous Footballers." Other notable players were J. A. Crawford and W. M. Inglis, who played for Scotland in 1934 and 1937/8 respectively, and H. H. C. Withers who represented Ireland in 1931/2. Inglis, F. W. Simpson, J. M. Griffith and J. R. Rawlence were awarded Cambridge Blues. On the twenty-five Corps players to win Army Caps, Simpson, S. T. A. Radcliffe, G. J. Bryan and L. J. Harris were selected for International trials, Harris being five times reserve for Wales. W. H. H. Aitken was a powerful forward and an excellent place kick, other outstanding forwards being R. P. G. Anderson, P. St. B. Sydenham and R. Llewellyn Brown. The sapper team in 1920/1 contained K. N. Crawford and D. Morris as halves, with Bryan, I. G. Loch and L. G. Thomas in the three-quarter line. All played for the Army but Morris not in the Inter-Service matches though he partnered Crawford for Kent. There was a great increase in the keenness and standard of performance of other ranks, who were always included in representative sides. Of the many fine other-rank players that the Corps has produced, A. J. Croston and F. W. Whitcombe were awarded Army Caps. In addition to those already mentioned the following R.E. officers represented the Army: G. C. Gowlland, A. M. Jackson, G. C. M. Kavanagh, E. S. Rideout, J. S. W. Stone and P. L. Wilkinson.

ASSOCIATION FOOTBALL, 1919-37

At Chatham, both the Training and Depot Battalions regularly entered teams for the Army Cup, the T.B. reaching the final in 1936/7 and the D.B. the semi-final in 1923/4. Each battalion also entered for various local and county cup and league competitions, for instance the Kent Senior Cup, the Kent Amateur Cup, and the New Brompton and District League—won by the T.B. in

1925/6. Attempts by the D.B. to regain their former position in the competition for the F.A. Amateur Cup, however, met with little success, and after 1923 they were abandoned. At Aldershot, until 1928, teams were entered for local civilian competitions such as the Hants. Senior and Junior Leagues, Senior and Junior Cups, the Russell-Cotes and Aldershot Charity Cups, as well as for the Army Cup, but since that time their activities have been confined to participation in service competitions. In these, their successes include the winning of the Aldershot Senior Cup in 1923, 1928 and 1932; the Charity Cup in 1912, 1913, 1923 and 1935; the Aldershot Junior Cup in 1922, 1935 and 1936; and the Command Senior League in 1932. They reached the semi-final of the Army Cup in 1935.

The Corps has produced a number of individual players of repute of which A. A. Cartlidge and R. R. Mudford were awarded Amateur International Caps, Cartlidge playing twice for England in 1927 and Mudford three times for Wales in 1937.

The following have represented the Army: L. Balcombe, L. Brown, W. Cooper, P. Gallacher, P. Henderson, B. O. Rodgers, A. J. Sergeant, W. Wearn and A. A. Cartlidge and R. R. Mudford.

HOCKEY

Between the wars the Corps hockey side could well have been ranked as one of the leading teams in the country. The fixture list included the majority of the leading London clubs, Oxford and Cambridge Universities, the Civil Service, the Royal Navy and the Royal Air Force. In 1922/3, their most successful season, the Corps side was undoubtedly the team of the year, with twenty wins out of twenty-nine matches played and a goal total of 94 to 46.

The match against the Royal Artillery was not resumed until 1921, but then took place annually with thirteen R.E. wins to three losses and three drawn games. Station teams were regularly entered for the Army Inter-Unit Tournament, which was won by R.E. Chatham in 1922 and by R.E. Aldershot in 1936.

During the period forty-eight Army Caps were awarded to Royal Engineers. No year passed without there being at least one sapper in the army side, and in 1926 no less than seven caps were given to members of the Corps. Individual honours include the following:—

International Caps : W. F. Hasted, England, 1924 and 1926 ; O. L. Roberts, Wales, 1924-7 and 1929-31 ; H. T. Heard, Ireland, 1926 and 1933-5 and J. M. W. Howe, Ireland, 1935 and 1936.

Cambridge Blues : O. L. Roberts, 1924 and 1925 ; H. B. Harrison, 1924 ; N. E. V. Patterson, 1925 and J. P. Thorp, 1934.

Army Caps : G. H. Latham, 1920 and 1926 ; C. C. Swift, 1921 ; H. T. S. King, 1922, 1923, 1925 and 1926 ; H. L. Withington, 1922 ; W. F. Hasted, 1923-6 ; E. E. Nott-Bower, 1923 ; W. A. Turner, 1924 ; H. B. Harrison, 1925 ; H. T. Heard, 1926 and 1932-7 ; O. L. Roberts, 1926-31 ; W. M. S. Lillie, 1926 and 1928-31 ; N. E. V. Patterson, 1926 ; R. C. N. Jenney, 1928 ; W. Kent, 1933-9 ; W. B. Edge, 1933 ; J. P. Thorp, 1934, 1936 and 1937 and L. T. Grove, 1939.

YACHTING AND ROWING

In June, 1911, the R.E. Yacht Club experienced a disastrous fire which gutted the raft and destroyed boats and gear of all kinds. As a result, it was not until 1913 that rowing and sailing were again in full swing. An eight was entered for the Thames Cup at Henley, and some success was enjoyed by representative crews at local regattas. *Fulmar*, *Mignon* and *Thalassa* (late *Ithnan*, the gift of Lieut.-Colonel J. T. Bucknill) formed the nucleus of the sailing section of the Club, and, to encourage private ownership, advances from R.E.Y.C. funds were made to prospective purchasers of boats. Bi-weekly races for one-design dinghies were instituted, and a Points Challenge Cup awarded at the end of the season on the results of the series. In 1914 a club-house was built at Upnor Hard, but before the experiment could be proved a success or otherwise, the war supervened.

After the war, an eight was entered for the Fawley Cup at the 1919 Peace Regatta at Henley, and a four for the Wyfold Cup in 1920. It was decided in 1920 to maintain a fleet consisting of *Fulmar*, *Thalassa*, another small cruiser to replace *Mignon*, and two punts. In 1921, *Fulmar*, skippered by N. A. Blandford-Newson, made a cruise to Heligoland and laid the foundations of the club's post-war revival. The following year she cruised to Zeebrugge, Dunkirk, and the Lizard and, with *Thalassa* and the newly purchased *Magnolia* raced regularly both at Burnham and on the Medway. Private ownership increased and dinghy racing was revived. An eight was entered for the Thames Cup and, though beaten by a narrow margin, the crew put up a very creditable performance.

The following year an appeal was launched for funds with which to replace the old raft. Upnor Hard had not proved satisfactory, as difficulties of launching and heavy maintenance charges made it unsuitable for rowing, while sailing was now based on Gillingham. The R.E. Games Fund contributed £500, the remainder being found from R.E.Y.C. funds and private subscription. In 1922, the barge *Gnat* was purchased, and suitable accommodation built into the hull to the designs of Major E. F. Tickell who personally supervised the reconstruction. Hinged landing stages and racks for the rowing boats were constructed alongside, and dinghies moored astern. By 1923 the completed raft was on her moorings at the Marine Steps and she made a very satisfactory base for R.E.Y.C. rowing and dinghy sailing till 1937, when she began to leak badly and had to be beached at Upnor where she remained in use.

In 1923 an eight was entered for the Thames Cup and in 1924, 1925 and 1926 a four for the Wyfold Cup at Henley, in 1924 only just being beaten in the second round by the ultimate winners. Difficulties of training precluded any further participation by the R.E.Y.C. at Henley Regatta until after the war. Rowing was kept alive, however, by inter-batch fours, local rowing regattas and, above all, the facilities offered by the Cambridge courses to individual enthusiasts. No officer succeeded in winning a Blue, but both R. L. Brown and R. H. Walker rowed for Jesus College in Head of the River crews. The arrival in the Corps of the Oxford, Leander and Olympic oarsman, J. D. Sturrock in 1936 did much for rowing and enabled R.E.Y.C. crews to carry all before them in the Lower Thames and Medway Regattas. In 1939 an R.E. eight did extremely well in the Head of the River race at Putney.

Meanwhile two important events had taken place. In 1926 *Fulmar* had been entered for the first ocean race to be sailed in British waters, from Ryde to the Fastnet Rock and back to Plymouth (a distance of 600 miles). Skippered by Blandford-Newson, she took second prize out of seven starters, although the smallest boat in the race, and laid the foundations of the Club's reputation in the new sport. Then, in 1926, a successful appeal for funds with which to replace *Fulmar* enabled the committee to purchase, for £850, *Ilex*, a fine old 20-ton yawl designed by Mr. C. E. Nicholson. Thereafter the history of the Club was so closely associated with her achievements that no chronicle of the period would be complete without mention of some of her successes.

From 1926 to 1937 *Ilex* sailed in twenty-two ocean races, winning

three first prizes, two seconds, seven thirds and a fourth. In her first year she won the Fastnet Race. Skippered by Blandford-Newson, she was sailed with great determination and averaged nearly six knots over the course. In 1930, skippered by Dennis Hunt, she won the Plymouth-Santander Race from eleven starters, having finished second in the previous year, and won the subsequent race to Bilbao. In addition to cups, these two Santander races brought in about £200 in prize money. 1931 brought her greatest achievement. She was entered for the Atlantic Race from Newport, R.I. to Plymouth. The funds necessary to cover the expenses were found by private subscription and by a grant from the Corps Games Fund. Various modifications were made to the ship's gear and she was converted from yawl to cutter and shipped to New York on board the *Berengaria*. There were ten starters, eight of them being new boats specially built for ocean racing, and it reflects the greatest credit on the skill and ability of her skipper—Denis Hunt—and his crew, that *Ilex* finished seventh out of a strong field, only fifteen hours on corrected time behind the yacht who took second prize. She took twenty-one days over her long passage of 2,950 miles. Gradually outclassed by modern boats, she was re-rigged as a Bermudan cutter in the winter of 1934/5, and in the following summer, skippered by W. M. Blagden, she astonished the sailing community by winning third prize and the Jolie Brise Cup in the Fastnet Race from a field of seventeen, including some of the finest off-shore racing yachts in existence. With H. S. Francis as skipper she went on to win third prize in the Belle Ile Race. She continued to do consistently well and in spite of competition from increasing numbers of new and specially designed off-shore racers, she was always well in the hunt, and gained an international reputation which it would be difficult to efface. Up to the end of 1936 she had sailed 37,000 miles, nearly one-third of which in ocean racing. Thereafter she continued to race and did well in the newly created fast cruiser class, and even raced several times after being laid up during World War II.

Of the other Club boats *Thalassa* and *Magnolia* were sold in 1926/7 and a 5-ton yawl *Theresa* was purchased as a beginners' cruising boat. She was sold in 1936 and replaced by a new 4-ton auxiliary sloop *Sandia*. The enterprise of private owners may be exemplified by the achievements of Lieut.-Colonel N. M. Vibart, who cruised his 14-ton cutter *Altair* to Vigo and Gibraltar in successive years but finally disappeared, an irreparable loss to the Corps, on

passage home from the Azores ; of E. F. Parker and T. M. Bostock, who chartered a dhow from Karachi harbour and sailed her from Karachi to Aden via Socotra ; of M. R. Jefferis and J. M. Gavin, who built a slim off-shore racer, *Prélude*, in one winter at Aldershot and entered her for the Maas Race in the following spring. She did extremely well in 1938, 1939 and after the war. Egypt has always been a keen centre for sapper yachting, and in 1939 sapper crews practically swept the board at both the Ismailia and Cairo regattas.

The R.E.Y.C. ran two annual events for all ranks at Chatham. The R.E. Regatta was held either at the Gun Wharf or at Upnor Hard and always attracted a large attendance. There were open events for Fours and Pairs in which the Medway and Lower Thames clubs usually competed. The cutter race for the Shield that had been presented by General Sir Charles Warren, late R.E., in 1899 was rowed every year by crews from the Royal Navy, Chatham, the Royal Marines, Chatham, the Training Battalion and the Depot Battalion, and was usually won by a sapper boat.

In 1935, the Club received its greatest honour when His Majesty King George V announced his intention of becoming Patron of the Club, an honour renewed by King George VI.

FOXHUNTING

Although few military stations were without a hunting sapper at one time or another, it was Aldershot that was the main centre of Corps foxhunting. Catterick, with ample opportunities for hunting with the Yorkshire packs, took the place of Ireland after the war, and Colchester was within easy reach of the Essex country. Round Chatham were the numerous Kent packs, but hunttable country had receded rather far from Headquarters, and the Drag, to some extent, supplanted foxhunting. Drag members were, however, occasionally able to enjoy a day's foxhunting as the guests of the Tickham or the West Kent Hunts. Elsewhere, there were generally a few sappers to be found spending their leave in Ireland or in the Shires. At Aldershot, the Hunt Club, to which the R.E. Mess was a subscriber, enabled members to hunt with the Aldershot Drag, the H.H., the Vine and the South Berks at very moderate cost and with the added advantage of an R.E. stable recently established, through the good offices of a local resident, at Bramley on the borders of the Vine and South Berks country.

Overseas, particularly in India, sappers were always very prominent in the foxhunting world. A. V. T. Wakely founded, in 1929, the M.F.H. Association of India, which did much to improve hunting conditions, especially in the matter of stable management. Wakely himself was Master of the Delhi Hunt in 1929-31 and of the Peshawar Vale in 1934-5. M. G. Gunning Campbell (whose brochure *The Management of a Field* was the standard work on the subject in India) was Master of the Poona and Kirkee Hunt in 1927-8, and R. A. G. Binny of the Quetta Hunt in 1938-9. Special mention should also be made of the Wana Hunt which from its inception in 1930 was hunted almost continuously under sapper masters—C. B. Boulden, 1930-1 and 1932-4, P. A. Tucker, 1931-2, J. M. Saegert, 1934-6 and T. M. T. Bostock, 1938. The Wana normally hunted a drag, as natural quarry had an annoying habit of running into Afghanistan. At Gibraltar, sappers played an important part in the Royal Calpe Hunt. J. H. B. Lacey was huntsman from 1935, and G. B. Roberts, G. F. B. Goldney and W. E. Britten were field masters. The Hunt Subalterns cup was won by sappers on five occasions—twice running by W. S. Wise. Finally, true to the sapper principle of ubiquity, N. Wilson was Master of the Royal Exodus Hunt at Baghdad from 1933-5.

The R.E. Point-to-Point Races were held at one or other of the various courses in the neighbourhood of Aldershot—Hawthorn Hill, Arborfield, Dippenhall and Maiden Erleigh—and then annually at Ashridge near Wokingham. The races included one for the Royal Corps of Signals. From 1927-33 a R.E. Race, for a cup presented by Sir Sydney d'A. Crookshank, was included in the R.A.S.C. Point-to-Point Meetings held on Salisbury Plain.

In steeplechasing, considerable successes were achieved during the inter-war years by a few officers of the Corps. Of these, the most noteworthy were D. W. A. Cleeve, E. C. W. Myers and R. W. Urquhart. In the 1935 season Myers won the Subalterns' Open Race in the Aldershot Steeplechase, and Urquhart was second. That year Myers had a series of spectacular wins, including three important open steeplechases and several of the better known point-to-points.

DRAG HUNT

In 1928, through the enterprise of J. E. Marsh (then a junior subaltern), a pack of draghounds was started at Chatham. It was

registered as " Mr. Marsh's Drag " and hunted by him as a private pack during the winter. By the next season, however, it had been taken over by the Corps and became the R.E. Drag Hunt. Thanks to the unremitting efforts of the earlier Masters and Secretaries, encouraged by Major-General G. Walker, Commandant, S.M.E., the Hunt was able to weather the first few years of precarious existence, and thereafter it rapidly developed into an established and popular institution in the garrison.

The country in the neighbourhood of Chatham was still singularly immune from urbanization, with the result that the majority of lines were over hilly grassland where natural fences and ditches combined with built up jumps to provide enjoyable gallops of from five to ten miles. Most of the original lines were extended and improved and new ones were added, so that, in due course, sixteen were regularly maintained. Each was assigned to an officer responsible for the standard of his line and that it was ready to ride on the agreed day. Hounds were kennelled at Fort Amherst and hacked out to meets by the hunt staff. Thanks to the generosity of Masters of Hounds in all parts of the country, first-rate hounds were drafted every year into the pack for the mere cost of their rail fare. Twelve couple were normally maintained in kennels. Horses used for hunting included officers' chargers, private horses and troop horses hired for drag hunting. The latter were normally obtained from cavalry regiments stationed in the command and allotted to individual officers for the season. The Hunt was well supported by the local farmers and gentry, the Royal Marines, the Royal Navy and by infantry regiments in the garrison, all of whom took an active share in the sponsoring and upkeep of lines. Hunting days were Tuesdays and Saturdays, and fields averaged about thirty.

Annual Hunter Trials were held at Chattenden, where an interesting course was laid out over a tract of War Department land which, from the point of view of both competitors and spectators, was admirably suited for the purpose. In February, 1938, for the first time, a Hunt Point-to-Point was held, in conjunction with the Royal Marines. The meeting took place at Goose Farm, Wrotham, and included six races. It was additional to the Corps event which took place as usual in the neighbourhood of Aldershot.

The following filled the office of M.D.H. : J. E. Marsh, 1928/30 and 1937/8 ; J. E. C. McCandlish, 1930/2 ; R. E. Black, 1932/4 ; G. C. Clark, 1934 ; B. C. Davey, 1934/5 and R. E. Gabbett, 1935/7.

POLO

For a variety of reasons, organized Corps polo never materialized at home, and no individual or team performances are worthy of note except that B. C. Davey was awarded a Half Blue at Cambridge. Overseas, however, particularly in India, R.E. polo was played in one form or another continuously after the war, and representative teams competed with considerable success in local and open tournaments.

The Bengal S. & M. Polo Club was started at Roorkee in 1926 to help officers in the buying of ponies. Station polo had been played previously on the dusty *maidan*, but the polo club led to the entry of the Corps into the tournament world. After three unsuccessful attempts the Roorkee Lansdowne Cup was won in 1929 and again in 1936. Competing for the first time in the Meerut Subalterns Tournament, the Corps team was disappointingly beaten in 1932, though they had just won the Bareilly Tournament. From then onwards they were regularly represented in the hot-weather and autumn tournaments at Dehra Dun, and at various times in the Delhi Week, the Meerut Autumn and the Naini Tal Summer Tournaments. Their successes include the Dehra Dun Hot-weather Cup four times in succession and the Autumn Cup in 1935. They reached the final of the Meerut Autumn Tournament in 1932, the semi-final of the Delhi Low Aggregate in 1934, and survived three rounds of the Baria Cup in 1936. This season was about the peak of their success, and the team consisting of G. D. Mc.K. Sutherland, R. I. C. Blenkinsop, S. H. M. Battye and E. H. W. Cobb would have been rated at about ten goals handicap.

Madras S. & M. polo was resurrected at Bangalore in 1920, when a team entered for the Christmas Tournament, and played in the Madras Novices Tournament the following March. After 1921 a Corps team took part in every tournament at Bangalore, Madras and Mysore; two teams were often entered and in 1932 three competed for the Rajah of Bobbili's Cup in the Junior Tournament. At Christmas, 1928, a team, led by Brigadier R. C. R. Hill, the Commandant, competed at Calcutta in both the I.P.A. Championship and the Ezra. A team, entered for the Poona Junior in 1933, was defeated by the D.L.I. The successes of the Madras Sappers include:—At Bangalore: H.H. Maharaja of Mysore's Cup (open handicap), 1921 and 1928; Rajah of Bobbili's Cup (5 handicap), 1929; Rajkumar Deseraj Urs' Cup (7 handicap), 1928, 1931, 1933

(all S. & M. final) and 1935 (S. & M. beaten by R.E. team in the final) ; Maharajah of Venkatagiri's Cup, till 1936 the Captains and Subalterns' Cup (open handicap), 1928, 1929 and 1935 ; Novices Tournament (3 handicap), 1933 and 1935. At Mysore : H.H. Maharaja of Mysore's Birthday Cup (open handicap), 1928, 1929, 1933, 1934 and 1937. At Madras : Novices Cup (5 handicap), 1925 ; Rajah Venugopaul Cup (8 handicap), 1925, 1932, 1933, 1935 and 1936 ; Sir George Stanley Cup (open handicap), 1932 and 1933. At Venkatagiri : Open Tournament, 1938.

At Kirkee, although individual officers played from time to time, the Bombay S. & M. did not produce Corps teams. At outstations, both the Bengal and Madras Sappers were well represented in local polo, especially at Sialkot, Peshawar, Risalpur and Nowshera, where S. & M. and R.E. teams attained some success, including the Gai Cup at Peshawar in 1934.

