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THE S.M.E. COMES TO CHATHAM

By Lieut.-Colonel F. S. Garwood, R.E.

IN Major-General W. Porter's *History of the Royal Engineers* no mention is made of the opening of the S.M.E. at Chatham. The story of its foundation has been told by the late Lieut.-Colonel P. H. Kealy in an article on Sir Charles Pasley, in *The R.E. Journal* of December, 1930; but it will bear telling again in the light of new information, which has recently become available, showing the intimate relations then existing between the R.A. and R.E.

The Debt of the R.E. to the Royal Staff Corps

It is an historical fact that the Duke of York, for a period of over twenty years, split the Engineers into two bodies, whose duties frequently overlapped. There were Royal Engineers under the Master-General of the Ordnance and rival engineers under the orders of the Q.M.G. belonging to the Royal Staff Corps, whose headquarters were at Hythe, and who were acknowledged experts in the science of military bridging. Like the R.E., the R.S.C. had its famous names, but it had no historian, and the only record of these great men is in the *Dictionary of National Biography*. The officer responsible for the training of the officers of the Staff, was an artilleryman, Sir Howard Douglas. He wrote a text book on Military Bridging, which it is said gave Telford the idea of making a suspension bridge across the Menai Straits. The suspension principle had been practically tested by the late Lieut.-Colonel Sturgeon, R.S.C., at Alcantara, on the River Tagus. The officers of the R.S.C. were also specialists in Survey; and Sir Charles Arden-Close once possessed a *Manual of Field Sketching*, by Major Basil Jackson, R.S.C. In these two important branches of the military engineers' art the R.S.C. were the pioneers and not the R.E. During the whole Napoleonic war the Corps of Royal Engineers consisted only of officers and possessed no rank and file; and although the R.S.C. was moribund, its companies were complete units, with their own officers and well trained men, and they can claim the honour of being the first Field Companies of Engineers who accompanied a British Army in the field.

The Cry for Sappers and Miners

By the time that this great war was drawing to its close, the junior officers of the R.E. consisted of young men, with very little academic training, who had been schooled by many years of hard fighting in all parts of Europe. They had had to conduct sieges without trained men to carry out their instructions. They built pontoon bridges, which might look well enough on a canal, but which promptly foundered on the turbulent rivers of Spain. The Royal Military Artificers, who served under their orders, were departmental non-combatants, who might be excellent tradesmen but were quite unfit to cope with problems such as these. From Spain came the bitter cry: "Send us out men trained to be sappers and miners." But this cry

General Sir Charles Pasley, K.C.B.

(1780–1861)

General Sir Charles Pasley KCB

rose to a scream in a private letter which Pasley wrote to a friend from Flushing in July, 1809. He writes: "The Corps of Engineers is disgraced and damned for ever. The cry of the whole army and navy is against us. I found Jones, when I landed, in a state of deep despair. Boteler wished that the first shot might take off his head. The French are making counterworks and do them faster than ours. We were offered the whole army to act under us. The Staff Corps—everything at our disposal. Such means, such powers, such circumstances would have put life into a statue, but what could we do with a parcel of old women at our head." Still nothing was done until in 1811 Captain Pasley, R.E., who was C.R.E. at Plymouth, began, at his own expense a system of instruction in siege warfare for junior R.E. officers and the N.C.O.s and men of the Royal Military Artificers. He reported the success of this experiment to Lord Mulgrave, M.G.O., who appointed a committee of senior R.E. officers to report on Pasley's proposals.

At the end of 1811 he was able to report to the M.G.O. (Lord Mulgrave) and to Lord Wellington that his system was proving very successful; as a result in 1812 a central school for all Engineers at Chatham, where "Pasley's course" was to be taught, was approved. Lord Mulgrave wanted to make Captain Pasley the Director of this new Establishment, but Pasley refused unless he was made a Brevet Major. Lord Mulgrave could not agree; a deadlock occurred, but was fortunately soon ended by the timely arrival of a despatch from Wellington sent from Badajos, in which he attributed the heavy losses incurred in the recent siege as entirely due to the lack of R.E. trained personnel. Pasley received his brevet at once. In May, 1812, he came to Chatham as Director and stayed in the appointment until promoted Major-General in 1841.

Pasley must have had his eye on Chatham for a considerable time. The Medway was an ideal tidal river for the practice of pontooning, and Chatham Lines very convenient for carrying out siege training; and Pasley, from his war experience, considered siege warfare and pontooning the two most important branches of Military Engineering. By May 12th the men of the Royal Military Artificers were already practising siege operations on Tower Hill, Pasley having found them quarters in Upnor and in the Casemate Barracks (St. Mary's) while he himself lived in the R.A. Mess. The Royal Sappers and Miners arrived just in time to be properly trained to take a distinguished part in that famous bridging operation, the crossing of the River Adour. I give a very short account of the military career of the man who, practically single-handed, founded the School of Military Engineering at Chatham.

Charles Pasley

Charles Pasley was born at Eskdalemuir, Dumfriesshire, on September 8th, 1780. After spending 16 months at the R.M.A., Pasley was commissioned in the R.A. as a 2nd-Lieut. but in less than six months was transferred to the R.E. Becoming a 1st-Lieut. shortly before his nineteenth birthday on 28th August, 1799, he was at once sent abroad and spent the next seven years in the Mediterranean, which was then the chief training ground for the British army. He served in Minorca, Malta, Naples, and Sicily, and was present at the Battle of Maida in 1806. In 1807 he took part in the siege of Copenhagen and in September, 1808, he landed in Spain. Because of his outstanding abilities he was appointed extra A.D.C. to Sir John Moore and was present at Corunna. Having lent his horse to a wounded soldier and lost one of his shoes, he experienced to the full the hardships of the retreat. But his spirit was in no way daunted, for in the Walcheren expedition at the

siege of Flushing in 1809, he led at his own suggestion a storming party to attack a French battery which was on a dyke. The attack was successful, the guns were spiked and fifty prisoners were taken, but Captain Pasley received a bayonet wound in his thigh and a musket shot through the body, fired at close range when he climbed the dyke. It grazed his spine and the first chapter of his career was ended. His military education was complete and his reputation was firmly established. The rest of his life was spent in proving to the world that he was a genius, and that his abnormal brain was capable of finding solutions to any problem from how to manufacture cement to carrying on an argument with a bishop on some abstruse question of theology. He had been entirely incapacitated by his wound for a whole year, but his mind was busy digesting the lessons he had learnt in the past eight years. In November, 1810, he published an *Essay on the Military Policy and Institutions of the British Empire* which attracted attention in the highest quarters. On the 24th May, 1813, the Director of the S.M.E. was made a Brevet Lieut.-Colonel.

The Early Days of the S.M.E.

It is difficult to imagine what Chatham was like before the arrival of the Royal Engineers; but the recent discovery of the diary of Major Thomas Scott, R.A., which covers the period 1811-1834, gives many vivid accounts of events in Chatham and Rochester. Scott was born in Rochester and his home was there, and in his pages the reader can relive the days when a tunnel was being driven through the chalk at Frindsbury to enable barges to travel to Gravesend. He can visit Strood Fair, which drew big crowds from all parts of Kent, and on Sundays, admire the local belles as they promenade on the terrace, listening to the band of the Royal Marines. Bright eyes await the young R.A. officers from the Artillery Barracks. For Brompton Barracks was then known as the Artillery Barracks, and four companies of Foot Artillery constituted the garrison, which war had reduced to a skeleton. The few R.E. officers in Chatham were members of the R.A. Mess and there is no mention of Colonel Pasley until the year 1818, when the Diary tells us: "24th January, 1818. Just went up to the Bridge to get a mouthful of fresh air before dinner; saw Pasley and the sappers trying some experiments with pontoons; was at one time apprehensive that the whole would have had at least a ducking, if nothing worse happened."

A week later Scott dines with Colonel Pasley; he writes: "There was a large party, but the conversation was so punning and disagreeable that I was not at all at home." Scott had a bad cough and felt no inclination to join in the conversation; but on Monday, February 9th, 1818, he dines in the mess with a gunner friend, Lieut. W. H. Hill, nicknamed "The Count." The entry in the diary reads: "In the evening went up to the Barracks to dine with the Count. Pasley was very entertaining, never heard him more so. His conversation was quite delightful, replete with anecdotes and interesting little tales, making one regret that so sensible a man should ever descend to the paltry amusement of pun making."

The truth is that, though the Royal Engineers had arrived, Chatham as yet was wholly unaware of their existence. The Director of the S.M.E. found himself with few scholars to instruct. War-trained officers were being pushed out of the Corps by dozens. *The R.E. List* shows that in the eight years 1817-1824 the total influx of 2nd-Lieuts. was eight. Scott describes the scene of desolation at the Artillery Barracks, parts of which had

been let to civilians. He had come from Woolwich to see his uncle, Colonel H. Evatt, R.E., who had just returned from Ceylon.

Wednesday, 16th June, 1919. "My uncle and self went visiting about. In the course of our rambles got up as far as the Barracks; not a soul did we see. The once fine parade is approaching to a green field with a beaten pathway to the only part of the square occupied. It is terrible to see it. Makes me regret happy times past." This entry is of interest, for it explains how Pasley had been able to accommodate his Sappers and Miners in Brompton Barracks and also to obtain classrooms and model rooms for the use of the S.M.E.

These long winters of discontent were not wasted by Charles Pasley. His brain had been active all the time and the world did not have long to wait before his genius blossomed into flower. Between 1814 and 1817 he published the three volumes of his work *Military Instruction*, so that text books would be ready when scholars became more plentiful. The second chapter of his career is drawing to its close. It had been far less spectacular than the first, but it is to have lasting effects on the scientific training not only on the Corps of Royal Engineers but on that of their sister Corps, the Royal Regiment of Artillery. In 1823 Captain Scott's Company is ordered to Chatham and arrived at the Artillery Barracks on 26th October.

The School of Military Engineering in 1823

Colonel Pasley now had two very distinguished R.E. Officers serving with him in Chatham. Lieut.-Colonel J. F. Burgoyne, the C.R.E. (1821-26) and Major W. Reid his Assistant Director at the S.M.E., who was later known to fame as the Prince Consort's chief adviser in the Great Exhibition of 1851. Scott's Diary includes first-hand evidence of the high state of efficiency attained at the S.M.E. after eleven years of Pasley's administration, *e.g.*:—

Thursday, 13th November, 1823. "Accompanied Reid to the office to look at Pasley's orders when the young men arrive at this station. Instead of throwing away their time, he gives them such tasks to perform as must employ them five or six hours a day, and that without relaxation. This gives them habits of steadiness and obliges them to become informed, at the same time that it prevents their running into all sorts of vices. We want something of the same kind, for our people think of nothing but dress and amusement; and what little duty they have to do is done slovenly and with discontent. Went in the afternoon over the whole establishment of the School, and a very complete thing of the kind it is; from the learning of their letters, to the examination from a model of fortification of all the parts, their use, the best methods of approaching, the different parallels and saps. I was highly pleased with every part of it, and hope to establish something of the same kind for our men to make them more intelligent and better men. I am in correspondence with Williamson on the subject and eventually I hope something may be done to brighten up our Corps."

Friday, 14th November, 1823. "Went to Saunders' room and had much amusement in looking over Burgoyne's *Directions for Sieges* and the reports of the different Engineers in the Peninsula. Commenced writing to Williamson on the subject of Schools." Colonel J. F. Williamson, who had been Scott's first company commander, was now a member of the Field Officer's Committee at Woolwich supervising artillery training. Scott was so impressed with what he had seen that he at once started a voluntary class for Artillery N.C.O.s belonging to the four companies stationed at Chatham. The facilities of the S.M.E. were placed at his disposal by Major Reid.

Tuesday, 18th November, 1823. "At half past two commenced schooling the N.C.O.s and I met encouragement from the attention and zeal they displayed; indeed I had a much fuller attendance than I expected and it appears that some of the N.C.O.s, who had at first refused attending, have come forward of themselves. This is pleasing to me as the proposer, and I hope will be of advantage to the men. It will be good employment during the winter."

Friday, 28th November, 1823. "Found abundance of occupation in the morning as we went out to practise hand-grenade throwing according to the system laid down by Pasley in his printed instructions. We may find it very useful at some future period. In the afternoon went down to see the Marines at the new drill, according to appointment with Atholl Stevens, and was much pleased with the inspection; hope to profit by it with regard to ourselves."

Monday, 1st December, 1823. "After Muster the whole four companies went out escalading under the immediate directions of Colonel Pasley and according to the instructions drawn up by him. We did it very well and the men seemed to enjoy it vastly. It is very simple and yet very good. I was highly delighted with our efforts. It continued until one."

By this time Scott was assisted in the management of the school by his great friend "Mac" (Lieut.-General A. Maclachlan). The diary continues:—

Monday, 23rd December, 1823. "Walked with my uncle (Colonel Evatt) to the Dockyard and had a minute examination of the new granite dry dock, which is certainly a very fine specimen of masonry; from thence to the Barracks and to my astonishment found that Williamson had arrived. Mac had acted as cicerone to the Colonel. In the afternoon he went into our school and was very much pleased at the progress we had made towards improving the minds of our N.C.O.s. I was very much pleased with the examination; they, generally speaking, answered very well, so as to do credit to themselves and to show that their instruction had not been thrown away upon them. Williamson and Mac came and dined with me, and the Colonel I thought seemed to enjoy himself very much."

The Diary relates that as soon as he returned to Woolwich Colonel Williamson, in frank imitation of Pasley, began writing detailed instructions upon "everything appertaining to the instruction of artillerymen."

The School of Military Engineering and Brompton Barracks

We have seen that the Army is in the throes of learning a new drill sponsored by Sir Henry Torrens. On the 30th May, 1824, Captain Scott is suddenly recalled from Chatham to Woolwich, having been specially selected to instruct all the officers of the garrison in the intricacies of the new drill. He does not return to Chatham, for on the 24th August, 1824, it is reported in Woolwich that General Christie at Chatham has written up to the A.G. to say the services of the four Artillery companies are no longer required in that garrison. There are more reasons for the eviction of the Gunners from their barracks than meet the eye. Scott's Diary for 30th August contains this remark: "Sir Henry Torrens has written to hope the Mess Room at Chatham may be given up to the Queens, who are to occupy our barracks. This is a modest request and old Christie would do it, were it possible, I am convinced; but Pasley will no doubt make the proper representations."

Thursday, 2nd September, 1824, is a red-letter day, for it marks the birth of the S.M.E. Mess at Chatham, so familiar to every sapper. The Royal Artillery marched out of their barracks, never to return. There was no R.E.

Band to speed them on their way as they trudged along the narrow streets which lead to Rochester Bridge. The day was most unpropitious, as the country was sweltering in a heat wave. This is how Scott records the exodus. "The heat was worse to-day than yesterday; the thermometer standing at 120. Went out to meet the companies from Chatham. Poor fellows, they suffered dreadfully, the wind in their backs the whole way. Several were knocked up, but a great many had sufficient pluck not to give up. Am very glad they are arrived. Met Sir H. Torrens going to Chatham. He in combination with Christie wished to get the barracks for his regiment. Not very handsome but brought up by a severe letter of Pasley's and foiled in his attempt. 'Twas a shameful proceeding of the old toad-eater's, his suggestion no doubt led to the business." So to Charles Pasley's firmness it was due that the fine old Artillery Mess was not handed over to the Infantry, but for more than a hundred years was the Headquarters Mess of the School of Military Engineering.

The Royal Military Repository, Woolwich

As a direct result of Colonel Williamson's visit to the School of Military Engineering, a School for the Instruction of the Royal Artillery was instituted at the Royal Military Repository at Woolwich, and Colonel Williamson was appointed its Superintendent, with Bt. Major Thomas Scott as its first Instructor. In *Kane's List*, 1900, there is a short biography of Colonel J. S. Williamson, which says: "Whilst Superintendent of the Royal Military Repository his time was devoted to the preparation of a new and extensive course of Instruction for the Artillery, which forms the basis of the exercise of heavy ordnance and of all the miscellaneous instruction of the Artilleryman at the present day. The large experience, the sound judgment, and eminently practical spirit in which the course is drawn up, give it a value which no change of material can effect. It will always remain a model for professional works of the kind."

If the Royal Engineers possessed, like the Royal Artillery, a series of short biographies of distinguished officers of the past, much the same panegyric, in slightly different words, might be bestowed on the life work of General Sir Charles Pasley. But Williamson was an imitator, while Pasley was an original genius. One cannot read Scott's Diary without realizing that the comradeship engendered by war had incorporated the Royal Artillery into one gigantic family; when they called the Royal Engineers their sister corps they really meant it. There was not an atom of jealousy between them; if the younger sister designs a new bonnet, the elder sister may copy it—she is welcome. And the thousands of men now serving in the R.E. should always remember that the R.A. and R.E. are sister corps. This is one of their earliest traditions.

VIVE L'ENTENTE CORDIALE

By Colonel H. B. Harrison

THIS article has been written for those who will be renewing acquaintanceship with our French allies across the Channel before the end of the War in Europe. It is a plea for clear thinking and for a mental outlook best suited for the maintenance of an Entente Cordiale which will be so essential a feature of post-war Europe.

The shock of events of 1940, followed by such unhappy episodes as occurred subsequently in Africa, Syria, and elsewhere, may have tended to create an unbalanced outlook towards all things French. Many of us, engrossed in pressing wartime activities, have probably not had the time or inclination to sift the grains of truth out of the mass of interested propaganda let loose on the subject.

It is therefore desirable that officers should clarify their ideas on the subject, and that they should ensure that the men under their command enter France in an unprejudiced frame of mind, and with an active determination to ensure the maximum friendly co-operation with our French allies. Unbiassed consideration of such thoughts as the following should go a long way towards bringing one's feelings into sympathy with the French :—

I

The maligned Maginot Line was, in fact, the logical strategical development of warfare for a country twice over-run and ravaged in recent years, and determined that never again should its own soil become a battlefield.

The assumption that the Line would hold, and that any threat through the Low Countries could be met and overcome by a mobile striking force, was falsified in the event by a woeful shortage of A.F.V.'s. The tremendous cost of the Maginot Line left insufficient funds for the provision of anything in the nature of parity between the numbers of French and German tanks.

In quality the French heavy tank was at least equal to anything the Germans could put against it, and the French tank crews throughout fought magnificently. Germany's superiority in numbers of tanks, however, was at least three to one, and with no room to cushion the blow by large-scale withdrawals, (cf. the Russian campaign), France was inevitably doomed to defeat.

Let us remember that it was only the natural anti-tank obstacle provided by the Channel that saved England from a similar fate.

II

No Englishman can adequately appreciate the stunning shock of sudden and total military defeat, with all its resulting mental and physical stresses, which overwhelmed the French armed forces and nation in May, 1940.

No British soldier can fully realize the searching test of loyalties which confronted each French officer, N.C.O. and private after the military debacle.

Do not, therefore, let us condemn where we cannot fully understand.

Many times I have recalled a remark made to me in 1926 by a French Captain of a battalion in Savoie to which I was attached at the time. We were discussing personalities and leadership, and he said:—"There are three men whom the French army will follow blindly anywhere—Petain, Weygand, and Lyautey." A significant remark in view of later events.

Those R.E. officers, who were undergoing their Y.Os' fieldworks course at the S.M.E., Chatham in 1935, may remember a certain French engineer Captain who came over and did a part of the bridging course with us. Convivial luncheon intervals in the Inn at Upnor, with enthusiastic singing of "La Madelon" and other patriotic songs were a feature of his visit.

Towards the end of 1941, when a C.R.E. in the Ninth Army, I found myself responsible for the liaison with those French engineer troops in Syria who had opted to remain and co-operate with us. A number had chosen to return to France and had been allowed to do so. While visiting, one day, the scene of the Syrian fighting, in company with the French C.R.E., I complimented him on the thoroughness of some of the demolitions the Vichy French had carried out against us, and asked him who had been in charge of them. The name he gave was that of this same French engineer Captain who had worked with us on the fieldworks course at the S.M.E., Chatham. The French C.R.E. noticing my surprise, I explained the reason and expressed regret that the officer had chosen to return to France rather than stay and co-operate with us. The French C.R.E. then said that he had been present when the officer in question had made his decision to return, and that on remonstrating with him had received the following reply:—"The Marshal (Petain) orders me to return: I therefore obey."

I repeat, do not let us condemn where we cannot fully understand.

III

The extent of the relentless underground opposition displayed by the mass of the French people to their German conquerors cannot yet be fully known, and is certainly not sufficiently appreciated. Patriotic Frenchmen die daily at the hands of the hated Boche. The active collaborators with the enemy are only a handful of contemptible self-seekers who place personal advancement above patriotism. The great inarticulate mass of true Frenchmen will know how to deal with these renegades when the time comes.

Once the brown plague of Hitlerism has been purged from her land, France will, and must, rise again and re-assume her rightful place in the assembly of free nations.

Taking past bitter lessons to heart, England and France must go forward together hand-in-hand. Let each of us search our hearts and ensure that on our next visit to France no word or action of ours may hinder the revival of a true and lasting "Entente Cordiale."

THE SUDAN DEFENCE FORCE GOES TO WAR

By Brigadier A. J. Knott, O.B.E.

THE Anglo-Egyptian Sudan is, in some ways, a Sapper country. The names of Gordon and Kitchener are closely linked with the history of the country, and are commemorated throughout its towns and villages. It seems suitable, therefore, to relate in this Journal the story of how that country and its little army, built on foundations well and truly laid by Sappers, rose to the occasion of this war. Whilst never officially declaring war on Italy, it played no mean part in the early operations which eventually led to the expulsion of the Italian forces from East Africa, and of the enemy armies from that whole continent.

When the Egyptian Army left the Sudan after the troubles of 1924, an armed force was required for the internal security of the country, and thus the Sudan Defence Force was born. A few Sudanese Battalions from the Egyptian Army were retained at first in the new force, but within a few years these were disbanded and the organization settled down on a geographical basis, designed to cope with internal unrest. The country was divided, for military purposes, into five areas: Northern, Eastern, Central, Western and Southern. In each of these, except the Northern, a Corps of the S.D.F. was stationed. The Eastern and Western Arab Corps were based on Gedaref and El Fasher respectively; the Camel Corps took on the Central Area, with Headquarters at El Obeid, and the Equatorial Corps covered the south, making its Headquarters eventually at Torit. The Northern Area was controlled direct from Khartoum, and included the Cavalry at Shendi, the Engineer Troops at Omdurman, and certain transport and other Headquarter units in Khartoum.

The composition of the various Corps differed according to the nature of the country over which they might operate, and the type of patrol or expedition probably required. In the West, Mounted Infantry Companies were most suitable. The Camel Corps comprised Infantry for work in the Nuba Mountains as well as Camel companies. The Eastern Area called for Infantry Companies with a small mounted element in them, Camel Companies, and at first, an Artillery Section, though that disappeared quite early. In the south, where animals could not be used on account of "fly," the Infantry was given an M.T. Company for transport as far as roads permitted. The Engineer unit, which might be called upon to operate with any part of the Corps, had no transport of its own, but could be allotted M.T., animal, or porter transport, according to the district to which it was sent. Thus the force was organized, with each unit designed to fill a particular role in a particular type of country, with the consequent lack of uniformity in the composition of units and Corps which this policy entailed.

In this form the whole Force was, by present day standards, non-mobile. The company was the tactical and administrative unit, and no operational, or higher formation, Headquarters existed. Companies could go out for a week, carrying all they needed and living on the country through which they moved. When in barracks, the men received no rations, but fed themselves. When on patrol, all they were given was an allowance of grain or flour,

though a special comprehensive ration could be issued in circumstances where they could not support themselves.

The first sign of the march of mechanization in the Sudan was the formation, about 1926-27, of two more Motor Machine Gun Batteries, bringing their total up to three. They were small units, of about 50 men each, mounted in Ford vans equipped with Vickers Guns, and were intended to be highly mobile, with great fire-power.

They had however a very limited range of action from their base, unless they were given a considerable amount of additional transport. Until 1934 however they were the only motorized units in the force, with the exception of M.T. Companies stationed at Khartoum, El Obeid, and Torit. Then the Italo-Abyssinian friction and the general trend of international events made it necessary to review the whole structure of the S.D.F. For some time previously many had advocated the abolition of a purely military force, on the grounds that any kind of civil disturbance, or tribal trouble, was so rare that a gendarmerie would be equally efficient, and more economical. But with the possibility of trouble on the frontiers, or even of external aggression, the pendulum swung right over. Mobility became the first consideration, for distances in the Sudan are great, communications poor—roads, except in the towns and some parts of the south, are almost non-existent—and water in many areas is very scarce. Financial considerations, and the difficulty of training drivers and technical specialists, precluded any immediate large scale modernization of the force, but in 1934, the formation of an experimental Motor Machine Gun Company began. This was built round the old M.M.G. Battery, which was given more transport, more weapons, and a fully mobile infantry element; thus it became a highly mobile unit with a greatly increased range of action. The company could carry water for three days at least and all other requirements for five days or more.

As the result of this trial five similar companies were formed, two from the Camel Corps in Kordofan, and one each from the Western Arab Corps (Darfur), the Eastern Arab Corps (Kassala), and the Engineer Troops (Omdurman). To give additional striking power, the companies were later given a platoon of armoured cars. These were produced locally on standard Ford chassis, thus simplifying the maintenance problem by confining the vehicles of the whole force to one make. These cars had many critics, who derided the idea that Khartoum could produce, for the amount of money available, what Woolwich Arsenal had barely managed to turn out at five times the cost. The S.D.F. armoured car was by no means perfect, but it stood the test of a year and more of active war. The formation, training, and equipment of these five M.M.G. Companies took four years to complete. For reasons of economy, two of them had dual roles.

First the Company formed from the Engineer Troops, which contained a number of tradesmen, was capable of carrying out field engineering works in addition to its role as a normal fighting company. Later experience showed that it was impossible to maintain the standard of training required for these two purposes and gradually, with the disappearance of the original men who had come from the Engineer Troops, the company lost its double nature and became identical with the other M.M.G. units.

Secondly, the Eastern Arab Corps Company, on its formation, retained its camels and was trained to operate either with camels or cars, according to the area of operations. Camels would be needed if there were trouble in the Red Sea Hills, which were then considered impracticable for motors. The improvement in the vehicles themselves, and in the standard of driving, soon indicated that a motorized unit could do all that was wanted, even in that inhospitable country, and when the camels were lost at the Italian

occupation of Kassala, they were not replaced, and the company became like the others in all respects.

