The Royal Engineers Journal.



Sir Charles Pasley. Part I LieutCol. P. H. Kesly	1
The Organization of the Higher Command in War	
MajGen. Sir Frederick Maurice	18
Reinforced Concrete Road Design	29
Monntsineering as Training for War The Right Hon. Leopold S. Amery	52
A Subaltern in the Indian Mutiny, Part III. Bt. Col. C. B. Thackersy	57
Samer Officers in War Major M. Everett	21
The Abor Military and Political Mission, 1912-13. Part IV	
fight P & Huddleston	77
Catterick Awash Cart A R Fines	85
Water Spinly in the Field Rt Lient Col G La O Marial	02
The Construction of Alexandres Didge Dignat (Wagisisten) by Not 10 and 12	
Field Companies O V O Waters Sannay and Minaw in 1000	100
Notes on the Transment of the Tellion Army	100
More on the Engineers of the Italian Army	100
	100
major H. A. Joly de Lotoiniere	108
The Queen of Spain's Cup	Πg
Burvey Sidelights Uspi, J. C. T. Willis	129
Memoirs Lord Thomson of Cardington, BrigGeneral Sir Frederick Gordon	
Guggisberg, LieutGeneral Charles Strahan, Major-General Sir George	
Barker, Colonel C. M. Browne, BrigGeneral Harold Pemberton Leach	128
Books. Magazines. Correspondence	161

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CONTENTS.

		PAGE
٢.	SIR CHARLES PASLEY. Part I (concluded). By LieutCol. P. H. Kealy, R.E. (ref.)	I
2,	THE ORGANIZATION OF THE HIGHER COMMAND IN WAR. A Lecture by Major-General Sir Frederick Maurice, K.C.M.G., C.B., Professor of Military History at University of London, delivered at the S.M.E.,	
	Chatham, on Thursday, 13th November, 1930	18
3.	REINFORCED CONCRETE ROAD DESIGN. By Captain A. Minnis, R.E. (With Sketches)	29
. į .	MOUNTAINEERING AS TRAINING FOR WAR. A Lecture delivered at the S.M.E., Chatham, on October 23rd, 1930, by The Right Hon. Leopold S. Amery, P.C.	53
5.	A SUBALTERN IN THE INDIAN MUTINY. Part III. Containing some letters of Lieut. Edward Talbot Thackeray, Bengal Engineers, after- wards Colonel Sir E. T. Thackeray, J.C., K.C.B., R.E. (1836-1927). Edited by Brevet Colonel C. B. Thackeray, D.S.O. (late LieutColonel, R.A.) (With Photographs and Math)	57
6	SADDER OFFICERS IN WAR BY Major M. Everett, D.S.O. D.S.C. R.E.	71
~	THE ABOR MULTURE AND POLITICAL MISSION 1012-12 COmpiled from	<i>,</i> -
7.	the Diary of the late Captain P. G. Huddleston, R.E. Part IV. (With Photographs and Map)	77
8.	CATTERICK AWASH. By Captain A. E. H. Lees, R.E. (With Photographs and Map)	85
9.	WATER SUPPLY IN THE FIELD. By Brevet LieutColonel G. Le Q. Martel, D.S.O., M.C., p.S.C., R.E. (With Pholograph)	93
10.	THE CONSTRUCTION OF ALEXANDRA RIDGE PICQUET (WAZIRISTAN) BY NOS. 10 AND 13 FIELD COMPANIES, Q.V.O. MADRAS SAPPERS AND	100
	MINERS, IN 1929. (Win Froidgraphs)	100
ΓΙ.	NOTES ON THE ENGINEERS OF THE ITALIAN ARMY, By TOHOUTAGES	102
12.	and Miners. (With Photographs)	105
13.	MAURITIUS. By Major H. A. Joly de Lotbinière, M.C., R.E	108
14.	THE QUEEN OF SPAIN'S CUP. By "Helmsman "	118
15.	SURVEY SIDELIGHTS. By Captain J. C. T. Willis, R.E	125
16.	Memoirs	128
	Lord Thomson of Cardington, {With Photograph.} Brigadier-General Sir Frederick Gordon Guggisberg, K.C.M.G., D.S.O.	
	Lieutenant-General Charles Strahan, Colonel Commandant R.E.,	
	Major-General Sir George Barker, K.c.B., Colonel Commandant R.E.	
	(With Photograph.) Colonel Charles Michael Browne, C.M.G., D.S.O. (With Pholograph.)	
	Brigadier-General Harold Pemberton Leach, C.B., C.B.E., D.S.O.	

CONTENTS.

PAGE 17. BOOKS 161 Goethals, Genius of the Panama Canal. (J. B. Bishop and F. Bishop.) H.B-W. Bedford Forrest. (Capt. E. W. Sheppard, O.B.E., M.C.) E.E.D.S. A Soldier's Note-Book, 1914-1918. (General A. A. Brussilov.) H.B-W Taschenbuch der Tanks. (Dr. Techn. Fritz Heigl.) A.S.H. A Study of the Strategy and Tactics of the Mesopotamia Campaign, 1914-1918. E.E.D-S. Secret Service. (Major-General Sir George Aston, K.c.u.) H.B.W. My Early Life. (Winston Churchill.) C.L.R. Route Surveying. (Pickels and Wiley.) B.C.T.F. Introduction to Structural Theory and Design. (Sutherland and Bowman.) R.S.R.K. Survey of India, H.L.C. The Extinction of Montenegro. B.R.W. The Mysterious Universe. (Sir James Jeans, M.A., D.SC., I.L.D., F.R.S.) H.L.C. The Complete Ski-Runner. (Arnold Lunn.) O. S. Yodel. Rediscovering England. (Charlotte A. Simpson.) P.H.K. 18. MAGAZINES ... 180 Bulletin Belge des Sciences Militaires, W.A.J.O'M. Revue Militaire Suisse, W.A.J.O'M. Militaerwissenschaftliche Mitteilungen, F.A.I. Herrotebrich ... Heerestechnik, F.A.I. Revue d'Artillerie. R.H.M. Revue du Génic Militaire. A.H.B. 19. CORRESPONDENCE 107 How We Won the War. R. H. Allen, Major and Brevet Lieut .-Colonel, R.A. All communications for the Institution should be addressed to :--The Secretary, The Institution of Royal Engineers, Chatham. COUNCIL OF THE INSTITUTION OF ROYAL ENGINEERS. (Incorporated by Royal Charter, 27th February, 1923.) Pairon :--- H.M. THE KING. President. Vice Presidents, Elected Ex-Officia. Ex-Officio. Naj.-Gen. H. L. Pritchard. C.B., C.M.C., D.S.O. (Cdt. S.M.E. and Inspr. R.E.). Col. E. E. B. Mackintosh, D.S.O. (A.A.G. R.F.). Col. R. C. Dotson, D.S.O. (A.D. TN.). Col. R. N. Burn, O.B.Z. (A.D. TN.). Col. R. Oakes, C.S.Z. (R.E. Board). Bt. LL.-Col. A. E. Grasett, D.S.O., M.C. (G.S.). Major P. K. Boulnois, O.B.E., M.C. (G.I.C.). Major C. C. Phipps, O.B.E., M.C. (G.I.C.). i Corresponding Members.

viii.

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The Assault on Delhi. Fighting inside the Walls, September 14th, 1357. (Near here Nicholson fell).

A subaltern in the Indian Mutiny

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SIR CHARLES PASLEY.

Ŧ.

HIS LIFE : A SKETCH.

(Continued.)

By LIEUTENANT-COLONEL P. H. KEALY, R.E. (retired).

1812

ON May 5th, Pasley received the order from the Master General of the Ordnance to march from Plymouth to Chatham with a detachment of the Royal Military Artificers. He started the same day, and on arrival took up his own quarters in Brompton Barracks, which were then occupied by the R.A. The men were guartered at Upnor and in the Casemate Barracks at Chatham (St. Mary's), and it was not till later that any of the men were accommodated in Brompton Barracks.

Pasley lost no time in getting to work, and on May 12th he started the men off on field works and all the operations of a siege on Tower Hill. The Inspector General of Fortifications had given him an entirely free hand. There were no text-books in existence, so Pasley set to work to write them himself and provide them with illustrations, after which he got them printed or lithographed and published. This was the general procedure as each course was added to the curriculum at Chatham, and as in many cases there were no data on which to base instruction or the data were considered unreliable, constant experiments were carried out under Pasley's directions so that the text-books might be as reliable as possible. Copies of the original editions and the manuscript records of a long series of experiments are now in the Royal Engineers' Museum at Chatham.

The first subjects taught at Chatham were naturally siege works of all sorts, that was the object of the School. But the men were also exercised with ball cartridges, drilling and marching, and an early order from the I.G.F. directed that the officers of Royal Engineers should fall in and drill as regimental officers. The divorce of the officers and men into two separate corps, which in fact persisted until 1856, was a thing which Pasley disapproved of, and in 1813 he wrote : "If I reason rightly, there ought to be no such thing as a Corps of Military Artificers, or a Corps of Sappers and Miners, commanded by A

officers who bear a different title. The one title for all should be 1813 ' Royal Engineers.' The term ' Engineer soldier ' would comprehend every possible duty in which their services could be required, either at home or abroad. I have little hopes of this change being made at present. That a man should be called a Sergeant, a Corporal, or a Private, of Royal Engineers is a thing so new that it would shock the ears of the greater part of the Corps." In his letter of November 27th, 1813, to General Sir Thomas Graham, who had charge of the siege of San Sebastian, Pasley remarks :-- " For this reason I was particularly happy to find that in your very handsome reports of the Corps, after the first unfortunate attack and subsequently after the glorious capture of San Sebastian, you included officers and men of the Royal Engineers under the same title, and fortunately the same thing has always been done in the official returns of casualties for many years past."

Pasley throughout his time at Chatham, and afterwards when in retirement, was exceptionally keen on pontooning, and at an early date in the life of the Establishment he obtained pontoons and started practice on the Medway : later on, in the summer of 1813, he carried out experiments with cask piers for bridges, and though the idea was not a new one, he worked out details of construction and drill which lasted practically unchanged until the war of 1914. The story of the pontoon in the British Army will be treated in a later number at greater length.

In July, 1812, Lord Mulgrave³¹ paid his first visit to the new Establishment at Chatham. He was accompanied by Lord Hallowby, President of the Council of the Liverpool Cabinet, and seemed very pleased with what he saw. Pasley dined with them at the Crown Inn in Rochester.

This first visit of the M.G.O. was the precursor of visits from a succession of important and interested notabilities throughout the years. During 1813 the Duke of Clarence (later William IV.) inspected at the Nore with the Russian Ambassador and a large staff, and then came on to Chatham. He was much interested in what Pasley had to show him, and drank "Success to the Sappers and Miners" at the banquet in the evening. He maintained his interest in the Establishment throughout his life and wrote many letters to Pasley on the tests of pontoons and other subjects.

In April, 1813, Pasley received a letter from Lord Mulgrave, saying he had recommended him to H.R.H. the C.-in-C. for promotion to Lieut.-Colonel, a contrast to the objections raised a short time before to the grant of brevet rank of Major.

During 1813, the teaching at the Establishment began to bear fruit, and by November 400 well-trained Sappers and Miners had been sent to the Peninsula. They made their first appearance in August at the siege of San Sebastian, and were distinguished from the men who had not yet been to Chatham by their red uniform, and were known as "Pasley's Cadets." The uniform of the officers of the Royal Engineers had been blue, at any rate since 1782, but had been changed to red in 1812: the uniform of the Royal Military Artificers had also been blue since they were raised in 1786, and the change to red perhaps followed on that of the uniform of the officers of the Royal Engineers and also to avoid the danger of the men being picked off in their blue coats amongst the red-coated working parties from the Line.

The newly trained men quickly proved their worth, and the following testimony is borne to them by Sir John Jones.⁵ It will be remembered that he had been insistent in season and out of season on the paramount importance of the proper training of the men as Sappers and Miners. In his Journal of Sieges in Spain, 3rd edition, 1846, he wrote :--- " This change of name [to Sappers and Miners] acted like magic. Everyone in an instant saw the propriety, nay, the absolute necessity, of the whole body being instructed in sapping and mining, and an institution was created by Lord Mulgrave for that purpose at The formation of the institution at Chatham was Chatham. followed by another simple change of equal or even paramount utility, viz., obliging the officers of Engineers, whilst amongst a stated number of the junior of the several ranks of 2nd captain, 1st lieutenant and 2nd lieutenant, to be for that period actually the regimental officers of the companies of Sappers.

"This measure, by linking together the officers and men, and closely connecting their mutual interests, gave discipline and pride to the soldier, whilst it conferred the utmost benefit on the Engineers, by obliging each officer, during three periods of his military service, to perform regimental duty and to acquire due experience in the drill, discipline and interior economy of troops. On the strict and impartial observance of this rule, and making every officer take his chance of the station and service of which his company may be employed during the whole period of his being on the list for regimental duty, the efficiency of the Corps of Sappers and Miners, and the zeal and assiduity of the officers, will ever mainly depend. Neither commanding influence nor petty favouritism should be allowed to interfere with this regulation.

"The company at San Sebastian was the first which entered the field after these great changes, and the men were found useful and intelligent. Since that time each company has been instructed in succession, and a detachment of greater or less strength has borne a useful part in all the military operations of the empire. Indeed, justice requires it to be said that these men, whether employed on brilliant martial services, or engaged in the more humble duties of their calling, either under the vertical sun of the tropics or in the frozen regions of the north, invariably conduct themselves as good soldiers, and by their bravery, their industry, or their acquirements, amply repay the trouble and expense of their formation and instruction."

Writing of Pasley, Sir John Jones said :—" On this point it may be observed that a most happy selection was made of an officer as Director of the Institution at Chatham in Lieut.-Colonel Pasley, who, uniting great zeal and unwearied perseverance to good talents, has succeeded in extending the course of instruction far beyond the original objects of the Institution, and has filled the ranks of the Sappers with good scholars, good surveyors and good draughtsmen." The old Military Artificers had come in for a good deal of abuse at one time and another as a useless, drunken lot; however much many of them may have deserved this description, it was soon seen that, as is so often the case, it was not the men who were at fault so much as the system, and that as soon as the men were properly treated, trained and looked after, they started to establish that reputation in the Army which their successors have done so much to increase.

1815

Army which their successors have done so much to increase. A letter of Pasley's will be quoted here, though chronologically a little out of its place, which again shows him to have been many years ahead of his times in Corps organization. On April 27th, 1815, Pasley wrote to the I.G.F. as follows :—" Sir, having heard that it is in contemplation to give Captain Rice Jones³⁷ some other appointment in lieu of the Adjutancy at Woolwich, it is under this supposition and with much diffidence, that I take the liberty of suggesting to your consideration the expediency of making some change in the Woolwich Establishment. I have long been of opinion that it is very prejudicial to the Corps of Sappers and Miners, that there should be, as it were, two Headquarters, the one for field duties at Chatham, and the other for drill at Woolwich, and that both of these services would be very much better carried on at one and the same place.

" My objections to the division of the duties are as follows :-In the first place, on account of the separation of the two detachments, there is nowhere a large respectable body of the R. Sappers and Miners collected together in one place, such as would make a show in case of reviews, inspections, etc., and give the public a fine idea of the Corps. [The Director was a great believer in due advertisement and propaganda.] In small detachments too there is always unavoidably a much less degree of esprit de corps, and less practicable knowledge of discipline than in a large body. Secondly :--- The men under the Adjutant at Woolwich are entirely separated from the officers of the Engineers, who are their natural officers, and with whom it is generally allowed to be a point of the greatest importance to unite them as intimately as possible. From 300 to 600 or 700 men, with only a few sub-lieutenants to assist the commanding officer, as is frequently the case at Woolwich, without any further gradations of rank, is certainly a very improper Establishment, and I believe unparalleled in any other regiment or corps. Thirdly :--Owing to the men for drill being at a distance from this Establishment no use can be made of them, in case of any very sudden or urgent emergency by way of diminishing the guards and regimental duties of the others, who may be preparing for immediate service. So that it has often been found impossible to furnish companies properly trained to the field duties when required. And they have constantly been hurried away from here in a very imperfect state. This unfortunate circumstance, which has repeatedly happened, is now likely to occur at this very moment, and must always occur from time to time from the same cause. It is a thing peculiarly to be regretted in a corps, which has as yet its character to establish, and the more particularly as that character must depend a great deal more upon the field duties than the drill.

" If, on the contrary, there were only one station for instructing and training the corps, I am persuaded that both the drill and the field duties would be learned infinitely better and in a shorter time. The recruit would be stimulated to give his whole attention to the drill and the field duties would be learned infinitely better and in a shorter time. The recruit would be stimulated to give his whole attention to the drill, knowing that when perfect, he might go to the field duties at once and obtain the extra allowance granted upon that service. At Woolwich the case is very different. There he cannot expect to get away from the drill, individually when perfect, but must wait the movement of some large detachment. And as he has nothing but guards and drills to look to, whilst doing duty there, there is little stimulus to exertion.

"Again, by blending the two establishments, a man, although employed only at the drill, would during that period have an opportunity of seeing the field works, and would consequently learn a good deal of this duty, both by observation and by the conversation of comrades who were more advanced. At Woolwich, on the contrary, the whole of the time he remains there is entirely lost to his improvement as a Sapper and Miner. If the Establishments were blended, the men would also be under the officers of Engineers instead of being left entirely to sub-lieutenants and non-commissioned officers and consequently they would improve much more, upon the whole both in knowledge of their duty, in habits of discipline, in attachment to the body of officers under whom they are to serve, and in *esprit de corps*, than is at all possible under the present system.

"Although I have always been a strong and zealous advocate for drill, it must be allowed that skill in the field duties is what must chiefly establish the fame and reputation of the Royal Sappers and Miners. In a review they may rival, but can hardly expect to excel other regiments. It is only by their expertness in mining, sapping, military bridges, etc., that they can hope to form a high character as a corps, and to attract public admiration. But owing to the division of the Woolwich and Chatham detachments, neither the one duty nor the other can be exhibited to advantage at either place. We are too few to go through the manœuvres of a review on a large and creditable scale, although no exertion is spared to perfect the officers and men in them. And we are even too few to show off all the field duties in style. For example, when H.R.H. the Duke of Clarence and Count Lieven, the Russian Ambassador, inspected our Establishment (6.8.1813) we were obliged to have the same men flying first from the sap to the mines, and afterwards from thence to the pontooning, as there were not enough to be stationed everywhere, and the same has always happened on similar occasions. At the time the Duke of York and the Duke of Wellington were expected last year, we had scarcely men sufficient to man the pontoons alone. In a country like ours, governed or influenced by persons not always well acquainted with military affairs, I conceive that however useful or necessary any corps may in reality be, they run a risk of being undervalued and neglected to the prejudice of the service, unless upon such occasions as have been alluded to, their appearance pleases the eye and their operations can interest as a kind of spectacle. It is upon this ground, and with a view to the benefit of the State solely that I regret that such an effect cannot be produced upon the public mind by any reviews or exhibitions of the Sappers and Miners, whose utility (they being a new corps) is liable to be called in question, by those who are ignorant of the nature of their duties.

" In the above observations, I beg leave to explain that I do not mean to make the slightest reflection upon the mode in which the Adjutant's department at Woolwich has been carried on. On the contrary, I think that Capt. R. Jones and his predecessors deserve the highest credit for having done so much with such imperfect means, and, with regard to him in particular, I am fully persuaded that no officer in the corps could have done more justice to the difficult and important task he has had to perform. For my own part, I can have, in making this suggestion, as my only object, the sincere desire for the good of the Service, and the improvement of the Corps. If the plan should ever be adopted, it must be allowed that it cannot increase either the advantages or the emoluments of my situation, nor can it ever be considered as an object of personal ambition. For it certainly will add nothing to my situation individually to be seen marching to church or saluting at a review, at the head of 5 or 600 men, instead of half that number.

"I also wish to explain that I have not the least desire to interfere with the general discipline or arrangements of the Corps, nor with the recruiting, clothing or other matters, nor with the transfers, promotions, etc., nor, in short, with any of the official business now carried on in the Adjutant's office at Woolwich. Indeed I am of opinion that these matters might be much better arranged in London, by some Staff officer or officers, entirely unconnected with the actual executive command, or with the regimental duties of any detachment, or portion of the Corps of Royal Sappers and Miners whatever. I do not desire even to interfere with the drill of the recruits, personally, but should be quite contented to wait until the officer, appointed to the charge of that duty, reported them perfect and fit to join the field works. The only thing I should require would be that the whole should parade together on Sundays, and that, on the drill days of the Establishment, which takes place once a week, such of the recruits as were the most advanced should fall in with the other men, in order to form a large body for the general parade.

"I am sensible how very delicate a matter it is for an officer of inferior rank to presume to address his superior unsolicited, in the manner that I now do, but I am encouraged by the knowledge that I have of your condescension. If this suggestion should not be approved, I trust you will excuse the liberty I take in consideration of my motives. If, on the contrary, it appears worthy of your attention, I conclude by saying that I shall be perfectly contented to move from hence to any other place, if such removal should be deemed essential to the service of the proposed united Establishment. Indeed, as far as the favour and good opinion of the public in general can be considered of importance to the efficiency of the Corps, I feel that a station nearer to the metropolis would be desirable.

"Since I began this letter, I have seen Captain Rice Jones, and talked over the subject with him and, as I find he agrees with me in almost all the leading points contained in it, I have the less hesitation in laying it before you."

It was not till the year 1850 that the Corps took over the whole of Brompton Barracks, and this recommendation of Pasley's was carried into effect by all the training being concentrated at Chatham. The move of the Headquarters of the Corps of R. Engineers from Woolwich to Chatham took place in 1857, by which time the officers and men formed one Corps.

To revert to the year 1814; in April, Napoleon abdicated, and the long state of war came to an end. The inevitable results ensued, and all army establishments were immediately reduced. On May 10th, Pasley wrote :—" I do not know how far the peace will affect the Establishment of which I have the direction. If they set it aside on that account, it will be a bad thing for the Service. We shall never have a good corps of Engineers for field service without it." Fortunately the character of the Director was such that if anyone could save the Establishment if it was seriously threatened, he was the man.

MARCH

The year 1814 was one of great bustle and confusion ; there was a coming and going of European Potentates, and the troops started returning from the war, causing difficulties over accommodation. Pasley had to represent the unsatisfactory state of the housing for the Establishment at Chatham, and obtained with difficulty a lien for himself on his quarters, and three houses at Brompton Barracks for his men as a permanent arrangement. He also had to ask that he might be allowed to withdraw the Sappers and Miners from garrison duties now that sufficient men of the returned line regiments were available; these heavy duties interfered seriously with the technical training of the men, and Lord Mulgrave, the M.G.O., wanted to show off his Establishment to the Duke of Wellington. Pasley was shrewd enough to see that in making the most of this feeling and interest in high places lay the best hopes of ensuring the continuance of the Engineer Establishment at Chatham.

Wellington in July, 1814, was appointed Ambassador Extraordinary to the Court of France. At the request of the Government, he visited the entire line of the Franco-Belgian frontier, and took with him Colonels Carmichael-Smyth,38 Chapman,39 and Pasley, all Royal Engineers. The Duke was received with great enthusiasm throughout his tour, there were many banquets and much cheering, and the Engineer officers came in for reflected glory :---" Before reaching Namur are received by a detachment of Dutch Cavalry who escort us into the town. The population take out the horses. Vast multitudes collect, and receive the Prince [of Orange] and the Duke with huzzahs and vivas. Chapman, Smyth and myself in the Duke's carriage." Many of the names of places familiar to us from the last Great War appear in Pasley's diary-Charleroi, Mons, Tourney, Courtrai, Ypres :-- " Reconnoitred the country between Ypres and Dunkirk including the works at Nieuport and discussed possibilities of inundations."

The Engineers handed in their report to the Duke at Paris on September 15th, and he declared himself satisfied with it. The Duke sent in his lengthy Dispatch on the subject dated September 22nd, in which as an afterthought he thanked Chapman, Pasley and Smyth.

1815 Nothing was done towards the strengthening of the Netherlands Defences until the beginning of 1815, when Engineers were sent over to organize works on a very large scale. Pasley wrote :—" No less than about 18,000 peasants and 2,000 horses worked by order of the Duke of Wellington under the direction of officers of the Royal Engineers in improving the defences of the Frontier of the Netherlands, for some months together, immediately before the great victory of Waterloo. And by all accounts the extensive works then in hand were conducted with the greatest regularity and dispatch. Now it may easily be conceived that to have directed such a great body of workmen to proper advantage by means of a few officers of Engineers would have been utterly impossible but for the system adopted of subdividing the various works among the N.C.O.s and privates, each of whom was made responsible for laying out the details of his own portion and for the direction of a party of from 20 to 100 men, or even more, according to circumstances.

"About five years before, I had received a letter from my friend Captain Squire,¹⁴ one of the Engineers superintending the construction of the celebrated lines of Torres Vedras in 1810, in which at one time no less than 7,000 Portuguese peasants were employed. After stating that he found the R. Military Artificers almost useless, as they could not understand the simplest plan or section and yet it was necessary for want of better, to employ them and artificers from other corps as overseers and foremen, he concluded by observing that efficient engineer soldiers could never be formed out of a body of men so stupid and ignorant. I differed from that opinion so far that I ascribed their irregularities to a vicious system of discipline and their ignorance to the want of instruction, and I had the pleasure, in little more than a year afterwards, of communicating to him the success of my efforts for the improvement of the Plymouth Company."

On March 1st, 1815, Napoleon returned from Elba and the "Hundred Days" began.

In May, 1815, we find Pasley writing to General Mann,27 I.G.F., and to the Duke of York, Commander-in-Chief, a strong protest against any other body of men being employed as pontooners with the army except the Royal Engineers and Royal Sappers and Miners. He recapitulated the successful efforts that had been made to train the Corps in pontooning, cited the famous bridge across the Adour in Southern France as an example of what had been done since men had been trained at Chatham, and pointed out the disadvantages of a permanent mixing of the personnel of the Army and Navy in such an undertaking as a bridging train. He asked that men trained by him might be tested in bridging, if necessary, before any decision was come to. There were naturally official difficulties over Lieut.-Colonel Pasley, Director of the Engineer Establishment, addressing the Commander-in-Chief direct ; these difficulties were surmounted by the following ingenuous opening :-- "As my situation does not entitle me to write your Royal Highness in an official manner, I beg that this may be considered a private communication "! The Duke of Wellington, if he had ever really contemplated the arrangement objected to by Pasley, decided eventually to leave the bridging entirely in the hands of his Engineers.

Pasley has left the following description of the personnel of the Engineer Establishment which accompanied the Army at Waterloo: "When the Duke of Wellington was preparing on the frontier of the Netherlands for his last and most glorious campaign, having deeply felt and suffered by its former inefficiency in Spain, he caused the Engineer Department to be organized on a scale of magnitude before unparalleled and in a most perfect manner, whether for fortifying positions, for the passage of rivers, or for regular sieges. For he had under his command more than fifty Engineer officers, 800 well-trained Sappers and Miners, and about 650 drivers.

When he advanced into France, about forty Engineer officers were attached to Divisions of the Army or to the Pontoon Train, having charge of 150 wagons (pontoon carriages included) and 1,100 horses : whilst others, including the Commanding Engineer and the officers of his staff, accompanied the movements of Headquarters, and the remainder were left on duty in the Netherlands. Every division of the Army had one Engineers' brigade attached to it, each brigade consisting of a complete company of well-trained Sappers and Miners, with Flemish drivers, horses and wagons carrying entrenching tools sufficient to employ a working party of 500 men, besides a proportion of artificers' tools and other engineer stores.

"A Captain and a certain number of subaltern officers were attached to each brigade and were responsible for the discipline of the men, and for the efficiency of the horses, etc., whilst the remainder of the engineers were left free for the general duties that might be required. Four companies were employed with the pontoon train, which consisted of eighty pontoons and four portable boats on carriages, besides 16 Flanders wagons for stores, sub-divided into four bridges and drawn by more than 900 horses ; the whole being under the command of a brevet major of Engineers assisted by a due proportion of captains and subalterns of the Corps. A forage cart accompanied each brigade and each bridge. An assistant ordnance Commissary with six clerks and nine conductors of stores and about forty civil artificers from Woolwich (note :-- this mixture of civil and military artificers is not to be recommended) also served with the Engineer Department beside two medical officers and a veterinary surgeon. Fifty-two Flemish seamen, accustomed to rivers and coasting navigation, were attached to the pontoon train, but in the construction of two bridges thrown over the Seine near Paris, it was observed that these men, for want of previous training, were by no means so serviceable as the R.S. and M. Of the drivers more than 170 belonged to the Corps of R.A. drivers, who, with two lieutenants of the same, were transferred to the Engineer Department only a little before the opening of the campaign and were exclusively employed with the pontoon train. The remainder, being men hired for the occasion in the neighbourhood of Antwerp and Brussels, were generally ignorant of their duty, and many of them of bad character, so that frequent desertions took place. However, by the great attention of the officers of Engineers, the horses were kept efficient and in good condition, for, as soon as any of the country drivers deserted, an equal number of men of the

R. Sappers and Miners were substituted in their places, who, from their peculiar habits of zeal and exertion, made no difficulty in reconciling themselves to the novel occupations of grooms and drivers. But for this measure, a number of valuable horses must have been lost, and the pontoon train as well as the Engineer Brigade must have become totally inefficient. But the value of this splendid Engineer field Establishment ably organized under the auspices of the Duke of Wellington by Lieut.-Colonel James Carmichael-Smyth,³⁸ the Commanding Engineer with the Army, and forming so striking a contrast with the beggarly equipments that marched against Badajoz and Ciudad Rodrigo, was never put to the test, because no war of sieges took place such as there had been every reason to anticipate before the battle of Waterloo, that great victory having been far too decisive to give the enemy any hope of success in further resistance."

The long period of peace which succeeded the battle of Waterloo was by no means a time of idleness to the Director of the Establishment. Though there were heavy reductions in the strengths of the Corps, both officers and men, the principle of the Establishment was not touched ; this immunity may be attributed largely to the character and reputation of Pasley. His name became well known far beyond the confines of the Corps; he reckoned amongst his friends and correspondents the famous engineers Telford, Brunel, Nimmo, Farraday, and the poets Southey, Wordsworth, and Coleridge. In 1816, he was elected an F.R.S., and in 1819 he formed one of the committee called to consider Brunel's Thames Tunnel scheme. which was carried out between the years 1825 and 1843. When in 1830 difficulties arose, Pasley was asked to report on the plan for completing it, and in asking him to act, one of the Directors wrote :---"I have more faith in your judgment than in that of any other person, and I believe I might say the same for my colleagues."

The troops in garrison were always exercised in opening a first parallel under the Engineers and practised in escalading. The whole 1816

garrison of Chatham and generally the cavalry from Maidstone were also passed over the Medway every year upon a pontoon bridge constructed in their presence, and all officers and soldiers off duty could witness the various experiments in mining. This was probably the only opportunity any regiment ever had at that time of using the spade or of seeing any bridging and field engineering, namely, during the time they happened to be stationed at Chatham. There was no permanent organization of the Army into Divisions complete with units of field Engineers; Field Companies did not yet exist.

Experimenting at Chatham was carried on continuously, and it will suffice to mention a few of the activities there throughout the years of Pasley's directorate to show that the Establishment was alive.

In 1815, at the request of the Directors of the Honourable East India Company, Pasley undertook the training of the Company's cadets from Addiscombe before they went to India, an arrangement which lasted until John Company's army was done away with. It has already been mentioned that Pasley was particularly interested in pontooning, and in 1817, 1823, and 1825 he had to defend his own design of pontoon against the onslaughts of Lieut.-Colonel Sir J. R. Collinton, of the Royal Staff Corps, and later of Major Blanshard, 40 of his own Corps, whose pontoon Pasley highly commended, and which was adopted as the pattern for the British Army. The continuous experimenting with explosives at Chatham led to the following tribute being paid in the House of Commons. On February 6th, 1840, when the vote of thanks to the Army was being debated after the capture of Ghazni, Sir Henry Hardinge observed :---" With respect to Major Thomson,⁴¹ it is not from any wish on my part to under-rate the merits of that officer that I feel it right to state that the merit of the invention (by the use of which the gate of Ghazni had been blown open) so admirably employed by him is due to Colonel Pasley under whom the gallant officer to whom I referred and others, also distinguished officers, received instruction."

For many years, ever since his service in Sicily, Pasley had been experimenting at intervals with an improved form of semaphore, and in 1826 a committee at the Admiralty recommended "Colonel Pasley's sea semaphore to be used for ships' signals, instead of the present sea semaphore." It is understood that this is the type of semaphore which is still in use.

1825

In 1825, under orders from the Duke of Wellington, a course of Practical Architecture was started at Chatham, and as usual the Director busied himself in writing the necessary text-book. For forty years, from 1815 to 1854, practically no Royal Engineer officer saw a shot fired in anger. There were, of course, wars in India, but from 1771 until the Mutiny in 1857, no Royal Engineer officer served in India. The lack of organization in the Army in those days and this long period of peace raised difficult problems for those who guided

the destinies of the Corps. How to justify the cost of the retention of a body of technical troops for whom no employment in the Army in their own line was to be found ? The following is an extract from the preface of the text-book on Practical Architecture written by Pasley :--- " I have heard it remarked by some gentlemen in civil life that it seems almost too much to expect the same individuals to combine the habits and feelings of the military life with the laborious pursuits of the men of business. In exacting both from the Corps of Royal Engineers the Government of this country appear, however, to have acted more wisely than if they had confined the Corps to military duties solely. The same kind of talents and knowledge that render an Engineer officer capable of forming the project of military works, and of arranging and directing great masses of workmen in a siege, or in fortifying the position of an army in time of war, by a very little more study will enable him to superintend construction of public works of equal importance in time of peace; and if the Government did not find employment of that description, such as the superintendence of public buildings and barracks, etc., and the execution of other public works for the officers of the Corps of Royal Engineers and the soldiers under their orders, it would be necessary in time of peace either to employ them in the common routine of infantry duties or to disband them. There is no other alternative, for their being allowed to remain idle is out of the question.

" By combining science and industry with the activity, zeal, and spirit of the military character, and by considering none of the multifarious duties that he may be required to perform as a drudgery, since they are all equally useful to his country, the young officer of Engineers has it in his power not only to establish a reputation for himself, but to contribute towards maintaining the fame of his Corps as one no less useful in peace than distinguished in war." Many of the old Peninsular officers deplored the part that the Corps now had to play; it crops up in many of the writings of that time and the following may be quoted as an example from an early number of the Professional Papers :-- " The subject here discussed [Intrenchments as supports in Battle] is not one suited to the present period of peace. Military exercises are now irksome, and military subjects tedious. The civil duties in which the Royal Engineers are engaged are under present circumstances far more interesting. But we must not forget that we are a component part of the Army, maintained for national defence, that the country in the late war suffered great losses from the imperfect state of the Engineer Department, and that it is for the members of the Corps themselves to show what is required to make them properly efficient.

"There is no risk in our being less frequently or usefully employed in civil pursuits, by maintaining and improving our military system and upholding our character as a military body; if we neglect this in the present day, the contrary probably would be the result."

That the Corps did not suffer more grievously from stagnation and was able to meet with credit the test of the siege of Sevastopol was due to the character and endeavours of Burgoyne, Pasley, the Joneses, Reid and other Peninsular veterans.

The credit of the discovery of modern Portland cement lies with Pasley, and was the outcome of the introduction of the Architectural Course ; the story of this will be related in a separate part.

Amongst the other experiments carried out with explosives was that of underwater mines. After many trials, a system of lead piping had been introduced by means of which charges in shallow water had been successfully fired. When, therefore, in 1837 the Director was approached by the Lord Mayor of London with a view to his undertaking the destruction of the brig *William*, sunk in the Thames opposite Gravesend, by explosives, the problem was not altogether a new one, and was approached with all Pasley's usual enthusiasm. Suffice it to say here that the undertaking was carried through successfully, as also the removal of another wreck in the vicinity. For this work Pasley was presented with the Freedom of the City in a gold box.

His success with the brig *William* led the Admiralty to ask that Colonel Pasley might be permitted to remove the wreck of the *Royal George*, which had been lying at Spithead since 1782. Pasley, his officers and Sappers and Miners worked on the wreck for six seasons, until 1844, and the work was completely successful, the cost being defrayed by the sale of the materials recovered from the wreck.

In the meantime, in 1841, Pasley had been promoted Major-General and had given up the Directorship at Chatham. He was Inspector of Railways until 1846, when he was made K.C.B. and went into well-earned retirement. From old letters at the S.M.E. we find him still active and interested in the subject of pontoons, iron band gabions and other matters, and no doubt his successor in the office of Director wished at times that his predecessor did not live within quite such easy reach of Chatham ! One last letter may be quoted, addressed to Col. H. Sandham,⁴² Director of the Establishment, on

1857 January 31st, 1857, on the subject of the demolition of old Rochester Bridge :—" I attended the Duke of Cambridge's levee yesterday, for the first time that I have seen him since he was appointed Commander-in-Chief, and as I know that brevity is expected from officers on such an occasion, I was at a loss what to say to him, for I could have spoken of many interesting subjects, but of none without circumlocution, and therefore to make use of Dickens' phraseology His Royal Highness might have been as much displeased with me, as that facetious writer is degusted with that sort of character which he calls a ' Barnacle.'

1837

" Fortunately the Duke after having cordially handshook or handshaken me (for I believe they are both good grammar) saved me the trouble of addressing him by asking me questions according to what is said always to have been the custom of the Royal House of Hanover, all relating to Chatham and the destruction of Rochester Bridge; in reply to which I took the liberty of telling him nothing could have been better managed and that you, though it had not been your lot to be employed on active service so much as other officers, were the most competent and best officer that could have been selected for your present important duties, also that the explosions could not have been more judiciously carried into effect than by the two captains acting under your directions, ' Shaw,' whose name he knew, for sinking the shafts, and driving the galleries, and the other whose name I myself had forgotten, for firing them by the Voltaic Battery, and making all the previous arrangements necessary, with Grove's, a much more powerful battery than had been used by me against the Royal George, or by my myrmidon Captain Hutchinson, against Round-down Cliff, Dover. On his mentioning that the weather was very bad, implying that to have been the reason that prevented him from witnessing the last day's explosions, and expressing a doubt whether the effects of either could have been seen to advantage, I told him that they well repaid a visit to Rochester, and that there would be more, and recommended His Royal Highness to go by all means to the next. Then I explained that the spectators were placed in a dry and comfortable situation, under one of the arches of the new bridge, where they had a full view of the old bridge opposite them, and saw the arches, piers and abutment that were to be blown up, in a perfect state, waiting till the signal to fire was given by the bugle; on which the explosions by the Voltaic Battery took place instantaneously; and as soon as the smoke cleared away, the said arches, piers and abutment had entirely disappeared, and only part of the fragments were visible, which had fallen on the large projecting starlings, and were just seen a few feet above the level of high water. I then described my own fate on quitting the above-mentioned comfortable place of shelter, and going to see part of the ruins of the abutment, amongst which I repeatedly tumbled down in consequence of being an aged fogey (but I did not designate myself by that dignified term) so that after my outer garments had been nearly saturated with rain, I was plastered all over with mud or semi-fluid chalk, but was helped up again by an able-bodied clergyman, and officers of the Corps, who took compassion upon me, as well as by the non-commissioned officers and soldiers, who had acted as the miners whose lifting hands to relieve me, I also implored.

"All these interesting and laughable circumstances were related by me in less than half the time that this truthful narrative occupied in writing."

Sir Charles died at his residence in Norfolk Crescent on April 19th, 1861, at the age of 80 years, and was buried at All Souls' Cemetery, Kensal Green. Captain Sir Henry Tyler,43 his son-in-law, wrote the following memoir in the Proceedings of the Royal Society of London : "Sir Charles Pasley's was no common character. Its principal feature was perseverance, amounting to pertinacity in carrying through whatever he undertook, almost without consideration for time, trouble or risk. From first to last, he evidently experienced that intense desire for distinction which incites to noble deeds, stimulates to constant labour, and leaves no room for timidity, or mistrust. He had none of that jealousy of others which such feelings produce in less exalted minds, and which induces them to oppose their progress, or to abstain from rendering them assistance. He was accustomed to volunteer himself in his early years in all services in which danger was to be encountered, or credit to be obtained ; and nothing gratified him more in his old age than to see his sons and other young men adopting a similar course. He appreciated so highly the little assistance he received, and the education that was afforded to him, in commencing his own life, that he never tired afterwards in employing his influence and his purse in promoting the interests of those who required them. It was a touching spectacle to those, who were nearly associated with him at the close of his career to observe, that while he was still engaged in launching young friends and connections into the world (preparing them for examinations, advancing their outfits, providing their education), he was at the same time receiving expressions of gratitude for similar favours from men who were retiring or had retired from their professions at their term of service, and who did not hesitate to acknowledge that they owed their success in life to his timely assistance and his large-minded liberality."

It is only now, perhaps, that we begin to see in its proper proportions the work, pursued with a "headlong ardour," that Sir Charles Pasley did for the country and the Corps of Royal Engineers.

Footnotes.—Reference numbers against names up to 36, inclusive, refer to notes given in the December number of the R.E. Journal.

³⁷ Rice Jones, K.II. 2nd-Licut., 1.2.1806. Col., 9.11.46. Died at Gibraltar, 20.3.1854. War Services: Buenos Ayres, 1807; Peninsula, 1809–12. ³⁸ James Carmichael-Smyth, Bart., C.B., K.C.H. 2nd-Lieut., 13.3.1795. Maj.-Gen., 27.5.1825. Died at Georgetown, Guiana, 4.3.1838. War Services: Cape, 1805–6; Peninsula, 1808–9; Holland, 1813–15 (Waterloo); Netherlands and France, 1815-18.

³⁹ Stephen Remnant Chapman, C.B., K.C.H. 2nd-Lieut., R.A., 18.9.1793. R.E., I.1.94. Lieut.-Gen., 9.11.1846. Died at Taunton, 6.3.1851. War Services: W. Indies, 1796-7; Holland, 1799; Cape, 1800; Copenhagen, 1807; Peninsula, 1809-10.

⁴⁰ Thomas Blanshard, C.B. 2nd-Lieut., 28.9.1807. Maj.-Gen., 16.12.54. Died at Hampton, 19.6.1859. War Services: Peninsula, 1814; America, 1814; New

at Hampton, 19.0.1859. War Services: reminsula, 1814; America, 1814; France, 1815-17. ⁴¹ George Thomson, c.B. 2nd-Lieut., 1.9.1818. Lieut.-Col., 28.11.54. Died at Dublin, 10.2.1886. War Services: Burma, 1824-6; Afghanistan, 1838-9 (Bengal Engineers). ⁴² Henry Sandham, 2nd-Lieut., 20.7.1813. Lieut.-Gen., 3.8.66. Died in Lon-don, 6.11.1868. War Services: Netherlands and France, 1814-18. ⁴³ Henry Whatley Tyler, Kt. 2nd-Lieut., 19.12.1844. Capt., 2.12.57. Died in London, 30.1.1958. Removed to civil employment, 30.10.1866.

1861

APPENDIX III.

(Warrant approving of the Establishment for the Instruction of the officers and men.)

In the name and on the Behalf of His Majesty,

George P.R.

Whereas you have represented unto Us, that it would tend much to the advantage of Our Service if a general System were established for the Instruction of Our Corps of Royal Military Artificers, or Sappers and Miners, as well as the Junior Officers of Our Corps of Royal Engineers in the Duties of Sapping, Mining, and other Field works. We, in the Name and on the Behalf of His Majesty do hereby approve of the annexed Establishment which you have stated to be necessary for conducting the Business of the proposed Instruction, and do authorize you to fix upon such Stations as you may consider most advantageous for carrying on the extensive Practice there to be performed. Our further Will and Pleasure is, that you or Our Master General of Our Ordnance for the time being, do from Time to Time select from Our Corps of Royal Engineers, such Officers as from their Zeal and Abilities you may deem most competent to fill the Appointments of Director and Assistant Director, for the Purposes aforesaid; And whereas the Appointment and Duties of Director are of much Importance, requiring a considerable Portion of Ability and Exertion on the Part of the Officer who may be entrusted therewith ; We are moreover pleased, in order to give due Weight and Authority to such Officer, to grant to him the Rank of Major in Our Army from the Date of his Nomination, to that Trust, provided he shall not have previously attained the said Rank; And We do also direct that you do cause the Amount of the aforesaid Establishment together with the expence of Materials, Tools, and other Articles required for the Operations to be carried on, to be inserted in the Ordnance .Estimates, to be from time to time presented to Parliament; and for so doing, this shall be as well unto you as to the Commissioners for Auditing the Public Accounts of the United Kingdom, and to all other Our Officers and Ministers herein concerned a sufficient Warrant.

Given at Our Court at Carlton House, this Twenty-Third Day of April, 1812, in the Fifty-second Year of Our Reign.

Public Record Office. Ordnance Correspondence Miscellaneous. W.O. 44/83/730.

[END OF PART I.]

(To be continued.)

THE ORGANIZATION OF THE HIGHER COMMAND IN WAR.

Lecture by MAJOR-GENERAL SIR FREDERICK MAURICE, K.C.M.G., C.B., Professor of Military History at University of London, delivered at the S.M.E., Chatham, on Thursday, 13th November, 1930.

You are all aware that there has been a good deal of acrimonious criticism, not always confined to civilian circles, of those who held high command in all armies during the Great War. Mr. Winston Churchill, in those brilliantly written volumes of his, called The World Crisis, devotes some pages of that invective of which he is a master to the "bankruptcy of the art of war" and the "lack of vision and imagination" in generals. But no one, so far as I am aware, has devoted a corresponding amount of space to the lack of vision and imagination on the part of statesmen, and yet so far as my study of the history of the Great War goes, the difficulties of those who were placed in high military and naval command were enormously increased by the fact that statesmen in this country and in other countries had failed to envisage what was required of government in modern war. In speaking of the organization of the Higher Command this evening I propose to devote myself to that questionthe organization of the supreme directing authority of civil, military, naval and air power in war. I think it is important, because that aspect of the question has been a good deal neglected by those who have written criticisms of the conduct of the War, and the vital importance of many of the changes which have taken place in our organization since the War have consequently been overlooked. In order to make my point clear I propose to give you a brief sketch of the development of our pre-War organization of the Higher Command, to follow that with a further sketch of its development during the progress of the War, and to conclude with the position as it is to-dav.

Our pre-War organization upon anything that we may call a serious scale began in the latter period of the Victorian era, when the army was for a considerable time on the operating table. There was a series of enquiries and commissions into War Office and military organization, and out of these enquiries developed the consciousness that some organization was required for the general direction of the machinery. In 1895 on the initiative of Mr. Balfour, as he then was, the Defence Committee of the Cabinet was formed to arrange for the co-ordination of policy with strategy, and the co-ordination of naval and military plans for the defence of the Empire. That sounded an admirable scheme, but like a good many other admirable schemes it failed in practice. The Ministers who composed the Defence Committee of the Cabinet were concerned with day-to-day political problems; they never had any time to give to the consideration of questions which were not of immediate political importance. So far as I have been able to ascertain the Defence Committee of the Cabinet never met, but the fact that it existed led to a further step.

It was then seen that if a higher organization of this kind was to function it must have some permanent organization, so in 1904 the Committee of Imperial Defence was created. That happened at an epoch-making period in the development of modern history, for 1904 was also the year in which we formed the Entente with France, when we departed from our policy of splendid isolation, and came into the European arena. In the following year a General Election took place. Mr. Balfour's Administration fell, and was succeeded by that of Sir Henry Campbell-Bannerman. During that General Election, there arose the first of a series of international crises. The Algeciras crisis had brought about the possibility of our having to implement the Entente which in the year before we had formed with France, and the immediate consequence of that crisis was that, actually while the General Election was in progress and before the new Government had met Parliament, the military conversations with France, which had produced plans for the campaign of 1914, were authorized. Sir Henry Campbell-Bannerman's War Minister was Mr., afterwards Lord, Haldane, and he has left in his book, Before the War, a very interesting account of the inception of those conversations :---

"About the propriety of the conversations which took place between members of the General Staffs of France and England questions have been raised. But these conversations were concerned with purely technical matters, and doubts as to their justification will hardly arise in the minds of people who are aware what modern war implies in the way of preliminary inquiries as to its conditions.

"We were not engaging in any secret undertaking. We were merely providing what modern military requirements had rendered essential. Without study beforehand by a General Staff, military operations in these days are bound to fail. If at any time, we had, by any chance whatever, to operate in France, it was essential that our generals should possess long in advance the knowledge that was requisite, and this could only be obtained with the assistance of the General Staff of France itself. We committed ourselves to no undertaking of any kind, and it was from the first put in writing that we could not do so. The conversations were just the natural and informal outcome of our close friendship with France. The French had said that if it was to be regarded as even possible that we should come to their assistance in resisting an attack, which might, moreover, result if successful in great prejudice to our own security in the Channel, we should find this study vital. Our General Staff took the same view, and at the request of Sir Edward Grey, who had written to him, I saw Sir Henry Campbell-Bannerman at his house in London in January, 1906. He was a very cautious man, but he was also an old War Minister.