R.E. officers were always keen supporters of the Gibraltar Polo Club whose ground was at Capamento in Spain. In 1912, 1913, 1914 and again in 1930 they won the Subalterns Tournament, and a Staff and Departments team which included three sappers won a cup in 1926. They reached the final of the Inter-Regimental in 1925 and 1926, and won it the next year, the team being W. E. Britten, W. S. Wise, G. F. B. Goldney and A. J. McDonald. They reached the final again in 1931, but after that a reduction in the establishment made it impossible to raise a complete team, and officers were attached to other units for tournament play. When the Spanish Civil War closed the frontier, polo was transferred to the Race Course at North Front.

Mention should perhaps be made of polo in China, played on China ponies at Hong Kong, Shanghai, Peking and Tientsin. R.E. officers, especially in North China, played fairly regularly, using their ponies for Paper Hunting (a local form of drag) in the winter.

BRAKE CLUB

In 1925, at the instance of D. W. A. Cleeve, a Shanks' coach was purchased for £10 from the field artillery brigade at Deepcut. It was reconditioned and taken into use by the R.E. officers stationed at Aldershot in replacement of the old pre-war coach which had been put away in store for the greater part of the war, and had turned out now and again for Ascot or for horse shows during the post-war period. Although there had been a considerable amount

of coaching activity throughout the earlier part of the period under review—for a number of years a coach, a brougham, a brake, and a dogcart had been kept in constant use—there had been no organized policy or programme, and it is this date, 1925, which marks the birth of the R.E. Brake Club as it existed until the outbreak of war in 1939. In 1926, Cleeve drove a short-tailed team to various shows and to the opening meet of the Coaching Club, of which the R.E. Brake Club had become a Regimental Member. A successful season culminated in the winning of 3rd prize in the Open Marathon at the International Horse Show at Olympia.

In 1928, the Club was able to acquire, on loan from the 10th Hussars, a coach, a brake, two sets of harness and a team of liver chestnut hackneys which were in a different class from anything that had been driven previously. Thanks to a grant from the R.E. Games Fund, the coach, hitherto available only to officers stationed at Aldershot, was made available to all R.E. officers and their ladies at public functions during the coaching season. In 1930, a tandem cart and dogcart were presented to the Club by Lieut.-General Sir Aylmer Hunter-Weston.

The 10th Hussars' coach had to be returned in 1933, but in the meantime, the Club was regularly able to turn out two, and on one or two occasions, three teams at Ascot and at all the most important shows within reach of Aldershot. A young team of chestnuts was obtained from Remounts in 1932, and from three of these, with two of the old 10th Hussars team, an "A" team was made up. After the Hussars' coach had been returned, the old coach was taken into commission again and used by "B" team until 1936, when the R.A.S.C. coach was purchased and brought into use as second string. During the 1937 season, the two coaches were turned out on twenty-one occasions, over 180 officers and ladies had seats, and a challenge cup and two silver trays were added to the list of trophies. It is interesting to note that after 1926, when the Club became a Regimental Member, the R.E. coach never missed a meet of the Coaching Club.

Under the able management of D. W. A. Cleeve, C. L. Fox, D. R. Vachell, R. N. Foster and P. A. Clauson, the activities of the Club were continued and extended, and as a result the R.E. coach earned for itself an honourable position in the coaching world, together with an ever-lengthening list of prizes and awards. The latter included the following first prizes: Military Coaches at the Royal

Counties Show, 1933-5 and 1937-9; Military Coaches at the Richmond Horse Show, 1931 and 1935-8; Military Class at the Aldershot Command Horse Show, 1935-9; Military Prize in the Marathon at Imber Court Horse Show, 1937; Gilt Challenge Cup for Military Coaches at Princes Risborough Horse Show, 1936 and 1937; Ring Class at the Bath and West Show, 1933; Open Marathon at the Royal Counties Show, 1938 and second prize in 1939. Second prize was gained in the Marathon at the International Horse Show at Olympia in 1929. In 1937 the Club was honoured by the election of a secretary, Cleeve, to membership of the Coaching Club.

In 1939, on the mechanization of the R.E. Mounted Depot, Aldershot, it was proposed that the existing team of coach horses should be purchased from the Remount Department and kept as the property of the Club. To this end, a subscription list was opened to the Corps, and within a few weeks a sum, more than enough, collected. Unfortunately, the second world war broke out just before the deal was completed, the horses had to be returned to Remounts, and all harness and equipment laid up against the day when such happy pursuits could again be enjoyed.

SHOW JUMPING

In 1925, S. A. H. Batten, the first R.E. officer to compete at the Royal Tournament and International Horse Show, qualified for the Daily Mail Cup with his two horses, Milly and Ghurka. Thereafter, individual officers and teams of N.C.Os. from the Mounted Depot appeared regularly at Olympia, where they achieved no small measure of success in competition with many of the leading horsemen of the world. In the Aldershot and Southern Command Horse Shows, in the Aldershot Bronze Medal Tournament, and later, at the Richmond and Ranelagh Horse Shows, they enjoyed a continuous run of success, the Aldershot meetings in particular being a happy hunting ground for both officers and N.C.Os. of the Mounted Depot during the whole of the post-war period.

At the International Horse Show, Batten was placed 2nd and 3rd in the King's Cup, 2nd and 3rd (three times) in the Connaught Cup and 2nd in the Canadian Cup; D. W. A. Cleeve was placed 5th in the Connaught Cup, and Batten, Cleeve, P. A. Clauson and Corporal Deeks all won open jumping pools; Batten and N. A.

Coxwell Rogers were selected as Reserves for the British Team in the Prince of Wales Cup.

At the Royal Tournament, Batten was placed 2nd and 6th in the King's Cup and 3rd and 4th in the Prince of Wales Cup ; both Cleeve and Clauson were placed 2nd in both the King's and Prince of Wales's Cups ; the Mounted Depot N.C.Os. won two second prizes and one third in the N.C.Os. Team Jumping Event.

At the Aldershot Command Horse Show and Bronze Medal Tournament, the Mounted Depot won the Aldershot Command Challenge Cup for Mounted Units on six occasions, the Team Jumping for N.C.Os. six times, the Open Jumping three times (Batten, Coxwell-Rogers and Cleeve) and the Aldershot Command Challenge Plate three times (Coxwell-Rogers, Cleeve and Corporal Deeks).

Batten was a member of the British jumping team that competed in Rome and Nice in 1927. Coxwell-Rogers won the Open Jumping at the Southern Command Horse Show in 1930. In 1936, Cleeve won the Earl of Athlone's Cup at Ranelagh, and secured three second prizes and two thirds at the Dublin Horse Show, where he was a member of the British team placed 2nd in the Aga Khan's Team Jumping Competition. In 1939, riding Hazel, he won all three Open Jumping Competitions at the Aldershot Command Horse Show, and again was a member of the British Army team competing at the Dublin Horse Show. Both he and Clauson were "placed" in the Duke of York's Cup at the Richmond Horse Show.

BEAGLING

The R.E. Beagles started life as a privately owned bobbery pack in the winter of 1906/7. The hound book (had there then been one) would have shown the pack to consist of a Staffordshire bull terrier, two fox terriers, a setter and a dog of uncertain parentage. Later in the season, however, three couple of beagles were purchased from the Welch Regiment by C. E. P. Sankey, the father of the Hunt, and hunted by him, as a drag, in the country between the Leather Bottle at Cobham and the Hoo marshes. The story of the Hunt moves rapidly through its conversion from aniseed to hares, its adoption by the S.M.E. and eventually by the R.E. Games Fund, and its development, under the able and energetic management of Sankey and his fellow enthusiasts, into a well established institution providing recreation and amusement to increasing numbers of

subscribers from the Corps, the Garrison and the civilian population of the Chatham area.

In the season of 1912/13, when this volume of the Corps History begins, hunt records show a total of 48 days' hunting with an average field of twenty-four and a maximum of seventy; an average pack of thirteen couple and a maximum of eighteen and a half; and a total of thirty hares killed. Up till this time hounds had been kennelled in what is described as a "tumbledown shanty" at Upnor, to which the requisite repairs had been effected. By 1912, however, the Hunt was in a sufficiently flourishing state to justify the provision of more permanent quarters, and enough money was raised by the issue of debentures, to construct new brick kennels in the Tank field at Upnor, where the pack was housed for many years. With the exception of the season immediately following the outbreak of war in 1914, and excluding casual stoppages for hysteria or foot and mouth disease, hunting continued uninterruptedly until 1940.

The Hunt extended, for the most part, over the Hoo peninsula from Shorne on the west to Grain marshes on the east, though there were one or two meets in the country south of the river. Here, for many years, the R.E. Beagles enjoyed the hospitality of land-owners, who co-operated whole-heartedly not only by allowing hunting over their land, but also in the matter of puppy walking and invitation teas. To some small extent their hospitality was returned by an annual Farmers' Dinner held at the Bull or the King's Head in Rochester, and later in the R.E. Mess. Early in the history of the Hunt an annual Puppy Show was inaugurated in order to encourage the breeding and training of hounds for drafting into the pack, and point-to-point races were also, for a time, a regular end-of-season feature.

Excluding the war period, when the office changed hands two or three times during the course of a season, Mastership of the pack was held by the following: R. H. Scovell, 1912-14; C. A. West, 1920-1; R. W. M. Marsden, 1922-3 and 1927-30; R. P. Pakenham-Walsh, 1923-6; B. C. T. Freeland, 1930-3; H. A. Baker, 1933-6; H. P. W. Hutson and L. G. Beach, 1936-7 and R. E. Fryer, 1937-8.

LAWN TENNIS

The period between the wars saw a continuous and world-wide increase in the popularity of lawn tennis, evidence of this being

given by the growing number of nations entering teams for the Davis Cup and, in England, by the opening of the new Wimbledon with accommodation for 15,000 spectators round the Centre Court. Everywhere new grass and hard courts were constructed and in British military stations at home and abroad improved facilities led to a general increase in the game's popularity and also to higher standards of play among both officers and other ranks.

It was not long before the Royal Engineers made their mark in army tennis. Their first success was gained in 1922, when L. C. Owen and R. G. W. H. Stone won the Doubles in the Army Championships at Queen's Club. In the following year the same event was won by H. J. Couchman and L. H. Jackson of the Survey of India. In 1924, H. T. S. King became Army Singles champion and also won the Doubles with Owen. In subsequent years G. O. Jameson won the Singles in 1930 and 1937 and C. R. D. Tuckey from 1931 to 1934 inclusive. In Doubles the Corps had an almost unbroken run of successes, winning the Inter-Regimental Doubles in the years 1926-8 and 1932-5, and the Open Doubles in 1931-3, the players concerned, besides those already named, being H. C. MacGeorge, R. S. Pain, G. L. Baker, H. R. Hutchings, G. S. Hatton and A. F. Toogood. In events for other ranks successes were won in the Singles by Sergeant F. R. Townsend in 1924 and 1925 and by Lance-Corporal H. G. Golds in 1931, while R.E. pairs won the Doubles in 1925, 1926 and 1938.

The outstanding player of the period was C. R. D. Tuckey, undoubtedly the best army player since the days of A. R. F. Kingscote. Besides being Army Singles Champion for four years, he won the Inter-Regimental Doubles (with Hatton and Jameson as partners) three times and the Open Doubles (with Jameson) also three times. Apart from his successes in army meetings, Tuckey (with G. P. Hughes) won the Doubles Championship at Wimbledon and the British Hard Courts Championship in 1936, and was a member of the British Davis Cup team in 1935-7—his doubles win in 1935 against the U.S.A. being the first by a British pair in the challenge round for twenty-eight years.

In July, 1928, a R.E. Lawn Tennis Club came into existence as the result of a meeting of Corps players at Queen's Club. It was decided to aim at arranging three or four Corps matches annually and to organize local teams in Commands through the agency of match secretaries at Bulford, Chatham, Aldershot and London, with the object of giving members as much experience of match play as

possible. Since the inauguration of the Club many matches have been played including regular annual fixtures against the Royal Signals and the R.A.S.C. The Club has undoubtedly done much to foster Corps tennis, while another favourable influence was the time spent at Cambridge by all young R.E. officers. Four of these (King, Tuckey, Jameson and D. I. Burnett) gained Blues at the University and several others played for their colleges.

In addition to successes in the Army Championships, officers of the Corps have played a prominent part in the Inter-Services Championships and other army matches. Of a total of sixty-five army players who have represented the Army in the Inter-Services matches, no less than sixteen have been from the Corps. They include most of the players whose names have already been mentioned above and, in addition, D. Campion, J. Innes, H. O'Hara Moore and D. W. Reid.

From this short account of R.E. Lawn Tennis between 1920-39, it will be evident that the standard of play in the Corps was remarkably high and that our record was one of which we may legitimately be proud. In this period of twenty years we won the Singles seven times and the Inter-Regimental Doubles nine times in the Army Championships, besides providing one-quarter of the players representing the Army against the Royal Navy and the Royal Air Force. It is hardly too much to say that, at their best, the R.E. could probably have fielded a team capable of meeting the rest of the Army on even terms.

In addition to those already referred to, the following represented the Army on one or more occasions during 1912-37: C. Russell Brown, C. P. C. S. Bright, A. D. B. Cox, A. G. Drake-Brockman, R. S. Pain, R. D. Ross, D. O'R. Schofield, C. D. Steel, T. H. Sweeny, P. St. B. Sydenham, K. H. Tuson, E. Waring, R. D. Waghorn and E. W. L. Whitehorn.

RACKETS

To the immense increase in the popularity of squash during the post-war period must be mainly attributed the decline of rackets in the Corps—and indeed throughout the country as a whole. At the time when this review begins, to represent the Corps against the Gunners was the ambition of a large number of keen players competing for the honour of selection: before its close the inability of either side to raise a pair at all, led to the abandonment of these

matches, which had continued in an almost unbroken series for the previous sixty years.

Corps rackets will ever be associated with the name of S. H. Sheppard. Though the peak of his playing career occurred many years before this volume of the Corps History begins, there are two remarkable achievements to be added to his already outstanding record. In 1921, at the age of 52, as a Major-General, he won for the third time the Singles Championship of the Army. Thirteen years later as a Colonel Commandant, R.E., he turned out to represent the Corps for the last time against the Gunners, and after playing a closely contested doubles match in the morning, won his singles in the afternoon against an opponent who was not only forty-four years his junior, but who was one of the then holders of the Army Doubles Championship.

No article on Corps rackets would be complete without some reference to W. C. Hedley, a great player in his day though his more notable achievements belong to an earlier period. B. L. Eddis and L. F. Hancock must also be honorably mentioned: the former's appearances for the Corps extend over a span of twenty-five years and he has played thirteen times against the R.A.

Apart from S. H. Sheppard's victory in 1921 the Corps has achieved no success at the Army Meeting since 1895 when the Corps pair were victorious in the Doubles. In 1931, however, R. S. Pain won the Open Singles Championship of Northern India, and, in partnership with C. G. Lewis, the Inter-Regimental Pairs at the same Meeting.

SQUASH RACKETS

Squash rackets is a very young game. It began before the 1914-18 war, but it was not until after that war that it began to grow popular, and the need for a governing body arose. The inaugural General Meeting of the Squash Rackets Association of Great Britain was held on 13th December, 1928, at the Royal Automobile Club.

The first representative Corps squash rackets match took place in London on 17th December, 1928, against the Guards Club, and resulted in a win for the Corps by four matches to one. In the following season two Corps fixtures were arranged, one against the Conservative Club and the other against the Royal Artillery, the latter being the first of a series of matches played annually for a challenge cup presented by Lieut.-Colonel P. K. Boulnois. Fixtures against Oxford and Cambridge Universities and the Jesters Club

were subsequently added, and one against Queen's Club substituted for that against the Conservative Club. For some time prior to the inauguration of the R.E. Squash Rackets Club, however, the S.M.E. had run a side selected from officers serving at Chatham, with fixtures against the Bank of England, Queen's, the Army and Navy, the Royal Automobile, and the Royal Air Force Clubs, the R.N.C. and the R.M.A.

In Army and Amateur Championship Meetings the Corps has always been strongly represented. The Army Championship was won on six occasions—by G. O. Jameson in 1931, 1932 and 1936, and by D. I. Burnett in 1935, 1937 and 1938. (He won it again several times after the war). Jameson also reached the final in 1930, 1933 and 1937. Jameson reached the semi-final of the Amateur Championship in 1931, taking two games off the invincible Amr Bey before being defeated. In 1933 he reached the final, again losing to Amr Bey. Burnett, who had been awarded his Half Blue at Cambridge in 1932, reached the final of the Amateur Championship in 1938, just losing to K. C. Gandar Dower in a long and closely fought match. The following have represented the Army against the Navy and R.A.F.: T. H. Sweeny, 1929-32; W. M. S. Lillie, 1930 and 1931; G. O. Jameson, 1931-8 (except 1936) and D. I. Burnett, 1933-9. The dates refer to the end of each season. It will be noticed that since these matches were started in 1929 the army team has always contained at least one sapper.

GOLF

The matches against the Royal Artillery, which had started in 1895, were resumed in 1919, and the following year the Household Brigade joined in to make an annual triangular contest on the links of the Royal St. George's Golf Club at Sandwich. Of the 21 matches against the R.A. between the wars 14 were won, 6 lost and 1 drawn, bringing the total score to 22 wins, 15 losses and 3 draws. Of the 20 matches against the Guards 8 were won, 8 lost and 4 drawn.

From 1919 to 1939 some fifty-five players represented the Corps in these annual eight-a-side matches of singles and foursomes. While foreign service prevented many from playing as often as their merits deserved, the following were regular representatives whenever they were serving at home. Colbeck played in fifteen of the matches, and frequently captained and managed the side. B. L. Eddis, W. H. H. Aitken and J. V. C. Moberly were there on

thirteen occasions each, I. S. O. Playfair ten and A. W. Kiggell nine times.

In 1925 a committee met in London to consider proposals to form a R.E. Golfing Society to hold golf meetings and to organize team matches against golf clubs and other golfing societies. The first Autumn Meeting was held at Rye in October of that year when a gold snuff box was presented by Brigadier-General T. A. H. and Lieut.-Colonel G. O. Bigge as a challenge trophy for the Championship of the Corps. This was played for annually by stroke play over thirty-six holes at the Autumn meetings of the R.E.G.S. The first winner was Lieutenant J. V. C. Moberly, who also won it on four subsequent occasions. Up to 1939 no other player was successful on more than one occasion. The first Spring Meeting took place at West Hill Golf Club, Brookwood, in 1926, and this also became an annual event which was most frequently held at Sunningdale. The principal event of the golfing society, however, was the Autumn Meeting, held on a seaside links, generally either at Deal or at Rye. At these meetings the first day was generally devoted to a practice match dividing all the competitors into two camps of even strength. The style of this preliminary match was frequently changed to adjust the balance. Sometimes it was Chatham *v.* the Rest, and sometimes Seniors *v.* Juniors. Sometimes Chatham was reinforced by Aldershot and sometimes the Seniors appeared more grandly as General and Field Officers against the Juniors. These "warming-up" matches were of but fleeting interest but they always achieved the happy object of bringing players together and mixing them up in friendly rivalry. The afternoons of the meetings were devoted to Bogey foursomes of one sort or another, for which the pairings were frequently drawn from a hat.

Area managers of the society succeeded in the earlier years in arranging several matches against clubs including Rye, North Hants, Knowle Park, Temple, Rochester and Cobham, and against other golfing societies such as the Rifle Brigade, the Gordon Highlanders, the Staff College, the War Office and the R.A.M.C. These were most enjoyable occasions, but the number of such fixtures had dwindled considerably by 1939 owing to the difficulty of raising teams.

The Corps was regularly represented by teams at the annual ~~Army Golf Meeting~~. ~~The Army Golf Challenge Cup~~ (teams of four) was won in 1929 by R.E. Aldershot and in 1935 by R.E. Chatham. Moberly won the Army Championship and Black Watch Gold Medal at Lytham and St. Anne's in 1928, and Aitken was the runner-up

and winner of the Silver Medal in 1927 and 1935. Aitken and Moberly have frequently figured prominently in club and open golf tournaments at home and abroad with several wins to their credit. Moberly won the Kent Amateur Championship in 1931, and Aitken was twice Army Champion in India. These two have frequently survived several rounds in the British Amateur Championship, and on one occasion they met in the first round in a field of 260, when they were the only two serving officers competing. That match went to the last green. W. B. J. Armstrong was the most notable recruit to R.E. golf in the later period. He reached the semi-final of the Irish Open Amateur Championship in 1934, when he was beaten by a small margin by H. G. Bentley, later Captain of the British Walker Cup team. P. G. Hatch was awarded his golf Half-Blue at Cambridge and later won the Championship of Bombay. Aitken, Moberly and Armstrong have played for the Army in the Inter-Services matches.