The training of the rest of the S.D.F. was not neglected during the years preceding the war, but it was only natural that interest should centre round these new units which were to be the advance guard of the Sudan army. Not only had the men to be trained in the extra automatic weapons with which they were equipped (light machine guns and anti-tank rifles were added to the original Vickers) but the section, platoon, and company commanders had to be taught and exercised in the handling of units which could move so much faster and farther than the Sudanese had ever done before. The natives took to the innovations both kindly and quickly. Westerners from Darfur and Beni Amer from the Eritrean border, whose previous acquaintance with mechanical transport had been limited to riding on the back of an over-loaded commercial lorry, soon turned themselves into reasonably good and extremely resourceful drivers; whilst their companions mastered the mechanisms of the new weapons as quickly as their fathers had become proficient in the Vickers. The Sudanese officers and the senior N.C.Os. had the most to learn. Tactics at 30 or more miles per hour and covering anything up to 200 miles per day differ considerably from those which saw them through on foot, horse, or camel. Many of the British officers had little if any experience of mechanized warfare and had to learn the characteristics and handling in the field of this new type of unit, which had no exact prototype in the British Army but proved eminently suitable for modern war in the Sudan.

In the training seasons of 1934 to 1938, the companies first learned their own business, then they were grouped for collective training, and finally carried out manœuvres involving the whole five companies and other units. A Group Headquarters, capable of administering and operating two or more companies, had to be improvised, and later formed into a proper unit for war. The background of all this higher training was a raid by an enemy mechanized column from Eritrea or Abyssinia; the object of our troops being to intercept the column, and deal with it if small or, if it was too big to be engaged by our limited forces, to let it pass and harass its communications from the flanks. Whether any one of these exercises was successful as an operation or no, the value obtained in training can best be judged by the account which the M.M.G. Groups gave of themselves when their real chance came in 1940 and 1941. The training of these new units inevitably monopolised a good deal of the attention of the authorities during this period, but the older units were not entirely neglected. Combined training and manœuvres were carried out in all areas as usual, by cavalry, infantry, and engineers. These units, if they could not alter their organization or armament to deal with modern requirements, could and did practise the measures necessary to counter the expected methods of the enemy, particularly, of course, attack from the air. Though natives in many parts of the Sudan were by then accustomed to the sight and sound of aircraft, they had no idea of its power as a weapon of war, or of the defence necessary against air attack. Everything possible was done to teach these measures in peace, but unfortunately the native only really learns by experience. This came soon enough to some of them to teach its grim and expensive lesson.

From the outbreak of war with Germany until the entry of Italy in June, 1940, the S.D.F. was almost continuously on the move, and its Commander and staff were always kept guessing. As the attitude of Italy changed from friendliness, through tolerance, to hostility and back again, so more units went to their war areas to carry out patrols and reconnaissance or were allowed to return to their homes and families. At the same time, establishments

were reviewed, to convert a force designed for internal security, and action against ill-armed tribesmen, into one capable of waging modern war against a well-equipped European enemy, and plans were made to expand the force to the utmost. Before describing the part which the S.D.F. played in the actual operations, an outline will be given of the nature and extent of the expansions which were achieved in the first two years of war, though details for obvious reasons, must be excluded.

The Sudan Frontier Battalion was the biggest single unit raised in that period. Its five companies were enlisted and given their initial training by existing Corps of the Force, which also provided a nucleus of N.C.Os. for the new unit. These companies were originally intended to form bases at selected points along or on the enemy side of the frontier, from which supplies, stores, ammunition, and assistance generally could be given to Abyssinian patriots for their own campaign against the Italians. How the Frontier Battalion was actually used when the time came will be described later.

Artillery, of which the Sudan had none before the war, was re-introduced and the Sudan Horse (by which name the Cavalry had been re-christened) followed the example of many horsed units at home and turned over to mechanized gunners. The few regular Gunner officers serving with the Force were extracted from their former units and sent to Shendi, to form a battery of 3.7 inch howitzers, which was ready to take the field within five months of the date on which training commenced, although none of the Sudanese officers or men had ever handled a gun before. In addition to this first battery, the S.D.F. Artillery later included A.A. and Anti-tank units, all mobile or semi-mobile. The formation of these units did not absorb all the personnel of the old Sudan Horse, and the conversion to a mechanized basis was completed by the formation of first one and then a second additional M.M.G. Company.

In the south, one additional company had been formed before the outbreak of war, on account of tribal trouble on the frontier. Other companies, which had small and varying establishments in peace, were now brought up to the size of the larger companies and given the complement of porters necessary to make them mobile for operations. In the end the Equatorial Corps was more than doubled in size.

The Sapper Company of the Engineer Troops, which financial considerations had reduced before the war to little more than an immobile cadre, was brought up to a fully mobile establishment roughly equivalent to a British Field Company. To assist in the execution of the large programme of works and buildings which the situation soon demanded, an Artisan Works Company was added to the strength of the Engineers. The resources of skilled tradesmen in the Sudan, however, are not great, and the formation of new technical units takes time.

Before the war the Ordnance and Medical Services for the S.D.F. were provided entirely by the civil government. The advent of active operations necessitated the improvisation of a complete military medical organization to take the field. Mobile Field Hospitals were formed from personnel of the Sudan Medical Service, to accompany each formation, and the necessary rear hospitals and services were incorporated in the establishment. The civil Stores and Ordnance Department continued to provide the Ordnance organization, absorbing military personnel as these became necessary and available. This Department was greatly expanded to meet the increased military commitments and took over the whole of the workshop side of the M.T. of the force, which had hitherto been done by M.T. units themselves. The absence of any regular ration issues in peace rendered unnecessary anything more than a very small and simple supply organization. The pros-

pect of continued operations in hostile and barren areas made the old policy of living on the country impossible. A complete daily ration was introduced, at first for units in fighting areas only, and later for the whole force, in order to build up recruits and keep the reinforcements fighting fit. This called for a supply service capable of providing, handling, and issuing rations over the whole Sudan and wherever the troops might be operating. The shortage of British personnel, and the difficulty of finding reliable and literate natives, made this expansion one of the most difficult of all.

Until two years before the war the S.D.F. possessed only visual signallers in units. The increased range and speed of operations due to the formation of M.M.G. Companies made the introduction of wireless essential, and Sudan Signals was formed. Again, financial considerations, and the time required to train natives in such highly technical work, made the progress of the unit very slow in peace and its immediate expansion in war very difficult. With a great deal of assistance from British and Indian Signal personnel, and units sent to the Sudan, it was managed somehow, and an organization was designed and executed to provide the signal requirements for the whole greatly enlarged force over the wide range of the Sudan.

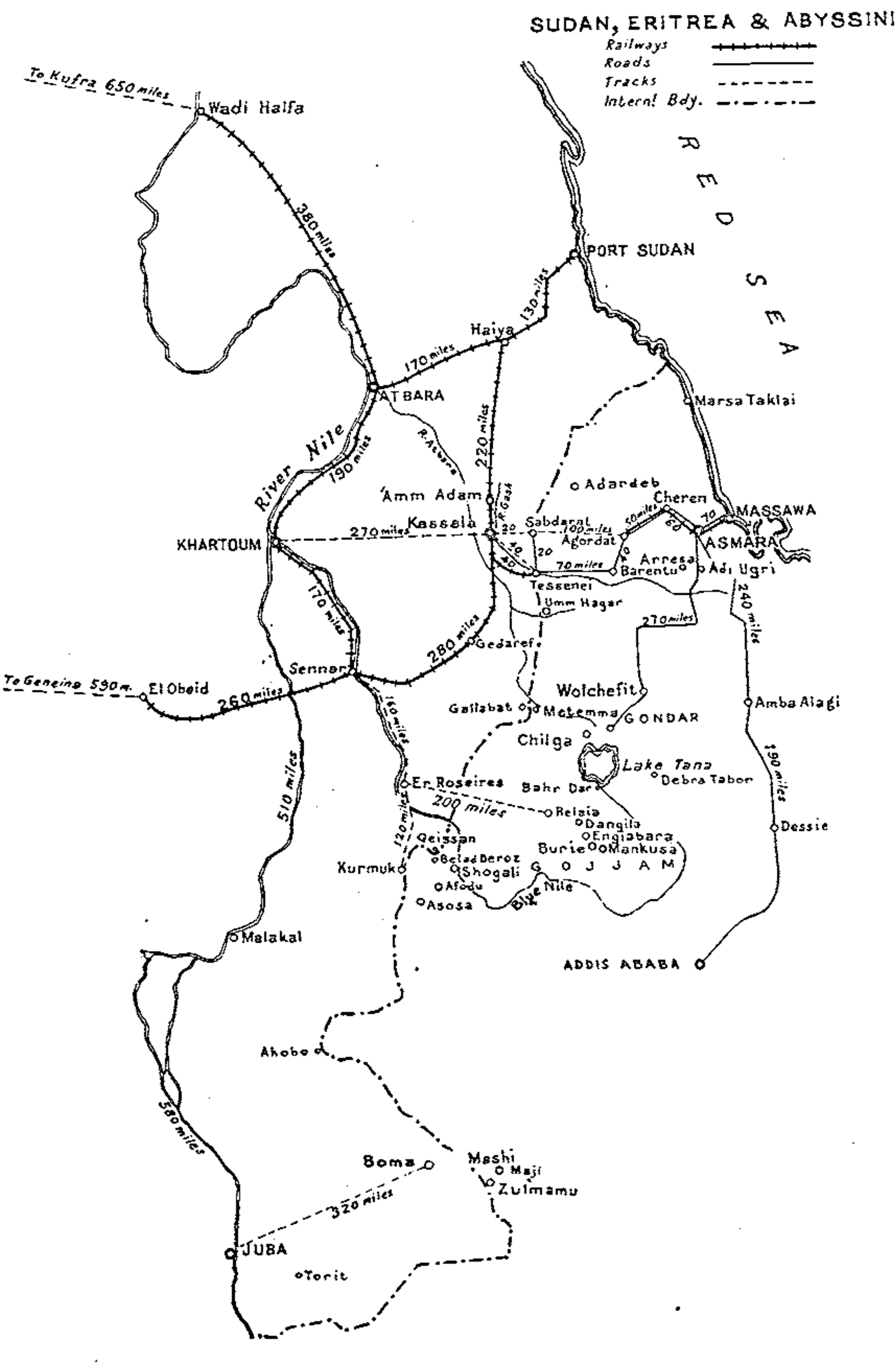
In addition to the expansion of the regular units of the S.D.F., the Sudan Police, who came under military command at the outbreak of war, were formed into improvised units on various parts of the frontier, and rendered valuable service, both independently and in co-operation with regular units.

Bandas were formed to operate with the police, and an irregular force was raised in the Red Sea Hills with a stiffening of police. To this was added the Sudan Auxiliary Defence Force, which grew up to meet urgent needs at the beginning of hostilities. This Force embraced A.A. units on a voluntary spare-time basis, which kept 24-hour watches for many months; Post and Telegraph units to allow civil officials to maintain military communications in forward areas; units to provide additional despatch riders, M.T. drivers, and interpreters; and Province Defence units which were the local equivalent of the Home Guard. Finally, a Marine unit was formed for work on the harbour defence of Port Sudan——the first time the Sudan has had its own Navy. Starting from a small military force of less than 5,000 before the war, the Sudan soon had many times that number of men contributing in varying degrees to the defence of the country.

Early Operations

For nearly a year after the outbreak of war with Germany, the S.D.F., police, and irregular forces were the only troops in the Sudan, except for the peace-time British and Egyptian garrisons. They were charged with the responsibility of watching some 1,200 miles of frontier on the East and South, as well as guarding vulnerable points elsewhere in that vast country. Until Italy came in it was merely a case of constant patrolling, the scale and intensity of which varied with the political situation. For the greater part of the time, "bon voisinage" and non-provocation were the order of the day towards Italy. The Commander of the Troops in the Sudan and the writer dined with the Italian Garrison in their mess at Metemma on New Year's Eve 1939-40 and drank with them to continued good relations, while as late as May, 1940, the S.D.F. officers in Gedaref and Kassala were being invited to Asmara as guests of the Italian officers they had met on the frontier.

The enemy lost no time after his declaration of war, for the very next day Kassala was bombed. From then on, reconnaissances by air over that area and Gallabat were almost daily occurrences. His morale, however, was reported to be low, and we took full advantage of this by constant raiding,


SUDAN, ERITREA & ABYSSINI
Railways
Roads
Tracks
Intern! Bdy.
RED SEA
To Kufra 650 miles
Wadi Halfa
380 miles
PORT SUDAN
130 miles
Haiya
170 miles
ATBARA
Marsa Takiai
220 miles
R. Atbara
River Nile
190 miles
Adardeb
'Amm Adam
R. Gash
Cheren
MASSAWA
Kassala
270 miles
Sabderat
100 miles
50 miles
Agordat
60
ASMARA
KHARTOUM
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70 miles
Barentu
Arresa
Adi Ugri
Tessenei
Umm Hagar
240 miles
170 miles
270 miles
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Gedaref
Sennar
To Geneina 590 m.
El Obeid
260 miles
Wolchefit
Gallabat
Metemma
GONDAR
Amba Alagi
160 miles
Chilga
Lake Tana
Debra Tabor
190 miles
Er Roseires
Bahr Dar
200 miles
Belaia
Dangila
Dessie
510 miles
120 miles
Qeissan
Engiabara
Burie
Mankusa
Belad Beroz
Kurmuk
Shogali
GOJJAM
Afodu
Blue Nile
Asosa
Malakal
ADDIS ABABA
Akobo
580 miles
Boma
Mashi
Maji
Zulmamu
320 miles
JUBA
Torit

usually with fair success. Our strength was so small compared with his that it was obvious that we could not hope to stand against a determined advance, either on Kassala or on Gallabat, or at some other point on the frontier. Our game, which the S.D.F. units quickly learned and played with considerable success, was that of a terrier with a large and stupid flock of sheep, constantly on the move, darting in here to-day, there to-morrow, somewhere else the next day, giving the enemy no rest at all, until he came to believe that he was faced by three or four times as many troops as we actually had on the ground opposite him. During the whole of the latter half of June, small, fast moving patrols of the M.M.G. Group in the Kassala area were constantly nibbling at the enemy and harassing him. These tactics established a definite moral superiority over the Italians, both white and native. One day a patrol took eight prisoners and inflicted twenty casualties; later a similar party bumped into an enemy battalion, which fired wildly and made off into the woods. A few days later, the same battalion was found by another patrol which closed to within a hundred yards of the enemy, inflicted considerable casualties and withdrew without loss to itself. One of our parties found two companies of the enemy in the open and inflicted a hundred casualties in a few minutes; while on another occasion 1,200 enemy cavalry advancing on Kassala were met and completely routed by one M.M.G. Company.

While this was going on opposite Kassala there was also activity in front of Gallabat. Here we had no mechanized troops and could not adopt the same tactics. Almost daily the enemy in Metemma fired wildly at nothing in particular, but did no damage to our men. Air raids were fairly frequent, and a bad one on Gedaref shook the civil population rather badly, but the troops stood up to it well. Twice an advance on Gallabat was checked and driven back. In the first of these attacks there was a moment at which the Sudanese troops were badly shaken and might have wavered, had it not been for the efforts of a young native officer of six months' service, who rallied them so effectively that never again was there any danger of their giving way. For his action on this occasion the officer received the M.C., thus gaining the distinction of being the first Sudanese to receive a British decoration in this war. A little later we scored a local success behind Metemma, but had to withdraw when counter-attacked by vastly superior numbers.

Throughout this early period our constant active reconnaissances had good moral effect on the local population and were most disheartening to the enemy. Stories reached Khartoum that all the Somalis were so disgruntled that they had to be moved from the Metemma area and employed on some other front farther from their homes and people and from the opportunities to desert. Deserters of all sorts came in regularly, on one occasion as many as 300 at once, with their arms. These minor engagements, too, were valuable training and testing for our own troops, who came well up to expectations.

The rainy season was now approaching, when it would be impossible for motor units to withdraw from Kassala across the Gash river, which might come down in flood at any moment. Accordingly, about the end of June, they were moved back to our side of the Gash, and their place in Kassala taken by a Mounted Infantry Company which had come over 1,000 miles from Darfur to take its place at the front. The change over was completed, and we had planned a general attack in the Kassala area for July 3rd, when one of those accidents of war occurred which can upset even the most carefully thought out plans. One signal failed to reach the commander for whom it was intended in time for him to make the necessary arrangements, and he had to ask for the attack to be postponed. Headquarters in Khartoum could do nothing but agree to the postponement, and instead of our attack

going according to plan, the enemy came in on July 4th, both at Kassala and Gallabat. Gallabat Fort was untenable by the troops we had there, but they were all successfully withdrawn, without serious casualties, to a second position which they held until the arrival of reinforcements, later on, enabled us to retake Gallabat. At Kassala, too, although the M.I. Company, in strange country, was harassed and dispersed by the enemy attack, the evacuation was successfully carried out with only negligible casualties to our own troops. One troop of M.I. got lost, and was missing when the withdrawal was complete, but it turned up again two weeks later with practically all its animals intact. This action showed that on the whole the little Darfur ponies were insufficiently trained to fire and noise; a considerable number of them broke loose and were lost, though some were rounded up later. It also proved without doubt that the organization of an M.I. Company, which had been adequate for internal security duties, was not suited to modern war. More animals, weapons, and horse-holders were added as a result.

The enemy attack had been heavily supported from the air, but our troops could get very little help in that direction. Even before the battle, the Sudanese had begun to ask "Where is the British Air Force?" when there had been no reply to enemy raids and reconnaissances. It was not easy to explain to them that distances in the Sudan are so great, landing grounds so few and far between, and the need for air forces in other theatres of war so pressing, that it was not possible to allot any for their support. This was unfortunate, for responsible commanders said afterwards that the air turned the scale. Had the enemy not been so overwhelming in that sphere, we might well have kept him out of Kassala. As it was we had to give way. The loss of the town was a blow to some of the civil population, to whom it had religious and social significance, and the consequent cut in the one railway line a minor nuisance, but no rolling stock or useful material fell into enemy hands. Otherwise, we lost little by giving up ground that we had never intended to hold in the face of a determined assault. The Italian casualties were estimated at 500 and may well have been more, against our total loss of less than 20, and we took up a position behind the Gash which, like the second line behind Gallabat, we held until the time came for us to advance again into Eritrea.

Along the whole of the Eastern frontier there now followed a period of waiting and watching, wondering whether the enemy would attempt any further advance from Kassala or an attack on Gedaref from the direction of Gallabat. In the middle of July a large concentration was reported round Um Hagar, between the two main areas of his occupation. Measures were taken to meet an advance in this locality, but nothing happened. In spite of the fact that rain was daily making more and more ground impossible for operations; deserters and escaped prisoners, who came over to us in a continuous if irregular stream, all brought news of impending attacks, now here, now there. These useful people also said that the Italians were nervous of our intentions, and of this we took full advantage. Their Intelligence always magnified the strength of our forces, and we helped them by continual sorties and reconnaissances, and by moving units and parties of M.T. up and down the frontier as the weather permitted. So successful were these ruses that at one time the Italians estimated our strength in one part of that sector at 3,000 regular troops with 80 armoured cars and 10,000 irregulars. The S.D.F. had certainly been reinforced by Imperial troops, but the whole strength of our forces in that particular area could not have exceeded 2,000 all ranks.

Meanwhile, further to the north, the other M.M.G. Group was not idle. Their task was to harass and delay the enemy if he advanced in the area be-

tween the River Atbara and the railway from Kassala to Haiya Junction. In the early part of August reports were received of enemy patrols entering the Sudan between the Eritrean border and the River Gash, and there were rumours also of a general advance on Amm Adam. A patrol from an M.M.G. Company (formed since the beginning of the war and now taking the field for the first time) reconnoitred that part of the frontier. They found no enemy, but previous reports were confirmed. A small force of an infantry platoon, from each of two British battalions, with mobile automatic weapons from the M.M.G. Companies, was constituted and immediate action planned. The imminence of rain made any prolonged or detailed reconnaissance impossible and it was decided to concentrate the attack of this little force on Adardeb. A preliminary move located and dispersed a party of some 30 enemy, the total strength of whose force was estimated at about 200. The commander had orders not to get heavily involved, but his main attack inflicted considerable damage and casualties before it was withdrawn. In this action, the first in which S.D.F. units had co-operated with British troops, the control was of a high standard and there were many instances of outstanding dash and bravery. Unfortunately two officers of the British platoons were killed, but casualties on our side were numerically small compared with the damage done.

The Main Operation

With the arrival in the Sudan of Imperial reinforcements, the part played by the S.D.F. in the operations decreased in relative importance. Yet these same Imperial troops paid tribute to the way in which the Sudanese, while they were only 4,500 men to 1,200 miles of frontier, had established such complete domination over no man's land and over the Italian psychology. The history of the operations has been told elsewhere, and here the briefest outline only is required. If it appears that justice is not done to the great achievements of the British, Indian, and other Imperial and Allied forces, in this campaign, it is because the object of this article is not to tell the story of the whole campaign, but to give some idea of the part which the S.D.F. played in it.

From now on, the S.D.F. took its place as a part of the whole Forces in the Sudan, operating under command of and in co-operation with Imperial formations in the various phases of the campaign. Administrative difficulties were encountered, since S.D.F. units were not used to a regular system of rations and supply, nor to the meticulous use of Army Forms indents, whilst the Indian supply machinery did not know what the Sudanese wanted nor the language or ways of the people. The S.D.F., brought up on a policy of self-sufficiency and great elasticity in regulations and procedure, did not take kindly to the more orthodox methods of regular units and formations. The commanders and staffs of these, faced with the problem of administering a private army, the like of which they had never seen, whose language they could not understand, whose regulations were non-existent or incomprehensible, whose methods, to say the least, were vague and individualistic, and which was officered by enthusiasts and amateurs, showed great patience and eventually solved the problems effectively. The S.D.F. on their side gradually learned to fall in with normal methods or remembered the rules, and so took their place in what turned out to be the first permanently successful venture of this war, the advance into and occupation of Eritrea.

While the bulk of the Imperial reinforcements was being concentrated in the Sudan, one M.M.G. Group was incorporated into a mobile force—named " Gazelle "—which, operating north and east of Kassala and Sabdarat,

continued the policy of keeping the enemy guessing where he would next be nipped, and gained that confidence in themselves and superiority over the Italians which were reflected in the dash and skill of their subsequent pursuit. Meanwhile, the second M.M.G. Group of the S.D.F. was working forward on the Barentu line with another Indian Brigade. Before Barentu fell they had executed a successful raid on the road running east from the town, inflicting heavy casualties. At the same time, one detached M.M.G. Company and an M.T. Company were allotted to a Brigade coming to threaten Cheren from the north.

Before the main assault on Cheren, the Barentu group, together with two M.I. Companies, carried out subsidiary operations in the Arresa area. They were not strong enough to make any ground, but served their purpose by pinning the enemy to that area and preventing him from reinforcing the formidable position at Cheren. When this stronghold fell, the Group joined in the general pursuit, while the M.I. Companies set out to force their way through to Adi Ugri and cut the road running south from Asmara towards Gondar, in anticipation of the fall of the capital. Both M.M.G. Groups joined in after Cheren, and one of them took part in the final battle of Amba Alagi, while the M.I. commander with some of his men united with Ras Seyoum, the patriot leader, and played their part in the fall of the last fortress. The other Group was eventually left watching Wolchefit, which was described as being equivalent to twice Amba Alagi and five times Cheren in impregnability, in the rain and cold, which were particularly severe on the Sudanese from the plains, suffering and indulging in intermittent shooting at an enemy they could neither see clearly nor reach with certainty, for some months. It was hard luck on them that the enemy capitulated a few days after the S.D.F. had been relieved by other troops. So ended the part played by the S.D.F. in the liberation of Eritrea.

Although operations in the Kassala-Gallabat portion of the frontier were more continuous and on a larger scale than elsewhere, other parts of the Sudan were not without incident. Within a week of Italy's entry into the war, Kurmuk had been bombed, and the civil population withdrew. We had no garrison there except the local police, but these gave a good account of themselves when, in early July, the enemy attacked and occupied the town. Most people who knew Kurmuk agreed that the Italians were welcome to it, for they gained nothing but prestige. They only occupied the place intermittently until finally ejected some months later.

At intervals reports came in of forces advancing or intending to advance into the Sudan in the south-eastern area and up the Blue Nile, but there was no major operation. As early as June they attacked and occupied Akobo, garrisoned solely by the local police. This loss might have been more serious than that of Kurmuk, for the tribesmen in that part are a somewhat uncertain quantity (many from the border area fighting on the other side), however, thanks to the action of the police and the local Political Officers, there were no repercussions from this further pin-prick of the Italians. The district remained comparatively quiet until, with the arrival of reinforcements, it became our turn to attack.

The Italian garrisons in this area covered all the possible entrances to Abyssinia, which we had to open to provide lines of advance and supply for the patriot campaign. In the early days we were limited to defensive patrolling by police and armed friendlies. Later it became possible to send a small force, composed of Eastern Arab Corps with one company of the newly formed Frontier Battalion and a troop of light artillery, to the area. This force was based on Roseires, whence it advanced southwards and fought a sharp action at Shogali crossing on the Blue Nile. After that, it took Qeissan

and Beladderoz, and later Afodu, having stormed the escarpment to do so. Not long after this Asosa fell to other forces and the whole frontier was cleared of the enemy. Our little force was then withdrawn for further service in the Gallabat area.

Imperial troops which had been operating in this area were withdrawn for the main effort in Eritrea. An improvised Composite battalion of the S.D.F. with a troop of guns was left, with a battalion of the Ethiopian army, facing Chilga and the escarpment, behind which lay Gondar; this proved to be the last stronghold of Italian resistance. The Composite battalion was made up of one regular company of the Eastern Arab Corps, one Banda company of the same Corps, partially reorganized to bring it on a footing with the regular company, and two Nuba companies. One a regular company of the Camel Corps, the other transferred (as mentioned later) from the Frontier battalion, not to be confused with the above Composite Battalion.

For some weeks they kept a much larger enemy force from helping in the main operation, particularly towards Debra Tabor. To keep them mobile and effective in the rough country beyond the end of the road from Gallabat, the Composite battalion had been given as many mules as could be scraped together, from which it organized first and second line transport and even pack transport for some of the guns, though they were not designed for this form of carriage and some of the experts said it could not be done. With the advance through Cheren demanding all the equipment that was available, only odds and ends could be spared for this little force, and they had to do the best they could with little or nothing. Rain came soon, which interfered with their movements and operations and eventually stopped them altogether. The commander was kept constantly guessing whether he could remain another day, and still get his scanty M.T. and his guns back, before the rain and swollen khors made movement on wheels impossible. He hung on to the last moment, and got the whole safely back to Gallabat and Gedaref, where they remained until the next dry weather made further operations possible.