"He at once saw the point, and he gave me authority for directing the Staff at the War Office to take the necessary steps. He naturally laid down that the study proposed was to be carefully guarded, as far as any possible claim to commitment was concerned, that it was not to go beyond the limits of purely General Staff work, and further that it was not to be talked about."*

The remarkable thing about that passage was that it was published in 1920 by a man of Lord Haldane's outstanding ability—and I personally agree with Earl Haig in describing him as the greatest War Minister we have ever had—a man of his outstanding ability, writing after the war was over, could not see that there was nothing wrong in the British Empire preparing for war in that way.

Well, we went on with our conversations—purely military conversations, confined to the General Staff of the War Office arranging details with the General Staff in Paris, and a military plan was gradually worked out.

In 1911 came the second of the great international crises, the Agadir incident, which brought us even closer to war than had the Algeciras crisis. Mr. Churchill, in his World Crisis, gives us an extraordinarily interesting account in great detail of what happened at the Committee of Imperial Defence when the situation arising out of that crisis came under review. He describes how the Committee met in the morning under the presidency of the Prime Minister, how General Wilson, turning to an immense wall map of the North-Eastern frontiers of France and Belgium, demonstrated the manner in which in the opinion of the General Staff an invasion of France and Belgium by the Germans would take place. The only question on which there was any real doubt was as to the number of German corps who would come through Belgium, west of the Meuse, and the answer of the General Staff of the War Office to this German plan was to place our Expeditionary Force at the earliest moment on the left flank of the French. So much for the morning. Then came the afternoon session when the naval views were heard. Naval

* Haldane-Before the War, page 161.

plans and strategy were expounded by Admiral of the Fleet Sir Arthur Wilson. Mr. Churchill states that while Sir Arthur did not expose the naval plans in any detail he showed quite clearly that the Admiralty were not in agreement with the General Staff of the War Office. Their view was that we should use our amphibious power to wait until we saw the lines on which the German movement was to take, and then land our forces at what was the most telling strategic point. There was a clear difference of opinion, and Mr. Churchill tells us what happened immediately after the meeting. Mr. Haldane went to the Prime Minister and said that as long as this difference of opinion existed he could not remain Minister of War, and Mr. Haldane being a man, as I have said, of outstanding ability, and I have no doubt, of great weight in the cabinet of the day. carried his point. The consequence was that the First Lord was dismissed, or at any rate removed, and his place was taken by Mr. Winston Churchill, who commenced by sweeping clear the whole of the Naval Lords, and putting in an entirely new group, with instructions to do what the War Office told them.

I say to you quite seriously that is not the way for the British Empire to prepare for a great war. We found that this method of preparing a plan of campaign hampered us from the very outset of the War. We sent our Expeditionary Force to France, and it extended the left of the French Army. We knew extremely little about the French plan; we had in effect given the French a blank cheque. We placed behind them the resources of the British Empire and we had not considered what were our own requirements in return for the enormous support we were putting behind France. You find the result of that most graphically described in Corbett's first volume of The Naval History of the War. I fear that, even in these days, soldiers only read military history and sailors only read naval history. We do not half enough try to see the point of view of the other Service, and I shall be surprised if this passage is not new to the great majority of this audience. Corbett is describing the situation at the time of the Battle of Mons. That is, as you know, the time of our first contact with the Germans :---

"Next day (August 23) our army was violently attacked at Mons, and although in face of greatly superior force they valiantly held their position all day, by nightfall it became evident a retirement was inevitable. With equal violence the French had been attacked at Charleroi, as a result they were retreating to their own frontier, and in sympathy our force had to fall back with its right on the fortress of Maubeuge. So difficult was the operation that no one could tell how or where it would end, and our anxiety for Ostend spread to Boulogne and even to Havre.

"So imminent was the danger to both those ports that the Admiralty began to make arrangements for withdrawing from them all

[MARCH

stores not immediately required by our army. The intention was to transfer them to Cherbourg, and before noon on the 24th word went out that no transport was to sail for Boulogne or Havre till further orders. Cherbourg was the new base favoured by the War Office in view of the case with which the Cotintin peninsula could be made an impregnable place of arms as long as we held command of the Channel. But for a really effective command of the Channel it was highly important that the Flemish ports should not pass into the hands of the enemy. The Admiralty, therefore, while pushing on all preparations for the transference of the base, were in no mind to abandon the more easterly Channel harbours without an effort to save them. Whether the army required them or not, their naval value was permanent and indisputable. Representations were therefore made to the French Admiralty as to the importance which, for naval reasons, we attached to defending Dunkirk, Calais and Boulogne as long as possible. For this object our Admiralty expressed their willingness to release Admiral Rodgers' squadron from the Western Patrol and to support him with a battle squadron. Dover was also offered as a base for the Calais and Boulogne flotillas, and transport was ready to bring their stores across.

"They further joined with the War Office in asking for particulars of the land defences at Dunkirk, Calais, Boulogne and Havre and also as to the permanent defence of the Cotintin Peninsula. At the same time Admiral Jellicoe was informed of the serious consequences which seemed to be developing out of the Battle of Mons, and warned to consider a new position for the Grand Fleet should the Germans get control of Calais and the adjacent French coast—that is in fact if they succeeded in breaking into the Dover Defile.

"Here then, as the direct result of a military reverse, we were faced with a by no means remote prospect of the fundamental redistribution of our Fleet no longer sufficing for the exigencies of the War."*

I suggest that that is a passage which should make us think. We had reached Mons and our line of communication ran thence to Havre. Apparently we had to trust to the French to protect that line of communication. We assumed, apparently, that they would regard Calais, Boulogne, and so on, as of special importance to them, and that we need not make special enquiries into the arrangements for their defence. That was an obvious military omission, but still, apparently, it was so. The French views as to the German forces were different from ours. They did not believe that the Germans could bring a large force west of the Meuse, they did not believe that these places were in any danger, and consequently took no adequate steps to protect them. The lines of communication to these ports

* Corbett-Naval History of the Great War, Vol. I, page 93.

1931.] ORGANIZATION OF HIGHER COMMAND IN WAR.

were not only of great importance to our army but the ports themselves were of vital importance to the Navy. Apparently that question had never been considered before war came, and I suggest that in 1906, instead of placing our conversations with France in the hands of the General Staff of the War Office they ought to have been placed in the hands of a body capable of co-ordinating political, naval and military plans. The Admiralty would then have had an opportunity of correcting any omission which the General Staff might have made on this question of security, but as it was the Admiralty had very little cognizance of the details of the military plans, and were not encouraged by the result of the 1911 meeting to make suggestions as to alternatives to these plans, and consequently both services suffered. We had our communications practically cut at the very outset, and the Admiralty had to consider the very grave possibility of having German flotillas in the Channel ports. We were eventually able to get round to Ypres before the Germans could get there, but that does not excuse the very serious omission in the preparation of our original plans. I trace that omission back to the fact that we had not yet got a proper organization for the preparation of plans for the British Empire for war ; we had an excellent organization for purely military and also for purely naval plans, but we had not yet got a proper organization for preparing Imperial plans. The more you study the early years of the War, the more you find how much we were hampered by the fact that we had gone to the French with a purely military plan. I had a good deal to do in the early years of the War with officers in High Command in France, and I never came across one who had even as much elementary sea sense as I had. That side of the problem simply did not concern them. They regarded the Navy as useful in controlling the seas, but were sceptical of its power to make a useful contribution to the problem of beating the Germans. The result was that when it came to 1915, when the deadlock arose from the North Sea down to Switzerland, and a number of questions, as to how our power could best be applied, came up for consideration, the French measured our efforts in the War not by our Imperial contribution but by the strength of the military forces which we had then in France, and our influence on their plans were pro rata. You will find an interesting letter from Lord Kitchener to Sir John French in which he stated the position in the beginning of 1915. The letter is dated January 2nd, 1915 :--

"There does not appear to be much sign of the contemplated push thro' on the part of the French Army. Probably they find themselves up against the same problem all along the front as you do in your part, viz., trenches that render an attack only a waste of men for a few yards gained of quite worthless ground. The feeling here is gaining ground that, although it is essential to defend the line we hold, troops over and above what is necessary for that service would
[MARCH

be better employed elsewhere. I suppose we must now recognize that the French Army cannot make a sufficient break through the German lines of defence to cause a complete change of the situation and bring about the retreat of the German forces from Northern Belgium. If that is so, then the German lines in France may be looked on as a fortress that cannot be carried by assault, and also cannot be completely invested, with the result that the lines can only be held by an investing force, while operations proceed elsewhere.

"The question of where anything effective can be accomplished opens a large field, and requires a good deal of study. What are the views of your Staff?"*

Our Government was, you see, considering a change in its policy for the conduct of the War, and out of that change arose the Dardanelles campaign. I do not propose to go into the lack of coordination of naval and military plans in the preparations for that campaign. That must be obvious to you. The point that I want to make is that, owing to the manner in which our original plans were made, we could not influence French opinion sufficiently to get an agreed allied plan. While we were trying to obtain decisive results in the Dardanelles, Joffre was trying to obtain decisive results on the Western Front. We had very strenuous opposition on the part of Joffre to the Dardanelles enterprise, and a "pull devil, pull baker" business went on between the two fronts. I was at G.H.Q. from March, 1915, until the end of that year, and I can assure you that, with the solitary exception of Neuve Chappelle, we did not fight a single battle on the Western Front on our own initiative or as we wanted. We did not wish to fight Festubert, Lord French did it entirely upon pressure put upon him by Foch, and because of his desire to co-operate loyally with our Allies. In the case of Loos, in spite of pressure put upon them by Foch and Joffre, Lord French and Lord Haig both strongly protested, but their protests were overruled by the British Government, who directed them to comply with the French plan. In the majority of the criticisms which I have seen of our generals in France, the writers nearly always write as if our commanders had been independent agents, but it was not until the spring of 1917 that any British military commander in France formed a plan on his own initiative, with the exception, as I said, of Neuve Chappelle.

So much as to our pre-War arrangements, and the effect upon our strategy of not having perfected them in time. Let me give you now a brief sketch of what happened during the War. We began by trying to govern this country in war as we did in peace, by a Cabinet consisting of a number of distinguished statesmen, each of them with a corporate and individual responsibility to the country. That

* Arthur-Life of Lord Kitchener, Vol. III, page 85.

1931. ORGANIZATION OF HIGHER COMMAND IN WAR.

system works perfectly well in time of peace, but it is a necessary consequence of it that any Cabinet Minister has the right to express his views upon any question that comes before the Cabinet. We attempted to carry that out in war, and you get an extraordinarily graphic account of the consequences in Sir William Robertson's Soldiers and Statesmen. He describes how in January, 1915, this question of the deadlock on the Western Front came up, and of the best methods of applying our power. A whole crop of plans streamed into the Cabinet. It began with the plan of campaign prepared by the Secretary of the Committee of Imperial Defence, with the idea of isolating Turkey. Three days later there was a memorandum from the Chancellor of the Exchequer proposing that the entire Expeditionary Force, with the exception of a reserve to be kept at Boulogne, should be sent to the Balkans. There were proposals from the Commander-in-Chief in France for combined naval and military operations on the Belgian coast, and there was a plan for combined operations in Schleswig-Holstein, and there were other proposals.

"Over and above this bewildering shower of proposals and projects, emanating respectively from the First Lord of the Admiralty, the Secretary of the War Council, the Chancellor of the Exchequer, the French Commander-in-Chief, the British Commander-in-Chief, and the First Sea Lord, the Government of India, under the auspices of the Secretary of State for India, had commenced operations at the head of the Persian Gulf, and their extension up to Baghdad, some 500 miles from the Gulf, was already mooted.

"These vital policies and plans, uncontrolled by any master hand, and never discussed by the War Council in terms of available means, continued to jostle each other in the Council's deliberations until matters came to a head on January 2nd."*

Gradually we evolved a better system. We created a small War Cabinet consisting of Ministers without portfolio. That was an immense improvement, but even its operations were very slow in taking effect. There still remained for a good long time the practice of separate departments of the State being responsible for military and naval operations. For example, until 1916 the Foreign Office was responsible for the Sudan and the western frontier of Egypt, the Colonial Office was responsible for the Cameroons, and the India Office was responsible for Mesopotamia. Finally, all these campaigns got into difficulties, and were then handed over to the War Office. But gradually towards the end of the War we did get a fairly good working system. The Chief of the Imperial General Staff became the responsible military adviser of the Government. He was given power to put the instructions of the Government into the form of executive orders to the Commanders-in-Chief in the field, and that

^{*} Robertson-Soldiers and Statesmen, Vol. I, page 84.

was a very great advance, but still there was a great deal capable of improvement. The positions of the First Sea Lord, the Chief of the Imperial General Staff and other officials responsible to the Government, had not been properly thought out, and there was a good deal of waste of time and energy in these high offices in consequence. Further, the time of the War Cabinet was not always perfectly organized for the conduct of war. Here is one small personal example. One day when the Chief of the General Staff had to be in France, a telegram came in from Maude in Mesopotamia requiring modification of instructions he had received from the Government. I went down to represent Sir William Robertson at the War Cabinet, and found a number of people in the room. The Cabinet was receiving the Archbishop of Canterbury and other high functionaries, trustees of the British Museum. The treasures of the British Museum are, as you know, priceless, and they were being endangered by air raids. The trustees were anxious to get from the Government a statement as to how these invaluable national treasures were to be protected. The discussion lasted some time, and I did not get my answer to a question concerning an important campaign until it was finished. That shows there was some possibility of improvement even in our later development of machinery for the supreme direction of the War, for it can hardly be right that the same body should be concerned with the conduct of the War and the protection of the British Museum.

I come now to the system as it is to-day. That dates from the report of the Salisbury Committee of 1924, which marks, to my mind, the greatest step forward in organization ever made in our military history, for the Salisbury Committee established a sub-committee of the three Chiefs of Staff as a permanent sub-organization of the committee. They called this sub-committee " a Super Chief of the General Staff in Commission." It implies that it is the responsibility of this committee of high officials to give corporate advice to the Government, and assures us that plans will not be made in future from a purely military, naval, or air point of view, but that the necessary technical reactions of each service on the other will be thought out before presentation to His Majesty's Government. That is a development of the highest importance. We have gone on developing the organization of the Committee of Imperial Defence in accordance with the experience we have gained from the War, and, in addition to that sub-committee of the heads of the Services, we have a sub-committee of the principal supply officers, who review the resources and requirements of the Empire in war. We have, further, a sub-committee on man-power which reviews the resources and requirements of man-power. Think what it would have meant if we had had this organization in existence in 1914. We have got as an adjunct of the sub-committee of the three Chiefs of Staff a

planning committee, in which each of the three Services is represented, and of that committee one of the secretaries of the Committee of Imperial Defence is secretary. We have now got a definite plan for the mobilization of the Government in war. That plan is submitted to each Prime Minister on taking office, and he puts his signature upon it as a proof that it is the policy of his Government, for governments require mobilization just as much as armies, navies, and air forces. There must be a very vital difference between the functions of Secretaries of State in peace and in war. In peace, it is essential that the political head of a service should be responsible to Parliament for all that goes on in that service, but in war, you require quite a different responsibility from him. If you have a sub-committee of the three Chiefs of Staff directly responsible to the War Cabinet, then quite clearly, the Secretary of State for War has no responsibility for war plans at all. A new "order in Council" is required, defining the changes in his functions on mobilization, and that is an example of the changes necessary to convert the peace system of government to one suitable for war. It is the function, now recognized, of the three Chiefs of Staff to translate decisions of the Cabinet into the necessary orders and instructions for their respective Services, and that is enormously to the good. But the vast importance of all this work which is quietly going on is unfortunately not realized, even in places where soldiers congregate. It is. I think, an unfortunate necessity that a great deal of what is being done is being kept secret. There is, in fact, so far as I can see, no necessity from a military point of view for keeping secret the plans for the mobilization of the Government, that is to say, how the Government is to be organized in war. This information is of no military advantage to the enemy. It is more likely that such difficulties as might arise would be eliminated, and better means introduced, if the plan were known. The real reason why it is kept secret is, I feel, not from fear of disclosing anything which might be of advantage to a possible enemy, but because any Government to-day is afraid of recognizing the fact that preparation for war is a necessity. That is a thing for which the state of mind of the British public is mainly responsible. It is generally recognized, to-day, that the importance in any main struggle of the mobilization of industry is hardly less than that of the mobilization of our fighting services. The United States of America and Japan have carried out experimental mobilizations of industry, but no British Government has dared even to suggest such a measure. Still, we have made these enormous steps forward in our organization, but we must not presume to have reached perfection. I hope I have said sufficient to show you, if it needed showing, the vital importance of having an arranged, well thought out organization for the supreme conduct of war, and to show you that in the absence of such well thought out organization

[MARCH

the tasks of admirals and generals are made enormously more difficult. Clearly there are still very important problems for us of the British Empire to think out. The question of the representation of the Dominions upon the Committee of Imperial Defence is a very difficult and complex problem from a political point of view, but its importance from the military point of view needs no emphasis. Then we have the still more complex and difficult problem of India. There you have got a semi-independent Government with an army and a Commander-in-Chief not under the control of the War Office. I say semi-independent, because the system is made more complicated by reason of the fact that India is governed and controlled to a great extent by a separate department of State in Whitehall, and that department of State has a small military staff of its own. It is by no means beyond the bounds of probability that we may be involved in a major operation of war on the frontier of India. If that is to happen, how is it to be directed ? That is one of the kind of problems which the British Empire has to face, and which no other country in the world has to face. We have, as the Great War showed, vast resources and powers such as no other nation possesses, but the problem of using those powers in the right way is for us more difficult than for anybody else. For that reason, the careful thinking out of this problem of the higher conduct of war is of supreme importance to us. If anything that I have been able to say this evening has convinced you of that fact I shall be amply rewarded.

REINFORCED CONCRETE ROAD DESIGN.

By Captain A. Minnis, R.E.

INTRODUCTORY.

IN an article published in the R.E. Journal of June, 1930, the present writer made somewhat free criticisms of the stereotyped design most usually adopted in reinforced concrete road construction. The present article is written with the object of following criticism which was largely destructive by, it is hoped, constructive suggestion.

The first article was not written simply to cry down what has been done up to date. There has been an immense amount of care and thought bestowed upon R.C. roadmaking, and if it has not always been well directed, it has at worst given knowledge from experience, and at best has succeeded in producing the best of our roads.

The present generally accepted idea of a reinforced concrete road is one consisting of a series of independent slabs, making a complete road in a single thickness. This idea has become so firmly established that the slab road will, without any doubt, continue to be made for many years to come. For this reason only, the writer proposes to discuss at some length the main considerations to be taken into account in the design of single-thickness slab roads; but it is his opinion that the type is already obsolescent.

Because of this opinion, the present article is divided into three distinct parts; the first dealing with slab roads, and the second with future design. Matters of common application to all kinds of concrete roads make up a separate final section.

As first written, the article went into details of several methods of dealing with each of the points raised, but it was found to be much too long and too expensive in reproduction of illustrations. As now presented, it deals only with the main considerations leading up to what the writer considers to be the best solution of the difficulties in design of each feature, and gives, usually, only that one answer.

PART I.—SLAB ROADS.

Size of Slab.

All single-thickness R.C. roads, whether intentionally or not, are laid in slabs of limited length. Even where so-called continuous work is adopted there are quite definite breaks where the work has

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stopped for meals, darkness, rain, delays in delivery of materials, or breakdown of plant.

Apart, therefore, from the considerations discussed in the June article, it is as well to adopt construction by slabs of definitely limited length and width at once, because joints will be forced on us whether we like it or not. In any case, the joints will be a source of trouble and weakness, so we may as well know where they are and take steps to overcome their inherent defects.

Slabs have been laid in lengths varying from 10' to 60', and although in some cases different conditions have caused apparently contradictory results, the writer has come to the fairly firm conclusion that the ideal length is between 25' and 30'.

Slabs of 30' and upwards in length have the advantage of reducing the number of joints and speeding up work, but have the grave disadvantage that cracks due to setting shrinkage are apt to be very wide and in some cases may go the whole way through the slab, thus breaking it unintentionally into two or more slabs with ugly, irregular, and unstrengthened joints.

Very short slabs, on the other hand, whilst not suffering from shrinkage cracks so much, cause a great many joints in the road.

Except on a bed allowing exceptionally free movement during the critical time when the green concrete is trying to pull in its extremities, slabs should be limited to the maximum of 30' and are better if made shorter. Similar arguments apply to the width of the slab. If a road exceeds 25' and is under 45' in width it should have a central longitudinal joint, and if over 45' should have two or more, according to its width. In many cases the necessity of keeping one side of the road open for traffic during reconstruction will automatically cause the use of a longitudinal joint, even in narrow roads.

Thickness of Slab.

The thickness of the slab should be decided upon after consideration of the duty the road will be called upon to perform, and the peculiarities of the foundation.

There will obviously be a great difference between the cases of a road over hard rock (where only a carpet of plain concrete is required to give a running surface), and of another over a bog (where a structure more ambitious in design than can truly be called a road in the ordinary sense of the word will be necessary).

All that is attempted in this article is to indicate a type of construction which will give a sound road over "average" soil; that is to say, over soil which varies in carrying capacity, but at its worst places will support a load of half a ton per square foot and at its best will take two tons or so.

It may happen that very soft places, such as an old, filled-in ditch, may occur, and that other places—e.g., a rock outcrop—will be

30

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1931.]

extremely hard. When such things are met with they will upset any design which attempts to use slabs of uniform strength throughout, and for good progress such a design is desirable. Special measures will be necessary to convert such places to a consistency in keeping with the normal run of the foundation soil.

Assuming that such preparatory work has been done, and that we have a soil which is reasonably even in quality, it is only necessary to design a slab which is sufficiently strong to carry traffic over places where support is not so good as elsewhere, without breaking.

Stated like that, the problem sounds easy; it is only when one sets about the task that its difficulties show themselves.

Whilst in principle the same, it differs from the design of a floor slab in a building or bridge deck, where the conditions of loading, span and arbitrary stress allowances can be defined closely.

In the case of a road slab, the only condition that can be stated with fair accuracy is that of loading; and even in this matter an arbitrary allowance, which may easily be very wide of the mark, must be made for "impact."

Then we come to the question of span, and ask ourselves :----

How wide and how long will any soft spot be?

- Must we assume that the soft spot is capable of giving some support, or none at all ?
- What help can be expected from adjoining parts of the slab to the place actually under load? (This immediately brings up the question of the shape, in plan, of the soft place, and we must work also on some assumption about the sharpness of definition of its edges, because obviously the amount of contraflexure will vary with the relative rigidities of the firm and soft places, and varieties in the effective spans over the soft places will follow.)

The only honest answer to the questions raised here is—" We don't know."

We have not yet finished with the uncertainties.

In reinforced concrete design of the normal kind, it is possible to calculate with reasonable accuracy the moment of resistance of any given part of a structure for definite stresses in the concrete and the steel, the only uncertain factor being the modular ratio.

But the case of a road slab is different, in that the consequences of failure being so much less serious than in other work, we are not concerned with any safety factor, but only with the breaking stresses, or, more properly, with the elastic limits of the materials.

When concrete is mixed under ordinary working conditions, samples taken from the same batch will show variations in breaking stress, and samples from different batches going into the same slab may show ultimate resistances to compression varying between 2,000 and 4,000 lb. per square inch or more. As to hazarding a guess at what the modulus of elasticity of any part of the set concrete may be, imagination boggles.

Seeing that only one of the many factors of the problem can be estimated with any approach to reality, and that all the others must be vaguely assumed, any attempt to determine the thickness of the slab by calculation is bound to be rather like trying to make ropes of sand. Optimism in making the necessary assumptions might result in failure, but the likelier course would probably be to err towards pessimism, and an unnecessarily expensive road would result. And if, "by a set of curious chances," all the assumptions were truly made, no one would ever know that the perfect design, without waste, had been made.

A dependable answer being unlikely to result from calculation based on the vague data available, use must be made of knowledge gained from observation of roads already in use.

Design will then be a matter of provision against the weaknesses that show themselves and against other likely troubles which reason suggests may be met with. Experience shows that the minimum thickness necessary if a slab is to stand up against average traffic for a reasonable length of time is six inches, but that eight inches is a better working thickness where all kinds of traffic have to be carried.

Some engineers prefer a thicker slab, and, of course, greater strength will naturally follow an increase in depth; but it is a very wasteful method to pursue if carried to its logical conclusion.

The writer has never seen or heard of any actual failure due to flexure where the concrete and the steel have been subjected only to the stresses (compressive and tensile respectively), which they are supposed to deal with; though he knows a few cases where subsidence has caused deflections of the order of three inches on spans of twenty fect. (These cases are of great interest, showing how "plastic yield" can allow such excessive deflection to occur without any sign of damage to the concrete.)

The failure which shows itself most plainly is that due to contraflexure (of a slab reinforced singly near the bottom), when there is no steel to take up the tensile stress at the upper surface.

If such trouble is to be avoided merely by thickening the slab until its depth is sufficient to enable the concrete to take up probable tensile stress at the upper surface, a very expensive road will result ; the obvious course seems to be to provide steel near both surfaces and in both directions, so that flexure and contraflexure, either longitudinally or transversely, are provided for. The ideal slab is one that will stand up to both tension and compression wherever applied. For this duty it should be equally reinforced top and bottom, and it will be amply strong if it is eight inches thick over all, with an effective depth either way of a little over six inches.

1931.] REINFORCED CONCRETE ROAD DESIGN.

Amount and Quality of Reinforcing Steel.

Adopting an 8'' slab, with steel set at 2'' from top and bottom, it remains to decide on the amount of steel which is required to give the section its maximum strength.

Here a few remarks on the use of high tensile steels will not be out of place. The practice of allowing a reduction of $33\frac{1}{3}$ per cent. of the specified area of reinforcement if high tensile steel is used is still quite common. Had such high tensile steel a correspondingly higher modulus of elasticity (compared with the mild steel normally used for structural purposes), such a reduction would be a reasonable practice to adopt, but that is not the case.

It should be borne in mind that the higher the stress in the steel the smaller the area of concrete in compression, and that, therefore, there is no object in using steel with a yield point higher than that of mild steel, where its greater strength cannot be used without overstressing the concrete.

There is nothing wrong in using high tensile steel so long as it is understood that it cannot, as a rule, be stressed higher than can mild steel, and that usually the same area will be required in both cases.

Various opinions have been expressed on this question of the amount of steel required in R.C. road slabs, and at least two of them are worth mention in order to show how the matter is viewed by others. One says that, as the concrete on the "tension" side of a doubly reinforced slab will fail in tension when the unit tensile stress in the steel exceeds the breaking (tensile) stress in the concrete \times the modular ratio; and as it is essential to prevent cracking at all, therefore sufficient steel should be provided to keep the unit stress in the steel below about three tons per square inch.

The second says that, as shrinkage cracks will occur in any case, a slab strip may be regarded as a number of separate blocks of concrete with steel running through them (somewhat like a very closely packed string of beads). Following up this conception, he makes the proposal that the only stress which the steel is called upon to withstand is that due to vertical shear, and that the amount required should be calculated upon the shear force due to a given wheel load. The present writer cannot see that a road slab differs in principle from a slab in any other situation, and therefore discards both these opinions.

As regards this first opinion, reasonable as it is, it takes no account of the fact that shrinkage cracks at the surfaces will happen anyway, and that they will be very much wider than any which are likely to occur due to tensile stress on a surface close to steel reinforcement.

The second opinion is based on the very large assumption that there will be a great many shrinkage cracks, all so severe in extent as to cause complete severance of the slab into separate small blocks,

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whereas it is very unlikely that many cracks will continue from top to bottom.

It seems to the writer, that, having decided on the thickness of the slab, all that is necessary is to put in the amount of steel required to make a composite unit which is sufficiently provided against tensile, compressive, and shear stresses.

An 8" slab, with steel 2" from each surface, should, strictly speaking, be considered to be doubly reinforced; but, as the steel on the compression side will be very close to the neutral plane, it may be ignored because it will not be possible to stress it to any useful extent without overstressing the concrete. In effect, therefore, the slab is singly reinforced; the steel near the upper surface being idle when the slab is subjected to sagging flexure, and taking tensile stress when the slab is hogged; the steel near the lower surface then being idle.

The usual allowance of steel in singly-reinforced roadwork is about 0.2 per cent., provided, as a rule, in the form of a mesh made up of four five-gauge wires. It is the writer's opinion that this allowance is much too little; and that it is the result of mistaken, but excusable, attempts to make R.C. roads at costs competitive under all conditions with other methods of road construction.

The breaking strength and the modulus of elasticity of concrete mixed and laid under the varying conditions of roadmaking vary between very wide limits; and it is possible to make various, but all quite reasonable, assumptions about them from which theoretical steel areas varying between 1.0 per cent. and 2.5 per cent. can be calculated.

Calculations giving these fantastic results are obviously valueless, except that they have the negative merit of showing that the normal allowance is absurdly low.

The writer is reluctant to give any hard and fast figure for the percentage area of steel required, knowing quite well that any figure can be shown by examples from different situations in practice to be too high and too low.

It is possible, however, to lay down reasonable limits between which the man on the spot can vary his steel according to variations of the soil between "good average" and "bad average" without straying into weakness or extravagance. These limits the writer would set at 0.5 per cent. and 1.0 per cent.

Anything less than 0.4 per cent. is not good enough if any reinforcement is considered necessary, and 0.8 per cent. is about as much as can justifiably be used in an 8" slab. If the soil is such that more than this is considered desirable, it is time to consider whether it would not be more economical to make the slab thicker.

The minimum allowance for ordinary work (0.5 per cent.) makes use of $\frac{5}{6}$ " bars at 10" centres in both directions; and, of course, at top and bottom of the slab. This wide spacing has the advantage of keeping down the number of crossings to be bound, and of giving stiffness by using stiff bars.

Shear Reinforcement.

It seems reasonable to suppose that the heaviest loads will be carried on the largest tyres, so that the area of tread in contact with the road surface in the case of a 15-ton axle load will be such as to distribute the 11-ton (allowing 50 per cent. impact) wheel load over a circle at least a foot in diameter in the interior of the slab.

Such a load, thus distributed, would cause a shear stress intensity at the neutral plane of about 120 lb. per square inch. Although this figure is higher than the usual working shear stress allowed in concrete, it does not call for any steel to be provided in ordinary circumstances. If, for any special job, it is considered that shear reinforcement is desirable it must be borne in mind that, as no one can predict in what direction the tensile component of the shear stress will operate at any given place, inclined stirrups, if used, must incline alternately in opposite directions. Except when using one of the proprietory systems of reinforcement, which may be obtained complete with shear reinforcement, it is both safer and easier to use vertical shear rods, which can easily be placed by simply sticking them into the soft concrete when about half the depth has been poured.

Joints.

The necessity for giving special attention to the design of the joints between adjacent slabs is now fully recognized by all engineers interested in R.C. road design. It is no exaggeration to say that at least 80 per cent. of the cracks which appear in a R.C. road are to be found near to the joints, and principally near to corners.

Out of 73 serious cracks counted recently by the writer in a little over half a mile of an arterial road completed within the last two years, 59 were within four feet of the ends of slabs 40' in length, and of these 48 were across slab corners.

A report (published in the *Engineer* of 1st August, 1930), by the Ministry of Transport on an 8" singly-reinforced concrete road, covered with 2" of stone-filled asphalt, contains the statement that 509 serious defects in the carpet showed themselves in a 3-mile stretch on 11th March, and that by the 2nd July the number had risen to 635; all the defects coinciding with joints between the R.C. slabs. This report, of course, does not mention what fractures have occurred in the slabs themselves; they are not visible. But it shows that movement occurs at the joints which is sufficient to cause the asphalt carpet, flexible and ductile as it is, to tear. The extent of the relative movement of adjacent slab ends when a load crosses the joint is always enough to be distinctly felt if one stands with one's foot on the joint, and sometimes it is so pronounced as to be easily visible.

Such movement cannot take place without contraflexure on both slab ends, nor without hammer blows on the forward slab. And cracks which develop near joints are more usual on the forward slab, as might be expected.

Various attempts have been made to deal with this trouble.

The first was to continue the steel from one slab into holes in the next, which gave sliding joints to allow for expansion and contraction. It was not a success, due to the steel failing by rust, or fatigue, or both; and sometimes due to the failure of the concrete in bearing.

Another idea was to use reinforced concrete beams, under the joint, wide enough to give a bearing to both slab ends. This is now discredited, because failures due to rocking of the beam have usually followed; but the writer considers that this method has never been given a fair trial. The beams used have always been much too narrow and usually not deep enough to give them reasonable stability; and (so far as the writer knows) the obvious expedient of preventing rocking by connection with longitudinal beams has never been tried.

The use of such sill beams will, however, always suffer from the defect that they are liable to be pressed down, and so leave the slabs' ends unsupported, or remain "proud" after foundation soil under the slab has sunk, thus depriving the slab of any support except at its edges. Even so, the writer thinks that a road consisting of slabs laid with their edges resting on a grid of longitudinal and transverse beams, all sides being supported by (but not attached to) such a grid, would be a very good road.

Precautions against creep and warping would be required, but would be very simple; being fulfilled by placing occasional slabs in a sunk rebate on the beams; and by strengthening ribs respectively.

Opinions now seem to be converging to agreement that the solution lies in some form of interlocking joint, capable of making the slabs mutually supporting, and of making both slab ends to deflect together.

Design of an Interlocking Joint.

The first idea which enters the mind of anyone attempting the design of such a joint is that it should be similar to the edge joints of tongued and grooved boarding.

The difficulty then presents itself that such a joint in a depth of 8" would be very weak, only a $2\frac{1}{2}$ " tongue within two $2\frac{1}{2}$ " jaws being





Plate 1.

37

possible, and when all possible tapering has been done (see Fig. 1) the joint is still not good enough.

The writer's solution of this difficulty is shown in section in Fig. 2.

One slab is thickened at its edge to allow for a stout tongue and jaws, tapered to give them the greatest practical thickness at their inner ends, where the stress will be greatest. (Incidentally, the tapers make removal of shuttering easy.)

The slab reinforcement is bent suitably to conform with the tongue and jaws, so as to provide against tensile and shear stresses due to alternations of loading. Further remarks on the functioning of the joint should be unnecessary, the drawing being self-explanatory; but some comments on its design appear to be called for.

Let it be admitted at once that it is clumsy when compared with the extremely neat joint patented by the Walker-Weston Company, and illustrated in Fig. 3.

The thickening of the slab and the labour in bending the reinforcement make the joint expensive. Shuttering is not difficult, all that is required being a board with suitably shaped blocks attached, to form the jaws at one end and the tongue at the other end of the slab. The ends of slabs already set then form the mould for the intermediate slabs, after being painted with grease or soft soap or anything else which will prevent adhesion of the new concrete to the old.

Whilst admitting the clumsiness and expense caused by the thickening of the slab edges, there are three strong reasons for this thickening, quite apart from the formation of the joint itself.

The first is that such thickening is required to give strength to the edges, and especially to the parts most liable to damage—the corners, which receive support from the converging longitudinal and transverse edge beams of their own or adjacent slabs.

The second, which will be dealt with more fully later, is that edges so strengthened are less liable to curl up due to warping of the slab.

The third is that the thickening of two edges, making projections below the underside, makes the slab much less liable to move from its place in the road than is a perfectly flat underside. The lack of anchorage of slabs of normal construction (*i.e.*, equal thickness throughout with a flat bottom) is one of the most fruitful causes of subsequent trouble.

It will be noticed that only two edges of each slab are deepened. The chief reason for this is that it is necessary to leave the two opposite edges flush with the bottom of the slab in order that shrinking of the setting concrete shall not be impeded. If opposite edges were both deepened they would anchor the slab in such a way that shrinkage movement would be forced to be towards the edges and away from the centre; so that a severe shrinkage crack at the centre would be liable to result.

Provision against Warping.

Since the publication of the writer's previous article, ample confirmation of his surmise as to the likelihood of warping being a principal cause of waviness has been given to him by engineers who have noticed, or read of, cases of this defect in ordinary slab road construction.

A committee (working under the U.S. Government) on road research in America reports that considerable changes in the surface contours of road slabs take place under varying conditions of sun, wind and wet weather.

The Ministry of Transport report already referred to (on the subject of joints) also remarks: "It has been definitely established that slabs of concrete curl up and down with changes of temperature, and that, therefore, the edges tend at some periods to lose contact with the subsoil and become unsupported."

After giving a good deal of consideration to all the information received on this matter, the writer is of the opinion that his original guess was correct, for England in normal summer weather; but that for the United States or other countries where prolonged hot sunshine is experienced, and even in England during a very dry summer, something more than warping takes place.

It would appear that a slab, which is perfectly flat at sunrise and damp with night dew, behaves as follows between sunrise and nighttime when subjected to day-long exposure to a hot sun.

During the first few hours, the moisture on the upper surface dries off, and as drying continues below the top skin, shrinkage of the upper surface takes place and warping occurs.

Later, as the temperature rises, the now dry upper surface expands, and the slab first straightens out, and then begins to rise in the centre, becoming definitely hog-backed due to the difference in temperature between the top and bottom causing the upper surface to overtake and pass the unshrunken, moist, undersurface. During night-time, the whole process is reversed.

Now, this recurring change between concavity and convexity, whilst doing no harm to the slab if nothing else interferes, is obviously a source of trouble when traffic is considered. Apart from the effect of waviness on motor vehicles, the impact of heavy traffic on a slab which may have no support at its edges at one time, and none at its centre at another, is bound, sooner or later, to cause damage.

In joinery work, where it is desired to maintain a flat surface on a wooden article (e.g., a drawing board), it is usual to secure it firmly

to battens; thus, in effect, increasing its depth and, therefore, its resistance to bending.

It appears reasonable to suppose that similar treatment will serve in the case of reinforced concrete road slabs. The addition of rib beams to the underside of the slab, the whole being poured at the same time, would serve the same purpose as the battens underneath the drawing board.

The joint design suggested in Fig. 2 would, if suitably reinforced, provide such beams to the edges; and probably this provision would suffice to prevent warping under English conditions, though a great improvement, at some little additional expense, would be made by using the extra depth given by the kerb, if it were run at the same time as the slab (see Fig. 7). When use of the kerb to thicken the slab on one edge, as well as deepening of two other edges in the joint construction is made, each slab will be stiffened on three edges, and its fourth will be held by the jaws of the adjacent slab. Each slab is thus provided with stiffened edges all round, without interference with shrinkage and other movement.

Anchorage,

One of the principle causes of trouble in jointed slab roads is the creeping together of slabs, especially on long slopes, whereby the easement spaces between slabs are closed up. "Creep," which is well known in railway practice, is one of the contributary causes referred to in the writer's previous article, without which, it was stated, trouble due to expansion was not to be feared. Slabs subject to vibration caused by traffic, changes in length from various causes, and changes in shape due to warping, are always "alive."

But so long as they are kept from separating too much, or from bunching together, no ill effects need be expected.

It is essential, then, having designed a slab capable of resisting every kind of stress and change, to make sure that it " stays put."

Here again the thickened edges of the slab shown in Figs. 4a and 4b have their use.

A slab shaped like this on its underside is obviously less likely to leave home than a flat-bottomed one.

PART II.-R.C. ROAD DESIGN IN THE FUTURE.

Although the writer believes that a road constructed in the manner described in the foregoing pages would be capable of fulfilling the requirements of a first-class road for many years, without any appreciable deterioration of the running surface, and with a negligible cost of maintenance, he does not consider that future design will follow this practice of laying R.C. roads in slabs. No one who has taken any considerable trouble to learn what has been done in R.C. slab road design before he has worked out his own solution, will view his child with complete complacency.

A very brief "medical history" of concrete roadmaking, showing the chief defects which have appeared and the steps taken to cure them (not always effective, because diagnosis has not been infallible) makes chastening reading for the cocksure. It is one long story of attempts to cure unforeseen troubles, a new disease developing for each one treated.

The first concrete road was continuous mass work. It cracked badly. "Expansion" was diagnosed, and intentional joints, with "expansion" spaces introduced.

Cracks still occurred. Reinforcement was now tried, not very intelligently, near the bottom of the concrete; and a reversion to continuous work was made in some cases. As cracks continued, the old "expansion" bogey again reared its head, and was again dealt with by wide joints filled with bitumen.

That is about as far as the generality of R.C. roadmakers have gone; but others, noticing that cracks still occurred, have gone on to make an enormous improvement by using reinforcement at top and bottom of the concrete. Cracking is now practically confined to the neighbourhood of the joints and corners. Some of the steps taken to cope with this have been discussed.

Further than these defects, we are faced with the evils of warping and creep, for which the writer's prescription is the provision of thickened slab edges, and, in some cases, stiffening and anchorage ribs.

This brief catalogue of troubles and their treatment is sufficient to cause one to wonder how long this game of "one down, another come up" will go on if slab construction is continued, and whether it is not time to stop and consider the whole problem afresh.

The principal causes of defects in concrete roads laid in one thickness (which makes soling and running surface in one unit) were discussed at length in the June article previously referred to. They will, therefore, be re-stated only as far as is necessary to make the ensuing argument clear.

They are :---

- (1) Shrinkage of concrete in setting, causing initial cracking.
- (2) "Creep" due to vibration, and assisted by warping, causing bunching together of slabs, with consequent closing of easement spaces.
- (3) Atmospheric and temperature changes, causing changes in length and warping of slabs.
- (4) Variation of quality of foundation soil.
- (5) Weakness of joints and corners.

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1931.]

The last four of these can be summarized by saying that a slab road is " alive."

If this can be prevented without damage, four-fifths of the problem is solved.

To do this we require a road which is unaffected by atmospheric conditions, will not creep or warp, is strong enough to carry over soft places in the foundation, and has no joints at all.

The success attained by two types of road construction employing concrete appears to point to the solution. One type is a plain concrete road laid on very good foundation soil; and the other, wood block or other paving laid on a reinforced concrete foundation. (This latter is a continuous reinforced concrete road protected to a large extent from temperature and moisture changes by the pavement.) Knowing, then, that concrete makes a perfect road if laid on a good foundation, and that a good foundation over any soil can be built of concrete suitably reinforced, the answer appears to be to combine the best of these two roads in one by constructing a reinforced concrete road in two layers.

There must be a bottom layer, laid continuously, and reinforced in such a manner as to make it capable of coping with traffic loads; and a top layer of plain concrete which will provide a perfectly smooth and incompressible carpet.

The function of the bottom reinforced layer is simply to provide a perfect foundation for the plain top layer, which we know will be perfectly satisfactory if laid on a good bed.

The function of the top layer is to serve as the running carpet, and to protect the bottom layer from moisture and temperature changes.

If suitable provision for anchorage of the top to the bottom layer is made, the first cause of trouble mentioned—shrinkage—becomes a virtue, making as it will innumerable invisible cracks which automatically provide easement for temperature and moisture changes within the top layer, but which can easily be waterproofed.

The quotation from a recent pamphlet by Mr. J. H. Walker, M.I.C.E., which follows, with the illustration given on Plate 3, explains the principle :---

"... the credit for laying down, during the last five years, some miles of the most perfect concrete roads in Great Britain, embodying the first principle of such design, lies with Mr. C. P. Courtenay, the Borough Engineer, Greenwich.

"These concrete roads are apparently crackless and free from opening and closing joints. The majority of the formations in the Greenwich district consist of hard pan gravel, capable of carrying four or more tons per square foot. The main principle underlying this success, leaving out many contributive details, is that the foundation





is grooved with small trenches, previous to casting thereon the 9" thick concrete road crust without any reinforcement. Thus the road crust is firmly keyed to the formation by means of the longitudinal and transverse ribs formed on the underside of the concrete.

" The reason for the success attained is as follows :---

"We know that when unreinforced concrete sets and dries, it contracts $\frac{5}{8}$ " in 100'; also that a concrete slab with a tensile strength of 300 lb. per square inch, if anchored at the ends, will crack with a fall of temperature of 27°F. If, therefore, a concrete slab is cast on a formation grooved with trenches, forming outlines 5' square, the concrete as it sets must crack into small squares separated by minute joints. By this expedient the concrete becomes ' inoculated' to cause the minor and unimportant disease of small and invisible cracks, and so prevent the serious deteriorations due to large cracks aggravated by the repeated blows of fast, heavy traffic.

"It will be obvious that, excellent as Mr. Courtenay's design is for non-compressible formations, it is likely to be unsuitable on a weak road bed, incapable not only of giving secure and immovable anchorage to the ribs cast in trenches to the underside of the concrete crust, but also of resisting, without settlement, the concentrated loading of II tons per wheel distributed to it through an unreinforced slab.

"Where a hard and incompressible road bed is absent on which to cast an anchored and purposely cracked road crust of plain concrete, the first essential is to form an artificial bed with necessary indents in its surface to give the required key for the upper layer.

"A suitable method of providing this artificial bed is comprised in an invention which is designed to provide an apparently crackless and jointless concrete road. For example, in the case of clay subsoil, the formation is dusted with fine ashes or sand and gridded with suitably spaced trenches 4" to 6" deep. On this prepared formation is cast an anchored and continuous raft, three or more inches in thickness, strongly reinforced with at least 0.5 per cent. of steel, both longitudinally and transversely. During the process of concreting the surface is suitably indented, as shown on Plate 3.

"The wearing surface of non-reinforced concrete is cast on this sub-base. This surface layer sets and dries and contracts, and those portions embedded in the indents of the surface of the lower layer are anchored, with the effect that the whole of the upper layer breaks up into small squares, each separated from one another by minute and invisible hair cracks or vertical planes of excessive tension.

[MARCH

REINFORCED CONCRETE ROAD DESIGN.

1931.]

"The result is a composite road slab consisting of two layers of concrete, keyed together in all directions to give the necessary combined strength as a beam or slab to resist the bending action caused by wheel loads, and thus distribute the load over a large area of formation. The bottom reinforced layer is isolated from great temperature variations by the thickness of concrete above it. The top layer, inoculated with invisible cracks, is thus provided with innumerable minute expansion and contraction joints which prevent permanent warping frequently found in non-interlocked, free moving slabs, and obviate the necessity for the usual type of expansion joint. The effect achieved is an ideal continuous pavement, free from objectionable cracks and joints of varying width.

"This continuity of pavement is interesting inasmuch as it reverts, with essential modification, to the original, though defective, method of laying reinforced concrete roads continuously. But its re-adoption greatly simplifies the process of construction.

"The continuous method now described permits of greater laxity in respect of the curing of the concrete surface after laying. The free moving slab method demands great care and the protection of the surface by covering it with wet sand or sacks for several days, but with the inoculated continuous slab invisible cracks are desired."

Such design will make use of one of the features of concrete —shrinkage—which has hitherto been a cause of trouble, and deal with the other defects mentioned by minimizing (3) and cutting out completely (2), (4) and (5).

Fig. 2 (2) shows the cross-section of a road embodying the writer's notion of the application of the principles stated above. It differs only in minor points from Mr. Walker's design, and makes use of the method of drainage adopted by him in the case of a road now under construction.

But it appears to the writer that the use of indentations in the lower layer to form shrinkage anchors for the top layer is unnecessary. If the tying down pins (marked A in Mr. Walker's drawing) are made stouter, they will serve the same purpose as the indentations; and, as it is possible to place them much closer together, the shrinkage cracks in the top layer will be both more numerous and fainter.

The finishing of the bottom layer will be simpler to carry out. It can be finished off smooth, and the anchor pins pushed into the soft concrete immediately behind the tamper.

They will project about 2" above the finished surface of the bottom layer, and once the concrete in which they are embedded is set, they will serve as rigid anchors between which local shrinkage cracks in the top layer (which will not be placed until the foundation layer is set) will form themselves.

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The design of the lower layer is of great importance, because it is on its stability that the efficiency and life of the plain top layer depends.

The writer, in the article of last June, stated that, in his opinion, it would be possible to lay a continuous R.C. road without any danger from temperature changes, but that cracks due to shrinkage, stoppages, etc., would occur.

The bottom layer of the road now under consideration is such a road, but in this case cracks are no more to be feared than in any other reinforced concrete construction, because the bottom layer is not to be exposed to traffic or to weather. Also, although it will be subject to variations in length due to temperature and varying degrees of dryness, such variations will be much less than in the case of a road made in one layer, and will be provided for during construction by shrinkage in setting, requiring no special provision in design.

In order, however, that the bottom layer shall be quite safe against buckling (or "blowing-up" as it is called), it will require to have sufficient depth, and to be reinforced at the top as well as at the bottom. To give it the depth necessary, all that is required is to provide it with deep ribs, suitably reinforced. See the ribs, marked A, with their twin bars at top and bottom. The slabs between the ribs will suffice to prevent sidewise buckling; for this reason no transverse beams, as shown in Mr. Walker's design, are considered necessary, except on long, straight stretches, when an occasional very deep transverse beam should be used as anchorage against any possibility of creep.

Between these longitudinal ribs a doubly reinforced slab is run. The necessity for the bottom reinforcement is obvious. The top layer of reinforcement is also required, at mid spans as well as over the ribs, because it is not absolutely certain that the ribs will always rest on a better foundation than the slab, and contraflexure (which is much more to be feared for its effect on the upper layer of concrete than sagging flexure) might occur anywhere within the slab, and is certain in the immediate neighbourhood of the longitudinal ribs.