BILLIARDS

Billiards was one of the first games at which regular matches were arranged against the Royal Artillery. The series began in 1873, and continued annually, except for three short periods, until 1937, when the R.A. were unable to raise a team. During the period 1912 to 1937 there were eighteen matches of which the R.E. won thirteen. The R.E. v. R.A. billiards and rackets matches usually took place on the same day, and the occasion was looked upon as one of the important functions in the Corps athletic year. Billiards and rackets, however, suffered a similar fate. The rival attractions of bridge, wireless and the cinema, and the greater demands made by work upon young officers' after-dinner time virtually killed the game, so far as officers were concerned. A mere handful still played at all seriously, as will be appreciated from the fact that the Corps representative teams for the sixteen matches played against the Gunners between the wars were all drawn from the same eleven officers—J. R. T. Aldous, B. L. Eddis, C. H. Foulkes, L. F. Hancock, F. P. Heath, H. B. Jones, H. T. L. Loftus Tottenham, T. E. Longfield, G. Master, T. H. Sweeny and W. S. Wise. Sweeny and Longfield were awarded Half-Blues at Cambridge University.

Billiards retained its popularity among the other ranks, and station and unit representative teams have achieved successes in service and local civilian competitions. The Aldershot Command Unit Team Cup was won by the Railway Training Centre in 1927, 1928

and 1929, and by the Anti-Aircraft Battalion in 1930, 1931 and 1933: while at Chatham, the Davis Cup was won, in 1922, by the W.Os. and Sergeants Mess of the Depot Battalion—the only occasion on which it has been won by a Service team. In Army Championship Competitions the Thurston Challenge Shield (Army Inter-unit Team Championship) was won by the Depot Battalion in 1923, 1934, 1936 and 1937. A. J. Cottle, the best other rank player the Corps has produced, created a record by winning the Army Individual Title on no less than five occasions—in 1923, 1934, 1936, 1937 and 1938. He has also won the Aldershot Command Individual Championship three times.

ATHLETICS

The period was one of varying success for Corp athletics. For the first five years, only one member found a place in an army athletic team, and not until 1930 did a R.E. team gain a higher place than sixth in the Unit Team Championships. The great successes of the period were those of the Training Battalion tug-of-war team who won the Army Championship in 1921 and the A.A.A. Championship in 1924 and 1925.

That is not to say that the nineteen-twenties were barren of athletic talent proper, but the individual successes had little effect on the general standard of Corps athletics. Of those who distinguished themselves at the time, four names stand out. J. H. L. Chase represented the army four times and England once in the High Jump. Lance-Corporal T. R. Jones ran for the army in the Quarter and Half Mile Relay races for four successive years and was Army Champion at 100 and 220 Yards more than once. Lance-Corporal G. C. Webb, who was later commissioned in the Royal Tank Corps, twice represented the Army in the One and the Three Miles, and in 1926 ran for England in the Four Miles. He also represented the army several times at cross-country running. Sapper A. Farthing was twice Army Champion at One Mile and ran for the army on three successive years.

The nineteen-thirties saw the arrival of new talent fostered by various causes of which perhaps the greatest was the experience gained on the Fenners ground by officers at Cambridge. A sapper unit was in the final of the Army Team Championships from 1930 till 1936, after which young officers under instruction were debarred from representing their battalions at Chatham. The training Battalion was fourth in 1930, third in 1931 and won the Champion-

ship in 1935 and 1936, setting up five Army team records in both track and field events. R.E. Aldershot figured among the runners-up. During the thirties a team of four distance runners originally from the 38th Field Company had consistent success, providing the winner of the Army Individual Three Miles five times and of the One Mile twice. They still hold two Army team records.

The most distinguished Corps athlete of the inter-war period was undoubtedly W. A. Land. In 1931, as a boy of 16, he broke the Army High Jump record with a leap of 6 ft., and that year represented England, an honour which was to be repeated for several years. He was Army High Jump Champion four times, improving his record to 6 ft. 2½ in. In 1935 he set up an army record for throwing the discus and won the javelin. He represented England that year in all three events. He twice gained the Cotterell Cup for the best performance at the Army Individual Championships.

Another successful athlete was E. W. Denison, who, after gaining a cross-country and an athletics Blue for the Three Miles at Cambridge, won the Army Three Miles three times, ran for the Army for three years and gained international honours in 1933. Contemporary with him was D. W. Price, who also ran three miles for Cambridge and for a number of years held the University One Mile record of 4 min. 17½ sec. He later won the Army One Mile Championship and ran for the Army in this race for five years, and for England in 1933. Sapper W. M. C. R. Swan, another of the Corps distance runners, represented the Army at cross-country in 1937, won both the Three Miles and One Mile Army Individual races, setting up an Army One-Mile record, and was awarded the Cotterell Cup. Successes at Cambridge included A. J. FitzGerald's Blue for the High Hurdles in 1923, and J. J. D. Grove's Half-Blue for the Pole Vault in 1932. In 1936 A. F. M. Jack represented Great Britain in the Modern Pentathlon at the Olympic Games in Berlin.

In addition to those already mentioned, the following represented the Army: J. F. Adams, W. L. Collins, D. Cooch, N. S. Cowan, C. Crouch, D. Dennison, A. H. Ellis, J. M. W. Howe, P. McCarthy, A. W. Tremlett and A. Woodland.

BOXING

We have yet to see a Royal Engineers boxing team win the Army Championship. Having made that admission at the outset, we can reflect with no little satisfaction upon the individual successes

that fell to officers and other ranks of the Corps at fairly regular intervals between the wars. The Army Team Championship was run on an inter-battalion basis, the equivalent Corps unit being the station. A sapper station team always had to depend upon the strength of a training battalion. Numerically this was sound, but physically not so, for recruits tend to be too young to be fully developed and P.S.Is. are often rather past it. Except for individuals entered for the higher competitions, Corps activities were thus usually confined to local events.

At Aldershot the Corps was always represented in the Command Inter-Unit Championship, Novices Team and the Enlisted Boys Championships, in all of which they enjoyed some success. At Chatham the Depot Battalion entered annually for the Gordon Farrar Cup against the combined teams of the Royal Navy new entries and artificer apprentices, and won the cup on four occasions. The Depot Battalion boys had an annual match against the artificer apprentices, and occasional meetings with the R.A. boys, the Arethusa boys, Dulwich College and others. Individuals also entered for the Army Boys Championships and produced three runners-up and a semi-finalist in the A.B.A. Junior Championships of Great Britain.

Individual successes include the following : Inter-Services Boxing Association Champions—1921 and 1922, Welterweight, G. le Q. Martel; 1936 and 1937, Featherweight, P. C. Grant; 1936, Lightweight, Driver L. Sheppard. Army Champions—1920, Welterweight, Martel; 1921, Heavyweight, F. E. Buller; 1931, Middleweight, T. Burrowes; 1933, Middleweight, H. A. H. Radcliffe-Smith; 1936, Featherweight, Grant and Lightweight, Sheppard. Major Martel (later Lieut.-General Sir Gifford) had previously been Army and Navy Welterweight Champion as a subaltern in 1912 and 1913. The following were awarded Boxing Blues at Cambridge: T. Wright, F. M. Hill, T. Burrowes, J. J. D. Groves, N. C. G. A. Charteris, J. C. F. McCarthy-Morrogh and J. R. H. Robertson.

FENCING

In January, 1919, four officers who were interested in fencing approached Felix Bertrand, the well-known London fencing master, and arranged for his son Leon to give lessons in the foil twice a week at Chatham. About a dozen officers joined the class and later in the

season advantage was taken of the presence in London of Fortunati Delzi, the Italian sabre master, who had come over to coach the British Olympic Team, to enlist his services for one additional evening a week to teach the sabre. R. A. Hay and R. Llewellyn Brown entered for the Epée Competition (now known as the Junior Epée Championship): both reached the final pool, Brown winning 3rd prize.

The following winter, classes were resumed, and a proposal was mooted to make fencing one of the regular Corps clubs. It was eventually decided, however, to avoid asking officers for yet another subscription by merging the new Fencing Club with the old Revolver Club. Thus the "R.E. Officers' Fencing and Small Arms Club" came into existence. After 1922 its secretary was an *ex-officio* member of the Army Fencing Union Committee, a privilege enjoyed by no other regimental club.

Matches took place regularly against the R.M.A., and at various times against the Royal Marine officers at Chatham and Deal, the R.N.C., Greenwich, the Inns of Court, the Sherwood Foresters, and Cambridge University. The club also, on several occasions, entered, but without great success, a team for the Savage Shield (the Team Amateur Epée Championship of Great Britain). R. A. Hay was, however, a member of the Army Team, placed 2nd in the competition in 1923. In 1937 four officers entered for the Eastern Command Championships, gaining two seconds and a third.

Among individual distinctions may be mentioned the following: R. A. Hay was awarded Army Fencing Colours, and was a member of every Inter-Service team entered for the Military Championship of Europe (Officers) between the wars. He reached the final pool of the Amateur Epée Championship twice, and was placed equal tenth in the European (World) Epée Championships in 1922. He was placed 2nd in the Army Officers Epée in the Royal Tournament in 1922, and has fenced for Scotland with Epée and Sabre. A. M. Anstruther was a member of the British Epée Teams in Portugal and at Ostend in 1929; has twice been placed 3rd in the final Epée Pool (Inter-Services) at Olympia; and has fenced for Scotland. C. H. Barnett, R. Montague Jones, T. W. Nash, A. C. Lewis and H. E. B. Frederickson were awarded Half-Blues at Cambridge University.

A minor activity of the Club in 1922 was Revolver Duelling with special bullets and reduced charges in the R.E. Mess garden at Chatham.

SWIMMING

For other ranks the facilities for competitive swimming at the two main Corps centres at home, Chatham and Aldershot, were not entirely satisfactory. Neither the open-air bath nor the small S.M.E. bath were really suitable for training; and, at Aldershot, the swimming season coincided with bridging camps and collective training. Continuous and systematic swimming training was, therefore, difficult to arrange.

Officers, however, had better opportunities. At Chatham, during the winter of 1925/6, permission was obtained to use the bath in the R.N. Barracks: W. J. Howcroft, the British Olympic coach, came down weekly, and, under his tuition, L. T. G. Ricketts, H. H. C. Withers, H. B. Calvert, J. R. Hornby and I. L. H. Mackillop made considerable progress. As a result the Training Battalion team set up, in the following year, a new record in the Army Team Relay event. Sappers featured well in army competitions about this time, and a strong water polo side at Blackdown was prominent in Aldershot Command matches.

In 1928 the best post-war Corps swimmer, A. May, joined at Chatham and at his first Army Meeting won the Army 100 Yards. He afterwards put up many fine performances both in Army and Inter-Service Championships. He was five times winner of the Army 100 Yards, five times winner of the 220 Yards, and twice winner of both the 440 and 880 Yards. In 1930 he won the 100, the 220 and the 440 Yards on the same evening, and held the Army Record for all three events. The Army 100 Yards was also won by Mackillop in 1927. J. M. Calvert won the Army 880 Yards in 1935, and W. A. Vinycomb the Army Inter-Services 100 Yards Breast Stroke in 1935 and 1936. Calvert and Vinycomb were awarded Half-Blues at Cambridge. The following swam for the Army in Inter-Service events: H. B. Calvert, J. M. Calvert, C. E. Cockburn, P. Estorffe, A. F. M. Jack, J. R. Hornby, W. Morris, A. May, I. L. H. Mackillop, L. T. G. Ricketts, E. A. Tindall and W. A. Vinycomb.

The Inter-Unit Team Relay Race was won by the Training Battalion in 1925, 1926, 1932 and 1933, and by the R.E. of Eastern Command in 1927 and 1928.

FLYING

Largely through the enterprise of E. C. W. Myers, a proposal

was laid before the Corps Committee in May, 1934, for the formation of a R.E. Officers' Flying Club. The proposal was adopted, £30 was voted from the R.E. Games fund and flying became a recognized Corps activity. The object of the club was to enable officers to learn to fly, and subsequently to maintain their flying, more cheaply than would otherwise be possible. By means of affiliations with various civilian flying clubs, members were enabled to obtain special reduced rates for tuition and hiring, and to enjoy the social and other amenities of the affiliated Clubs. The latter included Brooklands, Lympne, Northampton, Cambridge (Marshall's), Malling, Salisbury Plain, Gravesend, Brighton and Portsmouth Flying Clubs, and the London Air Park, Hanworth.

In 1935, the first year of the club's existence, an "At Home" was held, in conjunction with the R.N. Flying Club, at Malling Aerodrome. Three hundred and fifty visitors were entertained to tea and given an opportunity of inspecting various types of aircraft, taking joy-rides and witnessing displays of aerobatics. Landing and bombing competitions were organized, the former open to novices, and the latter to all comers. The meeting was a great success and provided the club with some very necessary publicity, but it was not repeated, the general view being that the money available could be put to more profitable use.

The club did not maintain its own machines, but an owner-member, N. A. Blandford-Newson, generously placed his at the disposal of qualified members.

In 1937 it was found possible to award £5 (later £10) to every member qualifying for an "A" Licence, and further encouragement was given to learners by offering a prize of £10 for the best performance in a cross-country test, carried out under the auspices of the Malling Aero Club. The original membership of thirty had risen by 1938 to 184, of which nineteen were qualified pilots.

It was intended that the activities of the club should include gliding, but, owing to the popularity of the sport among the general public, it was impossible to obtain concessions from any of the civilian clubs accessible to members. F. J. R. Heath, one-time Secretary of the club, achieved great distinction at the sport and placed his own sailplane at the disposal of members. Up to the outbreak of war, however, flying proved to be the greater attraction.

RESULTS OF R.A. v. R.E. MATCHES 1910-39*

Season ending	Cricket	Rugby football	Hockey	Golf	Rackets	Squash rackets	Billiards
1910	L. 9 wkts.	—	—	Halved	L. 0-3	—	L. 0-3
1911	L. 1 wkt.	—	—	L. 5-6	L. 1-2	—	L. 0-3
1912	Drawn	—	W. 11-0	L. 4-5	L. 1-2	—	W. 2-1
1913	L. 1 wkt.	—	W. 2-1	Halved	W. 3-0	—	W. 2-1
1914	L. ins. and 163	—	W. 2-1	W. 8-4	W. 2-1	—	L. 1-2
1919	—	—	—	L. 5-7	—	—	—
1920	L. 8 wkts.	L. 8-11	—	W. 7-3	—	—	—
1921	L. 8 wkts.	L. 12-14	W. 4-0	W. 5-4	—	—	—
1922	Drawn	W. 29-9	W. 5-1	W. 7-5	L. 1-2	—	W. 2-1
1923	L. 179 runs	W. 18-8	W. 2-0	L. 4-8	L. 1-2	—	L. 1-2
1924	W. 9 wkts.	W. 13-8	W. 2-0	L. 4-7	W. 3-0	—	W. 3-0
1925	Drawn	W. 6-3	W. 4-1	L. 2-10	L. 0-3	—	W. 2-1
1926	W. 7 wkts.	D. 3-3	W. 6-0	W. 7-4	W. 3-0	—	W. 3-0
1927	Drawn	W. 16-14	L. 2-4	W. 9-2	W. 3-0	—	L. 1-2
1928	Drawn	W. 3-0	W. 3-1	W. 7-5	W. 3-0	—	W. 2-1
1929	W. 188 runs	L. 6-10	W. 5-2	W. 7-4	L. 0-3	—	L. 1-2
1930	Drawn	W. 15-3	W. 3-2	W. 8-4	W. 2-1	W. 5-1	W. 3-0
1931	Drawn	L. 3-9	W. 5-0	L. 5-7	W. 2-1	L. 2-3	W. 3-0
1932	Drawn	L. 9-13	D. 2-2	W. 7-3	L. 1-2	L. 2-3	W. 3-0
1933	L. 7 wkts.	W. 6-5	D. 0-0	L. 5-7	W. 2-1	L. 2-3	L. 1-2
1934	Drawn	W. 13-6	D. 1-1	W. 6-5	L. 1-2	L. 1-4	W. 3-0
1935	L. 8 wkts.	L. 3-11	W. 3-2	Halved	—	L. 1-4	W. 3-0
1936	Drawn	L. 6-9	L. 1-4	W. 7-5	—	L. 2-3	W. 3-0
1937	Drawn	D. 3-3	L. 0-2	W. 9-3	—	L. 2-3	—
1938	L. 228 runs	L. 0-8	W. 2-0	W. 8-4	—	L. 2-3	—
1939	Drawn	W. 15-12	W. 2-1	W. 6-4	—	L. 2-3	—

ABSTRACT OF RESULTS OF R.A. v. R.E. MATCHES

	Cricket	Rugby football	Hockey	Golf	Rackets	Squash rackets	Billiards
First match	1864	1887 revived 1920	1912	1895	1894	1930	1894
Played	112	22	22	40	33	10	35
Won	36	12	16	22	17	1	20
Lost	39	8	3	15	16	9	15
Drawn	37	2	3	3	0	0	0

* The results of matches prior to 1910 were published in the Supplement to *The R.E. Journal* of March, 1910.

APPENDIX I

THE VICTORIA CROSS

Official citations accompanying awards of the Victoria Cross to
Royal Engineers, 1914-19

The London Gazette, 16th November, 1914

CAPTAIN THEODORE WRIGHT, Royal Engineers.

Gallantry at Mons on 23rd August, in attempting to connect up the lead to demolish a bridge under heavy fire; although wounded in the head he made a second attempt. At Vailly, on 14th September, he assisted the passage of 5th Cavalry Brigade over the pontoon bridge, and was mortally wounded whilst assisting wounded men into shelter.

The London Gazette, 16th November, 1914

LANCE-CORPORAL CHARLES ALFRED JARVIS (Regtl. No. 3976),
57th Field Company, Royal Engineers.

For great gallantry at Jenappes, on 23rd August in working for one and a half hours under heavy fire in full view of the enemy, and in successfully firing charges for the demolition of a bridge.

The London Gazette, 25th November, 1914

CAPTAIN WILLIAM HENRY JOHNSTON, Royal Engineers.

At Missy, on 14th September, under a heavy fire all day until 7 p.m., worked with his own hand, two rafts, bringing back wounded and returning with ammunition; thus enabling advanced brigade to maintain its position across the river.

The London Gazette, 18th February, 1915

LIEUTENANT PHILIP NEAME, Royal Engineers.

For conspicuous bravery on the 19th December, near Neuve Chapelle, when, notwithstanding the very heavy rifle fire and bomb-throwing by the enemy, he succeeded in holding them back and rescuing all the wounded men whom it was possible to move.

The London Gazette, 19th April, 1915

LIEUTENANT CYRIL GORDON MARTIN, D.S.O., 56th Field Company, Royal Engineers.

For most conspicuous bravery at Spanbroek Molen, on 12th March, 1915, when in command of a grenade throwing party of six rank and file. Although wounded early in the action, he led his party into the enemy's trenches and held back their reinforcements for nearly two and a half hours, until the evacuation of the captured trench was ordered.

The London Gazette, 24th August, 1915

CAPTAIN LANOE GEORGE HAWKER, D.S.O., Royal Engineers and Royal Flying Corps.

For most conspicuous bravery and very great ability on the 25th July, 1915.

When flying alone he attacked three German aeroplanes in succession. The first managed eventually to escape, the second was driven to ground damaged, and the third, which he attacked at a height of about 10,000 feet, was driven to earth in our lines, the pilot and observer being killed.

The personal bravery shown by this officer was of the very highest order, as the enemy's aircraft were armed with machine guns, and all carried a passenger as well as the pilot.

The London Gazette, 18th November, 1915

TEMPORARY SECOND LIEUTENANT FREDERICK HENRY JOHNSON, 73rd Field Company, Royal Engineers.

For most conspicuous bravery and devotion to duty in the attack on Hill 70, on the 25th September, 1915.

Second Lieutenant Johnson was with a section of his company of the Royal Engineers. Although wounded in the leg, he stuck to his duty throughout the attack, led several charges on the German redoubt, and at a very critical time, under very heavy fire, repeatedly rallied the men who were near him. By his splendid example and cool courage he was mainly instrumental in saving the situation and in establishing firmly his part of the position which had been taken. He remained at his post until relieved in the evening.

The London Gazette, 7th December, 1915

No. 91608, **CORPORAL JAMES LENNOX DAWSON**, 187th Company, Royal Engineers.

For most conspicuous bravery and devotion to duty on 13th October, 1915, at Hohenzollern redoubt.

During a gas attack, when the trenches were full of men, he walked backwards and forwards along the parados, fully exposed to a very heavy fire, in order to be the better able to give directions to his own sappers, and to clear the infantry out of the sections of the trench that were full of gas. Finding three leaking gas cylinders, he rolled them some sixteen yards away from the trench, again under very heavy fire, and then fired rifle bullets into them to let the gas escape.

There is no doubt that the cool gallantry of Corporal Dawson on this occasion saved many men from being gassed.

The London Gazette, 5th August, 1916

No. 136414, **SAPPER WILLIAM HACKETT**, late Royal Engineers.

For most conspicuous bravery when entombed with four others in a gallery owing to the explosion of an enemy mine.

After working for twenty hours a hole was made through fallen earth and broken timber, and the outside party was met. Sapper Hackett helped three of the men through the hole and could easily have followed, but refused to leave the fourth, who had been seriously injured, saying "I am a tunneller, I must look after the others first."