It is now past history that the operations round Gondar were brought to a successful conclusion and there the last of the Italian Generals was taken. The S.D.F. force, which started from approximately the same positions whence the rain had driven it the previous June, was again formed of the Composite battalion, now refreshed after short leave and partially re-equipped, the troop of guns as before, and this time some Sappers and Pioneers; more M.T. than had been possible on the previous occasion and a total of some 1,000 mules, largely captured from the Italians in other parts of the country. It was placed under the command of the Imperial Forces from East Africa, who were responsible for the operations. Our force was allotted the role of preventing the enemy from breaking out down the road towards Gedaref, and was instructed to make a strong raid towards Chilga in conjunction with the main attack on Gondar. In this raid they came up against great superiority in numbers and equipment, and suffered severe casualties, but the East African Command was well satisfied with their efforts. Gondar fell within a few days, and almost immediately our troops occupied Chilga.

In the south-eastern corner of the Sudan the Equatorial Corps, recruited entirely from the pagan tribes of the south, had seen service even before the beginning of the war, when tribal trouble astride the border called for a punitive expedition by one company. Until Kenya was ready to co-operate, the Sudan could do nothing in that part beyond maintaining patrols across and along the border. The natives on both sides of the frontier were unfriendly, and little help was to be expected from the patriots in the area.

Eventually four and later five companies of the Equatorial Corps were involved in operations at the end of a line of communications some 350 miles long from river-head at Juba, with only a home-made road for the greater part of the distance to the Boma Plateau, along which all their supplies had to be carried.

Ordered to move on Maji via Zulmamo, one company met a battalion of a Colonial Brigade, engaged them and left 150 dead for the loss on our side of 5 killed and 9 wounded. By now there was virtually civil war in this area, and our troops could do little. At the request of East Africa, they garrisoned Maji temporarily, and after meeting and overcoming many difficulties on the way, they occupied it and Mashi, from both of which the Italians had by then withdrawn. Amid heavy and continuous rain, defensive patrols were carried out from then onwards, but it was a profitless business, and our garrisons were eventually withdrawn to the Sudan.

The Equatorial Corps had little to show for their months of hard work, marching, and poor living, in an inhospitable country, all the time as liable to attack from the inhabitants as from the enemy. The difficulties of supply and maintenance were considerable and, as elsewhere, they could be given little in the way of M.T. or equipment to help them. From Khartoum they were fourteen days journey by steamer to river-head at Juba, and it was several days more, by road and porter, to where they were operating. They had to improvise and make the best of nothing, and they did it very well.

Perhaps the most romantic part in the whole of the operations in and from the Sudan fell to the lot of the newly raised Frontier Battalion. One company, the first to be ready for war, was employed with the Blue Nile force whose activities have already been described. This was a Nuba company, and it got on so well with another company of Nubas working alongside it, that it was never returned to its parent battalion but the two companies were kept together, and formed part of the Composite battalion in its operations on the Gallabat line. These Nubas, hillmen and more primitive than the Arab, work and fight very much better with their own kind. When placed alongside the Arab they appear at a disadvantage, almost as if they had some sort of inferiority complex. On their own, they fight magnificently. The difficulty their officers found was not to get them into a scrap but, having launched them, to control or withdraw them if they became too deeply involved.

To return to the remainder of the Frontier Battalion. A forward policy for the patriot campaign was decided upon in November, 1940, and this battalion was to be the main regular force employed in this important part of the East African operations. It had some M.T. and, since it would have to operate in country where vehicles could not go, it was also given animal transport. In addition to the animals of the battalion itself, some 25,000 camels were collected to carry in supplies, ammunition, money, weapons and all the requirements of the patriots. The first move was for one company to go to Belaya, at the foot of the escarpment, and establish a base for the Emperor. By the end of January, the whole battalion was at or near Belaya. They had had a hard time getting there, for the country was rough and unknown. Early attempts to get M.T. through by that route failed, but later on a track was made passable, involving much hard work and considerable casualties to vehicles.

In the middle of February, the approach of a company to Dangila caused the Italian commander to withdraw, while another company invested Bahr Dar, close to Lake Tana. By the end of the month, the whole battalion was again assembled in the area of Enghiabara. Throughout the advance, up to this point, it had been possible to carry with them only the barest minimum

of food and supplies ; but now they found that they could live on the country. Had this not been possible, the difficulties of supplying them from the rear were such that the campaign would have been well-nigh impracticable.

From the time when they first came within reach of the enemy the battalion could only move at night, since movement by day might have given away their presence and the whole patriot plan to the enemy. Progress was therefore slow, but secrecy was the key to the whole campaign, the full details of which will make fascinating reading if they can ever be published. For the moment it must suffice to mention a few isolated episodes. With an Ethiopian battalion, the S.D.F. attacked and took Burye and Mankusa. The Italians broke out of Burye, but were severely harassed by the Frontier Battalion on their way. The protection of their long line of communication all the way through hostile country back to the Sudan frontier was a constant drain on men and weapons, but at Debra Markos some 12,000 of the enemy were contained by two companies of the Frontier Battalion, totalling then about 300 men only. A little later the Italian Maraventano surrendered 7,000 men, 7 guns and a great deal of equipment to a force of 140 Sudanese and Ethiopian regulars with some 2,000 patriots.

On 28th April the Emperor crossed the Blue Nile to re-enter his capital, accompanied by what was left of the Frontier Battalion after they had detached sufficient men to guard their communications and man certain posts. The remnants of their M.T., too, had been taken up the escarpment and were once more available. The height and cold of the plateau were particularly trying to the plainsmen in their drill uniforms, many of them now ragged from hard wear, but they stood it well. In the space of six weeks this battalion had played a leading part with Ethopian troops and patriots in clearing the entire Gojjam of 16 Colonial battalions, 2 regular Banda Groups and 4 Blackshirt battalions with Artillery. Half the enemy forces had been captured or destroyed, while the remainder escaped to Gondar.

The high spot of the campaign came on 5th May, when the Frontier Battalion formed part of the escort to the Emperor on his ceremonial re-entry into Addis Ababa. Raised only eighteen months previously, each company from a different part of the Sudan, hurriedly trained and equipped, their achievement remains a tribute to the fighting qualities of the Sudanese and to the ability, energy, and perseverance of those who led them.

Conclusion

That is the end of this brief sketch of the S.D.F. operations in the first two years of war. Almost all units were then withdrawn from Eritrea and Abyssinia and were busily employed sorting themselves out and tidying up their affairs after a year and a half of being constantly on the move, if not actually fighting. Great as the difficulties of maintenance and communications were during the period of active operations, the semi-static conditions in which they now found themselves had their own problems. The Sudanese is not a professional soldier in the same way as the Indian, who is prepared to serve away from his home and family for long periods at a time. As long as he is fully employed in active war, the Sudanese is happy, or comparatively so. But ask him to sit down and garrison a place far removed from his family and village and he soon becomes restless and may even be troublesome. Any great sustained effort is beyond the powers and inclinations of the majority of Sudanese either in peace or war, and in any case many of them were convinced that the Sudan's war ended with the expulsion of the Italians. True to their title as members of a Defence Force, in spite of their achievements in attack, a great many soldiers soon wanted nothing

but to go back to their peace stations, where they could tell their families and friends how they drove the invader from the Sudan. Unfortunately, this could not be done so easily. There were posts to be garrisoned, aerodromes to be defended, communications to be protected, throughout the Sudan and beyond its borders. There was considerable doubt whether the S.D.F. was really suitable for employment on general service in the Middle East, but it obviously could and should take on local jobs and so relieve Imperial troops to go and carry on the fight elsewhere.

In the meantime, leave was arranged when possible, but it was not easy to keep the men happy and occupied far away from their homes with no active operations in immediate prospect.

Before the war, an S.D.F. company had a maximum of two British officers, all the other personnel were native. Casualties, the formation of new units and revision of establishments entailed bringing in new British blood to the force in considerable quantity. At first this was provided almost entirely locally. The Political Service, Government Departments, Cotton Syndicates, and commercial firms all contributed to the initial increase in British strength without which the Sudanese units could not have started operations. Latterly, officers and N.C.Os. were provided from the Middle East pool to fill establishments. At no time during the operations were there any reinforcements available to replace British casualties, but fortunately these were very light. But the Sudanese takes a lot of knowing, and the S.D.F. has always accepted Arabic as its language for all purposes. British officers and N.C.Os. frequently find the language hard to pick up. Without it, they can neither know nor teach their men, nor, which is often more important, can they keep them happy and find out and right their many little grievances.

The supply of native man-power was adequate to meet the requirements of the increased force, but no one can turn out Native Officers, tradesmen, and specialists in a few months. This necessitated the importation of a larger proportion of British personnel than in peace. These create new problems, accommodation, feeding, relations with the native, etc., which need time and tact for their solution.

Active operations in the Sudan ceased when Eritrea and Ethiopia were cleared, and full use was made of the respite to improve organization, amend establishments, and put the many improvisations on to a sound basis. If the war had returned to the Sudan, the S.D.F. would have been ready. However, it soon became clear that this was unlikely, thanks to the completeness of the victory there and the successes further north, but other employment was waiting for the Sudanese. After providing for garrisons in the Sudan and Eritrea, units were still available for service elsewhere and men for the further expansion of the force. The story of how this was carried out is not yet complete. Doubtless, when the time comes for it to be told, it will reflect as much credit on the Sudan Defence Force as the early exploits here recorded.

STILL MORE WAR BOOKS

By J.E.E.

AS the war books grow steadily in numbers, if not in variety, the reader, who, so far as print is concerned " may take as much or as little of the war as he will," has the more need of his critical faculty. For instance he might well employ it in considering the writings on the theory of war in general, and on the conduct of modern war in particular.

Makers of Modern Strategy should not be judged by its unhappy title; it is an exposition of " military thought from Machiavelli to Hitler " by twenty learned Americans who have read everything—or nearly everything—the editor being Professor Edward Meade Earl, of Princeton University. Comprehensive, and rather controversial, the book may be taken, in small doses, with advantage. Also from the U.S.A. comes *Defense* in which, in translation, General Field-Marshal von Leeb, adopting the role of propagandist, shows from instances in the 1914-18 War how successfully the German Armies—and no other Army—followed the Clausewitz dictum that the defensive is stronger than the offensive. The translators, who have written a third of the book for the author, explain how the Leeb theories were rejected by the Germans and employed by the Russians in 1941. In *Lend-Lease*, another American book, Edward R. Stettinius, jnr., explains the origin of the system and its value to Great Britain before America entered the War.

Guide to Modern Warfare, the work of Admiral Sir Reginald Bacon, Major-General J. F. C. Fuller, and Air-Marshal Sir Patrick Playfair, is lucidly written and well illustrated, though it contains a number of rather fearsome diagrams; the introduction composes this picture of total war which the general reader cannot fail to appreciate. Admiral of the Fleet Lord Keyes is stimulating and challenging in his *Amphibious War and Combined Operations*; he reviews past enterprises at Quebec, in China, at the Dardanelles, and at Zeebrugge, and finds modern instances in Norway and the Mediterranean.

The Hutchinson chronicle of the War, edited by Mr. Philip Graves, reaches, in *The Sixteenth Quarter*, the invasion of Italy and Russia's summer offensive of last year. It maintains its general high standard and, as a record of events, may be referred to with confidence.

The Royal Air Force, April, 1942—June, 1943, Air-Commodore L. E. O. Charlton's third volume, treats of the turn of the tide in Russia and Africa. The Mediterranean theatre is the theme of three R.A.F. officers, Wing-Commander T. H. Wisdom in *Triumph Over Tunisia*, Air-Commodore Harold Williams in *Now or Never*, and Air-Commodore A. W. F. Glenny in *Mediterranean Air Power and the Second Front*: all look forward to seeing our experience applied with profit to the problems of the invasion of northern Europe. *Skyways to Berlin*, by Majors J. M. Redding and H. I. Leyshon, describes how the U.S. 8th Army Bomber Force was built up in Britain for

the air offensive against Germany, and this book is supplemented by *Target Germany*, the official account (British edition) published by H.M. Stationery Office, which has also produced *There's Freedom in the Air*, an admirable tribute to the Allied air forces, representing eight different nations, which work with the R.A.F. Stories and studies of air pilots and aircrews may be found in *Cloud Cover* by Derek Gilpin Barnes and *The Fire was Bright* by Leslie Kark, both authors being R.A.F. officers who write from their own experience. *Bombing Vindicated*, by J. M. Spaight, the authority on air international law, emphasizes the importance of the heavy bomber's contribution to victory and hails it as the "saviour of civilization," in sharp contrast to Major Oliver Stewart who in *Air Power and the Expanding Community* suggests that the development of air power can only lead to "bigger and better wars." *Seeds of Chaos*, written for the Bombing Restriction Committee by Vera Brittain, is only mentioned here because it is wrong-headed and mischievous, however sincere it may be.

In the Royal Navy class, pride of place may well be given to *We fought Them in Gunboats*, by Lieut.-Commander R. Peverell Hichens, a well-known commander of "light coastal forces" who possessed the "Nelson touch." He has been killed in action. *The Little Ships*, by Gordon Holman, who was in the raid on St. Nazaire, also tells of the achievements of "amateur sailors" serving in motor-gunboats, motor-torpedo boats and motor launches; Nicholas Drew in *Amateur Sailor* writes of his experiences as a hand on a trawler during the Dunkirk evacuation and, later, as an officer of the R.N.V.R. in a corvette on convoy escort. By contrast we have *One Year of Life*, in which Alan and Gordon Franklin relate the story of our ill-fated battleship "Prince of Wales"; and *Find, Fix and Strike*, by Terence Horsley, an officer of the Fleet Air Arm who has first hand knowledge of the admirable work performed by our naval aircraft. *Britain's Merchant Navy*, a history of its growth as well as of its achievement in the present war, is by many contributors under the editorship of Sir Archibald Hurd, with many illustrations; *The Dark Seas Remember* contains stories of the Merchant Navy during the past few years, collected by Commodore G. Purssey Phillips. *The Royal Marines* 1939-1943, by Owen Rutter, is another of the excellent Stationery Office publications; it covers in a few pages the crowded record of the corps by land and sea, and has many illustrations.

From America come *Theodore Roosevelt and the Rise of the Modern Navy*, by Gordon Carpenter O'Gara and *Sea Lanes in War Time: The American Experience*, by Robert G. Albion and Jennie Barnes Pope, which covers the period 1775-1942.

Turning to the various theatres of war there is a little book on the defence of Malta which calls for special mention; it is *Grace under Malta*, by Sylvia Dobbie, for sixteen months of the siege the confidential secretary of her father who contributes a characteristic foreword. *Malta Spitfire* is written by George F. Beurling and Leslie Roberts, the former a fighter-pilot; it has an introduction by Air-Marshal W. A. Bishop, V.C.

The campaigns in Africa are still a favourite theme. It is good to hear that Major Hingston's *The Tiger Strikes*, which describes the services of the 4th and 5th Indian Divisions in Africa and the Middle East, has gone into a second English edition as well as being published in Urdu and Hindi. In *Speaking from the Desert*, Godfrey Talbot, the B.B.C. man who carried his microphone from El Alamein to Cape Bon, supplies a good and interesting narrative; A. D. Divine's *Road to Tunis* is more concerned with convoys and landings, and although it recognizes a great achievement, is inclined to be critical after the event. *The Eighth Army*, published for the War Office

by M.O.I., covers the four campaigns up to the capture of Tripoli and does not neglect the naval and air operations; the diagrams and illustrations are excellent and it is to be hoped that the record will be continued in the same form, though perhaps with more discretion as regards the criticisms of some of our commanders. *I was an Eighth Army Soldier* contains the experiences of Driver R. J. Crawford as related by him to Major John Dagleish. Lastly come two "prisoner of war" books: *The Sun Stood Still*, by Major J. C. Mustardé, a British medical officer captured at Tobruk and *Prisoner from Alamein*, by Captain Brian Stone. The former fared better with the Germans than he did with the Italians to whom he was handed over, but ascribes this to Italian incompetence rather than malice; the latter writes an honest account of his reactions to the ordeal through which he passed.

The capture of Crete by the Germans is an operation of special interest and John Hetherington, an Australian correspondent, has used all available official accounts and the stories of many participants to produce an excellent study, in considerable detail, called *Airborne Invasion*.

As the campaign in Italy is not yet over it will doubtless form the subject of many books still to come. *The Conquest of Italy*, by Lord Strabolgi, is certainly rather premature as regards its judgments although our "political strategy" is certainly open to criticism; it is contended that military opportunities were missed because the commanders on the spot were not given full control. Peter Stursberg, a Canadian broadcaster, describes the deeds of Canadian troops in Italy in *Journey into Victory* which also tells the tale of American energy and enterprise in building the Alaska highway; and John Gunther, forsaking world politics, relates in *D-Day* his experiences with the Eighth Army in Sicily with excellent "appreciations" of Eisenhower, Alexander, and Montgomery. The title of this book will become more and more misleading as time goes on.

Retreat with Stilwell, by Jack Belden, an American correspondent who obviously does not like us and saw in our misfortunes in Burma the break-up of the British Empire, contains some good descriptive writing. It gives us a glimpse of Gordon S. Seagrave, an American medical missionary who had laboured in Burma for many years, and also came out with Stilwell, as he himself relates in *Burma Surgeon* which is most heartily to be commended.

The Civil Defence of Malaya has been compiled by a committee under the chairmanship of Sir George Maxwell as a vindication of these services which were modelled on those of the United Kingdom. The actions of the Malayan Government and of the military administration do not escape criticism.

Two ladies who were interned at Hong Kong by the Japanese have related their experiences: Mrs. Gwen Priestwood in *Through Japanese Barbed Wire* which includes the story of her escape to Chungking, and Miss Gwen Dew, an American, in *Prisoner of the Japs*.

The war in the Pacific is represented by two books, first by *New Guinea Diary*, the work of George H. Johnston an Australian reporter, who shows us how vital was the retention of Port Moresby, and describes the Australian advance over the Owen Stanley range; and secondly by *Out on the Boon-Docks* [*sic*] the collected stories of twenty-one U.S. marines who took part in the fighting in the Solomons.

Undoubtedly the "Home Front" has received less attention from writers than it deserves. *Manpower*, prepared for the Ministry of Labour and National Service and published by the Stationery Office, describes the mobilization for war of our population; *Home Front* tells of the temper and spirit of the people in shipyards, munition factories, docks, the fire service, and other

centres of national effort, a 1942-3 diary full of interest, gathered at first hand by James Lansdale Hudson; *Heroes of Road and Rail* is a tale of the achievement of our transport workers under the strain of air-raids, written by George C. Curnock on the same lines as his *Hospitals Under Fire*; *Cockney Campaign*, by Frank R. Lewey, Mayor of Stepney during the worst air-raids on the East End, exalts the wonderful spirit of Dockland; and in *Fleet Street Blitzkrieg Diary*, Gordon Robbins relates how the newspaper and publishing world carried on under the German bombs.

Canada in World Affairs: Two years of War 1939-41, by Robert MacGregor Dawson, is issued under the auspices of the Canadian Institute of International Affairs; it shows how the policy of the Dominions has marched with the changes in the European and Far Eastern situation since the war began.

Though nothing like a full-length record of any of the Russian campaigns is available, more accounts of some phases of the fighting have appeared. Three books, published with official approval, are *Stalingrad*, a collection of the accounts of eye-witnesses, correspondents and soldiers, including the commander of the 62nd Army; *Sevastopol, November, 1941—July, 1942* to which, among others, the commander of the Black Sea fleet and the artillery commander of the fortress have contributed; and *The Battle of Orel*, written on the same lines to describe the capture of Byelgorod and Orel in July, 1943, when the fighting included a great tank battle. *Westbound Tanks*, describing the manufacture of heavy tanks and their experiences in action, is by A. Polyakov, a correspondent of the Russian military newspaper "Red Star" who was killed in October, 1942. *Twelve Months that Changed the World*, in diary form, is written from Moscow by Larry Lesueur, an American broadcaster who sometimes got near the battlefields; Walter Kerr, another American correspondent, gives us some interesting information in *The Russian Army*, commenting upon its very strict discipline.

Concerning the countries in German occupation not much appears to have been written lately. *Vichy: Two Years of Deception* is a scathing indictment, with judgments of Pétain, Darlan, and Weygand, by Leon Marchal, a diplomat who was always opposed to the armistice with Germany, but served as counsellor at the Washington Embassy until he joined de Gaulle on Laval's return to power. *Paris Underground* proves to be an account by Etta Shiber of the way in which she and her friend Mme. Beaurepos organized the escape of British prisoners of war. Major A. M. Meerloo in *Total War and the Human Mind* gives a better impression of daily life in Holland under the German yoke than he does of the Nazi mentality; the book has been written for the Netherlands Government Information Bureau. Published by the authority of the Royal Norwegian Government *Fighting Norsemen* is a good, if slight, account of Norwegian prowess in the War.

There is always something more to be written about our enemies. *German Strategy of World Conquest* is a summary compiled by Derwent Whittlesey, Associate Professor of Geography at Harvard, of the views of German writers who, since the eighteenth century, have pointed out the areas of the world which Germany should seek to possess and the best way to obtain them. The diagrams are rather formidable. Complementary to the above is *Generals and Geographers*, by Hans W. Weigert.

Hitler's Generals, by W. E. Hart, reputed to be a German ex-officer, is not so informative as one would expect. The decline of the *Luftwaffe* is the subject of C. G. Grey who in *The Luftwaffe*, speaking from his personal knowledge of German aircraft manufacture up to 1938, thinks that the

German air force was created to fight Russia. On the same theme Hauptmann Hermann, the pseudonym of a German pilot of the Last War with experience of German civil aviation up to 1939, gives us the "low down" in good American why the *Luftwaffe* never could and never will be able to fulfil a strategic operational role; his book *The Luftwaffe : Its Rise and Fall* is published in New York; it possesses a good bibliography.

Government by Assassination, by Hugh Byas is a well informed and, perhaps for that reason, a pessimistic study of Japan, her traditions, and the perverted moral sense of her people: truly a pretty Pacific problem for the United Nations.

Much has been written concerning post-war problems and the peace settlement with the enemy, questions which inevitably draw attention to the last "peace" and to the years between the wars. As soon as the U.S.A. entered the war she set her experts to undertake a methodical search for a practicable peace settlement, and in connection with this work there has been officially published the first two volumes of a series entitled *The Paris Peace Conference : Papers Relating to the Foreign Relations of the U.S. 1919*, which is to be completed in 15 or more volumes. This is only mentioned as evidence that the U.S.A. has a due sense of her responsibilities. Sir Geoffrey Knox, who was President of the International Commission of the Saar, after being a member of the British Mission in Berlin, and so should have few illusions left, voices his opinion very moderately in *The Last Peace and the Next*. In *Stresemann*, translated from the German, K. F. Bielick shows his subject as unscrupulous and cunning—too cunning for the French and British—and adept in using the Locarno spirit for the discomfiture of the Allies: "a German statesman who deserves well of the traditional Germany." This is a valuable antidote to those books which still strive to show how badly Germany was treated after the last war. Colonel T. H. Minshall's *Future Germany* suggests some form of international control of Germany's economic resources and real disarmament until a new anti-Nazi generation is educated. Gerald Abrahams, in *Day of Reckoning*, warns us that it will not be so easy to bring the "war criminals" to justice.

A later book which should command attention is Sir Edward Grigg's *British Foreign Policy*, distinguished by its realistic view of Britain's obligations and interests where international reconstruction is concerned. The author draws no distinction between Nazis and Germans.

Finally there is a survey of the war years which is of particular value; it is contained in the four published volumes of the Prime Minister's speeches, edited by Charles Eade. Mr. Winston Churchill is, of course, in an almost unique position as regards knowledge of policy and events; and, as we all know, it is a pleasure to read, or to listen to, his exposition of them. The latest of these volumes, entitled *Onwards to Victory* covers the period between the Casablanca and the Tehran conferences. Doubtless the series will continue, at least until all military operations are over.

MUSINGS ON ROADS (*Part* 1).

By Colonel E. St. G. Kirke, D.S.O.

THE Parliamentary Secretary, Ministry of Transport, recently voiced general opinion when he said, "Road accidents are not only a great social evil, which to-day causes more needless suffering and waste of life than other social evils like the slums—they are a social disgrace, and it is everybody's duty to wipe them out."

Comparison of Roads and Railways

No one who studies the yearly figures for casualties caused by accidents on roads and railways respectively can fail to be struck by the amazing preponderance of the former, amounting as they do to nearly a quarter of a million every year. It may be of interest, therefore, to examine the reasons for this great difference, and the points in which the problems of road and railway traffic coincide, with a view to seeing whether safety on the roads could not be greatly increased by the application to them of railway practice.

The first point we find is that railways are organized to work along systems specially designed for their purpose, fenced off from the public, and with due regard to the nature and volume of traffic expected. This means that adequate permanent way is provided; only expert drivers are employed; engines and rolling stock are kept in first-class condition; trains run to time-table; signals, while not yet standardized, are visible to all concerned and cannot be misread; visibility is definitely related to speed; and, above all, trains are physically prevented (apart from a combination of adverse factors) from coming into collision with each other, especially with those running in the opposite direction.

As regards road traffic, on the other hand, only one or two of these safeguards are beginning (and only just beginning) to receive attention. Road mileage in England has only been increased by four per cent since the coming of the motor car, nearly fifty years ago; drivers have very varying degrees of skill—serving as they do practically no apprenticeship; no machinery exists to ensure that vehicles, tyres, and brakes, are road-worthy; signals leave much to be desired; visibility bears no relation to modern speeds, except on a few roads; and head-on collisions are almost everywhere possible.

The causes of specific road accidents are an endless source of discussion and dispute among the various users of roads. The motorist blames the pedal cyclist for swerving to avoid puddles, potholes, and dogs; the (noiseless) cyclist blames the pedestrian for walking on the road when there is a footpath, or for stepping off the footpath without looking; the pedestrian blames both; while the motor cyclist is anathema to all three. In actual fact, an official review of typical accidents shows that pedestrians are themselves responsible for 63.5 per cent of those in which they are concerned, while the corresponding figure for pedal cyclists is 58.1 per cent.

Trams constitute a special problem, since they neither keep to the left nor stop against the kerb, thus violating two of the most important rules of the road; they therefore add to the dangers of all other road users. On the other hand, their inability to leave their appointed path, except where turn-outs are provided, is a point in their favour, but passing places where the

road is not wide enough for two tramways and two motor traffic lanes constitute a further menace, because the motorist may find himself pinched between the tram and the kerb.

The obvious remedy for the above is to segregate all the different types of road user from each other, and it does not seem likely that road casualties will materially diminish until the physical possibility of collisions has been reduced to an extent comparable with railway practice. The blame for railway accidents can be apportioned with a high degree of certainty by railway experts, who have served a long term of apprenticeship in their trade and who are for that reason appointed by the Government to hold enquiries into railway accidents.