Sufficient has been said to indicate the lines on which the writer believes that future R.C. road design will run. The cross-section illustrated represents a type only, and should not be taken to be an attempt at a design for any particular situation. The dimensions of parts can only be decided upon by the engineer in charge of a particular job of new road construction; but it may be noticed that this sort of construction enables him to *work out* his problem. The most irritating characteristic of ordinary slab road design, as has been pointed out, is the vagueness of the whole thing. The independent slab, liable to changes of shape, length and points of contact with the foundation soil, gives nothing to which one can pin any calculations of the strength of slabs necessary, and one is forced back upon the results of observation of former successes and failures, from which an empirical design may be built up.

This two-layer construction, as well as taking a short cut past joint troubles and all the other ills of slab roads, gives the designer something to work on when designing his bottom layer.

He can space his longitudinal T-beam ribs as he likes, and his spacings give him definite ultimate spans from which to calculate the strength of the slabs required between them. He is then in a similar position to the designer of a reinforced concrete bridge deck; he is relieved of that hopeless feeling of uncertainty which worries the souls of all good sappers when placed in an engineering difficulty where mathematics avail nothing.

From this firm datum he can work, making exactly similar assumptions as in any other structural design about loading, impact, distribution (in which the top layer will help), fixation, arbitrary stress allowances, etc., with a reasonable assumption as to the support, if any, which he may expect from the soil underneath the slab.

The one place in which calculation will fail him will be in the matter of the depth of his T-beam ribs; but if he feels any doubt as to the possible compressive stress which might cause buckling, he can cut out the difficulty by making, on long, straight stretches, a definite break every 300' or so. He has plenty of room in which to make a completely satisfactory long, sidewise-lapped joint, and he can take care that such joints do not occur near to joints in other ribs.

He need fear no damage to his slab or running carpet from distortion due to these staggered joints; he has, in addition to the plasticity of concrete and the intentional shrinkage cracks in the top layer, the amazing resilience of reinforced concrete to save him. Also, every marked change in direction of the road provides casement.

The writer feels sure that any such joints are an unnecessary complication, there being no fear of buckling of the insulated bottom layer if the ribs project about 12'' below the bottom of the slab, this depth being also sufficient to make a T-beam capable of carrying over any likely weak place in the soil immediately under the rib.

Without entering upon too long a discussion of details, no more can usefully be said now about R.C. road design. The writer will feel satisfied if he has been successful in reducing the problem to something definite from which any reader who is interested in reinforced concrete can work out his own road design.

PART III.-GENERAL.

Surface Drainage.

Camber is an evil. It is necessary to a greater or lesser degree according to the materials used in road construction, in order that the greater evil of standing water on the road should be avoided; but the less of it there is, the more efficient is the road. Excessive camber is not only unpleasant, it is dangerous. It causes a tendency for traffic both ways to use the crown of the road; and, when continued round bends, dangerous side slips if traffic keeps to the outside, and collisions if traffic takes the pleasanter running of the inside.

Of all materials used for roadmaking, concrete is able to discharge its surface water from the flattest slope, because it has such great compressive strength that it does not allow itself to be kneaded into ridges and hollows as do the more plastic carpets, which must be laid to a greater camber to allow for subsequent irregularities than they would require if they could be trusted to remain as laid.

A surface slope of I in 120 is quite sufficient for a reinforced concrete road to keep itself free from standing water and to allow of quick drying after rain.

But reinforced concrete allows of a radical departure from the normal centre-to-outside drainage provided by camber. Being capable of carrying itself over channels, drains can be run underneath it without such special construction as is necessary for culverts under macadam roads.

It is, therefore, possible to use central drainage, sloping the road downwards from each curb to the centre (the reverse of camber).

See Fig. 1 (2), which illustrates the Walker-Weston "inverted" road.

A road laid to this inverted camber encourages traffic to keep to the sides, which dry quicker after rain than does the centre; gives a slightly banked surface for fast traffic using the off-side to pass slower traffic, instead of the dangerous "away slope" of a normally cambered road; and keeps the central longitudinal joints (if any) closed without the provision of the special haunching required when slabs are laid to slope from the centre downwards to the sides. Incidentally, the absence of side gutters, and the quicker drying of the sides save pedestrians from being mud-splashed by passing vehicles.

Banking.

After paying such respect as is due to the opinion of those who defend the continuation of normal camber round bends on the ground that an "away slope" compels people (if they see it in time) to drive slowly round corners, the writer considers that banking of bends is definitely required.

He would go even farther than the provision of a regular outside to inside slope on roads carrying fast traffic, by making the crosssection of the road to a double concave profile.

Such construction is easy in concrete (though not likely to be successful in other materials), and it would, it is thought, cause traffic to keep to its own half of the road, as well as provide a greater degree of super-elevation to faster driven vehicles, which swing out farther than slower ones.

This increase of bank on the outside is not intended to encourage those drivers who take corners at high speed (they need none); but to lessen the likelihood of their causing damage to others.

The degree of super-elevation will, of course, vary with the sharpness of the curve and with the speed and weight of the type of traffic expected, so that no opinion can be given here, except that normally the bank should be such that a car can be driven "hands off " round the curve at a speed of about fifteen miles per hour.

Laying of Concrete.

Use wet concrete. However strong the laboratory evidence in favour of "dry concrete" may be (and it is very strong, indeed), experience shows very clearly that wet concrete makes better roads.

The writer has no explanation of this heresy worth putting on paper; he knows only that careful observations of old concrete roads, where some were made with wet and others with dry concrete, show that the "wet" roads are superior to the "dry" ones.

This statement that wet concrete is better for roadwork than dry, requires modification in certain respects. A little extra cement should be used in the mix to compensate for loss of strength due to excess of water. A rich, wet concrete with little punning makes a more consistent job than a dry concrete, which must be punned well to prevent voids.

Another point in this connection is the difficulty, met with on slopes of more than about I in 40, of flow of wet concrete. On slopes, dryer concrete must be used if slumping towards the lower end is to be avoided. Such slumping causes a slight over-brimming of the forms on the lower end and a slight under-fill at the upper end, which, though difficult to detect at the time of floating off, shows itself in the completed road, when a noticeable ridge at the junction of the upper end of each batch with the lower end of its uphill neighbour is left.

1931.] REINFORCED CONCRETE ROAD DESIGN.

This difficulty should be fairly simply overcome if a modification of the procedure adopted below for alternate bay pouring on the level is adopted.

When slab roads have been laid on the alternate bay system it is usually possible to detect the bays which have been laid first by an inspection of the joints.

It will be found that bays laid first stand slightly higher than those poured subsequently between them.

The reason for this is that the latter are usually screeded to a flush finish with those already set; with the consequence that they sink slightly in setting, leaving very slight steps up to their neighbours.

In the execution of a job very similar to slab roadwork (the laying of a 6" thick dining hall floor at Shoeburyness, which was laid in alternate bays) this difficulty was overcome by laying strips of 1/32" steel along the edges of the bays already set, and screeding from them. The intermediate bays were thus finished slightly " proud " of the bays already set, and gave a perfectly smooth, level joint after setting.

After Treatment.

Concrete is made definitely more resistant to wear if the surface is case-hardened by treatment with silicate of soda; and a further treatment which helps to preserve a concrete road by waterproofing it, and thereby checking swelling and shrinkage due to alternate wetting and drying, and which tones down the glare on the white concrete, is to spray over the surface a thin bituminous coating. An emulsion, which is capable of entering into small cracks and depositing a bituminous residue, such as "Colas," is admirable for the purpose.

MOUNTAINEERING AS TRAINING FOR WAR.

A Lecture delivered at the S.M.E., Chatham, on October 23rd, 1930, by THE RT. HON. LEOPOLD S. AMERY, P.C.

WAR is essentially an outdoor pursuit, calling for the highest combination of mental, moral and physical qualities, and that combination is in various degrees encouraged and developed by sport in its many forms. Some athletic pursuits, indeed, develop it far more than others. There are games and pursuits, for instance, which, while they afford exercise, train quickness of eye or hand, and promote comradeship, and so have their value, do relatively little to train the qualities and faculties most essential for war. Polo stands on a different level, as a rare training in horsemanship and physical nerve. Hunting stands a good deal higher, for it teaches knowledge of horsemastership and gives an eye for country to boot. Better still is big game shooting, for it takes the sportsman into difficult and often unexplored country, confronts him with a real living opponent, whose habits have to be studied and whose pursuit requires infinite cunning and endurance, and, not infrequently, brings him face to face with situations where his life depends entirely on his steadiness and skill.

But it is not given to every subaltern to shoot lions in East Africa, or, for that matter, even to stalk deer in the Highlands. Hunting and polo, too, are both expensive pursuits, and afford better training for cavalrymen than for the service as a whole. There is one sport accessible to most men, which can be learned and practised at any time of life, which need not be beyond the capacity of limited purses, and which provides an ideal training for war. That sport is mountaineering. In no other sport are the conditions so near those of active campaigning. The long days, the early starts-often soon after midnight-the frequent bivouacs, the importance of supply and transport, all reproduce the features of war which bulk so much larger in the soldier's experience than the occasional interludes of battle. Every mountaineer is an expert-or fancies himself one-on the question of supplies. With that profound insight into the intimate connection between the problems of supply and transport which can be attained only when one's provisions have to be carried in one's own "rucksack," he knows exactly what it pays to carry, and what not.

There is one gift which mountaineering teaches in a pre-eminent degree, that is, the gift of knowing country, of divining how the land lies on the other side of the sky-line. It does so, of course, for mountain country. No one, indeed, who has not climbed, or at least done much mountain walking, has the slightest idea, even with the help of a map, where he is or where to get to, once he is entangled in the maze of the high hills. But even for ordinary country, for all country, at least, that is not dead flat, it develops the instinctive eye for configuration, the judgment of how distant ground, seen or unseen, is likely to lie when you come to it.

And I know of no practical problem in staff work to equal the planning out of an attack in force upon a really serious mountain. There is the tactical problem of the actual line of attack to the summit. Frontal attack, or flank attack-main face, arête, or gully -they all present their difficult and dangerous features, to be elucidated by many a reconnaissance from surrounding heights. For each route, and for each section of it, not only the difficulty, but the time required, has to be taken into account. There is the no less important strategical problem of the valley to be ascended, of the strategical aufmarsch of the forces, and of all the supply and transport questions connected with it. Where, for instance, is the preceding night's bivouac to be ? One spot may be ideal for water and firewood, but yet be useless because it is too low down to allow the party to make sure of getting safely past a certain treacherous snow slope before sunrise. Another may be admirably placed for the next morning's start, but involve the most formidable difficulties in the way of carrying up provisions and kit-difficulties to be surmounted only, perhaps, on the Napoleonic principle that no great success in war was ever achieved on full rations. A third, otherwise suitable, may be swept by falling stones, or too exposed to the wind to make sleep possible. Other subsidiary questions suggest themselves. Can porters be got to help carry up camping things, and thus bring spare blankets, or even a tent, within the sphere of possibilities ? Can the army live off the country to any extent-in other words, can firewood be picked up on the way, and will the way to the bivouac lead past a chalet where milk can be bought for the making of chocolate? I admit, regretfully, that it is only in the comparatively unspoilt regions of the Alpine world that these problems of mountaineering staff work still present their full interest. In the ordinary tourist centres, every yard of every possible route is known, and the path to every summit is strewn with club huts, if not with two-storied hotels. In such circumstances, staff work chiefly centres round the struggle for hotel bedrooms, and extends, subsequently, to discreet investigations, in the hotel and among the guides basking in the sun outside, as to what other parties propose going to the club hut selected for the night, and getting there before them in order to annex the best berths and the first go at the cooking stove.

[MARCH

But, if good intelligence and good staff work are essential elements to success in climbing as in war, it must never be forgotten that on a mountain, as in a battle, nothing ever happens quite as it was meant to. The easy ridge of snow for which twenty minutes were allowed proves on closer contact to be a mere blanket of loose snow on a knife edge of hard ice, requiring two hours of step cutting and upsetting all calculations. The lack of one hand-hold at a critical spot may make the whole of a carefully-studied rock-face impossible, and compel a complete change of plans. The enemy may have laid an ambush and open fire with a continuous hail of falling stones down a gully which previous telescopic examination had pronounced absolutely safe. The weather may change, and a storm come up suddenly, when the party are barely an hour from the top. Then comes the moment for generalship ; then it is for the leader of the party to show his skill in improvising a new route, his determination in pushing on for the summit or pass, as the case may be, or his prudent firmness in deciding to turn back. There can be few better tests of the essential qualities of leadership than a really critical moment on a mountain. The man who can retain his judgment and confidence, and keep up the spirits of his party, when the way has clearly been lost, when all the rocks are coated with new verglas, when fingers are numb with cold, and when the guides begin to lose their heads and jabber furiously in incomprehensible patois-he is the man who is no less certain to keep his nerve and sustain his subordinates when casualties are heaviest and the hope of support faintest.

Last, but not least, climbing has its value for the soldier as a training in dealing with danger, a better training in that respect than most other sports can afford. The risks incidental to climbing are often ludicrously exaggerated. A week of hot weather is regularly attended in this country by a harvest of bathing fatalities almost as large as the Alpine death roll in a whole month. Of the accidents which do happen in the mountains the great majority are not really accidents at all, but the almost inevitable consequences of ignorance or gross carelessness; only a very small proportion represent the real dangers inseparable from serious climbing. any case, it is not the actual danger incurred, but the surmounting and avoiding of danger by the use of skill and judgment, that gives climbing its fascination and its value. The delight of the mountaincer is not in the prospect of sudden death, but in the sub-conscious sense of absolute security and mastery over nature with which he traverses places where the ignorant and inexperienced would meet with certain disaster. No mountaineer gratuitously exposes himself to the chance of an accident, any more than a soldier seeks unnecessary opportunities for getting shot. But in climbing, as in war, though no doubt less frequently, occasions do present themselves when real danger has to be faced and cannot be avoided. There are times when a descent of glazed rocks or the crossing of a stone-swept gully are the only alternatives to something much worse, and on such an occasion the qualities that make for success in the field have every chance for their exercise. The man who can cut good icesteps while the rocks fly past him buzzing like angry bees, and visible only when they bound against the sides of the gully, is fit for any place in the line of battle.

So far I have only spoken of mountaincering as a sport calculated to bring out the qualities most required in a soldier for use anywhere. But it is also a serious and necessary art in which our officers as a body, or, at any rate, a large proportion of them, should be obliged to acquire at least an elementary proficiency. To the uninitiated, the ways of a mountainous country are as a sealed book. In the easiest slope of scree or snow leading up to a pass, he will see an impossible precipice. But he will light-heartedly essay to walk in an afternoon-without a nail in his boots-up several thousand feet of jagged arête, or across a dozen gullies reverberating all day long to the crash and roar of a crumbling mountainside. In mountain warfare, an army ignorant of the elements of mountaineering will be as helpless as a flock of sheep in the midst of wolves, if it has to deal with an enemy led by men skilled in rock and snow craft. It will be forced to keep to the main valleys, able to move only along a single track, while its opponents freely cross the country in every direction. If it attempts to follow the enemy's example, it will run all the risks of destruction by avalanches, natural or artificial, of snow or falling rocks, and by all the other perils which beset those who, without knowledge, venture into the jealously guarded fastnesses of the high mountains. Reliance on native guides may prove of little use, even if the natives are friendly, for there are few native races which have acquired more than the merest rudiments of mountain work. The Gurkha comes from the slopes of the Himalayas, but General Bruce originally had to bring his men to Switzerland to teach them the art of climbing.

How important mountaineering should be to the British Army becomes evident when we reflect that the region which is one of the chief preoccupations of our strategists, and within which the fate of India is most likely to be settled, is nothing but a great sea of mountains, and as difficult to move about in as Switzerland was in the days of Hannibal. If our General Staff hope for victory in Afghanistan, whether over Russians or over Afghans, they must see to it that our officers are as capable of finding their way over the Hindu Kush at any point as Swiss officers would be of finding their way across the Oberland. In a war in those regions, a handful of officers acquainted with Pushtu and skilled in knowledge of the mountains could soon build up a light moving force worth many Russian divisions.

I have spoken of these matters in terms of infantry only. But, of course, there is such a problem as engineering in mountain country, where the mountaineer's knowledge may be invaluable to the engineer in telling him where it is possible to build a track or even a road, safe from rockfall, avalanche or flood. If Hannibal could take his elephants over the Alps, and if Austrians and Italians, in the late War, could get big guns up the most inaccessible peaks by road and cable, we may yet find the R.E. surprising the world by getting tanks over the Hindu Kush.

You will ask me where this sport is to be practised, this art acquired. Well, the natural high school for mountaineering is the Alps, and the best training to start with is to be got under a good Swiss guide-not, for choice, an ambitious youth thirsting to compile a good book of crack ascents, but a seasoned veteran who has taken up many generations of amateurs, and knows how to teach them and how to develop their powers progressively. There are a few guideless climbers who are even better teachers-but very few. In any case the object should be to learn to climb guideless, not so much with a view to becoming a star performer, but to be able to do any ordinary mountain or pass competently. And from the professional point of view, as well as for pleasure, it is far better to climb on the move, from valley to valley, instead of staying at some well-known centre and climbing the fashionable peaks. Incidentally, it is much less expensive ; in fact, it would be difficult to find a cheaper holiday than one divided between climbing huts and small hotels in secluded Swiss or (even cheaper) French or Italian valleys.

One drawback of the Alps from the soldier's point of view is that the best climbing season, from June to September, coincides with the busiest months of the soldier's life. But there is plenty to be done, short of the highest peaks, both before and after, and when skis are brought into play-and ski-ing is an essential part of allround mountaineering—any time from Christmas to June will afford unequalled opportunities. Besides, there are plenty of other playgrounds. North Wales, the Lakes, Skye, or the Cairngorms afford as good rock climbing as can be got anywhere. Across the Channel there are the North Galician mountains, the Pyrenees, the whole mass of mountains extending from the High Alps south-eastwards through Styria, Bosnia, Montenegro to the Balkans and down into Greece, the Tatra and Carpathians, Norway, Corsica and Crete. And further afield the world, and not least the British Empire, is full of excellent mountains : Canadian Rockies and Selkirks and coastal ranges, South African Drakensberg, New Zealand Alps, and, last but not least, the inexhaustible mountain world whose south-eastern wall is the Himalayas,

1931.]

A SUBALTERN IN THE INDIAN MUTINY.

Containing some letters of Lieutenant Edward Talbot Thackeray, Bengal Engineers, afterwards Colonel Sir E. T. Thackeray, U.C., K.C.B., R.E. (1836-1927).*

Edited by BREVET COLONEL C. B. THACKERAY, D.S.O. (late Lieutenant-Colonel, R.A.).

III.-DELHI (THE ASSAULT AND CAPTURE).

AND so, through the sweltering Indian summer months and the torrents of the monsoon, the siege dragged on. The papers from home were now bringing the London news into camp, and were When the first horror and indignation at the early eagerly read. massacres had died down, a muddy stream of ill-informed criticism was poured forth in the Press and on platforms by ignorant people, among them politicians and business men who ought to have known better. "What were our armies doing? Why did not Delhi fall?" They jeered about " jumping over the garden wall," That the garden walls were seven miles round, and twenty-four feet high, surrounded by a deep ditch, that within them were twenty or thirty thousand fighting men, and that the British army on the Ridge counted less than a quarter of that number-were considerations that did not seem to occur to them. A few red coats had only to appear before the ramparts and the gates would be thrown open. Soldiers and civilians were blamed for their incompetence and their harsh treatment of the "mild Hindu." It was the old story of every campaign—the public must have its scapegoats.

Towards the end of July things became quieter. The cannonade went on, but more fitfully. The men had by now, under General Wilson, learnt the value of cover. Planned operations took the place of casual skirmishing on both sides. The Field Force had settled down, with some grumblings, to await the arrival of reinforcements and a siege train. The troops set free from Persia had arrived in India. Those of the China Expeditionary Force had been intercepted and were on their way. Among the new regiments were the 78th and 93rd Highlanders. Rumours of the ferocity of the men in petticoats spread everywhere. A letter was intercepted from

^{*} These chapters are an abridgment of the first part of a future publication. Extracts from Sir E. Thackeray's *Two Indian Campaigns* (published in 1896 by the R.E. Institution), and other reminiscences, are distinguished by his initials, thus, [E.T.T.].

a *babu* inside Delhi to another on the Ridge, stating that "a regiment of women have arrived, and play Old Harry with everybody, and have an awful, savage appearance, and no chance for anyone seems left. I only tell you this as I am your greatest friend." Another regiment (37th) from Ceylon were said to be cannibals.

The Day—of the assault—was looked forward to as eagerly as if it were a *fête* day. One kind lady at Simla offered to send down cherry-coloured ribbons to distinguish our troops from the enemy. One superfluous gift did arrive on the Ridge, soaking wet—a mixed lot of female garments of every sort. They were hung up to dry outside the Staff tents, and caused much ribald merriment in camp. The only lady present with the Delhi Field Force was Mrs. Tytler, wife of a Captain of the Indian Army, whose baby, born on the Ridge, received the martial names of Stanley Delhi Force—an interesting family event, without a mention of which no history of the Siege of Delhi seems to be complete.

But one day a picquet of the 52nd saw two Indians with a boy making their way towards them. They were admitted, whereupon the boy flung his arms round the astonished officer's neck and burst into tears. He turned out to be a Mrs. Leeson, the widow of a clerk, who had escaped the massacre. For three days a small party, headed by a fiery Baptist missionary, had fought valiantly. Nearly all were killed, and when the enemy burst in to complete the slaughter, Mrs. Leeson lay wounded among the piled-up dead. friendly Afghan found her, took her away and kept her in hiding, treated her kindly, and finally brought her to the British lines. It chanced that the two Pathans who had rescued her were brought before the mighty Nicholson. The Brigadier, true to the character of the all-seeing and all-knowing Judge, which had made him known, feared and worshipped far and wide, recognized the men as dangerous escaped criminals. He gave them the choice of a flogging or undertaking a dangerous service. They chose the latter. Mrs. Leeson was given the run of the female wardrobe from Simla, and placed in charge of Mrs. Tytler until she could be sent to join her friends.

Immediately on his arrival in camp by mail-cart early on the morning of 7th August, a few days in advance of his column, Nicholson made a tour of the defences, and somewhat marred the prevailing spirit of harmony in the Force by his too outspoken and unappreciative criticisms of all that had been done. The editor of Archdale Wilson's papers observes that, whilst the arrival of Nicholson was welcomed as a great accession of strength, his manner was not altogether acceptable to those with whom he came in contact. That evening at the headquarters mess, a gathering that was looked forward to by all, the cheery good humour was distinctly damped by the silent solemnity of this big man with his great black beard and forbidding voice. Poor, anxious Wilson, already weighed down by ill-health and the responsibilities of his position, had to play the thankless role of peacemaker. He has never been given all the credit he deserved. However, a fresh vigour was infused into the General's councils by the white-hot energy of this unquenchable firebrand. On 24th August, Nicholson led a mixed force of 2,500 men against an enemy column three times that strength, which was on its way to intercept the expected siege train. Torrents of rain fell, but, marching all day through swamps, he overtook the enemy at Najafgarh, and in less than an hour routed the main body, capturing 13 guns, with a loss of four officers and 91 men.

Other reinforcements, British and native, with some antiquated brass cannon, augmented the Force. The irregulars were a useful addition, even if, as someone said, " a tom tom and a lattee (club) is all that should be allowed them for equipment." The Kashmir contingent, some two or three thousand strong, was more picturesque than well equipped or trained. As the long procession streamed into camp, their musicians redoubled their efforts; the tom-tomming rose to a deafening pitch, and the most frenzied and blood-curdling sounds rent the air. They were fine, powerful men, armed with long spears and matchlocks, dressed in chain armour. Their horses and camels were gaily caparisoned, and, with their shields and their bright brass mambrino-like helmets, they looked like an army of Don Quixotes. The spirits of men now rose with the thought of the coming triumph. The Headquarters Street became a popular evening resort. Every British regiment had its band, as well as some of the Sikhs and Pathans-" the latter regular snake-charmers," wrote one of the audience, " I was rather put to it when the Colonel asked me how his band played last night."

On the 4th September the long-expected siege train arrived. The Day of Reckoning was at hand. Wilson hesitated to approve of the assault, though no encouragement was needed in camps and messes. Nicholson and Baird Smith were insistent. Norman seems to have been more cautious. The Project of Assault had been drawn up in the minutest detail by Alex Taylor, approved and elaborated by Baird Smith. At length the general gave his consent. The evening of the 7th September was fixed for the commencement of the assailing batteries. Lord Roberts, then a young artillery officer on Nicholson's staff, relates that the Brigadier said to him, just before setting out to attend the momentous conference, "Delhi must be taken at once; and if Wilson hesitates longer, I intend to propose at to-day's meeting that he should be superseded." In the sequel, this high-handed measure was not needed. In justice to Wilson, it must be said that his caution is now generally admitted to have been justified.

"The project of assault provided for a concentrated, rapid and vigorous attack on the north face (about three-quarters of a mile), provision being made at the same time for silencing all important flanking fire that could be brought to bear on the assaulting columns. Due care was also taken to protect the exposed right flank of the
trenches from sorties. The left was secured by being rested on the river, and by the occupation of the Koodsea Bagh, a very strong post in front. The best information procurable indicated that on the front of attack the fire of some 25 to 30 pieces would have to be subdued. To effect this, 56 siege guns were available. . . . So arrangements were made for placing the siege ordnance against this front, and in about four days the whole opened with terrific effect. Two excellent breaches were made in the walls within 48 hours; the cover for the enemy's infantry was at the same time utterly swept away; an incessant storm of shot and shell poured into the place, and on the 14th all was ready for the final assault." [E.T.T.]

These few words give no indication of the tremendous hazard of this phase of the siege, nor the almost superhuman efforts needed to complete the preparations. Thanks to the ability and energy of Licut. F. Brownlow, tens of thousands of fascines and gabions and sandbags, and an ample supply of scaling ladders and materials for the bombardment and storming parties, had been got ready in the Engineer park. Every detail had been thought out, and, as far as possible, rehearsed. New breaching batteries and emplacements had to be erected within from one to four hundred yards of the defences, and this was carried out in from two to four days, some of the siege guns opening fire on the second day. Nevertheless there was some grumbling at the Engineers, who had rashly promised that all would be ready in one or two nights, not making enough allowance for the dearth of trained sappers.

There were 70 casualties in the trenches and batteries on the first day, and 327 between the 7th and 14th September. "About 1,500 camels were employed nightly to carry the fascines and other siege materials. The camels were quietly loaded, and the working parties marched off at dusk on the evening of the 7th. I remember," continues the author of *Two Indian Campaigns*, in one of his characteristic parentheses, "being much struck by the brilliancy of the fireflies which sparkled amongst the trees and bushes as we marched silently along with the long train of camels. Darwin remarks that" (here follow some observations on the luminosity of fire-

flies). "Everyone expected that the attention of the enemy would be attracted on the first night to the grunting and noise of the camels, but, strange to say, the animals were unusually quiet. Strange also though it may seem, the enemy fired very little on the batteries which were under construction, although a heavy fire was concentrated upon them after they were completed and had opened fire. From the 9th to the 14th, themorning of the assault, the pounding went on day and night from about 50 guns and mortars. The Mori Bastion was soon silenced and the line of parapet which sheltered the sharpshooters was stripped. The Kashmir Bastion was silenced in ten minutes after the Ludlow Batteries opened upon it." [E.T.T.]

By the evening of the 13th, breaches had been made near the Kash-

1931.] A SUBALTERN IN THE INDIAN MUTINY.

mir and Water Bastions. The Mori bastion was a heap of ruins. All seemed ready for the assault. It only remained to examine the two breaches at close quarters, and report whether they were practicable. This dangerous duty was carried out by four Engineer subalterns, Greathed, Home, Medley and Lang. Taking a ladder, Lang* descended the ditch and actually measured the breach before they were detected and fired upon, but no one was hit. By nightfall, Baird Smith was able to report to General Wilson that both breaches were practicable, and that all was ready. Orders were at once issued for the attack to be made at daybreak the next morning.

The first, second and third columns, which were to operate on the left and centre against the north face of the citadel, on a front of about 500 yards, were under the command of Brigadier-General John Nicholson, who personally led No. 1 column. Their orders were :—

No. I Column, 1,000 men from H.M.'s 75th Foot, 1st Bengal Fusiliers, and 2nd Punjaub Infantry to storm the breach near the Kashmir Bastion, in the centre.

No. 2 Column (Brigadier Jones, H.M.'s 61st Foot) 850 men from H.M.'s 8th Foot, 2nd Bengal Fusiliers, and 4th Sikhs to storm the breach near the Water Bastion, on the extreme left.

No. 3 Column (Colonel Campbell, H.M.'s 52nd L.I.), on the right of of No. r, 950 men from H.M.'s 52nd Light Infantry, Kumaon Battalion (Gurkhas), and 1st Punjaub Infantry to enter the Kashmir Gate, after it had been blown in by the Engineers.

No. 4 Column, under Major Reid, consisted of 860 men from his Sirmur battalion of Ghurkhas, the Guides Infantry, and spare men, together with 1,200 of the Kashmir Contingent. It was to operate on the extreme right against the outlying suburbs, and effect an entrance at the Kabul Gate.

The Reserve Column, Brigadier Longfield (H.M.'s 8th Foot) was to afford assistance wherever required. It consisted of 1,000 men from H.M.'s 61st Foot, 4th Punjaub Infantry, and Baluch Battalion, with 300 of the Jhind contingent. 200 men of the 60th Rifles formed a skirmishing screen for the assault, after which they were detailed to join the reserve.

"In order to provide these five columns," says Lord Roberts, "in all hardly 5,000 strong, the service of every man who could bear arms had to be put into requisition. Picquets were weakened to a dangerous extent, and many of the sick and wounded who ought to have been in hospital were utilized for the protection of the camp." At this moment the enemy were estimated to number not less than 30,000. A heavy fire from the batteries was kept up all night, and went on until an hour after daybreak on the 14th, some of the breaches having been repaired by the enemy during the night. Then the guns ceased suddenly, and for a few moments a pregnant stillness

^{*} See "The Diary and Letters of A. M. Lang," now appearing in The Journal of the Society for Army Historical Research.

MARCH

prevailed. Nicholson gave the signal. With a cheer, the 6oth Rifles dashed forward in skirmishing order, and opened fire from the low The scrub, within fifty yards of the ditch, losing many men. two columns on the left advanced to the assault. The explosion party, under Lieutenants Home and Salkeld, with powder bags and ladders, raced to the front. The third assaulting column, drawn up under cover of a fold in the ground, waited in tense suspense. A few minutes later, above the rattle of musketry, the roar of a loud detonation from the Kashmir Gate shook the air. It was followed by a bugle call, thrice repeated. This was the signal for the advance. The Gate had been successfully blown in. The Third Column rushed the breach thus made, some by the single remaining beam of the bridge across the moat, others dropping into the ditch and scaling the escarpment. Shortly afterwards the Reserve Column followed in the same manner, a bridge being hurriedly thrown across for the guns.

The First and Second Columns, led by Nicholson in person, stormed the two breaches on the left, in face of a fierce fire. It was ten minutes before the scaling ladders could be lowered, and the attackers poured into the ditch. The ladders were set up, hurled down, and set up again. At the Water Bastion twenty-nine out of the thirty-nine laddermen were killed or wounded in a few minutes. Nevertheless, the walls were scaled, the defenders driven back, and the stormers pressed through the breaches, into the city, and along the ramparts to right and left. The heads of these columns encountered the Third Column, entering at the Kashmir Gate.

The Fourth Column, under the gallant Reid, who was unfortunately wounded early in the day, met with a repulse. The Kashmir contingent gave way. The position was at one time most critical, as our right flank and the camp lay exposed. The heroic action of Tombs' Horse Artillery Troop and the Cavalry Brigade (9th Lancers and Native Cavalry), under Hope Grant, saved the day.

The reports that reached the General from the city were also disquieting. Most disastrous of all came the news that Nicholson had fallen, mortally wounded as it proved. The columns were disorganized, and co-operation was lacking. Some had gone too far, became embroiled in street fighting, and had to retire. Our losses were very heavy. Three out of the four officers commanding the assaulting columns were *hors de combat*. By nightfall 66 officers and 1,104 men had fallen, and we only held a precarious footing on the ramparts. All this greatly agitated and distressed the General, who had moved his Headquarters up into the city. Wilson had to consider the contingency of withdrawal. When a rumour of a retreat reached Nicholson, he is reported to have said: "Thank God I have strength left to shoot that man." The firmness of Baird Smith and Neville Chamberlain, both still suffering from wounds and sickness, heartened the General, whose personal courage



The city of Delhi before the siege, 1857



Hindi Rao's house in 1857

1931.] A SUBALTERN IN THE INDIAN MUTINY.

was never questioned, though his spirit was enfeebled by ill-health and anxiety. He chose the right course. The troops held the ground they had won.

Fortunately the enemy did not pluck up courage to counter-attack, though they kept up a desultory fire all night. At one moment an attack seemed likely, but, as Lord Roberts relates, the band of the 4th Punjaub Infantry opportunely struck up "Cheer, Boys, Cheer," the men did cheer, most lustily, other regiments took up the inspiriting hurrahs, and the disconcerted mutineers thought better of it.

The extension and consolidation of our hold on the city occupied nearly a week of desperate street fighting, with attacks on various strong points. The 15th was marred by drunkenness on the part of a few soldiers. The storming of a great fortified town cannot be carried out without some excesses. Quarter is neither given nor expected by combatants on either side. There is bound to be some indiscriminate looting. But an examination of all the evidence shows that, in the hour of triumph, the British soldier perpetrated no unnecessary slaughter, and that the retaliation dealt out to the rebels "did not exceed the bounds necessary to ensure the safety of the conquerors." Delhi did not degenerate into a Badajoz.

On the 16th the Magazine, famous for Willoughby's exploit of 17th May, was stormed and carried. Once more it was a point of vital importance, the loss of which might have imperilled our hold on Delhi. The Commander-in-Chief, in his dispatch, wrote, "A dash and cheer struck such terror that the rebels dropped their lighted port-fires, leaving their loaded guns an easy prey to us. 125 pieces of cannon and vast supplies of shot and shell were found in the Magazine alone." Later in the day counter-attacks were repelled. during one of which Lieutenant Thackeray earned his $\mathfrak{U}.\mathfrak{C}$.

The mutineers fought with great desperation, but they lacked any concerted scheme. We were losing heavily in the street fighting, and not advancing rapidly. It was Captain Alex Taylor, Baird Smith's indefatigable Second-in-Command, who, by his personal efforts restored the situation, and devised means to reduce the losses. By advancing down the streets, our men were being exposed to rifle fire and missiles, from every window and corner and doorway. Taylor organized parties of sappers under Engineer officers, who broke through the walls from house to house, followed by the infantry. On one occasion a party of the 52nd broke into an apartment where they found rows of women reposing on piles of cushions, covered with rugs. The men were leaving them alone, when one gallant fellow said he didn't see why he shouldn't have a kiss, and bent over a damsel. Next moment there was a shout and a scrimmage, and he had driven his bayonet into the body of a sepoy in hiding under the girl. Each couch with its pair of occupants had to be dealt with in like manner. Thackeray had lively recollections of this phase of the fighting, when the sapper officers stood,

63

revolver in hand, ready to rush in, as the partition walls fell under the axe-blows of the sappers. It was a long and tedious process, but combined with the bold use of artillery at point-blank range, it eventually gave us the city.

On the 20th the mutineers made their final stand, the last stronghold was carried, the Union Jack was hoisted at the Palace, and at sunrise on the 21st, a royal salute proclaimed that we were once more masters in Delhi.

The best short account of the Siege, Assault and Capture of Delhi is contained in the semi-official narrative by Major (afterwards Field Marshal Sir) H. W. Norman, at that time Deputy Adjutant General of the Bengal Army, published as a pamphlet in 1858. He says, "For the complete success that attended the prosecution of the siege, the chief credit is undoubtedly due to Colonel Baird Smith, the Chief Engineer, and to Captain A. Taylor, the Director of the attack. On this officer in fact (in consequence of the Chief Engineer being wounded), devolved the entire superintendence of the siege works. . . Throughout the operations he seemed to be omnipresent, and to bear a charmed life, for he escaped without a wound. The plan of the attack was bold and skilful; the nature of the enemy we were contending with was exactly appreciated, and our plans shaped accordingly. . . ."

The siege of Delhi, he concludes, bears comparison with Sebastopol. "In both, the strength of the fortifications was as nothing; it was the proportion of besieged to besiegers, the magnitude of the arsenal inside, and the impossibility of a thorough investment, that constituted the real strength of the place. . . ."

SIXTH LETTER.

E.T.T. to his brother, F.St.J.T. HEADQUARTERS, ENGINEER BRIGADE, CITY OF DELHI,

Sept. 25th, 1857.

You will have heard, perhaps, by the last mail of the Assault and Capture of Delhi. I should have liked to have written extremely, but at that time I had not a moment.

I am not certain whether the news can have gone home by the last mail of the capture of the City. I do not think you can have heard of the capture of the whole city, as the assault took place on the 14th and hard fighting went on inside the City till the 20th, when we took the Palace and the whole City was ours. I hope you saw the list of killed and wounded, and that it was a correct one, as that will have removed any anxiety about me.

I am sorry to say our Brigade (the Engineers) have suffered very severely. In fact more than any other regiment here. In the assault poor Tandy, a 2nd-Lt. of one year's more service than myself,

[MARCH

was shot through the heart. I was at school at Greig's two years with him, one year at Addiscombe, and one year at Chatham. . . . Ten Engineer officers were wounded in the assault. I daresay you would like a correct list of the losses in our brigade during the whole siege and assault, which I give. . . .*

It is a sad, long list, but most of the wounded except poor Salkeld are getting on well. Brigadier Nicholson is the greatest loss. He was one of the best officers in the Indian Army. He lived four days after he received his wound at the assault.

About the end of August, Brigadier Nicholson went out with a force and completely routed a large force of the enemy, taking 13 guns. About this time the siege train of heavy guns arrived from the Punjaub. Up to this time we were acting almost entirely on the defensive. We had not sufficient men or guns to commence the siege, and it was all we could do with our small force to repel the numerous attacks of the enemy. That time was, I think, the worst part of the whole. We were often on duty three nights out of every week, making defensive works. When we once began the siege we knew we should soon take the place, which kept us up to any work.

On the 8th September large working parties from all the regiments in camp paraded at the Engineer Park, taking tools with them. We marched down to within three hundred yards of the walls and the bastions of the City. The men were employed in filling sandbags and making the ground ready for the batteries. Previous to this, for about a fortnight we had to go out at night with large working and covering parties and cut all the trees where the works were intended to be. That was the worst part of all. Stumbling about all night in the long rank jungle, sometimes five feet high, wet through with the dew, and frequently attacked by the enemy. On the 9th, 10th, 11th and 12th the batteries were completed. They were immensely large, built up to the bottom of the embrasures of solid fascines. (Some were thirty feet thick.) 1,500 camels were employed nightly in carrying down the fascines. Strange to say, the enemy did not fire on us much while building the batteries. We were almost all of us on duty three nights running. On the 12th the batteries opened fire, when, after seeing the first shell knock down a large portion of the Kashmir Bastion, I was so tired that I lay down and slept during the roar of the guns for three or four hours. There were four batteries, one of them having 20 heavy guns and howitzers. The walls seemed to crumble before the weight of metal, and after two days' firing the breaches were made and a great part of the parapet stripped off the wall. One sandbag battery was within 100 yards of the Water Bastion. The fire of musketry from the walls of the town at the Battery was tremendous. The guns were obliged to

^{*} The list shows, out of a total of 30, 3 killed, 2 died, 15 wounded. Five were sick or wounded in camp during the assault.

MARCH

have iron mantlets fixed on them to protect the men while working the guns. I was in this Battery when poor Captain Fagan of the Artillery was shot through the head by a musket ball. He would expose himself, though frequently warned. He used to get up and look over the mantlets to lay his guns better. Captain Taylor, Engineers, managed the attack admirably. He was Director of the Attack. On the night of the 13th he and Lieuts. Medley and Lang, Engineers, with two or three riflemen, crept up to the ditch and ascertained that the breaches were practicable, and got back again without being seen. Captain Taylor instantly determined on the assault by the following morning. There were five columns of attack. Two or three Engineer officers were told off to each by seniority. The seniors went with the first column. The next with the second. Ward and myself, the unfortunate juniors (Carnegie and Forbes being sick) had to go with the 5th Column, or Reserve, so I do not consider that we had so much danger to encounter as the others, though the fire was rather sharp even when we went in. But it was the only way it could be done, as the Chief Engineer of course would not let the junior officers go in before the senior. All the Engineer officers in the other columns except Home, Lang and Thomason were wounded. We paraded about three o'clock in the morning of the 14th. We paraded with our separate columns with sappers with powder bags, etc., and marched down to the attack. It was just daylight when the 1st Column halted at a turn in the road which concealed them from view of the walls, but close to the Kashmir Gate. Lieuts. Salkeld and Home, Engineers, and Serjeants Carmichael, Burgess and Smith and four sappers and a bugler of H.M. 52nd Regt. advanced from the column up to the Kashmir Gate.* It was an immensely heavy wooden gate flanked on all sides by the walls. Home laid the powder at the foot of the gate. They were instantly discovered and a heavy fire opened on them from all sides. Serjeant Carmichael took the fuse, and was on the point of firing it when he was shot dead by a Sepoy who placed his musket through a hole in the gate. Serjeant Burgess took the fuse from his hand and was likewise shot dead. Lieut. Salkeld then took the fuse and was shot through the arm and fell into the ditch, breaking his leg by the fall. As he fell he threw up the fuse, which Serjt. Smith seized and fired the charge. At the same time the bugler sounded the advance and on rushed the column. The charge blew in the gate and about 17 of the enemy who were close to it. Our troops rushed in at the gate, up the bastions and along the walls. At the same time the 2nd and 4th Columns attacked by the breaches The Kashmir Gate and the walls were cleared of all the defenders. presented a horrible sight. Thirty or forty sepoys, some blown

^{*} Some of the minor details of this action, given here, are incorrect. A corrected version, from the various reports and dispatches, will be found in Part VI of this series (*Five Victoria Crosses*).—ED.

up and others bayoneted and shot down, were lying all about. It was the same all along the walls and bastions. No quarter was given, but they made very little defence and retired into the city, where they again made a stand. I went into the bastions. Such a scene of ruin you never saw. Almost every gun was dismounted and had a great piece of iron knocked out of it and dead sepoys lying all about.

The troops took up their quarters in the College and Church, but the enemy fired on us all night. We made a battery by the College at night and commenced shelling the town and palace. We lost most of our men in the town. They advanced too far without supports and were fired at from the walls and houses. Our losses in the whole of the assault and taking the city from the 12th to the 20th were sixty-four officers and thirteen hundred and eighty men killed and wounded. [The total for the actual siege and assault, from 8th to 20th, is officially given as 1,674.—ED.]

On the 15th we attacked and took the Magazine. I went with the column. We took them by surprise and they offered very little resistance. But in the afternoon they returned and attacked the Magazine and set the roof on fire. We had to get up on the roof with leather bags of water and put it out while they threw large stones at us. They were fanatics, I afterwards heard. I think that day I had the narrowest escape of any. After putting out part of the fire, I was just jumping down when three of them put their heads over the wall and took three deliberate shots at me, all of which missed. They could not have been above ten yards off. I fired my revolver at one, but don't remember whether I hit him or not. A Lieutenant of Artillery then got on the top of the Artillery Magazine with 10-inch shells in his hand.* He lighted the fuse and dropped them on their heads. Five or six he let off in this way. It must have killed a great many of them, for they fled almost directly. On the 20th, after pouring a tremendous fire of shell into the palace, our troops attacked the palace. There were very few sepoys found in it. They had almost all fled during the night.

Thank God it is all over. I am sick of bloodshed and seeing men killed. You necessarily get callous, but I am very glad it is all over. I never felt so much seeing a European killed as a poor private of H.M. 61st. I was in a turret with him in the magazine making some loopholes of sandbags. The sepoys were firing from houses all round and he was firing at them with his rifle and asked me to take a shot with his rifle. I took his rifle and was taking aim at a man, and he was looking through a loophole to see the shot, when a bullet sang through the turret and killed him by my side.

Lieut. Hodson took the King of Delhi prisoner about four miles

^{*} Licut. (afterwards Major-General) Renny was awarded the $\Im \mathfrak{C}$. Licut. Thackeray received his nearly five years later, three years after his name was submitted. For a full account see *Five Victoria Crosses* (Part VI of this series).

THE ROYAL ENGINEERS JOURNAL.

from here. His two sons and grandson were killed.* His son, the heir to the throne, was the man that killed some of the Europeans in Delhi with his own hand. The King is a very old man, but if it is proved that he aided in the murder of Europeans he will not be spared. Fancy, a European was taken who has been fighting on their side all along. He is Serjeant-Major in a native infantry regiment, and had turned Mussulman. He will doubtless be hung. † . . .

A good deal of plunder has been found in the city, but not as much as we expected. There are prize agents who are supposed to stop plundering (loot as it is called), but I don't think they do much. All the plunder is supposed to be divided among the army. I trust we shall get a medal for Delhi. I am sure we have had as hard fighting as we could well, though against mutineers. They say we shall get six months or a year's furlough, but I don't care much about that if we get a medal.

A column is gone out in pursuit of the fugitives. We get very little news from down country. The whole of the Bengal side and the North-West Provinces are still in a very disturbed state. We want many European troops out here. I only hope you will get this letter, for it is a great nuisance writing a long account and then having it stopped.

Our Corps has, I am glad to say, distinguished itself very much. There are only four Victoria Crosses given, and three are to the Engineers,-Lieuts. Salkeld, Home and Serjt. Smith, and the other is the bugler, and well they deserve it. I only hope poor Salkeld‡ will recover to wear it, but he is in a very dangerous state. Home was very fortunate, he was not touched.

I have been over a great part of the town. All the houses are thrown open and plundered. Articles of all sorts are lying about. I am going to try to get some curiosities to send home.§ The Jumma Musjid, the great Mussulman place of Prayer, is a most wonderful place. It is almost entirely solid marble, and enough to make about 50 Marble Arches. The palace is the same. All the King's private apartments, etc., are marble, and in many places inlaid with precious stones.

We have taken up our quarters in a very good house close to the palace, only unfortunately the Pandies had used it as a powder magazine, in consequence of which it is very dirty, and the other day an unfortunate native was sitting at the bottom of what he thought

‡ Salkeld succumbed to his wounds. Home was accidentally killed a few days later. Vide Five Victoria Crosses (Part VI of this series). § The only "loot" taken by him was some swords and other weapons, which be found at believe and was how the proceeding of his altert are he found at Delhi and Lucknow, now in the possession of his eldest son.

[&]quot; I can only affirm that I never heard a dissentient voice at that time to the statement that the Princes had deserved their punishment. I saw the bodies of the Princes exposed in the Kotwali. They were dressed like native servants." [E.T.T.,

^{1896.]} † This story was generally believed. The man gave himself up, asserting he had been kept prisoner. The evidence against him was inconclusive, and he was not

1931.] A SUBALTERN IN THE INDIAN MUTINY.

was rubbish, smoking his hookah, when it suddenly ignited and blew him up. It turned out to have been a lot of loose powder.

I hope everybody at home is quite well, and that they will not mind me not writing to them all, as I really have had very little time, and you will tell them all about me. . . You will not have seen any mention of the sappers at the battle of the 8th June, as their work is chiefly at a siege. I have lost a great many friends of other regiments, Webb of the 8th, Phillips* and many others. I believe we are going to stay here two or three months. I believe it has been forwarded to the Governor-General to know what is to be done with the City. Many of our sick and wounded are going off to the hills, Carnegie, Medley, Geneste. How I envy them. This is such an unhealthy place.

Sept. 26th. Last night I had a bad attack of fever, and lately, whenever I go in the sun, I come back very feverish. I take large doses of quinine. Most of us are a good deal knocked up by the campaign. I don't know when I shall go back to Roorkee, but I shall not be sorry to get away from here. [It was the common belief that the campaign was practically over, when Delhi fell.—ED.]

I think the best regiments here are H.M. 60th Rifles and the Gurkhas. I don't like the Sikhs much. I certainly ought to be very thankful to have been spared all through this campaign without a scratch. You see by the list I have sent you what a small proportion of us have escaped untouched. I dare say you will think I write a great deal about my own Corps, but it is natural.

. . . I think you had better direct here, but I don't know where I shall be. Please excuse bad writing and mistakes, but I have not good materials.