Meantime the hole was getting smaller, yet he still refused to leave his injured comrade. Finally the gallery collapsed, and though the rescue party worked desperately for four days the attempt to reach the two men failed.

Sapper Hackett, well knowing the nature of sliding earth, and the chances against him, deliberately gave his life for his comrade.

The London Gazette, 14th September, 1917

LIEUT.-COLONEL (T./BRIGADIER-GENERAL) CLIFFORD COFFIN, D.S.O., Royal Engineers.

For most conspicuous bravery and devotion to duty.

When his command was held up in attack owing to heavy machine-gun and rifle fire from front and right flank, and was establishing itself in a forward shell-hole line, he went forward and made an inspection of his front posts.

Though under the heaviest fire from both machine-guns and rifles, and in full view of the enemy, he showed an utter disregard of personal danger, walking quietly from shell hole to shell hole, giving advice generally, and cheering the men by his presence.

His very gallant conduct had the greatest effect on all ranks, and it

was largely owing to his personal courage and example that the shell-hole line was held in spite of the very heaviest fire.

Throughout the day his calm courage and cheerfulness exercised the greatest influence over all with whom he came in contact, and it is generally agreed that Brigadier-General Coffin's splendid example saved the situation, and had it not been for his action the line would certainly have been driven back.

The London Gazette, 2nd April, 1918

War Office,

2nd April, 1918.

His Majesty the King has been graciously pleased to approve the award of the Victoria Cross to the undermentioned officer:—

2ND LIEUTENANT (T./CAPTAIN) JAMES BYFORD McCUDDEN, D.S.O., M.C., M.M., Gen. List and R.F.C.*

For most conspicuous bravery, exceptional perseverance, keenness, and very high devotion to duty.

Captain McCudden has at the present time accounted for 54 enemy aeroplanes. Of these 42 have been definitely destroyed, 19 of them on our side of the lines. Only 12 out of the 54 have been driven out of control.

On two occasions he has totally destroyed four two-seater enemy aeroplanes on the same day, and on the last occasion all four machines were destroyed in the space of 1 hour and 30 minutes.

While in his present squadron he has participated in seventy-eight offensive patrols, and in nearly every case has been the leader. On at least thirty other occasions, whilst with the same squadron, he has crossed the lines alone, either in pursuit or in quest of enemy aeroplanes.

The following incidents are examples of the work he has done recently:—

On the 23rd December, 1917, when leading his patrol, eight enemy aeroplanes were attacked between 2.30 p.m. and 3.50 p.m. Of these two were shot down by Captain McCudden in our lines. On the morning of the same day he left the ground at 10.50 and encountered four enemy aeroplanes; of these he shot two down.

On the 30th January, 1918, he, single-handed, attacked five enemy scouts, as a result of which two were destroyed. On this occasion he only returned home when the enemy scouts had been driven far east; his Lewis gun ammunition was all finished and the belt of his Vickers gun had broken.

As a patrol leader he has at all times shown the utmost gallantry and skill, not only in the manner in which he has attacked and destroyed the enemy, but in the way he has during several aerial fights protected

* Enlisted as a bugler in the Royal Engineers.

the newer members of his flight, thus keeping down their casualties to a minimum.

This officer is considered, by the record which he has made, by his fearlessness, and by the great service which he has rendered to his country, deserving of the very highest honour.

The London Gazette, 8th May, 1918

2ND LIEUTENANT (A/CAPTAIN) ALFRED MAURICE TOYE, M.C., Middlesex Regiment.*

For most conspicuous bravery and fine leadership displayed in extremely critical circumstances.

When the enemy captured the trench at a bridgehead, he three times re-established the post, which was eventually recaptured by fresh enemy attacks.

After ascertaining that his three other posts were cut off, he fought his way through the enemy with one officer and six men of his company.

Finding seventy men of the battalion on his left, retiring, he collected them, counter-attacked, and took up a line which he maintained until reinforcements arrived. Without this action, the defence of the bridge must have been turned.

In two subsequent operations, when in command of a composite company, he covered the retirement of his battalion with skill and courage.

Later, with a party of battalion headquarters, he pressed through the enemy in the village, firing at them in the streets, thus covering the left flank of the battalion retirement. Finally, on a still later occasion, when in command of a mixed force of the brigade, he re-established, after hard fighting, a line that had been abandoned before his arrival. He was twice wounded within ten days, but remained at duty. His valour and skilful leading throughout this prolonged period of intense operations was most conspicuous.

The London Gazette, 4th June, 1918

T./2ND LIEUTENANT CECIL LEONARD KNOX, Royal Engineers.

For most conspicuous bravery and devotion to duty. Twelve bridges were entrusted to this officer for demolition, and all of them were successfully destroyed. In the case of one steel girder bridge, the destruction of which he personally supervised, the time fuse failed to act.

Without hesitation 2nd Lieutenant Knox ran to the bridge, under heavy rifle and machine-gun fire, and when the enemy were actually

* Enlisted as a trumpeter in the Royal Engineers.

on the bridge he tore away the time fuse and lit the instantaneous fuse, to do which he had to get under the bridge.

This was an act of the highest devotion to duty, entailing the gravest risks, which, as a practical civil engineer, he fully realized.

The London Gazette, 6th January, 1919

No. 213078, **SAPPER ADAM ARCHIBALD**, 218th Field Company, R.E. (Leith).

For most conspicuous bravery and self-sacrifice on the 4th November, 1918, near Ors, when with a party building a floating bridge across the canal.

He was foremost in the work under a very heavy artillery barrage and machine-gun fire. The latter was directed at him from a few yards' distance while he was working on the cork floats; nevertheless, he persevered in his task, and his example and efforts were such that the bridge, which was essential to the success of the operations, was very quickly completed.

The supreme devotion to duty of this gallant sapper, who collapsed from gas poisoning on completion of his work, was beyond all praise.

The London Gazette, 31st January, 1919

LIEUTENANT (A./MAJOR) BRETT MACKAY CLOUTMAN, M.C., 59th Field Company, R.E., T.F.

For most conspicuous bravery on the 6th November, 1918, at Pont-Sur-Sambre.

Major Cloutman, after reconnoitring the river crossings, found the Quartes Bridge almost intact but prepared for demolition. Leaving his party under cover he went forward alone, swam across the river, and, having cut the "leads" from the charges, returned the same way, despite the fact that the bridge and all approaches thereto were swept by enemy shells and machine-gun fire at close range. Although the bridge was blown up later in the day by other means, the abutments remained intact.

The London Gazette, 31st January, 1919

No. 422047, **CORPORAL JAMES McPHIE**, late 416th (Edinburgh) Field Company, R.E., T.F.

For most conspicuous bravery on the 14th October, 1918, when with a party of sappers maintaining a cork float bridge across the Canal de la Sensee near Aubencheul au Bac.

The farther end of the bridge was under close machine-gun fire and within reach of hand grenades. When infantry, just before dawn, were crossing it, closing up resulted and the bridge began to sink and break. Accompanied by a sapper, he jumped into the water and endeavoured to hold the cork and timbers together, but this they failed to do. Corporal McPhie then swam back and, having reported the broken bridge, immediately started to collect material for repair. It was now daylight. Fully aware that the bridge was under close fire and that the far bank was almost entirely in the hands of the enemy, with the inspiring words "It is death or glory work which must be done for the sake of our patrol on the other side," he led the way, axe in hand, on to the bridge and was at once severely wounded, falling partly into the water, and died after receiving several further wounds. It was due to the magnificent example set by Corporal McPhie that touch was maintained with the patrol on the enemy bank at a most critical period.

The London Gazette, 13th February, 1919

T./CAPTAIN (A./MAJOR) ARNOLD HORACE SANTO WATERS, D.S.O., M.C., 218th Field Company, R.E.

For most conspicuous bravery and devotion to duty on the 4th November, 1918, near Ors, when bridging with his field company the Oise-Sambre Canal.

From the outset the task was under artillery and machine-gun fire at close range, the bridge being damaged and the building party suffering severe casualties.

Major Waters, hearing that all his officers had been killed or wounded, at once went forward and personally supervised the completion of the bridge, working on cork floats while under fire at point-blank range. So intense was the fire that it seemed impossible that he could escape being killed.

The success of the operation was due entirely to his valour and example.

The London Gazette, 15th May, 1919

CAPTAIN (A./MAJOR) GEORGE DE CARDONNE ELMSALL FINDLAY, D.S.O., M.C., 409th (Lowland) Field Company, R.E., T.F.

For most conspicuous bravery and devotion to duty during the forcing of the Sambre-Oise Canal at the Lock, two miles south of Catillon, on 4th November, 1918, when in charge of the bridging operations at this crossing.

Major Findlay was with the leading bridging and assaulting parties which came under heavy fire while trying to cross the dyke between the forming up line and the lock. The casualties were severe, and the

advance was stopped. Nevertheless, under heavy and incessant fire he collected what men he could and repaired the bridges, in spite of heavy casualties in officers and other ranks. Although wounded, Major Findlay continued his task, and after two unsuccessful efforts, owing to his men being swept down, he eventually placed the bridge in position across the lock, and was the first man across, subsequently remaining at this post of danger till further work was completed.

His cool and gallant behaviour inspired volunteers from different units at a critical time when men became casualties almost as soon as they joined him in the fire-swept zone, and it was due to Major Findlay's gallantry and devotion to duty that this most important crossing was effected.

The London Gazette, 18th July, 1919

Air Ministry,

Hotel Cecil, Strand, W.C.2.

18th July, 1919.

His Majesty the King has been graciously pleased to approve of the award of the Victoria Cross to the late **CAPTAIN (A./MAJOR) EDWARD MANNOCK, D.S.O., M.C.**, 85th Squadron, Royal Air Force,* in recognition of bravery of the first order in Aerial Combat:—

On the 17th June, 1918, he attacked a Halberstadt machine near Armentières and destroyed it from a height of 8,000 ft.

On the 7th July, 1918, near Douliu, he attacked and destroyed one Fokker (red-bodied) machine, which went vertically into the ground from a height of 1,500 ft. Shortly afterwards he ascended 1,000 ft. and attacked another Fokker biplane, firing sixty rounds into it, which produced an immediate spin, resulting, it is believed, in a crash.

On the 14th July, 1918, near Merville, he attacked and crashed a Fokker from 7,000 ft., and brought a two-seater down damaged.

On the 19th July, 1918, near Merville, he fired eighty rounds into an Albatross two-seater, which went to the ground in flames.

On the 20th July, 1918, east of La Bassée, he attacked and crashed an enemy two-seater from a height of 10,000 ft.

About an hour afterwards he attacked at 8,000 ft. a Fokker biplane near Steenwercke and drove it down out of control, emitting smoke.

On the 22nd July, 1918, near Armentières, he destroyed an enemy triplane from a height of 10,000 ft.

Major Mannock was awarded the undermentioned distinctions for his previous combats in the air in France and Flanders:—

Military Cross. Gazetted 17th September, 1917.

Bar to Military Cross. Gazetted 18th October, 1917.

Distinguished Service Order. Gazetted 16th September, 1918.

* Seconded from the Royal Engineers.

Bar to Distinguished Service Order (1st). Gazetted 16th September, 1918.

Bar to Distinguished Service Order (2nd). Gazetted 3rd August, 1918.

This highly distinguished officer, during the whole of his career in the Royal Air Force, was an outstanding example of fearless courage, remarkable skill, devotion to duty, and self-sacrifice, which has never been surpassed.

The total number of machines definitely accounted for by Major Mannock up to the date of his death in France (26th July, 1918) is fifty—the total specified in the *Gazette* of 3rd August, 1918, was incorrectly given as 48, instead of 41.

APPENDIX II

CHIEF ROYAL ENGINEERS

In 1936 His Majesty King Edward VIII was pleased to approve the revival of the office of Chief Royal Engineer, and the appointment of General Sir Bindon Blood thereto.

The following notification appeared in *The London Gazette* :—

The London Gazette

Friday, 16th October, 1936.

War Office,

16th October, 1936.

Gen. Sir Bindon Blood, G.C.B., G.C.V.O., ret. pay, Col. Comdt., is appointed Chief Royal Engineer. 16th Oct. 1936.

Holders of this office have been :—

General Sir Bindon Blood, G.C.B., G.C.V.O.	...	...	...	1936
Lieut.-General Sir Ronald E. Charles, K.C.B., C.M.G., D.S.O.	...	...	...	1940
General Sir Guy C. Williams, K.C.B., C.M.G., D.S.O.	...	...	...	1946
General Sir Edwin L. Morris, K.C.B., O.B.E., M.C.	...	...	...	1951

APPENDIX III

COLONELS COMMANDANT, ROYAL ENGINEERS

Field-Marshal Sir John F. Burgoyne, G.C.B.	...	...	...	1854
General Sir Charles G. Ellicombe, K.C.B.	...	...	...	1856
General Sir John M. F. Smith, K.H.	...	...	...	1860

General W. R. Ord	...	...	...	...	...	...	1861
Lieut.-General T. Foster	...	...	...	...	...	...	1866
General M. Williams	...	...	...	...	...	...	1867
General R. J. Stotherd	...	...	...	...	...	...	1868
General H. Servanté	...	...	...	...	...	...	1870
General E. Frome	...	...	...	...	...	...	1871
General W. T. Renwick	...	...	...	...	...	...	1871
General Sir Frederick E. Chapman, K.C.B.	...	...	...	...	...	...	1872
General W. E. D. Broughton	...	...	...	...	...	...	1872
Field-Marshal Sir J. Lintorn A. Simmons, K.C.B.	...	...	...	...	...	...	1872
General E. W. Durnford	...	...	...	...	...	...	1874
General G. Wynne	...	...	...	...	...	...	1876
General Sir Henry D. Harness, K.C.B.	...	...	...	...	...	...	1877
General C. G. Ford	...	...	...	...	...	...	1877
General R. G. Hamilton	...	...	...	...	...	...	1879
General W. C. Hadden	...	...	...	...	...	...	1880
General E. Ogle	...	...	...	...	...	...	1882
General Sir John S. Hawkins, K.C.M.G.	...	...	...	...	...	...	1884
General H. W. Montagu, C.B.	...	...	...	...	...	...	1887
General C. Fanshawe	...	...	...	...	...	...	1890
General J. F. M. Browne, C.B.	...	...	...	...	...	...	1890
General Sir Lothian Nicholson, K.C.B.	...	...	...	...	...	...	1890
General J. Bayly, C.B.	...	...	...	...	...	...	1893
General Sir William F. D. Jervois, G.C.M.G., C.B., F.R.S.	...	...	...	...	...	...	1893
Lieut.-General Sir Thomas L. J. Gallwey, K.C.M.G.	...	...	...	...	...	...	1895
Lieut.-General R. Dyott	...	...	...	...	...	...	1897
Lieut.-General A. C. Cooke	...	...	...	...	...	...	1899
Lieut.-General C. B. Ewart, C.B.	...	...	...	...	...	...	1902
Lieut.-General G. D. Pritchard, C.B.	...	...	...	...	...	...	1902
Lieut.-General Sir James B. Edwards, K.C.M.G., C.B.	...	...	...	...	...	...	1903
General Sir Richard Harrison, G.C.B., C.M.G.	...	...	...	...	...	...	1903
Major-General W. J. Stuart	...	...	...	...	...	...	1903
General R. N. Dawson-Scott	...	...	...	...	...	...	1905
General Sir Charles Warren, G.C.M.G., K.C.B.	...	...	...	...	...	...	1905
Field-Marshal Viscount Kitchener of Khartoum, G.C.B., O.M., G.C.M.G., P.C.	...	...	...	...	...	...	1906
Major-General C. J. Moysey, C.M.G.	...	...	...	...	...	...	1912
Major-General Sir Thomas Fraser, K.C.B., C.M.G.	...	...	...	...	...	...	1913
General Sir Bindon Blood, G.C.B.	...	...	...	...	...	...	1914
Major-General Sir William Salmond, K.C.B.	...	...	...	...	...	...	1915
Lieut.-General Sir Herbert C. Chermiside, G.C.M.G., C.B.	...	...	...	...	...	...	1916

Lieut.-General G. Henry, C.B.	1916
Lieut.-General Sir William T. Shone, K.C.B., D.S.O.	1918
Lieut.-General Sir Ronald C. Maxwell, K.C.B., K.C.M.G.	1920
Lieut.-General Sir Henry H. Settle, K.C.B., D.S.O.	1921
Lieut.-General Sir Aylmer G. Hunter-Weston, K.C.B., D.S.O.	1921
Lieut.-General Sir George H. Fowke, K.C.B., K.C.M.G.	1921
Major-General Sir Elliott Wood, K.C.B.	1921
Major-General D. A. Scott, C.V.O., D.S.O.	1922
General Sir Reginald C. Hart, V.C., K.C.B., K.C.V.O.	1922
Major-General Sir Arthur R. F. Dorward, K.C.B., D.S.O.	1922
Lieut.-General Sir Fenton J. Aylmer, V.C., K.C.B.	1922
Major-General H. W. Duperier	1922
Lieut.-General Sir Henry M. Lawson, K.C.B.	1922
Major-General Sir George Barker, K.C.B.	1923
Lieut.-General Sir George M. W. Macdonogh, G.B.E., K.C.B., K.C.M.G.	1924
Major-General Sir James R. L. Macdonald, K.C.I.E., C.B., LL.D.	1924
General Sir George F. Goringe, K.C.B., K.C.S.I.	1927
General Sir George M. Kirkpatrick, K.C.B., K.C.S.I.	1927
Major-General Sir Andrew M. Stuart, K.C.M.G., C.B.	1929
Lieut.-General Sir Edwin H. de V. Atkinson, K.C.B., K.B.E., C.M.G., C.I.E.	1930
Major-General Sir Hugh B. Bruce-Williams, K.C.B., D.S.O.	1930
Major-General Sir Reginald U. H. Buckland, K.C.M.G., C.B.	1931
Lieut.-General J. R. E. Charles, C.B., C.M.G., D.S.O.	1931
Major-General Sir Hubert A. A. Livingstone, K.C.M.G., C.B.	1931
Major-General Sir Richard P. Lee, K.C.M.G., C.M.G.	1931
Major-General H. L. Pritchard, C.B., C.M.G., D.S.O.	1932
Major-General Sir William A. Liddell, K.C.M.G., C.B.	1933
Major-General S. H. Sheppard, C.B., C.M.G., D.S.O.	1933
Major-General G. A. J. Leslie, C.B., C.M.G.	1934
Lieut.-General Sir Hugh J. Elles, K.C.B., K.C.M.G., K.C.V.O., D.S.O.	1935
Major-General Sir Henry F. Thuillier, K.C.B., C.M.G.	1935
Major-General R. N. Harvey, C.B., C.M.G., D.S.O.	1935
Major-General G. Walker, C.B., C.B.E., D.S.O.	1935
Major-General A. G. Stevenson, C.B., C.M.G., D.S.O.	1935
Major-General Sir Sydney D'A. Crookshank, K.C.M.G., C.B., C.I.E., D.S.O., M.V.O.	1936
Major-General W. H. Beach, C.B., C.M.G., D.S.O.	1936
Major-General Clifford Coffin, V.C., C.B., D.S.O.	1936

Major-General C. G. Fuller, C.B., C.M.G., D.S.O.	1937
Major-General C. H. Foulkes, C.B., C.M.G., D.S.O.	1937
Major-General Sir M. Graham Bowman-Manifold, K.B.E., C.B., C.M.G., D.S.O.	1938
Lieut.-General Sir Maurice G. Taylor, K.C.B., C.M.G., D.S.O. ...	1938
Major-General R. L. B. Thompson, C.B., C.M.G., D.S.O.	1939
Major-General A. Brough, C.B., C.M.G., C.B.E., D.S.O.	1939
Lieut.-General Sir Guy C. Williams, K.C.B., C.M.G., D.S.O. ...	1940
Major-General G. H. Addison, C.B., C.M.G., D.S.O.	1940
Lieut.-General W. G. S. Dobbie, C.B., C.M.G., D.S.O.	1940
Lieut.-General D. S. Collins, C.B., D.S.O.	1940
Major-General H. S. Gaskell, C.B., D.S.O.	1940
Major-General A. E. Davidson, C.B., D.S.O.	1940
Lieut.-General F. P. Nosworthy, C.B., D.S.O., M.C.	1940
Lieut.-General L. V. Bond, C.B.	1940
Major-General F. S. G. Piggott, C.B., D.S.O.	1941
Major-General M. N. MacLeod, C.B., D.S.O.	1941
Lieut.-General C. A. Bird, C.B., D.S.O.	1942
Lieut.-General Sir Giffard Le Q. Martel, K.C.B., K.B.E., D.S.O., M.C.	1944
Lieut.-General Sir Edwin L. Morris, K.C.B., O.B.E., M.C. ...	1944
Major-General P. Neame, V.C., C.B., D.S.O.	1945
Lieut.-General Sir Alfred E. Grasett, K.B.E., C.B., D.S.O., M.C.	1945
Lieut.-General Sir Maurice F. Grove-White, K.B.E., C.B. ...	1946
Lieut.-General Sir Gordon N. Macready, Bart., K.B.E., C.B., C.M.G., D.S.O.	1946
Lieut.-General Sir Charles J. S. King, K.B.E., C.B.	1946
General Sir Brian H. Robertson, Bart., G.B.E., K.C.M.G., K.C.V.O., C.B., D.S.O., M.C., A.D.C.	1950
Major-General Sir Eustace F. Tickell, K.B.E., C.B., M.C. ...	1950
Lieut.-General Sir Ronald MacK. Scobie, K.B.E., C.B., M.C. ...	1951
Lieut.-General Sir Kenneth N. Crawford, K.C.B., M.C.	1951

The ranks and decorations given are those held on the date of appointment as Colonel Commandant.