With road accidents, on the other hand, no certainty of blame is possible under present conditions, and judgments of the Courts frequently fill life-long motorists with the utmost astonishment. In short, the motorist has no assurance that the Court has any expert motoring knowledge at all, and it may have to depend upon the evidential value of witnesses who are interested parties, or whose evidence is in some cases technically and mechanically quite impossible. Is it too much to hope that some day motor accident cases will be heard by judges who, appointed as expert motorists, are able to discount such evidence? At present the Courts command but little confidence in motoring circles and, in consequence, risks are taken by bad or reckless drivers who hope that they will be able to escape conviction if an accident of their making leads them to Court.

Traffic in Towns

The thorough modernization of some of London's roads has been estimated to cost £2,000,000 per mile. As a counter to this staggering figure it has also been estimated that traffic delays in London alone account for an overall loss of ten times this sum every year.

Pedestrian crossings, designed to safeguard pedestrians, are often the scene of accidents because, for some unfathomable reason, traffic lights cannot be seen by pedestrians, but only by drivers of road vehicles. The unfortunate pedestrian is thus completely in the dark as to the traffic position and is as likely as not to try and cross just as the lights turn to green. The exhortation to pedestrians in the Highway Code " (99) Never attempt to cross the road just as the traffic is about to start " is vain. How are they to know when the traffic is about to start? They cannot do so until the lighting system is so altered that they can see the traffic lights. And so, in contrast to signals on railways, we have road traffic signals which can only be seen by a minority of those whose movements they are intended to control and not at all by the majority. Could absurdity well go further?

This disability is entirely removed by the Russian system of traffic control, as installed in Moscow, which consists of large clock faces (in lieu of lights) suspended by wires high up over the centre of cross-roads where they can be seen by all interested parties from every direction. Each face is divided into green, amber, and red segments, over which the single clock hand travels at a regular speed. Thus a glance will show how long each particular colour will be in operation, and when the right of way will change. Moreover the relative size of the segments is proportional to the importance of each of the converging roads, and the sizes of segments can easily be changed to correspond with any change in the volume of traffic. Another advantage of this form of traffic signal is that the pavement is not obstructed by posts.

While on the subject of signals, it may be pertinent to consider signals given by motorists to each other. What can be said in favour of the Highway

Code when it lays down the same hand signal for both slowing down and stopping? Obviously, the two actions have entirely different implications, and many an accident can be traced to the driver of a following car thinking that the driver of the car in front was merely going to slow down, when in fact he intended to, and did, stop. On roads to the coast, during a week-end or Bank holiday, when cars follow each other at one second intervals, half-a-dozen cars will run into the back of the car ahead, unless the intention to stop is made absolutely clear—and in good time. Most drivers, fortunately still make the old stop signal, i.e., raising the forearm vertically from the elbow with fingers extended. Oddly enough, the Highway Code makes no mention of the alternative slowing down signal—made by "flashing" the stop light—which is useful when both hands are required on the steering wheel.

In England the Law decrees that the pedestrian always has right of way at pedestrian crossings not controlled by police or by signal lights, and the motorist is enjoined to "give way to any pedestrian." This procedure, if strictly followed, would allow troublesome small boys or cantankerous old gentlemen to hold up road traffic almost indefinitely, if there were enough of them and if they were well enough organized for the purpose. Fortunately the innate common sense and helpfulness of the public lead them to realize that it is easier—and far safer—for the pedestrian to give way than for a stream of road traffic to stop. And so, in some sort, the system works.

But the danger is still there and can only be removed by the building of subways or overbridges for pedestrians, who would then be prohibited from crossing the road except under police protection. This would correspond with railway practice, where, in the absence of overbridges or subways, level crossings are provided, having gatekeepers and gates interlocked with traffic signals. Whether the public can be prohibited from doing anything at variance with established practice remains open to doubt, if one may judge from the subways at Piccadilly Circus, which are seldom used except by persons intending to travel by train. They might, however, be persuaded to use the subways if railings were provided high enough and long enough to prevent them from crossing the road. Most pedal cyclists, too, show an almost insensate hatred of the special tracks built (at no extra expense to themselves) for their safety, preferring daily to court death rather than abate one iota of their rights as freeborn Englishmen to use the public highway. Whether any government will be strong enough to make it an offence for cyclists not to use such tracks remains to be seen. Cyclists, ten millions of them, have votes.

As between overbridges and subways, the latter have the advantage that they need only be some seven feet high and can be approached by ramps suitable for use by "the maimed, and the halt, and the blind," or by perambulators; whereas overbridges form a potential obstruction to traffic, may be unsightly, and require more upkeep—unless made of reinforced concrete. In most towns, however, the cost of subways would be prohibitive without a Government grant, as they would entail the pulling down of houses to make room for them, the disturbance of sewers, and of gas, water, and electric light mains. Under such circumstances overbridges would be cheaper to instal.

The railings suggested above for Piccadilly would certainly add to the safety of pedestrians in all busy towns, and have already appeared in some at dangerous corners. Pedestrians who climbed over such railings, and got hurt on the road, would automatically be adjudged blameworthy, and much fruitless argument would thus be saved. In other words, a definite physical obstacle would be provided to save the lives and limbs of the careless or half-witted. No one would think of using a railway track or formation as a public footpath, yet this is a fairly true picture of prevailing conditions on the

roads in a busy town, apart from the generally slower speed of town traffic and the shorter stopping distance required by road vehicles.

The foregoing leads to a consideration of the dangers which await school children when they hurtle happily out of their classrooms into the road during a break in lessons, or at the end of the day's work. The time of such an exodus is not known to motorists unacquainted with the schools' curriculum, and it is doubtful if any even experienced driver has not at one time or another missed by a hair's breadth killing or maiming a child under such circumstances, particularly on a greasy road when the sudden application of brakes has thrown his car into a skid.

Why should this fearful danger be allowed to persist, when the remedy is so simple, namely, to put an adequate fence between the exit from the school and the road—long enough to absorb the initial velocity of the romping children? Many schools have already installed such a safeguard, but many more still lack these fences. The same danger exists outside public houses, cinemas, and other places of entertainment. During blackout in wartime the utmost circumspection is necessary on coming out of almost any doorway that is not set well back from the road.

Another danger, particularly to children, is the frequency with which footpaths in semi-rural districts change, for no apparent reason, from one side of the roadway to the other, every few hundred yards. In rural districts there is often no footpath at all, and pedestrians have to squeeze into the hedge or ditch to avoid being run down by one or two vehicles passing each other in their vicinity. At night, particularly on Sundays when best (usually black) clothes are being worn, pedestrians may be quite invisible to drivers when they are dazzled by on-coming headlights, and wise motorists do their best to get home before dark. A beginning is being made to take in a strip from adjoining fields so as to make a footpath, but progress in this matter is still woefully slow. Many country roads are still far too narrow for two lines of traffic, and have a disconcerting habit of varying their width for no predictable reason.

Trunk Roads

Of the 181,500 miles of roads in England 4,500 are trunk roads, maintained by the Ministry of Transport under the Trunk Roads Act of 1936. Such bodies as the County Surveyors' Society, the British Road Federation, and the Institute of Municipal and County Engineers, have long been pressing for a large increase to this mileage. The anomaly of a major road suddenly becoming a minor road at the County boundary—as for instance between Denham and Rickmansworth some years ago—or changing the nature of its surface, would then become a thing of the past. The necessity for sensibly planned trunk roads can be gauged by the fact that, up to the time this war started, the Automobile Association was still "routing" cars bound from the Surrey-Hampshire border to Carlisle up the Great North road, some sixty miles east of the direct line and involving a corresponding increase of mileage. A short time ago the Parliamentary Secretary, Ministry of War Transport, stated in the House of Commons "There is a strong case for reserving exclusively for motor traffic some of the by-pass and other roads designed to prevent motor traffic passing through built-up areas."

"Clover leaf" road crossings are familiar in theory to all who study the press, and they constitute an application to roads of the railway practice of fly-over junctions—designed to render impossible the collision of trains going in opposite directions. The expense of "Clover leaf crossings" is high but could be reduced by steepening the approach to the overbridge to

1 in 10 or even 1 in 7—the gradient of many main roads in England to-day.

How many traffic lanes are required in each direction on trunk roads? Expense apart, one for commercial vehicles whose speed is at present limited by law to 30 m.p.h. (though capable of, and frequently indulging in, much higher speeds); one lane for 60 m.p.h.; and a third for 100 m.p.h. and for overtaking. In addition, a fourth lane is required for 100 yards where minor roads join in, so that the drivers of incoming cars may have ample time to appreciate the traffic situation before joining the main stream. "Draw-ins" at bus stops, view points, and watering points for steam vehicles, are provided on some roads and are certainly necessary. (Indian and other railways have the same idea in providing four lines through small stations, the outer two for serving platforms, the two inner ones for expresses.)

Many will say that the day of fast private cars is virtually over and that, as we have already crossed the threshold of the Air age, their place will be taken by Helicopters, flying "Jeeps" and the like. They are probably right as regards the younger and coming generations, but there will always be those who prefer to move themselves and their belongings with less risk, they may think, on *terra firma*.

The principle has generally been accepted that road traffic going in opposite directions must be divided into two separate streams, physically separated from each other, but some of the safety, which this separation is intended to ensure, is lost through two causes. The first is that on only a few trunk roads, or lesser dual roads, has any attempt been made to screen drivers going in one direction from the headlights of cars approaching from the other—particularly necessary round curves. Obviously, quick-growing evergreen hedges should be planted between the two halves of the road as soon as construction permits. (What form this hedge should take depends upon soil, climate, and humidity. *Cupressus macrocarpa* for instance among the conifers, is only suitable for southern England. A hardier variety of *cupressus* is the *Lawsoniana*, but in such matters expert botanical opinion should decide.)

Most motorists will remember the reluctance of our legislators to make back-mirrors compulsory, long after the necessity became patent to all drivers on the road. Is it too much to hope that some day adjustable glare-shades, fitted to the windscreen of all road vehicles, will also be made compulsory to safeguard traffic at night on all types of road? They would save many an accident.

The second cause on two- and three-lane one-way roads is that the drivers of slow vehicles will *not* keep to the near-side lane, and thus they rob the road of some of its available width. On two-lane roads such drivers can, and do, entirely prevent faster cars from passing at all. This is a matter to which traffic police might well devote more attention than they have done hitherto: it is far more important than harassing comparatively inoffensive motorists for technical, and often trifling, breaches of the law which carry with them no danger to life or limb.

It should in fact be the primary duty of traffic police, on arterial roads in particular, to insist that traffic should keep to its left, and they should be armed with cine- or other cameras so that delinquents could be confronted with irrefutable evidence of their guilt. For the first offence they should be warned, and subsequent offences should be punishable by fines, on a steeply ascending scale, or in aggravated cases by imprisonment, until the pernicious practice of "crown-crawling" is stamped out.

The Ribbon Development Act now prevents houses being built too near to roads, so that it should no longer be necessary to build a by-pass to by-pass the by-pass, as many people think should be done for the arterial road round Kingston-on-Thames. (It was on this road that the local inhabitants lay

down as a protest against the danger of their children having to cross over it to go to school. An overbridge has now been built where this outburst of parental indignation took place.)

An interesting suggestion has recently been made by the President of the Town Planning Institute to deal with what he calls the "daily tidal flow of traffic," namely that there should be triple, in place of dual, carriage-ways, each composed of the required number of lanes; and that the centre carriage-way should be switched to take traffic in the tidal direction—as is done with moving staircases on the London tubes during the rush hours. Such an arrangement would be a boon to traffic to and from large towns and for sea-side traffic at the week-ends.

Mention has been made above of minor roads entering trunk roads, and there is no doubt that there are far too many of them at present. Railway practice forms a good guide in this matter by limiting the frequency of stations to an average of about five miles. The application of this principle to roads would relieve drivers of much anxiety, as they would know that no vehicle could suddenly assail them from the flank, except at definite road junctions properly laid out to avoid accidents. This is particularly important in foggy weather or on ice-bound roads.

(*To be continued*)

A PRIVATE VIEW

A pal o' mine, a clever bloke,
Tells me they've got a scheme
For 'ousing 'eroes, chaps like us,
In 'omes just like a dream.

Prefabricated 'omes from 'ome,
Is what 'e says they'll be,
"You may be right," I says, "but that
Don't mean a thing to me."

"They fabricate, that's short for make,"
'E 'astened to explain,
"Your 'ome in factories miles away,
And send the parts by train."

"The PRE before the fabricate,
Means that it's on a plan,
So easy that it can be built
By any 'andy man."

It don't sound very good to me,
It seems a bit too trickey,
But then I may be prejudished,
'Cos why, 'cos I'm a Brickie.

A.R.A.I.

A MINOR BRIDGING EPISODE

By Brigadier H. de L. Panet, C.B.E.

THE Raschid Ali rebellion of 1941 in Iraq was a tidy little minor campaign tucked neatly into the month of May, but it produced some interesting bridging problems which had to be solved, largely by expedients, with little help from standard bridging equipment.

Raschid Ali and his pro-German "Golden Square" Generals had seized power in Iraq by a *coup d'etat* in April, and in May they used the arrival at Basra of a second brigade from India as an excuse to open hostilities against the R.A.F. base at Habbaniya, 50 miles west of Baghdad. A strong Iraqi force of all arms marched out of Baghdad, under pretence of manœuvres, and dug themselves in on the plateau, some 150 ft. high, which completely overlooks at short range the airfield and cantonment of Habbaniya. Then they presented an ultimatum forbidding all flying by R.A.F. aircraft, and hostilities opened on 3rd May. The time of year was important, because the Euphrates and Tigris were in high flood and the Iraqis made full use of inundations to cut off the Indian brigade in the Basra-Shaiba area and so prevented them from coming to the relief of Habbaniya.

Habbaniya consisted at that time of Air H.Q. Iraq, and a Central Flying School training on obsolescent aircraft. It had a ground garrison of R.A.F. Levies, mostly Assyrians, and had been reinforced by a battalion of British Infantry. Later a battalion of Gurkhas was flown up from Basra and Colonel O. L. Roberts, a Sapper, took command of the troops until the arrival on 17th May of Habforce—a mechanized column from Palestine under the command of Major-General George Clark. The siege of Habbaniya was most unpleasant, but the Iraqis failed by lack of determination to take advantage of their superior numbers and commanding position on the plateau, and after bombing, and some quite heavy infantry fighting, they were driven off the plateau and withdrew to Falluja down-stream and to Ramadi upstream. At the same time they cut the river bunds and flooded the countryside both sides of Habbaniya, so producing the bridging problem which this article describes. (See map opposite page 188.)

When hostilities broke out the river gauge at Habbaniya read 45.8 metres, nearly one metre above "serious flood level" and 3 metres above the level of the airfield and R.A.F. cantonment; so that the resulting floods, when the bunds were cut, made a series of obstacles completely impassable by M.T. (see map). To the west Ramadi was completely isolated and the road Rutba-Ramadi-Baghdad impassable. The Mujara cut, at the south end of lake Habbaniya, had only been opened in April and was flowing full-bore from the overflow of the lake and flooding the low ground nearly to Kerbala. The regulator at Mujara, on the alignment of the Haifa-Baghdad Road, was incomplete, the piers being to the top of the regulator gates only. The bridge at Suttaih between Ramadi and Habbaniya had been blown by the Iraqis, and in any case the Ramadi road was under flood further west.

To the east the Takiya bund had been cut, the floods crossed the Falluja road and made a breach 400 yards wide in Hammond's Bund, an embankment on the alignment of the Haifa-Baghdad Road. North of the Euphrates river bunds and canal banks had been cut near the Saqlawiya regulator and

the regulator gates jammed open. These demolitions not only blocked the approaches to Falluja along the left bank, but also raised the level of the Aqar Quf depression and flooded some of the approaches to Baghdad. The Abu Ghuraib canal head was held, throughout the fighting, by a determined garrison of Iraqis, who beat off several attacks and kept up the water level in the canal to flood a series of trenches cut across the road east of Khan Nugtah. The bridge, two spans of 30 ft., crossing a branch of this canal on the main Baghdad road some twelve miles east of Baghdad was completely demolished. Altogether the Iraqi Engineers had made very adequate use of the high flood season in their demolitions, and thus proved the excellence of their training by the British Military Mission.

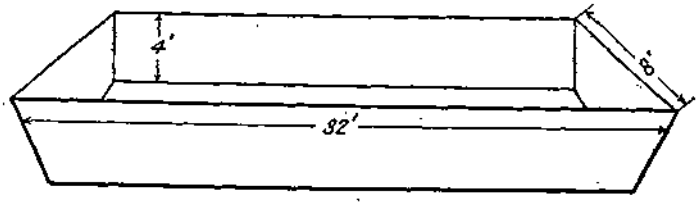
Almost the only thing they had not done was to blow the main bridge across the Euphrates at Falluja. This was perhaps a policy ruling, because in none of their demolitions anywhere did they do any damage that took long to repair once the floods subsided, but we were very frightened at the prospect of this large steel bridge being blown. There was one rumour that the bridge had been prepared for demolition, and that a newly arrived Iraqi commander had said that he could not tolerate an untidy mess of wires, and a lot of dangerous explosives, lying about on " his " bridge and : " take them away at once." I was unfortunately unable to check this story afterwards, but to Sappers it has a ring of plausibility.

After the Iraqis had been driven off the plateau, the first problem was to open a road from the west, to let the relieving column from Palestine into Habbaniya, and the next was to let them out again on to Baghdad. No proper bridging equipment was available, until a small consignment arrived from Palestine about 24th May, but fortunately two big firms of British contractors had been working on Iraqi Government contracts near Ramadi and Mujara, and it was known that they had a lot of useful plant, although no one knew what condition it would be in by the time it fell into our hands again.

The Air Ministry Works Directorate in peace time depended largely on Arab labour, most of whom disappeared on the outbreak of hostilities, except one or two loyal old hands. Engineer labour available consisted of the A.M.W.D. Officers and subordinates, the power house and workshops staff, who were mostly Assyrians or Indians, and some British contractors' staff who happened to be in the camp when hostilities broke out, reinforced by volunteers from other civilian departments of the R.A.F. A section of No. 10 Field Coy. Q.V.O. Madras S. & M., arrived by air on May 10th, and a troop of 2nd Cheshire Field Sqdn., with the Habforce column from Palestine, on the 17th and 18th.

The work at Mujara started on 10th May. The piers of the incomplete regulator at the head of the cut had been built to about 4 ft. of their final level, but the concrete abutments on either bank were up to final road surface. A reconnaissance party sent out on the 9th found the regulator undamaged, with a contractor's foot-bridge still in place. Europeans' bungalows had been looted and all M.T. removed, but engineer plant and stores had been little damaged. Work was started next day under infantry escort. R.S.J's of odd sizes available in the contractor's yard were laid across the regulator spans and concrete blocks cast to hold them in position. Decking was of sleepers. The concrete abutments were lowered to temporary road level by bore-hole charges. A scraper on the west bank, repaired with parts from other damaged plant, was available for the heavy earthwork remaining on this approach. The bridge was tested on the 16th by bringing this scraper across, and was ready when the head of Habforce column arrived next day. The whole work was done by three British Engineers,

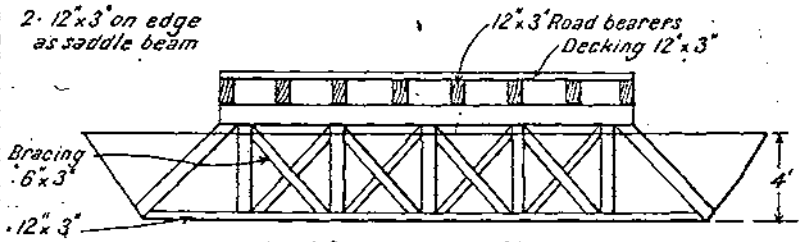
FIG. 1.



Sketch of Shaktura

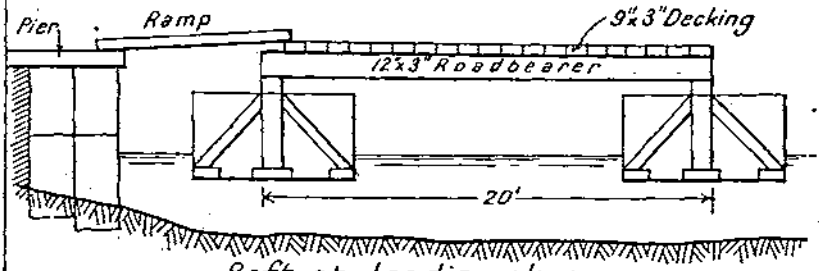
Each was stiffened with L Irons and Cross bracing.

FIG. 2.



Longitudinal Section thro' Shaktura

FIG. 3.



Raft at Landing place

Scale $\frac{1}{8}$ in. to 1 Foot.

with a sub-section of Sappers and Miners for carrying and fixing sleepers. Without mechanical plant the lowering of the abutments, and the completion of the western approach ramp, would have required large working parties, and more time.

While this was going on work started on the second problem, the exit eastwards. Four steel "shakturas," *i.e.*, scows 32 ft. by 8 ft. by 4 ft., of about 25-ton buoyancy, were fortunately available among contractors' plant along the river and on May 10th the decking of two of these for use in a flying bridge was begun. Saddle beams of heavy timber were built into each shaktura, to give central loading, and for decking 9 by 3, on 12 by 3 road bearers, was used. The full length of available 12 by 3 was used to give a deck space 20 ft. by 20 ft., the length of 20 ft. on line of bridge being the least that could safely be allowed for embarking armoured cars and 3-ton lorries. A steering oar of about 12 sq. ft. of planking on a 14 ft. pole pivoted on a rope lashing, kept the raft at sheering angle. (See Figs. 1, 2, 3.)

The site finally selected for the crossing was at Sin el Dhibban, 4 miles downstream of the cantonment. It was used as a crossing in the last war, but no trace of the old work remained except an earth bank on the left bank, said to have been a railway embankment. The river here was 750 ft. wide. with a strong current. The only available rope long enough was a 1,500 ft. coil of 3 in. S.W.R. from Mujara, which was got across the river on the 14th, using a motor boat and brute force after attempts to float it across had failed. The far end was secured to an anchorage of date palm trunks, buried in the old railway bank about 40 yds. inshore, and held well throughout, but on the right bank, where there was no high ground and the anchor logs were buried at subsoil water level, the anchorage was a constant source of anxiety.

Taking up the slack of the wire rope proved full of snags. The rope sank in the soft mud and stuck, the near anchorage threatened to fail, and the hand-winch sheared a cog. Success was finally achieved by salving an incompletely looted D8 Tractor, which was kept in position, after the rope was taut enough for ferrying, as a shore anchor to back up the weak anchorage. The first very halting round trip of the ferry took place at 15.00 hours 18th May, and Roberts, who was to command the actual attack on Falluja, promptly decided to cross that evening and attack next day; refusing all pleas to give us one more day to make sure the ferry really would work. Time was vital, because by then the German Air Force had appeared and was being rapidly built up through Vichy Syria; therefore, it was important to get to Baghdad, and clear out the rebel government, before this German aid had time to grow dangerous. In the event the risk was justified. Passage of troops for the left flank columns begun at 18.30 that evening, was successfully completed by 09.30 19th May, and Falluja was taken the same day. A nice little action that included air bombing, columns down each bank of the Euphrates, and an infantry coy. delivered by air to the enemy's rear.

To go back to the Euphrates ferry; while the struggle with the cable was in progress, work had been started on landing piers made of bitumen drums filled with earth and anchored by Decauville rails driven as piles. These were built about 15 yds. below the cable, on the assumption that the ferry would "fly" on a long line. Actual trial proved that it would only work hauled up as close to the cable as possible, and this error in siting the piers necessitated casting the raft off the cable to load, and then hauling up again to hook on for each trip, which added greatly to the time required for the round trip, and for the training of working parties in rope-drill. It also nearly led to disaster when one newly-arrived upstream rope party let go, and took cover from air attack, without realizing what effect this would have

on the raft. The spare anchor on board failed to hold but a very old motor boat for once started first swing and successfully retrieved the raft, with its passengers, from the Arab Legion ("Glubb's Gals") quite unperturbed. They thought it was all part of the drill. A second landing pier close to the cable was eventually built on the right bank; it greatly eased working, but by the time labour was available for a similar pier on the left bank, traffic had slackened off and it was never built.

With the design of decking adopted, ending over the central saddle beam in each shaktura, the gap from deck edge to bank seat was at least six feet, and more if the inshore cables were not hauled absolutely taut. Ramps made of short lengths of channelled sheet piling were tried but proved impracticable because some of the captured vehicles had twin rear tyres too wide for the channels. The ramps finally used were made of four 10 ft. lengths of steel shuttering 8 in. wide, bolted together in their flanges and provided with rope lifting-loops. Two of these were provided for each bank and placed to suit the driver of the vehicle: they worked well, but their weight, 500 lbs. each, made very heavy work for the handling parties.

The chief trouble throughout was the tremendous whip on the cable and consequent very heavy wear on the runner gear. A first attempt to lift the cable clear of the current on a tripod of steel pipe failed because the ground would not take the thrust on the footings. As men could be spared from working the traffic, the cable was gradually raised on either bank by jacking up on sleeper cribbing, so in the end the greater part was out of the water and the vibration much reduced, but it always remained a problem and in the first heavy rush of traffic the vibration was at its worst. Several designs of running gear were tried, each an improvement on its predecessor, but none stood up long to the constant vibration. Under continuous traffic the life of a runner wheel was only two hours and the supply of suitable sizes of steel for turning them out was nearly exhausted.

The Euphrates ferry was finally dismantled on 10th June. Taking two vehicles per trip, the average capacity was 6 to 8 vehicles an hour in each direction and with good working parties 10 an hour was reached. On the other hand, any accidents such as drivers dropping a wheel off the landing ramps or even, as happened more than once on both ferries, driving on too fast and dropping both wheels over the edge of the deck, caused a lot of delay. Minimum working parties per shift were one N.C.O. and six on the raft, preferably Sappers and Miners but B.O.R's were used for some shifts, and one B.N.C.O., or Levy Officer, and twelve men on each bank—nine upstream cable, three downstream cable, and all handling landing ramps once the cables were made fast.

Once across the Euphrates, the left bank columns still had to cross several water gaps before reaching Falluja. The armoured cars, and troop-carrying M.T., made a wide sweep to the North along high ground to reach the northern outskirts of Falluja, but the infantry and pack-mules moved along the bunds on the left bank, with two gaps at Saqlawiya and Notch Fall. From air photographs it appeared that these gaps were fordable by infantry. To assist them in getting stores and ammunition across, three rafts were made up each of 48 four-gallon petrol tins roughly framed and wired to a deck made of part of an aircraft case. These rafts could be loaded on a 3-ton lorry. For the leading Saqlawiya column on mule transport a raft was loaded on a specially constructed hand-cart. The other rafts went to Notch Fall and Hammond's Bund.