This short account of the siege and taking of Delhi cannot be more fittingly concluded than in the inspiring words of Lord Roberts, the hero of a dozen campaigns, who ranks Delhi as the hardestfought of all. In his *Forly-one Years in India* he pays a "tribute of praise and admiration to the troops who bore themselves so nobly from the beginning to the end. Their behaviour throughout was beyond all praise, their constancy was unwearied, their gallantry most conspicuous; in thirty-two different fights they were victorious over long odds, being often exposed to an enemy ten times their number, who, moreover, had the advantage of ground and superior Artillery; they fought and worked as if each one felt that on his individual exertions alone depended the issue of the day; they willingly, nay, cheerfully, endured such trials as few armies have ever been exposed to for so long a time. For three months, day after day, and for the greater part of the day,

* Lieut. Phillips de Lisle was posthumously awarded the U.G. fifty years later.

[MARCH

every man had to be constantly under arms, exposed to a scorching Indian sun, which was almost as destructive as, and much harder to bear than, the enemy's never-ceasing fire. They saw their comrades struck down by cholera, sunstroke, and dysentery, more dispiriting a thousand times than the daily casualties in action. They beheld their enemies reinforced, while their own numbers rapidly decreased. Yet they never lost heart, and at last, when it became evident that no hope of further reinforcements could be entertained, and that if Delhi were to be taken at all it must be taken at once, they advanced to the assault with as high a courage and as complete a confidence in the result as if they were attacking in the first flush and exultation of troops at the commencement of a campaign, instead of being the remnant of a force worn out by twelve long weeks of privation and suffering, by hope deferred (which truly ' maketh the heart sick '), and by weary waiting for the help which never came. Batteries were thrown up within easy range of the walls, than which a more heroic piece of work was never performed ; and finally, these gallant few, of whom England should in very truth be everlastingly proud, stormed in the face of day a strong fortress defended by 30,000 desperate men, provided with everything necessary to defy assault.

"The list of killed and wounded bears witness to the gallantry of all arms of the service. The effective force at Delhi never amounted to 10,000 men. Of these 992 were killed and 2,845 wounded, besides hundreds who died of disease and exposure. Where all behaved nobly, it is difficult to particularize; but it will not, I hope, be considered invidious if I specially draw my readers' attention to the four corps most constantly engaged: the 60th Rifles, the Sirmur battalion of Gurkhas, the Guides, and the 1st Punjaub Infantry. . . : Further, it is a great pleasure to me to dwell on the splendid service done by the Artillery and Engineers. The former, out of their small number, had 365 killed or disabled, and the latter (more than—ED.) two-thirds of their officers and 293 of their men."

The Field Marshal concludes with the closing words of Lord Canning's Dispatch: "The Governor-General in Council records his gratitude to Major-General Wilson and the brave army of Delhi. He does so in the sure conviction that a like tribute awaits them, not in England only, but wherever within the limits of civilization the news of their well-earned triumph shall reach."

Erratum.—The following names were omitted from the list of officers present with the Bengal Engineers during the siege of Delhi:—Colonel (then Lieut.) J. G. Forbes, Bengal Engineers. Also Assistant Engineers, attached:—Lieuts. Nuthall, Knowles, and Gustavinski, of the Bengal Staff Corps, and Lieut. Bingham, Bengal Sappers and Miners.



SAPPER OFFICERS IN WAR.

By MAJOR M. EVERETT, D.S.O., p.S.C., R.E.

1. Most officers, if asked what the R.E. do in war, would reply that they man the divisional field companies; if pressed, they might add that they believed that a few of them were also engaged in curious and little known activities on the L.-of-C.

This is completely wrong; a great deal more than half the officers of the Corps in a normal theatre of war are employed behind the divisions, and without these activities it would be quite impossible for the Army to reach the enemy or to fight at all.

This paper, which is absolutely elementary and contains no single item of new information, is an attempt to bring matters into correct focus, especially for the junior officers in the Corps.

2. As a result of the mistaken impression alluded to above, there is a feeling among certain officers of our own Corps, as well as in other arms, that what the army needs is a good Pioneer only, and that therefore the very expensive and prolonged technical training of the Sapper officer is a waste of money and time. This is not correct : every R.E. officer must be a trained engineer, whose duty is, by his knowledge of the arts of peace, to assist the army in war to fight its battles successfully and economically.

It has been suggested that our Corps might, with advantage, be split into two branches, one of which, the "Royal Horse Engineers," would specialize in field works and tactics, and would provide the divisional engineer units, while the other, the "Royal Skilled Engineers," would man all the technical units; but there are many insuperable objections to this.

Firstly, what would happen in the senior ranks? The two branches must come together under one head at some stage. Let us assume that they meet at the Chief Engineer of the Corps: and suppose that the Chief Engineer had spent all his days in peace studying electricity: how much use would he be to his General in war? Or suppose that he had never in peace dealt with anything more abstruse than the building of a box-girder bridge: how could he advise on an electric light scheme for Corps dumps?

Secondly, it is wrong to suppose that the Field Company will never have to do any technical work at the Base or on the L.-of-C. For example, in Mesopotamia, in 1915 and 1916, there were, to begin with, no R.E. units except Field Companies, the officers of which had to deal with all the technical work involved in getting Basra into shape as a Base, and also had to do all the survey work : the officers of at least one of the field companies in the Lahore Division were very largely employed on survey in 1916.

We must not be led astray by the state of affairs during the Great War in France, when all the engineering power of the Empire was engaged and every engineer in the Empire was employed. Our normal outlook must be for a small British Army operating overseas, with its own engineers, as happened in 1914 in France, and in 1916 at Salonika, when the officers who will, at any rate at first, have to direct the activities of all our technical units will be regular R.E. officers. They must consequently be educated and experienced in the work they will have to do, that is to say, they must thoroughly appreciate the needs of the force, and know the best way of applying engineering science to assist.

3. There is a good deal of information in Engineer Training, Vol. II, as to the names and duties of the various non-divisional R.E. units, and an attempt is being made to rub in their importance by means of a new amendment to that book, which will give a list of our activities, divided up in accordance with whether one is considering the Base, the L.-of-C., the Army and Corps areas, or the Divisional areas. The same division of duties will be followed here in rather more detail.

A full list of the R.E. units that may be found in a theatre of war is given in Appendix "A."

4. Let us now consider what happens in war. Our Expeditionary Force lands, probably, in an allied country. It needs a dock, lit by electric light, supplied with water and power, and also facilities for passing from it on to railways to take it up towards the enemy. No dock which exists for peace time traffic is suitable for troop traffic, nor are enough peace time civilian operators probably available: to provide the necessary facilities we, therefore, have a Dock Company, R.E., with 14 officers and a number of crane drivers, stevedores, railway clerks and so forth.

To maintain and operate the railways, and if necessary to construct new branch lines and sidings, a very large force of little-known R.E. units are required, of which a list is given in Appendix "B." The numbers of each of these units required depends, of course, entirely on local conditions. The names of the units describe their duties.

To light the docks, to provide power and water, to operate machinery, and to carry out minor repairs to engineer plant, we have Electrical and Mechanical Companies, R.E., and possibly Boring Sections, while to look after, and carry out heavy repairs to engineer plant, there are Engineer (Base) Workshops and Engineer Store (Base) Depots.

Then, again, there is always a lot of general engineering work

to be done in a Base, and for this Army Troops Companies, R.E., are provided. These are organized very like Field Companies, though with more, and better skilled, artisans. They would provide huts, store sheds, watering and sanitation facilities, hospital accommodation, and so forth, and would, with the possible help of Road Construction Companies, R.E., construct and repair roads. To provide the necessary stone for this, we may have Quarrying Companies, R.E., who would open up and operate any likely stone quarries that are available.

Then, again, a Base is probably subject to hostile air attack, so to help our R.A.F. and the Gunners, the Corps provides an A.A. Searchlight Battalion, R.E., with 42 officers and nearly 1,400 men, part of which would be stationed at the Base.

In many countries it is possible to send a good deal of heavy stores forward by canal or river: for the operation of this service, we have Inland Water Transport Units, R.E. These were used on the canals in France, on the Tigris, and in many other theatres of war.

In war, we have no G.P.O. and we therefore find the Postal Service yet another R.E. activity.

5. We have now got the Force landed and ready to advance, using railways, canals and roads; and all up the L.-of-C., up to and including the advanced bases and railheads, we find all the Sapper units which have been mentioned re-duplicated over and over again.

As we approach the enemy, the danger of attack by fast-moving A.F.V.'s increases, and Army Troops Companies, R.E., are therefore required to prepare defences against such attack.

6. In Army and Corps areas, engineer units are needed for communications, such as roads, bridges and light railways, for accommodation, water supply and sanitation, for the repair and issue of engineer plant, and for A.A. defence, just as in the L.-of-C. area. Here, therefore, we shall find the Army Troops Company, the Electrical and Mechanical Company, Companies of the Anti-Aircraft Searchlight Battalion and many of the others.

In addition, several fresh units appear. Our ideas about survey have undergone a very great change recently, and the large scale map now has a tactical value as a means of putting down accurate artillery fire: we therefore have the Field Survey Company, R.E., capable of making a map from aeroplane photographs or from nothing at all, or of checking and adapting existing maps for army purposes.

Then, too, the enemy may use gas, so we find 7 R.E. officers forming an Anti-Gas Laboratory: if the use of gas were to become general, we should have large numbers of Gas Companies, R.E., as we had in France.

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The preparation of rear lines of defence, and possibly of extended demolition areas and artificial wildernesses, will be necessary : this would probably be carried out by Army Troops Companies, R.E.

If warfare becomes static, we shall find that huge organization for mining, which we had in France, starting again, with its dozens of Mining Companies, R.E.

Finally, there is a vast mass of engineering material and plant which has to be collected, looked after, and issued: this is done, in the Army and Corps areas, by the Workshop and Park Company, R.E.

7. This brings us at last up to the fighting line, the Divisional areas, where we find in each Division the 3 Field Companies, R.E., and the Field Park Company, R.E., and in each Cavalry Division the Field Squadron, R.E., with which we are all familiar.

8. In peace time, the only R.E. field units in existence are the A.A. Searchlight Battalion, the Field Squadron and the Field Company: Field Park Companies are in cadre form only. We hope that the near future will see a permanent Field Survey Company, R.E., in being, and, as finance allows, it may be possible to form, in future years, a sample Electrical and Mechanical Company and one or more sample Field Park Companies: the formation, in peace time, of any of the other R.E. units mentioned above is most improbable.

As, therefore, these L.-of-C. R.E. units do not exist in peace, they will be largely recruited, on the outbreak of war, from the civilian engineers of the country, officers with little or no military training; and as the using of a unit in war must be in the hands of officers who have military knowledge and experience, the control of these units must be, to begin with, in the hands of Chief Engineers and Directors of Works and their subordinates, all of whom are regular R.E. officers.

From this it follows that these same regular officers must have not only military knowledge but a thorough technical training as well.

APPENDIX "A."

R.E.	UNITS	AND	Their	DUTIES.
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Location.	Duty.	R.E. Unit.	No. of R.E. Officers per Unit.
Base and Lof-C.	Docks Railways	Dock Coy.* (See App, " B.")	I4
	Canals and rivers Roads	I.W.T. Unit Road Construction	14
	Accommodation for	Coy	4
	men and material Hospitals	A.T. Coy	6
	Electric light	E. and M. Coy	6
	water Operation and repair of	Boring Section	I
	A.A. defence Storage and repair of engineer plant and	A.A. Searchlight Bn.	42
	materials	Engineer Store (Base) Depot* Engineer (Base)	9
		Workshops*	10
	Provision of stone	Quarrying Coy:	4
	Provision of timber	Forestry Coy	2
	Postal Service	Base Post Office* * At Base only.	3
Advanced Base.	Defences	A.T. Coy	6

Also as for the Base but in a smaller proportion.

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THE ROYAL ENGINEERS JOURNAL.

[MARCH

Location.	Duty.	R.E. Unit.	No. of R.E. Officers per Unit.
Army and Corps areas.	Railways (possibly) Light railways Roads Bridges	(See App. " B.")	
	Accommodation fo men and materia Hospitals Sanitation Rear defences	A.T. Coy	6
	Demolition areas Electric light	E. and M. Coy	6
	A.A. defence Survey	A.A. Searchlight Bn. Field Survey Coy. Anti-Gas	42 6
	Mining Storage and repair	Mining Coy	?
	engineer plant an materials • And poss	M Workshop and Park Coy ibly Gas Coy.	6
Divisional	Roads		
areas.	Water supply Demolitions Defences	Field Squadron Field Coy Field Park Coy	9 6 3
	Accommodation Sanitation, etc.)	

APPENDIX "B."

RAILWAY R.E. UNITS.

KALWA	KAILWAY K.E. ONIIS.			No. of Officers.		
H.O. Railway Operating Group				•••		2
Railway Operating Coy				•••		5
H.Q. Railway Stores Group		•••	•••	•••	• • •	2
Railway Stores Coy	•••	•••	•••	•••	•••	5
Base Railway Workshop Coy.				•••	•••	5
Railway Construction Coy.		•••	•••	•••	•••	6
Railway Survey Unit	•••	•••	•••	•••	•••	7
Composite Railway Coy			•••		•••	6
H.Q. Railway Construction and	Maint	tenance	Group	•••	•••	3

76

THE ABOR MILITARY AND POLITICAL MISSION, 1912-13. (Continued.)

Compiled from the Diary of the late Captain P. G. Huddleston, R.E.

4. ON THE DIHANG.

We are now proceeding as follows: Men, food and stores reach Kobo either in ten odd days by river steamer, or rail and steamer, or by rail to Saikwar Ghat and then four hours down the Brahmaputra by dug-out or small steamer to Kobo. Kobo is the base, and in case of accidents, or, in fact, now almost certain delay, rations for the whole force till August have been ordered. From Kobo to Pasighat, some 100-200 bullock carts ply in 2 stages; there are also a few elephants. From Pasi to Yembung, 700-800 mules in 3 stages (Rengging and Rotung). Now that the rain has almost started, this mule road continues to "wash out" periodically. In Yembung is kept up a month's reserve for the whole force ahead. From Yembung to Yekshing, to Dosing, to Riga, to Syrnyuk, to Ramsing, to Bomdo, to Angong, to Miging, to stage I (Paling), coolies move daily, except Sundays. In each post there are enough coolies, plus 15 per cent. for sick from 300 downwards, to keep their own posts and the posts ahead fed, and with certain reserves in each post turning over. Each post is guarded by 20-40 rifles, which also accompany the up and down meeting half-way convoy each day. The line of communications is divided into sections over which there are one or two officers and there ought to be more. Dysentery has broken out among the coolies at Yekshing, where, being nearer the plains, the conditions are worse and the doctor has written up that they may not last another fortnight. However, they are very healthy this end on the whole, and we shall probably keep shoving on till June 30. The head of the line does not move on a stage until the sappers have strengthened the various cane bridges with wire for daily, loaded coolies. The Abors generally rebuild their bridge and Pemberton then puts on the wires. From Angong to stage 2, there are six such bridges, the largest (Sirapateng) having a span along the wire of nearly 300 ft. Each bridge takes roughly 4-7 days. Accumulations of rations for the force at the head of the line for 20 days or so have been brought up from the stage below. Hence, as each stage is made and passed, the necessary coolies and rifles are dropped for its post. Of course, this is slow work, but at the same

MARCH

time it is sure and the only way. The 500 odd coolies at the head of the line are fully employed in bringing up the accumulations of rations and building the permanent post camps which in the posts below have been occupied for nearly six months. When the coolies are on their last legs, the accumulations of rations and the remains of the 500 coolies are ready for a dash for 15-20 days on ahead, and back to the last stage. From the survey point of view, this procedure by stages in this country is excellent, as it enables one to wait for the fine breaks and then dash on a march beyond the last stage. If you march for 6-7 days in the rain seeing nothing, it is almost impossible to start surveying again and carry on the back work when the weather suddenly clears. Traversing in this country is hopeless and you get 2-3 inches at once in 4-6 marches.

It may be thought curious that throughout we have not insisted on more help and obedience from these tribes. The reasons are: (1) We are out for survey work, and survey work only, which means guides and help are essential. (2) The people are very democratic, and the only way of punishment is to burn their village and take their foodstuff. This would so terrify them that (as in the case of Ro last year) they would fly to the jungle and hide for at least six weeks, during which time work would be stopped to a large extent. (3) They do not understand money. (4) These more northern tribes are now hard at work in their fields and if they were taken away for many days it might mean starvation for them next year.

April 11. Hamid Gul and I start to-morrow with 6 days' rations up the Sike River.

April 12. Camp on stream beyond Sireng. Worst camp I have camped in yet. Had to start without a guide and lost myself.

April 13. Camped on cross route into Sira Pateng.

April 14. Top of Siropat Hill, nearly 9,000 ft. A most exciting climb, at least for the last 1,000 ft. Hamid Gul was ahead and he had to cut his way up through rhododendrons and among the rocks and in some places we only just got the coolies up. The top is rhododendrons, and two little rocky platforms from which, if it will only clear, we ought to get the best view of the Dihang round the bend that has yet been obtained. Will it clear to-morrow? That is the question. Rain and mist to-day since 9 a.m., and we are all again drenched to the skin. Our water supply ought to see us through till breakfast to-morrow, when I fear we must return.

April 15. Rain all night and still thick mist, and the yet unseen world at our feet remains unseen. Have decided by scrimping and scraping to send some men back, and stay up here another night. It cuts it too fine for getting back, but is well worth the risk. A river is roaring below, which I think is the Sira Pateng. Rations short. Still raining.

April 16. Rain and wind up to about 3 a.m., which kept blowing

1931.] ABOR MILITARY AND POLITICAL MISSION, 1912-13.

in my face and waking me up. At 4 a.m. the cook woke me up, and, seeing a dim outline, I struggled up to the top to get there just as the mist came down again, and I went back in disgust. At about 5.30 another false alarm and the wind changed, so thinking it no good, I packed, ready for breakfast and return, when suddenly I saw that the mist had risen. Giving a whoop ! to Hamid Gul, I dashed on top just about 6.30, and there, there was the little world unrolled at our feet, straight down from the snows through a narrow wild valley with no villages in it, going to meet the Dihang, the valley of which could be seen winding down from a huge wall of snows. Out of this wall sometimes one peak, sometimes another, would dimly appear until finally old Pemakoi,* our N.E. frontier champion of 25,741 ft., glistened in the sun. The panorama, though never at the same moment complete, on account of the misty clouds floating about, was wonderful, and I am the first white man to have seen at least half of it. Of course they got to Singging last year, at the bend, but it rained the whole 3 days they were there. At about 10.30 the mist lowered again, and at 12.30 we had to come down, and get back to camp, where we arrived, just before a thunderstorm, at 4 p.m. The actual head of the Sike never cleared, and Hamid Gul was naturally rushed for time and was not able to finish it off as "pukka-ly" as I should have liked. But when is it that one does not want a little more than one gets, and in this case we might have got nil. Anyhow, we have seen at last, though roughly, where the Tsang-po breaks through this enormous range, and I should say it would be immediately east of Pemakoi peak.

April 17. Rejoined main party and camped under Luyor Hill. By means of threats and displays of rifle fire, Hore had got two old Gasheng men as guides, but at the last moment they beseeched Hore not to kill them on the way and eat them as a sacrifice to the map.

April 19. Top of Luyor pass. Had crow's nest built on a high tree on a spur immediately above the camp. Rain and mist all day. Very cold and damp.

April 20. Rain all night and rain hard till noon. Thunderstorm later which cleared the air. Porter and I were just playing the deciding hand at piquet, when suddenly we saw the opposite range. There was a rush for the crow's nest, a coolie first, self second, Hore a bad third. Then another of these wonderful views. Then everyone was ordered out of the crow's nest and Hamid Gul and the plane-table left in possession. Hore and I dashed off to a place ahead and got a still broader view of the snows and came back in the dark, congratulating ourselves on having seen the most wonderful view probably along the whole length of the Himalayas of India, just where they bend round to Burma. With a wonderful full moon

* Now shown on maps as Namcha Barwa, 25,445 ft.

79

above us felt almost sentimental, and that it was a most fitting finale to the little worries of the last three months.

April 21. Luyor Hill Pass. Up at 4 a.m., and at the clearing ahead with Hamid Gul by 5 a.m. and worked till about noon, he sketching it near, accurately, and far, by eye, as much as possible as a guide for next year's work. I took photographs with my Sanderson and read usual heights, etc. H.G. surpassed himself. Hore and Porter rolled up at 5.30 a.m. and would not have missed the view for anything. Of course we do not know whether the main column has been able to send out columns in the last month or not. At any rate, a far greater area this side of the Frontier is opened up. The Dihang appears to have some 4-5 big tributaries that may have to be explored on our side, and itself seems to go much farther to the N.E. Such a large area is opened that it cannot possibly be finished this year, perhaps in two years. More triangulation must be done in advance east of Pemakoi. What luck to be working in such a fascinating portion of the world, and one, probably, of the oldest. Must try and get hold of some of the old Tibetan legends of the falls and the god's head in the centre. Just started raining again.

April 22. Fair day, only a little rain. Hamid Gul was able to complete the Nigong. A very curious divide here, a sort of miniature of Irrawaddy, Salween and Mekong. Erected a big white signal of split white trees on Luyor Hill, as I hope we may be able to do some permanent theodolite work from there. Into camp on Nigong River about 3.30 p.m. after a decent march, 4,800 ft. drop, being rather wearing to the knees. Very hot down here, some fever in the evening. Sanguinary night with sandflies.

April 23. On the Dihang again. Hurrah I And reached it in front of the main advance by some 7 miles. The country has changed again and is now on a gigantic scale. The Dihang, a very narrow gorge of which one cannot see the bottom, and this village (Mosing) some 1,300 to 1,700 ft. above the river. Very hot climb up from the Nigong, with the sun on our backs. Mosing friendly and not nearly so independent as the Siyom Boris. It appears they are not quite Boris. Though snows have not again been visible, weather has been good and Hamid Gul has been able to carry his work down to the Dihang and survey in a considerable area, which is very pleasing.

April 24. Advance guard of the main advance arrived, and we met again after just over 3 months' wandering on our part. For the present we halt here, on the Angong River, and it is to be one of the permanent posts, and Janbo only a half-way meeting place. Much talk and congratulations to us, but naturally they are disappointed at the slowness of their advance. Very nice being together again, and all cheery.



Abors in War Kit.

The Abor military & political mission, 1912-13



Dino Signal & Yamhe Valley

1931.] ABOR MILITARY AND POLITICAL MISSION, 1912-13.

April 25. Thunderstorm last evening and night. Dihang in flood. Dundas started off by catching a 40-pounder. Eight weeks' mail in the evening.

April 27. Coolies given a rest. Got a good deal of work done. One fish.

April 28. Finished off all urgent odds and ends and went with Trenchard to see Pemberton and his sappers and the Janbo men rebuilding the bridge. The old cane suspension bridge is only a few feet above the Angong stream, and would be swept away in a high flood, leaving our communications cut for perhaps a week. So Pemberton is persuading the Janbo to build another cane bridge, he making the abutments for them. The Abors only take a day or two to make one of their bridges, and when it is finished Pemberton runs two cables through the canes and improves the footway, and you have an excellent permanent coolie bridge. The mixture of Madrassis (sappers), Gurkhas, Abors, coolies, all climbing and swearing over cane ropes and logs on that bridge was worth seeing.

May 7. Nigong camp. As luck would have it, it cleared unexpectedly, and, Oakes observing, self recording, we made a start on Panorama II. Overnight, Oakes had been able to spot a hill he had half-fixed from one of the theodolite stations near Pasighat (12-15 miles off) and near the line of communication, from which we could connect our triangulation work ahead more accurately with the *pukka* Indian triangulation series in Assam. Hence it was decided that I should go and get this hill cleared, and make the necessary observations from it with the other theodolite. Got down the 5,000 ft. to Nigong and have revelled in a quiet read of a sixpenny novel, the first opportunity I have had for many weeks.

May 8. Angong camp. Went ahead with 3 rifles and saw a mirage of snow mountains up a wooded glen, due to the sun just breaking through the morning mist.

May 9. To Bomdo, full 9-hour march. Very hot day. Up 2,200 ft. and down again, all along the Dihang gorge. Very fine in parts. Interviewed Bomdo $g\hat{a}m$.

May 10. Teryong camp B. Twelve sappers and miners have been lent to me for a fortnight as they are not required on ahead at present. The old S. and M. camp A. is at a bridge on the line of communications between Ramsing and Bomdo, and 120 coolies ply daily (Sundays excepted) taking up rations ahead, and except for what spares I can pick up, I have been told to try and get on with the Abors. Was given 36 for the one day only, which has got me to camp B. Bomdo gâm and 2 Abors as guide.

May II. Camp B. No Abors turned up. So khalasies and sepoys responded like the good fellows they are and carried up bedding, food and water for Bambo Ram, surveyor; 4 sepoys and 5 khalasies who started clearing hill.

[MARCH

May 12. Luyong (Hill station). Camped near summit. Most salubrious. At 9.30, to my relief, 26 Bomdo men and women turned up and most cheerily carried out kit, etc., 2 days' supply of water and 4 of food for our 16 mouths. In return, the men get a piece of white cloth (a dress length, 24×8 inches), and the women a brass bell like those on children's toy horses' harness. Got a good start on hill, but it will take 4-6 days to clear. Thunderstorm and rain, which will give more water. All saucepans, baths, etc., put out to catch it.

May 13. Thunderstorm at night and most of us a little wet. At the claps one could almost imagine the whole hill was shaking.

May 14. Got the gap complete for Oakes to see the signal tree, and if he was on the look-out, he will have got his shots between the mists.

May 15. Cutting all day. The hill is getting very naked. Rain and mist most days, but generally clearing a little in the evenings.

May 19. What a rush, but just did it. After as long a delayed breakfast as possible to get up an appetite, there appeared to be a lull in the rain and I rolled out of my hut to take a squint at the mist. Noticed a near hill and felt a warm smell in the air, as if there might be a bit of blue sky about. Shouted for the theodolite and finished its adjustments. After a hasty lunch, there was no question but that something was up, and till it was too dark to read the theodolite we were hard at it. Essential work for joining with rear practically done. Dinner. Means of angles and checking accuracy of results. Just before turning in, a walk on my quarterdeck. It is at such times that one realizes how grand a surveyor's job is. As Hore and Porter involuntarily remarked at dinner after our first view of up the Dihang from Luyor, "If it weren't for the beastly map I wouldn't mind being in the Survey." A full moon and a starlit sky. Not a stir except the seething of the Tsang-po 5,000 ft. in the black valley below. All round black walls rising right up to the lighted heavens, except where topped by jagged sheets of white, where the snowy ranges surround us on nearly three sides.

May 20. Up at 9 a.m. Pemakoi in all his glory as clear as crystal. Breakfast with the porridge spoon in one hand and binoculars in the other, ready to spot new peaks with. Everything finished by II a.m. Most satisfactory. Great stroke of luck. Must be off. Can't wait for Abors. Everyone agrees to pack up and reach camp B. to-day, resulting in my having to carry three-quarter way the two theodolite boxes and stand, normally 3 khalasie loads. Thank goodness someone else took the bedding. All arrived a bit done at 6 p.m. However, I hope to get a hustle on the Abors from here. Got out of my clothes for the first time for 3 days and had a wash. On the whole a most successful day.

1931.] ABOR MILITARY AND POLITICAL MISSION, 1912-13.

May 21. B. camp still. Abors were having a puja, and no one in his senses tries to make a native work once he has started on his holiday.

May 23. Angong. Very long 10-hour march. Rain all day. Very steamy.

May 24. Miging. Up 2,200 ft., down 2,000, up 2,500, down 300; 10-hour march. All rather done. Still raining torrents.

May 25. Finished means of angles, etc., by 9.30 a.m. and overtaking convoy. Got in to stage I at 4.30 p.m. Soaked as usual.

May 26. Started computations; pelted hard all day.

May 27. No rain and fine evening. Dopo of Yardong has been in, and confirms practically entirely the explorer Kinthup's tale. Dopo is a Memba and the first Memba village is two marches ahead. Though originally of Tibetan stock, like the Abors, they pay tribute and trade mostly this side of the range, but further N.E., which increases our area for survey. They, of course, talk a Tibetan dialect and on being asked the name of the Dihang (just below at the moment), said, "Oh, this is, of course, the Tsang-po. It is also just the other side of the high snow mountains behind you." Oh, most wonderful and interesting of rivers! The rain having stopped, we are now assailed by bugs and sandflies innumerable.

May 29. Computations from morning till evening.

May 30. Computations till 10 a.m.; results satisfactory for provisional field values. Got some six more points and snow peaks ahead. Ready for working out many more as Oakes observes them from Dino. Much more satisfactory being able to extend our triangulation like this and makes the work much more *pukka*, apart from the enormous help it will be to the survey. Fixed up trips for surveyors. Bamba Ram to go up the Ringong River, a few miles ahead, for 10-12 days, up another of these cross trade routes into Tibet. The pass is still closed for another month, but they may be able to get some way up and do the necessary survey. Hamid Gul to go up a hill above Tuting, which we shall shortly reach, to get a good view when the next fine day comes along.

May 31. Chit from Oakes with some Dino observations. Started on them with Trenchard.

June 1. Except for $1\frac{1}{2}$ hours' snooze after lunch, computations solid till 2.30 a.m.

June 2. Finished computations by midnight, sending in list of new points to surveyors ahead.

June 3. Lovely morning. Very annoying to be computing instead of up some hill. Plotted points and odd arrears.

June 5. Fine and hot, with whole landscape blotted out by *jhum* fires for this year's fields. Computations with Trenchard till 2 a.m. Sending on six more points to the surveyors. Thunderstorm and rain during night.

83

June 6. Woke up by roof leaking on my nose. Fairly busy day with odd jobs. Rain stopped. Hot and thunderstormy.

June 7. Tuting village camp. Stage 2. The last Abor (or Loba) village. Very different from its namesake. Hamid Gul knocked off a splendid piece from his 11,500-ft. hill and from his camp climbed 14,000 ft., but only got a poor view. Pretty good effort on his part, 3,000 ft. over frozen snow. Good going. The sepoys in his camp killed a *takin*,* sort of sheep-cow, very rare beast, only found on this frontier and in China. One in the Zoo at home. So we had a great dinner of it, and the fresh meat did us good. Very pretty camp, and air delicious.

June 8. Very fine day. This break in the weather is curious, and a pity we cannot take full advantage of it, but Dundas does not wish to send on small parties ahead just at the time of our first advance into Bemba land. Computations all day with Oakes. What a pity we are not two months earlier, or that we could be certain of the coolies below sticking out the rains.

June 9. Still fine. Oakes finished another 12 points by midnight.

June 10. Hamid Gul went on with the sappers, Bethel and 2 squads to the bridgehead. Hore and Wickham up the hill above, to try and shoot some *takin*, as there was nothing else for them to do. Thunderstorm and downpour after dark. Several Membas over to-day to see Dundas, including one official, so we are getting to a land of some sort of government. The official comes from Shoya, where the Membas pay tribute.

June 11. Finishing computations and plotting.

June 13. Trenchard and Oakes remain to go up the Dihang. I return to Miging for the Sira Pateng trip.

* Budoreas taxicolor, about the size of a Kerry cow.

(To be continued.)



THE ABOR MILITARY AND POLITICAL MISSION, 1912-13.

SKETCH MAP SHEWING ABOR COUNTRY, AND GORGE OF TSANG-PO RIVER.

"CATTERICK AWASH."

By CAPTAIN A. E. H. LEES, R.E.

It has been thought that an account of the havoc caused in the electricity and water supply services at Catterick Camp, due to the abnormal thunderstorms of 28th and 29th August, 1930, might be of some interest to readers of the *R.E. Journal*. At the least, those who have, in the past, been stationed at Catterick will be able to congratulate themselves on being out of all the trouble.

The writer is not ashamed to say that he enjoyed every minute of that hectic week-end, though it is doubtful whether the other inhabitants of the Camp would see eye to eye with him in this respect.

To those who do not know Catterick a short account of the general arrangement of the electricity and water supply systems will be of assistance in following the subsequent narrative.

The accompanying skeleton map of the Camp shews the power station and the lay-out of the high-tension transmission lines and the larger water mains.

The power station is situated almost in the centre of the Camp and in the valley of the main stream which intersects it.

The plant installed comprises one 1,000-kw. turbo-alternator, generating at 3,000 volts and two reciprocating sets, each of 300-kw. capacity, generating at 440 volts, this voltage being stepped up to 3,000 for transmission.

The peak load at the time of the year in question is about 500 kw.

The steam-producing plant comprises three 200 lb. per square inch water tube boilers, one of 12,000 lb. per hour capacity and the other two each of 7,000 lb. per hour capacity.

Transmission is by aerial at 3,000 volts which is stepped down to 440 volts between phases at some forty kiosks distributed over the Camp. Power is also transmitted outside the Camp Area to the aerodrome, four miles away; the town of Richmond, two miles away; and to the water pumping station at Lowenthwaite on the River Swale, four miles away.

In addition to the steam plant at the power station there is an emergency generating set, this being a six-cylinder Thornycroft petrol-paraffin engine coupled to an alternator of 36-kw. capacity.

The water supply for the Camp is pumped from the River Swale

by centrifugal pumps driven by electric motors which draw their power from the Camp. The water is pumped a height of about 400 feet into storage tanks of an aggregate capacity of one million gallons, and thence it runs by gravity through a 10-in. main to California, in the north-west corner of the Camp. Here the main bifurcates. The western branch runs along the western edge of the Camp to Druggon Hill, which is near the south-west corner, and where is situated a storage tank of a half-million gallons capacity. The eastern branch main from California feeds the Hipswell division of the Camp, while the Druggon Hill tank feeds the Scotton division and the aerodrome, to which a 4-in. main runs.

The two water systems, which consist of series of ring mains, are connected together at two points, though these connecting links are normally kept closed.

The normal daily consumption of water is nearly 500,000 gallons, so it will be seen that three days' supply could be held in the storage tanks. The pumps can lift 50,000 gallons per hour, so that an average of ten hours' pumping per day must be done to balance the demand.

August 28th.

The fun rightly started on Thursday, 28th August. On this afternoon there was a violent and prolonged thunderstorm which, besides causing temporary lightning interruptions in the electricity supply, filled up the streams with flood water. The worst spate occurred in the Leadmill Beck, which bisects the Camp and runs past the power station.

About two hundred yards above the power station a disused railway embankment crosses the valley of the Leadmill Beck; the beck passing under it through a culvert consisting of three old boiler shells, each three feet in diameter and 60 feet long. These proved too small to take the volume of water, which piled up on the upstream side of the embankment. Eventually the bank burst, with the result that the power station was suddenly and unexpectedly flooded to a depth of about a foot.

Strenuous work on the part of the staff prevented water reaching any vulnerable machinery, and it was not necessary to shut the station down.

By 9 o'clock at night most of the trouble was over, and the E. and M. staff were congratulating themselves on having come through, successfully, a flood of a magnitude that had never previously been experienced and could not possibly happen again. Little did they know what the following day had in store for them !

Photographs Nos. 1 and 2, taken in the morning of Friday, 29th August, show the up and down stream ends of the cooling pond, through which the beck runs.

August 29th.

The floods of the 28th August were merely a prelude to those of the next day.

At about 4 p.m. on the 29th August a series of thunderstorms of most extraordinary violence, accompanied by the blackness of night, descended on the Camp and the surrounding country.

Every dip in the roads in the Camp was flooded, in some cases to a depth of a foot or more. Below the power station, where the Leadmill Beck goes under the Richmond road, near the Camp centre, the arch was not large enough to carry the water, which made up to the height of the parapet top and covered the road for a width of 50 yards with a swirling torrent, in places three feet deep. This the E. and M. officer and the Station Engineer found, to their cost, when they plucked up courage to wade through, in order to reach the power station (Photo No. 6).

The power station was flooded to a depth of two feet, and, at 5.30 p.m., had to be shut down when the water reached the boiler feed pumps, which are on the floor of the boiler-house; the water also filled the well where are situated the condensate pumps of the turboalternator.

Nothing could then be done but to wait for the flood to subside. Photographs Nos. 3 and 4 were taken at about this time. These photos should be compared with Nos. 1 and 2, which are of the same aspects. But more trouble was on its way! At 6 p.m. a report arrived from the higher parts on the north side of the Camp that the water supply had failed. Since the water had not been cut off this could only mean one thing—that somewhere there was a broken water main. When it was realized that, at no less than seven places, large mains crossed the becks, either below the stream or on piers above the normal water-level, the possibility of a floating tree having carried away a main seemed very strong.

By telephone the pumping station was instructed to cut off the water supply, and a man was sent to the Druggon Hill tank to do the same. Orders were also sent to the 55th Field Company to stand by in readiness to carry out any rush repairs on the water mains that might be found necessary.

By this time the entire E. and M. staff had collected at the power station and set to work to try and keep water out of the station so that something could be done to get the plant running again. Even the Chief Clerk, not to be left out in the cold, took charge of the power station office, and did invaluable work for the rest of the night, answering, as tactfully as his patience would allow, the telephone enquiries of irate householders. It is said that when some important person kindly informed the station that "he had no electric light," the answer was given, "I know—and in about two minutes you won't have any water either." The E. and M. officer and the Station Engineer then set out on a preliminary inspection of all the vulnerable points on the water mains.

The first to be examined was Throstle Gyll, a very deep and narrow valley, where the ro-in. main from the pumping station is carried over the stream at a height of about six feet. To reach it a half-mile journey across flooded fields had to be made—a fruitless journey as it proved, for the pipe was found to be intact.

The sites of all other crossings were then examined before darkness set in. At two of these, where the pipe is visible, no damage was found to have been done. At the other four, where the pipes are below the beds of the streams, all that could be said was that there was no evidence of breakage.

By this time the water had subsided from the power station sufficiently to allow work to be started to get the place going again.

It was found that the two boiler feed pump motors were soaked through with water, as were also those of the turbine condensate pumps. The leads to, and the windings of, the reciprocating set alternators, were also damp. Two boilers were under steam and were fortunately fairly full of water.

One of the reciprocating sets was accordingly started up at 7.30 p.m., and was run at a reduced voltage until the windings were dried out. It was thus possible to give a supply to the hospital, the local lighting in the power station, and to the power station workshops.

In an attempt to dry out the feed pump motors, these were started up and run for a few minutes at a time until they began to smoke. Although this method promised well at first, it was not, in the end, successful. It did, however, get a little water into the boilers.

One motor was then removed and dismantled. The stator was first washed with methylated spirit, for which we have to thank the hospital authorities, who handed over two gallons without a murmur at 11 o'clock at night. It was then allowed to dry on the warm brickwork on top of the flues and then shellacked. The insulation was tested and found to be reasonably good, and the motor was accordingly reassembled and replaced on its bed, where it caused intense disappointment by immediately breaking down again.

The time was now midnight, and the water in the boilers having got perilously low, it was necessary to shut the steam plant down. The emergency petrol-paraffin set was accordingly started up. This, however, draws its cooling water from the water mains which, it will be remembered, had been cut off earlier in the evening.

The water supply could not be restored to the power station without including half the Camp, besides possibly feeding the, as yet, undiscovered break. The small supply of water in hand would not allow of this.

The emergency set had to be shut down at 12.30 a.m., when it was getting dangerously hot from lack of cooling water.



No. 3.

After Friday's flood. Compare with Nos. 1 and 2.

Catterick awash 1-4


No. 8 .- The emergency boiler feed pump.

Catterick awash 5-8

1931.]

The last reserve had failed ; the station was plunged into darkness and the staff groped their way out by the light of matches and retired to bed.

August 30th.

For some, however, the night's work had not finished. The Station Engineer, not to be beaten, thought of a scheme whereby water could be got to the emergency set. In pitch darkness—the whole supply of candles in the camp had been bought up long before —he and four skilled assistants rigged up a pipe from the test cock of one of the condenser circulating pumps to the cooling system of the engine. This work was finished by 2.30 a.m., the Thornycroft was started up, ran the motor driving the circulating pump, and so cooling water was delivered. The set ran in this way as long as it was required.

It is slightly ridiculous to think of a 36-kw. generating set running a 15-kw. motor to supply its own cooling water, but it worked, and that was all that matters. After all, the pump motor was only taking a fraction of its rated input.

Next morning at dawn—about 5 a.m.—the staff recommenced work. The first job was to improvise a boiler feed pump or to find an electric motor to drive one of the existing pumps. To this end a deputation invaded the Ordnance Depot—surely a more difficult task than for the proverbial camel to pass through the needle's eye !

The night watchman was found and persuaded to admit the deputation, which next awakened an Ordnance Officer whose quarter is inside the Depot. He appeared in a dressing gown, and gave permission for the motors in the workshops to be examined. A suitable one was found and arrangements were made for it to be removed and taken to the power station.

The installation of this motor would take time, so the deputation next proceeded to the fire station. Here the N.C.O. in charge responded with enthusiasm. The engine, a very modern motor pump, was turned out, its suction pipe was dropped through a manhole that was still welling storm water, the pump delivery was throttled down, and it was found possible to pump against a pressure of 200 lb. per square inch.

Without more ado the engine was taken to the power station and backed against the boiler-house wall. The suction was inserted, *via* a hole knocked in the corrugated iron wall, into the feed tank and the delivery was connected to the feed range by means of water piping and flexible pressure hose. (Photo 8.)

By I p.m. the boilers had been filled up and steam raised; at I.I5 p.m. one of the reciprocating steam sets was started up, enabling power to be supplied to the pumping station, which thenceforth pumped at full capacity, about 50,000 gallons per hour for the rest of the daylight hours. A minor trouble, that of the supply of make-up feed water, which is normally taken from the mains, was overcome unconventionally but simply. The end cover of the condenser in use was removed and several tube ferrules were taken out, thereby allowing cooling water to leak into the condensate. At the first attempt it was found that too many ferrules had been removed and the feed tank was being flooded; accordingly the cover was again removed and some ferrules were replaced. This time, fortunately, the happy mean was found.

Meanwhile a gang was busy installing the motor borrowed from the Ordnance Depot. This was spiked on to baulks of wood which were in turn strutted against the roof and walls. A suitable belt pulley was found and a sleeve was made to bring the shaft size up to the size of the hole in the pulley boss.

One of the burnt-out motors was replaced on its bed and coupled up to its pump so that the two coupling flanges would form a broad enough belt pulley and also so that the motor bearing, which was roller type, might take the pull of the belt.

This pulley was only $5\frac{1}{2}$ inches in diameter, and it was running at about 2,000 r.p.m., but it was found that, with the liberal application of belting compound, very little slip took place. In fact, this expedient ran continuously without trouble for four days, until the first of the feed motors was returned by the repairers to whom it was sent. (Photo No. 7.)

This more orthodox feed pump took over at 6.45 p.m. from the fire engine, which had thus been feeding water into the boilers for 6 hours. It had not been run continuously, but for ten minutes at a time, with rests of ten minutes, as it was found impossible to keep the engine cool enough. This was due to the fact that, when pumping, the engine draws its cooling water from the water which it is pumping and, in this case, this water was hot feed !

The fire engine was not taken away at once, but was kept as an emergency stand-by until the next day. It was not required, however. Turning to the other pieces of machinery damaged by water, it was decided that the drying out of the turbine condensate pump motors could be tackled in the Camp. They were accordingly removed from their beds and sent to the W.D. Bakery, where the R.A.S.C. placed at our disposal one of their ovens. The motors were kept at about 300° F. for 12 hours, and this "baking" was perfectly successful. They were replaced by 2.30 p.m. on the 31st, thus enabling the turbo to be started.

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While all this work was going on, the resurrection of the water supply was in progress.

The first task was to trace the damaged main, and to this end water was turned on to the Hipswell division from the main valve at California. The water was kept on for half an hour and, during this period, the meter was watched. A very reasonable consumption was recorded, and so it was concluded that the break must be on the Scotton side. Hipswell was turned off as the reserve of water was not yet large enough to give a general supply, and attention was transferred to Scotton.

First of all every branch from the 9-in. and 8-in. mains was turned off and then the main was charged in sections; the meter at Druggon Hill tank being watched after each turn on. A high initial flow was at first recorded, due to the mains filling up, but after this the flow dwindled to nothing, showing that each section of the main was intact. After a day's work the tracing of the leak had made no progress.

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To return to the power station. During the day the electrical staff had examined and tested transformers and switchgear in all the kiosks and had disconnected all the time clocks controlling street lighting, so by nightfall everything was ready for a general turn on. The town of Richmond was informed that they would have a supply, but that if they exceeded one quarter of their normal load they were liable to be turned off. They did not keep within the limit imposed upon them, though it was found possible to keep them on. The peak load only rose to 335 kw., and this was only 10 per cent. overload on the set that was running.

The pumps, which had been running all day, were taken off when the lighting load came on and were put on again at 11 p.m. when the load eased up again. Then the power station staff got to bed, after working continuously for something like 36 hours.

August 31st.

Sunday, the 31st, dawned more hopefully.

The station was running happily, albeit "tied up with string," and a fair reserve of water had been built up. The only fly in the ointment was the broken water main that refused to be found.

A remaining section of the Scotton water system was first fille and tested, and then Hipswell was tackled again.

The water was turned on at California as before, but this time the flow did not steady up even though it was left on for two hours. At the end of this time it was decided that the break must, after all, be on this system, as the flow was about 60,000 gallons per hour as against a normal one of 30,000 gallons.

The failure, on the previous day, to locate the break can only be accounted for by the fact that the meter, one of the inferential type, must have been badly clogged with silt.

With the water still on, the vulnerable points on the main were

examined and a miniature waterspout from the middle of the Leadmill Beck proclaimed, without doubt, the position of the break.

It appears that one of the steel culverts, displaced by the flood, must have struck the pipe which lies, covered with concrete, in the bed of the stream on the downstream side of the demolished railway embankment. (Photo No. 5.)

Once found it was a simple matter to isolate the broken length of main, as it only serves as a link between Hipswell and Scotton and its use is not normally necessary. It only remained for the branch mains on the Scotton side to be turned on. In doing this five miles were covered in a car and 19 valves were turned on in 30 minutes.

The task of restoring the water supply was completed by 4.30 p.m.

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The Field Company worked on the Saturday and Sunday strengthening and repairing the concrete walls and weir of the power station cooling pond, which had been undermined by the floods, and so by Monday everything was safe and to all outward appearances normal.

The total shut down of electricity supply had lasted for two periods of two hours each, and a service limited to the bare necessities had been given for 16 hours.

The shut down of water supply had lasted about 44 hours, but this did not mean that the Garrison had to go thirsty, as there are several small independent sources of supply in the Camp. Very satisfactory arrangements were made by the Divisional Staff whereby unit water carts collected water from these sources of supply for the troops and for married families. Apart from this, for at least 48 hours after the storms, all the ditches and streams were very full of running water, which water was made use of by all for every purpose.

In spite of these palliatives it must be admitted that it was a very anxious time for those responsible, as upon their efforts depended the supply of water to approximately 10,000 people, and of electricity to 15,000.

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WATER SUPPLY IN THE FIELD.

By BT. LT.-COL. G. LE Q. MARTEL, D.S.O., M.C., p.S.C., R.E.

ALTHOUGH everyone supposes that the Indian Army is less efficient than the British Service in every respect, there is at least one example to the contrary in our Corps; the Sappers and Miners Field Companies are in no way inferior to the Home units in general efficiency, and over the question of water supply they are a long way ahead. This is perhaps only natural because water supply is such a vital question in the East, but as there is now so little chance of any British unit seeing service anywhere except in the East, it might be well to investigate the chain of thought and solution which we have now reached in India, and see whether something very similar would not be equally suitable for home Field Companies; they might then be equipped so as to be prepared to deal with water supply in the field in any part of the world, and not only in a European country.

To begin with, water supply may be divided into two conditions :----

- (a) When the water is in shallow wells or running water such as rivers and canals, etc., and generally fairly abundant.
- (b) When the water is in deep wells (over 30 or 40 feet deep) and in these cases the wells are usually few and far between.

If we were certain that conditions (a) would always apply, the obvious solution would be to let every unit carry a few lift and force pumps and the necessary troughs and tanks. Every unit would then be self-contained and produce its own water supply with the minimum of trouble and inconvenience to everyone. It is sometimes suggested that the units would smash the pumps, and that these must be looked after by Sappers. This is really pure nonsense. To say that a unit which has to look after armoured machine-gun carriers and anti-tank machine-guns, etc., is incapable of looking after a pump is absurd. This view is merely based on the fact that, if you lend a pump to a unit temporarily, they often make no proper arrangements for someone to look after it and the pump is roughly handled and broken, but if the unit was issued with its own equipment and someone placed in charge of it, it would be cared for just as well as any R.E. pump. There are, however, other and very real objections to distributing the water supply gear of a division in the field to all the units.

These objections at once appear in case (b), when the water is

[MARCH

deep or isolated. If it is deep—an ordinary lift and force pump is quite useless, and some form of belt or deep-well pump is essential. Moreover, a large number of units—perhaps a whole Brigade group or more—may have to come to one well for water. It therefore becomes essential to make a main water point at this place. If the troughs and tanks are all with units, they must be first called in and handed over to the Sappers to form the water point. This would cause much delay and would be most unsatisfactory in many ways, and it becomes essential that the Field Units shall have enough gear to form the water point under these conditions. Hence, if both the units and the Sappers are to have water supply gear, double the amount is necessary and double the transport compared with the case when the Sappers carry it all.