APPENDIX IV

THE KING'S CHIEF ENGINEERS

Bishop Gundolphus	...	...	...	...	...	...	1078
Waldivus, Ingeniator	...	...	...	...	...	...	1086
Geoffrey, Ingeniator	...	...	...	...	...	...	1131
Allnoth, Ingeniator	...	...	...	...	...	...	1158
Magister Albertus, Ingeniator	...	...	...	...	...	...	1200
Peter, Ingeniator	...	...	...	...	...	...	1226
Richard, Magister Ingeniatorum	...	...	...	...	...	...	1287
Brother Robert De Ulmo	...	...	...	...	...	...	1300
John Gruynard	...	...	...	...	...	...	1354
Nicholas Merbury	...	...	...	...	...	...	1414
William Pawne	...	...	...	...	...	...	1509
Sir Richard Lee, Kt.	...	...	...	...	...	...	1540
Sir William Pelham, Kt.	...	...	...	...	...	...	1575
John van Cranvelot	...	...	...	...	...	...	1603
Bernard Johnson	...	...	...	...	...	...	1620
Captain Thomas Rudd	...	...	...	...	...	...	1627
John Lanyon	...	...	...	...	...	...	1627
Lieut.-Colonel John Paperill	...	...	...	...	...	...	1628
Cornelius Drebel	...	...	...	...	...	...	1630
Sir Godfrey Lloyd, Kt.	...	...	...	...	...	...	1640

PARLIAMENT'S CHIEF ENGINEERS

John Lyon	...	...	...	...	...	...	1642
Major Morgan	...	...	...	...	...	...	1643
Peter Manteau van Dalem	...	...	...	...	...	...	1647
Eval Tercene	...	...	...	...	...	...	1654
Nathanial Nye	...	...	...	...	...	...	1657

CHIEF ENGINEERS OF ENGLAND

Sir Charles Lloyd, Kt.	...	...	...	...	...	...	1660
Sir Bernard de Gomme, Kt.	...	...	...	...	...	...	1661
Colonel Sir Martin Beckman, Kt.	...	...	...	...	...	...	1683
Vacant, 1702-11							
Brigadier-General Michael Richards	...	...	...	...	...	...	1711
Major-General John Armstrong...	...	...	...	...	...	...	1714

Lieut.-Colonel Thomas Lascelles	...	...	...	...	1742
Vacant, 1750-7					
Lieut.-General William Skinner...	...	...	...	...	1757
Major-General James Bramham	...	...	...	...	1781
General Sir William Green, Bart.	...	...	...	...	1786

INSPECTOR-GENERALS OF FORTIFICATIONS

General R. Morse	...	...	...	...	...	1802
General G. Mann	...	...	...	...	...	1811
Major-General Sir Alexander Bryce, Kt., K.C.H., C.B.	...					1830
Major-General R. Pilkington	...	...	...	...	...	1832
Lieut.-General Sir Frederick W. Mulcaster, K.C.H.	...					1834
Field-Marshal Sir John F. Burgoyne, Bart., G.C.B.	...					1845
Major-General E. Frome...	...	...	...	...	...	1868
Major-General Sir John W. Gordon, K.C.B.	...	...	...	...	...	1869
Lieut.-General Sir Frederick E. Chapman, K.C.B.	...					1870
General Sir J. Lintorn A. Simmons, G.C.B., G.C.M.G.	...					1875
Lieut.-General Sir Thomas L. J. Gallwey, K.C.M.G.	...					1880
Lieut.-General Sir Andrew Clarke, G.C.M.G., C.B., C.I.E.	...					1882
General Sir Lothian Nicholson, K.C.B.	...	...	...	...	...	1886
Lieut.-General Sir Robert Grant, K.C.B.	...	...	...	...	...	1891
General Sir Richard Harrison, K.C.B., C.M.G.	...	...	...	...	...	1898
Lieut.-General W. T. Shone, C.B., D.S.O.	...	...	...	...	...	1903

DIRECTORS OF FORTIFICATIONS AND WORKS

Brigadier-General R. M. Ruck	...	...	...	...	...	1904
Brigadier-General F. Rainsford-Hannay, C.B.	...					1908
Major-General Sir George K. Scott-Moncrieff, K.C.B., K.C.M.G., C.I.E.	...	...	...	...	...	1911
Major-General Sir Phillip G. Twining, K.C.M.G., C.B., M.V.O.	...					1918
Major-General Sir William A. Liddell, K.C.M.G., C.B.	...					1920
Major-General Sir Henry F. Thuillier, K.C.B., C.M.G.	...					1924
Major-General Sir Philip G. Grant, K.C.B., C.M.G.	...					1927
Major-General R. L. B. Thompson, C.B., C.M.G., D.S.O.	...					1931
Major-General D. S. Collins, D.S.O.	...	...	...	...	...	1935
Major-General G. B. O. Taylor, C.B.E.	...					1939
Major-General W. Cave-Browne, C.B.E., D.S.O., M.C.	...					1940
Major-General A. G. B. Buchanan	...	...	...	...	...	1941
Brigadier H. E. Hopthrow, C.B.E.	...	...	...	...	...	1943
Brigadier E. J. B. Buchanan, D.S.O.	...	...	...	...	...	1945
Brigadier D. Harrison, C.B., D.S.O.	...	...	...	...	...	1946

Brigadier H. de L. Panet, C.B.E.	...	...	...	...	1947
Brigadier L. D. Grand, C.I.E., C.B.E.	...	...	...	...	1949
Major-General L. D. Grand, C.B., C.I.E., C.B.E.	...	...	...	...	1951

ENGINEERS-IN-CHIEF

Major-General C. J. S. King, C.B., C.B.E.	...	...	...	...	1941
Major-General H. B. W. Hughes, C.B., D.S.O., O.B.E.	...	...	...	...	1944
Major-General Sir Eustace F. Tickell, K.B.E., C.B., M.C.	...	...	...	...	1945
Major-General A. D. Campbell, C.B.E., D.S.O., M.C.	...	...	...	...	1948
Major-General G. N. Tuck, C.B., O.B.E.	...	...	...	...	1952

The names in this Appendix are displayed on the walls of the office of the Engineer-in-Chief at the War Office. The ranks and decorations were those held during the appointments, after which certain promotions, of course, took place. For instance, Major-Generals Dudley S. Collins, Charles J. S. King and G. Brian O. Taylor received Knighthoods and the first two of these officers attained the rank of Lieut.-General.

APPENDIX V

DIRECTORS OF THE ROYAL ENGINEERS ESTABLISHMENT, CHATHAM

Major, later General Sir, Charles W. Pasley, K.C.B.	...	...	...	...	1812
Colonel, later General Sir, J. M. F. Smith, K.H.	...	...	...	...	1842
Lieut.-Colonel, later Lieut.-General Sir, Harry D. Jones,					
G.C.B.	...	...	...	...	1851
Colonel, later Lieut.-General, H. Sandham	...	...	...	...	1855
Colonel, later Major-General Sir, Henry D. Harness, K.C.B.	...	...	...	...	1860
Colonel, later Field-Marshal Sir, J. Lintorn Simmons, G.C.B.,					
G.C.M.G.	...	...	...	...	1865
Colonel, later Lieut.-General Sir, Thomas L. J. Gallwey,					
K.C.M.G.	...	...	...	...	1868

COMMANDANTS, SCHOOL OF MILITARY ENGINEERING

Colonel, later Lieut.-General Sir, Thomas L. J. Gallwey,					
K.C.M.G.	...	...	...	...	1869
Colonel, later Lieut.-General Sir, John Stokes, K.C.B.	...	...	...	...	1875
Colonel, later Lieut.-General Sir, Andrew Clarke, G.C.M.G.,					
C.B., C.I.E.	...	...	...	...	1881

Colonel, later Major-General, E. C. A. Gordon	...	...	1882
Colonel, later Lieut.-General Sir, J. Bevan Edwards, K.C.M.G., C.B.	...	...	1885
Colonel, later General, R. N. Dawson-Scott	...	...	1888
Major-General, later Lieut.-General, E. O. Hewett, C.M.G.	...	...	1893
Colonel, later Major-General Sir, John C. Ardagh, K.C.I.E., C.B.	...	...	1895
Colonel, later Major-General Sir, Thomas Fraser, K.C.B., C.M.G.	...	...	1896
Major-General, later General Sir, Reginald C. Hart, V.C., K.C.B., K.C.V.O.	...	...	1902
Colonel H. W. Smith Rewse, C.B., C.V.O.	...	...	1905
Colonel, later Brigadier-General, F. Rainsford-Hannay, C.B., C.M.G.	...	...	1907
Colonel, later Major-General, J. A. Ferrier, C.B., D.S.O.	...	...	1908
Colonel J. L. Irvine	...	...	1910
Colonel, later Major-General Sir, John E. Capper, K.C.B., K.C.V.O.	...	...	1911
Brigadier-General F. Rainsford-Hannay, C.B., C.M.G.	...	...	1914
Brigadier-General, later Major-General, A. L. Schreiber, C.B., C.M.G., D.S.O.	...	...	1917
Major-General, later Sir, Henry F. Thuillier,* K.C.B., C.M.G.	...	...	1919
Major-General, later Sir, Philip G. Grant,† K.C.B., C.M.G.	...	...	1923
Major-General G. Walker,† C.B., C.B.E., D.S.O.	...	...	1927
Major-General H. L. Pritchard,† C.B., C.M.G., D.S.O.	...	...	1931
Major-General, later Lieut.-General Sir, William G. S. Dobbie,† G.C.M.G., K.C.B., D.S.O.	...	...	1933
Major-General, later Lieut.-General Sir, Lionel V. Bond,† K.B.E., C.B.	...	...	1935
Major-General R. P. Pakenham-Walsh,† M.C.	...	...	1939
Colonel E. E. B. Mackintosh, D.S.O.	...	...	1939
Colonel R. Briggs, D.S.O., M.C.	...	...	1940
Brigadier M. Luby, D.S.O., M.C.	...	...	1940
Brigadier N. A. Coxwell-Rogers, D.S.O.	...	...	1941
Brigadier D. Harrison, D.S.O.	...	...	1942
Brigadier H. T. S. King	...	...	1943
Brigadier B. T. Godfrey-Faussett, C.B., D.S.O., O.B.E., M.C.	...	...	1945
Brigadier B. C. Davey, C.B.E.	...	...	1948
Brigadier C. E. A. Browning, C.B.E., M.C.	...	...	1951

* Also G.O.C., Chatham Area.

† Also G.O.C., Chatham Area and Inspector of Royal Engineers

APPENDIX VI

CHAIRMEN OF THE R.E. INSTITUTE COMMITTEE

Lieut.-General Sir Frederick E. Chapman,		
K.C.B.	I.G.F.	1870-1875
Field-Marshal Sir J. Lintorn A. Simmons,		
G.C.B., G.C.M.G.	I.G.F.	1875-1880
Major-General Sir Thomas J. L. Gallwey,		
K.C.M.G.	I.G.F.	1880-1882
Major-General Sir Andrew Clarke, G.C.M.G.,		
C.B., C.I.E.	I.G.F.	1882-1886
General Sir Lothian Nicholson, K.C.B. ...	I.G.F.	1886-1891
Lieut.-General Sir Robert Grant, G.C.B. ...	I.G.F.	1891-1898
General Sir Richard Harrison, G.C.B., C.M.G.	I.G.F.	1898-1903
Major-General Sir William T. Shone, K.C.B.,		
D.S.O.	I.G.F.	1903-1904
Major-General Sir Reginald C. Hart, V.C.,		
G.C.B., K.C.V.O.	C.S.M.E.	1904-1905
Brigadier-General R. M. Ruck, C.B., C.M.G.	D.F.W.	1905-1908
Brigadier-General F. Rainsford-Hannay,		
C.B., C.M.G.	D.F.W.	1908-1911
Major-General Sir George K. Scott-Mon-		
crieff, K.C.B., K.C.M.G., C.I.E.	D.F.W.	1911-1918
Major-General Sir Philip G. Twining,		
K.C.M.G., C.B., M.V.O.	D.F.W.	1918-1920
Major-General Sir William A. Liddell,		
K.C.M.G., C.B.	D.F.W.	1920-1922

PRESIDENTS OF THE INSTITUTION OF ROYAL ENGINEERS

Major-General Sir William A. Liddell, K.C.M.G., C.B. ...	1922-1926
Major-General Sir Henry F. Thuillier, K.C.B., C.M.G. ...	1926-1927
Major-General Sir Philip G. Grant, K.C.B., C.M.G. ...	1927-1931
Brigadier-General Sir James E. Edmonds, Kt., C.B.,	
C.M.G.	1931-1935
Major-General Sir Hugh B. Bruce-Williams, K.C.B.,	
D.S.O.	1935-1938
Major-General Sir Charles W. Gwynn, K.C.B., C.M.G.,	
D.S.O.	1938-1941
Major-General G. H. Addison, C.B., C.M.G., D.S.O. ...	1941-1944

Lieut.-General Sir Lionel V. Bond, K.B.E., C.B.	...	1945-1947
Major-General Sir Eustace F. Tickell, K.B.E., C.B., M.C.		1948-1950
Major-General Sir Horace E. Roome, K.C.I.E., C.B., C.B.E., M.C.	... ..	1951-

APPENDIX VII

APPOINTMENTS HELD BY CERTAIN DISTINGUISHED R.E. OFFICERS, INCLUDING THOSE WHOSE PORTRAITS ARE IN THE 1914-18 WAR PORTRAIT GALLERY.

At the end of the 1914-18 war a portrait gallery was prepared of certain R.E. officers who had held distinguished appointments during the war. These pictures were hung in the R.E. H.Q. Mess at Chatham until after the 1939-45 war, when they were transferred to the R.E. Mess at Gordon Barracks, Gillingham, and were replaced in the H.Q. Mess by a 1939-45 war portrait gallery.

Reproductions from the 1914-18 war portrait gallery have been included in Volumes V, VI and VII, and below is given a list of some of the more important appointments held by these officers, as well as details of certain other officers who held important positions up to 1939.

The list is not a comprehensive one, but is intended to show the great variety of work undertaken by sapper officers. It is arranged in alphabetical order and the rank shown in each case is the most senior rank held.

MAJOR-GENERAL G. H. ADDISON, C.B., C.M.G., D.S.O., M.A., M.I.Mech.E., M.I.Struct.E.

1895, Commissioned R.E.; 1927-30, A.A.G.R.E., W.O.; 1930-1, C.E. Aldershot Command; 1932-6, E-in-C. India; 1936-7, Financial Adviser, A.H.Q. India; 1939-41, Insp. R.E.; 1940, Col.-Comdt. R.E.

BRIGADIER-GENERAL SIR FRANCIS J. ANDERSON, K.B.E., C.B.

1878, Commissioned R.E.; 1894, Pres. Municipal Commission, Georgetown; 1900-2, employed on decoding intercepted Boer cypher messages; 1904, Comdt. 2nd Q.O. (Madras) S. & M.;

1909, A.D.F.W., W.O. ; 1913, C.E. Eastern Command ; 1914, Chief Cypher Officer G.S. ; 1915, Chairman, Army Sanitary Committee.

Memoir in *R.E. Journal*, March, 1921.

**COLONEL SIR CHARLES F. ARDEN-CLOSE, K.B.E., C.B., C.M.G.,
D.Sc., F.R.S.**

1884, Commissioned R.E. ; 1887-8, Served in Balloon Det. ; 1889-93, Survey of India ; 1895, in charge Niger Protectorate—Kamerun Boundary Survey ; 1898, British Commissioner on the Nyasa-Tanganyika Boundary Commission ; 1899-1900, served in South African War ; 1905-11, Head of the Geographical Section, G.S. ; 1911-22, Director-General Ordnance Survey ; 1927-30, Pres. R. Geographical Society.

**LIEUT.-GENERAL SIR EDWIN H. de V. ATKINSON, K.C.B.,
K.B.E., C.M.G., C.I.E.**

1885, Commissioned R.E. ; 1915, C.R.E. 38th (Welsh) Div., France ; 1918, C.E. First Army, France ; 1919, C.E. Iraq ; 1921, E.-in-C. India ; 1924, M.G.O. India ; 1930, Col.-Comdt. R.E.

Portrait in Vol. V. Memoir in *R.E. Journal*, September, 1947.

BRIGADIER-GENERAL H. H. AUSTIN, C.M.G., D.S.O.

1887, Commissioned R.E. ; 1890-1907, Served in India and East Africa ; 1907-11, D.A.Q.M.G., Eastern Command India, and D.A.Q.M.G., Intelligence Dept. Simla ; 1914, G.S.O.1 Staff College, Quetta ; 1915, Comdt. Cadet College, Quetta ; 1916, B.G.G.S. Mesopotamia and G.O.C. Tigris Defences ; 1918, Comdt. Jebu Refugee Camp, Baqubah.

LIEUT.-GENERAL SIR FENTON J. AYLMER, Bart., V.C., K.C.B.

1880, Commissioned R.E. ; 1901, A.Q.M.G. Madras Command ; 1904, Comd. Inf. Bde., Quetta ; 1912, Adjutant-General in India ; 1915, Corps Commander, Mesopotamia ; 1917, Comd. Mhow Div. Area ; Victoria Cross received for blowing in the gate of Nilt Fort on 2.12.1891 during the Hunza-Nagar Expedition ; 1922, Col.-Comdt. R.E.

Portrait in Vol. VII. Memoir in *R.E. Journal*, December, 1935.

BRIGADIER-GENERAL R. K. BAGNALL-WILD, C.M.G., C.B.E., D.L., J.P.

1893, Commissioned R.E.; 1902-5, In I.G.F. and D.F.W. Office; 1906-9, Sec. Mechanical Transport Committee, W.O.; 1909, Retired R.E.; 1913, Inspector of Engines R.F.C.; 1916-21, Director of Aircraft Inspection, R.F.C.; 1921-4, Director of Research, Air Ministry; Past President Institution Automobile Engineers; Past Chairman Royal Aeronautical Society.

COLONEL A. H. BAGNOLD, C.B., C.M.G.

1872, Commissioned R.E. and served mostly with Telegraph Units; 1887, Director of Telegraphs to Egyptian Field Frontier Force; 1899, C.R.E. Jamaica; 1902, C.R.E. Isle of Wight; 1903, Supt. of Building Works, Woolwich Arsenal; 1914, Mil. Asst. to Chief Supt. of Ordnance Factories, Woolwich; 1916, Chief Experimental Officer, Signal Experimental Establishment, Woolwich.

Memoir in *R.E. Journal*, June, 1944.

COLONEL B. C. BATTYE, D.S.O., A.M.

1900, Commissioned R.E.; 1904, Ferozepore (Awarded Albert Medal for putting out fire in the Arsenal); 1914-18, O.C. 21 Fd. Coy. 3rd S. & M. and various staff appointments, France; 1921-32, Punjab Govt. hydro-electric scheme.

Memoir in *R.E. Journal*, December, 1932.

MAJOR-GENERAL W. H. BEACH, C.B., C.M.G., D.S.O.

1889, Commissioned R.E.; 1915, General Staff (Intelligence) Mesopotamia; 1918, B.G.G.S. (Intelligence) Mesopotamia; 1929-32, Comd. 42nd East Lancs. Div.; 1926-8, A.D.C. to the King; 1936, Col.-Comdt. R.E.
Portrait in Vol. VII.

MAJOR-GENERAL SIR FRANCIS G. BOND, K.B.E., C.B., C.M.G.

1876, Commissioned R.E.; 1879, Zulu Campaign; 1882, Egyptian Expedition; 1891, Hazara Campaign; 1896, S. of I. Roorkee; 1897, Tirah Campaign; 1901-2, D.A.A.G. 4th Div., S. Africa; 1903, Comdt. Q.O. Madras S. & M.; 1904, A.Q.M.G. Punjab Command; 1906, D.Q.M.G., A.H.Q., India; 1908,

D.G.M.W. India ; 1911, Comd. Southern Bde., Madras ; 1914-19, D. of Q., W.O.
Memoir in *R.E. Journal*, June, 1931.

LIEUT.-GENERAL SIR LIONEL V. BOND, K.B.E., C.B.