For the forward troops assault bridges were improvised, such as dismasted dinghies from the R.A.F. sailing club on the lake, planks lashed to inflated inner tubes, and four petrol tins roughly framed. These proved

disappointing. At Saqlawiya the current was too strong and the light rafts were carried away almost at once. At Hammond's Bund, where the water, except at the breach, was waist deep for several hundred yards, the light rafts carried too little to be of much use and soon broke up.

A sub-section of Sappers and Miners went to each bridging point, one under its own R.E. Officer and two under A.M.W.D. Officers. Each sub-section also carried a limited amount of round poles and straw mats, in case either closing the breaches or erecting foot bridges proved feasible, but this could not be done. In every case the gaps were more formidable than appeared from air photos, due to the very rapid spread of a breach in this silt soil once the flow started. The plan was based on photos taken 48 hours or more before the operation. The rafts handled by Sappers proved their value and enabled machine guns, ammunition, rations, and a certain amount of clothing, to be got across dry. At Notch Fall infantry as well as stores were ferried across a 7 ft. deep canal. The raft was then floated down-stream, carried across country and launched again to ferry stores across a breach. Had Sappers been available to handle the improvised assault material, this too would probably have proved useful. After the capture of Falluja the gap in the Saqlawiya bund was partly filled and crossed by a heavy trestle bridge built by A.M.W.D. personnel, providing an alternative M.T. route to Falluja *via* Euphrates ferry.

The primary task of the southern or right bank column was to secure the Falluja road bridge undamaged. Leading to it was the road formation of the new Haifa-Baghdad road, almost complete, but unfortunately a small gap had been left for putting in an irrigation culvert. The water from the breached Takiya Bund flooded 2 miles of the old Falluja road and, widening the gap, carried away about 400 ft. of Hammond's Bund. Air photos and reconnaissance in an armoured car indicated that the flooded area was fordable and that there was a good prospect of closing the breach in Hammond's Bund completely. Work was started on this plan on the morning of the 19th, as soon as the first attacking troops were across the flooded area. A scraper was used to bring earth to the end of the undamaged bank, but the site was very congested, with flood water on either side of the bank; progress was slow and made heavy demands on labour. The river level obstinately remained high and by the evening of the 21st it was obvious that there was too much water coming down to leave any hope of closing the gap completely. It was therefore decided to bring the two remaining shakturas downstream by motor boat to the breach in the Takiya Bund, and from there try and work them by hand through the flooded area to Hammond's Bund. Two sub-sections of Sappers and Miners under an A.M.W.D. officer very skilfully delivered the shakturas at the breach by 16.00 hours on the 22nd, a most successful operation of wading, towing, pushing, and feeling their way through very muddy water and over country seamed with concealed banks and ditches.

Forming these two boats into a raft, similar to the Euphrates ferry, began next day, while on the bund working parties concentrated on making good the ground gained and improving the surface of the newly filled bank to take M.T. About half of the original 400 ft. had been regained and the resultant heading up of water left a gap 200 ft. wide, scoured 10 ft. deep and flowing 4½ to 5 knots. The scour around bank heads was severe, and, throughout the period of ferrying, the bank heads required constant reinforcement with sandbags filled with gravel and laid in bundles of six or eight in wire netting. Earth-filled sandbags melted away at once. Soft patches in the new bank were doped with gravel and overlaid with army track, but the bank gave constant trouble under traffic.

The raft was completed on the 25th and ferrying of vehicles started after dusk that evening. To allow for a possible rapid drop in flood level, and also to protect the bottom of the boats against air-attack, which was then becoming frequent, three layers of gravel-filled sandbags were put on the floor of each shaktura. As it happened no bullets hit the boats, except one or two above the water line during assembly work, but the reserve of buoyancy just enabled ferrying to continue until 9th June, without having to lower the bank seats.

At this site no flying bridge was possible. An anchor was laid 200 yds. upstream and the raft swung on that, hauled across the gap by pulling parties. The bank heads were only 12 ft. wide, so only one vehicle could be embarked per trip. The capacity of the ferry was 6 to 8 vehicles an hour, much the same as the Euphrates ferry, and working parties were organized the same way—6 on the raft and 12 on each bank. On the 21st an old Turkish metal half-pontoon was put into action downstream of the gap, hauled by hand on a runner ring sliding on fencing wire. Primarily intended for getting engineer working parties to the far side, it was in constant use for infantry reinforcements and stores.

As soon as Hammond's Bund ferry was working, guns and M.T. were sent forward and the main body began its advance along the Falluja-Baghdad road, using both ferries to reach Falluja. A column had already been sent around by the North, with its L. of C. *via* the Euphrates ferry.

On the 24th a convoy of bridging material from Palestine arrived at Mujara, consisting of :—

F.B.E. on its own lorries and trailers.

2 raft units.	10 assault boats.
2 motor-propulsion units.	10 recce. boats.
1 trestle unit.	

Pontoon equipt. on three heavy commercial lorries.

1 two-pier raft.	2 half-floating bays.
2 trestle bays.	2 shore bays.
2 trestles.	

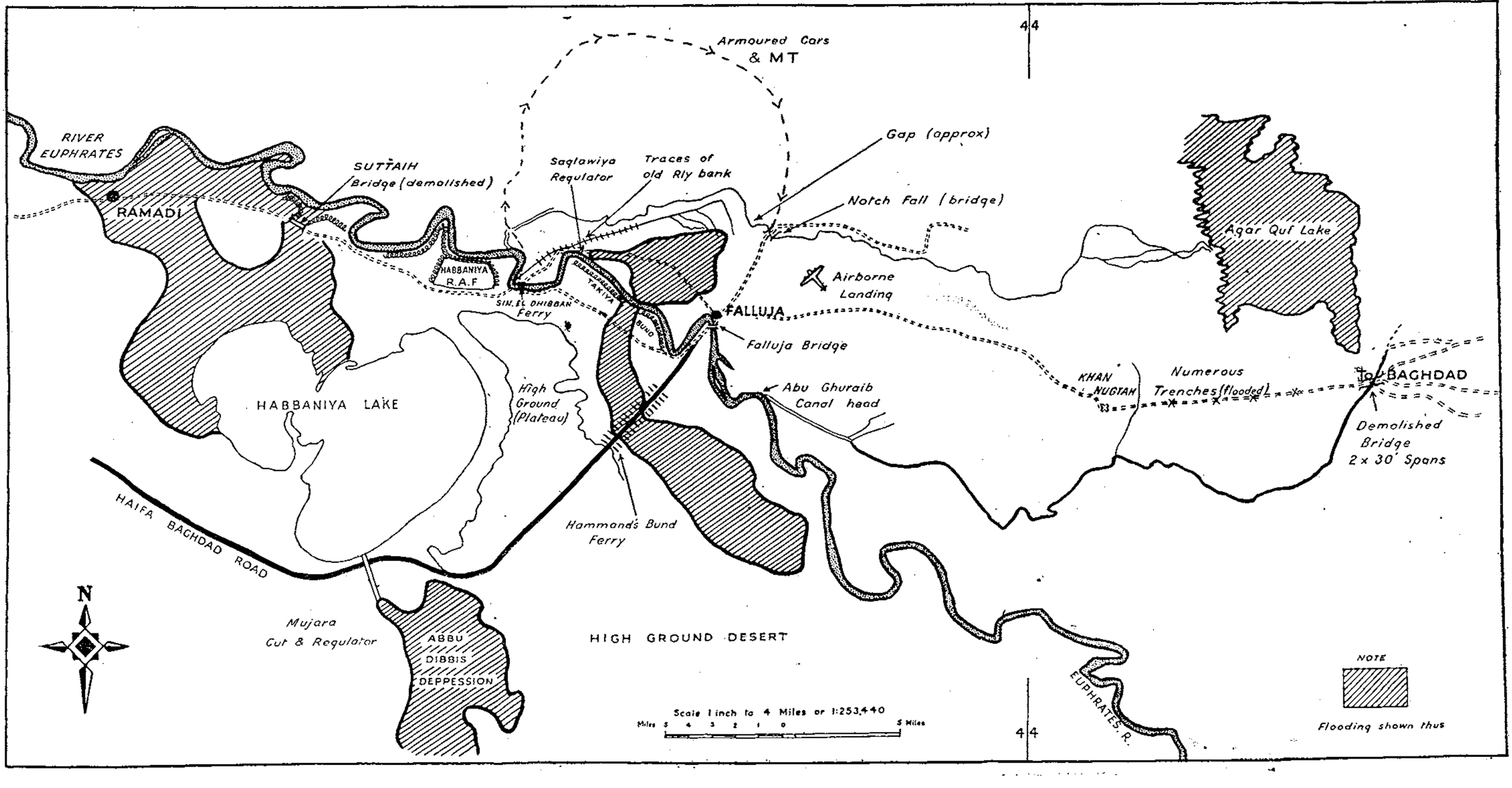
On the 28th reports were received that the main body was held up by flooded trenches cut across the main road east of Khan Nugtah, whilst air photos showed that a bridge across a new branch of the Abu Ghuraib canal was demolished. From such local information as was available it appeared that this bridge was one span of 30 ft. but it turned out to be 2 spans of 30 ft.

The Field Troop were very scattered on the 28th, the O.C. and a small party out with a raiding party of the Arab Legion, the second Subaltern and a half troop with the north column ; and the remaining Sappers under a Serjeant on Hammond's Bund.

To meet immediate demands, ten pairs of ramps were made up of steel shuttering, like the ferry ramps, and sent up on the 28th for crossing trenches. Fortunately these proved sufficient because they nearly finished stocks of shuttering. A hasty check of the pontoon equipment failed to find any saddle beams, so the Serjeant's party of the Troop were sent up on the 29th with the F.B.E. trestle, in order to get at least 30-cwt. loads across the canal.

While the Troop were erecting the F.B.E. trestle, the pontoon lorries were brought into Habbaniya and unloaded, when the missing saddle beams were found tucked under a pontoon behind other stores. The heavy commercial lorries were too long to cross by ferry, so a trestle and two bays of superstructure were loaded on 3-ton lorries and sent up on the 30th. Owing to the difficulty of loading road bearers, only 7 per bay could be sent up with the first consignment. The balancing of roadbearers on a Bedford lorry, the

A MINOR - BRIDGING EPISODE



only suitable vehicle available, produced a very unstable distribution of weight, and the loading party were greatly relieved to hear that the lorry had successfully negotiated the steep ramps and uneven surfaces on its route.

The heavy trestle bridge was completed on 1st June, but by then Raschid Ali had fled and an armistice had been concluded.

Labour, and especially skilled labour with any knowledge of watermanship, was always short. On the first night (18/19th) when three sub-sections of Sappers and Miners were sent forward with attacking columns, the working parties on the Euphrates ferry were R.A.F. Levies, willing but completely ignorant of rope work. Without the help of officers of every grade, from a superintending mechanical engineer to a junior auditor, all working as coolies on the ropes, it is very doubtful if the whole force could have been got across. Throughout the ferrying the value of trained rope parties in speeding-up output was most noticeable. A change of working party, especially if made at night as sometimes did happen, at once cut the rate of ferrying by half, until the new men could be taught their work.

So ended a minor campaign about which little seems to have been written so far. An article in the *Army Quarterly* gave an account of the Assyrian Levies and of their very gallant fighting at Falluja. Another article by Colonel Walter Elliot, M.P., in the *Spectator* of 25th December, 1942, which describes the travels of Habforce, lightly skates over the water obstacles in the phrase " They ferried across the gap . . . in the round boats of these parts," surely the first time the Arab " goofa " has been credited with carrying two armoured cars and 30 men at a time.

Of the gallantry of the pupils of the Flying Training School no account appears to have been published. With their obsolescent training aircraft they took on everything that came along, and so harried the rapidly increasing German Air Force that it was never able to use its full strength. Their casualties were heavy but they delivered the goods. People in Baghdad still talk of the day two Gladiators shot down two Messerschmitts, in full view of all Baghdad, to the great joy of the British Embassy and all the people shut up in it.

This article cannot attempt to describe the fighting or the other engineer works that were accomplished—hasty clearing of new runways and the like. Of the engineer troops concerned, the Field Troop were with the columns and only rarely available for bridging. The section of 10th Field Coy. Q.V.O. Sappers and Miners were invaluable. Mostly young soldiers, no work seemed too hard for them and no hours too long. General Clark paid them a well-deserved tribute when he thanked them for what he described as " a campaign won on two ropes," perhaps not a very big campaign to have won, but as the Air Officer Commanding said—" Supposing we had lost ! " Iraq and its oil, Syria, Persia, Turkey, the Persian Gulf, the possibilities were alarmingly vast.

But we did win, and that consoled the O.C. Section even for the last bitter blow, the comment of a young infantry officer crossing at the tail of a very long convoy, who asked him bitingly " Is this really the best you could devise ? "

POST-WAR ARMY HOUSING

(A discussion with CHARLES)

By Buccaneer

Foreword

Some readers may remember Charles, who appeared in these pages in "Charles' Army" (*R.E.J.* June, 1942). He is as breezy and revolutionary as ever.

I HAD not met Charles for quite a while, and then as luck would have it, the exigencies of lunch-time crowding brought us to the same table at the Club. We are both civilians now. Charles is an ornament of the N.F.S., while I endeavour to assist our American allies.

After some preliminary skirmishing, during which Charles delivered himself of some refreshing remarks about officialdom as he found it, I endeavoured to bring him back to earth.

"Charles," I said, "my mind is exercising itself about the problem of Post-war Army Housing."

"Why should it?" retorted Charles, "I told you all you want to know about Army Housing years ago. My ideas haven't altered a jot. Give up the silly idea of building to establishments, and build barracks to tumble down in 30 years. That's the whole thing in a nutshell."

"But when we last talked about Army building it was before the war. Things have changed, and besides—."

"Not at all," he interrupted, "my policy remains exactly the same. The only change is that the war has given us a much better chance of carrying it out."

I pondered for a moment.

"But you see, Charles, we are now faced with a lot of unknown quantities."

"Splendid!" said he, "I love unknown quantitites, positively thrive on them. I used to be a dab at equations. Trot them out. Call them x, y, z, and then start on the Greek alphabet." He took some soup.

"Well x is a bit of a teaser. It's the size of the post-war Army at home after we have dealt with both Germany and Japan."

"Don't worry about that, it's bound to be far bigger than pre-war."

"I agree, but still we must have some sort of a figure."

"I disagree *in toto*," snorted Charles, "it doesn't matter a bit whether it's 100,000, or 200,000, or 500,000. Policy remains the same. What's y?"

"Oh, y is the annual intake, and the method of recruiting, whether by compulsory service, or by the voluntary system, or some combination of the two. Naturally it depends on x."

"Then cut it out too."

"But, Charles," I complained, "you can't deal with a complex subject like this in such a free and easy way. These unknowns have a vital bearing on the questions."

"Rubbish!" he put in quite rudely. "The trouble is that you're suffering from muddled thinking. So long as it's certain, as it is, that the size of the post-war Army will be greater than that of the pre-war, it doesn't matter a row of beans what the surplus is. My policy is the same for 100,000 or 500,000, and the same applies to the annual intake."

I pretended to ignore this outburst.

"Now z," I continued, "you simply can't dispose of so easily. It's the question of keeping the territorial system for infantry, or of forming a general Infantry Corps."

"That's the first sensible remark that you've made so far," grinned Charles. "Certainly to an old infanteer like myself it's a matter of supreme importance. For my part I think that the territorial system has stood the test, and done us proud. The very idea of destroying our splendid regimental spirit with all its traditions appals me."

"I thought this would make you sit up at last. I'm a bit of a Conservative myself. But, after all, the Navy has a spirit quite apart from that which each ship possesses, and when you used to dream about your Army, you used to talk about inculcating an Army spirit."

"Touché," admitted Charles, "but mayn't a man change his mind? Anyway, let's see what bearing this has on your policy."

"Well, it's pretty obvious," said I, delighted to take the offensive. "Your territorial system involves depots, usually in your County towns. The majority are composed of dingy, out-of-date buildings; you simply can't scrap them, and replace them on their sites by barracks built to tumble down in 30 years."

"Hm! that's rather a fast one. I can see that we shall have to make depots an exception to the general rule. But, in some cases," he continued more cheerfully," we could sell the sites, which are enormously valuable, clear out just outside the town, and start afresh."

"Yes," I conceded, "that is possible. So you want to keep your territorial system and your depots, and make them an exception?"

"I simply must. I hate making exceptions, but it's an English prerogative to seek compromises."

"Very well," I said, "I have no more unknowns; let's adjourn to the morning room, and continue over our coffee."

When we had settled ourselves comfortably, I explained to Charles that the reason why I was so interested in the subject was that, having been employed on works for much of my Army service, I should hate to see the War Office simply drift and muddle along. "The Army," I insisted, "has just as good a right to be properly housed as the civil population. It is recognized that housing is one of our biggest post-war problems, and I am desperately anxious to see the Army state its case, and stake its claim, before it is too late."

"I cordially agree," said Charles, who seemed the better for his lunch. "Even a mediocre plan is better than the series of improvisations that some of our friends delight in. It saves expense, and you know just where you are."

"Good, it's splendid to have a firm basis of agreement at last. Let's proceed in the manner of an appreciation. First comes the general situation, which in this case starts with our housing assets."

"Not up to much," commented Charles.

"Nonsense," I said firmly, "we've got quite a lot of new barracks, built on the Sandhurst block principle—"

"Silly waste of money," he interrupted.

I ignored this.

"Then there are barracks modernized as far as possible; our militia camps in wood; and a host of hutments made of wood, brick, concrete, Nissen and other pre-fabricated construction, which have been erected during the war, both for our needs and for those of our American allies. In addition, of course, we have a mass of requisitioned property."

"Count that out; it will all have to go back to the owners directly the war stops. And aren't most of your camps built on requisitioned land? That will have to be given up too."

"That is so, but the War Office has bought some land outright, especially that on which we had to build in brick and concrete."

Charles leaned back in his chair, "So that's the picture," he remarked, "and a pretty grisly picture too. White elephants of Sandhurst blocks which will last a century, and will be quite out of date in 25 years; a lot of old barracks imperfectly modernized; and a mass of hurriedly put up huts, probably all in the wrong places for peace."

"Well, it's no use wailing about it. We must take things as they are. Anyway we've probably got enough accommodation of a sort to take the Army at home during the period immediately following the Armistice, even when we have given up all our requisitioned property."

"That is quite likely, but I see a horrid danger. If the War Office doesn't look out, those huts will never be scrapped. They will be patched and painted, and made to last until they perish of rot, and the troops with them. Didn't you tell me once of Crimean huts which you met at Shorncliffe in 1930?"

"True, that's just why there ought to be a clear-cut policy to stop that sort of thing happening again. The maintenance of huts is very expensive, they are uncomfortable to live in, and many of them are in the wrong places for peace-time purposes."

"You talked of an appreciation," put in Charles. "Are we not getting the headings confused? We ought to have information about the Enemy. By the way," he added with a twinkle in his eye, "who are the Enemy? My friends the inverted Micawbers?"

"Drift and Muddle," I replied firmly, refusing to be drawn.

"And what is the information about them?"

"Strongly entrenched, facing us."

"And what is the information about our side?"

"At present a policy of Wait and See. Dignified and Dim."

"Well, let's skip the courses open to both sides—they're pretty obvious, and go on to the Plan. Mine is simple."

"Yes, I know your plan, and we'll just go over it again. Let's take the point of building to establishments first."

"Very well," said Charles, settling himself comfortably again, "first let me point out how silly the present idea is. Suppose it were decided to increase the troops at some station, say Bordon, by one battalion; what would happen? First they would look out the establishment which might be, say, 30 officers and 842 men, and then they would design and approve a set of buildings to house this precise number. The job would probably take two or three years to carry out, but in the meantime another branch decides to abolish, say, the mortars; then someone else gives the battalion a troop of parachutists, and so on. By the time that the barracks have been built, and a battalion comes along to occupy them, its establishment may be 32 officers and 860 men. So it does not quite fit, and at once reappropriations and misappropriations result. But secondly, another thing frequently happens. Policy changes while the barracks are under construction, and they don't

send infantry to Bordon at all, but tanks. Then the fun really begins! Do you agree?"

"Wholeheartedly. It is seldom in my experience that a barracks is actually occupied by the type of unit for which it was designed."

"Precisely. So this sort of nonsense will have to stop, and *the Army will have to accept a completely new idea about life in barracks.* No longer should a particular set of barrack buildings be occupied by a particular unit, but all accommodation at a station should be pooled, and administered by a Garrison Commandant or Barrack Master, whatever you like to call him." Here Charles thumped the table to emphasize his point.

"Suppose a unit arrives at Bordon," he continued. "The Garrison allots accommodation according to strength, NOT, I repeat NOT, Establishment; that is, so many bed spaces for men, so many quarters for officers, so many offices, stores, hardstandings, and so on. Incidentally, men of different units will be mixed up in the barrack blocks, and this, I hold, would be a good thing, and tend to broaden their minds. Then too, messing both for officers and men, much of the recreation, and the interior economy, would be run by the Garrison."

"How would this be done?" I interjected.

"Oh," said Charles, warming to his work, "we should have to create a new Corps, and call it, say, the Quartermaster Corps. It would be recruited partly from women and partly from time-expired soldiers. The women would do much of the clerical work, and staff the messes, dining-rooms, cookhouses, and recreation establishments for the most part, while the men would do the heavier work and certain jobs unsuitable for women. Thus unit commanders would be responsible only for the discipline and training of their men, and that's a full time job in itself. We've wasted far too much time and labour in the past in regimental fatigues, scrubbing floors, peeling potatoes, and the like, all calculated to brown off a keen young soldier."

"Wait a minute," I put in. "If a unit had all its cooking, conservancy, and so forth done for it by the Garrison, how on earth would it get on in the field?"

"Oh, that's quite simple. Every unit would keep a number of men trained in Field Cookery and Sanitation at Central Schools, and they would get plenty of practice in the course of field training periods. I've thought it all out, you know.

"Then again, pay. This would be entirely run by the R.A.P.C. who would do all the accounting, and have Garrison Cashiers to do all the paying out. No more struggling with the Pay and Mess book for the regimental officer.

"The more you look into the scheme the better it seems. Army life would approximate much more to civil life, and surely with a national Army, recruited as I hope it will be from all sections of the population, this is much to be desired."

Charles leaned back and regarded me with a quizzical smile.

"Well," I admitted, "I think you have certainly made out a case for pooling accommodation, and for the Quartermaster Corps. The other system never worked out right. Now let's take your idea of building barracks to tumble down in 30 years."

"Oh, that's where you come in. The idea is sound enough. In the past you have built in permanent materials, and consequently in many places are tied to barracks built 100 years ago. In spite of your valiant attempts at modernization they don't fit the Army, or modern life. Inventions are succeeding one another rapidly, training and establishments alter frequently,

and there is no doubt that permanent buildings are a great encumbrance. What can you as a Sapper suggest ? "

I thought for a space.

" Well, I plump for framed construction. You can make your frames of steel or wood, and there are numerous materials which you can use for the exterior and interior filling. Doubtless some day we shall use plastics. We can thus get flexibility, that is, you can easily add or subtract from a building, or if necessary remove it altogether, without much difficulty. Comfort and convenience to my mind depend more upon good planning than upon the use of certain materials. So long as buildings are warm and dry in our winter climate and conveniently planned, I'm sure that an Army of young soldiers wants nothing further."

" Splendid ! " exclaimed Charles, " that seems to me to fill the bill admirably. There's just one point which struck me when you talked of adding to a building, and that is Land. To my mind the Army has always suffered from shortage of land for training, recreation, and even necessary extensions to barracks. There has always been a tendency to acquire exactly what was needed for a particular purpose, and no more. How often has the long view been unheeded when land was cheap, and a short-sighted policy adopted. In the Golden Age when our housing policy comes into being I hope that ample land may be acquired in connection with new works, that is, more than appears to be immediately essential. A surplus can always be let, or if not ultimately required, resold. I think that this is most important."

With these words Charles rose, murmured something about a date, and disappeared, leaving me to cogitate over our conversation. Eventually I took a piece of notepaper, and wrote down the heads of our discussion. Here they are.

1. A long term policy is essential.
2. In new building work on any considerable scale :
   (*a*) A Garrison policy should be adopted, and NOT one of building to Establishments.
   (*b*) Framed construction should be used in place of permanent brick, stone, etc.
   (*c*) A long view regarding Land should be taken.
3. A Quartermaster Corps to include women should be formed, and as far as possible accommodation in existing barracks should be pooled.
4. If the territorial system for the Infantry is retained, Regimental Depots should be an exception to the above.

Then I too faded away.

CONTRIBUTIONS TO THE ROYAL ENGINEERS JOURNAL

All articles for *The R.E. Journal* from officers on full pay should be forwarded to the Editor, as laid down in K.R. 547 (c) 1940, in duplicate if possible, together with a statement from the authority (if any) under whom the writer is serving, that such authority has no objection to publication. The Editor will then apply to the War Office for permission to publish. Articles written by officers serving in India must be submitted for permission to publish to the Commander-in-Chief in India before despatch to the Editor.

R.E. WORK FOR THE MECHANIZATION OF THE ARMY

PART II.*

AFTER AUGUST, 1914

(An Extract from unpublished Corps History)

Compiled from the Work of various Authors.

THE main principles of the relations between civil and military mechanical progress, referred to in Part I, operated continuously throughout the period of history with which this second part deals; i.e. the first world war and the post-war period.

Again, we see the prominence of some R.E. officers in the work proceeding in the civilian mechanical world. For instance, Brigadier-General R. K. Bagnall-Wild (late R.E.) was President of the Institution of Automobile Engineers from 1917 to 1918, and in 1935 Major-General A. E. Davidson (then a Colonel) had the very great honour of becoming President of the Institution of Mechanical Engineers.

During the first world war the R.E. had no responsibility for the development of the mechanical transport of the British Army, which had been completely assumed by the R.A.S.C., but Major Lindsay Lloyd, R.E., who had retired a few years before the war, rejoined on mobilization and became a very important member of the Directorate of Supplies & Transport at the War Office. His knowledge and experience, and his close association with the mechanical world as a previous Secretary of the War Office M.T. Committee concerned with numerous trials and experiments, enabled him to do extremely valuable work throughout the war in providing and organizing M.T.