It is no use suggesting that a Division might be fitted out for conditions (a) or (b), depending on the type of country it will be working over. Conditions often change very quickly; a Division may start the day's march with conditions (a) prevailing, and complete the march with supply water under conditions (b). The more the matter is thrashed out the clearer does it become that the only solution is for our Field Units to carry the water supply gear of the Division. There are, however, often cases where some units are unavoidably isolated, particularly mounted units, and it is not always possible for our Field Units to compete with every isolated case. Hence it would be very desirable for all mounted units to have pumps, on a scale of say one per regiment or artillery brigade, and two troughs; they could then make their own arrangements when units were scattered, and could not all be supplied with water from water points erected by Sappers. Many units possess this gear, which they have purchased privately, and it is considered this should become official equipment.

When working under conditions (b) a very large quantity of water is required. For instance, a Brigade group may want 15,000 gallons of water, and this must be pumped up in four hours at the most, if long tedious delays over watering are to be avoided. This means about 4,000 gallons an hour, and would require six or eight lift and force pumps, even if the water was comparatively near the surface. Hence, a power pump which can be used either when the water is near the surface or deep down in wells is essential for these main water points. It should here be explained that there is little value in having a number of small power plants to replace the lift and force pumps. If the water is shallow and plentiful (case (a)) it is nearly always better to make a number of water points and divide the units among them ; in this case one or two lift and force pumps at each point is sufficient ; they are not very exhausting to work and would probably give far less trouble to all concerned in the end than if they were replaced by a number of small power pumps.

Granted then that what we require is one power pump with each Field Unit which will supply some 4,000 gallons an hour from any source, varying from surface water to wells up to say 100 feet deep, what type of plant will suit us best ? To start with the engine, there is a natural desire to go for a high-speed petrol engine. Somewhere about 5 h.p. is needed, and quite a small light engine would produce enough power. It must, however, be remembered that if the army sits down for a few days, there will be heavy demands on the central water points, and in practice the engines often have to run practically continuously. Then in the East, sandstorms are normal, and the combination of long hours of running and sand will reduce the life of the little high-speed petrol engine to an absurd figure-perhaps as little as a week. For this reason India selected the 5 h.p. Petter engine. This is a substantial engine which has shown that it will run for days on end in spite of dust storms, and needs very little attention when used for months on water supply work ; it is fully worth the 5 cwt. which it weighs, even though a high-speed petrol engine might only weigh a quarter of this amount.

Then as regards the pump, a belt pump is obviously indicated. Both the Aquatole and the Bolton and Paul were tried. The latter is easily damaged in transit, while the chain of the former is indestructible—a very important point in field equipment. Also the length of the Aquatole chain can be adjusted in a few minutes, compared with a quarter of an hour with the Bolton and Paul. Against this, the Bolton and Paul will work with the pulley submerged in 15 ft. of water, while the Aquatole is limited to some three feet. After field trials the Aquatole was selected. Some trouble was experienced with the pulley rising and tangling the chain, but this was easily cured by hanging a small weight below the pulley. A centrifugal pump is, of course, needed to lift the water from the spill tank, and this is driven from a side pulley, as shown in the photograph, which shows the pump at work.

If the water is near the surface the centrifugal pump alone is used, and the Aquatole belt is not placed in position. It is true that under these conditions the engine is still driving the Aquatole belt pulley, but this absorbs practically no power nor is it a heavy addition to the weight of the equipment. There seems no call for a separate plant for use when the water is near the surface, such as is being tried out for use in Field Units at home.

The equipment is mounted on two 15-ft. steel joists, which are normally placed over the top of the well, so that the chain can fall straight down into the water. The belt drive may be criticized as old-fashioned, but when you have in any case to use long steel joists to span over the well, there is no objection to separating the engine and pump by sufficient length for this drive. A belt drive is after all quite fool-proof, and works perfectly in practice. The joists are cut in the centre, so that the plant is carried in two halves; when it is assembled the joists are connected at the centre with short channels and bolts. This is a clumsy joint, but these and many other minor points in the detail design will be put right soon, and we should then have a really first-class power equipment for water supply which would seem to be ideal for Field Company use.

As regards the distribution of water supply gear, the following table shows what is carried by Field Units. The D.H.Q. Company corresponds to the Field Park Company at home, and the Field Troop is a rather larger and more self-contained unit than at home.

Gear.	Fiela Troop.	Field Coy.	D.H.Q. Coy.	Capacity.	
Mechanical pumping s	et	I	1	I	4,000 gallons an hour from 40 feet deep.
Chursa set	•••	3	2	3	Same as lift and force pump.
2,300 gallon tank	•••	2	4	. 4	Holds 1,500 gallons under average conditions.
500 gallon tank	•••	4	2	2	Holds 500 gallons under all conditions.
600 gallon trough	•··•	8	5	10	Holds 350 gallons under average conditions.
Lift and force pump	•	6	6	8	500 to 700 gallons an hour, depending on lift and height to be forced.

The policy on which these figures were based was that the plant should be capable of supplying the water for all animals in two hours, and if the drinking water for men has also to be pumped or raised, the total requirements should be supplied in four hours at one gallon per man.

The chursa set needs a little explanation. It consists of a canvas bag which is lowered over a pulley down deep wells and hauled up by a mule or horse. The water is poured into a spill tank and the bag is lowered again down the well. It is a method of raising water which was invented by the Chinese some 2,000 years B.C., and on my arrival at Roorkee I found them inventing a portable military set for use in the field. At first this seems absurd, but it is difficult to suggest anything more suitable. The chursa set is for use when the conditions as regards water supply are neither as (a) or (b) above. It happens fairly frequently in the East that the water level is about 30 or 40 feet deep, and that every little village has one or more small wells of that depth. If a mechanical set is erected over one of these small wells it is sucked dry in perhaps half an hour, and the only solution to the water supply problem is to extract water from all the small wells in the neighbourhood, and then wait for some hours while they recuperate. There is obviously no point in having a number of powerful mechanical sets for this purpose, and small

mechanical sets are apt to be troublesome and unreliable. The *chursa* set appears to be the right solution; it can be erected in a few minutes; it is quite fool-proof and is worked by one or two mules or horses.

The 2,300-gallon tank in the above list is, of course, for storage of men's drinking water, and the 500-gallon tank is for storage for small isolated units or Headquarters. This latter tank is a particularly neat design, and stands up like a tub with no pickets or supports.

There is only one further plant in water supply gear which is still needed and has not yet been produced. All the above plant except the mechanical set can be loaded on pack for mountain warfare, and it is during this form of warfare that large quantities of water are often needed from the only available well or source. The quantities needed are much greater than in normal warfare because of the large numbers of pack animals. It is believed that the above mechanical set can be loaded on a camel, and this may be the solution, but failing that, a light set may have to be designed using a high-speed petrol engine, and we may have to accept the disadvantages of this compared with the more solid slow-speed engine.

We now come to the calculations for the requirements in water supply in the field. These can, of course, quite easily be worked out from first principles in each case, but this is tedious. Most people have their own pet methods of overcoming this, but for those who have not, the following may be of interest.

Taking horses first, a horse needs from 5 to 15 gallons a day, depending on the weather ; three gallons per horse at one watering is a normal allowance, and he will seldom drink more than five gallons at a time however thirsty he is. Now the service trough will water 18 horses at a time, watering from both sides of the trough, and relays can be arranged at six-minute intervals. Hence 180 horses can be watered in one hour, and normally require 540 gallons or an absolute maximum of 1,000 gallons of water (allowing 100 gallons for wastage). This gives what we will call one unit for horses, i.e., 180 horses watering from one trough in one hour, and needing one lift and force pump. If the water is much below trough level or has to be forced up a fair height or if the horses are very thirsty it may need two pumps to keep one trough going, but very often when the horses are only averagely thirsty and the water level is near trough level, one pump will serve two troughs; the unit always remains 180 horses for one hour at one trough.

Then for men the unit is 1,000 gallons, which is sufficient on active service for 1,000 men for one day, and can be produced by two lift and force pumps in one hour.

It is now possible to translate all units with which one is dealing into water units for purposes of calculating their requirements. The table shown is only worked out approximately but will serve to

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indicate what is meant. It gives rough requirements in water units for various units and groups at war strengths, and the figures cover British or Indian Establishments—whichever needs the most.

	Heiter Craub						Water Units Requirements.		
Unit or Group.						Horses.	Men.		
Div. Cavalry Regiment						3	1		
Inf. Bde		•••				4	4		
Inf. Bde. Group		$\begin{cases} I & In \\ I & Fd \\ I & Fd \\ I & Fd \\ Det. \end{cases}$	f. Bde. l. Bde. l. Coy. l. Amb. . Signals	···· ···· ····	···· ··· ···	9	б		
Div. H.Q., including		R.A R.E Nor Prov	. H.Q. . H.Q. mal Šigs vost	····	 	I	I		
Div. H.Q. with all Div. Troops			•••		18	5			
Div. Train			•••	•••		I	I		

From this table it will be seen that to water the horses of a Div. Cav. regiment in one hour, three pumps and three troughs are required, or with one pump and one trough, all the horses can be watered in three hours. With surface water and when horses are not very thirsty, one pump may serve two troughs.

It will be noticed that a Field Company has five troughs which will water the horses of an Infantry Brigade Group in about two hours if four pumps are sufficient, leaving two pumps for men's drinking water, if this needs pumping up also. Also D.H.Q. Company can water the horses of Div.H.Q. and Div. Troops in about two hours.

Tables of this nature, made out for the strengths of the unit with which one is actually working, might be equally useful to both the "Q" Staff and the R.E. officer concerned.

It is often suggested that the water gear should be more centralized and kept at, say, Div. H.Q., and sent out as required. This would no doubt lead to a small economy in material, but it could only be used successfully if it could be guaranteed that the water gear could be delivered up in front at the right place and at the right time.

As this is impossible, it remains essential to keep some gear with each Field Unit, and the present scale appears to be the minimum to which it can safely be reduced. In this way, an Infantry Brigade which is sent off to a flank will normally have a Field Company with it, and will thus have its own water supply gear, and can arrange for A SUBALTERN IN THE INDIAN MUTINY.



The Assault on Delhi. Fighting inside the Walls, September 14th, 1357. (Near here Nicholson fell).

Water supply in the field

water points without the inevitable delays which would occur if all the plant had to come from Div. H.Q. The argument for centralization of water gear rests partly on the fact that a Field Company often makes a water point and has to leave the gear down for a second brigade which is following on. If water gear all belonged to the D.H.Q. Coy., they could then dispatch a duplicate set to the Field Coy. that has shed its gear on the water point. This point is perfectly true, but this leapfrogging is not always normal; water gear needs a great deal of care and attention, and it is better for each unit to possess its own gear, which it will normally both use and take up afterwards. If it has to be left down, the solution is for the unit to leave one or two men with it to look after it and see that it eventually comes back complete and correct. If necessary, the unit that takes over the water point can send up a similar quantity of gear to the forward company, again on loan in a similar manner with a storekeeper.

As regards transport, the accepted policy in India is now that each Field Company shall have four 30 cwt. 6-wheel lorries for water gear. These will carry some 30 men, besides the water gear, so that the unit can send up the necessary gear and party to erect it as soon as orders are received from the Headquarters concerned. This should save much time and add greatly to the comfort of the troops. The lorries will be arriving shortly for some of the Field Companies, and this marks a distinct, orward step in water supply work in the field.

Only one point remains to be discussed—that of water parties. Much has been written on this subject. Some staffs get it on the brain and consider that a permanent R.E. water party is the solution to all water supply problems.

As with everything else, common sense in the employment of permanent R.E. water parties is the solution. When passing through country in which the water conditions do not vary and when carrying out regular marches, permanent water parties who take their orders in a Brigade direct from the Staff Captain are often the simplest solution to water supply work, but there are plenty of cases where such parties are a pure waste of R.E. labour which can be ill afforded. If the Company Commander knows his work, he can always advise the staff when these water parties should and should not be provided.

This system of water supply in the Field which has been described is largely the work of Brigadier E. F. J. Hill, assisted, of course, by the Commandants of the three Sapper and Miner Corps. The mechanical set was produced at Roorkee. Both the equipment and the policy appear to be working remarkably well, and will improve in time, especially when the 6-wheel lorries arrive.

The British Service might do worse than copy the whole scheme in toto.

THE CONSTRUCTION OF ALEXANDRA RIDGE PICQUET (WAZIRISTAN) BY NOS. 10 AND 13 FIELD COMPANIES, Q.V.O. MADRAS SAPPERS AND MINERS, IN 1929.

GENERAL.

THE road from Bannu to the Razmak plateau, occupied in 1923, passes over the Narai at Duncan's Picquet, 7,200 feet above sea-level and about seven miles from Razmak itself. Immediately east of Duncan's Picquet, Alexandra Ridge rises to 8,000 feet, and at this point control of the whole Narai area is obtained.

The early temporary picquets scattered about the Ridge have been replaced by semi-permanent structures, and in furtherance of this policy it was decided in 1929 that the pivotal point should be fortified in a manner to house, in comfort and command of the situation, a garrison of two platoons of infantry, plus signallers and M.G. detachment. M.E.S. rates in Waziristan have always been high, but the idea being noised abroad that the new picquet had to be built quickly, the G.E. received such unreasonably high tenders that none could be considered. After some delay the G.O.C. Waziristan District ordered the construction to be commenced immediately by the two field companies, hoping that if the undertaking were successful it would prove a lesson to the maliks and contractors who were endeavouring to get unfairly high rates for the work. A temporary picquet was therefore prepared (perimeter wall and wire were crected by 1st Bn. Sikh Pioneers), about 200 yards from the site of the new picquet No. 10 Field Comand the existing structure was demolished. pany moved out from Razmak on 5th June, was joined by No. 13 Field Company from Manzai on 6th June, and work commenced on 10th June.

The Plinth Area estimate was Rs. 78,070. Actually the construction costs reached Rs. 61,000, including a payment of Rs. 9,495 to the Field Companies, a great proportion of which was needed as compensation for extra wear and tear of clothing.

DESCRIPTION OF THE PICQUET.

The perimeter walls were built 20 ft. above plinth level, forming a rectangle 170 ft. x 100 ft. with two diagonally opposed treble-storied towers protruding 10 ft. in plan. Foundations 3 ft. x r ft. stepped were coursed rubble masonry in lime mortar, while all other masonry was built in mud, mixture pointed. Inside the enclosure, cookhouses,



The construction of Alexandra Ridge picquet



No. 8 .- The emergency boiler feed pump.

The construction of Alexandra Ridge picquet 5-8

armoury and fireworks store, water and ration storage arrangements, B.O.s' and I.O.s' quarters were built, accommodation being provided for a garrison of 1 B.O., 2 I.O.s, 82 I.O.R.s, and 9 Followers.

A shed was erected outside the walls for mule stables. Certain deviations from the blue prints were permitted. These became necessary as work progressed, *e.g.*, the temporary picquet overlooked the permanent one, and in consequence the south wall was raised and provided with M.S. plate loopholes. Drainage was provided as found necessary, the eastern barracks being built on a terrace 3 ft. above the level of the remainder of the fort. Timber and angleiron ladders were used instead of reinforced concrete ones. The number of rivets in all ironwork was considerably reduced.

Direct visual communication is obtained with Bannu, Idak, Mir Ali and Razmak.

CONDITIONS.

The men had no comforts, tents being pitched chock-a-block in the temporary picquet and working hours being abnormal. In order to complete the work before the frosts of the winter commenced and before 13 Field Company moved back to Bangalore, it was necessary to concentrate on nothing but work, and consequently the actual working hours on the job averaged $9\frac{1}{2}$ daily throughout the whole period. Men employed in the workshops at Razmak worked the same hours. Sunday as far as possible was a holiday, when men bathed and washed their clothes in a spring $1\frac{1}{2}$ miles away and 800 ft. down the hillside—there was no water for this sort of thing on the Ridge. All other days were full working days, though 70 men were able to stop work at 5 p.m. on Saturdays and proceed to Razmak by lorries, returning to the picquet on Sunday evenings.

July and August proved to be unusually wet months, and caused considerable delay, while the hands of men engaged on stones and lime became so soft and torn that they needed bathing three times a day in picric acid.

Contractors and their labour (donkeys and coolies) were proved to strike under very little provocation, but without their co-operation the transport of stores up from Duncan's picquet of stone, water and sand became impossible.

The temporary picquet was commanded by the senior S. and M. officer present, and his garrison was augmented by 25 signallers and a M.G. detachment from an infantry regiment. Protection whilst at work was afforded by Khassadars, and (for some time) two platoons of infantry brought out daily in lorries from Razmak.

13 Field Company left on 29th September, a detachment of 10 Company completing the outstanding work by 5th October, when the new post was officially opened by the Commander, Razmak Brigade.

NOTES ON THE ENGINEERS OF THE ITALIAN ARMY.

By " PONOCRATES."

OWING, perhaps, to the difficult nature of her frontier regions, which has induced a study of engineering problems, perhaps to the high intelligence which is a characteristic of the Italian race, the Italian Army has always been fortunate in its engineers. The old Roman roads in Europe bear witness to their work many centuries ago, while a tour of the battlefields of the Great War in Italy convinces that the modern Italian engineer has by no means lost his art.

STRENGTH AND ORGANIZATION.

The establishment of the engineer arm provides for between 1,000 and 1,100 officers. It is interesting to note that this establishment allows more lieutenant-colonels than majors and more captains than subalterns i

Up till the time of the big reorganization of the army in 1926, engineers consisted of a combatant and a non-combatant branch, the former known as the "Engineer Arm" and the latter as the "Engineer Service." The difference in duties between these lay in that the "Arm" was responsible for military engineering, while the "Service" performed works services, often on a large scale. After the 1926 reorganization, the "Service" was abolished as a separate organization, its duties being mainly transferred to the Ministry of Public Works, while its officers were either transferred also or amalgamated with the "Arm." The "Engineer Arm" then became responsible to a limited degree for works duties, primarily in connection with the army.

This reorganization was found, however, to be incomplete without some provision for purely technical experts, and a special branch was formed, known as "the Service of Engineer Specialists," but part of the "Engineer Arm." Only officers with special qualifications are posted to the "Specialists," where they remain for the remainder of their service. They are then treated differently from the other officers of the "Arm," in that they do not do duty in command of troops and have different examinations, but they are all on the same promotion list. Each Army Corps has a "Specialists" head-

1931.] NOTES ON THE ENGINEERS OF THE ITALIAN ARMY.

quarters, and this service finds the personnel for a military wireless institute, workshops for electrical and constructional engineering, and instructional centres.

Apart from the "Specialists' Service," the "Engineer Arm" is organized into Army Corps engineer regiments (one per Army Corps), two wireless regiments, a railway regiment and a bridging regiment. There are also a balloon group, a camouflage section per Army Corps and units for water supply, flame projectors and carrier pigeons.

The Infantry and Cavalry Divisions have no engineers at present permanently allotted to them. In war, it is visualized that their requirements will be met by detachments from Corps regiments. As the latter are only some 1,500 strong and are responsible for signals as well as field engineering, it is clear that Italian formations are not generously treated as regards engineers. The system, however, ensures strong, centralized control over all the engineers in the Army Corps, and is consequently conducive to economy in engineers.

The Army Corps regiment contains normally one battalion of sappers and miners and one telegraph battalion. On occasion it also contains a mountain ropeway battalion. The sapper and miner battalion is about 450 strong and is organized into 4 companies, each of 3 platoons, and possesses partly pack and partly mechanical transport. The telegraph unit has the same organization of companies and platoons and has cable both on carts and in pack. The mountain ropeway battalion carries in lorries apparatus for $1\frac{1}{2}$ miles suspension, capable of a load of about 100 lb. and of a capacity of about 1,000 lb. an hour. The apparatus is split up into manloads.

BRIDGING.

The control of the main bridging material is also centralized, the one bridging regiment being under either Army or G.H.Q. control, and Army Corps do not have their own units. Infantry and Cavalry Divisions have bridging sections as described below.

The regiment consists of 3 bridging battalions and 1 inland water transport battalion. The bridging regiment is about 1,500 strong and has 3 companies. It carries material for about 250 yards of medium bridge, or about 150 yards of heavy bridge, all in 4-wheeled wagons.

The Infantry Divisional bridging section carries 8 pontoons, and 5 trestles, and with trestles and pontoons combined constructs between 35 and 40 yards medium bridge. The Cavalry Divisional unit has 6 pontoons and I trestle of a lighter type, and is capable of somewhat less performance than the Infantry Divisional section. All divisional bridging is still horse-drawn.

103

THE ROYAL ENGINEERS JOURNAL.

EXPERIENCE OF CIVIL ENGINEERING.

Prior to the 1926 reorganization and the taking over of certain duties by the Ministry of Public Works, a large number of the officers of the non-combatant branch undoubtedly had excellent facilities for studying civil practice and in carrying out large-scale construction, such as roads and docks. Now, conditions are less favourable. To remedy the situation, some 20 specially qualified officers, between the ranks of major and subaltern, are seconded each year to the Ministry of Public Works.

TRAINING.

The supply of engineer officers required each year for the regular Army is found entirely from the Military Academy at Turin, where the candidates complete a five years' course before obtaining a commission. Entrance to the Academy is by competition, and the cadets are taught, apart from military subjects, mathematics, science, languages, drawing, equitation and accounting.

Training of engineer officers after joining the Army is carried out entirely within engineer regiments until officers reach the stage at which they are qualifying for unit command. They then are required to pass a short course at the Central All Arms School, at Civitavecchia, near Rome, similar to our Senior Officers' School. At Civitavecchia there is also an Engineer School, at which specialists' courses are held and at which experiments and research are carried out. That the training within units reaches a high standard is proved by the work which is carried out in the field.

THE ENGINEER MUSEUM IN ROME.

In Rome there is an exceptionally fine engineer museum, which no officer in the Corps who has the opportunity should miss seeing. This museum shows how, like the Royal Engineers, the Italian military engineers mothered in their infancy many new forms of activity which later became dissociated, such as the early flying.

It also shows the marvellous accomplishments of the engineer corps in the Great War, there being excellent models of the roads, railways, ropeways, etc., constructed in the most difficult terrain.

[MARCH

NANJANGUD.

THE ANNUAL BRIDGING CAMP OF THE Q.V.O. MADRAS SAPPERS AND MINERS.

JUST 100 miles from Bangalore, the main Nilgiri road to Ootacamund and Wellington crosses the Kabani river in Mysore State.

Here, each year, from the end of July until about the middle of October, the units of the Madras Sappers, which are stationed in Bangalore, go in turn into Camp for bridging. Each unit spends a fortnight there, thus making five separate camp periods—one for each of the three Field Companies, one for the Field Troop with a party of Recruits, and one for the two Army Troops Companies combined. The Divisional Headquarters Company remains down there for the whole period, running the electric lighting services for the Camp.

The Field Troop marches both ways by road, the remaining units either march out and return by train, or vice versa. For a Field Company normally nine days are allotted for the march-a liberal allowance for a 100-mile march, enabling the unit to carry out training in field operations on the way. A normal day's routine on the march is réveillé at five o'clock, the men have coffee and bread, kits are packed, tents struck and transport loaded up. The transport is mixed, mechanical and animal-four 30-cwt. lorries, a box Ford and nine army transport carts being a usual allowance for a unit. (It must be borne in mind that rations for half the march have to be carried with the column, as refilling is only carried out at one place on the road.) The mechanical transport, with a small advance party, moves off at c615, and the Company marches at o630. An average march of 12 or 13 miles is done, and combined with it is usually some tactical scheme : for example, the action of an advance guard, or, where the ground is suitable, training in picqueting. On arrival at the Camp site, tents are pitched, water supply arranged for, food cooked, and the remainder of the day devoted to education, swimming where water is suitable, writing up reconnaissances carried out on the march or where facilities occur, sightseeing-the old fort at Seringapatam with Tipoo's summer palace, the power station at Sivasamudram and the zoo at Mysore proving never-failing attractions

Although never going completely dry, the Kabani river, in common p*

[MARCH

with all rivers in India, varies in width and velocity with the rainfall at its source, the Highlands of the Western Ghats. This governs the choice of the time of year for the Camp, as before the end of July there is usually not sufficient water in the river to make a Camp really profitable. As it is, it is no uncommon event for the river to rise or fall 10 feet in a few days, both contingencies annoying in their consequences, the first often upsetting schemes for landing stages and piers, the second revealing unsuspected snags in the form of submerged rocks and tree trunks. At a good time, the river is about 150 yards wide, with a current of about four miles an hour.

The Camp is perched up under trees on the high bank of the river near to the Civil Rest House. Everything is close at hand, the river just below, the main road on the other side, and across that the railway station. Everyone is under canvas, though on a rather more lavish scale than provided by the Field Service allowance of one r6o-lb. tent to 20 men, and the presence of the Divisional Headquarters Company with their electric light lorry enables all the tents to be lit by electric light. In practice, most units find it convenient to hire one room of the Rest House as a messroom for the officers' mess.

The fortnight passes rapidly. India, as yet, only possesses the old-fashioned, bi-partite pontoon, and all pontoon bridging has to be carried out with these. In addition, excellent practice can be had in launching trestles in fast-running water, bridging expedients, the erection and maintenance of flying bridges, and the execution of ferrying schemes. Very often a section of armoured cars from the Company stationed in Bangalore joins a Sapper unit down there for a few days, and very trustingly allows the latter to ferry their cars across the river, or experiment with grass mat tracks across the sandbanks downstream of the camp.

There is no suitable area for a hockey ground, but every evening, after work, two basket ball grounds are always in full use until, and even after, dark, and the annual inter-sub-section tournament arouses great enthusiasm.

There are naturally unlimited opportunities for swimming and the British N.C.O.s, with the Company, never tire of the improvised surf board towed behind the cutter with the outboard motor. At the end of the Camp, an aquatic sports meeting is held, with its pillow-fighting on spars, greasy pole, pontoon and rescue races, and the many amusing events which occur to the ingenious mind.

Sport, too, is not lacking. The Camp is held too early for the migratory duck to have arrived, but the later companies get the first snipe, and there are always the resident spotbill, cotton and whistling teal to be looked for. Seldom does a Company fail to



1.-- A general view of the camp.



2 .- Armoured car crossing sand on grass track.



3 .- Flying ferry for armoured car. Running on to the raft.



4.-Flying ferry for armoured car. Approaching the landing stage.



5 .- Placing a treatle by means of a derrick erected on a pontoon raft.



6.-Swinging bridge.



7.-- A leopard shot from camp



8.-The surf board.

Nanjangud 5-8

collect one or more mugger—the blunt-nosed crocodile. There is one favoured rock, right opposite the Camp, on which, unexpectedly and quietly, a mugger often appears, sometimes when the river seems to be as populous as the Serpentine. One moment he was not, the next he is. Such excitement and the hurried detailing of an assault party armed with '303 rifles. More often than not the quarry escapes, but now and again one is shot and, what is even harder, retrieved. Leopard, too, 'are to be found in the neighbourhood, and last year a Company, which arrived in on a Monday, secured a female, 6' $5\frac{1}{2}$ " long, on Tuesday, and her mate, 7' 1" long, on Thursday, both in the same patch of scrub jungle only twelve miles from camp, the officer in each case leaving Camp by car at 3.30 p.m. and returning with his victim by 6.30 p.m.

The great Dusara festival occurs in October, and Mysore (only 15 miles away from Camp) then provides what is possibly the most gorgeous pageant to be seen in the whole of India. It is usually arranged that a Company is on the move back at that time and that it runs a Camp in Mysore for visitors and polo players from the Corps.

Altogether, these four weeks in the summer provide a Company with what is probably its most valuable training of the whole year, and officers and men return to Headquarters better in every way from the interesting work and change of air.

MAURITIUS.

By Major H. A. Joly de Lotbinière, m.c., R.E.

IN view of the steady reductions that are taking place in overseas garrisons, occasioned by the insistent demands of economy on the one hand, and by improved communications on the other, it may be of interest to officers of the Corps if a brief description is here given of the last R.E. Station south of the Equator, before it, too, may disappear through force of circumstances.

Mauritius has often been called the "Cinderella of the British Empire" and this description is not entirely unmerited, as doubtless, owing to its isolated position in the Indian Ocean, its existence is more often than not unknown to the average individual, who—even if he knows the name of the Colony—usually places it in the West Indies.

In case, therefore, any reader of these notes is still slightly hazy as to the whereabouts of Mauritius, he will find it situated in the South Indian Ocean, to the east of Madagascar, some 1,550 miles north-east of Durban, and 2,200 miles south of Colombo, in latitude 20°S. and longitude 57°E. approximately.

In extent it certainly merits the appellation "minuscule," a favourite term used by the local press in describing their diminutive country; since its length and breadth measure only 40 and 30 miles respectively, and its area some 720 square miles, over one-third of which is covered by mountains and forests.

The past history of the island is most interesting, and is a veritable epitome of the early struggles for supremacy which took place in the Indian Ocean between the Dutch, French and English.

Mauritius was undoubtedly known to early Arabian seamen, and was probably first sighted by some dhow blown out of its course when making the run between East Africa and the Malabar Coast.

We obtain our first historical records, however, from the Portuguese who discovered and named the island "Cerné" in 1507, only a few years after Vasco da Gama's historic voyage to India.

The Portuguese made no attempt at permanent occupation, and used the island only as a place of call; and it was not until 1589 that the island was formally annexed by Admiral Van Waërwijek on behalf of the Dutch Government, who renamed it Mauritius, in honour of Prince Maurice of Nassau, the then reigning Stadtholder of Holland. In 1638, the first settlement was made at Port South-East, now called Vieux Grand Port, on Mahébourg Harbour. The Colony was, however, never a success, being handicapped from the start by the parsimony of the Dutch East India Company, and by the maladministration of its numerous governors. At first, ebony wood proved a lucrative export, but when other more prolific sources of supply were discovered, this ceased to be shipped. Sugar cane, the staple industry of the island, was first introduced by the Dutch, b little headway was made in this direction owing to the depredations of the rats, and later of the "Maroons," or escaped Malgache slaves.

In 1658, the Colony was abandoned in favour of the new settlement at the Cape, but was again resumed in 1664.

In 1710, the Company decided to abandon the settlement once more, this time finally, as the young colony had never proved a source of profit, but rather an endless drain on their diminished income. Steps were therefore taken to destroy everything which might prove of value to either of the other competitors, even to cutting down all ebony trees in the island and burning the plantations.

Thus ended the Dutch connection with Mauritius, of which no trace now remains except in the names of Piton Pieter Both and the districts of Plaines Wilhems and Flacq (Vlackte). In connection with the Dutch occupation, it is interesting to note that until their arrival, the dodo existed in large numbers, but within a few years not one of these interesting birds remained alive; and at the present date only two fairly complete skeletons exist in the world.

From 1710 to 1721, the island remained uninhabited except for roving bands of Marcons; and occasional buccaneers, who used the island for careening their ships.

In 1715, however, the French Government, realizing the immense strategic importance of the island in connection with their growing Indian Empire, took possession of the island in the name of King Louis XV; and in 1721, the French East India Company, to whom the island had been transferred, dispatched a body of settlers from the neighbouring colony of Bourbon to the site of the ruined Dutch settlement at Port South-East, now renamed Port Bourbon, and later, Grand Port.

From that date to the present time the island has always remained in occupation, and has continued to increase in wealth and population.

The greatest name in Mauritius' history is that of Comte Mahé de Labourdonnais, who was appointed Governor in 1735. To this exceptional individual, Mauritius in great measure owes her present prosperity.

Sugar cane planting was vigorously undertaken, the defences of the island were commenced, and from being a struggling settlement in 1735, Mauritius, by 1747, had become a flourishing and selfsupporting Colony. In that year, unfortunately for the island,

[MARCH

Labourdonnais was recalled to France to answer certain charges of treason falsely levelled against him by Dupleix, with whom he had been associated in his attack on Madras. It is sad to record that this fine figure in French history died in extreme poverty in 1753, after three years' confinement in the Bastille, from which he was finally released an innocent man.

In 1767, the Colony fell on bad times, owing to the incompetence of the French Company; and it was then that the French Crown was compelled to assume full responsibility for its administration.

As in other French possessions, the Revolution of 1789 made itself felt in Mauritius, but with no lasting effects, since the French population of to-day remains almost entirely Royalist in sentiment, the slave-owning planters at that time having little sympathy with the current republican ideas regarding the equality of mankind.

During the Napoleonic Wars, under the able administration of General Decaen (1803 to 1810), one of Napoleon's young commanders, the island became the centre of a flourishing industry that existed by seizing British merchantmen in Indian waters. By 1809, matters became so acute that the H.E.I. Company's representative, Lord Minto, decided to organize an expedition for the capture of the "Isle de France," as Mauritius was then known, together with its neighbour, Ile Bonaparte, as Bourbon had been renamed in honour of the Emperor.

To ensure a secure base from which to operate, the small island of Rodrigues, lying some 300 miles to the east of the Isle de France, was occupied by a small force from India, subsequently increased for the final operation against Mauritius to 14,000 men, by means of detachments from the Presidencies of Bengal, Bombay and Madras, and also from the Cape, which had been re-occupied by the British in 1806.

The first operation undertaken was that against Bourbon, and was a complete success, the island surrendering unconditionally to Lieut.-Colonel Keating, after a brilliant action near St. Denys, the capital, on July 10th, 1810.

This victory is commemorated by the battle honour "Bourbon," which is still borne by the Welch Regt., Royal Ulster Rifles and several Indian Regiments on their colours.

The second, and most important object of the expedition, *i.e.*, the capture of Mauritius, was effected on December 3rd, 1810, after a successful combined naval and military operation under the command of General Sir John Abercromby, son of the famous victor of Alexandria in 1801. These notes do not permit of any details regarding this well-planned and well-executed operation; but it stands out in bold relief against the hare-brained and ill-conceived expedition to Buenos Aires in 1806, and that undertaken four years later in 1814 against New Orleans.

MAURITIUS,

These notes would not be complete without some reference to the battle of Grand Port—or, as it is sometimes called, the battle of the Isle de la Passe—which was fought between August 23rd and 28th, 1810.

This action was the outcome of a preliminary operation against Mauritius, which aimed at the capture of the island battery guarding the entrance to Grand Port Harbour. Emboldened by the ease with which the Isle de la Passe fell into their hands, the British frigates Sirius, Nereid, Iphigenia and Magicienne rashly attempted to enter Mahébourg Harbour late in the afternoon of August 23rd, with a view to attacking a French fleet of equal size and weight of armament, under Commodore Duperré. The Sirius and Magicienne went aground early in the action, while the dismasted Nereid, under the command of the indomitable Captain Willoughby, was compelled to surrender at midnight to the French flagship Bellone, having most of her complement killed or wounded, and her guns knocked out of action. Next day, the 24th August, the sole British ship affoat, the Iphigenia (Captain Lambert), having removed the crews of the stranded Sirius and Magicienne, blew up both ships and retired to the cover of the Battery on the Isle de la Passe, only to find herself later blockaded by a second French squadron, which had arrived from Port Louis. Finding himself between the devil and the deep sea, and being short of food and water, the gallant Lambert had no option but to surrender to the enemy on August 28th.

This hard-fought action was a severe blow to British naval prestige in Indian waters, but availed nothing to the French, who were forced to surrender the captured *Nereid* and *Iphigenia* four months later when the island capitulated.

In 1814, the Isle de France passed permanently into British possession, having miraculously escaped the hands of the peacemakers at Vienna, who handed back to France and Holland most of their lost possessions. Among the latter, Bourbon, sometimes called Réunion, was handed back to France.

The conditions imposed at the capture of the new colony were extraordinarily favourable to the French, and even Napoleon himself was constrained to admit that they were as generous as any ever granted by a conqueror to a helpless foe.

As a result of the capitulation in 1810, the island has remained almost entirely French in its sentiments and its language; and it is only among the business community in Port Louis that any degree of contact takes place between the permanent French residents of the island and the floating British population, composed for the most part of Government officials and merchants.

French remains the language of the island, and has even been adopted by the Indian immigrants, who employ it in the form of "creole," a French patois, which closely resembles "negro" English in its structure, but which also contains numerous Bantu and Malgache roots.

The term "creole" is misapplied locally to the coloured descendants of the former slaves employed on the estates before the advent of Indian labour, and is never used in Mauritius in its correct sense as implying French families of European origin settled in Louisiana and the West Indies.

Until 1869, the island retained its full strategic importance as the "Key of the Indian Ocean," this latter fact being so well understood that it is enshrined in the Colony's motto, "Stella clavisque Maris Indici" (The Star and the Key of the Indian Ocean). After the opening of the Suez Canal, its importance somewhat waned; but during the last years of the nineteenth century, and the opening years of the twentieth, a large garrison was maintained, available as a reinforcement either for South Africa or for India. Records show that, as the political situation varied in the Middle and Far East, so did the strength of the garrison, which has fluctuated between 5,000 in 1812 and 3,000 in 1903. Since the latter date the garrison steadily decreased, till in 1914 it consisted of only 2 Companies of Infantry (the Essex Regt.), 2 Companies of Garrison Artillery and the 43rd (Fortress) Coy., R.E.

During the Great War, practically all the Regular troops were withdrawn, their places being taken partly by new troops from Home and partly by local volunteers. Since 1921, however, the garrison has been reduced.

Up till 1867, the climate of the island remained one of the healthiest in the world, but in that year a terrible scourge in the form of malaria appeared, with the result that for many years Mauritius was regarded by the Home authorities as being on a par with Sierra Leone. This change was occasioned through the introduction of malaria into the island by the Indian labourers, imported in large numbers to work the sugar estates, which form, as has already been stated, the staple industry of the island. Before the emancipation of the slaves in 1835, all work on the plantations was undertaken by slaves imported from various parts of Africa and Madagascar; but on the latter attaining their freedom, they refused to work as hired servants for their former masters, who were thus compelled to import Indian labour. Since then, the latter have bred and multiplied to such an extent that they now outnumber the former by 4 to 1.

The present population, which is steadily increasing, approximates 450,000; and as emigration seems closed to the coloured population of the island, a grave situation in the course of several generations appears probable, unless the inhabitants can be persuaded to reduce the present size of their enormous families.

With regard to the question of population, it is of interest to note that Mauritius is unique as a tropical island in that it possesses a large resident European community, numbering some 5,000 persons, who regard the island as their permanent home. These latter are almost entirely persons of French descent, whose families have lived in Mauritius for generations.

As a result of the malarial epidemic in 1867, the troops were gradually moved up-country, the numerous detachments round the coast being withdrawn. Up to that date, the policy pursued had been to man the forts situated at the various landing places on the coast, with a view to repelling any surprise attacks; but with the advent of the submarine cable, these precautions were no longer necessary, and the garrison was concentrated at Port Louis and Curepipe, the latter situated in the centre of the island, some 1,800 feet above sea-level. In 1901-03, the present military headquarters were built at Vacoas, a small village lying some 11 miles from Port Louis, the capital, and 3 miles from Curepipe.

In 1927, Curepipe Barracks were sold; and at present the whole garrison is concentrated for the bulk of the year at Vacoas Camp, 1,300 feet above sea-level; fortress training being carried out during June, July and August, at Fort George, which covers the entrance to Port Louis Harbour.

The climate "up-country" is delightful throughout the year, except when cyclonic disturbances visit the neighbourhood of the island, when the heat becomes very oppressive, and heavy rain falls for hours on end.

The coastal regions, on the other hand, are generally unpleasant for Europeans, except during the winter season, from July to September, as the temperature is high and malaria very prevalent.

Apart from malaria and the cyclones, which from time to time visit the island, and often cause heavy loss to the sugar industry through the destruction of the sugar canes, the general climatic conditions in Mauritius must compare most favourably with any other spot within the tropics.

In Vacoas, the temperature rarely exceeds $85^{\circ}F$, and in winter warm clothing is necessary after sundown. One drawback, however, to the climate up-country is the intense humidity of the atmosphere, which ruins all one's possessions, unless great care is taken.

As a military station, Mauritius has many drawbacks, among which are the lack of opportunities for improving one's technical qualifications and keeping in touch with up-to-date ideas on military matters; but to those who refuse to let themselves vegetate, much can be done by intelligent reading. On the other hand, the work is congenial, and combines a pleasant mixture of "works services" and regimental routine; and if one is fortunate enough to command the Station, a great deal can be learnt of administrative value; since this Station is treated as a "command," all correspondence being carried on direct with the War Office. In addition to purely military matters, the "O.C. Troops" is *ex-officio* a Member of the Executive Council; and if a Lieut.-Colonel, ranks next to the Governor-in-Council. In this manner he is enabled, as a comparatively junior officer, to study at close quarters the administrative problems of Crown Colony Government.

Mauritius enjoys a measure of representative government; the Legislative Council (or Council of Government, as it is known locally) consisting of His Excellency the Governor, as Chairman, and 8 *ex-officio*, 9 nominated and 10 elected members, who meet once a fortnight.

In appearance, the island presents a beautiful panorama of vivid green plains and forest-covered hills, the latter rising in some cases to nearly 3,000 feet above sea-level. Owing to the steepness of the hills and the heavy rainfall of the island, its surface is cut up by numerous wooded valleys, through which run shallow streams broken here and there by cascades, many of which are of considerable height and great natural beauty.

The writer has visited many parts of the world, both in the East and in America, but for attractive scenery and beautiful outline, Mauritius, in his opinion, has few equals.

For those who delight in country scenery and in hill-climbing, the country round Vacoas offers many attractions; and for those who enjoy risking their necks, the Montagne du Rempart and the famous peak of Pieter Both are formidable adversaries.

Geologically, Mauritius is a new arrival, being volcanic in origin, and containing at least three extinct craters, the most famous of which, the Trou-aux-Cerfs, situated close to Vacoas, is an immense inverted hollow cone, 300 yards in diameter and nearly 100 feet deep.

In consequence of its volcanic formation, the soil is extremely fertile, and for 150 years has been intensively cultivated for sugar cane. Owing, however, to the constant crops taken off the land, the latter needs heavy manuring, which adds considerably to the cost of production, which is further increased by the comparatively high cost of local labour, thus placing the sugar industry of the Colony at a considerable disadvantage in comparison with Java and Cuba, its two most formidable rivals; and it is only, indeed, the preference at present accorded to Imperial sugar that has prevented the ruin of the industry.

Throughout the War, Mauritius was one of the principal sources of sugar supply to the United Kingdom, and in consequence, enormous profits were reaped by the Colony; but since 1921, the price of sugar has steadily dropped, and at present, even with the preference enjoyed by British sugar, the industry can only just support itself.

Efforts have been made from time to time to induce the inhabitants

MAURITIUS.

to become more self-supporting by planting food crops, but as the bulk of the inhabitants are rice-eaters, this has met with small success; and in consequence, all foodstuffs—European and Indian have perforce to be imported from overseas. This necessity has had the effect of increasing the cost of living considerably in comparison with India and the United Kingdom; the approximate difference between Mauritius and the latter being between 25 and 30 per cent.

For those fond of social life, Mauritius compares favourably with most R.E. Stations abroad. The circle of English society is necessarily somewhat restricted; and after a prolonged residence in the island, one's views are apt to become somewhat parochial; but, on the whole, the average officer and his wife, if sociably inclined, can pass a thoroughly enjoyable three years: and in spite of the many disadvantages due to its isolated position, most officers sooner or later must look back, somewhat longingly, to the pleasant existence they passed whilst stationed in the Colony.

Only one English club exists, and that is run by the Garrison; although practically all the English residents of Vacoas are members. Golf is the principal recreation, the frequent rain rendering tennis somewhat uncertain and difficult to arrange.

For the younger members of the community, ample facilities exist for indulging in rugger, soccer, hockey and cricket, all of which are played the whole year round.

Shooting is non-existent, nearly all the game having been destroyed by the ubiquitous mongoose, introduced many years ago to destroy the cane-eating rats.

In the numerous forests, however, large herds of deer roam—the descendants of the Javanese stags introduced by the Dutch—and the Indian sambhur brought to Mauritius by the French. These animals are strictly preserved, and, strange to say, do little or no harm to the estates.

During the months of June, July and August, numerous chasses are organized by the French community, who appear to derive immense pleasure from the shooting of the stags, who are driven by beaters towards the line of heavily-armed chasseurs; indeed, at times, the scene is distinctly reminiscent of the late War! The pièce de résistance of all good chasses is, however, the banquet en plein air, which invariably follows the slaughter!

For those fond of deep-sea fishing, the waters round Mauritius offer an attractive harvest, some immense fish of the *Empereur* species being caught from time to time. Those, however, who are after "big game" require a strong stomach, as it is necessary to fish for the former outside the reef, which rings the island like a protecting breakwater.

No fish of any size are obtained in the numerous rivers, although.

[MARCH

one of the most delicious morsels obtainable anywhere—the "Camaron," or Mauritius fresh-water shrimp—is found in large quantities in some rivers.

The outstanding feature of Mauritius is, however, the wonderful sea bathing obtainable at most points on the coast. Since communications are fairly good, most residents own motor-cars, and by means of the latter, the seaside can be reached in an hour to an hour and a half.

The scene which meets the visitor's eye at such places as Blue Bay and Pointe d'Azur recalls most vividly Robert Louis Stevenson and his South Sea Islands. Green Filao woods—coming down almost to high-water mark—silver sands, encircling a sea, ranging from ultramarine to emerald green, fringed in turn by a reef on which the Indian Ocean breaks in an incessant line of white foam; and above all, a sky of the most vivid turquoise blue.

During the cold weather season, all who can afford to do so migrate from the highlands of Vacoas and Curepipe (the French centre up-country), and take up their residence by the sea, where they occupy most attractive thatched wooden cottages, known as *campements*. During the cold season, malaria temporarily subsides, the anopheles mosquito presumably hibernating for a while.

At other times of the year, daylight picnics are the rule; care being taken to leave the coastal plains before sunset.

For those who may be ordered to Mauritius, this brief description is not intended in any way to replace the *Descriptive Accounts of Foreign Stations*, which are obtainable from the Institution of R.E. the publication dealing with Mauritius being, on the whole, fairly accurate and up-to-date; but prospective arrivals are warned that they should bring with them all household necessities, as the prices charged locally are very heavy, many of the things dear to the average housewife being non-existent, the local shops catering almost exclusively for French requirements.

Apart from furniture—which can be bought or hired locally everything should be brought from home, including motor-cars, which can be shipped and landed for about £50.

Seven Married Officers' Quarters are available—and, as the total strength of officers is at present limited to eleven, there is no dearth of accommodation; and no officer will normally find himself compelled to live outside the Camp, where houses are expensive and sanitation is even more primitive than in India.

I cannot conclude without some reference to the famous R.A. tortoise, with whom so many generations of soldiers in Mauritius have been familiar. To any old "Mauritians" who may read these notes, it may be of interest to learn that they can resume once more their old acquaintanceship—since the tortoise was sent home to the South Kensington Natural History Museum last year, where, I

MAURITIUS.

understand, it now occupies an honoured position befitting its great size and age.

This famous specimen of Marions tortoise appears to have first been borne on the establishment of the garrison in 1766, having been introduced either from Aldabra Island, south of the Seychelles, or from the neighbouring dependency of Rodrigues. At any rate, it is mentioned in one of the inventories of stores handed over by the French to the British at the capitulation in 1810.

From that date till 1914 it continued to live in Line Barracks, Port Louis, and latterly, when it became quite blind, an orderly was provided for its care from the battery of Hong-Kong and Singapore Artillery stationed in Port Louis. A concrete swimming pool and ramp were provided by a sympathetic C.R.E.; and had it not been for the War, it is more than probable that the animal would still be alive, as, apart from its blindness, it was in robust health at the time of its unhappy demise.

On the outbreak of the War, the gunners moved into Fort George, taking their pet with them; but in 1916, sad to relate, it was discovered one day lying on its back with a broken neck, in a disused gun pit, having committed suicide, so the gunners say, when the last regulars left the island.

Fortunately, the then C.R.A. arranged to have it stuffed and mounted; and for many years it remained the principal object of interest in the Garrison Officers' Mess, Vacoas. In 1929, however, in deference to the wishes of His Excellency the Governor and the authorities of the South Kensington Museum, the officers of the R.A., Mauritius, consented to part with their at least 170-year-old mascot.

If, by any chance, the writer has by now awakened some faint interest in the "Pearl of the Indian Ocean," as this beautiful island is so rightly called, he will feel that these notes have not been written in vain.

1931.]
THE QUEEN OF SPAIN'S CUP.

By "HELMSMAN."

BETWEEN the finish of the Fastnet race and the start of the Plymouth-Santander race, it was decided by the skipper, much to the disgust of the rest of the crew, that we must clean *Ilex's* bottom. Several of the crew who had viewed this operation at Chatham with horror, hurriedly found jobs ashore which called for their immediate personal attention.

At low water, the dirty work commenced; the bottom was first cleared of weed and oil, and then a mixture, prepared by our handyman, of grate polish and stale beer, was painted over it; there is not usually much stale beer in *liex*, and I was assured that this was especially brought for the job. As soon as it was dry, it was polished hard with grate brushes, and a beautiful shine was raised; this was the signal for those of the crew who had gone ashore to return and cast disparaging remarks about the dirtiness of the upper works, which, by mischance, had received a liberal dose of the blacking.