1903, Commissioned R.E. ; 1908, Operations in Zakka Khel and Mohmand Areas ; 1914-19, European War, Mesopotamia ; 1935-9, Comdt. S.M.E., Inspector of R.E. and G.O.C. Chatham Area ; 1939-41, G.O.C. Malaya ; 1940, Col.-Comdt. R.E.

MAJOR-GENERAL SIR M. GRAHAM E. BOWMAN-MANIFOLD, K.B.E., C.B., C.M.G., D.S.O.

1891, Commissioned R.E. ; 1914, 1st A.H.Q. Signal Coy., France ; 1915-18, Director of Army Signals, Gallipoli, Egypt and Palestine ; 1924, Retired ; 1938, Col.-Comdt. R.E.
Portrait in Vol. VI. Memoir in *R.E. Journal*, June, 1940.

MAJOR-GENERAL A. BROUGH, C.B., C.M.G., C.B.E., D.S.O.

1895, Commissioned R.E. ; 1914-18, Served European War ; 1919-20, South Russia ; 1927-31, A.D. Engineering, W.O. ; 1932-6, Dir. of Mechanization, W.O. ; 1939, Col.-Comdt. R.E.

MAJOR-GENERAL SIR HUGH B. BRUCE-WILLIAMS, K.C.B., D.S.O.

1885, Commissioned R.E. ; 1914, Base Comdt., No. 1 Base, France ; 1915, Major.-Gen. G.S., Second Army, France ; 1916-18, G.O.C. 37th Div., France ; 1930, Col.-Comdt. R.E.
Portrait in Vol. V. Memoir in *R.E. Journal*, June, 1943.

MAJOR-GENERAL SIR. REGINALD U. H. BUCKLAND, K.C.M.G., C.B.

1883, Commissioned R.E. ; 1908, C.R.E. Salisbury Dist. ; 1911, C.R.E. Cairo ; 1913, C.E. Egypt ; 1914, C.E. IV Corps, France ; 1918, C.E. Fourth Army, France ; 1919, C.E. B.A.O.R. ; 1931, Col.-Comdt. R.E.
Portrait in Vol. V. Memoir in *R.E. Journal*, March, 1934.

COLONEL SIR SIDNEY G. BURRARD, Bart., K.C.S.I., F.R.S.

1879, Commissioned R.E. ; 1899, Supt. of Trigonometrical Survey India ; 1908, Officiated as Surveyor General of India ; 1911, Surveyor General of India ; 1916, Pres. Annual Science Congress, Lucknow.

Memoir in *R.E. Journal*, December, 1943.

MAJOR H. E. BURTON, G.C., O.B.E.

1902, Commissioned R.E. from ranks ; 1914-19, Comdt. and C.I. of a Command School of Signalling, Field Engineering and Bombing ; 1919-27, After retirement gave distinguished service to the Royal National Life-boat Service. In 1924 when the Life-boat Service completed its first hundred years he was awarded the Medal of the Order of the British Empire for Gallantry, converted in 1941 to the George Cross. He already held eight life-saving medals, including the Royal National Life-boat Institution's Gold Medal and the Gold Cross of Honour of the United States ; 1924, Adjutant 50th Northumbrian Div., T.A. ; 1939, Administrative Officer to a Div. Engineers at age of 75 ; When he finally retired he joined the Home Guard.

Memoir in *R.E. Journal*, March, 1945.

MAJOR-GENERAL SIR JOHN E. CAPPER, K.C.B., K.C.V.O.

1880, Commissioned R.E. ; 1903, Comdt. Balloon School ; 1911, Comdt. S.M.E. ; 1914, Deputy Inspector-General of Communications, France ; 1915-17, G.O.C., 24th Div., France ; 1918, Director-General Tank Corps ; 1920-5, Lieut.-Governor Guernsey ; 1923, Col. Comdt. R.T.C.

Portrait in Vol. V.

LIEUT.-COLONEL SIR JOHN R. CHANCELLOR, G.C.M.G., G.C.V.O., G.B.E. D.S.O.

1890, Commissioned R.E. ; 1896, Served in Dongola Expedition ; 1897-8, Tirah Expedition ; 1906, Secretary to the Colonial Defence Committee ; 1911-16, Governor and C.-in-C. Mauritius ; 1916-21, Trinidad and Tobago ; 1923-8, Southern Rhodesia ; 1928-31, High Commissioner and C.-in-C. Palestine ; 1940-1, Vice-Chairman of the British Council and Member of Executive Committee ; Member of Council and Foreign Secretary of the Royal Geographical Society.

**LIEUT.-GENERAL SIR J. RONALD E. CHARLES, K.C.B., C.M.G.,
D.S.O.**

1894, Commissioned R.E.; 1914, General Staff, Indian Exp. Force, France; 1915, B.G.G.S. Indian Army Corps; 1918, G.O.C., 25th Div., France; 1919, B.G.G.S., Staff College, Camberley; 1921, D.S.D. A.H.Q. India; 1923, Comd. Waziristan Force, India; 1924-6, Comdt. R.M.A.; 1926-31, D.M.O. & I., W.O.; 1934, M.G.O., W.O.; 1931, Col.-Comdt. R.E.; 1940-6, Chief Royal Engineer.
Portrait in Vol. V.

MAJOR SIR JOHN E. CLAUSON, K.C.M.G., C.V.O.

1885, Commissioned R.E.; 1895, Staff Capt., W.O.; 1900, Sec., Colonial Defence Committee; 1906, Chief Sec. to Govt. of Cyprus; 1912, Lieut.-Governor, Malta; 1914, High Commissioner and C-in-C. Cyprus.

MAJOR-GENERAL CLIFFORD COFFIN, V.C., C.B., D.S.O.

1888, Commissioned R.E.; 1914, O.C. 98th Field Company; 1917, Comd. 25th Inf. Bde.; 1917, Awarded the Victoria Cross at Westhoek, Ypres; 1918, G.O.C., 36th (Ulster) Div., France; 1920-4, A.D.C. to the King; 1936, Col.-Comdt. R.E.
Portrait in Vol. V.

**LIEUT.-GENERAL SIR DUDLEY S. COLLINS, K.B.E., C.B.,
D.S.O.**

1899, Commissioned R.E.; 1901-2, Served in S. Africa; 1914-16, European War; 1931-5, C.E. Southern Command; 1935-9, D.F.W., W.O.; 1939-41, D.Q.M.G., W.O.; 1940, Col.-Comdt. R.E.

BRIGADIER-GENERAL E. W. COX, D.S.O.

1900, Commissioned R.E.; 1914, General Staff (Intelligence) G.H.Q. France; 1918, B.G.G.S. (Intelligence), France.
Portrait in Vol. V. Memoir in *R.E. Journal*, February, 1919.

**MAJOR-GENERAL SIR SIDNEY D'A CROOKSHANK, K.C.M.G.,
C.B., C.I.E., D.S.O., M.V.O.**

1889, Commissioned R.E.; 1914, O.C. Field Squadron, France;

1918, D.G. Transportation, France ; 1919, Secretary in P.W.D. and Consulting Engineer to Govt. of India ; 1923, C.E. Southern Command, U.K. ; 1936, Col.-Comdt. R.E.
Portrait in Vol. V. Memoir in *R.E. Journal*, December, 1941.

MAJOR-GENERAL SIR REGINALD S. CURTIS, K.C.M.G., C.B., D.S.O.

1883, Commissioned R.E. ; 1895-6, Ashanti Exp. Force, Director of Telegraphs ; 1899, Falkland Isles—Admiralty (special duty) ; 1899-1900, South African War, Asst. Director and Director Army Telegraphs ; 1905, I.G. S. African Constabulary ; 1908, C.R.E. Edinburgh ; 1911, Comdt. Army Signal School ; 1913, A.A.G.R.E., W.O. ; 1917, M.G.A. Aldershot Command ; 1920, Retired.
Memoir in *R.E. Journal*, June and July, 1922.

MAJOR-GENERAL A. E. DAVIDSON, C.B., D.S.O., M.I.Mech.E., M.I.Mar.E.

1899, Commissioned R.E. ; 1902, Served South African War ; 1910-14, Sec. Mechanical Transport Committee, W.O. ; 1914-18, European War ; 1920-4, Chief Inspector R.E. Stores ; 1924-5, D.A.D.F.W., W.O. ; 1927-31, Chairman Technical Committee, Mechanical Warfare Board ; 1931-5, A.D.W., W.O. ; 1935-6, A.D.C. to the King ; 1936, D. of Mechanization, W.O. ; 1935, President Inst. of Mech. E. ; 1940, Col.-Comdt. R.E. ; 1950, President, Diesel Engine Users Assoc.

MAJOR-GENERAL J. E. DICKIE, C.B., C.M.G.

1874, Commissioned R.E. ; 1905, C.R.E., N.W. Frontier Province and Secretary to Govt. in the P.W.D. ; 1908, C.R.E. 1st (Peshawar) Div. ; 1911, D.G.M.W., India ; 1913, Retired ; 1915, C.E. London Defences ; 1917, L. of C., France ; 1918, Independent Air Force, France (preparation of aerodromes).
Memoir in *R.E. Journal*, June, 1939.

LIEUT.-GENERAL SIR WILLIAM G. S. DOBBIE, G.C.M.G., K.C.B., D.S.O.

1899, Commissioned R.E. ; 1914-18, Served European War ; 1926-8, G.S.O.I, W.O. ; 1928-32, Brigade Commander, Egypt ;

1932-5, Comdt. S.M.E. and R.E. Depot, Inspector of R.E. and Comd. Chatham Area; 1935-9, G.O.C. Malaya; 1940-2, Governor of Malta; 1940, Col.-Comdt. R.E.

**MAJOR-GENERAL SIR ARTHUR R. F. DORWARD, K.C.B.,
D.S.O.**

1868, Commissioned R.E.; 1900, Boxer Campaign, Military and Civil Commissioner at Wei-Hai-Wei; 1914-18, Inspector of Hutting, W.O.; 1922, Col.-Comdt. R.E.
Memoir in *R.E. Journal*, June, 1949.

MAJOR-GENERAL H. W. DUPERIER

1871, Commissioned R.E.; 1903-8, Director-General, Military Works, India; 1914-17, Home Selection Board, Inns of Court and Artists Rifles O.T.C.; 1922, Col.-Comdt. R.E.
Memoir in *R.E. Journal*, March, 1941.

**BRIGADIER-GENERAL SIR JAMES E. EDMONDS, Kt., C.B.,
C.M.G., D.Litt.**

1881, Commissioned R.E.; 1890-6, Instructor R.M.A.; 1899-1901, D.A.A.G., W.O.; 1901-2, Served S. African War; 1904-8, D.A.Q.M.G., W.O.; 1909-10, G.S.O.I., W.O.; 1914-19, European War, (Deputy E.-in-C., B.E.F., 1918); 1919-49, Officer in charge of Military Branch, Historical Section, Committee of Imperial Defence, now Cabinet Office.

**GENERAL SIR HUGH J. ELLES, K.C.B., K.C.M.G., K.C.V.O.,
D.S.O.**

1899, Commissioned R.E.; 1914, D.A.Q.M.G., 4th Div., France; 1915, B.M. 10th Brigade; 1916-18, Comd. Tank Corps in the Field, France; 1926, D.M.T., W.O.; 1934, M.G.O., W.O.; 1935, Col.-Comdt. R.E.
Portrait in Vol. V. Memoir in *R.E. Journal*, December, 1945.

MAJOR-GENERAL J. A. FERRIER, C.B., D.S.O.

1873, Commissioned R.E.; 1908-10, Comdt. S.M.E.; 1915-17, G.O.C. Humber Garrison.
Memoir in *R.E. Journal*, December, 1934.

MAJOR-GENERAL C. H. FOULKES, C.B., C.M.G., D.S.O.

1894, Commissioned R.E.; 1914, O.C., 11th Field Company; 1915, G.S.O.I, G.H.Q., France; 1916, Comd. Special Brigade, France; 1918, Director of Gas Operations, France; 1924-6, D.C.E. Southern Command; 1926-30, C.E. Aldershot Command; 1928, A.D.C. to the King; 1937, Col.-Comdt. R.E.
Portrait in Vol. V.

LIEUT.-GENERAL SIR GEORGE H. FOWKE, K.C.B., K.C.M.G.

1884, Commissioned R.E.; 1909, C.R.E. Aldershot; 1910, A.A.G.R.E., W.O.; 1913, Inspector of R.E.; 1914, Engineer-in-Chief, France; 1916-18, Adjutant-General, France; 1921, Col. Comdt. R.E.
Portrait in Vol. V. Memoir in *R.E. Journal*, June, 1936.

LIEUT.-GENERAL SIR JOHN S. FOWLER, K.C.B., K.C.M.G., D.S.O.

1886, Commissioned R.E.; 1914-18, Director of Army Signals, France; 1921, G.O.C. Singapore, later G.O.C. China Command; 1923, Col. Comdt. R.C. of S.
Portrait in Vol. V. Memoir in *R.E. Journal*, December, 1949.

MAJOR-GENERAL SIR THEODORE FRASER, K.C.B., C.S.I., C.M.G.

1886, Commissioned R.E.; 1914, Embarkation Commandant, Marseilles; 1915, A.A. and Q.M.G. 3rd Lahore Div., France; 1916, B.G.G.S. III (Ind.) Corps; 1918, G.O.C., 14th Indian Div., Mesopotamia; 1922, Comd. British Forces in Iraq; 1924-7, Comd. Troops in Malaya.
Portrait in Vol. VII.

MAJOR-GENERAL SIR HENRY F. E. FREELAND, K.C.I.E., C.B., D.S.O., M.V.O.

1891, Commissioned R.E.; 1914, Assistant Director Railway Transport, France; 1918, Deputy Director-General Transportation, France.
Portrait in Vol. V. Memoir in *R.E. Journal*, December, 1946.

**MAJOR-GENERAL RT. HON. SIR LOVICK B. FRIEND, K.B.E.,
C.B.**

1873, Commissioned R.E. ; 1906-8, A.D.F.W. and President R.E. Committee ; 1913-16, M.G.A. Irish Command, Privy Councillor Ireland ; 1916-18, President Claims Commission, B.E.F. ; Director of Hirings, Requisitions and Billets.
Memoir in *R.E. Journal*, March, 1945.

MAJOR-GENERAL C. G. FULLER, C.B., C.M.G., D.S.O.

1893, Commissioned R.E. ; 1915, A.A. and Q.M.G. and G.S.O.1, 29th Div., Gallipoli ; 1917, B.G.G.S. France ; 1923-5, Comd. 130th Bde. T.A. ; 1925-8, Comd. Canal Bde., Egypt ; 1929-31, M.G.A. Eastern Command ; 1931-5, Comd. 48th (South Midland) Div., T.A. ; 1937, Col.-Comdt. R.E.
Portrait in Vol. V.

BRIGADIER-GENERAL F. G. FULLER, C.B., C.M.G.

1888, Commissioned R.E. ; 1915, General Staff, Gallipoli ; 1916-18, Brigadier-General, General Staff, XII Corps, Salonika.
Portrait in Vol. VI.

MAJOR-GENERAL H. S. GASKELL, C.B., D.S.O.

1900, Commissioned R.E. ; 1914-18, Served in France, Belgium, and Mesopotamia ; 1918-20, Persia ; 1920, Arab Rebellion, Iraq ; 1932-5, C.E. Northern Command, India ; 1936-9, E.-in-C. India ; 1940, Col.-Comdt. R.E.

COLONEL SIR E. PERCY C. GIROUARD, K.C.M.G., D.S.O.

1888, Commissioned R.E. ; 1896, Director of Railways, Egyptian Army ; 1898, Pres. Egyptian State Rlys. ; 1899, Director Rlys. South Africa ; 1902, Commissioner Rlys. South Africa ; 1907, High Commissioner and C.-in-C. Northern Nigeria ; 1909, Governor and C.-in-C. East Africa Protectorate.
Memoir in *R.E. Journal*, June, 1933.

**MAJOR-GENERAL SIR FREDERICK M. GLUBB, K.C.M.G.,
C.B., D.S.O.**

1877, Commissioned R.E. ; 1903, C.R.E. Mauritius ; 1905, C.R.E. Aldershot ; 1909, C.E. Northern Command ; 1912,

C.E. Southern Command ; 1914, C.E. III Corps, France ; 1915, C.E. Second Army, France ; 1917-18, Engineer-in-Chief, Italy ; 1918-19, C.E. Army of Occupation.
Portrait in Vol. V. Memoir in *R.E. Journal*, December, 1938.

**BRIGADIER-GENERAL E. G. GODFREY-FAUSSETT, C.B.,
C.M.G.**

1888, Commissioned R.E. ; 1915, D.D. of Army Signals, First Army, France ; 1916, D.D. of Army Signals, Fifth Army, France ; 1919-22, Comdt. Signal Service Training Centre.
Memoir in *R.E. Journal*, December, 1942.

**LIEUT.-GENERAL SIR GEORGE F. GORRINGE, K.C.B.,
K.C.M.G., D.S.O.**

1888, Commissioned R.E. ; 1900, D.A.A.G., H.Q. Staff, S. Africa ; 1902, Governor, Sennar Province, Sudan ; 1906, D.M.Q., W.O. ; 1909, Comd. 18th Inf. Bde., Lichfield ; 1912, Comd. Bombay Bde. ; 1915, G.O.C. 12th Div., Mesopotamia ; 1916, G.O.C. Tigris Army Corps, Mesopotamia ; 1916-18, G.O.C. 47th Div., France ; 1919-21, Comd. 10th Div. Egypt ; 1927, Col.-Comdt. R.E.
Portrait in Vol. VII. Memoir in *R.E. Journal*, June, 1946.

MAJOR-GENERAL SIR PHILIP G. GRANT, K.C.B., C.M.G.

1888, Commissioned R.E. ; 1915, C.R.E. 8th Div., France ; 1916, C.E. XV Corps, Mesopotamia ; 1918, C.E., Fifth Army, France ; 1919, D.C.E. British Forces, France and Belgium ; 1921-3, Director of Public Works, Palestine ; 1924-7, Comdt. S.M.E. ; 1927-31, D.F.W., W.O.
Portrait in Vol. V. Memoir in *R.E. Journal*, December, 1943.

**LIEUT.-GENERAL SIR A. EDWARD GRASETT, K.B.E., C.B.,
D.S.O., M.C.**

1909, Commissioned R.E. ; 1914-18, Served European War ; 1921-3, Operations on N.W. Frontier of India ; 1937-8, B.G.S., Northern Command, U.K. ; 1938-41, G.O.C., China ; 1941, Divisional Commander ; 1941-3, Corps Commander ; 1944-5, S.H.A.E.F. ; 1945, Lieut.-Governor and C.-in-C. Jersey ; 1945, Col.-Comdt. R.E.

COLONEL E. H. GROVE-HILLS, C.M.G., C.B.E., D.Sc., F.R.S.

1884, Commissioned R.E. ; 1899, Officer i/c Geographical Section of G.S., W.O. ; 1905-12, Hon. Treasurer, R. Astronomical Socy. ; 1908, President of Geographical Section of British Association ; 1913-15, President R. Astronomical Socy. ; 1914-18, D.C.E. Eastern Command.

Memoir in *R.E. Journal*, December, 1922.

**BRIGADIER-GENERAL SIR FREDERICK G. GUGGISBERG,
K.C.M.G., D.S.O.**

1889, Commissioned R.E. ; 1905, Dir. of Surveys, Gold Coast ; 1910, Dir. of Surveys, S. Nigeria ; 1913, Surveyor-General of Nigeria ; 1914-18, 94th Fd. Coy., France, C.R.E. 8th Div., C.R.E. 66th (Lancs.) Div., Comd. 170th Inf. Bde., Comd. 100th Inf. Bde. ; 1920-7, Governor Gold Coast Colony ; 1928-9, Governor British Guiana.

Memoir in *R.E. Journal*, June, 1931.

**MAJOR-GENERAL SIR CHARLES W. GWYNN, K.C.B., C.M.G.,
D.S.O.**

1889, Commissioned R.E. ; 1915, General Staff, 2nd Australian Division, Gallipoli ; 1915, Comd. 6th Inf. Bde., Gallipoli ; 1916-18, B.G.G.S. XXII (II Anzac) Corps, France ; 1923-4, A.D.C. to the King ; 1926-30, Comdt. Staff College, Camberley. Portrait in Vol. V.

LIEUT.-GENERAL SIR GEORGE M. HARPER, K.C.B., D.S.O.

1882, Commissioned R.E. ; 1911, G.S.O.1, War Office ; 1914, General Staff, France ; 1915-18, G.O.C. 51st (Highland) Div., France ; 1918, G.O.C. IV Corps, France. Portrait in Vol. V.

MAJOR-GENERAL R. N. HARVEY, C.B., C.M.G., D.S.O.