When the war caught India, without any previously prepared organization or mechanical transport in their Army, they had the good fortune to find Lieut.-Colonel C. H. H. Nugent, R.E., at Army Hd. Qrs. in India. The work and experience of this R.E. officer has already been related. He was, therefore, given the extremely difficult task in 1914 of improvising forthwith the mechanical transport of the Indian Army, also armoured car units, not only in India but in the theatres of war in which they were operating. With the assistance of Capt. E. N. Manley, Capt. A. H. C. Trench, Major G. H. Willis, Capt. B. Burgess, Capt. G. Nottidge, Capt. A. H. Morse, and Lieut. F. E. Buller—all R.E.—and some R.E. N.C.O.'s, with officers and British other ranks recruited from the Indian Army Reserve and Territorial Units in India, and with enlisted Anglo-Indians and Indians, Nugent succeeded in rapidly creating and working an efficient M.T. organization and corps for the Indian Army at war. After two years, some R.A.S.C. Companies of M.T. arrived in India in 1916 and Nugent handed over the whole organization to the Director of Supply & Transport.

The very prominent part played by the R.E. in the production of Tanks and the creation of the Royal Tank Corps during the war and after it, is told in *The R.E. Journal* for September, 1942, and June, 1943, under the heading: "The R.E. and the Royal Tank Corps."

* Part I was published in *The R.E. Journal* of March, 1944.

After the war, R.E. officers were constantly associated with the experiments and trials of mechanical 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, and 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 1932 Lieut.-General Sir Ronald Charles (the present Chief Royal Engineer) became the first Royal Engineer to hold the post of M.G.O. on the Army Council. In 1935 he was succeeded as M.G.O. by Lieut.-General Sir Hugh Elles (late R.E.).

From 1932 to 1936 Major-General A. Brough (late R.E.) was Director of Mechanization at the War Office and was succeeded by Major-General A. E. Davidson. 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. Martel's original work with Tanks is told in the article "The R.E. and Royal Tank Corps."

During the years 1929 to 1932, Major R. A. Bagnold, F.R.S. (late R.E. and son of an R.E.) on his own initiative carried out valuable and extensive explorations by motor vehicle in deserts in Egypt, the Sinai Peninsula, Palestine, and Transjordania—sometimes accompanied by Lieut. E. Bader, R.E., and Capt. V. F. Craig, R.E.—for the purpose of obtaining experience concerning water consumption, tyres, and many other details affecting design, performance, and equipment for such journeys. Navigation and rapid survey methods were also evolved. A remarkable feature of the 6,000 miles journey of 1932 was that the programme made out before starting was adhered to within one day. His explorations are described in the *Geographical Journal* and in his book *Libyan Sands*. He was awarded the gold medal of the Royal Geographical Society in 1935.

In 1929 Colonel A. E. Davidson was despatched 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 Transjordania and recommended that experimental mechanical convoys be sent on an exploring tour to gain experience as to type and designs, and travelling procedure. As a result, a mechanical convoy in 1932 travelled 5,600 miles in the Sudan. Lieut. H. P. Drayson, R.E., was the navigator of this convoy and of another one in 1933 (*vide The R.E. Journal*, March, 1934).

Other explorations of R.E. officers by car were made by Lieut. A. W. G. Dobbie (*vide The R.E. Journal*, September, 1934); Major R. S. Horner from Baluchistan to England; Lieut. W. F. Anderson, R.E. (*vide The R.E. Journal*, March, 1935). In 1934-35 Captain H. P. Drayson, R.E., acted as navigator to Captain Kellett's experimental convoys through various European and Asiatic countries to India.

Since the war the Army was unceasingly striving to improve the cross-country capacity of M.T. because, until a satisfactory standard in this qualification was attained, it would not be practicable to scrap the animal transport of the Army (and here may we insert a warning that portions of the Army* will find themselves operating in some parts of the world where the *pack* animal will never be replaced by M.T.). From 1923 to 1927 the produc-

* Written in 1937, proved in 1941-1944 in Abyssinia, Syria, Tunisia, Italy, Burma, and the Pacific Islands. Our Allies and our enemies have also used pack transport.

tion of the 6-wheel lorry was a milestone in the search for cross-country capacity. In 1923-24 the Sahara Desert was crossed by a 6-wheel pneumatic-tyred Renault car and in 1926-27, following this experiment, the R.A.S.C. evolved the Army's 6-wheel lorry. In 1930 an even more important discovery was the great cross-country performance of the large low-pressure tyre.

So far the main activities in mechanization with which R.E. officers were connected, have been mentioned.

The organization dealing with mechanization has not been discussed except to mention that many important posts were held by R.E. officers. This question of organization was, however, one of paramount importance. The work connected with mechanization is mainly in the sphere of the mechanical engineer, and as the Royal Engineers had already been the engineers of the Army, and, as we have seen, had done a great deal for the mechanical development of the Army, it was natural that we should consider very closely our position as regards this important and rapidly expanding branch of engineering in the Army.

During the war it was found necessary to employ a special body of engineers to deal with the mechanical engineering side of the Tank Corps, and suggestions were then made that, in view of the rapid growth of mechanization, the Army would, in future, need a great body of mechanical engineers to deal with both the repair and provision of armament and all mechanical vehicles. In a committee over which Lord Weir presided in 1923, he made similar suggestions and gave it as his opinion that R.E. officers should be employed on this work. It was, of course, quite 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, primarily of the Master-General of Ordnance and of the Quarter-Master-General, and secondly 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 connection with this fundamental proposal from Lord Weir's Committee.

So far as the Royal Engineers were concerned, the main questions were :—

(1) Should the R.E. be responsible for the administrative duties at the War Office and in Commands, at that time dealt with in branches under both the M.G.O. and the Q.M.G., concerned with design, manufacture and provision of weapons, vehicles, and technical equipment of all kinds—in fact, of "munitions"?

(2) Should the Royal Engineers take over all mechanical workshops in the Army and be the sole source of supply of Mechanical Engineers and artisans for the Army?

As regards (1), it was agreed that, as in the past, 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 officers of "user" branches of the Army, who likewise showed aptitude for this work, should help to staff the administrative posts.

Question (2) was a much more thorny problem as it required radical re-examination of the functions, organization, and training of the Corps of Royal Engineers.

Was it necessary that this mechanical work should be done entirely by specialists relieved of all the military and general engineering responsibilities hitherto resting on the Royal Engineers? For reasons for which space cannot be found here (but the reader may find them argued in an article in *The R.E. Journal* of March, 1932), the Corps of R.E. had, generally speaking, found it necessary to avoid complete specialisation in training and work for 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 of a general military and civil engineering training and employment, or could they take in this mechanical work for the Army without departing from this principle?

Volumes might be written to discuss the "pros and cons" of these questions but the historian must be content here to record results only.

The Army Council decided not to place this responsibility on the Corps of R.E. but there was no serious effort made to form a separate body of Mechanical Engineers, although the numbers of Ordnance Mechanical Engineers (O.M.E's) slowly increased as time went on.

When Field-Marshal Lord Milne became C.I.G.S. in 1926 he revived the whole question of an organization to deal with the mechanical work of the Army and appointed a committee to investigate, over which he presided himself.

The Committee decided to make changes in the distribution of duties between M.G.O. and Q.M.G., and transferred 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. They left responsibility for *repairing* M.T. vehicles with the R.A.S.C. under Q.M.G., but the design and production of these was to be under M.G.O. But again no serious attempt was made to raise a body of Mechanical Engineers for the Army. 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 numbers of O.M.E's in the R.A.O.C. and of Mechanical Engineers in the R.A.S.C. did, however, begin to increase after this Committee had given their recommendations.

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 properly constituted body of Mechanical Engineers in the Army. He 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.

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 of war experience a separate Corps, entitled the Royal Electrical & Mechanical Engineers (R.E.M.E.) was constituted in 1941, in time to prove their great value in the critical battles of El Gazala and El Alamein and in the pursuit to Tripoli in 1942 and 1943, and subsequently.

MEMOIRS

MAJOR-GENERAL A. C. JOLY DE LOTBINIÈRE, C.B., C.S.I., C.I.E.

ALAIN CHARTIER JOLY DE LOTBINIÈRE was born at Quebec on 31st October, 1862, the second son of the late Sir Henri Joly de Lotbinière, K.C.M.G. He was educated at Bishops College School, Lennoxville, and at the Royal Military College of Canada, Kingston, where he graduated on completion of the course in 1883. For the next two years he served in the Canadian Pacific Railway Workshops with a view to becoming a Mechanical Engineer.

Owing to the Russian war scare in 1885, the British Government offered Canada a number of additional commissions in the Corps; he was granted one of these and joined at the S.M.E. on 1st January, 1886, as a 2nd Lieutenant. On completion of a short course at the S.M.E. he proceeded to India in 1887 and served in the Military Works Dept. (now the M.E. Services) for the following 9 years. The main important works on which he was employed were the construction of the Light House at Manora (Karachi) Rawalpindi defences, Murree water supply, Bombay defences, and the Bangalore City water supply.

Now a Captain, he reverted to the Home Establishment in 1898 and joined the S.M.E. as Instructor in mechanical engineering. Next year he received a cable from the Diwan (Prime Minister) of Mysore State, inviting him to return to India as Deputy Chief Engineer, Mysore Public Works, and he was allowed by the Home Authorities to accept the appointment.

It was while holding this post that he conceived the idea of the Cauvery Hydro-Electric scheme and succeeded in obtaining the approval of the Mysore Durbar, and the provision of the necessary funds for the entire project. He carried out this work to its completion in 1902 at a cost of £340,000, since when it has proved a great success both technically and financially.

An interesting description of the birth of this scheme and its completion is given in his own words in Vol. II of the *Military Engineer in India* by Lieut.-Colonel E. W. C. Sandes, D.S.O., M.C., late R.E. It is worth noting that this was the first large Hydro-Electric transmission power scheme in the East, and at that time was the longest power transmission line in the world.

An article in *Engineering* of January 19th, 1906, states:—"The chief credit for the completion of the Cauvery Power Plant is due to Major A. C. Joly de Lotbinière, R.E., who not only conceived the plan of the installation but successfully arranged for financing the entire project, overcoming prejudices that would have deterred a man less sound in his convictions.

He was promoted Major in 1903; and in 1904 the Kashmir State Durbar invited him to visit Kashmir with a view to examining the possibilities of Hydro-Electric generation, and to prepare a scheme to utilize the water power he considered most suitable. As a result of his investigations a scheme to harness the waters of the Jhelum River was sanctioned in 1905, and he was appointed Chief Engineer, Kashmir State Public Works, in 1906. The project was completed in 1908.

Not satisfied with merely producing electrical power, he made proposals for making use of it in various ways, one of which was the dredging of the outlet of the Wular Lake and the mouth of the Jhelum River at Baramula,

Maj Gen A C Joly de Lotbiniere CB CSI CIE

with a view to draining the upper portion of the valley, thereby preventing the frequent floods which caused so much damage. This was a big undertaking as it entailed the construction of dredgers at the site and the carriage of all machinery, etc., up the Jhelum Valley 170 miles from railhead. In this undertaking he showed the same self-reliance as he had done previously, and nothing could deter him from taking entire responsibility once he was convinced of the soundness of his ideas. The scheme was sanctioned by the Durbar and was eventually carried out.

He was promoted to Lieut.-Colonel in 1911, and in 1913 he was transferred to Bengal as Chief Engineer and Secretary P.W.D. He was made a member of the Legislative Council. This appointment he held until 1914, when on the outbreak of hostilities he was selected by Major-General Birdwood, now Field-Marshal Lord Birdwood, as Chief Engineer of the Anzac Corps. He joined the Anzacs at Cairo, and his first duty in 1915 was to prepare the defence of the Suez Canal. He was promoted to the substantive rank of Colonel that year. He was present at the landing at Gallipoli, and eventually became Director of Works and Engineer-in-Chief for the final evacuation of the Dardanelles. Subsequently he accompanied the Anzac Corps to France and remained with it until 1918, when he reverted to the Home Establishment, and became Chief Engineer, Eastern Command, with the temporary rank of Major-General. He held this appointment until January, 1919, when he retired.

His services were rewarded with the Gold Kaiser-i-Hind Medal in 1903; the C.I.E. in 1906; the C.S.I. in 1911; and the C.B. in 1917. He was also granted the Legion of Honour (officier) in 1916, and was mentioned in despatches five times. On retirement his interest turned to the City, and it was not long before he was made a Director of a number of Companies connected with gold mining and electricity. These appointments he held until his death.

Joly de Lotbinière ("Lobo," as he was known to his friends) was a man of great imagination, with an inventive turn of mind. Self-reliant and full of confidence, he never hesitated to accept responsibility, and was always prepared to consider any suggestion for the improvement of his schemes or the method of carrying them out. He had the gift of selecting the best men for any particular work, and invariably retained the loyalty and friendship of his "team." He possessed an extraordinarily kind and generous disposition, and never refused an appeal for charity or failed to assist anyone in difficulty: and although a most religious man, he was never bigoted. With his great kindness of heart and sense of fair play, ill feeling was unknown to him and he made unfailing friendships everywhere.

In his young days he was a great athlete and when at the R.M.C. won the Athletic championship four years running. Throughout his life he was devoted to Sport, and was a first class small game shot and an ardent fisherman.

In January, 1887, he married Helen Marion (Cerise), daughter of Colonel J. Campbell, of Kingston, Ontario, Canada. Throughout the 57 years of their married life they were a most devoted couple. Wherever they resided their hospitality was proverbial, and they will be remembered by a host of staunch friends. Mrs. de Lotbinière had been ailing for some time previous to her husband's illness, and she passed away peacefully only 12 days after his death, which occurred on April 14th, 1944. An only son survives, Brigadier H. A. Joly de Lotbinière, M.C., who is also a Sapper.

In so short a note on such a full life it has been difficult to do justice to a character so full of charm and personality.

A.E.P.

BRIGADIER T. D. BROUGHTON

THEODORE DELVES BROUGHTON was born on Christmas Day 1872 at Southsea. His father was Commander Cecil Delves Broughton, R.N. and his mother was the daughter of the Rev. Theodore Bouwens.

From Stubbington House preparatory school at Fareham, he went in 1886 to Bedford School as a dayboy. Thence he passed direct into the Royal Military Academy, Woolwich, and received his commission in the Royal Engineers on the 22nd July, 1892.

After leaving the S.M.E. Chatham, Broughton spent the first six years of his service as a Submarine-Miner at Gravesend, Bombay and Rangoon. He was then transferred to the Indian Military Engineer Services as Garrison Engineer, Poona, and after two years' service there, he reverted to the home establishment. A two-year spell of D.O. work at Alderney and Newcastle-on-Tyne was followed by six years' service with the 34th, 28th and 24th Fortress Companies at Malta.

In 1914 Broughton was transferred to Bristol as D.O. and two years later he was sent out to India, first as Garrison Engineer, Darjeeling, and then as Asst. C.R.E., Mhow. It was not until 1917 that he was given the chance of active service with the Mesopotamian Field Force and in 1919 he accompanied the Magil expeditionary force as A.D. Works. For his services in the Great War he was Mentioned in despatches three times and received the General Service and Victory medals.

He returned to India after the war in 1920 and was posted as Asst. C.R.E. Deolali. The following year he was transferred to Wellington, coming in for the Moplah Rebellion, and received the Indian General Service medal. In 1923 he went to Mhow as C.R.E. and officiated as Chief Engineer, Eastern Command, at Naini Tal. After that he went back to Wellington as C.R.E. and the following year was called upon to officiate as A.A.G. in the Adjutant-General's branch at Delhi. In 1925 he was appointed Chief Engineer, Eastern Command, and retired on the 23rd December, 1928. He was faced with a serious disaster in 1926. Early in the year the Kulsi bridge over the Jumna was carried away, breaking the road to the important British hill station of Chakrata. It was only by Broughton's all-out efforts and devotion to duty that it became possible to use the hill station that year.

Broughton was married twice. In 1897 he married Marion, the daughter of C. A. T. Bouwens and leaves a son and daughter by her. In 1908 he married Zoë, the daughter of Colonel J. W. Sill, who survives him, and by her he leaves two daughters.

On his retirement the Broughtons settled down on the outskirts of Pewsey, at the N.E. corner of Salisbury Plain, in a comfortable house with a beautiful old-world garden. He had a stroke some ten years ago and had to go slow, but was always cheerful, and delighted in visits from his old friends. A second stroke on the 2nd February, 1944, caused his death.

Broughton was not a person who sought the limelight; just a conscientious hard worker, whose aims were work well done and eventual happiness, which he attained in full measure. He was an ardent student of Natural History, and was quite knowledgeable on the subject of Indian butterflies.

W.H.E.

Brigadier Theodore D Broughton.

COLONEL H. W. WEEKES, D.S.O., O.B.E.

THE death of Colonel Henry Wilson Weekes, D.S.O., O.B.E., on the 29th December, 1943, has removed an officer well-known and appreciated by an unusual number of all ranks of the Corps, with whom he had been associated during his service as recorded below.

He was born in 1870, the son of the late Rev. W. J. Weekes, at one time Precentor of Rochester Cathedral. He was educated at King's School, Rochester, which ranks with King's School, Canterbury, and St. Peter's School, York, as the oldest schools in England. On the 27th July, 1888, he passed from that school into the Royal Military Academy, Woolwich.

After completing his courses at Woolwich and Chatham, he was posted to the Military Works Department in India. He took part in the Relief of Chitral, in a Unit of Sappers and Miners, and received the medal and clasp.

In 1894 he married Catherine, daughter of the late Rev. Chancellor Harman, Cork Diocese. They had one daughter.

Returning to England in 1897 and promoted Captain in July, 1899, after being posted to " M " Coy. Submarine Miners, he became in 1900 assistant adjutant to the Service Battalion at Chatham, from which he was soon selected to be adjutant of the Training Battalion until the end of 1904.

After 2 years in command of the 5th Field Coy. at Pretoria, and a few months commanding the 56th Field Coy., Bulford, he was selected in 1906 for the post of Staff Captain in the D.F.W.'s Directorate at the War Office and promoted to Major.

In 1910, he was chosen for the post of Brigade Major and Secretary at the S.M.E., another key post in which the occupant can exercise a great influence on junior officers and other ranks of the Corps. He was holding this appointment on the outbreak of war in August, 1914. The improvization of the new armies, and consequent great expansion of the Corps, threw a great strain upon all ranks at Chatham and especially on the Brigade Major during 1914 and 1915, until organization and establishments were systematized.

In January, 1916, having been promoted Lieut.-Colonel, he was appointed C.R.E. of the 51st Highland Division and was awarded the D.S.O for his strenuous exertions in the fighting in which that famous Division took part.

So far Weekes had been selected for one appointment after another, and now seemed established on the road to further distinction, but at this critical time he had the misfortune to suffer from ill-health, which absolutely necessitated his being invalided to England.

In early 1917 he was back again in France. In 1918 he was O.C. 1st Reserve Battalion at Chatham, and from 1919 to 1921, O.C. Training Battalion, R.E.

Few officers had such an intimate knowledge of the regimental work of the Corps, so that when he was promoted full Colonel in 1921 and joined the D.F.W.s branch at War Office which among other matters was concerned with personnel, he was completely at home. In that capacity he was an important member of a Committee on whose recommendation the scheme was adopted, which has proved such a success for providing the Corps with fully qualified Surveyors of Works, R.E., commissioned from the ranks of the Corps. In 1925 he retired, and lived for some time in North Italy and the South of France. He had returned to England before the outbreak of World War II, but his health was failing and he could only undertake part time war work. Five days before his decease he was working in the Library of St. George's Hospital, and it may well be said that he died in harness, as he would have wished.

H.L.P.

COLONEL E. A. H. JAMES

ONE of the most brilliant Engineer officers of his generation, greatly respected by many friends, but comparatively little known in the Army outside his immediate circle, died at Stanford-in-the-Vale on March 15th. The career of Arthur James was a striking example of how fortune, good or bad, can affect the lives of all of us. In his case it was uniformly bad, and many achievements were performed under circumstances that either prevented their full recognition, or consigned them to oblivion at an early date. Yet he might have been famous had the cards fallen more kindly—though he never sought fame, and was content to do the jobs that fell to him supremely well, and then efface himself. During the last few years of his life he threw his steadily-failing strength (he had suffered from heart trouble since retiring in 1938) into all the local war activities that came his way; and perhaps the confidence and appreciation of his neighbours was as precious to him as any recognition he ever received from the State.

Ernest Arthur Henry James was born in Tokyo on September 17th, 1883, the son of the late Captain T. H. James, R.N., one time a Naval Adviser to the Japanese Government, and Arthur spent most of his early life in Japan. He won a Scholarship into Cheltenham in 1897; and he was near the top of the Upper VI when he broke his leg playing football, just before the entrance examination to the Royal Military Academy, Woolwich, at the end of 1899. He was thus prevented from competing until the following summer; this delay eventually cost him a year's seniority in the Royal Engineers, into which he passed 6th out of the 31 cadets of Bushell's Batch, in December, 1901. His first foreign station was Cairo, and while there he was selected for special work in the Sinai Peninsula; during the course of this duty, he incurred a severe attack of sunstroke and the effect was so prolonged that he had to be placed on half-pay, thus losing more seniority. He resumed active work at Chatham, and during his service spent two other periods there, one of them towards the end of the Great War. Many of the Y.O.'s who knew him at the S.M.E. recall with gratitude and pleasure the courtesy and friendliness with which they were treated by this quiet senior officer.

In 1913 James returned to the land of his birth, having been selected for the prescribed three years study of the Japanese language, and attachment to the Army of our then Ally. The outbreak of the Great War, however, curtailed his tour of duty by one-half, and prevented his qualifying for an Interpreter's certificate. Two of his contemporaries, J. W. Marsden, R.A., and H. J. Simson, Royal Scots, remained longer in the Far East, Simson accompanying the Japanese Expeditionary Force to the Siege of Tsingtau; but James and the rest of the small body of officers of the British and Indian Armies returned home. His subsequent war experiences were often cited by his friends, but never by himself, as unique: first, Gallipoli as a regimental officer; then Mesopotamia as Adjutant of the 13th Divisional Engineers; and finally Siberia, as Liaison Officer between the Canadian contingent and Japanese H.Q. No rewards came his way except one "Mention," a Czech *Croix de guerre*, and the Japanese Order of the Rising Sun. His abilities and experience clearly entitled him to a nomination to the Staff College after the War, but instead of this, after brief sojourns at Salisbury,

Portsea, and Tidworth, he was detailed for regimental duty at Tientsin. While here he supplemented his knowledge of Japanese by learning Chinese; and he thus became one of the very small band of people who knew the two races really well, not only because he spoke their languages, but by reason of the many personal and official relationships he had formed with both. He was frequently asked, in consequence, the age-old question—"Which do you prefer?" James eventually devised the following formula which satisfied all enquirers: "I like some Japanese better than some Chinese, and some Chinese better than some Japanese." *Verb. sap.* indeed.

He had now been a Major about eight years, and in 1925 became O.C.R.E. at Tientsin; but his most important rôle, albeit unofficial, was the maintenance of liaison and good relations between the British and Japanese military authorities, both countries having troops stationed in North China under Treaty right. Many witnesses testify to the advantage reaped by both parties through the unobtrusive efforts of the O.C.R.E. Only a year or so after his return from Tientsin the civil wars in China threatened the lives and property of the British and other foreign communities in Shanghai and elsewhere, and James was appointed C.R.E. of the Shanghai Defence Force. At long last his outstanding merits were recognized, and he received a brevet lieutenant-colonelcy for his services, dated January 1st, 1928. The little Gods of Ill-fortune, who had dogged his footsteps so long, since the accident on the playing-fields of Cheltenham College nearly 30 years earlier, must have had a good laugh over this reward; for, instead of gaining several years seniority, he was promoted substantive lieutenant-colonel nine months later—his brevet thus proving almost worthless.

After two or three years at Catterick as C.R.E. he took up what was to prove his last appointment, Military Attaché at Tokyo. His previous residence, and personal contacts of earlier years, ensured his success, especially with the Japanese Army; and many of the older generations of Japanese statesmen and officials did not forget that his father had served them well in bygone days, including the last eleven years of his life as London Manager of the great steamship company, the N.Y.K. Arthur James spent nearly two years on half-pay after relinquishing his appointment in Tokyo, before retiring at the early age of 54—taking with him into private life not only exceptional knowledge and wide experience but a singularly upright and lovable character. A keen sense of humour prevented his showing any resentment, still less anger, at his treatment by Fate. In his heart he must have known that he was a first-class man, but he remained modest, retiring, and whimsical to the end.

He was slightly short-sighted, and played few games, even as a young man. Anything of pleasure he may have lost on this account was made up by the happiness he derived from music, and by his love of beauty in all forms. He also had an unusual literary *flair* and greatly enjoyed reading; his handwriting was strikingly artistic, and his letters models of clear expression and lucid argument, enlivened with touches of humour. Colonel James had no children, and is survived by his widow and two sisters, one of whom, Grace James, is well-known as an authoress. Mrs. James shared her husband's fortunes for 34 years, and greatly helped him in his social life, notably in Tientsin and Tokyo.

F.S.G.P.

BOOK REVIEWS

(Most of the books reviewed may be seen in the R.E. Corps Library at Brompton Barracks, Chatham.)

THE GERMAN ARMY

By Herbert Rosinski

(The Infantry Journal, Washington. Price $3.)

This book is an expansion for American readers of a little book published, but little noticed, in England in 1939. It is neither a handbook nor a history of the German Army, but a popular account of how, from very small beginnings in Prussia, the force has grown to the immense array at the disposal of Adolf Hitler. The author is a young German of Jewish blood who fled to England in 1939 and after a stay there removed to the U.S.A. Far from being prejudiced against his former country, he is obviously very proud of its victories and inclined to attribute them to the superior military skill of its generals, and the superior valour and efficiency of its troops. It has therefore a distinct propaganda value. It is not a book for beginners; but to the older generation who know Germany and the German Army it will be found most interesting; for it gives the views of one who must be accounted a "good" German, a human being, not a "Boche," the synonym for an arrogant bloodthirsty bully.

The book falls into 3 parts: first, a summary of Prussian and later German Army history up to 1914 and the War of 1914-18; secondly, the events in the years between 1918 and 1939; and thirdly, an account of the German Command and Staff systems, with remarks on current German ideas and German strategy in the present war.

Prussia (and Germany after her) won her successes not by superior strategy, etc., as the author would have us believe, but by lulling her neighbours to sleep, by surprise, by superior numbers, and by use of "secret weapons"—these last it may at once be said included the previously concealed breech-loading rifle in 1866, against her opponent's muzzle-loader, and in 1870 the B.L. gun with a fuze adjustable to any range against a M.L. gun and a fuze for two fixed ranges. *Nota bene*, she did not invent these any more than she did aeroplanes, tanks, trench mortars and other warlike apparatus; for the British had the Armstrong breech-loader gun in the Crimea, and the Americans used breech-loading rifles, even repeating rifles, in their Civil War.