By Saturday morning, however, everything was shipshape and all the crew had joined. We were divided into two watches of three each, with the skipper and a spare hand not standing a watch, and Carter, of course, to do the cooking and dirty work below. D. N. B. Hunt was again skipper and had as spare hand Ll. Wansbrough-Jones. The two watches comprised H. A. Macdonald, H. S. Francis, E. F. Parker, and M. T. L. Wilkinson, J. de V. Hunt, Major J. A. C. Pennycuick.

It is certainly an advantage having the skipper's younger brother on board, as all the really dirty jobs are, with brotherly affection, pushed on to his shoulders. We early had a sample of this.

It was decided to sail out into the Sound as soon as possible, and finish the stowing there; we pulled the dinghy on board and lashed it, before realizing that our warps were still made fast to the mooring buoys. This was the first chance for "brother John"; he was politely ordered to swim through the cold and dirty water of the docks, and cast off our warps. He obeyed without a murmur.

Outside, there was great activity; a host of small boats and yachts were getting under way and the committee boat was steaming majestically through them. There was a fairly strong westerly wind, but it looked as if the weather was taking a turn for the better. THE QUEEN OF SPAIN'S CUP.

We prepared the jackyarder for setting, but the skipper decided that there was too much weight in the wind for *Ilex* to carry a topsail; we noticed that all the other starters were reefed, but in the Sound at any rate, *Ilex* was standing up well to her full mainsail.

There were twelve starters, and the following were the handicaps :---

Avocet	••	British yawl		scratch.
Amaryllis	••	British yawl	••	5 hrs. 10 mins
Neptune	••	British cutter	۰.	5 hrs. 10 mins.
Inconnue	••	French schooner		6 hrs. 0 mins 45 secs
Lelanta	••	American schooner		6 hrs. 9 mins. 45 secs
Ariel	••	French cutter	• •	8 hrs. 56 mins. 30 secs.
Jolie Brise	••	British cutter		9 hrs. 25 mins. 30 secs.
Ilex	••	British yawl		10 hrs. 30 mins. 45 secs.
Uraba III.	••	Colombian yawl		12 hrs. 55 mins. 45 secs.
Maitenes II.	••	British cutter	• •	15 hrs. 28 mins.
Hope	••	British cutter	••	19 hrs. 27 mins. 15 secs.
Karen III.	••	British cutter	••	20 hrs. 47 mins.

It was a good start, none of the boats being very late, while half the fleet crossed the line in a bunch, about half a minute after the gun. Karen III. led, closely followed by Jolie Brise, Ilex and Maitenes II. in the order named; at the breakwater, which it required a short leg on the port tack to make, the order of the first four was unchanged, except that Karen had dropped back to fourth.

Outside the shelter of the breakwater there was a lumpy sea, and the force of the wind made itself felt; we handed the mizzen, and also the jibheaded topsail, which we had optimistically set as we crossed the starting line. We found that we could lay our course to Ushant with the wind about a point free on the starboard tack, but appeared to be the only boat to lay this course. Jolie Brise and Maitenes were standing up to windward, while the rest of the fleet were sailing freer than we were, apparently hoping that the wind would veer. This inspection of the fleet was rudely interrupted by our cook, who beseeched the crew to go below, as the dinner was trying to slide off the table; despite his entreaties, however, only three of the crew, all of whom had been hardened by the Fastnet race, dared go below to eat a hearty meal; the others sat miserably on deck toying with a sandwich.

By the time we had reached the Eddystone, it was possible to sum up the form of the boats who had not previously competed in ocean races; *Karen*, to whom we had to conceed about ten hours, was going very well down to leeward of *Ilex*, whilst *Uraba III.*, another dark horse, to whom *Ilex* gave two hours' start, was also.

1931.]

[MARCH

travelling well, a little distance ahead of *Karen*, but further still to leeward. It looked as if we were lying second to *Jolie Brise*, as the only other boat to windward was *Maitenes*, and she was some way astern. The wind lightened as we got away from the land, and we were able to set our jackyarder.

We kept the same course all the afternoon, and at dusk appeared to be quite well placed; the majority of the crew were also feeling better, especially those of the watch below who had wisely turned in during the afternoon. During the night the wind dropped very light and headed us, until we could not lay our course close-hauled; about 2 a.m., we passed close to another competitor, which we discovered by vocal effort to be *Neptune*; we were told later that she had torn her mainsail while shaking out a reef, and had to remain reefed till daylight, when repairs could be carried out.

During Sunday morning, we made out Vierge lighthouse about six miles ahead, so went about on to the port tack; the crew were very cheered to see *Jolie Brise* only a couple of miles ahead, and *Maitenes*, the only other boat in sight, was well down to leeward. There was practically no wind and it was delightfully warm; the crew began to take an interest in food, and some of our well-known gourmands were restrained with difficulty from polishing off all the delicacies at one sitting. Throughout the day we made very little headway, in fact, we were probably carried back a bit, and at teatime we made a leg inshore to catch the first of the west-going tide.

When the tide turned in our favour, we started to move past the land at a very good speed; as we neared Ushant we saw *Jolie Brise* standing in towards the land, and there was terrific excitement when we crossed her bows about two miles away. This seemed too good to be true; it looked as if we must be leading the fleet, a much better position than we had ever dreamed we would occupy, after more than a day's sailing; the auspicious occasion was suitably celebrated, and thus warmed the crew began to talk extravagantly of *Ilex* being the first boat to finish at Santander.

We were brought back to earth again by our old salt, who, on espying a smudge of smoke on the horizon, stated authoritatively that it was the first of the destroyers, kindly provided by the Spanish authorities to patrol the course. We had heard similar stories before, and were genuinely surprised, when, on closer inspection, it turned out that his prognostication was correct. The destroyer steamed rapidly towards us, and our yeoman of signals hurriedly delved into the sail locker in his efforts to find our set of flags.

Two nice hoists were prepared, which we hoped would mean, "What ships have passed?" When she was really close to *Ilex*, we made our signal, but she appeared to take no notice. However, just as she was steaming away, a white figure leant over the stern and shouted, "You are ze fairst"; this confirmed our previous guesswork and put everyone into a good frame of mind.

It was now getting dark and the Ushant lights appeared about two points off the port bow; we were fairly close to the shore and had the assistance of a five-knot tide. At 9.30 p.m., Ushant light was abeam, and the pessimists assured us that we should have another very nice view of it when the tide turned and carried *Ilex* back past it again; these prophets were dumbfounded, however, as on the other side of Ushant we picked up a very nice easterly breeze, which allowed us to lay a course just outside the Saints.

The wind freed us and we passed the Saints soon after 3 a.m.; we could now lay our course for Santander with the wind about two points free, and we sailed fast with the jackyarder and the new long-hoist jibtopsail doing excellent work. During the morning we spoke the second Spanish destroyer, but in answer to our famous signal, she informed us that she was not allowed to tell us our position in the race; she also unfortunately misjudged our speed and crossed close across our bows at a good pace; the attendant wash shook *Ilex* rather badly and nearly washed the gramophone and records, which happened to be on deck, overboard.

The breeze freshened in the afternoon and we watched the topmast anxiously; those of the crew who had sailed in the 1928 Fastnet race, when *Ilex* lost her topmast, were particularly keen on watching its performance, but it stood up to it well, and there was no necessity to shorten sail. By tea-time, the wind had died right down, and we imagined our rivals bowling along with a nice breeze; the lull, however, was greeted with satisfaction by our cook, who, owing to the heel, had not been able to show us his best culinary efforts during the day.

Another destroyer came up and spoke to us before dusk, and our flag work ran on similar lines to our previous efforts. It usually ran something like this :---

Ilex : "What ships have passed ?"

Destroyer : "Secret," or "Cannot tell," and once even, "Have you any women on board ?"

Ilex : " Thank you."

Destroyer : "Wishing you a pleasant voyage."

Ilex : "Good-bye."

We got to know all these signals by sight, but we may have been wrong about the "women" signal; it does not look a very long conversation, but it used to take us a good time to decipher the replies. With darkness, a thick fog came up, and what wind there was came from the west. We held some sort of a wind throughout the night, but it meant hard work getting any good out of it; we were hard at work all night trimming sheets and changing headsails. When I did get below to have a sleep, I was immediately wakened

[MARCH

by our ship's carpenter, who was carrying out his nightly prowl below decks; to stop any misapprehension, I hurry to explain that he is not searching for any hidden leak, but for food; he appears incapable of lasting a watch on deck without a considerable amount of sustenance. After he has been on watch, the cockpit will be found to contain a couple of biscuit tins, a thermos flask, and a beer bottle, all empty. Chocolate biscuits are his *forte*.

Tuesday morning brought us another change of wind, the easterly breeze returning again; we started to go well and our hopes of making a landfall that night revived. We spoke the fourth destroyer with the usual results, but we still optimistically hoped that *Ilex* was leading. Like the previous day, the wind blew steadily until about 4 p.m., and we made very good progress; soon after the mid-day meal, a sail was sighted just forward of the beam, about five miles to starboard.

This caused great excitement and a good deal of discussion; all that was certain was that it was a cutter; through glasses, our skipper thought he could recognize Neptune's jibheaded topsail; our old salt, through his very peculiar telescope, swore he could see tan sails. The majority favoured his decision, as being more reasonable ; how could Neptune have possibly got ahead of us ? When we had last seen her, she was doing very badly, and we thought we had been doing well ever since. There had been a number of false alarms about sighting competitors, which had in every case turned out to be tunnymen; tan sails might mean Jolie Brise or a fisherman. We found out later that it was Neptune, which must have been very well sailed to have made up all the ground she lost while repairing her mainsail. Neptune was in sight till dusk and appeared to be drawing away from us slightly, and we did not see her again during the race. We gave up theorizing, however, for the more interesting problem of a suitable aperitif. Our cook had prepared a special supper on the understanding that it would be our last night at sea, and it behoved us to do it justice. On seeing the way we tackled the food, he recovered his true form and muttered a few dismal warnings about the dangers of the Spanish coast ; we expected any moment that he would give us his favourite story about the Bay, entitled, " The captain's hair which turned grey in a night."

We little knew what an unpleasant night was in store for us; it started rather foggy with little wind, but this soon cleared off and we were treated to a brilliant lightning display. The skipper, ably assisted by our spare hand, took the chance of a clear sky to do some good work with the sextant; this was the only work that the spare hand could do, as he had carefully found a doctor in Plymouth, who had forbidden him use a poisoned hand for the duration of the race.

The lightning was the forerunner of a series of thunder squalls,

and the resultant puffs of wind kept the crew hard at it all night. The fun started when the watch below were at supper; *Hex* was sailing peacefully along on the port tack at about six knots when, after a momentary lull, the wind came up strongly from the starboard side; the skipper, who was struggling with Aquino, imagined that the helmsman was to blame for our sails being caught aback, and dashed on deck with an oath. He was just in time to give a hand, trimming the sails to this new wind.

By the time a blasphemous watch had wrestled with backstay preventers, mizzen jumpers, jib sheets, jibtopsail sheets, and particularly the reaching staysail sheet, the wind had decided that it had been mistaken in changing, and had gone back to its original quarter, whether *via* the north or the south no one could say; again the headsails were taken aback, and the watch below wondered uneasily whether the helmsman had supped too well.

This happened four times in the space of half an hour, and all the time the ship was travelling well. The wind did not content itself with this one trick, but tried several others during the course of the night; about I a.m. it came astern and the spinnaker was set to port, but hardly was the job completed when it was necessary to gybe and the spinnaker was reset to starboard. The wind was by then abeam and reaching sails were required; however, it continued round the compass and in a short time had made two complete circuits. We had one very good puff which lasted just over half an hour and took us along at nine knots; we lost it directly we handed the jackyarder, but this was necessary as one of its spars was weak, where our carpenter had had to repair it the day before. This casts no aspersion on the carpenter's work, of course.

All the crew, except for obvious reasons, the spare hand, were worn out by morning. From five till nine we made practically no progress, and in the still air the heat was intense; we set the spinnaker in the hopes of attracting a wind, but we only made about half a knot with its assistance. Soon after nine, "brother John," who was at the helm, noticed a ripple on the water out to port, which seemed to denote wind; at the cry of "down spinnaker," the watch below gallantly rushed on deck, and assisted to set the yankee jib and reaching staysail in place of the spinnaker.

This manœuvre was carried out just in time, and we were soon bowling along at five knots with a nice beam wind; this wind had a great deal to do with our success as apparently no other boat carried it. *Ilex* made good progress, and at noon, while the skipper was shooting the sun, the last destroyer came up to us. They appeared to think that we were lost, as they insisted on signalling our exact position; it disagreed by two miles with our reckoning, and later events showed that our navigation was correct. We were then about 15 miles from the finish and travelling well on a flat, calm sea, in

[MARCH

glorious sunshine; we sighted land through the haze when about 8 miles from it. All that could be distinguished was that it was high land, but nevertheless the crew imagined that the skipper and Wilks, the only previous visitors to Santander, would be able to recognize it immediately.

A horrible rumour was started that it was Santona (8 miles east of the harbour), but at about five miles' range both the experts agreed that we were heading straight for the harbour entrance. No rival could be seen approaching the finish, but the visibility was still rather poor. The skipper insisted that the crew should make themselves more presentable, and chaos reigned below, where half a dozen people were trying to shave or change; suit cases were lying everywhere, and there is definitely not room in *Ilex* to do that sort of thing in comfort. On deck, everything was tidied up, and our taskmaster instigated brass polishing, an unheard of thing for the R.E.Y.C. when ocean racing.

As we approached the finishing line, a seaplane circled round us and a motor-boat cruised alongside, ready to give *Ilex* a tow. We received our gun from Cabo Mayor just after three o'clock, and stood by ready for a tow. The motor-boat, owned by a friend of last year, came alongside, and we were told that we had finished third; no one could tell us the times exactly, but it looked as if we were second on corrected time. It certainly appeared unlikely that we had saved our time on *Jolie Brise*, as we only received just over an hour from her and we had not been able to see her finish.

However, when we arrived under tow at the Yacht Club, we heard the welcome news that we had saved our time by four minutes. Not too bad at the end of a 435-mile race. *Neptune* had finished first, half an hour before *Jolie Brise*, a good performance after her early misfortunes. The only other excitement that remained was whether one of the boats receiving a long handicap would save her time on us. Here we were lucky, as the breeze that brought us in, faded away soon after our arrival, and no other boats finished until 10 a.m. the next morning. Thus we found ourselves winners of the Queen of Spain's Cup. It would take a volume to tell of the hospitality enjoyed by us in Santander, and it is sufficient to say that it was greater, if possible, than the year before. Once go to Santander and you will wish to go every year.

Note.—A photograph showing the crew of the Ilex, with H.M. The King of Spain, appeared in the October, 1930, Monthly Supplement to the R.E. Journal.

SURVEY SIDELIGHTS.

By CAPTAIN J. C. T. WILLIS, R.E.

Ι.

Nor without reason did the authorities, with the full scope of the Latin Dictionary as a hunting ground, select the motto "Ubique" for the Corps.

This motto applies to few with greater force than to the Surveyor, the very nature of whose employment takes him to parts of the world that are little known and gives him dealings with peoples who live on the very hem of civilization's cloak.

These few stories, all of which came under the personal notice of the writer whilst surveying, show that the work is not all theodolites and plane tables, and that much time is of necessity taken up with native coolies, with their troubles, their food, their health and their domestic afflictions. Some of them have little or no direct connection with survey matters as discussed in the various text-books, but serve to throw a little light on the mentality of the Sarawak Dyaks who worked and are still working for the Colonial Survey Section R.E. in Johore.

Now take, for instance, the case of Chennang. Chennang was the headman of a village many miles up the Rejang River, and was respected by many and feared by not a few. In fact, a martinet. It is often, however, the case that a strong-willed father breeds headstrong sons, and Chennang was no exception. For his son, Bilong, a lad of about seventeen, had a will and determination of his own. He knew his own mind, the workings of which unfortunately led him to spend most of his spare time ogling the ladies of the village, whose breasts were set aflutter not only by his charming smile and the cottonreel bobbin inserted in the lobe of each ear, but also by the intricacy of the blue scroll-work tattooed upon his lower dorsal curve. In fact, Bilong was a lad with the ladies.

To such an extent did he model his behaviour upon that of Lothario that Chennang finally summoned his offending offspring and said, "Me lad, that's about enough; if ever I catch you slipping out of the house again in the evening, I will cut your — head off "—or, as the Manual of Military Law naïvely has it, " words to that effect." That same evening Bilong's place around the rice-pot was again

[MARCH

empty, and Chennang, more in anger than in sorrow, was looking for his whetstone. The errant son and heir on his return some hours later was greeted by his father, who had thoughtfully sat up for him. After explaining that his previous threat had been no empty one, and possibly adding, "This hurts me more than it does you, my boy," Chennang fulfilled his vow and cut Bilong's head off with just that accuracy and dispatch with which one removes the head of a thistle with a cane. He then cleaned his *parang*, replaced it in the 'heath, and retired to his slumbers. A man of his word, this Chennang.

At this point, as far as Chennang (and the luckless Bilong, too) was concerned, the whole incident was considered closed. But civilization, as well as providing the Dyak on survey work with khaki shorts, if not with the urge to wear them, has also initiated for his benefit the machinery of Government and the Administration of the Law. The long arm of the white man's code reached out, and manifested itself in the form of a posse of police in Chennang's village, urgently requiring the company of "the man Chennang "on a charge of wilful murder. Chennang, to whom wilful murder, or, at any rate, the hobby of head-hunting, was a legitimate pastime in which the only person who could really complain was the least in the position to do so, accompanied them cheerfully. He had the reputation of being a man of his word, and, if the white men wished to prove it he would be only too glad to discuss the incident more fully with them.

The proceedings before the magistrate conveyed little or nothing to him. His defence, conducted by himself with a frank and engaging smile, was to the effect that Bilong was the son of Chennang and not the son of the magistrate. If he, Chennang, was perfectly satisfied with the justice of the case, who was the magistrate to complain ? Complain, however, he did, and to such effect that Chennang's subsequent condemnation to death became a *cause cillbre* throughout the neighbourhood. The victim bore his sentence with much equanimity; in fact, perhaps he was not averse to the publicity which his exploit had gained for him. Had an evening paper been in existence in the country there is no doubt that "The Man who Gave his Life to Keep his Word" would have provided headlines for many a day.

Even in a country which is denied the privilege of having its mind made up for it by a newspaper, feeling ran high, with the result that Chennang, shortly after a proud farewell to his relations, who had come in from the villages on purpose to say good-bye, was reprieved. He found himself instead the possessor of a sentence of twelve years' penal servitude. An indignant complaint was immediately forthcoming to the authorities, who had already been somewhat harassed by this particular case, and this time the complaint came from Chennang. Why had he been thus let down? They had said he was to be hanged. He had told his relations he would be hanged. These same relations had incurred no little trouble and expense in coming to say good-bye to him under what were now shown to be false pretences. And what about his much cherished reputation of being a "man of his word." Would the authorities please reconsider their decision and allow him to fulfil the expectations of his friends and die, as he hoped he had lived, a truthful man? No. The authorities wouldn't. The file labelled "Chennang General" had already grown to considerable proportions, and the sub-file, headed "Chennang, application to be hanged of," showed signs of developing a similar obesity. So to prison Chennang went.

After the first week the Governor was startled by an application from Chennang to know how much he had to pay for his board and lodging. This prison idea was evidently quite new to Chennang, who was more than contented with his lot. He ate well, slept well and worked well, and his naïve enjoyment of the certainty and regularity of his meal hours was only marred by doubts in his own mind as to how long these halcyon days would last.

If he was contented, others were not, as a sudden outbreak of Chinese prisoners in the tenth year of Chennang's tenancy amply showed. The outbreak was quelled, not without difficulty and not without the assistance of Chennang, who, coming to the aid of the warders at the critical moment, prevented the disturbance from reaching serious proportions.

His behaviour was noted, the authorities were touched and the remainder, or unconsumed portion, of Chennang's visit was dispensed with. Chennang was set free. His receipt of the news was unexpected. What had he done, to be thus turned away? Had he not worked hard—he would work harder still! Anything that lay in his power to make amends, he would do. Why was he thus dismissed? They said he was to come for twelve years, and now they were sending him away with ten scarce completed. Had no one any pride in keeping their word except himself? And what would his relations say, when they saw him return two years early, and realized that once again he had deceived them ?

His protests were of no avail—he was given an exemplary character and returned to his village with a heavy heart.

For ten years the Government files marked "Chennang" had been more or less undisturbed. Ten days after his return to the village they received an unexpected addition in the form of Chennang's latest communication to the Government, whose mind he felt he had at last fathomed. In view of the fact that Chennang had worked ten years for the Government and bore an "exemplary" character, was he entitled to a pension please !

1931.]

MEMOIRS.

LORD THOMSON OF CARDINGTON.

THE career of a soldier, who rises to become a Cabinet Minister and Secretary of State, must be an enduring cause for reflection among his comrades. The non-military world commonly looks on the soldier as a specialist who does not really know the world we live in. It is not true. On the contrary, it can be shown by many examples from history, and from public life of to-day, that where a keen soldier has the opportunity of measuring his intellect, his energy and his sympathy against those qualities in his civilian contemporaries, he serves his country at least as well as do other leaders of men.

Christopher Birdwood Thomson, the third soldier of our time who has risen to become Secretary of State, was a man of great energy, fine intellect and living sympathy. It was perhaps through his especial ability to master foreign languages and his vivid and versatile conversation that he first forged his way to the front; but these powers alone would not have made him loved and trusted, as he was, by men naturally of other ways of life and thinking than his own. To those qualities he added an idealism so unexpected that some of his friends could hardly believe it was there: a sympathy which led him to do all he could for anyone who asked: and a driving force which, if in the end it drove him to his death, also drove his vessel in the Fleet of State in a manner unexampled in our time.

It is perhaps rare that a soldier should possess all these qualities in so rich abundance. The Army and his Corps may be proud to have Thomson's name in the highest records of England.

He was born on 13th April, 1875, at Nasik, in India, the son of Major-General David Thomson, R.E. Through his mother, he was a cousin of Field-Marshal Birdwood. There was Huguenot blood in his veins, and his life-time love of the French was perhaps in some sense a home-coming. As a boy he was imaginative, thoughtful, and a considerable reader. His nature then, as always, was an especially forgiving one, while full of high spirits.

He entered Cheltenham College in 1888 as a day boy, as his father lived in that town. His career at Cheltenham seems to have been principally noted for excellence in French. He must have worked



Brigadier-General the right hon. Lord Thomson of Cardington. PC CBE DSO 1931.]

hard, as he started low in the school and got into Woolwich nineteenth on the list, at the early age of 16 years 8 months.

At the Shop, he came to the front as an under-officer. He was distinguished-looking then, as he was all through his life, and his bearing showed forth the man.

One of his batch at Chatham writes of him: "He was a most amusing and entertaining companion, and even then had a most facile and delightful ease of conversation. Interesting talk came easy to him, and he had a wonderful ability to keep up a clear flow of argument, while his mind was engaged in thinking out the main subject of the discussion."

After Chatham, he went to Plymouth for nine months as a Submarine Miner with W. C. Macfie, H. L. G. Bell and R. M. Macrory. Thomson was evidently not meant to be a sailor, and life in a "J.B." boat was somewhat a trial to him. A brother officer writes of him then as being an extremely nice, quiet and unaffected fellow.

A member of his family speaks of his intensely cosmopolitan tastes, which affected his whole outlook on life generally, and adds, "It always seems to me that he was, in his heart of hearts, more at home abroad than in England," though no man cared more deeply for his country than C.B. did.

So from submarine mining he went to South Africa and served in the Mashonaland operations in 1896, where he won his first medal and got to know Cecil Rhodes. Then three years in Mauritius and then came the South African War, where he served with the 11th Field Company under Major (now Colonel) G. F. Leverson, the other officers being H. B. Williams (now Major-General Sir H. Bruce-Williams), A. Meares, D. Forster and R. F. A. Hobbs (the last two now Brigadiers).

As usual, field company sections worked almost entirely independently, and Thomson thus came directly under the notice of well-known commanders, notably Lord Methuen and Smith-Dorrien. His section worked on the Modder and Orange rivers, found itself at Kimberley and, later, on the main line railway at Fourteen Streams. He helped to chivvy De Wet, and it was while repairing with great vigour a general railway *débâcle*, brought about by the Boers, that he came under the notice of Lord Kitchener.

Colonel Leverson writes: "After August 15th, 1900, Thomson served with Smith-Dorrien for the rest of the war, who reported very highly on him and recommended him for a brevet majority, which he got on promotion to Captain." He was for a time the youngest major in the army.

Having served through the whole South African War, Thomson came home and was appointed an Assistant-Instructor in Fortification at Chatham. There the writer remembers him well, as the centre of all that was going on, delightfully cheerful at all times and a keen follower of the chase, throwing his heart over his fences. In 1905, he was transferred to the 2nd Bridging Company, and early in 1907 he went to Sierra Leone, where he spent a year.

York saw him for a few months and in January, 1909, he went to the Staff College, Sir Henry Wilson being then Commandant. Wilson and he had the same brilliant imagination and talk, and it is no wonder that the former took care not to lose sight of C.B. Here we cannot refrain from quoting from *The Times* obituary :—

"It was at this juncture that politics began to attract one, whose fertile brain was supported by a nimble sense of humour and ready tongue. Original in his ways of thought, conscious of intellectual superiority, burning to differ from others and to enter into any argument wherein a witty phrase would disarm, if not convince, an antagonist, Thomson underwent a change which was completed by a warm-hearted sympathy for the less fortunate in life, and a superior contempt for what he considered stupidity."

On leaving the Staff College, Thomson spent a few months at Colchester, and then joined Sir Henry Wilson, who was Director of Operations at the War Office. For four years, Thomson served in the Operations Branch. As their representative in 1912, he was sent to the Serbian Army in their war against Turkey and afterwards against Bulgaria.

With Wilson on the H.Q. Staff, he sailed for France when the War broke out. So good a linguist was naturally made a liaison officer. After various work of this kind, he was sent, in February, 1915, to Bucharest as our Military Attaché, and subsequently head of the British Mission, when Rumania came in. Anyone who would like to know the Thomson of those days must read *Smaranda*, his book, in which, under some slight disguise, he tells us of his life and his friends there. It is a very good book indeed, beautiful in many ways, and pathetic; pathetic in the way that, strangely enough, Thomson's life itself always was. He loved Rumania and laid all his powers at her disposal.

For over two years Thomson was at Bucharest, and when Rumania was overwhelmed by Mackensen, his occupation was gone, and he found himself back as a R.E. regimental officer again, C.R.E. of the 60th Division in Egypt and Palestine. He received the D.S.O. at this time.

But once more Wilson called for him, and the most brilliant epoch of his military career began. He joined the Supreme War Council at Versailles and became a Brigadier-General. There he was indeed in his element, and many times he used to tell me of his talks with the great men whom there he met ; their words being perhaps sometimes more convincing than their deeds. He was immensely popular with Frenchmen and must have added to our country's prestige not inconsiderably.

It was the end of his career as a soldier, and a fine end. In September, 1919, he retired and seemed to vanish. To the surprise of 1931.]

his friends, we next heard of him as Labour candidate for Central Bristol, and his new life began.

A very chequered life it was, and at times none too hopeful. A distinguished soldier who suddenly leaves the army for something so very different as Labour politics has his own battle to fight, and alone.

A lonely time it was for him in Bristol, going through the uninspiring process of "nursing his constituency." The writer was at that time living in Bristol, and Thomson used to come and tell amusing tales, but without an iota of malice or superiority, about his new activities and friends. But the iron will was there behind it all, as well as the humour and philosophy. He meant to come through, and he did.

The action in his political life most subject to criticism is undoubtedly his report for the Labour Party on the behaviour of our troops in Ireland in 1920. For his share in this report, he has been very adversely referred to by those in military authority.

In 1921, as Special Commissioner for the International Committee of the Red Cross, he went through Europe, inquiring into the condition of refugees and on behalf of the "Save the Children" Fund. His journeys took him to Russia, and he had some vivid talks with Trotsky, then second power in the Soviet, who must have been surprised at Thomson's solicitude for the down-trodden of this world.

Meanwhile, he was unsuccessful in getting into the House of Commons, failing to win first Bristol and later St. Albans. But outweighing these mishaps was the close friendship between himself and Mr. Ramsay MacDonald. It is no wonder that the Prime Minister found in Thomson a man of parts and initiative to whom he could entrust affairs of importance. Hence it was that when, in 1924, for the first time in our history, Labour attained office, Thomson found himself within a week—from being a struggling Parliamentary candidate—a Privy Councillor, a Peer, a Member of the Cabinet and a Secretary of State. Such prizes does Fortune sometimes offer to those who walk in her ways.

Whatever may be said of Lord Thomson's championship of the lighter-than-air vessel, by which in the end he died, it will never be denied that he served his country splendidly at the Air Ministry. His vigour and love of travel and of the glories of the air reacted brilliantly throughout the whole personnel of the air arm. He loved nothing so much as a thrilling flight by plane—70 miles in 20 minutes by night was what he was telling me of at almost our last meeting. Like the good officer he was, he liked nothing so well as being among his men—not a Secretary of State, but an airman. It might be said that this was no part of his work : that his office chair at the centre of the web was where he should have been. But, at least, his old comrades in the Corps will sympathize and understand why his choice lay so often in action. One who, some years ago, was a prominent civil officer in the Air Ministry, under Lord Thomson, has told the writer that his Chief's great work for the air was not connected specially with airships, but with the replacement of petrol by heavy oil for all types of aircraft : and that the unhappy R ror was mainly a floating platform for experimenting with this future fuel of the air.

Thomson did other work of the first importance. His air journey to the Middle East, in 1924, inspired the Service and fired the imagination. His presidential support of civil air clubs and leagues and his championship of them in Parliament and before the Treasury has had enduring results. Only a man, himself an active traveller through the air, could have carried these things through so effectively. The extension of Imperial Airways was, he thought, the greatest work to be undertaken. To him the Air Ministry was not "office": it was service.

And so, after lecturing to Americans and others while in the cold shades of opposition (and an excellent lecturer he was), and taking his full share of the difficulties of Labour struggles in the House of Lords, he returned, in 1929, to his old Ministry, and to the events which were so soon to lead to the R ror disaster and his own death. And in those months his singular powers as a debater were exercised to the full in the Upper House. None so well as he could withstand the late Lord Birkenhead to his face and come off at least equal at the end. He led the House in the Coal Bill, and his speeches on that complex subject make good reading. Debates on such varied matters as the Singapore Dock, death sentences on soldiers and airmen, the Naval Treaty, relations with, and prayers about, Soviet Russia, financial economy, and the like, all came easily to him : in him his Party have lost a very unusual man.

No memoir of Lord Thomson would be adequate which merely wrote about him : a few extracts from his more important speeches will be given, by which officers may be reminded of the line he took in the defence of the realm. The quotations are from the Official Reports of the debates in the House of Lords. He is speaking of air defence, on 9th April, 1930 :--

"Up to date, I am sorry to say no means of purely passive defence have yet been devised for dealing with attack by air. I know that there are some people who hold contrary views, but I have never heard them, in holding those views, meet the real case, the surprise attack. I have not the least doubt that devices could be put up at fabulous cost which would make it extremely difficult for attack by air to be made, but even then, against surprise attack I doubt of their being entirely effective. In any case, you cannot put them up all over the country. The defence is reprisals —that is the terrible part about air warfare—reprisals and the interception to some extent of the attacking aircraft." Again, in the same speech on humanizing warfare :---

"I was much struck by one remark made by the noble and gallant Earl, Lord Cavan, on the subject of endeavouring to humanize warfare. I sympathize with that, but I am surprised that he, who has seen so much of war, should still believe that anyone can humanize it. I would like to think it were so. Without admitting for a single moment that a bomb is more cruel than a shell, even then I am afraid I am sufficient of a cynic to believe that you will never make war anything but terrible, and that possibly the most insidious way of prolonging war as a means of settlement between nations is to endeavour to make it a gentlemanly occupation. It will always be a brutal and a bloody thing, unlimited, unscrupulous. Therefore, if the bomb acts as a deterrent—and I think it does—I should say that that was an added reason for the employment of the Air Force.

"We have had many interesting remarks about the effects of air action on tribes in backward regions. There again, the deterrent acts-wonder and fear. . . . Only in the last few months a most signal success has been achieved by the Royal Air Force in Arabia. A tribe of truculent character, led by one of the most truculent chiefs in Arabia, surrendered without a single casualty. Warning bombs were a deterrent. I do not think that any remark has struck my colleagues and me more, coming from a man of war, than a remark made by a certain distinguished Air Vice-Marshal, who was sent out on special duty the other day to a disturbed area in the Middle East. He saw two or three of us before he left, and the remark that he made to me was this : ' I shall feel that I have failed if I drop a single bomb on human beings.' It is the most humane of weapons for dealing with these countries, because it deters and prevents and does not always necessarily punish. This has been proved many times."

. On the 3rd June, he is dealing with civil aviation :---

"I would point out that at this present moment there are in the British Empire something like 22,350 miles of air route in regular operation. As a people, we rather decry our own efforts and make little of our achievements, but I would like to point out to the House that that is the second largest mileage for air routes in the world. It is second only to the United States, which enjoys unique advantages in this respect from the extent of its territory. The British Empire has more miles of air route in regular operation than either Germany or France, and Germany, it must be remembered, is singularly favoured in a geographical sense. . . . It is a feature of travel on the Continent by air how every traveller of whatever race will always go in a British aeroplane if he or she can. That, I believe, is largely due to the excellence of our pilots. But it is in some measure due to the ground organization and the care that has been taken to eliminate all possible risks through faulty structure."

And on the same occasion, tragically and as though under the very portals of Fate, he is speaking of the coming flight of the R IOI to India :—

"This is one of the most scientific experiments that man has ever attempted, and there is going to be no risk, while I am in charge, of the thing being rushed or of any lives being sacrificed through lack of foresight. It is far too scientific and important a matter for that. . . . If the almost unthinkable happened and these ships failed on their final flights, there might be a strong movement towards scrapping of the programme. That would be heart-breaking. I cannot tell you what magnificent work has been done by the airship men. There are officers in that work to-day who have sacrificed promotion and many other advantages in order to get on with this great experiment. We have a body of enthusiasts at work there, and only the worst of luck could interfere with the success of the experiment. If we have bad luck, I should have thought it was in the British character to stick to it still and triumph over temporary adversity. . . . The hour is late and the faithful few have listened to me with a patience for which I am indeed most grateful. I wanted to make a statement about this new experiment. I wanted, if I could, to reassure people as regards the progress that is being made and the success that we have achieved hitherto. I have always been an enthusiast in these matters. I take a special pride in the fact that I introduced this programme and I want to see it through to ultimate success. I can only add this, that in spite of many setbacks and some disappointments, my faith is absolutely undimmed, and I am sure the people of this country will be right in continuing these experiments. They can continue them on the basis of research alone and they will find that their money has been well expended. It is unnecessary to point out what the airships may mean to our race and to our Empire. It is essentially a vehicle for going over wide open spaces. It is not much for going over land. It would link up our Empire in a way that, so far as I can see, no other means of transport can approach. . . . "

There spoke the man, once a cadet and 2nd-Lieutenant of Royal Engineers, and a few years later a Cabinet Minister responsible to his countrymen for our air defence, perhaps even for what Tennyson called our "all in all."

And then, on the 4th of October, 1930, alert, happy and enthusiastic, with his beloved airmen around him, he left English soil in a manner which brings back to our memory that other Royal Engineer Secretary of State, and met his death near Beauvais while serving his country.



Brigadier General Sir Frederick Gordon Guggisberg , KCMG, DSO

BRIGADIER-GENERAL SIR FREDERICK GORDON GUGGISBERG, K.C.M.G., D.S.O.

FREDERICK GORDON GUGGISBERG, born at Toronto, Canada, on the 20th July, 1869, was the eldest son of Frederick Guggisberg, of Galt, Canada, who in early youth had accompanied an uncle from Switzerland to Canada. He was educated at Burneys, in Hampshire, passed into the Royal Military Academy, Woolwich, in 1887, and was commissioned into the Royal Engineers on 15th February, 1889. After completing his training at the S.M.E. he was posted to Gosport, returning to Chatham in the autumn of 1891. He was promoted Lieutenant on 15th February, 1892, and in June, 1893, was sent to Singapore, where he served three years.

After a further spell of six months at Chatham he was appointed Instructor of Fortifications at the Royal Military Academy, Woolwich, on 27th January, 1897, where he spent $4\frac{1}{2}$ years. This period he always referred to as one of the happiest of his life, and he marked it by writing a most interesting history of that institution—*The Shop*: *The Story of the Royal Military Academy*, which is to be found in many military libraries, and is still the only history of the Shop in evistence. He also wrote a volume entitled *Modern Warfare*—both being published under the pseudonym "Ubique." During his time as an instructor he introduced new methods into the training by eliminating antiquated teaching and bringing the syllabus up to date. It was here that he first showed that power of clear thinking and of organization which were two of his most outstanding characteristics. He was promoted Captain on 15th February, 1900.

In the autumn of 1902 he started his career on the West Coast of Africa, with which his name will always be connected and where he was to spend $18\frac{1}{2}$ out of the remaining $27\frac{1}{2}$ years of his life. He was first employed on Special Survey duty in the Gold Coast Colony, under Captain Watherston, R.E., rising to be Director of Surveys in that colony on 20th April, 1905, when he was granted the temporary rank of Major. When he started his work on the Gold Coast there was practically no survey in existence, and the pioneer work he did and directed was of the greatest value. He had various R.E. officers as assistants in the Survey Directorate.

The value of his work was officially recognized by the award of a C.M.G. in 1908. During this period he wrote, in conjunction with his wife, now Lady Moore-Guggisberg, a most interesting book entitled We Two in West Africa.

In 1908 he was promoted Major in the Corps, and returned to

Chatham for a little over a year. But his value as surveyor was too great for him to be left long at other work, and on 1st April, 1910, he was appointed Director of Surveys in Southern Nigeria. Here he found full scope for his energies, and his previous experience . proved a great asset in the task of reorganizing a very unsatisfactory department. After making himself fully acquainted with the nature of his job he set himself to write instructions for the guidance of the assistants, and his Handbook of the Southern Nigeria Survey is still considered of the greatest value to anyone concerned with survey in the tropics, for it deals not only with the administration of his own department but gives very complete instructions as to details and methods best employed for any such survey. He took over a certain number of civilian surveyors whom he found out there and gathered round him a body of officers and N.C.O.s from the Corps and officers of other arms, whom he inspired with his own energy and enthusiasm for the work. On the amalgamation of Southern and Northern Nigeria in 1913, he became Surveyor-General of Nigeria.

Sir Charles Close, c.M.G., formerly head of the Geographical Section, General Staff, and later Director-General of the Ordnance Survey, writes of the Handbook and of the Survey generally. "The duties of all members of the staff were strictly defined and, in particular, sensible rules were laid down as to the relations of the Survey Staff with the Civil Administration. Much attention was paid to the treatment of villagers; unpaid labour was forbidden; all goods bought were to be paid for at the recognized rate, and great care was to be exercised not to damage the crops. On the technical side great emphasis was laid on the standards of accuracy, on tests and reliability and on the uniformity of the work. They were model instructions, and the Survey of Southern Nigeria was a model survey, and the results fully justified the care and ability which the Director of Surveys exercised in every detail of the administration."

The point in the above remarks which we shall see brought out more and more in Guggisberg's life was his insistence on the due regard of the interests of the natives of the country with which he was dealing.

At the outbreak of war, he had been selected as Director of Public Works on the Gold Coast, but he immediately returned to the Army and was posted to the 94th Field Company of "Kitchener's Army," which he trained at Codford and elsewhere, and with which he proceeded to France in 1915. He was soon appointed C.R.E. of the 8th Division and served with them until September, 1916, taking part in the battle of the Somme. After a short spell at home he was appointed C.R.E., 66th (Lancs.) Div., in November, 1916, with whom he served six months until appointed to the 170th Infantry

MAGAZÍNES.

primary requirements of tactics : intense fire effect and, simultaneously, rapidity of movement. Thereby, it was also hoped to regain the power to surprise an enemy.

In practically every country researches are now in progress with a view to affording the troops the benefit of armaments embodying the advantages of "mechanization" and "motorization" in combination. The following matters are dealt with successively in the numbers of the *Bulletin* under notice: (a) systems combining mechanization and motorization for the henefit of the infantry, which, it is assumed, will continue for some time yet to be the principal arm; and (b) systems where mechanized and motorized machines are intended to replace, to some extent, the infantry as the leading arm.

Part 9 contains an examination of the progress made in England in recent times in relation to the solution of problems connected with mechanization and motorization. Part 10 contains an account, in relation to the same problem, of the work done in the U.S.A., France and Germany. Part 11 is devoted to a consideration of the more revolutionary developments due to mechanization and motorization in combination, viz., the tendency to replace infantry by "tank corps "; the advantages claimed for the last-mentioned arm are briefly reviewed.

L'Aviation et Les Troupes Légères. This article is contributed to No. 4 by Major-Aviateur de Cartier and Major Berctze; they point out that the experiences of the Great War, and peace-time manœuvres subsequent thereto, have brought about a codification of rules in relation to the execution of aeronautic missions carried out for the benefit of the infantry and the artillery. During the War, it was only on rare occasions that "light troops" acted in combination with the Air Force; in consequence, matters affecting the co-operation of these two arms have been, it is suggested in the original article, insufficiently dealt with in the Belgian Règlement de l'Aéronautique d'Observation and Règlement sur l'Emploi des Troupes Légères. The authors of the article give their views as to the manner in which co-operation between the Air Force and "light troops" may be effected in (1) carrying out reconnaissances, and (2) during a collision with hostile troops.

Le Siège de la Citadelle d'Anvers en 1832. The 7th and final parts of the article by Major Delvaux on this subject are published respectively in Nos. 4 and 5 of the Bulletin. The events of December 14th to 23rd inclusive are dealt with in No. 4. The French pushed on during this period with the construction and arming of new batteries, and continued their saps. The French sappers worked with great vigour, and by the night of December 15th/16th, they had crowned the covered ways on the left of the demi-lune II-III and on the right of bastion II. The French artillery co-operated splendidly with the sappers. The text of the Ordre du jour issued to the French artillery on December 20th is reproduced in full; the tasks assigned to the various batteries are stated therein. At this time, the Belgians brought into position, about 1,000 metres from the fortress, a "Monster Mortar" (cal. 60 c.; weight approx. 7½ tons), constructed at Liege; it was ready to come into action on December 20th. A description of this weapon is given in No. 4; the shot weighed nearly half a ton. The first round from the mortar was fired on December 21st; during that and the succeeding days 15 of its projectiles fell in the Citadel.

On December 20th, Chassé was again summoned to surrender the fortress, but refused to do so. Accordingly, during the next couple of days, the Dutch defences were heavily bombarded. At 6 p.m. on December 22nd, Chassé assembled the Council of Defence and obtained the views of its members. The morale of the Dutch troops had by now been much shaken ; having regard to the opinions expressed by the majority of those present at the Council meeting, that it would not be possible to beat off the assaults of French, Chassé reluctantly consented on December 23rd to capitulate ; the terms proposed by him to Gerard are set out in No. 4. These terms, however, Gerard was not willing to accept, and, in consequence, it became necessary for the two Commanders to enter into fresh negotiations.

The further negotiations are dealt with in No. 5 of the Bullelin. A description is

Brigade, which he commanded for 14 months. He was promoted Lieut.-Colonel on 31st December, 1916.

In the summer of 1918 he was appointed Assistant Inspector of Training in France, still with the rank of Brigadier-General, and later commanded the 100th Infantry Brigade for a short period.

He was five times mentioned in dispatches, received the D.S.O. on 1st January, 1918, and was promoted Brevet Colonel on 1st January, 1919. He was also a recipient of the Legion d'Honneur.

He retired from the Army on 24th September, 1919, with the honorary rank of Brigadier-General, on his appointment under the Colonial Office as Governor of the Gold Coast Colony.

In his book, We Two in West Africa, Guggisberg had shown how much he was impressed by the possibilities of economic development of the Gold Coast, coupled with the treatment of the native population on sound lines. He kept in touch with the Colony during his service in Nigeria, where also he devoted much thought, as we have seen above, to the treatment of native questions. While he fully realized his own powers, he was not unaware of his tendency not always to cut his coat according to his cloth. In this case he was fortunate, for the "cloth" in the Gold Coast was abundant. As a result of the post-war demand for cocoa-based partly on prohibition in the U.S.A. and on the greater demand for chocolate owing to higher scale of living in the United Kingdom-the population was enjoying unprecedented prosperity. The merchant firms were making handsome profits and a demand for every kind of European goods was growing up. The revenue of the Colony was therefore high, and during Guggisberg's Governorship showed a tendency to increase. Previous projects of development, initiated by his predecessor, Sir Hugh Clifford, having been held up by the war, a large reserve of money was available to finance the new Governor's schemes of development.

One who knew him well and served many years with him, both in Nigeria and on the Gold Coast, says : "The energy and determination with which he embarked on a great and far-reaching programme of development was sufficiently remarkable to cause alarm in more conservative quarters and no little resistance to the changes involved. The chief plank in his programme was the education of the native races and their general improvement, and to get the money for this he proposed to develop the country and thereby increase its wealth."

His ideas of native education were advanced, and aimed at producing a better African, both morally and industrially, rather than a second-rate "European," which is too often the only result of the so-called education given by the white man to the native. He realized that to carry out this plan he must first teach the teachers and to provide suitably trained native instructors he built Achimota College, which is the largest and most complete educational establishment in Africa.

In the economic sphere Guggisberg set his face most resolutely against any form of exploitation or expropriation of the native producers and landowners, thus maintaining the traditional policy of the Colony. His idea was that the country should be developed by the native and for the native rather than for the benefit of European capitalists. This policy brought some opposition, but being one of fair play and not of sentiment, was successfully carried through.

The main plank of his economic development programme was the provision of a deep-water harbour to enable ocean-going ships to be loaded without recourse to the slow and often perilous surf boat, which was then the only link with the shore. The position selected for this harbour was at Takoradi, whose possibilities had been under discussion for many years. But it was Guggisberg's drive that brought this project into practical politics, and it was his energy and readiness to assume responsibility that, in spite of enormous technical difficulties and almost disasters, enabled this new harbour to be formally opened on 3rd April, 1928, a year after the termination of his Governorship.

Internal communications were improved by linking up the railways between Accra and Kumasi (which would have been done earlier had it not been for the war) and by constructing a new central railway, while surveys of every possible railway extension were undertaken. During his Governorship the railway mileage in the Colony was doubled. In addition to this, the country was further opened up by a comprehensive system of road construction, and water supplies, electric lighting installations, hospitals and so on were constructed or enlarged and improved in many stations.

One of his officials, already quoted above, says: "He knew every European personally, and not only their names but generally their nicknames and all about them. His influence on the natives was immense, as they slowly came to realize what he was doing for them and what he meant to do. He left the Gold Coast in a strong and prosperous condition, and time is proving the greatness of his work for that country and the rightness of his conceptions."

It was during his Governorship that the British Empire Exhibition at Wembley took place, and visitors were much struck by the Gold Coast section. This was organized by his wife, Lady Moore-Guggisberg, and represented the expenditure of some £60,000 voted by the Legislative Council of the Colony.

The usual tour of a Governor in these Colonies is four years, but Guggisberg was given an extension, and after nearly eight years in this appointment left the Colony in April, 1927. In recognition of his work he had been made a K.C.M.G. on 31st December, 1921. After a year of unemployment, much of which he spent lecturing in the United States, he was, in August, 1928, appointed to the Governorship of British Guiana, and took up his work there in November of that year. Long years of arduous work on the West Coast had considerably impaired his health, and when he took on this fresh burden he was very far from being fit. The climate of British Guiana and the immense amount of work he took on to his own shoulders broke him down, and in July, 1929, he was forced to return to England with all his schemes for reform only just begun. He hoped to go back, but that proved impossible, and in January, 1929, he resigned his appointment.

One of his principal officials writes :---

"The fame of Gordon Guggisberg as an administrator preceded him to British Guiana. The Colony expected great things of him, and the reception he received from all classes of the community proved that they had full confidence in the man who had been sent to shape their destinies.

"Prior to his arrival in the Colony, Sir Gordon had, with that characteristic energy and insight, examined most of the main problems which awaited him.

"His forceful personality carried all before him.

"He knew he was a sick man, and although he spoke cheerfully and confidently of the future, it was evident that he felt, at times, that he had a great deal to do in a short time.

* * * * * *

"He had realized that the Colony's main need was population, and he had formulated schemes for the introduction of immigrants, and a tentative land settlement scheme was fully developed by him and put into being, mainly as an experiment with a view to proving the possibility of colonization by East Indians and others from the neighbouring West Indian Colonies.

"As an engineer and a trained surveyor he was dissatisfied with the maps and surveys which existed of the Colony, and set to work at once to supply what he considered necessary in that direction.