1888, Commissioned R.E. ; 1914, Assistant to E.-in-C., France ; 1916, Director of Mines, France ; 1918, C.E. VI Corps, France ; 1920, C.E. Aldershot ; 1921, A.D.C. to the King ; 1924-9, E.-in-C., India ; 1935, Col.-Comdt. R.E.

Portrait in Vol. V. Memoir in *R.E. Journal*, December, 1937.

**MAJOR-GENERAL SIR GERARD M. HEATH, K.C.M.G., C.B.,
D.S.O.**

1882, Commissioned R.E. ; 1906, C.R.E. London District ; 1908, Comdt. 1st S. & M. Roorkee ; 1911, B.G.G.S., S. Africa ; 1915, C.E. II Corps, France ; 1917, Engineer-in-Chief, France.
Portrait in Vol. V. Memoir in *R.E. Journal*, June, 1929.

**MAJOR-GENERAL F. C. HEATH-CALDWELL (formerly HEATH),
C.B.**

1887, Commissioned R.E. ; 1894-9, B.M., S.M.E. ; 1901-2, Served S. African War ; 1902-4, C.R.E. South Gibraltar ; 1904-6, C.R.E. London ; 1906-8, A.A.G.R.E., W.O. ; 1908-12, Inspector of R.E. ; 1913-14, Comd. Scottish Defences ; 1914-15, D.M.T., W.O. ; 1916-18, Comd. Portsmouth Garrison.
Memoir in *R.E. Journal*, March, 1946.

COLONEL SIR WALTER C. HEDLEY, K.B.E., C.B., C.M.G.

1884, Commissioned R.E. ; 1885-1909, County Cricketer (Amateur Doubles Championship, Rackets, 1890) ; 1911-20, G.S.O.1 (M.I.4), W.O.
Memoir in *R.E. Journal*, March, 1938.

**LIEUT.-GENERAL SIR AYLMER G. HUNTER-WESTON, K.C.B.,
D.S.O., D.L.**

1884, Commissioned R.E. ; 1906, G.S.O.1 Eastern Command ; 1908, G.S.O.1 Scottish Command ; 1911, A.D.M.T., W.O. ; 1914, Comd. 11th Inf. Bde., France ; 1915, G.O.C., 29th Div., Gallipoli ; 1917, G.O.C., VIII Corps, France ; 1921, Col.-Comdt. R.E.
Portrait in Vol. VI. Memoir in *R.E. Journal*, March, 1941.

MAJOR-GENERAL SIR LOUIS JACKSON, K.B.E., C.B., C.M.G.

1876, Commissioned R.E. ; 1879, Served Afghanistan ; 1904-6, C.R.E. Dublin ; 1907-10, A.D.F.W., W.O. ; 1910-13, C.E. London District ; 1914, Asst. Director, W.O. ; 1915, Director-General in Min. of Munitions ; 1916-17, Controller, Trench Warfare Research ; 1918, Employed by W.O. on special duty in Canada.
Memoir in *R.E. Journal*, March, 1947.

**MAJOR-GENERAL A. C. JOLY DE LOTBINIÈRE, C.B., C.S.I.,
C.I.E.**

1886, Commissioned R.E.; 1906, India, C.E. Kashmir State P.W.D.; 1913, C.E. and Sec. P.W.D. Bengal—Member Legislative Council; 1914–18, C.E. Anzac Corps, D.W. and E.-in-C. for final evacuation of Dardanelles; C.E. Anzac Corps, France; 1918, C.E. Eastern Command.
 Memoir in *R.E. Journal*, September, 1944.

MAJOR-GENERAL E. R. KENYON, C.B., C.M.G.

1874, Commissioned R.E.; 1915, C.R.E. 20th Div., France; 1915, C.E. Third Army, France; 1918, Deputy Controller of Chemical Warfare.
 Portrait in Vol. V. Memoir in *R.E. Journal*, September, 1937.

GENERAL SIR GEORGE M. KIRKPATRICK, K.C.B., K.C.S.I.

1885, Commissioned R.E.; 1906, A.Q.M.G. India; 1910, Inspector-General Australian Army, Melbourne; 1914, D.M.O., India; 1916, Chief of General Staff, India; 1920, G.O.C. China; 1923, G.O.C.-in-C. Western Command, India; 1927, Col.-Comdt. R.E.
 Portrait in Vol. VII. Memoir in *R.E. Journal*, June, 1950.

**FIELD-MARSHAL EARL KITCHENER, K.G., K.P., G.C.B.,
O.M., G.C.S.I., G.C.M.G., G.C.I.E., P.C.**

1871, Commissioned R.E.; 1885, D.A.A. and Q.M.G., Sudan Campaign; 1886, Governor of Suakin; 1888, 2nd in Command Egyptian Army and Inspector-General of Police; 1892, Commander-in-Chief, Egyptian Army; 1899, Governor-General of the Sudan; 1900, Commander-in-Chief South African Forces; 1902, Commander-in-Chief India; 1911, Consul-General in Egypt; 1914, Secretary of State for War; 1916, Drowned in H.M.S. *Hampshire* off the Orkneys; 1906, Col. Comdt. R.E.
 Portrait in Vol. V. Articles in *Supplement*, July, 1916, *R.E. Journal*, January, 1922, December, 1940, December, 1943.

LIEUT.-GENERAL SIR HENRY M. LAWSON, K.C.B.

1877, Commissioned R.E.; 1899–1902, South African War, A.A.G. and D.A.G.; 1902–3, Chief of Staff to C.-in-C., South

Africa ; 1904, Director of Movements and Quarters, War Office ; 1906, Comd. 13th Brigade, Ireland ; 1907, M.G.A. Aldershot Command ; 1910, G.O.C. 2nd Div. ; 1914, Lieut.-Governor of Guernsey ; 1915, G.O.C.-in-C. Northern Command ; 1917, Inspector-General of Communications, Italy ; 1922, Col.-Comdt. R.E.

Portrait in Vol. V. Memoir in *R.E. Journal*, March, 1934.

MAJOR-GENERAL SIR RICHARD P. LEE, K.C.B., C.M.G., D.L.

1885, Commissioned R.E. ; 1914, C.R.E. 7th Div., France ; 1915, C.E. I Corps ; 1916, C.E. Fifth Army ; 1917, G.O.C., 18th Div., France ; 1931, Col.-Comdt. R.E.

Portrait in Vol. V.

COLONEL SIR GERALD P. LENOX-CONYNTHAM, Kt., F.R.S.

1885, Commissioned R.E. ; 1912-21, Superintendent of the Trigonometrical Survey of India ; 1921, Retired ; 1922-47, Reader in Geodesy, Cambridge University ; 1923, Represented H.M.'s Government at 2nd Pan-Pacific Science Congress and at the 3rd Congress held in Japan in 1926.

MAJOR-GENERAL G. A. J. LESLIE, C.B., C.M.G.

1887, Commissioned R.E. ; 1914, C.R.E. 1st Indian Cavalry Div., France ; 1915, C.R.E. 7th (Meerut) Div. Mesopotamia ; 1917, Comd. 21st Bde., Mesopotamia ; 1918-20, G.O.C. 17th Indian Div., Mesopotamia ; 1920, Acting G.O.C.-in-C. Mesopotamia ; 1934, Col.-Comdt. R.E.

Portrait in Vol. VII. Memoir in *R.E. Journal*, June, 1936.

MAJOR-GENERAL SIR WILLIAM A. LIDDELL, K.C.M.G., C.B.

1884, Commissioned R.E. ; 1914, C.R.E. Army Troops, G.H.Q., France ; 1916-17, Deputy E.-in-C., France ; 1918, C.E. Third Army, France ; 1921-4, D.F.W., W.O. ; 1924, Director of Works, and Buildings, Air Ministry ; 1933, Col.-Comdt. R.E.

Portrait in Vol. V. Memoir in *R.E. Journal*, March, 1950.

**MAJOR-GENERAL SIR HUBERT A. A. LIVINGSTONE, K.C.M.G.,
C.B.**

1884, Commissioned R.E.; 1909, C.R.E. Singapore; 1911, C.R.E. Forth Defences, Scotland; 1915, C.R.E. 9th (Scottish) Div., France; 1916, Chief Engineer, Salonika; 1918, E.-in-C., Salonika; 1919, E.-in-C., Army of the Black Sea; 1931, Col.-Comdt. R.E.

Portrait in Vol. VI. Memoir in *R.E. Journal*, December, 1940.

COLONEL SIR HENRY G. LYONS, F.R.S.

1884, Commissioned R.E.; 1894, D.G. of Geological Survey of Egypt; 1896-1909, D.G. of Survey Dept. Egypt; 1906, F.R.S., D.Sc. (Oxon); 1908, Sc.D. Dublin; 1915, Pres. R. Meteorological Socy.; 1918, Director Meteorological Office; 1919-31, Dir. and Sec. S. Kensington Museum; 1929-39, V.-Pres. and Sec. Royal Society; 1923, A/Governor of Imperial College of Science and Technology; 1928-37, Gen. Sec. International Council of Scientific Unions; 1934-42, A Trustee National Portrait Gallery. Compiled History of the Royal Society.

Memoir in *R.E. Journal*, December, 1944.

**BRIGADIER-GENERAL SIR GEORGE B. MACAULEY, K.C.M.G.,
K.B.E., C.B.**

1889, Commissioned R.E.; 1906-14, Gen. Manager, Egyptian State Rlys.; 1915-18, Director of Railways, G.H.Q. Cairo; 1920-2, Inspector-General of Communications, Egyptian State Rlys.

Memoir in *R.E. Journal*, June, 1940.

**LIEUT.-GENERAL SIR GEORGE M. W. MACDONOGH, G.B.E.,
K.C.B., K.C.M.G.**

1884, Commissioned R.E.; 1914, General Staff, G.H.Q., France; 1916-18, Director of Military Intelligence, W.O.; 1918, Adjutant-General to the Forces; 1924, Col.-Comdt. R.E.

Portrait in Vol. V. Memoir in *R.E. Journal*, September, 1942.

MAJOR-GENERAL M. N. MACLEOD, C.B., D.S.O., M.C.

1900, Commissioned R.E.; 1902-14, Served India; 1914-18, Served European War as O.C. 145th A.T. Coy. R.E. and 4th Field

Survey Bn. ; 1919-23, Chief Instructor, Survey, School of Artillery ; 1923-9, Ordnance Survey, Southampton ; 1929-34, Gen. Staff, W.O. ; 1935-9, Director-General, Ordnance Survey ; 1936-9, A.D.C. to the King ; 1941, Col.-Comdt. R.E.

**LIEUT.-GENERAL SIR GORDON N. MACREADY, Bt., K.B.E.,
C.B., C.M.G., D.S.O., M.C.**

1910, Commissioned R.E. ; 1914-18, Served European War ; 1918-19, A.A. and Q.M.G. Supreme War Council, Versailles ; 1919, A.A.G. British Military Mission, Berlin, and Special Mission in Poland ; 1926-32, Asst. Sec. to Committee of Imperial Defence ; 1933, Imperial Defence College ; 1934-6, G.S.O.I, W.O. ; 1936-8, D.D.S.D., W.O. ; 1938, Chief of British Military Mission to Egyptian Army ; 1940-2, Asst. C.I.G.S. ; 1942-6, Chief of British Army Staff at Washington ; 1946-7, Reg. Commissioner for Lower Saxony, Control Commission, Germany ; 1947-9, British Chairman of Economic Control Office for British and American Zones of Germany ; 1949, Economic Adviser to British High Commissioner in Germany ; 1946, Col.-Comdt. R.E.

**BRIGADIER-GENERAL SIR H. OSBORNE MANCE, K.B.E.,
C.B., C.M.G., D.S.O., M.Inst.T.**

1895, Commissioned R.E. ; 1901-2, Served S. African War ; 1914-18, European War ; 1916-20, Director of Railways, Light Rlys and Roads, W.O. ; 1919-20, Transportation Adviser to British Delegation, Paris, and Pres. Communications Section of Supreme Economic Council ; 1941-4, Director of Canals, Ministry of War Transport ; 1926, Triennial Gold Medal, Institute of Transport.

**LIEUT.-GENERAL SIR GIFFARD le Q. MARTEL, K.C.B., K.B.E.,
D.S.O., M.C., M.I.Mech.E.**

1909, Commissioned R.E. ; 1914-18, Served European War, France ; 1930-4, Instructor, Staff College, Quetta ; 1936-8, Asst. Director of Mechanization, W.O. ; 1938-9, Dep. Director of Mechanization, W.O. ; 1939, Comd. 50th (Northumbrian) Div. T.A. ; 1940, Comd. Royal Armoured Corps ; 1943, Head of Military Mission at Moscow ; 1944, Col.-Comdt. R.E.

LIEUT.-GENERAL SIR RONALD C. MAXWELL, K.C.B., K.C.M.G.

1872, Commissioned R.E. ; 1900, C.R.E. 7th Div. S. Africa ; 1901, C.R.E. Pretoria District ; 1902, A.A.G.R.E., W.O. ; 1906, B.G.A. Western Command ; 1909, M.G.A. Southern Command ; 1911, Comd. Eastern Coast Defences, Chatham ; 1914, Inspector-General of Communications, France ; 1915-17, Quartermaster-General, France ; 1920, Col.-Comdt. R.E.

Portrait in Vol. V. *Memoir in R.E. Journal*, December, 1924.

LIEUT.-COLONEL H. T. MORSHEAD, D.S.O.

1901, Commissioned R.E. ; 1913, Exploration Rivers Tsang-po of Thibet and Bramaputra of Assam ; 1914-19, Western Front and N.W. Frontier of India ; 1920, Attempt on Mount Kamet with Dr. Kellas ; 1921, First Everest Expedition ; 1922, Second Everest Expedition ; 1927, First crossing of Edge Island in Spitzbergen ; 1928-31, Director of Burma Survey Circle.

Memoir in R.E. Journal, December, 1931.

MAJOR-GENERAL SIR HERBERT MULLALY, K.C.M.G., C.B., C.S.I.

1878, Commissioned R.E. ; 1895-9, Offg. Sec., Mily. Dept., Govt. of India ; 1899, South African War ; 1900, D.A.Q.M.G. Army H.Q. India ; 1903, Dep. Q.M.G., later D.M.O., India ; 1908, Chief Staff Officer, Bazar Valley Expedition ; 1909, Chief of Staff, Mily. Dept., India ; 1910, Comd. 1st (Peshawar) Inf. Bde. ; 1914-19, Comd., East Coast Defences U.K.

Memoir in R.E. Journal, September, 1932.

LIEUT.-COLONEL THE RT. HON. SIR MATTHEW NATHAN, P.C., G.C.M.G., D.L.

1880, Commissioned R.E. ; 1895-1900, Sec. Colonial Defence Committee ; 1900-3, Governor Gold Coast Colony ; 1904-7, Governor Hong Kong ; 1908-10, Governor Natal ; 1911-14, Chairman of Board of Inland Revenue ; 1914, Under Sec. of State for Ireland ; 1916, Perm. Sec. Min. of Pensions ; 1919-26, Governor of Queensland.

Memoir in R.E. Journal, September, 1939.

**LIEUT.-GENERAL SIR PHILLIP NEAME, V.C., K.B.E., C.B.,
D.S.O., F.R.G.S.**

1908, Commissioned R.E.; 1914-18, Served European War (V.C. 1914); 1919-23, Instructor, Staff College, Camberley; 1925-9, Served in India with K.G.O. Bengal S. & M.; 1930, Imperial Defence College; 1932-3, G.S.O.1 Waziristan District, India; 1934-8, B.G.S. Eastern Command; 1936, Went to Lhasa, Tibet, with political-military Mission; 1938-9, Comdt. R.M.A. Woolwich; 1939-40, Deputy Chief of the Gen. Staff, B.E.F.; 1940, Comd. 4th Indian Div. Western Desert, G.O.C. Palestine and Transjordan; 1941, G.O.C.-in-C. and Military Governor, Cyrenaica; 1941, Prisoner of War; 1943, Escaped from Italy; 1945, Lieut.-Governor and C.-in-C. of Guernsey; 1945, Col.-Comdt. R.E.

LIEUT.-GENERAL SIR F. P. NOSWORTHY, K.C.B., D.S.O., M.C.

1907, Commissioned R.E.; 1914-18, European War, France; 1919, 3rd Afghan War; 1919-22, Instructor, Staff College; 1922-6, General Staff, W.O.; 1926-30, Chief Staff Officer and 2nd-in-Command, Sudan Defence Force; 1931, Imperial Defence College; 1932-5, G.S.O.1 British Troops in China; 1935-8, Comd. 5th Inf. Bde.; 1938-40, Deputy Chief of General Staff, Army H.Q. India; 1940, A Corps Commander; 1943, C.-in-C. West Africa; 1940, Col.-Comdt. R.E.; 1946, Col.-Comdt. Royal Indian Engineers.

LIEUT.-COLONEL W. A. J. O'MEARA, C.M.G.

1883, Commissioned R.E.; 1900, Govt. Commissioner Johannesburg; 1902-12, Asst. E.-in-C., later E.-in-C., P.O. Engineering Staff; 1913, Barrister-at-law; 1924-6, Chairman of Board of Studies in Electrical Engineering at University of London. Memoir in *R.E. Journal*, March, 1940.

COLONEL R. OAKES, C.B., C.B.E., M.I.Meeh.E.

1896, Commissioned R.E.; 1914-17, Inspector of Iron Structures; 1918, Dep. Director, Mesopotamia Rlys.; 1920-5, D/E.-in-C. (E. & M.) India; 1925-9, Asst. Dir. of Transportation, W.O.; 1930-1, President, R.E. Board. Memoir in *R.E. Journal*, December, 1944.

MAJOR-GENERAL F. S. G. PIGGOTT, C.B., D.S.O.

1901, Commissioned R.E. ; 1904, Specially employed in Tokyo during Russo-Japanese War ; 1906-8, Adjutant R.E. Gibraltar ; 1910-13, Attached to H.M. Embassy, Tokyo ; 1914, Gen. Staff, W.O. Served in Egypt and France during European War ; 1919, Staff College, Camberley ; 1920-1, Gen. Staff, W.O. ; 1921-6 and 1936-9, Military Attaché to H.M. Embassy, Tokyo ; 1927-30, G.S.O.1, War Office ; 1931-5, Deputy Military Secretary, W.O. ; 1941, Col.-Comdt. R.E.

MAJOR-GENERAL H. L. PRITCHARD, C.B., C.M.G., D.S.O.

1891, Commissioned R.E. ; 1895-6, Served Ashanti Expedition ; 1896, Dongola Exp. Force ; 1897-8, Nile Operations ; 1899-02, South African War ; 1914-18, European War ; 1921-3, C.E. Northern Command ; 1923-5, A.D.F.W., W.O. ; 1925-9, C.E. Eastern Command ; 1929-31, G.O.C. Malaya ; 1926-9, A.D.C. ; 1931-3, Comdt. S.M.E., Inspector of R.E. and Comd. Chatham Area ; 1932, Col.-Comdt. R.E.

BRIGADIER-GENERAL SIR EDWARD RABAN, K.C.B., K.E.E.

1871, Commissioned R.E. ; 1900-4, Suptg. Engineer, Portsmouth Dockyard ; 1905-12, Director of Works, Admiralty (responsible for design and construction of naval base at Rosyth) ; 1913, Consulting Engineer to Greek Govt. for construction of an arsenal ; 1914, C.R.E. South London Defences ; 1915, R.E. Adviser to C-in-C. Home Forces ; 1917-18, D.D.F.W. Aerodrome Construction, W.O. ; 1919-23, Consulting Engineer for Greek Govt. for construction of an Arsenal and improvements to Port of Pyraeus. Memoir in *R.E. Journal*, September, 1927.

BRIGADIER-GENERAL F. RAINSFORD-HANNAY, C.B., C.M.G.

1873, Commissioned R.E. ; 1885-9, I.G.F's. Office, W.O. ; 1890-4, Australia (special duty) ; 1898-1905, Asst. I.G.F. and A.D.F.W., W.O. ; 1906, C.E. Irish Command ; 1907, Comdt. S.M.E. ; 1908-11, D.F.W., War Office ; 1911, Retired ; 1914-17, Recalled for service as Comdt. S.M.E. Memoir in *R.E. Journal*, March, 1951.

MAJOR-GENERAL SIR S. ROBERT RICE, K.C.M.G., C.B.

1877, Commissioned R.E. ; 1903, C.R.E. Portsea ; 1909, C.E. South Coast Defences ; 1911, C.E. Aldershot ; 1914, C.E., I Corps, France ; 1917, Engineer-in-Chief, France ; 1918, Comd. Forth Garrison.

Portrait in Vol. V. Memoir in *R.E. Journal*, June, 1930.

MAJOR-GENERAL J. C. RIMINGTON, C.B. C.S.I.

1884, Commissioned R.E. ; 1910, D.D.G.M.W., Simla ; 1914, C.R.E. 4th Div. Quetta ; 1915, Brigadier-General R.E. Mesopotamia ; 1916-18, Engineer-in-Chief, Mesopotamia ; 1919, Director-General, Military Works, India.