When Prussia had not these advantages she was beaten. Even Dr. Rosinski has to admit she was brought to her knees, and Frederick the Great was preparing for suicide, when "the miracle of the House of Brandenburg," the death in January, 1762, of the Tzaritza Elizabeth (who by the way insisted on the permanent crippling of Prussia) intervened to save him. The author has many excuses for the decisive defeats of Jena and Auerstadt, all except the superiority of the French Army and its leaders; for it was Marshal Davout, not Napoleon, who smashed the main Prussian Army and thus brought about its ignominious flight and surrender.

In dealing with 1866, the author omits to say that Italy was Prussia's Ally, and that part of the Austrian forces were sent south and decisively defeated the Italians on land at Custozza and on sea at Lissa.

Similarly, in mentioning the triumph of 1870-1 there is no hint of the more than triple numerical superiority of 673,000 against 205,000 to begin with, and ever increasing; nor of the blunders of the command and staff, as related by Generals Prince Krafft von Hohenlohe, von Kretschmann, Fritz Honig and others (the German official history is a work of fiction and patriotic propaganda).

The Prussian Army had grown and grown, and each successful campaign had brought not only increase of territory, but increase of citizens and therefore more soldiers. Here we miss figures, but the British *Official History* supplies some of them: the *peace strength* had risen from 425,872 in 1875 to 802,046 in August, 1914, and the war strength had been quadrupled.

Dr. Rosinski thinks that in 1914, had it not been for German staff blunders, "the French (he entirely ignores the B.E.F.) completely surprised and outmanœuvred . . . might well have succumbed." He won't have it that the Marne counter-offensive (by which the Germans were surprised and outmanœuvred) was the turning point. He prints in italics that the 15th September, "the morning on which Flakenhayn [*sic*] decided against a return to the mobile strategy of the first weeks must be considered to be the real turning point of the war." He has a poor opinion of Ludendorff: "a curiously narrow one-track mind without depth or subtlety." Defeat came not from being beaten by superiority of strategy and endurance, but from "inferiority of manpower and material."

The account of "the years between" is excellent. It contains many details of how Germany evaded both the armistice terms and the peace terms, maintained the forbidden General Staff and Staff College (Kriegsakademie, which throughout the book is translated "Military Academy"), maintained and trained far more than the 100,000 men allowed, and generally from the 18th November, 1918 (just a week after the Armistice) onward, began to prepare for the next war. More interesting still is the account of the struggle for power which went on in Germany, first between the General Staff and the Government, which as long as General von Seeckt remained at the head of the Army went in his favour. Then the Brown Shirts entered the struggle and defeated and split the General Staff, largely it seems because the President, Field-Marshal von Hindenburg, did not like General von Schleicher, his Chancellor.

The transformation of the system of command is also very interesting. Normally, under the Kaiser the Army was managed by three great officers, the Chief of the Military Cabinet (who was also senior A.D.C. to the Kaiser and controlled patronage), the Minister of War (Supply) and the Chief of the General Staff (training and operations). No arrangement existed for combined operations with the Navy. In 1914-18 the two first-named officers, and even the Kaiser, lost both prestige and power. In the organization in 1919 of the Reichswehr, which covered both *Reichsherr* (Army) and *Reichsmarine* (Navy) and eventually the *Luftwaffe*, a head of all three services was provided. Owing to the clash of personalities this did not work smoothly. Then Adolf Hitler established the absolute concentration of authority in himself and assumed direct personal command, reducing the heads of services to mere executive officers. He is now assisted by "a special liaison staff" under General Jodl, who is also Deputy Chief of Staff of the High Command (*Ober-kommando der Wehrmacht*, otherwise O.K.W.) and has the help of a super-General Staff (*Wehrmachtstab*) entrusted with the strategic co-ordination of the three services, and also a *Wehrwirtschaftsstab* for the general organization and planning of the economic war effort. All this, by the way, was foreshadowed in Ludendorff's *Total War*—no narrow-minded effort.

Dr. Rosinski has ignored one matter of high importance, for it is part of Germany's armoury. The *Nachrichten Bureau* (as it used to be called) and the secret service with over two million pounds per annum—the capital stolen from the Hanoverian royal family in 1866 and known as the *Reptilien Fonds* (Reptile fund)—at its disposal for propaganda by literature and other means in neutral and enemy countries; for the subordination of the press, home and abroad; for the enlistment and payment in peace time of fifth columnists and other agents; for keeping control of German minorities and an eye on all nationals abroad; and for the encouragement and financing of strikes abroad, and even of assassinations.

J.E.E.

MALTA MAGNIFICENT

By Francis Gerard

(Cassell & Co., price 10s. 6d. 192 pp. with a frontispiece and three maps.)

A well-chosen title; for nothing in this book impresses one more than the magnificence of Malta's spirit throughout the years of her agony.

The author creates this impression, not by painting lurid pictures, or by quoting official statistics and detailed records, but by describing simply what all classes of Malta's people had to endure in their daily round. He weaves his material into a not uninteresting narrative of his own doings in the Mediterranean as well as on the island, and thereby produces an atmosphere of intimacy which helps his readers to an almost personal sympathy with the sufferers. He pays tribute to the steadfastness of both the garrison and the civil population from Governor to peasant, doing special homage to the women of Malta, to General Dobbie and to those "young paladins" who, in the beginning, flew the six aeroplanes which were all the island possessed.

This tale of those first two years is worth telling and is well told. Both the heroism and the horror in it are emphasised, but mainly by suggestion, with due restraint and in proper proportion. Malta "endured as few others have endured . . .; but she kept a brave heart and she never broke. Her name has become synonymous with fortitude, that rarest kind of courage."

Those interested to learn how she has struck back should read an article by Air-Marshal Park ("Malta as an offensive Springboard") in the *R.U.S.I. Journal* of February, 1944. Another article to be read in conjunction with this book is that written by General Dobbie himself in *The R.E. Journal* of March, 1943.

Lastly, to descend from grave to gay, one slip by Major Gerard must be recorded, but more in amusement than in anger. Many of his readers will get a shock when they meet, not only once but twice, in his pages an old Urdu friend masquerading in a toga as "*Haec dum*" [sic]!!

T.F.

CIVIL AVIATION

By Michael Young

(The Pilot Press, 45 Gt. Russell St., W.1. *Target for Tomorrow*, No. VII 1944. 64 pp.)

This attractive little book opens with a brief historical account of the progress of aviation during the first 37 years, reckoning from December 17th, 1903, when Orville Wright made his first flight of 40 yards. As the author remarks, the technical development of the aeroplane had indeed been rapid during that period. Much was due to the speeding-up required for military purposes, though "there is no reason why the aeroplane should not be used as a dynamic instrument for the welfare of mankind," and we may confidently look for a great increase in civilian air traffic of all kinds when the war is over.

But it is not only a question of air traffic, in the ordinary sense; the aeroplane can be used for opening up areas difficult of access, such as parts of the Amazon basin, of Siberia, of Northern Canada, of New Guinea, and (shall we add?) the South Polar plateau; and for surveying, especially in undeveloped countries.

The author writes sensibly, and with due restraint, on the ultimate effect of the war on post-war civil aviation. He remarks that "the only generalisation that is safe is that aviation has been stimulated by the war, and that the stage is set for a great expansion after. He thinks that there will be no great extension of private flying, for it will be necessary to consider the risk of collisions in all but out-of-the-way regions, remote from the main air trunk routes. There is a short, but valuable, discussion of the number of aircraft that may be needed; Sir Stafford Cripps is quoted as saying that the British aircraft industry could

not hope to maintain more than one-tenth of its present output after the war. There is an interesting comparison of the flying needs of the United Kingdom with those of an area within 400 miles of New York, with about the same population.

The book is admirably illustrated, and amongst the illustrations may be noted a couple of maps showing great circle air routes. For the geographer the question of great circle routes has some fascination. Such routes can be determined, between any two terminal points, by calculation. There are also three graphical methods; by the use of a gnomonic projection; by the use of a two-point azimuthal projection; or, neater than either, by employing a transverse Mercator graticule, drawn on transparent paper, and applying it to a Mercator map, or to an oblique Mercator. This method seems to have been devised by M. Favé; it is described by Mr. A. R. Hinks in the *Geographical Journal* for May, 1940. Some of the great circle routes, e.g., that from Chungking to New York, will go over, or near, the North Pole.

C.F.A-C.

NO GREAT SHAKES

By Lieut.-Colonel C. O. Head.

(Messrs. Hale, Ltd. Price 12s. 6d.)

This certainly is, as the publishers describe it, "a lively and entertaining book of reminiscences and reflections."

Colonel Head's "reminiscences" of his first twenty years' service in the Field and Horse Artillery will, naturally, be most highly appreciated and enjoyed by his own contemporaries, viz., the old "die-hards" who gained their commissions fifty and sixty years ago. But no reader will fail to realize the spirit of loyalty, comradeship, and human sympathy which characterized the majority of regimental officers in those far-off days, and the young officers of to-day may well sigh for a similar life of good service and good sport, healthy rivalries and "clean mirth."

The author's "reflections" which he records, in company with his later experiences in and out of the army, are a more serious matter.

As an extremely active and efficient "dugout" in the war of 1914-19, he plumbed mud and muddle to their depths. No wonder, then, if he displays some bitterness in his criticisms of the conception and conduct of operations in which his batteries took part; but he is too ready to generalize from the particular. All the "brass-hats" in France and Flanders were not "Chateau Generals" nor "Office-chair Staff Officers!" Yet, Colonel Head's diatribes are not without some reason; and he is an honest critic.

The subject of most far-reaching interest in his book, however, is contained in his description of life in Ireland before and after "the surrender," his chapter on Home Rule, and his tracing of the crooked paths whereby certain politicians and plotters reached their goal. No true Briton can read the sorry tale without some feeling of shame and disgust.

But politics are taboo in *The R.E. Journal*; so this review may end with an acknowledgment of the author's obvious *mens sana in corpore sano*, and he writes as well as he rides. Hence a most readable book.

T.F.

HIGHER SURVEYING

By Arthur Lovat Higgins

(Macmillan & Co., St. Martin's Street, London, 1944. Price 25s. od.)

The first thing is to give a warm welcome to a book, practical, helpful, and up-to-date, which fills a growing gap on the Survey bookshelf. The last edition of that most useful and widest-read of survey manuals—the *Text-book of Topographical Surveying* (Close)—is nearly twenty years old, and very much has happened in that time. The S.M.E. *Notes on the Making of Plans and Maps* (Fryer, 1937), although fortunately it does include the Tavistock theodolite, is not nearly so full of information about modern instruments, or so complete about Engineering surveys.

One wonders a little at the title. Why higher? Is it based on the German *höhere geodäsie;* but then this book does not pretend to be a manual of geodetic survey. Probably, as it is addressed primarily to pupils and instructors in advanced engineering surveys, that side of a wide subject has usurped too general a significance.

Chapters I "Instruments"; II "Engineering Surveys"; IV "Field Astronomy" and V "Geodetic*al* (?) Surveys"; are all full of value for the Engineer. Chapter III "Photogrammetry" is just as good, but includes topography. Yet here, as elsewhere, the characteristics of the small area, large scale, preliminary engineering survey take charge. For example, under the rather dubious title "Locating Contours" precision is taken to be a function of the vertical interval. Obviously the V.I. has nothing whatever to do with the accuracy of levelling, pegging, and finally surveying a contour, and the absurd conclusion of classing in the "moderates" instead of the "accurates" the carefully levelled and surveyed hundred-foot contours of the Ordnance Survey proves the point.

To revert to Photogrammetry, it is pleasant to read an account which shows the sequence of invention, and of plotting machinery, which began with Laussedat, Deville, Fourcade, Thompson (of the Corps), Von Orel, and ends in the highly ingenious machinery of to-day. The theme is how to deal with the photo: and the position of the camera but an aspect of that theme. The Corps shows up well in this record. F. V. Thompson's Stereoplotter was not so much a step as a whole staircase and is too scurvily treated on page 230. We have another Sapper, Thompson, whose Cambridge Comparator comes on page 253. Then no account would be complete without the doings and writings of Hotine.

Chapter V on Geodetic Surveying is useful although it includes some curious statements. For example it is suggested (p. 340) that the use of Invar tapes obviates "the uncertain and usually crude corrections for temperature—." To the description in inverted commas we gladly subscribe, but the conclusion, alas! will not wash. Moreover, on page 377 we are told that the Bessel figure of the Earth is accepted for international work. In 1924 the International Union of Geodesy and Geophysics agreed to accept the Hayford figure, differing quite appreciably from the Bessel, and although some of us were far from enthusiastic, that is the present international position.

There is nothing about projections, nor a single word about the interplay of all those craftsmen who combine to produce plan or map, but then these matters could hardly come in a book devoted to the instrumental measurements and calculations of engineering surveys.

Two relatively unimportant points about the book should be noted. First, after each subject, comes a list of questions, very useful to the instructor and the pupil, but unimportant to the R.E. Officer. Secondly, titles and descriptions include a number of doubtful terms and words. "Indicating in the plastic," "photographic navigation," "terrain" and so on, are instances of that professional jargon that every subject is apt to gather; the chaff which accompanies the wheat of progress.

H.S.L.W.

BRITISH RAILWAY TRACK

EDITED BY R. A. HAMMETT

(Published by The Permanent Way Institution, 338 pages. Price 15s.)

This book has been issued by The Permanent Way Institution to serve as a textbook on British permanent way practice. It contains ten chapters devoted to formation, P.W. materials, crossings, maintenance, renewals, arithmetic and formulæ, curves, setting out of points and crossings, calculations of leads, and designs of layouts.

The first chapter gives the basic principles of work in banks and cuttings, and on drainage. Figures for pressures (per sq. in.) are given as a possible twenty tons on the rail, distributed by the chairs not to exceed 400 lbs. on the sleepers, thence to 150 lbs. on the ballast, which may have to be thick enough to reduce the safe pressure on the soil to 20 lbs. or less.

The next Chapter describes " British Standard (Revised) " 95 lb. Bull-head P.W. materials and mentions manganese steel rails with as much as 12/14 per cent. of manganese. (Nothing is said as to whether this increases the wear and the tear on rolling-stock, so presumably this earlier difficulty has been overcome.)

An interesting point made is that steel keys, driven in the direction of traffic, remain tight for long periods (except in very cold weather) and check rail-creep, whereas wooden keys do neither. Good Baltic redwood sleepers are said to last twice as long as those made of quicker growing timber (such as Douglas fir) which have a life in the main line of only 15 years.

In the third chapter, semi-curved switches are laid down as British standards (though the G.W.R. have a wholly curved switch) and tables of details, fittings, and chair spacings, are provided. Table 5, " standard leads of main line railways," shows that there is still much diversity of practice between the five main railways (the London Passenger Transport Board being the fifth). Standard switches would be better shown in heavy type, viz.: " A " switch, 1 in 7 crossing ; " B " 1 in 8 ; " C " 1 in 10 ; " D " 1 in 12 ; " E " 1 in 16 ; " F " 1 in 20.

Chapter four, Maintenance, is too long to review in detail but give a particularly clear description of the versine method of correcting faulty curves.

Chapter five describes various methods of relaying lines, with and without full possession, and should be of special interest to military engineers in view of the nonsense in the press from one or two " military correspondents," enlarging on the delays which must be caused by changes of gauge in Russia.

Chapter seven, deals with curves, and R.E. Officers, used to Indian (*i.e.*, American) practice of describing curves as the angle subtended at the centre by a 100 ft. chord, will cavil at calculations being carried out sometimes in feet, and sometimes in chains. No doubt a legacy from the past. The relation between versine, chord and radius is given ; setting out curves by versines and offsets (but not by theodolite) ; calculations for the shortness of the inner rail ; super-elevation ; transition curves ; behaviour of wheels on curves and consequent wear of rails ; and resistance to movement caused by curves.

The ninth Chapter gives thirty-nine rules for the calculation of the leads and radii of various turnouts and crossings, with both straight and curved switches. As regards turnouts from a curved main line, the point is well made that switches must be longer than would be necessary from a straight main line.

The last Chapter deals with more complicated features of permanent way, such as cross-over roads ; scissors (or diamond) crossings ; double line junctions ; three-throw turnouts ; single, double, and outside slips ; with useful diagrams for obtaining leads and radii.

As a compendium of present-day British railway P.W. practice, this book can confidently be recommended to students of railway engineering.

E.St.G.K.

MAGAZINES

GEOGRAPHICAL JOURNAL

January-February, 1944

In the tenth Asia Lecture, dealing with " Some Problems of Central Asian Exploration," Evert Barger takes as his theme the impact of nomads on settled peoples, and illustrates it by a study of the ancient Province of Bactria, now called Afghan Turkistan. He thinks that excavation and research in this area is likely to throw valuable light on some aspects of Asiatic history, and to supply evidence on the question of climatic change. He concludes with an appeal to Western nations to help the Eastern in the study of their own history and culture.

In a paper on " The Excluded Areas of Assam " Sir Robert Reid, a former Governor, describes the tribes which inhabit the northern and eastern boundaries of Assam, and which do not come under the ordinary machinery of government. These wild tribes, which differ markedly among themselves, have the common characteristic that they have no affinity with the peoples of India proper, and are mostly rather backward.

Dr. Rudolf Bicanic deals with " The Effects of War on Rural Yugo-Slavia," of which one of the most important is the change over from great families—*i.e.* congregations of interrelated families on the clan system—which were entirely self-supporting, to small families which are independent and not self-supporting.

J. N. L. Baker and E. W. Gilbert, in a joint paper, discuss the doctrine of an " axial belt of industry " in England, which term they say has appeared in a number of official reports, and which they think gives an inaccurate representation of the facts.

March, 1944.

This number opens with a discussion on the Geography of Post-war Air Routes, in which Lord Brabazon, Sir H. Tizard, Sir Alan Cobham and others, took part mainly from the aviation point of view, while Mr. A. R. Hinks dealt with some of the mapping problems.

Thomas Hay contributes an account of moraines in the Lake District, with illustrations.

E.M.J.

EMPIRE SURVEY REVIEW

April, 1944.—E. Wilfred Taylor contributes an interesting article on the evolution of the dividing engine, being a sequel to an earlier article. The author says that his object is to do honour to the pioneers in the development of this instrument. The names of some of them will be very familiar to surveyors ; for example Ramsden, the maker of the great 36-inch theodolites for the Primary Triangulation of Great Britain ; the two Troughtons, John and Edward, founders of the firm which bears their name ; and their partner Simms. There are some good illustrations.

Sir Charles Arden-Close gives an account of the work of C. R. Conder, the R.E. officer who, under the auspices of the Palestine Exploration Fund, carried out the survey of the Holy Land. It will be remembered that Lieut. H. H. Kitchener, later Lord Kitchener of Khartoum, was also employed on this survey.

A short account of the training of African surveyors in Nigeria is of special interest, as being written by an African.

Under the head of Notices is a most interesting account of a wartime development of the Trigonometrical Survey of South Africa, which is the manufacture of optical instruments for the armed forces of the Union. This development of a complete manufacturing department from a small instrument-repairing section is a remarkable achievement, and seems likely to form the foundation of a valuable industry for the future,

E.M.J.

THE ENGINEERING JOURNAL

(Published Monthly by *The Engineering Institute of Canada*)

The February, 1944, number contains a leading article on " Plastics in Engineering," wherein Plastics are defined as :—

Materials which at some stage of their processing are amenable to moulding to a desired shape. Plastics may be conveniently divided into two types :—

Thermosetting and Thermoplastic.

The first type cannot be softened after moulding, but it has high tensile and compressive strength and is resistant to high temperatures for considerable periods. The second, after moulding, can be reversibly softened by heat. It has a higher impact strength than the first type, but cannot be used under continuous stresses of any magnitude.

A combination of these two types, in the form of laminated plastics, is proving satisfactory and development is proceeding continuously. Some of these as now manufactured compare favourably with aluminium alloys.

As regards the value of the adhesive type of plastics, the modern wooden aircraft has been made possible by the development and application of synthetic resin glues in conjunction with acetylene black.

The March, 1944, number begins with a paper by Mr. C. J. Mackenzie on Industrial Research. He takes as his text the following conclusion of the Federation of British Industries :—" The Application of Research is a certain means of increasing employment by the improvement of existing and the creation of new industries ; conversely, the lack of it spells stagnation and ultimate bankruptcy." Canada's pre-war expenditure on Industrial Research was relatively small, and its Industry was existing mainly on blood transfusions from Great Britain and the United States. Mr. Mackenzie shows clearly the cumulative dangers of this policy, and urges that Canada should maintain, in the immediate Post-War years, her present overall expenditure on Research.

Mr. C. R. Young puts forward a plea for the " Desirability of Establishing Technical Institutes in Canada." These are to fill the present gap between secondary schools, and the degree-granting engineering faculties and colleges.

The April, 1944, number, with the exception of News, Notes, Notices, etc., is entirely devoted to the story of the Shipshaw Water Power Development Scheme on the Saguenay River, Quebec, Canada.

The cover of the Journal gives an excellent view of the inside of the Power House with six Hydro-Electric Generators already installed ; and in the text there are five very clear and well illustrated articles which deal in turn with : The engineering history, the water storage development, the design, the construction, and the electrical equipment.

The Power Station has been designed for a total maximum output of 1,000,000 h.p. to be made up of twelve 85,000 h.p. Units, and one-half of this plant was working by June, 1943, which was before the scheduled date. It was essential to push construction forward as rapidly as possible, since the power was required to meet the urgent need of the Allied Nations for aluminium. The contracts placed for this metal were calculated on the assumption that the first 85,000 h.p. Unit at Shipshaw would be turning over by 1st January, 1943, but it was actually running on November 23rd, 1942, and the second, two days later. This acceleration of the completion dates permitted production of some 30,000 tons more of aluminium, at a particularly critical period in the War, than would otherwise have been possible.

A tribute paid to those who built Shipshaw runs as follows :—

" Even in normal times the construction of Shipshaw would rank as one of the great achievements of an engineering age. But it was erected under the stress of War. Work proceeded day and night throughout the year in spite of unusually severe difficulties of nature. Everyone who did a share in this work will find lasting satisfaction in being able to say—I helped build Shipshaw."

H.M.F.

JOURNAL OF THE UNITED SERVICE INSTITUTION OF INDIA

January, 1944

Lessons from the Italian Campaign

The story is given in brief nearly up to the end of 1943 ; the main point is that road and railway demolition by the enemy has been so thorough that our armies have been forced into country difficult for tanks and heavy artillery. Here some lessons are brought out. Troops must be prepared for—and well versed in—breaking through a minefield, crossing a river, and an assault landing from the sea ; troops must dig in, however tired they may be ; road-blocks must be reported as soon as located ; and finally, the Germans will not face the bayonet.

The Bandar Shahpur Incident

" Mouse " has written many humorous articles for the *Journal* and this is no exception. It describes a good example of naval and military co-operation.

Review of N.W. Frontier Policy (1st Part)

A comprehensive statement of what has been done in this troublesome part of India, from the time that we took over the border as a *damnosa hereditas* from the Sikhs in 1849. From then on to 1890 our policy was little more than raid and counter-raid. From 1890 to 1900 we maintained a forward policy ; this period included the demarcation (and in part delimitation) of the Durand Line and the biggest Frontier war we had as yet experienced.

Burma—Three Pacifications

These are—after the war of 1852-3 ; in 1885-91 ; and after the rebellion of 1931. In all of these the same difficulties recurred, and will, the author states, when the Japanese are turned out. The Burmese is described as being extraordinarily gullible, and will believe any piece of propaganda.

What do you think of that ?

A first hand account of the sinking of the *Bismarck*, especially of the part played by the *Dorsetshire* therein. It is believed that the final torpedo fired by the latter went up the *Bismarck's* funnel as she was heeling over.

Civil Liaison

Is an account of an organization to " place the army in touch with the temper of the countryside," it deals among other things with an enormous number of petitions. " It would seem as if directly the family bread-winner is away to the war, an enemy, who has long awaited his opportunity, fells a tree from his neighbour's garden, encroaches on his neighbour's land, steals his neighbour's wife, and, to finish the good work properly, bribes all those who might give evidence on his neighbour's behalf."

F.C.M.

THE INDIAN FORESTER

February, 1944.—*Sand-clay Roads.* The Government of Bombay in 1938 appointed a committee to investigate the question of constructing cheap and durable roads. The most satisfactory is a 6-in. coating, consisting of a mixture of 30% clay and 60% sand plus silt on a foundation of earth and *muram*, which is a subsoil composed of decayed laterite. Consolidation by a light roller is desirable, and the road is said to be able to stand up to moderately heavy traffic.

The Gohna Lake and Trout Fishery. Sandes' *Military Engineer in India*, Vol. II, p. 45 records the formation of a lake in Garhwal through an enormous landslip across a tributary of the Ganges, and the successful efforts of Lieut. (afterwards Maj.-Gen. Sir Sidney) Crookshank to minimize the damage due to the eventual carrying away of the upper part of the natural dam. In this article the story is given in much greater detail, and forms a fitting tribute to the skill and courage shown by that officer in his dangerous task, The permanent lake left has already silted up to some extent, but it is estimated that it will continue to exist as a lake for about a century. Trout fry were introduced in 1935, and the lake is now a very valuable fishery.

March, 1944.—Most of us who have visited Kashmir will be interested to learn that Shankaracharya Hill, near Srinagar, formerly a very bare rocky mountain, is being afforested.

F.C.M.

THE INSTITUTION OF CIVIL ENGINEERS OF IRELAND

Bulletin, *December*, 1943

This number contains only two papers, the Presidential Address by Mr. T. C. Courtney, and a paper by Mr. T. B. Byrne, B.A., B.A.I., on the Purification of Water by Sterilization.

Mr. Courtney reviews the major projects carried out by Engineers in Ireland in recent years, in spite of World War conditions, and the problems which will have to be faced when more normal conditions recur. From these he draws the conclusion that there is, and will be, more opportunity for Irish Engineers to get employment and experience in their own country than there has been in the past. He makes a special plea for the study of agricultural engineering, as agriculture must form the basic industry of the country and should be brought up to date in every way.

Mr. Byrne deals in the most clear, practical, and concise manner with almost every known method of sterilization of water, assessing briefly the scope, advantages and disadvantages of each method.

Chlorination and the chloramine process are dealt with at some length as the most popular methods, being effective, simple, easily controlled, and economical. Brief remarks are made on the practical aspect of applying the chlorine and of controlling the dosage. This is most important as the two disadvantages of simple chlorination, namely the danger of occurrence of "aftergrowths," and the danger of taste, demand great nicety of control. The advantage of the chloramine process in providing a stable and persistent chlorine residual, without having to use dosages liable to produce taste, is well brought out.