"Financially the Colony was in grave straits, and Sir Gordon at the earliest moment commenced to effect all possible economies in the cost of administration. His methods have been described as ruthless. They may have been; but they were necessary. He allowed no consideration to stand in his way when he had made up his mind that any given economy could be made.

"During the short eight months of his administration he practically demolished the then existing administrative structure and had commenced to rebuild it to his own design. A process which, had he been spared, may confidently have been expected to produce a new, progressive, and prosperous British Guiana." On his return to England he was a very sick man, though he maintained his interests and corresponded with his friends. The end came with unexpected suddenness, and he passed over on 21st April, 1929, in his 61st year.

Guggisberg was of tall and athletic figure ; as a young man he was very handsome, and later in life of strikingly dignified presence with a most winning smile and manner. The hot temper of youth developed into the unyielding determination, bordering at times on ruthlessness, of his maturity. He was a well-known figure on many athletic fields, playing cricket for the Corps, the M.C.C. and Free Foresters. Between 1892 and 1911 he played in all but four matches against the Gunners, and towards the end of his cricket career he was an extremely able captain of the Corps side. He also played polo, racquets and golf with skill. At Association football he played for the Casuals for several years.

Guggisberg married first Miss Forestier Walker, whose two daughters survive him, and secondly Miss Decima Moore, now Lady Moore-Guggisberg, C.B.E., who was decorated for her work in the War, largely with the Women's Emergency Corps which she originated, and with leave clubs in Paris and Cologne.

G.G.W.

LIEUTENANT-GENERAL CHARLES STRAHAN, COLONEL COMMANDANT R.E., LATE SURVEYOR GENERAL OF INDIA.

(1843–1930.)

THE late General Strahan was born in 1843. In 1858, at the age of 15, he entered the Military College of the Honourable East India Company at Addiscombe, and he obtained his commission in the Bengal Engineers in 1860.

He was one of five brothers, the eldest of whom was in the Artillery. His second brother, George, was in the Bengal Engineers, and was a distinguished officer of the Survey of India, mathematician, topographer, and astronomer, whose scientific gifts were hidden from the public eye by his genius as a landscape painter. The third brother, Sir Aubrey Strahan, was well known in England as the Director General of the Geological Survey, and the youngest brother, Henry, was the Mayor of Hythe.

Charles Strahan went to India in 1862 at the age of 19, and in 1863 he followed in his brother George's footsteps and was appointed to the Survey of India. Almost all men are born with certain aptitudes, but it does not fall to the lot of all to be selected for careers



Lieutenant General Charles Strahan, Colonel Commandant, RE.

suitable to their natural bents. The two Strahan brothers, George and Charles, had been endowed with scientific and artistic gifts; they were both interested in scientific instruments and observations, and for both the artistic representation of hills and valleys had a fascination; they were clear thinkers and in Survey matters were unswerving in their attachment to principle. They were not pioneers and so their names are not attached to any particular reform, but their influence upon the Indian Survey and its maps has been valuable and permanent.

The topographical surveys of the native states of Rewah and Bundelkhund, of Central India and Rajputana, have always been regarded as the school in which surveying by plane-table was elaborated and brought to perfection, and not a little of the credit of this was due to General Charles Strahan, who for 20 years of his life devoted himself to this work.

In 1865 he saw active service with the field force under General Tytler in Bhutan, and here his topographical experience became widened by his reconnaissances over an unexplored portion of the Himalaya Mountains, a portion inhabited by an unknown race whose geographical names had been evolved from a peculiar Tibeto-Burman dialect.

In the Afghan War of 1879 Strahan again saw active service, and on this occasion with the Peshawar Field Force under Sir Samuel Browne; his topographical experience became thus extended over eastern Afghanistan, from Ali Musjid and Jalalabad through the Jagdallak Pass to Kabul. He here came in contact with the Pushtu and Persian languages, and this experience was of use to him later when he was called upon to consider Asiatic nomenclature as a whole.

In 1883 he was selected by General Walker for the charge of the Headquarters Drawing Office at Calcutta, and he then became responsible for the geographical maps of the whole country from Ceylon to Tibet and from Arabia to Siam. He remained in the Calcutta office for the rest of his service, and did not again join a party in the field.

When one passes in review the maps of India from 1800 to 1900, collected at the India Office, one realizes the steady progress throughout the century. Controversies arose at intervals; in the early years of the century there was heated controversy over the relative merits of astronomy and triangulation as a basis of surveys. In the middle of the century there was a controversy over the relative merits of the compass and plane-table, and towards the end of the century there was a wide and prolonged discussion over the spelling of geographical names. The maps collected at the India Office show that improvements constantly occurred as new ideas came into force, and a considerable forward jump occurred under the influence of Charles Strahan. The following extract is from a speech of Sir John Benton, the Inspector-General of Irrigation, at a meeting of engineers in India in 1912. "We engineers," Sir John Benton said, "pride ourselves "upon the benefits conferred upon this country by our roads and "railways and canals, but I feel that we ought in fairness to acknow-"ledge that the Survey of India has been the foundation stone upon "which we have always built. Whatever part of the country I have "had to visit, and whatever project I have had to consider, the maps "of the Survey have been my basis of knowledge; without them I "should have been impotent; and in my career as an engineer I "have never been let down by the Survey." This tribute from a civil engineer was the more striking, seeing that in the maps of the Survey the military requirements have been given foremost consideration.

Strahan was in charge at Calcutta when the new system of transliterating geographical names was being introduced. This system had been devised by Sir William Hunter, I.C.S., and had been accepted by the Survey of India in 1875; but "the tangled growth of a cen-"tury," wrote Dr. Hunter, "cannot suddenly be cleared away, and "a whole generation must pass before uniformity can be looked for." Even now, complete uniformity has not been attained, as the spellings of names in Central Asia adopted by European explorers do not always agree with those adopted in Calcutta. The correct spelling of geographical names became Strahan's absorbing interest.

The difficulties confronting the Surveyor-General may be realized if we consider the map of Europe, and if we suppose that one central drawing office was given control of the mapping of Europe.

In Europe, the place-names have originated from perhaps 40 different languages, but in India there are more place-names and many more languages; in Europe, all the languages with small exceptions belong to the Aryan family, but the Survey of India has had to deal not only with ancient and modern Aryan languages but with Mongolian, Dravidian and Semitic.

India being under one government, uniformity in spelling was found to be necessary; 50 years ago it was not uncommon to see the name of the railway station spelt differently from the name of the post office; it frequently happened, too, that both these spellings differed from that of Survey maps and all differed from the spelling of the magistrate's court. Uniformity in spelling has not been considered necessary in Europe. The Surveyor-General of India has endeavoured to find a spelling for Kanchenjunga which will satisfy both the Bengali and the Tibetan races, but in Europe the Germans and French continue to spell such names as Cologne and Mainz differently. In southern Asia, Calcutta is spelt Calcutta everywhere, but in France, London is spelt Londres. In England, the famous cities of Italy are spelt in a way that the Italians do not recognize.

MARCH

MEMOIRS.

Fifty years ago similar discrepancies existed in India. The province of Sind was spelt Scind and Scinde and Sindh. On crossing , the border between the Bombay and Madras presidencies the name Kanara used to change to Canura. And the eastern cities of India used to spell the name Karachi as Crotchy.

The benefits conferred upon India by the introduction of uniformity have been so far-reaching as to be beyond description in a memoir such as this, even though it be the memoir of one of the founders of the system. In the discussions over difficult names the opinion of the Survey carried great weight, and General Strahan was the Survey's representative. Sir William Hunter accepted the popular spelling of certain famous names, such as Bombay, Lucknow, Cawnpur, Kinchinjunga and others, and refused to alter them. His refusal has led to occasional difficulties; for example, the spelling Kinchinjunga had become popularized through the writings of Sir Joseph Hooker; but in recent times linguistic authorities have objected to Hooker's spelling. Though their objections have been reasonable, they have pressed their own views too far, and have insisted upon spellings derived from the supposed origin of the name thirty centuries ago. Sanskrit authorities have put forward a Sanskrit origin for Kanchenjunga, Tibetan linguists are in favour of a Tibetan origin, and British soldiers at Darjeeling have traced the origin to English words, kitchen and jungle. But neither in Europe nor in India are the spellings of names based upon hypothetical origins; modern pronunciations are the usual criteria. Interested as Strahan was, he never attempted to trace names back to their origins.

Strahan was a strong supporter of the name of Mount Everest as being an exceptional case without any possibility of a parallel. He objected to personal names being applied to mountain features, but not when applied to a station like Dalhousie, which was the creation of man. The natives of India have attached many personal names to cities such as Fatehgarh, Ferozpur, Ahmedebad, but never to mountain features; the mountain name of Takht-i-Suleiman means "the throne of Suleiman," and is not a mere personal name. The name of Lansdowne was given with Strahan's concurrence to the military hill-station in Garhwal, because the Gurkha sepoys objected to the original Hindu name of Kala Dhanda.

During General Strahan's long tenure of the Calcutta charge, he came to be regarded as the expert authority on questions of topography and nomenclature, and he was consulted from all parts of the country.

All maps must inevitably get out of date owing to the changes that a progressive country undergoes—just as all handbooks of science get out of date—and Strahan's maps have had to be revised; but a revision means a building upon the past and not its effacement, and though Strahan's maps may have disappeared, his influence upon the topographical edifice remains. He has been followed in the Drawing Office by able and devoted geographers, and if what I have written concerning their predecessor happens to meet their eyes, I am sure that it will receive their endorsement. During Strahan's many and long hot weathers in Calcutta, his boyish gaiety was an encouragement to Europeans and Indians alike.

When in 1895 he was selected to succeed Sir Henry Thuillier as Surveyor-General of India, his appointment was welcomed throughout the department.

During his sojourn at Calcutta he took great pains to make a relief model of topographical India out of plaster of Paris; the horizontal scale was 32 miles to the inch, and the vertical scale was 12 times as large; the highest peaks of the Himalaya were about two inches high. This relief model was presented by the Government of India to the Imperial Institute.

In 1898, when he was Surveyor-General, he joined the Astronomer Royal's camp at Sahdol in Rewah for the total eclipse of the sun; and the fine drawing he made of the corona during the 70 seconds of totality testifies permanently to his decision and accuracy as a draftsman.

In 1869, Lieutenant Charles Strahan married Miss Rose Dick, the younger daughter of General Alexander Dick. Mrs. Strahan died in 1914, and their only son, who was a captain in the Black Watch, was killed in the trenches at Bethune in the first year of the Great War. General Strahan leaves two daughters.

He served in India for 36 years, and during that period he took furlough three times. His total furlough in 36 years amounted to $3\frac{1}{2}$ years; during his 16 years in the Calcutta office the time he spent on furlough was $1\frac{1}{2}$ years only.

On his retirement the following notification was issued by the Government of India :---

"Major-General Charles Strahan is the last officer of the Royal (late Bengal) Engineers in the active service of the Government of India, and with his retirement the honourable and distinguished record of the Corps of Engineers of Bengal, Madras and Bombay, raised under the Honourable East India Company and covering a period of over a century is brought to a close.

"Major-General Strahan's service in the Survey of India has "extended to 36 years, during the last $4\frac{1}{2}$ years of which he has con-"trolled it as Surveyor-General. Under his charge the Survey of "India has fully maintained its great professional reputation and "alike in peace and in the field has continued to render eminent "service to the State. The good wishes of the Governor-General in "Council go with its late chief in his retirement."

S. G. BURRARD.



Major-General Sir George Barker, KCB. Colonel Commandant. RE

MEMOIRS.

MAJOR-GENERAL SIR GEORGE BARKER, K.C.B., COLONEL COMMANDANT R.E.

THE subject of this memoir, son of Colonel G. Barker, H.E.I.C.S., was born on December 17th, 1849.

Throughout his long career he was always known in the Corps, and to many outside it, as George, and this will account for the frequent use of his Christian name in this memoir. The practice arose because in the same batch there happened to be another very popular Barker, still happily with us, and distinction between the two was secured, first of all by the soubriquets "short Barker" and "long Barker," and subsequently by calling one George and the other Jim.

George Barker's first commission was dated January 13th, 1869, when he passed out of Woolwich third to Sir Henry Cunynghame and to the late Sir Arthur Yorke in a batch of nineteen, among whom was General Sir Reginald Hart, who gives George a very good character as a young man.

He was very popular and sociable at Chatham and was keen both at work and at play, very soon making a reputation in both respects. Taking play first, his name figured in the season of 1870-71 in the Corps football team, then led by Merriman and Marindin, and the football records contain many allusions to his effective play. His name does not appear in the team which won the Association Cup in the following year, but he was very prominent in the season of 1872-73, at the close of which he went on foreign service. When he returned to Chatham four years later he renewed his football activities and captained the Corps team from 1877 to 1880. In the season of 1879-80 the chances of our team winning the Cup once more seemed very rosy, and they went from one success to another, a result largely due to George's excellence as a captain, and to his combined work with Von Donop on one of the wings. It was a tragedy, therefore, when, in the semi-final against Oxford University at the Oval, his leg was broken with a crack that resounded all over the ground; with this match his career as a football player came to an end.

Turning now to work, it so happened that when he was finishing his course at the S.M.E., a commencement was made of large purchases of submarine mining stores and the first Submarine Mining Company was brought into being; this took place in April, 1871, and the first officers of the Company (4th) were Capt. G. Stockley and Lieut. R. G. Scott; the next officer posted was Lieut. George Barker, who was, therefore, the second subaltern, and the first "young officer," to join the Submarine Mining Service, and he certainly was one of the earliest and most active of its pioneers.

George served at Chatham for two years with this Company and we read that, in 1872, a regular system of mines was laid down off Hoo and Darnet Forts by Lieuts. G. Barker and Ord, and was kept out until 1873, in spite of the protests of the local skippers.

In 1873, the first dispersal of the little group of Submarine Miners took place, and in May of that year the second Section of the Company, under Lieut. G. Barker, with W. St. G. Ord, embarked with stores for Bermuda and Halifax, where they started S.M. establishments at both places. After two and a half years of what must have been a most interesting experience, George was ordered home and was placed in charge, at Woolwich, of the Store Department of the S.M. Service, an important post in view of the large quantities of stores required. In May, 1877, he left Woolwich for Chatham on selection as Assistant Instructor in Submarine Mining, and he held the post for four years and his appointment thereto was a recognition of his value as a Submarine Miner.

A memory of those days and illustrative of Barker's zeal for smartness is recalled by the following from Major H. E. Burton,* O.B.E.—then a bugler on H.M.S. *Hood*—whose remarkable career is a source of pride to members of the Corps.

"I was then a boy of 15, and the thing which impressed me most was the spick and span manner in which the special cutter was kept which conveyed the Assistant Instructor in Submarine Mining to and from the ship to the shore. The boat's crew had to be on their best behaviour when the A.I.S.M. hove in sight. No naval captain's gig was ever so well looked after."

His next move (in 1881) was to become Secretary of the R.E. Committee. When he took up this post the time was one of very rapid expansion of the S.M. Service, especially on the experimental side. Searchlights were first being tried, telephones were in a very early stage and nearly the whole of the original S.M. equipment was being revised. The R.E. Committee was much concerned in such matters, and it was generally recognized that George did valuable work in getting things of such importance carried through without delay.

During this period the Channel Tunnel question came up for consideration and in February, 1882, George was made Secretary of a Technical Committee appointed to consider the means by which the use of a Channel tunnel, if constructed, could be interdicted to an enemy in time of war.

Sir Archibald Alison was Chairman, and among the members were

^{*} The Monthly Supplement of August, 1924, records the unique and splendid lifesaving achievements of Major Burton, whilst in the Supplement of February, 1925, I gave a sketch of his outstanding services in the Great War.—H.M.L.

the I.G.F. General Gallwey, the D.A.G. R.E., Sir John Stokes, and the Commandant of the S.M.E., Sir Andrew Clarke.

The story goes that when it came to framing the report, the members were so much at variance in their views that Barker wrote the whole of the report himself, and it was agreed to and issued in that form.

The report was signed on May 17th, 1882, and it is natural to suppose that George's share in the work was instrumental in his being appointed two months later to be Adjutant to the C.R.E. of the 1st Division of the Force which carried to a rapid and successful conclusion the campaign of Tel-el-Kebir. He made the most of his opportunities on the occasion, gained a high reputation as an active service officer, and was rewarded by a brevet-majority.

Meanwhile, there had been a change of I.G.F.s, and just before the Egyptian campaign began, Sir Andrew Clarke succeeded General Gallwey.

Sir Andrew was a thorough-going reformer, and in the years he held the appointment, he succeeded, despite considerable opposition, in introducing much needed changes and in improving and developing every branch of military engineering. He believed in young and clever men and lost no opportunity of getting them to the War Office and of taking them into his counsel. George Barker was one of those whom he selected, and within a month of his return from Egypt, Barker joined the I.G.F.'s Office, where, with two temporary absences, he remained for five years, during four of which Sir Andrew was at Whitehall.

Sir Andrew did not always receive a sympathetic response from his senior advisers to his various schemes of reform, and so on occasion he relied on the younger men : of these the chief was Capt. Sydenham Clarke (now Lord Sydenham) ; but George ranked high among those who were sometimes termed " the illegitimate advisers of the I.G.F." Lord Sydenham writes in reference to Barker at this time: "He and I were classed as conspirators in the eighties, because we were generally in revolt against the orthodox and usually in full agreement. He was always a cheery soul, who took rebuffs to his views with philosophy and without discouragement." Sir Andrew had a great affection for George, whom he frequently employed as his A.D.C., and who must have been able to help him in many of his schemes, and not least in the expansion of the S.M. Service, which was one of the features of Sir Andrew's tour of office. George must have learnt much from his chief, whose reforming spirit he shared as well as his absence of anything in the nature of military pedantry.

Always ready to help those who served him well, the I.G.F. released Barker to serve as D.A.A.G. on the Bechuanaland expedition commanded by Sir Charles Warren. Unfortunately, perhaps, from

[MARCH

certain points of view, Sir Charles was so successful that he attained his ends without any fighting, and those participating got no medal or rewards. George did very well, was at the front all the time with his chief and received a well-earned "mention" in dispatches. After his year's absence in South Africa, he rejoined the War Office, only to be sent two months later, in connection with Lord Carnarvon's most important Commission, to inspect and report on the defences of coaling stations abroad, in company with Colonel Ellis, R.A., work which Lord Sydenham refers to as being perhaps the most important and valuable to the nation that Barker ever took in hand.

This tour lasted eleven months and when George rejoined the War Office at the end of 1886, he found Sir Lothian Nicholson installed in the chair which Sir Andrew had recently vacated. A year later, on completion of five years' service at the W.O., and on attaining the regimental rank of Major, Barker was sent to Aldershot to command "A" Pontoon Troop, which a few months later developed into the Bridging Battalion of "A" and "B" Pontoon Troops.

This was his first experience with a mounted unit and there may have been misgivings among some old Aldershotians when they saw the famous "A" Troop handed over to a Submarine Miner.

Such fears, however, were groundless, for George quickly showed that he was as effective with a mounted as with an amphibious unit, and was as much at home with wagons and horses as he had been with launches and mines : the fact that he had hunted all his life and was an excellent horse-master stood him in good stead. His success was immediate and it is perhaps not going too far to say that "A" Troop, through its distinguished existence, was never better horsed than in his days, or ever reached a higher pitch of smartness on mounted and dismounted parades and duties. Recognizing as he did the value of soldierly smartness, he realized that much more than that was needed for real efficiency. The technical instruction was brought to a high state of excellence, not only in pontooning, but in bridging of every description and field works. Sappers without trades were converted into handy men, the troops learnt to make much of their bridging equipment, and the mounted men were taught how to lend a hand to their dismounted brethren in all bridging activities. Everyone was expected to work hard, and to those who tried, their C.O. was the best of friends ; but slackers and evil-doers had life made very unpleasant for them. He supported and backed his subordinates and encouraged initiative on their part : their trust in him was unbounded. Endowed with a progressive intelligence, Barker was " all out " for progress along every path, and the writer, who had the advantage of serving under him at this period, cannot imagine a more efficient and effective commanding officer.
MEMOIRS.

When his five years of command were over, he handed the Bridging Battalion to his successor in the very highest state of efficiency, and his name was long held in affectionate remembrance among many friends of all ranks who had served under him. It was in no small degree due to the principles he had installed and the standards he had set, that the Bridging Battalion won the admiration of all branches of the army in the South African War.

After Aldershot, Barker put in the last two years of his service as a Major at Portsmouth, where he came under H.R.H. The Duke of Connaught, under whom he was later to serve again when H.R.H. was Inspector-General of the Forces and he was Inspector of Engineers.

In September, 1894, just as he attained the rank of regimental Lieut.-Colonel, George was selected to serve as Assistant Inspector-General of Fortifications at the War Office, and he remained in this post for close on six and a half years, at first under Sir Robert Grant and later under Sir Richard Harrison. This period included the Omdurman Campaign and the first half of the South African War, and it is a pity that he missed both these opportunities of active service. If he only had had his chance in South Africa, his subsequent career might have been altered, as he had all the qualities to command success on active service : the fates willed otherwise and he doubtless rendered valuable service in his responsible post at home.

When he left the War Office he was only four weeks on half pay before he was re-employed as a Colonel on the Staff, at first at Colchester for two years and then in London as C.R.E. IVth Army Corps. During this period, much of the reconstruction of the barracks at Colchester was carried out under him, whilst he was frequently employed at Army Manœuvres as Head Compensation Officer.

In 1904, the Esher Committee, of which Lord Sydenham was the dominant member, changed the higher organization of the Army; an Army Council was created and an Inspector-General of the Forces, suitably staffed, was brought into being. Among other appointments to disappear was that of I.G.F., and many looked on its abolition as a blow to the efficiency and prestige of the Corps. Experience does not seem to have justified this view, for the effect of the change was to draw the R.E. closer to the Army, to throw open the military field and so much increase the number of Army appointments held by officers of the Corps. In August, 1904, Barker became the first Inspector of Engineers under the new regime, and held the post for four years, being promoted Major-General in 1906. Here he laid the foundations of a fresh appointment, was uncommonly active, and devoted himself to promoting sound military progress ; he had considerable weight in regard to the higher appointments

MARCH

and patronage in the Corps, and that weight was thrown in on the side of efficiency, whilst he gave a helping hand to the various changes that went to make the Corps the valuable instrument it proved in the Great War.

At the conclusion of four years as Inspector, Barker was appointed G.O.C. Eastern Coast Defences and spent two and a half years at Chatham until retired for age in December, 1911. He was made a K.C.B. in 1911 and a Colonel Commandant in April, 1923.

When the Great War broke out he volunteered, but apparently stipulated that his service should be overseas, a condition which his age and rank made very difficult to comply with. The stipulation was unfortunate, for at home he would have been invaluable as a Coast Defence Commander, or as one of those who trained the Divisions of the New Army. His years in retirement were spent in farming, first near Faringdon in Berkshire, and later near Chichester, where he purchased a property and worked untiringly until his death, not only at his farm but at various local activities; strong, determined and industrious to the end.

To the writer it seems as if George Barker, full though his life was, and important as were the responsibilities that fell upon him, never reached the position in the Army to which his qualities might have carried him. He had all the characteristics for success in war, courage, quick intelligence, tenacity of purpose and driving power. He would have done brilliantly had the opportunity come, but it was willed otherwise.

He died at Salthill, Chichester, on March 5th, 1930, and was buried three days later at East Lavant Church, Chichester. A detachment of Royal Engineers from Bulford attended the service and the "Last Post" was sounded by R.E. trumpeters from Aldershot.

He married, in 1888, Clemency, daughter of the first Lord Addington, and was survived by her and his three children—one daughter and two sons. The second son, Evelyn, has carried on the military traditions of the family in the King's Royal Rifle Corps, and after service in the Great War and passing through the Staff College, is now a Major on the General Staff of the Army.

H. M. LAWSON.



Colonel Charles Michael Browne, CMG DSO

COLONEL CHARLES MICHAEL BROWNE, C.M.G., D.S.O.

CHARLES MICHAEL BROWNE was born at Dharwar on November 26th, 1878. He was the youngest son of Lieut.-Colonel C. M. Browne, Indian Army, and grandson of H. K. Browne, well known as the illustrator of early editions of Dickens' and Lever's works, under the name of "Phiz."

Browne was first educated at Mr. Fyson's school in Brighton, and afterwards at the United Service College, Westward Ho! He passed direct from school into the R.M.A., nineteenth on the list, and thereby gained the scholarship granted at Westward Ho! to boys who passed in amongst the first twenty. He represented "The Shop " at Rugby football and gymnastics, and passed out top of the batch, being awarded the Pollock medal.

Gazetted 2nd-Lieutenant on December 23rd, 1897, Browne joined at Chatham in the following March. Having completed the full two years' course at the S.M.E., and gained the Fowke Memorial Medal, he went straight to India, joining as Assistant Garrison Engineer at Mian Mir in April, 1900.

At the beginning of December, 1901, he was posted to Miramshah as G.E., Tochi, and was there during the operations against the Mahsuds, carried out between November 23rd, 1901, and March 15th, 1902, thereby becoming eligible for the frontier medal.

In November, 1902, punitive measures were undertaken against the Kabul Khel Waziris. Browne was attached to No. 3 Co., Bengal Sappers and Miners, and accompanied a small column of all arms which left Bannu early on the morning of November 18th under the command of Colonel V. C. Tonnochy, c.B., 3rd Sikhs. On nearing Gumatti, it was found that six outlaws were occupying a fortified enclosure. They refused the terms offered them, so fire was opened from the two guns. Whilst watching their effect, Colonel Tonnochy fell mortally wounded. Major J. H. B. Beresford, the next senior, decided to send a storming party against one of the bastions, and ordered Browne to blow a breach in the wall. Twice did Browne and his party of four sappers fire a charge, but on both occasions the effect was small. The bastion was then stormed by a party of Sikhs, led by Captain G. White (who was unfortunately killed in the subsequent fighting), but it was not till an hour later that the last outlaw was dispatched.

For his gallantry in this small but bloody affair, "crossing three times the ground between the tower and the troops at the imminent risk of his own life"—so runs the official dispatch— Browne was awarded the D.S.O. After a few weeks of duty in the C.R.E.'s office at Kohat, Browne was transferred to the Survey Department and joined the Trigonometrical Branch at Dehra Dun in January, 1903.

His more interesting work as a surveyor included a field season in the winter of 1904-5 in charge of a topographical party working in the Tochi Valley, and three years, 1906-9, spent on geodetic triangulation. Two seasons were passed in the desolate and barren wastes of Baluchistan, a country practically uninhabited except for a few nomad shepherds and the residents in the *thanas* along the Seistan trade route. One of the stations was fixed on Koh-i-Malik Siah, the junction point of Persia, Afghanistan and Baluchistan. An interesting mountain, fixed with care from no less than ten stations, was Koh-i-Taftan. Its summit is formed by two main peaks of nearly equal height, the southern and highest being still an active volcano. The positions hitherto assigned to the peaks of this mountain were found by Browne to be in error by over 600 feet.

In the succeeding years he carried out survey work in the Southern Shan States, Malabar, Cochin and Travancore. He had a short but interesting job in 1914, laying out a wireless transmission station near Kirkee, one of a series of imperial long-distance stations, intermediate to similar stations at Cairo and Singapore.

Soon after the outbreak of war, Browne was recalled to military duty, and started from Bombay in the Salsette on October 24th, 1914, together with 75 other R.E. officers, 27 of their wives and 18 children. This memorable company, having transhipped tos.s. Multan at Aden, reached Plymouth on November 13th. Here all, except 12 officers who had disembarked at Marseilles, dispersed to their stations, Browne going to Bordon as Adjutant, 15th Divisional R.E.

On February 11th, 1915, Browne, who had been promoted to Major on October 30th of the previous year, joined the 2nd Division as O.C. 5th Company. He had increased considerably in girth since he was a Y.O., and his C.R.E. was at first not favourably impressed. But he soon had reason to change his mind : " I suppose he was the ideal company commander, absolutely tireless, being able apparently to work in the trenches most of the 24 hours ; brave as a lion ; full of sympathy for his men and watchful of their interests, very tactful in his dealings with everyone and a sound engineer. He always took things calmly and never lost his head or seemed worried when he was harassed. He was beloved by everyone in the Division from his own sappers to the Brigade Commanders, who could not speak too highly of him." Browne remained with the 5th Company till September 5th, 1916, a period which included the attack by the 2nd Division at Givenchy, the battles of Festubert, Loos, the Somme, Delville Wood and Guillemont.

He had received the brevet of Lieut.-Colonel on January 1st, 1916, and on September 6th was appointed C.R.E. of the 8th Division, then in the line in the neighbourhood of the Hohenzollern Redoubt. In October, it was moved to the Somme area, where the trenches were particularly bad. The R.E. work during the winter was of the usual miscellaneous character, but a point to which Browne paid special attention was the repair and reconstruction of roads, which had been much neglected. During the advance consequent on the German retreat to the Hindenburg Line, the conditions were to a great extent those of open warfare, but Browne adapted himself withou't difficulty to the altered circumstances. Towards the end of April he was wounded by a shell and was sent to England; the Divisional Staff was so anxious to retain his services that when he returned to France he was reappointed to his former position. In June, 1917, the Division moved up to the Salient, and Browne was immediately absorbed in the preparations for the big attacks of July 31st and August roth.

When the German offensive was launched on March 21st of the following year, the 8th Division was in G.H.Q. Reserve, but the R.E. units were in the Ypres area. There they had passed all the winter engaged largely on the construction and repair of plank roads, bridges, etc., in the desolation between Ypres and Passchendaele. They were at once ordered away, one to each Brigade, to fight as infantry. The C.R.E. and his adjutant, left without a command, acted until the end of the retreat more or less as odd-job men, making reconnaissances, taping out trenches, acting as straggler posts, getting up R.E. stores, and so on.

In May, the 8th Division was sent south to form part of the IX Corps, then attached to the Sixth. French Army. The defensive positions were all north of the Aisne, and the C.R.E. had to make arrangements for the blowing up, in case of necessity, of 33 bridges over the river and canal. In spite of protests, the French authorities would not allow charges to be placed before an attack actually occurred; the result was that when, without warning, the German attack was suddenly launched on May 27th, the Field Companies, despite their utmost efforts and at very heavy cost in casualties, were unable to destroy more than sixteen of the bridges before they were overwhelmed. During the retreat the Field Companies were so reduced that they had to be combined to form a single company—and that a weak one.

After a period of rest near the coast the Division went back into line north of Arras with Headquarters at Château d'Acq. Preparations for the great advance were put in hand and Browne devoted much care and anxious thought to the problem of crossing the wide devastated area. The result of his foresight was seen in the smoothness with which the engineer arrangements worked in very difficult circumstances during the advance through Douai, Marchiennes and St. Amand. Greatly to his own and the Division's regret, Browne was selected for a well-deserved but inopportune rest just as the operations were reaching their culminating point, and he was relieved by Colonel C. Russell-Brown on November 9th, 1918.*

There is no doubt that Browne was very highly appreciated by the Divisional Staff. A G.S.O.I. writes : "As the C.R.E. of the Division, Colonel Browne seemed to me ideal. He co-operated with me to the utmost. . . He was very gallant and always very cheerful, whatever the circumstances." The Divisional Commander under whom Browne served for nearly two years, writes : "I formed a very high opinion of him and his work. He was very cheery and was the soul and life of any gathering he attended. An exceedingly hard worker with a very agile and quick brain. . . ."

For his services with the 8th Division, Browne was awarded the C.M.G. He had previously received the Cross of the Legion of Honour and was mentioned in dispatches four times during the War.

After a few months as Commandant at the R.E. Command Depot, Crowborough, Browne was appointed C.R.E. of the 2nd Brigade Group, one of two which were proceeding to North Russia to relieve the British Troops there. His command, consisting of the 385th Field Company and the 250th Signal Company, was formed at Chatham in April, 1919, and sailed at the end of the month for Archangel. In July, the Brigade moved up the Dvina as far as Troitsa, arriving on July 5th, two days before the mutiny of Dyer's Battalion. Browne had a narrow escape on this occasion. He and some of the Staff were isolated in a house, in a village which was for some hours in the hands of the mutineers. When the Field Company arrived next day he was found quite unperturbed with a couple of bullet holes through his jacket, supervising a working party of Russian men and women, with the aid of his engineer clerk.

The principal work of the R.E. was the making of corduroy roads and landing stages; working parties were largely composed of *barishni*, who as workers were apparently more efficient than the male natives. In order to facilitate the withdrawal which had been decided upon when it was realized that a junction with Kolchak would be impossible, a determined attack in which the R.E. took part was made on August 10th against the Bolshevik position. It was entirely successful, and the evacuation was soon after carried out without much difficulty, being completed on September 27th, 1919.

For his services in North Russia, Browne was mentioned in Lord Rawlinson's dispatch and was awarded the Cross of St. Anne, 2nd Class.

Having returned to India in October, 1920, Browne spent the next four years in charge of the topographical survey in Shillong. He was promoted Lieut.-Colonel on September 21st, 1922. In

^{*} On pages 263 and 268 of *The Eighth Division in War* by J. H. Boraston and Cyril E. O. Bax, the C.R.E. is incorrectly referred to as Lt. Col. C. R. Brown, D.S.O.



Brigadier-General Harold Pemberton Leach. CB, CBE, DSO

April, 1924, he was transferred to Bangalore, where he became Director of Survey, Southern Circle, a post which he held till his death.

In 1927 he was taken dangerously ill with heart trouble, but after leave at home he returned in November, 1928, with his health much improved.

Though he had been warned to live quietly and avoid strenuous exercise, Bruno, as he was affectionately known, was an active and prominent figure in the social life of Bangalore. He was acting president of the club, secretary of the local branches of the British Musical Society and of the Faculty of Arts, a keen Freemason, and a trustee of the local Nursing Home, for the foundation of which he was largely responsible. He never spared himself, and on August 29th, 1929, after a particularly strenuous time during "Planters' Week," he suddenly collapsed, to the great sorrow of his many friends.

In 1905, Browne was married to Isabel Marie Nicolay, who predeceased him. He leaves one son, Charles Gordon Knight Browne, now at Magdalen College, Oxford.

From the human point of view, Browne had a most attractive personality. He was always fond of games and exercise and was very quick at getting across country on foot and at climbing hills. He was a keen fisherman and stamp collector, and was particularly fond of gardening, at which he was a real expert. Perhaps his greatest social asset was his really beautiful tenor voice, which contrasted strangely with his massive presence. He had the gift of human sympathy in a remarkable degree, and inspired all who knew him with genuine affection. With the kindest of hearts, he was paternal in the care of those serving under him. He was a born optimist, full of good cheer and the joy of living-extremely sociable and a good conversationalist, for he was exceptionally well-informed and could talk interestingly on a large variety of subjects and places. Withal he was modest and unassuming, the soul of honour, unswerving in his devotion to duty, in truth "a just man that walked in his integrity."

A.H.B.

BRIGADIER-GENERAL HAROLD PEMBERTON LEACH, C.B., C.B.E., D.S.O.

By the death of Harold Leach, at his house in London, on the 22nd September last, a remarkable family association with the Corps of Royal Engineers has come to an end. His father, Lieut.-Colonel Sir G. A. Leach, K.C.B., joined the R.E. in 1837, no less than 93 years

ago and his brother, General Sir E. Pemberton Leach, v.c., K.C.B., K.C.V.O., was gazetted in 1866. Memoirs of both these distinguished officers appeared in the R.E. Journal of 1913, and indicated how greatly they were attached to the Corps and (especially in the case of Sir George Leach) how much they were able to do in furthering its interests.

Harold was the fourth son of Sir George Leach and was born in Londonderry, on the 14th April, 1851; he was educated at Sir Roger Cholmeley's School at Highgate (he was a Governor of this school in his later years), where he was a Foundation Scholar and distinguished himself equally well in work and play. He passed into the R.M.A. in January, 1868, and was gazetted to the R.E. on the 2nd August, 1871.

After joining the S.M.E. at Chatham, he really enjoyed life thoroughly, made many friends (as, indeed, was his habit everywhere), learned a good deal of field engineering, which came in useful not very long afterwards, and although, perhaps, not quite in the first rank at games, he played in many of the lesser matches, both cricket and football.

On leaving Chatham in 1873, he was attached to the War Office for a short period and then embarked for India, where he joined the Bengal Sappers and Miners in 1874, at Roorkee.

In 1878, he had his first experience of active service, for he joined the Khyber Field Force in the First Afghan War as Officer Commanding the 8th Company Bengal Sappers and Miners, and was present at the capture of Ali-Musjid and several other engagements.

He was mentioned in dispatches, and General Maude reported, on 26th December, 1878: "Seeing the Afridis on the top of a steep mountain become troublesome, he (Brig.-General Tytler) directed Lieut. H. P. Leach, R.E., with his half-company of Sappers who had just reached the crest, along with a party of the 27th Native Infantry, under Lieut. G. A. Williams, to take the summit of the hill. This was gallantly carried. The advance of the Sappers and 27th Native Infantry being covered by the fire of the troops on the crest."

Brig.-General Tytler also mentions Lieut. H. P. Leach as one of the officers to whom he was much indebted and who rendered him the most valuable assistance.

Leach afterwards joined the Kurram Field Force and was present at the assault of Zawa. In a dispatch, dated 20th December, 1879, Brig.-General Tytler wrote: "On moving up the defile, I found the bed of the stream exceedingly rough, being strewn with boulders and heights on either side precipitous. It was mainly owing to the exertions of the Sappers and Miners under Lieut. H. P. Leach that I reached the village of Bagh, distant $3\frac{1}{2}$ miles from Chanarak, by 3.30 p.m." Leach received the thanks of Government and medal with clasp for the Afghan Campaign.

Not long afterwards, and as the result of his own experience, Leach wrote a pamphlet on *The Treatment and Management of Camels*, and it was owing to this fact that, some three or four years afterwards, he was employed on the Nile expedition in the Transport Service.

He was appointed O.C. 9th Company, Camel Transport Corps, and marched across the Bayuda Desert with the force, under Sir Herbert Stewart, being present at the actions of Abuklea and Gubat: it is evident, from a diary which he kept at the time, that during the advance and retirement from Metemmeh, Leach was largely employed on Engineer duties, as well as Transport work, putting villages in a state of defence, making entrenchments, etc. For this campaign, he received the Brevet rank of Major, the medal with two clasps and the Bronze Star.

On his return to India, in 1885, he resumed duty with the Bengal Sappers and Miners until, $3\frac{1}{2}$ years later, he was appointed senior R.E. Officer with the Lushai expedition, and later C.R.E. of the Chin Lushai Expeditionary Force, under Brig.-General Tregear, who, at the close of the latter campaign, reported as follows: "Major H. P. Leach, Commanding R.E., has had very arduous duties to perform in the construction of the road from Fort Lungleh to Haka, the bridging of the Swat and Kolodyne rivers and the building of the port at Fort Tregear, and as was the case last expedition, a very heavy share of this year's operations has fallen upon him. But it has been carried out with the same intelligence, energy and forethought, and he has again proved himself an excellent and most valuable officer."

For his services in connection with these expeditions, Leach was mentioned in dispatches, received the Brevet rank of Lieutenant-Colonel and medal with two clasps. In the next Birthday *Gazette*, he was also given the D.S.O.

He was shortly afterwards appointed Commandant Bombay Sappers and Miners (June, 1890), but he did not hold this position long, for in October, 1891, he was gazetted Military Secretary to the Commander-in-Chief, Bombay, General Sir George Greaves.

In June, 1893, Leach received the coveted appointment of Commandant Bengal Sappers, an appointment which he held until January, 1900, but during this period he occupied, temporarily, several other positions of importance. Thus, in 1895, having been promoted Brevet Colonel in the preceding year, he was appointed C.R.E. and Colonel on Staff of the Chitral Relief Expedition, under the command of Lieut.-General Sir Robert Low. During the campaign which followed, Leach was present at the storming of the Malakand and the actions at Swat and Panjkora rivers: the admirable work which he accomplished is fully described in a letter attached to this memoir, which has recently been received from General Sir Bindon Blood, G.C.B., Colonel Commandant R.E. Leach was again mentioned in dispatches, received a medal and clasp, and was made a C.B.

Lieut.-General Sir Robert Low reported as follows: "The campaign has been remarkable for an exceptional amount of Engineering work, and in carrying it out, the services of Colonel H. P. Leach, D.S.O., have been of great value. He is an officer of conspicuous ability, wide experience, of great readiness of resource and of remarkable activity and energy: and I consider that his presence with the Expedition contributed materially to its success."

In 1896, Leach was promoted to the rank of Brigadier-General and officiated as G.O.C. of the Peshawar District for six months in this year, and again for a short time in 1898.

In January, 1900, he was given the Command of the Presidency District (with headquarters in Calcutta), which he held for five years, but during this time he also held the Command at Lahore for six months.

Whilst holding the Command of the Presidency District, he received the thanks of the Government of India for the good work done in connection with the dispatch of the Indian Contingent to China. Leach returned to England in 1905, when he retired from the Command of the Presidency District and took up his residence with his father, Sir George Leach, in London, renewing many old friendships and making many others.

When Leach retired from the service in 1908, he was, not unnaturally, disappointed in not being promoted to the rank of Major-General and, indeed, when reading his Record of Service, it is difficult to realize why he was not given this rank. Perhaps it was due in some measure, as Lieut.-General Sir Henry Lawson suggests, to his modesty and habit of self-depreciation, which sometimes led others to doubt his real capacity. I am sure that he felt this matter deeply, as indicated by some of his correspondence, but it seemed to have little or no effect on his galety of disposition, or on his habit of kindly assistance to others. I, personally, never heard him allude to the subject, showing a screnity of mind which is certainly very rare.

During the later years of his father's life, Harold devoted himself nearly entirely to him and effectually guarded him against loneliness and most of 'the discomforts of old age.

Shortly after his father's death in 1913, the Great War broke out, and Leach was one of the first of the retired officers to offer his services to the War Office in any capacity. After serving as a Group Commander of Surrey Volunteers and assisting in training recruits at Finsbury and elsewhere, he was appointed to the Command of the 89th Infantry Brigade, afterwards the 1st Reserve Infantry Brigade, stationed first at Darlington and afterwards at Cannock Chase, in the Northern Command.

Lieut.-General Sir Henry Lawson writes as to the value of Leach's services whilst acting in this capacity, and General Lorn Campbell and others have written to the same effect: they all describe the keenness, knowledge of his duties, and power of getting the best work out of his officers and men, combined with unfailing cheerfulness and sympathy.

He was given the C.B.E. for his services during the Great War.

After peace was declared, Leach returned to his house in London and once more devoted himself to generous hospitality and to the assistance of those of his relations and friends who were not so well situated as himself.

It is this side of his character that one would specially like to enlarge upon, for it was of a rare quality, which the official reports naturally do not touch upon. Gifted with a fine sense of humour which was almost irrepressible at times, and much intuition, added to the kindest disposition possible, he was the joy of all children and also of most grown-ups. Even now, as I write, I recall a conversation with him shortly before his death, when we were discussing the trials of writing memoirs of one's friends, a subject of which we had both had some experience. But it was the humour of the situation which specially appealed to him and the difficulties in some cases of reconciling the opinions of the various relations and friends. If my old friend can see me now, endeavouring to give some faint idea of his delightful and generous nature, I am sure that his face will wear that whimsical expression that endeared him so greatly to all who knew him. As Brig.-General Stafford writes: "No kinder-hearted man than Harold ever lived." It was a stroke of rare good fortune to have had such a friend.

Many communications have been received from Harold Leach's brother officers and friends, enlarging either on the value of his military services, or on his social qualities; these include letters from Lady Greaves, Lady Smith-Dorrien, Generals Sir Bindon Blood, Sir George Richardson, Sir Henry Lawson, Sir Henry Thuillier, Lorn Campbell, Lake, Stafford and Buston, Colonels G. W. Addison, Darling, Sir Buchanan Scott and Barton. All refer to his great gift for friendship and some give instances of his generosity.

I have included extracts from the letters which have been received from Generals Sir Bindon Blood and Sir Henry Lawson, as they relate specially to his military capacity. I regret that want of space prevents the inclusion of the remainder, but I understand that it is the intention of some of General Leach's family to circulate a selection of these letters, together with copies of this memoir (after publication), to many of his relatives and friends.

General Sir Bindon Blood, G.C.B., Colonel Commandant R.E., remarks :---

"Harold Leach was an excellent officer all round. He was a first-rate Sapper, with plenty of brains, smart, strong, healthy and regardless of hardships; and he was a very good leader and commander of men, especially on active service.

"Socially he was universally popular wherever he went, and he was a most valuable man in a regimental mess. He was a right good sportsman, rode and shot well, played polo regularly in very good form and was a first-class man ' after a pig.'

"Harold Leach served only once under me in the field, namely, in 1895, as C.R.E. on the Staff of the Chitral Relief Force, of which Staff I was Chief. The Chitral Relief Force had some stiff fighting, which it carried out most gallantly and brilliantly, but next to its fighting and marching qualities, its success depended on the bridge-building and road-making of the Sappers with it, under Harold Leach.

" In our first action, the assault on and capture of the Malakand Pass, Leach had a large force of Sappers at work on the track up the Pass, under fire, during the Infantry attack on it.

" The Swat River, Alexander's ' Swastes,' some 11 miles beyond the Malakand, was forded by the Force, but immediately afterwards became unfordable, being changed into a torrent, running sometimes nine miles per hour, by the water from the melted snows near its source in the mountains. It was bridged, in time to prevent trouble about communications, with the Bengal Sappers' pontoons and trestles brought over the Malakand on the road which had been made passable for their wagons. Again, a couple of marches beyond the Swat, we encountered the Panjkora, one of its affluents, another torrent running in a deep ravine with cliffs on both sides, and quite unfordable. This river would have delayed us seriously, had it not been for a suspension bridge hung from ropes made of telegraph wire, after a plan invented and worked out long before by that gallant Sapper, now Lieut.-General Sir Fenton Aylmer, Bart., v.c., etc. Naturally, care had been taken that Aylmer and his Company should be there when wanted, and under Leach's orders the bridge was got ready in a marvellously short time.

"The success of the expedition depended on the rapid making, and on the maintenance afterwards, of these two bridges, which never failed us. I look back with pride and pleasure on my service with the 'Gallant and brilliant 'Chitral Relief Force, and in doing so, I always remember—also with pride and pleasure—the services of the members of my own Corps with that Force.

"After 1895, Leach and I did not serve together again, but our friendship, and my high esteem for him, endured to the last."

* * *

Lieut.-General Sir Henry Lawson, K.C.B., Colonel Commandant R.E., remarks:---

"In the Great War, Brig.-General Leach commanded a Training Brigade under me, first at Darlington and later at Cannock Chase, and I always thought him one of our best and most efficient Brigadiers—hardworking and untiring to a degree, always up at cock-crow, riding round and looking after things and always taking his full share of whatever he did or initiated. I remember hearing of practice nights in the trenches, even in mid-winter, and how Harold would always be the first into the trenches and the last to leave them in the morning. He knew his work so thoroughly, too, and gave such good and sound instruction."

* * * * *

These extracts complete the memoir of a distinguished officer of the R.E., whose military career and personal character have, I submit, done honour to the Corps to which he was always so greatly attached.

R.M.R.

BOOKS.

(Most of the books reviewed may be seen in the R.E. Corps Library Horse, Guards, Whitehall, S.W.I.)

GOETHALS, GENIUS OF THE PANAMA CANAL.

A BIOGRAPHY.

By J. B. BISHOP and F. BISHOP.

(Harper Brothers, New York, 1930. Price 18s.)

It is disappointing to find so little in this volume about the great engineering problems on the Isthmus, and the means whereby the enormous difficulties, which faced the Americans when they took over the derelict works of the French Canal Company, were successfully overcome, but as the life history of a great military engineer the book is well worth reading.

As a boy, Goethals had no intention of joining the army. By a mere accident he went to West Point, and the story of the development of the smart military cadet into the most famous civil engineer of his day cannot fail to interest officers of the sister Corps in this country, and especially those who have had to do with public works in India and elsewhere.

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It will be remembered that the U.S. Military Academy at West Point, on the Hudson River, was established under the guidance and direction of French military engineers. It was the first, and for some time, the only technical school in the U.S.A., and while it was founded primarily as a school for military engineers and artillerymen, it was not incumbent on all the graduates to enter the Regular Army, and many of the seniors on the passing-out lists went into civil life. In the course of time, the universities and colleges were able to provide technical training, and it became unnecessary to draw on West Point for civil engineers.

The Corps of Engineers are charged with not only the design and construction of the fortifications of the country, but are also responsible for the improvement and maintenance of harbours and rivers—a Federal responsibility owing to inter-State jealousies—and for survey, both topographical and geological, including the Coast and Lake Surveys.

The career of an officer of the U.S. Engineers was not very different from that of an officer of our own Corps in pre-war days. The army was, however, small—only 60,000 men—and when an officer took up public works, he had little opportunity to keep in touch with the military side of his profession.