Portrait in Vol. VII. Memoir in *R.E. Journal*, March, 1943.

MAJOR-GENERAL SIR RICHARD M. RUCK, K.E.E., C.B., C.M.G.

1871, Commissioned R.E. ; 1885-96, A/Inspector, then Inspector Submarine Defences, W.O. ; 1897-1902, C.R.E. Shoburness, then C.R.E. West Sub District, Malta ; 1902, D.I.G.F., W.O. ; 1904-7, D.F.W. ; 1908-12, M.G.A. Eastern Command ; 1914, C.E. Central Force ; 1915, M.G.A. Eastern Command ; 1916, G.O.C. London Defences and Vice-Pres. Air Inventions Committee. Memoir in *R.E. Journal*, June, 1935.

BRIGADIER-GENERAL G. A. F. SANDERS, C.B., C.M.G.

1888, Commissioned R.E. ; 1915, C.R.E., Later Comd. 6 Div., Mesopotamia ; 1916, D.Q.M.G., India ; 1918-19, Comd. 53rd (Indian) Bde., Mesopotamia ; 1920-1, Comd. 17th (Indian) Div., later, special duty, A.H.Q. Simla ; 1923, Comd. 15th (Indian) Inf. Bde.

Memoir in *R.E. Journal*, June, 1941.

CAPTAIN M. H. P. R. SANKEY, C.B., C.B.E.

Won Pollock Medal and Sword of Honour, R.M.A. ; 1873, Commissioned R.E. ; 1889, Retired ; 1904, Director, Marconi's ; 1920-1, Pres. Inst. of Mech. E. ; 1914-18, Engineering Adviser to D.F.W. Reported upon the possibility of inundating certain portions of the Western Front. For this received the C.B. (Civil).

Memoir in *R.E. Journal*, December, 1925.

**MAJOR-GENERAL SIR GEORGE K. SCOTT-MONCRIEFF,
K.C.B., K.C.M.G., C.I.E.**

1873, Commissioned R.E. ; 1901, C.E., N.W. Frontier Province ;
1904, C.R.E. Curragh ; 1906, A.D.F.W., W.O. ; 1909, C.E.
Aldershot Command ; 1914-18, D.F.W.

Portrait in Vol. V. Memoir in *R.E. Journal*, June, 1924.

MAJOR-GENERAL S. H. SHEPPARD, C.B., C.M.G., D.S.O.

1890, Commissioned R.E. ; 1914, General Staff, East Africa ;
1916-17, Comd. 1st and 2nd East African Brigades, East Africa ;
1918, B.G.G.S., East Africa ; 1920-1, Major-Gen., Gen. Staff,
A.H.Q. India ; 1933, Col.-Comdt. R.E.

Portrait in Vol. VII.

LIEUT.-GENERAL E. K. SQUIRES, C.B., D.S.O., M.C.

1903, Commissioned R.E. ; 1920-1, Staff College, Quetta ;
1922-4, G.S.O.2 Simla ; 1925-7, G.S.O.2, W.O. ; 1928, Student,
I.D.C. ; 1929, Instructor Staff College ; 1933-5, B.G.S.
Southern Command ; 1936, D.S.D., W.O. ; 1938, Inspector-
General, Australian Military Forces ; 1939, Chief of G.S. Australia
Army.

Memoir in *R.E. Journal*, September, 1940.

MAJOR-GENERAL A. G. STEVENSON, C.B., C.M.G., D.S.O.

1891, Commissioned R.E. ; 1914-16, C.R.E. 6th Div. and Con-
troller of Mines Second Army, France ; 1917, Dep. E.-in-C.
Italy ; 1918, C.E., V Corps, France, C.E. IV Corps, Rhine ;
1920, C.O., R.T.C. Longmoor, Pres. R.E. Board ; 1922, C.E.
British Forces, Constantinople ; 1923-6, C.E. Aldershot Com-
mand ; 1925, A.D.C. ; 1927-32, E.-in-C. India ; 1935,
Col.-Comdt. R.E.

Memoir in *R.E. Journal*, June, 1939.

BRIGADIER-GENERAL E. R. B. STOKES-ROBERTS, C.B.

1884, Commissioned R.E. ; 1915, C.R.E. Mhow Division, India ;
1916, C.E., Tigris Corps, Mesopotamia ; 1917, Director of Works,
Mesopotamia.

Portrait in Vol. VII. Memoir in *R.E. Journal*, March, 1930.

MAJOR-GENERAL SIR ANDREW M. STUART, K.C.M.G., C.B.

1879, Commissioned R.E.; 1905, R.E. Member of Ordnance Committee; 1908, C.R.E. Liverpool; 1910, A.D.F.W., W.O.; 1914-18, Director of Works, France; 1919, Director of Works and Buildings, Air Ministry; 1929, Col.-Comdt. R.E. Portrait in Vol. V. Memoir in *R.E. Journal*, March, 1937.

COLONEL H. G. C. SWAYNE, C.M.G.

1880, Commissioned R.E.; 1891-2, Survey of Somaliland; 1893, Led expedition for exploration across Somaliland to head waters of R. Shebeyli; 1894, O.C. Coy. at Chatham; 1896, Indian Govt. representative on Political Mission to Addis Ababa; 1911, C.R.E. 8th (Lucknow) Div. Area; 1915, O.C. 5th Labour Bn. R.E. Pioneers; 1919, W.O. Lecturer—Army of Occupation. Memoir in *R.E. Journal*, September, 1940.

MAJOR-GENERAL SIR ERNEST D. SWINTON, K.B.E., C.B., D.S.O.

1888, Commissioned R.E.; 1907-11, Instructor R.M.A. Woolwich; 1914, General Official War Correspondent, France; 1916, Comd. Heavy Section, Machine Gun Corps, the originator of the Tank; 1918, Asst. Sec. Imperial Defence Committee; 1919, Controller of Information, Air Ministry (Civil Aviation); 1925, Chichele Professor of Military History and War in Oxford University; 1934, Col.-Comdt. Royal Tank Corps. Portrait in Vol. V. Memoir in *R.E. Journal*, June, 1951.

COLONEL THE HON. MILO G. TALBOT, C.B.

1873, Commissioned R.E.; 1884, Afghanistan, Extensive Survey Work; 1889-91, Staff College; 1892, Bridging Bn. Aldershot and W.O. Mapping Section; 1893-1905, Director of Surveys, Egypt and Sudan. Memoir in *R.E. Journal*, March, 1932.

GENERAL SIR MAURICE G. TAYLOR, K.C.B., C.M.G., D.S.O.

1900, Commissioned R.E.; 1914, Staff College, Camberley; 1914-18, Served European War; 1919-21, D.D. Movements, W.O.; 1921-5, Senior Instructor Staff College, Camberley; 1925-7, A.Q.M.G. Eastern Command; 1927-31, Comd. 166th

Inf. Bde. T.A. ; 1932-4, Comd. 46th (N. Midland) Div. T.A. ; 1934-7, M.G.A. Aldershot Command ; 1938-9, Deputy M.G.O. War Office ; 1939-41, Senior Military Adviser to the Ministry of Supply ; 1938, Col.-Comdt. R.E.

**BRIGADIER-GENERAL THE RT. HON. LORD THOMSON OF
CARDINGTON, P.C., C.B.E., D.S.O.**

1894, Commissioned R.E. ; 1896-1901, Served in South Africa and Mauritius ; 1901, A/Instr. Fortifications S.M.E. ; 1905, 2nd Bridging Coy. ; 1907, Sierra Leone ; 1910-14, G.S.O.2, W.O. ; 1914, Liaison Officer, France ; 1915-16, Mil. Attaché Bucharest ; 1917, C.R.E. 60 Div., Egypt and Palestine ; 1918, Supreme War Council, Versailles ; 1921, Special Commissioner for International Red Cross ; 1924, S. of S. for Air and P.C. Member of Cabinet ; 1930, Killed in R.101 disaster. Memoir in *R.E. Journal*, March, 1931.

MAJOR-GENERAL SIR HENRY F. THUILLIER, K.C.B., C.M.G.

1887, Commissioned R.E. ; 1915, C.R.E. 1st Division, later Comd. 2nd Inf. Bde., France ; 1916, Director of Gas Services, France ; 1917, G.O.C. 15th (Scottish) Division, France ; 1918, G.O.C. 23rd Div., Italy ; 1919, Comdt. S.M.E. and G.O.C. Thames and Medway Area ; 1924, D.F.W., W.O. ; 1927, G.O.C. 52nd (Lowland) Div. T.A. ; 1935, Col.-Comdt. R.E. Portrait in Vol. V.

**MAJOR-GENERAL SIR PHILIP G. TWINING, K.C.M.G., C.B.,
M.V.O.**

1886, Commissioned R.E. ; 1914, C.R.E., Meerut Div., France ; 1917, D.A. and Q.M.G., First Army, France ; 1918, D.F.W., W.O. Portrait in Vol. V. Memoir in *R.E. Journal*, April, 1920.

**BRIGADIER-GENERAL SIR WILLIAM D. WAGHORN, Kt.,
C.B., C.M.G.**

1887, Commissioned R.E. ; 1889-99, Served on Railways in India ; 1899-1902, D.A.D. Railways and Sup. of Works, South Africa ; 1905, Dep. Manager N.W. Rly. India ; 1913, Agent O. & R. Rly. India ; 1914, Dep. Director Rly. Transport, W.O. ; 1915,

Chief Rly. Con. Engr. France; 1916, Director of Railways, France; 1917, C.E. XVII Corps; 1921-4, President Rly. Board India.

Memoir in *R.E. Journal*, December, 1936.

**MAJOR-GENERAL C. M. WAGSTAFF, C.B., C.M.G., C.I.E.,
D.S.O.**

1897, Commissioned R.E.; 1916, G.S.O.1 5th Australian Div. Gallipoli and France; 1917, Head of British Mission at H.Q. American Exp. Force, France; 1921, B.G.G.S. Northern Command, India; 1925, G.S.O.1, W.O.; 1926, Comd. Nowshera Bde., India; 1930, Commandant R.M.A.

Memoir in *R.E. Journal*, June, 1934.

MAJOR-GENERAL G. WALKER, C.B., C.B.E., D.S.O.

1888, Commissioned R.E.; 1914-15, O.C. 59th Fd. Coy. and C.R.E. 27th Div., France; 1915, C.R.E. 27th Div., Macedonia; 1916-17, C.E. XII Corps, Macedonia; 1918, C.E. London District; 1921, C.E. Irish Command; 1923, C.E. Eastern Command; 1927-30, Comdt. S.M.E., Inspector of R.E. and Comd. Chatham Area; 1935, Col.-Comdt. R.E.

Memoir in *R.E. Journal*, June, 1937.

COLONEL R. A. WAUHOPE, C.B., C.M.G., C.I.E.

1873, Commissioned R.E.; 1875-1901, Served in India mainly on Survey Work and carried out many Surveys in Baluchistan, Zhob Valley, Waziristan, Aden, the Durand Boundary between India and Afghanistan, Pamir and Tirah; 1901-4, Chief British Commissioner on Anglo-Turkish boundary in S.W. Arabia; 1905, Retired; 1915, Political and Military Intelligence Officer S.W. Arabia; 1916-19, Indian Survey.

Memoir in *R.E. Journal*, March, 1922.

**GENERAL SIR H. COLVILLE B. WEMYSS, K.C.B., K.B.E.,
D.S.O., M.C.**

1910, Commissioned R.E.; 1914-18, Served European War; 1921, Transferred Royal Corps of Signals; 1935-7, A.A.G., W.O.; 1938, Imperial Defence College; 1939, Director of Mobilization, W.O.; 1940-1, Adjutant-General W.O.; 1941-2, Head of

British Army Staff in Washington ; 1942-6, Military Secretary, W.O. ; 1944, Col.-Comdt. Royal Corps of Signals.

MAJOR-GENERAL SIR GODFREY WILLIAMS, K.C.I.E., C.B.

1878, Commissioned R.E. ; 1903, D.D.G.M.W., India ; 1909, C.R.E. Lucknow ; 1910, C.R.E. Quetta ; 1912, D.G.M.W., India ; 1915, C.E. Anzac Corps, Gallipoli ; 1915-16, E.-in-C., Gallipoli and Egypt ; 1918, D.G.M.W., India.
Portrait in Vol. VI. Memoir in *R.E. Journal*, December, 1940.

GENERAL SIR GUY C. WILLIAMS, K.C.B., C.M.G., D.S.O.

1900, Commissioned R.E. ; 1909-14, Surveys, East Africa Protectorate ; 1914-18, European War ; 1919, Staff College, Camberley ; 1920, G.S.O.I, U.P. District, India ; 1922-3, G.S.O.I, Staff College, Quetta ; 1923-7, Deputy Military Secretary, W.O. ; 1927-8, Comd. 8th Inf. Bde., India ; 1928-32, Army Instructor Imperial Defence College ; 1932-4, C.E. Aldershot Command ; 1934-7, Comdt. Staff College, Quetta ; 1937-8, G.O.C. 5th Div. ; 1938-41, G.O.C.-in-C., Eastern Command ; 1940, Col.-Comdt R.E. ; May-Nov. 1941, Military Adviser to N.Z. Govt. ; 1941, Retired ; 1944, Resettlement Officer, B.B.C. ; 1946, Chief Royal Engineer.

COLONEL SIR GEORGE H. WILLIS, C.I.E., M.V.O.

1895, Commissioned R.E. ; 1907, Dep. Mint Master Bombay ; 1909-14, Mint Master, Calcutta ; 1915, Mint Master, Bombay ; 1921-4, Responsible for the layout, design and equipment of the Indian Security Press ; 1925-34, Master of Security Press.
Memoir in *R.E. Journal*, March, 1941.

MAJOR-GENERAL H. B. H. WRIGHT, C.B., C.M.G.

1884, Commissioned R.E. ; 1908, C.R.E. Bermuda ; 1911, C.R.E. 3rd Div. ; 1914, C.E. Egypt ; 1916-18, Engineer-in-Chief, Egypt and Palestine.
Portrait in Vol. VI. Memoir in *R.E. Journal*, March, 1949.



Maj Gen W H Beach CB, CMG, DSO



Maj Gen Sir Theodore Fraser KCB, CSI, CMG



Lt Gen Sir George F Goringe KCB KCMG



Gen Sir George Kirkpatrick KCB KCSI



Maj Gen C A J Leslie CB C M G



Maj Gen J C Remington CB CSI



Maj Gen Sheppard CB, CMG, DSO



BrigGen E R B Stokes-Roberts CB

APPENDIX VIII

FORMATION OF THE CORPS (LATER ROYAL CORPS) OF SIGNALS

Published with Army Order 275 of 2nd July, 1920

ROYAL WARRANT

Corps of Signals

GEORGE R.I.

Whereas We deem it expedient to authorize the formation of a Corps to be entitled "Corps of Signals."

Our Will and Pleasure is that the Corps of Signals shall be deemed to be a Corps for the purpose of the Army Act, and that the words "Corps of Signals" shall be inserted in Our Warrant of 7th July, 1916, defining the expression "Corps."

Our Further Will and Pleasure is that the rates of pay for officers, warrant officers, non-commissioned officers and men of the Corps of Signals shall be as provided in the Schedule attached to this Our Warrant.

Given at Our Court at St. James's, this 28th day of June, 1920, in the 11th year of Our Reign.

By His Majesty's Command,

WINSTON S. CHURCHILL

ARMY ORDER 276 OF 2ND JULY, 1920

Corps of Signals :—

1. With reference to Army Order 275 of 1920, the Corps of Signals will consist of such Signal units, Royal Engineers, as are now in existence, those of the additional personnel now serving with the Signal Service, Royal Engineers, who wish, and are accepted, for transfer, and such other Signal units as may hereafter be formed.

2. The establishment of the corps as regards officers, warrant officers, non-commissioned officers and men will be notified in due course.

3. The officers required for duty with the corps will consist of :—

- (a) Officers on the permanent establishment.
- (b) Officers of other arms of the Service seconded to the Corps of Signals to complete the number required additional to the permanent establishment (see *Note*).

* * * * *

10. To complete the initial establishment of the corps, officers now serving in the Signal Service, Royal Engineers, may have the option of transferring to the Corps of Signals provided vacancies exist in the permanent establishment of the corps, and they are accepted for such transfer. Officers for whom no such vacancies exist, but who are wanted to complete the number required with the corps may continue to be seconded from their own arms of the Service provided they have not already been seconded for more than four years. Those who have already been seconded for four years may be seconded for a further period not exceeding two years from the date of this Order.

* * * * *

13. To provide the numbers required on the formation of the corps, those warrant officers, non-commissioned officers and men who are now serving with the Signal Service, Royal Engineers, and wish for transfer, will be transferred from their present corps to the Corps of Signals provided vacancies exist in the permanent establishment of the corps. Warrant officers and non-commissioned officers will be transferred in their present permanent rank.

* * * * *

Note.—Throughout this Army Order "attached for duty" should be substituted for "seconded" in the case of officers above the rank of captain, and those belonging to arms of the Service from which officers cannot be seconded, e.g., Royal Engineers.

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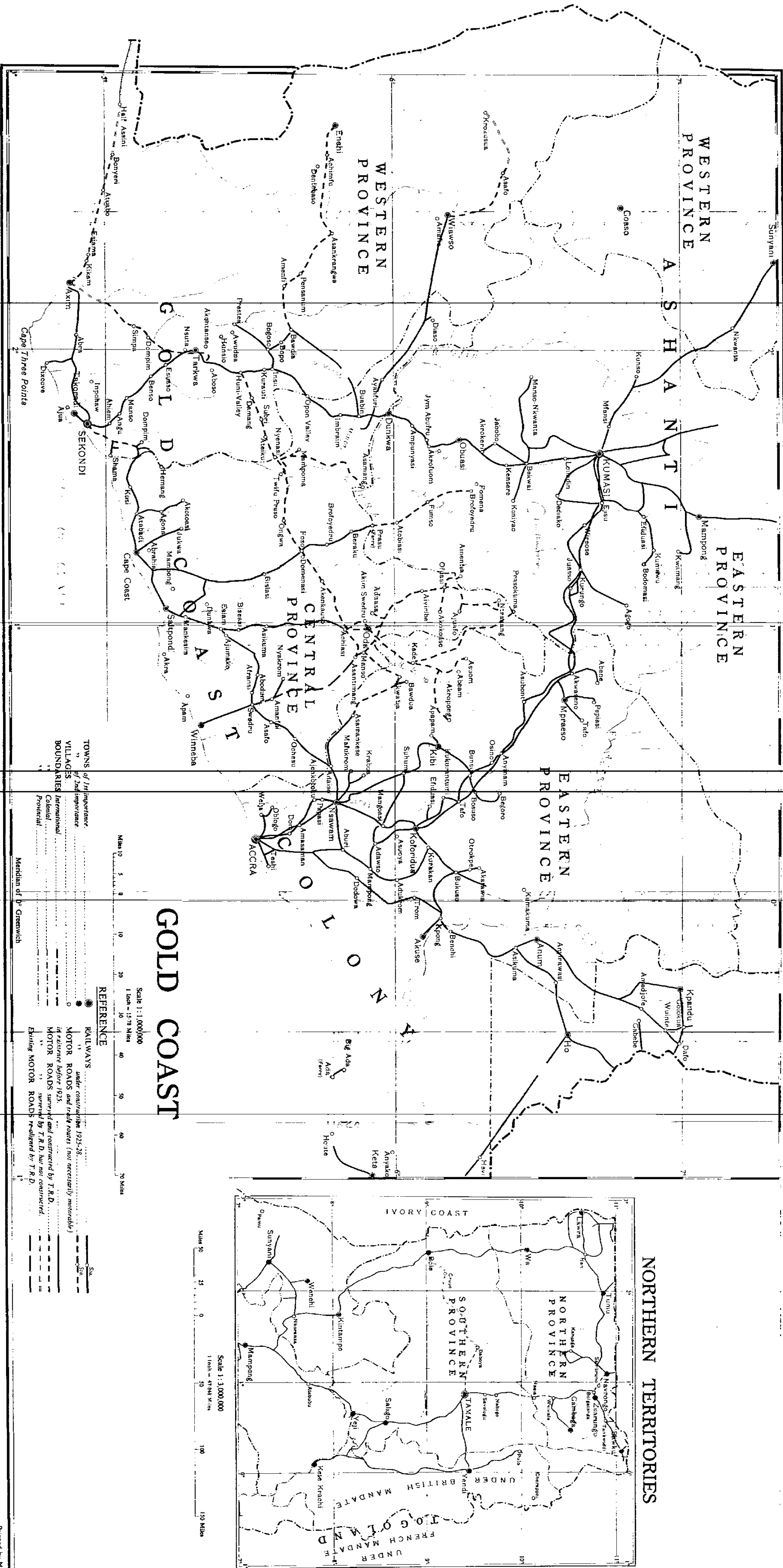
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