Super chlorination means applying to the water, for short periods, chlorine at a rate 4 to 5 times that required for a simple chlorine application. It is adopted where rapid sterilization is required. This process causes the immediate destruction of biological impurities; the excess chlorine makes the water unpalatable but can be eliminated by the use of dechlorinating agents such as activated carbon, sulphur dioxide, etc. Taste troubles are minimised and aftergrowths eliminated.

The latest development in chlorination is that known as "Break-point" chlorination, now being developed in the U.S.A. The author describes this as a method where large doses of chlorine, 5 to 35 parts per million and upwards, are applied to the water until a point is reached where the residual chlorine falls suddenly to almost zero. This point is known as the "Break-point" when organic matter is apparently destroyed; the small amount of residual chlorine is very stable and aftergrowths are eliminated.

The method is particularly useful in coping with mouldy, froggy, or earthy tastes and the great concentration of chlorine at or near the "Break-point" is able to oxidise the compounds causing taste. A further claim for this method is that taste and odours produced by seasonal algæ growths are also eliminated. The greatest advantage of the process is that full use is made of the great bactericidal qualities of chlorine some 20 to 30 times more powerful than chloramine.

The chloramine process is the application of ammonia and chlorine to water. This process is slower than simple chlorination but the residual chlorine is more stable, with the advantage of being able to act as a factor of safety for sudden increases of bacterial load, also aftergrowth trouble is largely eliminated. The author describes the methods of applying chloramine to the water.

The statistics quoted in the paper of the decrease in the death ratio from water-borne illness, as a result of sterilization of water by various municipal authorities, is ample evidence of the need and the effective results of sterilization.

R.P.P-W.

AN COSANTÓIR

(Journal of the Eire Army)

March, 1944.—The essay on Leadership, continues into the next quarter. The author is Maj.-Gen. Costello,. Cdr. 1st Division. It is an original and serious study of the subject, too comprehensive to be adequately " noticed " here ; in addition to the theoretical discussion of requirements, hints are given as to what to look for and how to encourage desirable developments in N.C.O.'s and junior officers. The " Leader " must be a man of strong emotions—or he will fail to inspire his subordinates, and though the velvet glove should be worn it MUST be only a cover for the iron hand inside !

" East of North, eight-one degrees " is an amusingly written, but very practical, original article on a successful competition organized for a platoon to encourage map-reading ; useful ideas for a H.G. Instructor. " Hints for combat "—extracted from a U.S. journal—contains practical advice for a Field Artillery unit on how to look after themselves in war, and is illustrated by a number of real incidents during the Tunisian fighting.

" Dig for your lives "—also by a U.S. Field Artillery Officer—besides stressing the importance of slit trenches and of digging in guns and other vehicles, is a heartfelt plea for something better than the pick and shovel. A good point is made that with so much M.T. available, including some " winch " trucks—surely some form of drag-line excavator could be extemporised which would save endless man-hours of drudgery on most, if not all occasions. The idea seems well worth investigation—since some (steel ?) rope and one or two " scoops " (a commercial type might be readily adaptable) are all that is needed. The idea is readily applicable to every unit with suitable M.T. vehicles.

In " Night War " B.T.M's are quoted by the U.S. Infantry author to support his thesis that a unit which cannot work efficiently at night is not a trained unit.

" Swiss Ideas on Night Combat " shows its importance for a country likely to be outnumbered by any attacker, who would also be superior in the Air and in Armour.

May, 1944.—A recent A.T.M. stressing the importance of training snipers gives special interest to a reprint from *The American Rifleman*, " Snipers in the Attack." This describes a Bn. attack in 1918, on a fortified village. A " handful " of selected snipers in pairs led the attack, about 2–300 yds. ahead of the Bn. ; instructions were that each pair was to attend to a small portion of the front and engage any M.G. which opened up. The advance, covered by the usual heavy artillery, etc. barrage, had to cover about 500 yds. of bare ground sloping gently upwards to the village, through 3 belts of wire each about 6 yds. deep. The main body of the Bn. did not fire a shot during this phase of the attack and suffered only one casualty, wounded. On " cleaning up " the village subsequently, 17 M.G's in pillboxes absolutely untouched by the very heavy artillery bombardment were found, manned by 69 dead Germans, each neatly killed by a sniper's bullet.

A short survey of the history of the " Irish Brigades in Spain " shows them to have played a notable part in almost every Spanish war from 1585 to 1818. It is a strange commentary on these times that in the Battle of Dunkirk Dunes (1685 ?) between French and Spanish Forces, there was not merely an Irish contingent fighting on both sides—but also a Scottish and an English contingent on both !

June, 1944.—" Small Arms, Great Deeds " is another article from *The American Rifleman* detailing a few, less spectacular incidents of 1940, illustrating how great delay can be caused on a local attack by the well-aimed rifle fire of a few good shots, intelligently used. There is a general tendency to believe that the infantryman's rifle is seldom used in defence nowadays, and never in attack unless to hold the bayonet ; the May article shows that a few accurate rifle-shots can on occasion do more than heavy artillery to prevent infantry casualties—this article that they can on occasion be just as useful in defence.

D.ff-M.

THE MILITARY ENGINEER

(Published by the Society of American Engineers)

February, 1944

Combat Engineers in North Africa. Part II. Operations in Tunisia. By Lieut.-Colonel F. A. Henney.

The writer describes the work carried out by his Combat Battalion in the operations at Kasserine, Gapsa, and Sedjenane. It consisted very largely of clearance of enemy mines, road and track construction, and water supply. At the Kasserine Pass extra work was caused through the hasty laying of about 10,000 mines by various troops. Many of these un-co-ordinated mine-fields were not charted. The engineer battalion had to lift these mines, and plant across the pass a charted mine barrier co-ordinated with the defensive fire of the infantry.

Innovation of Amphibious Warfare. By Rear-Admiral L. B. Combs.

The pontoon has played a significant role in virtually all the major campaigns of the second world war. It has made possible the successful landings in the Solomons, the Aleutians, North Africa, Sicily and Italy.

The present day Navy pontoon was designed by Captain Laycock to fulfil the following conditions : To serve lighterage purposes as well as the traditional uses of pontoons ; so standardized in design that it can quickly be mass-produced ; to be light, but strong, easy to handle, and capable of self-propulsion if necessary.

The outcome of his investigations was a pontoon unit which can be used singly or in groups. The unit is a welded steel box, manufactured in two styles. One, the standard section, is rectangular in shape, 5 ft. by 7 ft. in top dimensions, and 5 ft. deep. The other, 7 ft. by 7 ft., and 5 ft. deep, is curved at one end and is used for the prow of the barges.

In making practical tests, pontoon units were assembled in strings on the decks of freighters while at sea. On reaching their destination, the strings were dropped overboard and fastened together, and were used as lighters, barges and tugs ; for this purpose they were fitted with specially designed out-board motors. Other pontoons came fitted with in-board motors which gave them speeds up to 8 knots.

In addition, these pontoons can be used as piers, wharves, floating dry-docks, fuel and water barges. It is certain that in any future amphibious operations they will play an important part.

Water Supply by Combat Engineers. By Captain J. A. Lieberman.

The Combat Engineer Battalion is responsible for supplying water to the 15,000 troops of the division. It is normally equipped with four standard portable water-purification units. In this article the writer describes the work carried out by the 118th Engineer Battalion in the South Pacific. On the whole the standard equipment provided proved very satisfactory. Coral sand was used for the pressure filters when ordinary sand was not available, and gave good results. In some of the islands it was necessary to use salt water distillation units. Their operation presented no great difficulties, beyond an occasional mechanical breakdown of the petrol engines. The main trouble was the weight of the apparatus and the transport of fuel. The consumption of water averaged 5 to 6 gallons per head daily.

Engineer Equipment in the Theatres of Operations. By Major-General E. Reybold.

In the almost unlimited list of articles of heavy equipment required by engineers in theatres of operations, the writer places the bull-dozer first. It does more things well than any other machine, and it is not easily stopped by rifle or machine-gun fire. Machinery for road construction and equipment for water supply are essential. Steel landing mats (to be replaced later by asphalt or concrete) are of the utmost importance in air operations.

March, 1944

Road Construction in New Georgia. By Captain J. A. Lieberman.

One of the major problems facing the American forces landing in the Russell Islands and the New Georgia Group was the lack of existing roads. An Engineer

Combat Battalion had to tackle the task in the middle of a wet period, during active operations. While in combat, passability was the only requirement, and bull-dozer trails were made just sufficient to take the necessary traffic. As the operations progressed, the bull-dozer trails were maintained by corduroying or by spreading coral, sometimes by both methods in combination. Coral was usually found within a few feet of the ground surface, and, with its good compacting and self-cementing properties, proved an excellent carpet.

Topographic Mapping in the Redwoods. By C. K. Lyman.

The mapping of the giant redwood-timbered areas in northern California presented unusual features. This article shows how the problem of surveying 1,611 square miles of forest land in this area was tackled by a combination of aerial survey with triangulation points built on the tops of the highest trees.

April, 1944

Naples : Case History in Invasion. By Colonel J. S. Gorlinski.

The lessons learned by the Allies in October, 1943, when they drove the German forces out of Naples, will be of great value when landings have to be effected in other European harbours. To keep a force of 500,000 men supplied with all the materials necessary for carrying on a campaign, a minimum of 750,000 tons per month is required, the equivalent of 68 fully-loaded Liberty Ships. Thus, port facilities should be provided for unloading at least this number.

In the case of Naples, all buildings that had not been destroyed by Allied bombing were systematically destroyed by the retreating Germans. 32 large vessels had been blown up or scuttled at the quays, to prevent our ships from using the normal berths ; 300 smaller vessels were sunk in various parts of the harbour ; all cranes had been wrecked beyond repair or tipped over into the water. The branch railway line connecting with the harbour had been entirely destroyed.

Repairs were put in hand as soon as the Allies captured the port. The work was divided into three phases. In the first phase the debris was merely pushed to one side. Unloading points were cleared for lighterage craft, and, where possible, berths were cleared for ships to be brought alongside. By the time the second phase started, about October 6th, a reasonably comprehensive survey of the conditions had been carried out. Sites were selected for clearance on the principle that those requiring a minimum of labour and materials should have first call. In some cases sunken ships were used as piers by constructing timber ramps over them. Then, the third phase was begun, in which more methodical and deliberate work was carried out.

In addition to providing unloading facilities at the port, the Engineers were employed in providing water points throughout the city pending restoration of the normal water supply.

Soil Engineering Practices for Military Engineers

Lieut.-Colonel W. C. Carey stresses the importance of stabilizing the soil of embankments by controlling its moisture content. This can be done by (1) selecting suitable soils, if available, (2) by adding a stabilizing agent—such as calcium chloride, asphalt emulsion, powdered resins, or Portland cement, (3) by using mechanical plant.

Ocean-to-Amazon Highway. By Major-General J. L. Schley.

The Peruvian government has recently completed the construction of a highway, 522 miles long, connecting Lima with Pucalpa, on the Ucavali River. From this point a river steamer takes passengers and goods to Iquitos on the Amazon River, a distance of 650 miles.

The road is a fine piece of engineering, crossing, as it does, the main range of the Cordilleras over a pass nearly 16,000 feet high. Its construction is a valuable contribution to the war effort, as it opens up a region producing natural rubber, barbasco and other strategic materials.

A.S.H.

INFANTRY JOURNAL

(Published by the U.S. Infantry Association)

March, 1944.—*Armour and Counter-Armour. Part I. The Basis of Shock Action.*

Basing his study on two classical examples, viz., Alexander the Great's victory over the Persians under Darius at Arbela, and Hannibal's victory over the Romans under Varro at Cannae, Major-General J. F. C. Fuller shows how the same principles apply to tank warfare nowadays. He states: "The decisive point of attack will again become the rear of the enemy's army. The approach will be made rapidly, by road, and across country, consequently the nature of strategy will be changed. Area warfare will replace linear warfare, and the front may be anywhere."

As regards shock tactics in the present war, the campaigns fought to date fall into two well defined groups—*i.e.*, those waged in Poland, France, and the Balkans; and those waged in Libya and Russia. The first three were so rapid and startling that the conditions which favoured the Germans were largely obscured by their very brilliance. The more important conditions were: (1) the theatres of operations were restricted in size, (2) the vital points of the country were within easy reach of air and motorized attack, (3) the enemy was unprepared to face shock tactics.

In the case of Russia and Libya the conditions were different. In Russia the theatre of operations was so huge that the Germans were never able to close the Russian back door, although they succeeded in turning and enveloping the Russian flanks.

In Libya, in December, 1940, where one flank was restricted by the sea and the other by the desert, General Wavell sent his armoured and motorized forces through a gap in the Italian line and fell upon the rear of Marshal Graziani's left wing. Similar manœuvres were carried out by General Auchinleck in November–December, 1941, by Marshal Rommel in May–June, 1942, and by General Montgomery in October-November, 1942. All were based on the Arbela principle.

April, 1944.—*Armour and Counter-Armour. Part II. Attack of Armoured Forces.* By Major-General J. F. C. Fuller.

The two essentials in shock attack are reconnaissance and secrecy of movement. Air reconnaissances are carried out prior to and during the forward movement, while the columns of attack move forward in the order in which they will be called upon to attack. The first column generally consists of motor cycle units, armoured car units and motorized infantry; the second of armoured divisions; the third of marching infantry; the fourth of motorized shock troops; and the fifth of all these various arms combined.

May, 1944.—In *Ten Days a Nazi Prisoner* (*Part I*), Lieut. X relates his experiences after capture by the Germans in the Mateur area. His first reaction was a feeling of utter disgust. He had little to complain, however, of his treatment when in German hands, although the food was none too good. He makes some interesting observations with regard to the German officers and men with whom he came into contact.

Armour and Counter-Armour. Part III. Defence against Armoured Attack. By Major-General J. F. C. Fuller.

The whole problem of the defensive battle is reduced to this: The role of the infantry is to resist; the role of armour is to counter-attack; the role of aircraft is to assist both, and the defences should be as deep as possible. The counter-attack is not carried out by the defenders of a zone, but by the armoured and motorized troops held in reserve in rear. The Commander of a zone does *not* meet the enemy's armour by armour of his own.

A.S.H.

REVUE MILITAIRE SUISSE

December, 1943.—*Breviaire Tactique.* A few extracts from a Tactical Pocket-book by Colonel Frick, who commands one of the Swiss divisions. The book appears to be a collection of precepts and maxims of war clothed in modern dress. Some of these relating to engineer interests may be quoted :—

" *Fortifications* can either be the most beneficial points of support for manœuvre or dangerous hindrances to liberty of action. They are worth neither more nor less than their defenders. The weapons of a fortress, the strength of its walls, its roof, its armour, the inaccessibility of its front, its flanks, or its gorge are nothing but unproductive capital. Only the will to resist of its commander and of its garrison makes it function and yield good interest."

" *Dispositions.* Depth facilitates command ; extension in width renders it more difficult." The little book has recently been published.

L'Enseignement par l'image. By Major Nicolas. A series of air photographs (from German sources) showing the bombing of various targets, with some notes urging the necessity of dispersal against air attack.

Commentaires sur la guerre actuelle. These notes relate to the period November 18th—December 17th, 1943. The conferences of Moscow, Cairo, and Tehran had just taken place. No hopes of a separate peace could be extracted from them.

January, 1944.—*L'Aviation peut-elle gagner la guerre ?* By Lt. van Muyden. A review of Major A. de Seversky's *Victory through Air Power.* While it is generally agreed that no military operation to-day can be successfully undertaken without at least a local mastery of the air, there are theorists who go so far as to say that it is possible to overcome an adversary by air-power alone, without the classical processes of invasion and costly land struggles. Even Douhet, the apostle of massed aviation, did not contemplate such a complete role for air-power.

Seversky analysed three of the campaigns of the present war in the light of the employment of air forces : the Campaign in Norway, the Battle of Britain, and the Campaign of Crete. In the first, although Britain had overwhelming naval superiority, it was the German air superiority which drove out the British land forces.

In the second, the defeat of the Luftwaffe by the inferior numbers of the Royal Air Force is attributed to the fact that the German machines were designed to give tactical support to ground troops and not for aerial combat.

The Campaign of Crete is an example of the defeat of superior naval forces by superior air forces. The German air forces were based on land. The British could only have reinforced their air forces by carrier-borne planes, and no aircraft-carrier was engaged.

The article quotes eight general principles deduced by Seversky. Of these, the following seem to be the most important :

1. It is impossible to carry out a successful operation on land or sea before gaining air superiority in the region of the operation.
2. The blockade of a nation has now become a matter of air power.
3. Only air-power can conquer air-power.
4. Aircraft based on land is always superior to that carried by sea.

Applying his theory to the war in the Pacific, Seversky puts forward his view that it would be much less costly to bomb Japan by long-range heavy bombers from Alaska than to attempt the slow process of conquering one by one the island bases of Japan. But the writer doubts whether air bombardment, even on the greatest scale, will by itself bring about psychological collapse. He refers to the British large-scale bombing of Germany, and says that our plan is nearer to Seversky's than anyone else's, but he prefers the view that destroying the enemy's industrial organization and his power to make war must precede and facilitate the land operations which alone can bring home to an enemy the fact that he is vanquished. With this opinion we may cordially agree.

Commentaires sur la guerre actuelle. This month's article is devoted to the Russian offensive in December, 1943—January, 1944.

Von Manstein had succeeded in checking Vatutin's drive on the Kieff front by a strong counter-blow which regained Jitomir and warded off the danger of an encirclement of the German position on the Bug; but the Russians, yielding ground slowly, for the next five or six weeks allowed the Germans to use up their troops without any decisive result.

When the German attacks petered out on December 11th, Vatutin launched a new offensive the next day, which was the first of the series of blows struck in succession by the four Ukrainian Army Groups. Vatutin recovered Jitomir on January 1st, 1944, and shortly afterwards Konieff took up the attack, increasing the threat to Manstein's armies in the Dneiper bend. The offensive now covered a 100-mile front. Kirovograd was taken on January 8th. The German High Command was now speaking of the Ukrainian battle as the decisive battle of the war—a little prematurely perhaps.

Away to the north, a new offensive was opened in the Vitebsk sector by the 1st Baltic Army Group, and yet further north, in the Lake Ilmen sector, a fresh blow was struck which preluded the liberation of Leningrad.

The whole Eastern front was aflame, and the Russian winter campaign was in full blast. The German strategical reserves, if there were any, were not being used to stem the tide.

February, 1944.—Commentaires sur la guerre actuelle. The pressure of the Russian winter offensive was now being exerted along the whole of the Ukrainian front. The forces in the sectors north of the Pripet marshes were prepared to exploit any success, and everywhere the initiative was now in Russian hands. The new armies furnished by the German total mobilization of 1942-43 were to have forced the final decision in the spring or summer of 1943, but beyond staving off defeat of whole groups of armies by desperate counter-attacks, the Germans had scarcely checked their long retreat from Stalingrad; much less had they achieved any successful blow themselves. They had travelled back 1,000 kilometres from Stalingrad.

Two great battles were now being fought, with German forces encircled in the Kanev pocket and at Nikopol.

In the north, a new offensive, long prepared, was launched by the Russians with the object of freeing Leningrad. Between Lake Ilmen and the Gulf of Finland, the Russians reached the Narwa river, and were continuing their advance. New generals were coming to the fore. Wherever the Germans looked on the Eastern front, they found the Russian pressure mounting up, and they were prevented from denuding their Atlantic Wall and its reserves. Where was the great strategic reserve of which they boasted? Would it be used to stem the tide in the East, or would the line be withdrawn according to plan, in order to conserve the final effort for the west?

In Italy, the commentator found nothing to indicate any change in the slow process of "inching" forward. The terrain was not comparable with that of the rolling plains of Russia. Kesselring had been given time to build up his defences round the new Anzio beach-head, and the Allies were held around Cassino and on the Garigliano. By taking three divisions from his southern front and four or five more from the north of Italy, Kesselring formed a strong flank by which he scotched the threat from the new beach-head. But he lacked air-power, and presently he found his communications being relentlessly hammered.

The commentator adds "if the Nettuno landing had any strategic object, it has failed for the time being; if it only aimed at pinning down a few German divisions, it has succeeded, but it has disappointed some Allied quarters where great results had been expected from this operation."

W.H.K.

JOURNAL OF THE BUENOS AIRES ASSOCIATION OF THE INSTITUTION OF CIVIL ENGINEERS

No. 12. *Session* 1942.

This number marks the initiation of what it is hoped may be a lasting exchange of publications with the " Centre of British Engineering and Transport Institutions " of Buenos Aires.

Of the 107 members of the " Centre " in 1942, twenty-one were already serving in H.M. Forces (mostly in the Royal Engineers) and others have joined up subsequently as and when arrangements could be made to relieve them in the key positions they were holding in important Public Utility undertakings.

The inaugural address by the Chairman for the year (Mr. F. W. Butler, B.Sc., M.Inst.C.E., who has since been commissioned in the Royal Engineers) deals with the Public Services of the City of Buenos Aires, almost all of which were originated and constructed by British Engineers, though most have now passed into Municipal or Argentine Government hands.

Water Supply now provides an average of 400 litres (85 gallons) of filtered water per head per diem for the 3¼ million inhabitants, mainly derived from one pumping and filtration plant at Palermo on the outskirts of the City, taking its water from the River Plate.

Drainage. Main outfall 14½ miles below the City. Main and branch sewers in service total about 1800 miles. Storm water conduits 200 miles.

The remainder of the address dealt with the Docks, Gas, Electricity, Telephones, and Transport. The accounts were historical rather than technical.

Useful graphs accompany the address.

Mr. D. G. Butlin, M.Inst.Pet., gives a short account of the Argentine Petroleum Industry which accompanied his exhibition of films.

Much space is given to an address and subsequent discussion between experts on High-Speed Railway Tracks, during which much practical experience was interchanged amongst Ways and Works, Locomotive, and Traffic representatives of the various British Railways in Argentine, and future requirements forecast.

An address on the Corps of Royal Engineers given by Colonel R. E. M. Russell, Military Attaché to the British Embassy, Buenos Aires (an old Sapper) at the special request of the " Centre," is reported in full.

At a subsequent meeting the Chief Engineer of the Central Argentine Railway recalled that his Institution came into being 124 years previously as a break away from the Military Engineers, and that the Civil Engineers had remained aloof until now when it is realized how much the two depended on each other. He had no doubt that the contacts now created between Military and Civil Engineers will continue to develop for the benefit of both and of the Motherland.

R.E.M.R.

CORRESPONDENCE

EQUATOR AND ECLIPTIC

240 Iffley Road,
Oxford.

DEAR SIR,

In an article in *The R.E. Journal* for June, 1943, Lieut.-Colonel T. C. Skinner raises again the Drayson theory of precession, in which precession was said to be not round the pole of the ecliptic, but round a point 6° from it. Drayson dismissed as an impossibility the idea that precession was due to the action of the sun on the " equatorial bulge " of the earth. He gave no reason why the precession should be round his own centre six degrees away. Nor apparently does Colonel Skinner. Actually there is no force which can produce such a precession and Drayson was certainly unaware of the principles governing the combination, in a body, of two or more rotations.

Again, Drayson's theory requires an annual precessional shift of the equinox, or first point of Aries, of 40.9″ of arc, whereas the actual shift is 50.2″.

The theory would put history into confusion. I do not know what foundation Drayson has for saying that it is known and admitted that at the commencement of the Christian era the radius (precessional) was 24°, but, if so, we must put the erection of Stonehenge—a stone-age product—at about A.D. 300, *i.e.*, late in the Roman occupation.

I am limited to a short letter and cannot deal adequately with the theory, but I think that these and other objections should be fully dealt with before acceptance, though tribute can be paid to the great amount of work Colonel Skinner and his friends are putting into it.

Yours faithfully, A. G. SHORTT, *Lieut.-Colonel late R.A.*

DEAR SIR,

Replying to Colonel Shortt ; there is surely nothing infallible about mathematical theory ; witness the case of Chandler v. Euler. Actual evidence of the stars alone is of value, and by examination of that evidence eighty years ago, Drayson was enabled to locate the centre of the precessional circle 6° away from the ecliptic pole, in r.a. 18 hours (assigned), precisely where it is found to-day. The polar trace, thus defined, has been admitted correct by our astronomical colleague, Prof. Stratton.

Yet, though there is nothing to prevent anyone from going over the same ground in endeavour to prove Drayson in error, so far as I know no one has ever even attempted it ; at least if he had, he kept the results to himself. Instead, the opposition has always been of the nature of rearguard action to cover a " get-away " from the real issue ; for example, the 3° maximum variation of O.E. within a million years or so of our epoch, which was supposed to preclude Drayson's 12° in 16,000 years, is now recognized to refer solely to movement of the *ecliptic plane*, and in no way to limit the possible tilt of the *earth's equator and axis*, which, as nutation shows, is under lunar control.

Space in the *Journal* forbids a more detailed reply to Colonel Shortt's objections, but if he care to communicate with me direct, I will be glad to discuss them with him in like friendly spirit.

Yours faithfully, T. C. SKINNER, *Lieut.-Colonel R.E. (ret.)*.

SPECIAL NOTICE

The fact that goods, made of raw materials in short supply owing to war conditions, are advertised in this magazine should not be taken as an indication that they are necessarily available for export.

Silver
Tea Service
by Paul Storr
GEORGE III 1814

Few British silversmiths have surpassed in craftsmanship Paul Storr, examples of whose superb workmanship are eagerly sought by collectors. Although a prolific craftsman, genuine pieces of "Storr" are comparatively scarce. Much of Storr's work was executed to the order of royalty—George III and George IV—and remains today the property of His Majesty in the magnificent collections at Windsor Castle and Buckingham Palace.

It is his unsurpassed workmanship that provides Storr's passport to fame. One could almost wish that those deft fingers had handled the hammer and the chaser's tools in a freer, less circumscribed age when skill might have had its fullest opportunity on worthier design. For the austere classicism of the Adam brothers which had previously set the pattern for both furniture and silverware had given place to the flamboyant "Empire" influence from France. Much of Storr's work belongs to this period when the motifs admirably adapted to the ormolu of Empire furniture were considered the only fashionable design for silver. More's the pity, for even a cursory examination of a piece of "Storr" makes us wonder what might have been if such outstanding craftsmanship had been wedded to designs planned for silver and not for gilded bronze.

May the time be not far distant when the fine workmen of today will return to their accustomed task of making beautiful things in gold and silver. May the designs be worthy of the greatest traditions of the craft so that their art may reflect the spirit of our time and English gold and silverware become once again an Ambassador of our culture throughout the world.

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