It is interesting to trace the gradual development of the West Point cadet and learn how he acquired the knowledge and experience which caused him to be selected by the President of the United States for the great responsibilities of Chief Engineer of the Panama Canal and later Governor of the Panama Canal Zone. On leaving West Point, Goethals went, armed with a letter of introduction, given him by the Congressman who had nominated him for the Academy, to call on the Commander-in-Chief of the Army, General W. T. Sherman. He received him cordially and asked him what branch of the service he had joined. "The Engineers, sir." "Oh 1 Hell," said Sherman, who was an Artilleryman and had served in a Light Battery (equivalent to a R.H.A. Battery). "However, in spite of that, I hope you "may do some good for your country some day !"

He was posted to West Point and remained there for some months as an assistant instructor in Practical Astronomy. Thence he was sent for a two years' course to the Engincer School of Application, corresponding more or less to the S.M.E. On completion of the course he was posted to Vancouver Barracks, Washington Territory, in the far west, as District Engineer, and was employed chiefly in surveying and astronomical work, but also gained some practical experience in bridging rivers with only what materials he could find on the spot. In 1884 he married and became Assistant Engineer on the Ohio River improvements. In the following year he was appointed Assistant Professor in Civil and Military Engineering at West Point. There he remained four years. In 1889, he returned to river work on the Cumberland and Tennessee rivers, and gained much experience in the construction of locks and dams. In 1891, as a Captain, he obtained his first independent command as Engineer in charge of the Tennessce River improvements, and very soon established his reputation as a canal engineer by designing, and when the contractors defaulted, personally supervising the construction with direct labour of a big lock at Riverton, with a lift of 26 feet, a height unheard of at that time, when there was no lock in the country with a lift of over 14 fect.* This led to his transfer to the Headquarters of the Engineers at Washington, D.C., where for four years he was employed, under three successive Chiefs of Engineers, in reviewing and reporting on specifications for all kinds of engineering work, examining contracts, and supervising the finance of the Engineer Department.

On the outbreak of the war with Spain, in 1898, Captain Goethals was given a commission as Lieut.-Colonel of U.S. Volunteers, and was ordered to Georgia to prepare a camp for a division of the Volunteer Army at Chickamauga Park. Camp Thomas, as it was named, subsequently earned an unenviable reputation as a hotbed of typhoid fever. There were 3,426 cases. But Goethals was absolved of all

^{*} There is now a lock on the Welland Canal with a lift of over 40 feet.

BOOKS.

blame. The outbreak was attributed to general lack of knowledge of the elements of sanitation amongst the newly-recruited and ill-disciplined troops of the Volunteer Army, and to the fact that the men, instead of drinking from the authorized water supply, which Goethals had installed, drank from the numerous shallow springs, which were mostly polluted : flies and dust did the rest. No doubt, Geothals profited from this experience when it fell to his lot to reorganize the sanitary arrangements in the Panama Canal Zone with Colonel Gorgas, the senior medical officer in charge at the time of his arrival on the Isthmus. From Camp Thomas, Lieut .-Colonel Goethals proceeded to Porto Rico as Engineer Officer attached to the Staff of a brigade of the Expeditionary Force. No arrangements for landing had been prepared at Arroyo, where the brigade was to disembark ; but seeing five large, flat-bottomed sugar barges lying in the roadstead, Goethals ordered his engineers to secure one of them, fill it with sand, and sink it as a foundation for a wharf. This done, they were taking a second barge when a naval licutenant appeared and informed Goethals that the barges had been captured, and were being held by the Navy as prizes of war, and were not to be touched. Goethals replied that he was acting under the orders of his commanding officer and would take none from anyone else. The sailor reported to his admiral, and returned with a message that, unless the Colonel hecded his orders, the battleship would open fire on him. Colonel Goethals completed his wharf, and was reported and threatened with a court martial, which did not take place ! The force landed and pushed the enemy into the interior, but before the Americans received their baptism of fire, an armistice was declared, and shortly afterwards the war ended.

Goethals reverted to Captain in the Regular Army "on honourable discharge from the Volunteers," and once again was posted to West Point, as Instructor in Practical Military Engineering, and remained there until he was promoted to Major, in 1900, and detailed for a turn of coast and harbour work. While in charge of the Newport district, he completed the defences of several coast forts, and gained some experience in railway work on the lines he constructed to carry material for the fortifications on Rhode Island. During the coast manœuvres in 1902 he had charge of all the searchlight work on shore.

With such all-round experience, Goethals was now a fully-equipped military engineer. On the creation of the General Staff, in 1903, he was appointed to it, and became one of the permanent instructors at the War College, corresponding rather to our Staff College than to what we know as the Imperial War College. This led to his becoming Secretary of the Fortification Board formed by Mr. Taft, who was then Secretary of War, and eventually, through his becoming known to Mr. Taft, resulted in his being recommended to President Roosevelt as a likely man for the Canal.

In 1903, President Roosevelt had acquired—some people used the word "seized " the Panama Canal Zone. A chapter of the biography is devoted to the arguments in this controversy, and is worth reading. The Isthmian Canal Commission had been formed to get on with the construction of the Canal. A great deal of preliminary work, especially on the railway across the Isthmus, had been accomplished, but the public and the politicians had become impatient and money was running short. President Roosevelt determined to take the matter into his own hands, and put a military engineer in charge. Mr. Taft's recommendation was shown him and Colonel Goethals was appointed Chief Engineer to the Commission. It was against the grain, but Goethals considered it his duty to accept. Within a year, he had made himself fully acquainted with all the details of the problem, and put forward a plan for the entire reorganization of the Work on the Isthmus. President Roosevelt knew his man, and made him head of the Commission and the Panama Railway and Steamship Company—ruler, in fact, of the Canal Zone, responsible direct to the President, and the President alone.

It was no easy task that confronted Goethals in 1907. He found an "army"

of 29,000 men at work on the Isthmus—afterwards increased to 40,000—men of all nationalities, French, Spanish, Greeks and negroes from the West Indies.

The supply problem for this army was not easy ; the sanitary problem with yellow fever and malaria rife in the Zone was difficult ; while the engineering difficulties were stupendous. He did not receive a friendly welcome. The Canal men, officials and workmen, resented the idea of a soldier being put over them, and also resented the forced resignation of his predecessor, Mr. Stevens, an efficient and popular man. But they soon found that there was no militarism about " the Colonel," as he came to be affectionately known. He dropped his uniform and badges of rank at once and only appeared in civilian clothes. He had the gift of choosing the right men for every job; he had got to know many first-rate civil engineers and foremen in the course of his work on the rivers and harbours, and he soon surrounded himself with a loyal staff. Before long, " the Colonel " was the most popular man on the Isthmus, and he retained his popularity to his death-the tribute of the negroes to his justice and kindliness was one of the warmest his widow received. He worked from morning to night, spent more time out of his office than in it, and was competent to deal with any situation, whether it was a landslide, discontent amongst the workmen, an official detected in dishonesty, or an invasion of Congressmen from Washington-out to make trouble.

He remained on the Isthmus nine years, and completed not only the Canal, but also the fortifications for its defence. A celebrated contractor, who went to see the Canal building, was asked on his return what he thought about it. His reply was: "It's a big job, but that man Goethals is a damned fool. I offered him a million "dollars to come to me, and he refused." When a friend spoke to the Coloncl about this offer, Goethals smiled—"All my training, all my education, has been at the "expense of the public in the free schools of Brooklyn and New York and at the "U.S. Military Academy. I owe it to the public to stay here until the Canal is "finished." It is a fact that when he became Governor of the Zone, his salary was cut down from 20,000 dollars to 10,000 dollars—a paltry $f_{2,000}$ a year. This was in 1914, when, as the Canal was nearing completion, the Isthmian Canal Commission was dissolved and Goethals was appointed first Governor of the Zone by President Wilson.

In 1916, "the Colonel "left the Isthmus for the last time, and retired from the army with the rank of Major-General.

Immediately he joined a firm of consulting engineers, but he was too valuable a man to be lost to the State. The President wished him to join the Shipping Board. A chapter is devoted to the story of his connection with the Board and the struggle between the advocates of wood versus steel in ship construction for the War. Goethals was a steel man, and was so disgusted with the underhand intrigues that were resorted to by the timber interests in the West, that he resigned and returned to consulting work. The Shipping Board proved a failure, and though it existed till the Armistice, would have failed to deliver the goods had the War gone on. About this time, Goethals tried to induce General Pershing to give him employment overseas, but he refused to put him over the heads of men who had served him well in France; Goethals could only have filled the highest post wherever he worked. The State of New Jersey-his native State-then appointed him State Engineer, but at the end of 1917 he was unexpectedly recalled to the active list as acting Quartermaster-General, with the rank of Assistant Chief of Staff and the direction of Purchase, Storage and Traffic. He set to work to make order out of chaos and entircly reorganized the Quartermaster's Department before the end of the War.

In 1919, General Goethals retired for the second time, and together with many other honours, was made an honorary K.C.M.C. by His Majesty. He returned to his consulting office and his work as State Engineer of New Jersey. Thanks to his experience while Q.M.G. in the War, he was able to initiate many improvements in the arrangements in New York Harbour, and became Chief Engineer of the Port. As a consulting engineer, his services were requisitioned all over the country, and the amount of work he accomplished was prodigious. In harness to the last, he died after a short illness on January 21st, 1928, at the age of 70.

The origin of the name Goethals is curious. His father, a woodworker, and his mother were immigrants from near Ghent in Belgium, in the 'fifties of last century, The name is a common one in Flanders, and the family traced their descent through a long line of Goethals-many of them famous men in their time-to Honorius, a senator of Rome, in the ninth century. When the Saracens invaded Apulia, in 880, Honorius marched to meet them and engaged their Emir in single combat. The Saracen's scimitar struck the Roman's neck a blow which would have been fatal had Honorius not been wearing an iron gorget. Before his opponent could recover, Honorius cut him down, and the Romans won the day. Thereafter his descendants were known as the Bonicolli-they had good necks ! Goethals is the Flemish version of the name adopted by a branch of the family who found their way to Flanders. By a play on the words " hals " (neck) and " als " (all), the name reversed became the family motto-" In als goet." The General lived up to his motto. " There " was something about him that you find hard to describe," said General Jadwin, Chief of Engineers, on hearing of his death. "He was just about the hardest worker " I have ever known. He carried to conclusion the greatest of tasks without much " apparent effort. He was not a society man ; just a man who loved family, friends " and his work. And with all this, he was about the greatest executive the Corps " of Engineers has known,

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" The Canal is his Monument."

Not the least interesting pages in the biography contain the address which Colonel Goethals gave to the cadets at West Point, on June 12th, 1912 (pp. 462-469). It is a model of what a speech on such occasions should be.

H.B-W.

BEDFORD FORREST.

THE CONFEDERACY'S GREATEST CAVALRYMAN.

By CAPTAIN E. W. SHEPPARD, O.B.E., M.C.

(H. F. & G. Witherby. Price 16s. net.)

Those officers who underwent the course for senior officers of the Royal Engineers, held at Chatham in 1930, may remember that their efforts as Engineers of the Federal Army to give General Sherman a proper advanced base at Chattanooga (transposed by a wave of the scheme-makers' wand to Maidstone) were seriously complicated by the threat of attack from a Confederate commander named Bedford Forrest. Attempts to find out from the directing staff who the man was and what he was doing left the inquirer, I fear, little the wiser, the impression given was probably that he was a violent and sudden personage with a taste for hostile advanced bases, a capacity for high mobility and a disposition to push things to extremes, all of which peculiarities the Directing Staff used, as is usual with directing staffs, unfairly. As if to cross the t's and dot the i's of the S.M.E., appears Captain Sheppard's life of Bedford Forrest, and should anyone who attended that senior officers' course be driven by interest or curiosity to read this most interesting work, he will probably agree that, to a man like Forrest, hard as nails and a hard driver of men as hard as himself, with a formidable quality of going cool-headedly berserk in battle, a base such as Chattanooga was in the scheme would need to be well defended to be safe.

Captain E. W. Sheppard has told his story well; sketches of Forrest's early life serve to show what manner of man developed from the youth (quick with pistol and bowie knifc), brought up as a pioneer in Mississippi, to the prosperous and humane slave-owning planter of Memphis, where the Civil War found him at the age of forty. His life before the war had in it all the varied colour of the growing West. The war and his post-war activities as first Grand Wizard of the Ku Klux Klan made his first forty years dull in comparison with what was to come. The writer disclaims any intention of using Forrest's career as a covert means of instruction in the military art; he denies that he has any novel theories of how the Civil War was won or lost, and, most astonishing of all from an officer of the Royal Tank Corps, as to how the next great war will be decided, for Forrest never worried his head about strategy or tactics, and nor will his biographer.

Nevertheless, military readers must not be deceived by this pacific utterance; there is much to be learnt about warfare in the book, for Forrest was a military gambler with something very like a system, though he knew naught, and cared less, about the mathematics at the back of systems. He fought. His aim was to get where it hurt the enemy most for him to be; he had the power of always keeping something in reserve for use in emergency, if it was only his own battle fury. He understood the essentials of organization, supply and mobility, and his time and space calculations were those of a genuis. He was primarily a fighter, and the good sense of the higher command, with which he was frequently at loggerheads, led them to leave him where his personal influence and local knowledge were of the greatest possible value to the Confederacy—in the West. So Forrest, starting as a trooper in the Tennessee Mounted Rifles, became in the course of the war the bugbear of all Federal commanders who had to fight in the basins of the Mississippi and Tennessee rivers, and ended it as a Licutenant-General in the Confederate Army.

It is an absorbing story, interestingly told, and the information it gives about the Confederate operations on their western front, where distances were greater and forces relatively weaker than in Virginia, makes the book an essential adjunct to Captain Liddell Hart's Sherman.

The writer shows how Forrest's personal defects, his lack of tact with his superiors and his quick temper seriously handicapped his career, and perhaps led to his being kept as far as possible from G.H.Q. But Captain Sheppard makes a good case for his claim that Forrest's military qualities were not given proper scope until it was too late to be of use. It is suggested that had the supreme command in the West heen given to Forrest, Sherman would not have been so fortunate as he was, and that, in the encounter of two realists, one rough diamond might have neutralized the other. That may be, and now it doesn't matter, since the issue of that war is settled for all time. What will, however, always interest soldiers, or, indeed, any student of humanity, is the way in which men like Forrest or Cromwell, or Blake or De Wet, with all of whom he has something in common, succeeded within the limits of the conditions of their time in fitting the means available to the object in view, which is the secret of waging war.

Wherever we meet a man who successfully achieves this essential dovetailing, we meet a commander whose methods merit the closest study, so, in the words of the writer, " Meet General Forrest."

E.E.D-S.

A SOLDIER'S NOTE-BOOK, 1914-1918. By GENERAL A. A. BRUSSILOV. (MacMillan & Co., Ltd., London. 1930. Price 188.)

The author does not claim to have written a complete account of the war on the Russian Front, nor even of events in the sectors in which he was in actual command, but he has produced a very readable volume which will be useful to the historian of the World War and provides the present-day student with some first-hand evidence of the enormous difficulties under which the Russians fought from the very outset of the campaign.

BOOKS.

To most of us the name of Brussilov is only known in connection with the timely and unexpectedly successful offensive which the Russian General conducted against the Austrians during the summer of 1916, when, in the ten weeks between June 4th and August 12th, the armies under his command on the South-Western Front, advanced and captured 8,255 officers and 370,135 men, 496 guns, 144 machine-guns, 367 trench mortars and a vast quantity of transport and miscellaneous war material. He had already proved himself to be a capable and enterprising commander during the earlier stages of the War, in the advance to Lemberg and Przemysl, and it was not due to mere accident or thanks to influence in high places that he was eventually selected for the command of the group of armies on the South-Western Front, in March, 1916. Unlike many of the Russian Generals, he had no friends at Court : he was not a favourite with the General Staff ; and owing to his outspoken criticisms and complaints, he had made himself unpopular with some of his superiors and the heads of the rearward services, whom he blamed for the breakdown of supply and the shortage of munitions. He had, however, a staunch friend in the Commanderin-Chief, the Grand Duke Nikolai Nikolaievich, to whose personal intervention he owed the fact that he survived the intrigues of jealous competitors in the race for high command. When, after the disastrous summer campaign of 1915, his share in the retreat was severely and unjustly criticized by General Ivanov, Commander of the South-Western Front, he tendered the resignation of his commission, the Grand Duke refused to relieve him of his command of the Eighth Army; and it was only a few months afterwards that he was appointed by the Tsar, who had called Ivanov to his staff, to command the South-Western Front. In the interval, the Grand Duke had himself been superseded and sent as Governor-General to the Caucasus, to the sorrow of the whole Russian Army, who realized that he was not to blame for the course of events in 1915, or for the shortage of munitions to which the disasters of that year were due. General Brussilov never ceased to deplore the Grand Duke's retirement and regarded the assumption of the Supreme Command by the Tsar as a disaster for Russia.

Nicholas II. had little knowledge of military affairs and appeared to take little interest in what was happening, even when he was in supreme command. He was completely in the hands of the courtiers round him, and relied entirely on the Stavka (General Staff). When he inspected his troops, he seemed not to know what to say to them, when the right word would have instantly opened the springs of their inborn loyalty and caused them to forget the sufferings they had endured. The author's feeling against the Tsar is continually cropping up throughout the book, and he shows little pity for him in his difficult position. The Russian regular troops, writes General Brussilov, were well trained and disciplined in 1914 ; the junior offiers were, as a rule, good and did their duty nobly; the General Staff and Staff officers generally were efficient but unpopular; the failures were in the higher commands. But there was no sort of enthusiasm amongst the rank and file, or real understanding of the War, or of its character. The Tsar himself, of this there is no question, was in principle opposed to any kind of war, especially one with Germany. He could not bring himself to believe that the tension in Europe could only end in war. He cannot be blamed for the War, because he was bound to intervene on behalf of Serbia. Had he not done so, the Revolution would have taken place in 1914 instead of 1917. When war came, he had a wonderful opportunity to unite Russia against Germany, who had thrust the war on her. But he failed to see the opportunity. He did not know his own mind, nor realize the true situation. He and his Government had only to stop quarrelling with the Duma, and could then have combined with it to marshal all the social and political forces of the nation in a common effort. But if they failed to combine, either the Monarchy or the constitutional government as represented by the Duma was bound to fall; and it was the Monarchy that succumbed.

As already indicated, much of the value of the book lies in the author's evidence of the state of the army at the outbreak of the War. He traces the trend of Russian military policy in the two decades leading up to the declaration of hostilities.

During the reign of the Tsar Alexander III., who was known as the "Peacemaker," the external policy of Russia had been a peaceful one, but the Tsar had realized that to maintain peace it was necessary to make Russia safe against aggression, and he had set himself to reorganize the army and develop the defence of the Western Frontier, including the Polish salient. This he successfully achieved during the thirteen years of his reign, while Germany kept a jealous eye on her neighbour. Upon the accession of the Tsar Nicholas II., German influence was immediately brought to bear on Russian policy. Alexander's able War Minister, Vannovski, and Chief of Staff, Obruchev, were both dismissed, and Kuropatkin, whose name was to become so well known in the Japanese War, was appointed War Minister. Kuropatkin subordinated military efficiency to Court favour, and much of the good work of Alexander III. was undone, while Germany set to work to strengthen her position and increase her army with energy and perseverance. Utterly unprepared for war in the Far East, where no plan of mobilization and much less a plan of campaign had been worked out, egged on by the German Kaiser, Nicholas II. suddenly found himself at war with Japan. This disastrous campaign, which ended in the Revolution of 1905-6, utterly disorganized the Russian Army and completely neutralized the work of Alexander III.

It was not till 1909 that Russia began to pull herself together. Kuropatkin had temporarily disappeared, and Sukhomlinov, who was appointed War Minister in that year, immediately set about reorganizing the army and creating order out of chaos. It was at this moment that General Brussilov, who had served in the Japanese War, came on the scene and was appointed to command the XIVth Army Corps in the Warsaw Region. On assuming command, he found many units of his Corps still quartered in Eastern Russia, far from their mobilization stations on the Western Frontier ; the transport not only of this Corps but of the whole army was practically non-existent; equipment was available only for peace requirements, and hardly that ; there was neither clothing nor boots for the men to be called up on mobilization ; there was a general shortage of ammunition, both for guns and rifles. The lessons of the Russo-Japanese War had been ignored ; the number of machine-guns had not been increased; there were no howitzers; no trench mortars; no hand grenades. The Russian General Staff, like the German, scouted the idea that the war of positions to which the Russians had been driven in Manchutia could ever be repeated in a European war.

In 1910, there was a war scare consequent on the annexation of Bosnia and Herzogovina by Austria. Russia was powerless to intervene, even if Germany had decided to invade Poland and the Baltic Provinces. The Imperial Duma was seriously alarmed and prepared to do its utmost to develop Russia's military resources and provide the necessary credits. Sukhomlinov was given a free hand.

Between the years 1910 and 1914, an immense amount was done to improve the army and fortify the frontier. But much more could have been done if Sukhomlinov had not taken the opportunity to feather his own nest. He found himself at loggerheads with the whole of the Duma. General Brussilov holds him responsible for the grave shortage of munitions which led to the disasters of 1915; and he also blames him for his mistaken policy in abolishing the fortress troops and reserve regiments, which formerly provided the garrisons for the frontier fortresses. The improvised garrisons, collected from all over Russia when war was threatening, were strange to their surroundings and offered little or no resistance when the Germans advanced —thus compromising the whole plan of defence of the frontier.

Throughout this period before the War, German influence continued to spread all over Russia. General Brussilov attributes the failure of the Government to educate public opinion for the inevitable European War entirely to this evil influence. Germans occupied the highest offices of State and enjoyed favour at Court. At

BOOKS.

1931.]

Petersburg, there was even a powerful Russo-German party, which demanded a definite alliance with Germany. No wonder that when war had already broken out, many of the troops that came from the interior of Russia did not know why they were fighting, or why Germany should want to make war on them because of the Serbians, of whom most of them had never heard, any more than they had heard of the Slavs |

The German Intelligence Department must have had an easy task when Germany sent her ultimatum I General Brussilov admits that the Russian General Staff did not expect Germany to be ready before 1915, and that the Germans were well aware that the reorganization of the Russian Army could not be completed much before 1917.

It is not possible within the limits of a review to follow the operations which General Brussilov describes and which the reader can follow fairly easily with the aid of the sketch maps provided. But a good general map is needed, and it is not forthcoming with the volume.

The following is a summary of the author's opinions and conclusions on the organization of the Russian Army, and how it stood the test of war.

(a) The infantry were armed with a good rifle, but had only 8 machine-guns per regiment of 4 battalions. General Brussilov considers that there should have been not less than 40 to a regiment, and 160 to a division (instead of 32).

(b) Regiments of 4 battalions and divisions of 16 battalions were too cumbrous for easy handling. He favours the principle that everything should be divided into threes, and considers that a regiment should consist of 3 battalions (12 companies), a division should have 12 battalions, and an Army Corps should consist of three, not two, divisions. There would then be 36 battalions instead of 32 in an Army Corps.

(c) The 8-gun field battery was a mistake. A 6-gun battery, provided it has plenty of ammunition, can develop as much fire as a battery commander can desire and control.

A Russian Army Corps, apart from field guns, possessed only one howitzer division of 12 howitzers, and some of the Corps had also a division of 12 heavy guns. The Russian Army Corps of 32 battalions thus had only 95 field and 12 heavy guns, while a German Army Corps of 24 battalions had 130 field guns, 36 howitzers and 12 heavy guns—178 in all. The Russian artillery was, therefore, only just strong enough for defensive purposes, and was more than likely to be overwhelmed when it came to attack. The Russian artillery had not been trained at all in using massed fire of all calibres, or in the proper support of infantry in attack.

(d) As regards engineers. Each Army Corps had only one battalion of 4 companies (3 of sappers and miners and r of telegraphists). So small a force in view of trench warfare was utterly inadequate. But the authorities did not anticipate the war of positions, in spite of the experience of Manchuria. General Brussilov adds: "One "must admit that in pcace-time our infantry detested and scamped its lessons in "the art of fortification, and, generally speaking, engineers and their work were "unpopular in the Army."

(e) In general, the Russian Army was too well supplied with cavalry, especially when trench warfare commenced; a group of 4 dismounted squadrons was then formed in each cavalry division.

Cavalry and Cossack divisions consisted of 4 regiments of 6 squadrons each, and included a detachment of 8 machine-guns and a horse artillery group of two 6-gun batteries. General Brussilov, himself a cavalry soldier, considers that each cavalry division should be allotted a divisional unit of "sharp-shooters" to rely on as supports—presumably he means a company or battalion of trained and mounted riflemen.

(f) Aircraft. At the outbreak of war, the Russian air service, both dirigibles and aeroplanes, was grossly inadequate and out of date. There were no aircraft

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factories in Russia before the War, and the Army was handicapped throughout the War by a shortage of machines.

Generally speaking, General Brussilov considers that, compared with the Germans, all the Russian technical equipment was inferior, and the inferiority was paid for in the blood of the Russian soldier.

In conclusion, it must be mentioned that, although the original intention of the Russian General Staff was to defend the Western Frontier on an advanced line, including the Polish salient, this policy was changed in the years immediately preceding the War and it was decided to abandon the salient and concentrate defence on a shorter line further eastward through the fortress of Brest Litovski. When it came to actual war, there was no alternative, if France was to be saved, but to hold the advanced line and Poland with a view to an immediate offensive; and this it was that the Russian C.-in-C. decided to do, although it meant upsetting the plan of mobilization and concentration.

H.B-W.

TASCHENBUCH DER TANKS.

By DR. TECHN. FRITZ HEIGL, Major, Austrian Army.

(1930 Edition.)

The first edition of this book appeared in 1925. At that time not only the Austrians, but all military powers, were impressed by the rapidity of the development of tanks, and it was thought that other armoured fighting vehicles, such as armoured cars and armoured trains, would become of secondary importance, and, in fact, that the former would disappear altogether.

During recent years it has, however, been realized that wheeled vehicles have not yet given place to chain-track vehicles, and that, on the contrary, highly specialized armoured cars have attained the mobility of light tanks. Most great powers have increased their cadre of armoured cars, and the appearance of a large number of these cars at the outbreak of hostilities might have a decisive effect on a campaign.

The author apologizes for mistakes that may have appeared in previous editions, but explains the difficulties that he has had to contend with, owing to the extreme scerecy with which the Entente powers (especially the French) conceal all their developments. A foreign technical journal has credited him with having had a large staff of German collaborators, whereas, as a matter of fact, he has had no official help of any kind in the collection of his material.

The book is divided into three parts. The first deals with the construction of modern fighting vehicles, and is sub-divided into Armoured Cars, Tanks, and Armoured Trains. The second part describes the armoured fighting vehicles of all foreign nations (*i.e.*, other than Germany and Austria). The third part deals with their tactical employment.

Armoured Cars.

Armoured cars were first used by the British in 1901 during the Boer War. They were armed with two guns. The French used a car armed with a single machine-gun in Morocco in 1902.

The author, however, considers that the first real armoured car was that constructed by the Daimler Company in Vienna, in 1905. It was completely armoured and carried its armament in a turret: it also possessed a mobility that was, at that time, remarkable. The car was, however, rejected both by the German and Austrian Higher Commands. The author considers that the Central Powers lost a great opportunity, and after ten years, had to make good from the lessons learnt from the Entente.

Armoured cars can be employed for the following purposes: (1) reconnaissance;

170

BOOKS.

(2) attacks on the enemy's flanks or rear; (3) seizing important points, especially at the outbreak of hostilities; (4) action in advanced or rearguards.

As regards design, the author prefers the four-wheeled car with four-wheel drive to the six-wheeled car, but considers that if it were possible to design a six-wheeled car with the drive on the front wheels as well as on the back wheels, such a car would be superior to all others.

It is important that a car should be capable of starting immediately in reverse, and that it should possess equal speeds forwards or backwards.

The same maxim applies to the armoured car as to the tank : its crew should be a minimum, it should offer a small target and be as light as possible; on the other hand, it should possess a maximum of fighting power.

As regards armour, a thickness of 7 to 8 mm. is a minimum. Although this is not proof against modern rifle bullets at close range, a good deal can be done by sloping the armour and avoiding vertical plates as much as possible.

An ideal tyre has yet to be discovered, but the N.A.P. (Normal Air Pressure) tyre made by Messrs. Macintosh, of Manchester, is considered a very good one. Various types of grips and chains are described, the object of which is to prevent skidding.

Tanks.

There are two types of tanks: those with convertible wheel and caterpillar track, and those with a chain track pure and simple. Examples of the former class are the Vickers-Wolseley Armoured Car-Tank and the French 8-5-ton St. Chamond Tank. In Germany, it was believed during recent years that this was the tank of the future. This opinion was not held in Great Britain nor in America.

The caterpillar tank of 1919, with chain track only, was deficient in mobility and speed, and this led to the introduction of the Car-Tank. (The German name is *Räder-Raupentank*, or, briefly, R.R. Tank.) Thanks to the British, there is a prospect of obtaining the desired speed in a tank with an ordinary caterpillar track, that will, moreover, not injure the road surface. Successive developments of this form of tank are seen in the Medium Vickers Tank, Mk. I—II, the Vickers Light Tank, Mk. C, and the Carden-Loyd Tanks.

The author deals at some length with different types of chains. Great improvements have been made in order to lengthen their life. At the end of the War, the life of British tank chains averaged 300 km. Nowadays, with the rubber link chain, designed by Major Johnson, a life of 4,000 to 5,000 km. is attained. The latest six-ton Vickers Tank has a remarkable chain carried on rubber-tyred rollers, and attains a speed of 35 km. per hour.

The author goes on to describe observing arrangements. He states that the British and Americans have been content with the most primitive methods; the French have been more thorough in their details.

As regards turrets, the American turrets are the best, the British and French are good, others are not so good. The observation slit is, in every case, the weak point.

In armoured cars the machine-gun armament is best arranged in two revolving turrets, either alongside one another, or placed diagonally; the turrets should not be one in front of the other.

In tanks the armament is more complicated. Even a small two-man tank should be armed with a gun as a defence against enemy tanks, as well as with a machinegun.

As regards the further development of tanks, the British, Americans and French all work on different lines. Speed and armour are, of course, contradictory terms. The French and Japanese are in favour of heavy armour, so are (as regards medium tanks) the Americans. The British have hitherto been in favour of light armour.

There is no doubt that, in a war between European Powers, the very heaviest type of tank is necessary, and that use will be found for all three types: heavy, medium and light.

Armoured Trains.

Armoured trains played a very modest part in the Great War, but they performed important services on the Austro-Hungarian fronts. They were, however, employed to the best advantage during the Russian Civil Wars of 1918–22 and in the Russo-Polish War.

Owing to the danger from contact mines, there should be one or two platform trucks at each end of a train. Next should come an armoured truck armed with a gun or machine-gun, after this the (armoured) engine, and then another truck armed with a machine-gun.

An armoured train is at a disadvantage compared with armoured cars or tanks in having a very large dead angle uncontrolled by fire.

It is an open question whether the armoured train of the future should not consist of a series of independent armed trucks, each driven by a petrol or Diesel engine, and capable of acting on its own.

The second part of the book gives a description of the various types of armoured cars and tanks, and of anti-tank guns, in forcign armies. These details take up nearly 200 pages, and it is impossible, in such a brief review, to make any selections out of the list for special mention.

The third part deals with the tactics of armoured cars and tanks.

The main duties of armoured cars are laid down in Part I.

The writer quotes instances of the successful use of armoured cars in the Rumanian campaign, and then asks the pertinent question : "What should we have done in the place of the Rumanians ?"

He also quotes from British sources (*History of the 4th Army* and *The Tank Corps*), showing the successful use of armoured cars in the advance of the 8th August, 1918, and gives another instance of the relief of the hard-pressed British front on the 21st March, 1918, by the timely intervention of French armoured cars.

He gives several extracts from Tank and Armoured Car Training, 1927. In discussing British ideas of tank v. tank fighting, he criticizes the "line ahead" formation as being a relic of ficet action. There will never be an instance of "crossing the T" as at Tshushima, but it may be possible, as at Lissa, to split the enemy's force in two.

At the end of the chapter, instances are given of the successful and unsuccessful employment of armoured trains during the Russian Civil War.

A.S.H.

A STUDY OF THE STRATEGY AND TACTICS OF THE MESOPOTAMIA CAMPAIGN, 1914–1918, WITH SPECIAL REFERENCE TO GENERAL MAUDE'S OPERATIONS.

(With 13 maps.)

(Sir Isaac Pitman & Sons, Ltd. Price 58, net.)

Sir Isaac Pitman & Sons offer this handy treatise as an introduction to their military postal courses, which, the publishers' note states, are intended to aid the military neophyte on his passage from the cradle of promotion to Captain to the grave of Camberley or Quetta.

The claim, as regards this book, is justified, for the main outlines of this campaign are clearly shown, and, while leaving official corns untrodden, the muddled cats' cradle of politico-military aims, which sent an important part of the Empire's war effort galloping into the desert after the mirage-distorted image of Prestige, is well described. The strategical lessons are competently taught and the writer shows, in

BOOKS.

a sketch map, his solution of the problem of economically clipping the Turkish wings, which makes a useful contrast to the extravagant way in which the work was actually done. The administrative difficulties of warfare in undeveloped areas, the solution of which is the basis of successful strategy and the neglect of which brought us to disaster, is well and interestingly set out and is kept to the fore throughout the book.

Curiously enough, considering how condensed a book of this sort must be, the tactical lessons are most clear. The writer grasps the essentials of each engagement, and the student of the higher arts of combat would do well to follow the brief accounts of the actions subsequent to the fall of Bagdad, when General Maude was disposing of the Turkish remnants at stock prices.

In describing the campaign, the writer's practice is to precede a detailed account of each year's operations by a general summary of the events of the year. I feel that this summary should more logically have followed the detail. Again, the writer devotes the latter part of the book to illustrations of the principles of war. This, though it may have an examination value, has the effect of removing the principle from its context, for instance, the failure of the cavalry in pursuit, after the Shumran crossing had forced the Turks to retreat, is a glaring example of lack of co-operation between the mobile and the stable arms, which does not get the criticism it deserves until the principle of co-operation is discussed. The infringement of a principle of war is best learnt when the events which caused the failure are being read. In the actual criticism of this operation one sentence is somewhat confusing : "There was, however, lack of adequate co-operation by the Cavalry during these "operations. Their movements were slow and their handling indicated passivity " and initiative in attempting to envelop the enemy's Northern flank by making full " use of their mobility. . . ."

Something must be lacking, and the effect produced has all the delightful obscurity of certain passages in the training manuals. The book is very fair to the Turkish Higher Command and their troops, tribute is paid to their strategical ability and to the vigorous counter-attacks with which they so frequently restored an almost hopeless battle.

Although this campaign should never have been waged, its history is crammed with military lessons for all ranks, and these lessons have been skilfully and carefully emphasized.

Books are cumbrous things for the young soldier to transport; nevertheless, this slim, paper-backed volume is well worth a place in any budding Napoleon's knapsack, not just for the purpose of meeting an examination crisis, but for the value to be got from study of a hard-fought campaign in which an Anglo-Indian army finally surmounted almost impossible difficulties.

The maps are clear and adequate.

E.E.D.S.

SECRET SERVICE.

By MAJOR-GENERAL SIR GEORGE ASTON, K.C.B.

(Faber & Faber, Ltd., London. 1930. Price 18s.)

The title is a misnomer. There is comparatively little in the volume about the secrets of secret service, but much that is interesting about the Great War, based largely on the personal reminiscences of the author, who served for many years in the Naval Intelligence Department and later on the General Staff of the Army at the Staff College, in South Africa, and at the War Office during the War. The object of the author is to give the reader sufficient examples of the activities of the British Intelligence Service to enable him to form his own judgment of its efficiency

1931.]

or shortcomings. Incidentally, in describing the various incidents, the author gives some interesting facts and comments, some of which may be new to the reader. He commences by describing the hastily improvised raid on Ostend in 1914, by a force of Royal Marines under his own command. One cannot help being amazed at the state of affairs at the Headquarters of the Army in London, which, after the departure of the B.E.F. with most of the War Office Staff, permitted such an expedition to take place. Though seemingly destined to certain failure and possible disaster, the author is probably justified in his claim that it effected its object, which was to threaten the right flank of the German rush through Belgium and cause them to delay their march and detail forces to deal with the threat. He considers that events show that the German Intelligence Service was defective and that the bluff succeeded.

Spies, spy rumours and women spies are then discussed, but the author has little to add to what has already appeared in print.

From spies, he turns to secrets—well and badly kept. The worst kept secret of the War, he says, was the Dardanelles Expedition. The best kept were the dispatch of the B.E.F. to France; the deception practised on the Turks in July, 1917, as to the direction of Lord Allenby's blow when he advanced in Palestine; the raid on Zeebrugge in April, 1918; and Lord Rawlinson's great attack east of Amiens on August 8th, 1918. Each of these phases of the War is described at considerable length, three chapters being devoted to Zeebrugge.

In his chapter on the battle of Jutland, Sir George Aston considers von Scheer was badly served by his Intelligence Service and his airships gave him erroncous information. He discusses the question of truth or only half the truth in the communiqués issued after the battle. "To lie like a Bulletin" was proverbial in the Napoleonic Wars, and the omission in the German communiqué after Jutland of all reference to the loss of the Lutzow and the beaching of the Seydlitz caused all their subsequent communiqués to be viewed with suspicion. The bad effect of Lord Jellicoe's first report, which gave all our losses, would have been obviated had the Admiral had a properly qualified pressman at his elbow when he wrote it.

General Gough has already expressed his appreciation of what Sir George Aston has written about the Fifth Army in March, 1918; and he is quoted as having given it as his opinion that "on the whole it may be said that the fog on the morning of "March 21st favoured the Fifth Army," in that it made it impossible for the Germans to develop the full power of their vast reserves. The author also tells us how the Secret Service discovered in a Baden newspaper that von Hutier, the hero of Riga, had arrived on the Western Front, and how well informed the British were both as to the direction and date of the great German attack on March 21st, days before it took place.

In contrast to this instance of good information, Sir George Aston cites the fact that the French refused to believe that the Germans intended to attack the Chemin des Dames, and were completely taken by surprise, although the American Intelligence had drawn the deduction as early as May 14th that the attack upon the French on May 27th, 1918, would take place.

The author devotes a chapter to "Third Party" crimes in the United States while that Power was still a neutral, and expresses the opinion that a good many missing American vessels carrying munitions to the Allies were sent to the bottom by explosions and fires caused by bombs hidden in their cargoes by German agents, but he does not believe that any of the explosions in British war vessels in our home waters were due to enemy action.

Although a great deal in the book is not new, it is worth reading and will serve as an introduction to the study of intelligence work in time of war.

H.B-W.

1931.]

MY EARLY LIFE.

By WINSTON CHURCHILL,

(Thornton & Butterworth. 215.)

Take wars and rumours of wars, politics and glimpses of great men; acidify with satire, garnish with anecdote, and season with philosophy to taste.

The well-tried recipe has not failed Mr. Winston Churchill in his latest production.

My Early Life comes as a welcome restorative after the spate of brilliant books about nothing that publishers have let loose during the last few years. The fleeting fashion for studies in microscopy by neurotic geniuses, and for these vast tomes, emanating from Russia or Germany, which hope to capture the epithet " stupendous " by their very size, has run its course. We return to the normal. This book is as large as life, no smaller and no larger.

The path from Sandhurst to Westminster led through India, the Sudan and South Africa. At an age when the modern young officer is still at school, Lieut. Winston Churchill had seen active service in both hemispheres ; in the West, in Cuba-a trial trip undertaken on leave to discover (I quote from memory) " whether the conditions of active service were suited to my temperament "-and in the East, on the North-West Frontier, under Sir Bindon Blood.

We follow him, then, through regimental life in India (the description of the polo match has the true " Maltese cat " flavour) to the Sudan with, or rather, in spite of Kitchener. The description of the battle of Omdurman, though admittedly it was the last battle to fall in line with Hollywood tradition, might well be prescribed as an

antidote to the evil effects of prolonged exposure to $\frac{dy}{dx}$.

The episodes of the South African War are familiar. Here is a personal account, full, vivid, and as usual, convincing.

Between soldiering and acting as War Correspondent, Mr. Churchill devoted a few weeks to standing for Parliament. The first attempt failed. On the second and successful one the book closes.

C.L.R.

ROUTE SURVEYING.

By PICKELS and WILEY.

(Chapman & Hall, Ltd. Price 178, 6d.)

Owing to the diversity of the branches of engineering with which the R.E. officer has to deal, he is sometimes, of necessity, rather rusty when taking over a job, and would be glad to have by him a book giving the essentials of his subject.

To those employed on laying out roads, canals, pipe and transmission lines, etc., Route Surveying supplies the necessary information in a simple and concise manner.

Modern practical methods are explained without detailed mathematical solutions. The simplified curve nomenclature, as recommended by the American Railway Engineering Association, has been adopted. The spiral given is of a general form and is equally applicable with chords of any desired length, as a so-called "sixchord " or " ten-chord " spiral. Table 12 gives spiral data of curves up to 25° and values for "k " from 1 to 10.

Parabolic curves have been allotted an entire chapter and all phases of the vertical curve have been dealt with.

For railway work, diverging track and connection problems are solved, so as to bring the frogs to an existing rail joint. Turn-outs are presented in practical form, as used in American railroad practice, with "straight" frogs and switches. For earthwork, the co-ordinate method of computing end areas is explained, and a very

[MARCH

efficient method of computing end areas of incompleted and irregular sections is given.

At the end of the book there is a very useful set of tables, which deal with all the data necessary for working out curves.

The volume is well indexed and the contents are clearly set out.

B.C.T.F.

INTRODUCTION TO STRUCTURAL THEORY AND DESIGN.

By SUTHERLAND and BOWMAN.

(Chapman & Hall. 1930. 178. 6d.)

This treatise is from the United States of America, and makes use of American symbols, formulæ and units, and therefore is not recommended for students who are reading for English examinations.

It is, however, a well-written and well-illustrated book, with fully worked out examples, and will be of considerable interest to those officers who wish to follow up their Cambridge course.

The first seven chapters deal with the statics of structures, but assume a prior knowledge of the general theory of structures. Considerable stress is laid on "influence lines" in connection with rolling loads.

Then follow some excellent chapters on deflection methods, rigid frames, indeterminate trusses and secondary stresses. The "skyscraper" problem is dealt with in two chapters entitled, "Wind Stresses in Tall Building Frames" and "Space Framework."

Finally, an appendix on loads summarizes the various American codes dealing with live loads, wind and snow pressures, etc.

R.S.R.K.

SURVEY OF INDIA.

GENERAL REPORT, 1928 TO 1929.

(Published by order of Brigadier R. H. THOMAS, D.S.O., Surveyor-General of India.)

According to the recommendations of a Committee appointed by Lord Curzon, then Viceroy of India, modern maps of the whole of India, on a scale of 1 inch = 1 mile were to have been available in 25 years, that is, in the present year, 1930. But for one reason or another, the work did not progress with anything like the anticipated speed. As a matter of fact, notwithstanding a reduction of scale over a very considerable portion of the area, which was introduced in 1913, by the year 1925 only about one-half of the original programme had been carried out, and this, as already pointed out, was only possible by a reduction of scale of survey over a large area. The figures given in this Report, carrying the surveys up to October, 1929, show that out of a total area in India and Burma of 1,864,275 square miles, there has been completed 980,123 square miles on modern lines.

Since the scheme originated in 1905, it follows that some of these so-called "modern" maps are now 25 years out of date, and at the rate of progress the whole scheme will not be completed until about the year 1947. It is to be noted that the reduction of scale from 1 inch = 1 mile to $\frac{1}{2}$ inch and $\frac{1}{2}$ inch = 1 mile has not been altogether a success, for the Report states "there is a tendency to revert to 1 inch = 1 mile in special cases, owing to the pressing requirements of geologists and engineers, combined with the modern military view that this is the smallest scale suitable for tactical operations." We remember these views were urged at the time the reduction of scale was insisted upon, but without avail. If, therefore, the maps of India are to be kept reasonably up to date, and the 1905 scheme completed in a reasonable time, measures will have to be taken to expedite both survey and revision. The following are some of the events of interest with which this comprehensive Report deals. An Air Traverse Detachment has been formed for the purpose of carrying out the fixing of control points on the ground in connection with air survey for settlement purposes. This method of mapping for producing revenue maps is finding increasing favour in India. It is more rapid ; does not involve bringing the surveyors into contact with the cultivators to nearly the same extent as formerly, a great advantage.

The survey of Chitral on 1-inch and $\frac{1}{2}$ -inch scales was completed during the year, which included "mountainous and glaciated areas involving regular climbing to well over 18,000 feet." Previously unexplored areas in Butan, comprising 790 square miles, were surveyed by permission of the Butanese Durbar. Under the head of adventures and casualties it is recorded that two Kachin coolies of No. 10 Party were killed by tigers and that the jungle where this party worked was infested by man-eating tigers and wild elephants. An act of gallantry by Muhammad Rafi, a porter of "A" Company is mentioned. A porter of the Company having fallen down a crevasse on the Darhat Pass, the sides of which were composed of heavy, brittle icicles, where he lay unconscious for three hours, M. Rafi descended the crevasse on a rope, at considerable personal risk, and attached a rope to the unconscious man who was drawn up alive.

The usual comprehensive tables appear, giving details of out-turn and cost rates of various classes of survey. These could, in some cases, have been made still more informative than they are by just a little additional information. For instance, it is stated, under the head of Air Traverse Detachment, that 3,796 linear miles were executed at a cost rate of 14.8 rupees per linear mile, but it does not state how many square miles this length of traverse served, in other words, it would have been useful to know what the cost of the traversing was per square mile of area photographed.

No survey department that we know of publishes anything like as useful or detailed reports as the Survey of India.

H.L.C.

THE EXTINCTION OF MONTENEGRO.

A NEGLECTED CHAPTER OF CONTEMPORARY HISTORY,

This is a booklet of 20 pages, reprinted by permission of Prince Milo of Montenegro, from La Macédoine, of 14th February, 1930.

The booklet is copyrighted for *The British Friends of Montenegro*, for whom it has been printed by Messrs. Hazell, Watson & Viney, Ltd., London and Aylesbury.

Prince Milo tells his story with commendable restraint. If we were not so thoroughly accustomed to the divorce of Policy from Justice, it would be impossible for any citizen of England, France or the United States of America to read his statement without shame and remorse, coupled with a determination to put an end to so gross a miscarriage of justice.

R.E.s may at least feel some satisfaction in reading of Lord Sydenham's efforts in the House of Lords to bring home to allied politicians the undoubted truth that "Broken promises always bring their Nemesis."

B.R.W.

THE MYSTERIOUS UNIVERSE.

By SIR JAMES JEANS, M.A., D.SC., LL.D., F.R.S.

This book is an expansion of the Rede Lecture delivered before the University of Cambridge, in November, 1930, by Sir James Jeans. It is certainly well to learn, from time to time, what our great scientists are thinking about, and the new ideas which they are developing. It is on occasions like this that we have an opportunity

[MARCH

of doing so, and seldom from a more able and lucid pen than that of Sir James Jeans.

In some respects this is not a very satisfactory book, largely because of the nature of the subject and its inherent difficulty. It certainly impresses on one how mysterious the universe is, but it does little to unravel that mystery, anyhow so far as the plain man is concerned. To be told that the universe consists mostly of mathematical abstractions does not take those who are not pure mathematicians, *i.e.*, the vast majority, much farther.

This view seems, as Sir Oliver Lodge says, "to shut the door on future discovery "and say that we only deal with nothing but abstractions." To most of us, the universe appears more objective than subjective. That light and heat can be propagated through space without the intervention of any medium, more definite than an abstract thought, is beyond the understanding of the ordinary man. But Sir James might answer the universe was never intended for the ordinary man to understand. If so, this is unfortunate, as we instinctively look to the scientists and mathematicians to so expound it in a way the ordinary man can understand. There have been so many wonderful and revolutionary discoveries in the last few years that perhaps some way of doing this will be discovered.

To us, the most interesting chapter is concerned with the nature, or, should we say, want of nature, of the ether, that subtle, imponderable fluid, which is supposed, by some, to pervade all space. That all the energy, as the result of which we "live and move and have our being," reaches us from the sun, and elsewhere, in the form of waves, is not in dispute, but exactly what undulates we do not know. Whatever this substance is, it must be perfect in its actions; it must be everywhere, from the remote depths of space to the interstices of the densest matter, and since it gives us everything, including life, it seems to possess many of the qualities we are accustomed to think of as attributes of the Deity. It is inherent in man to explain the subjective in terms of the objective. For this reason, we try to materialize this mysterious entity and call it the Ether. From its known reactions on matter, it has been thought to have a real existence, while all attempts to detect it experimentally have signally failed, so much so, that Sir James Jeans considers it to be a mere figment of our imagination.

To the ordinary person, this view is not at all easy. Take the case of wireless waves which are admittedly propagated from one place to another, and that no ordinary matter takes part in the process. They differ only from light and heat waves, travelling across space, in that they are longer. If a transmitting station can produce strains resulting in waves which can be received and recorded by physical means at great distances, are we not justified in thinking there is some substance involved, subject to physical laws, more material than a mathematical abstraction ?

It seems to us much more reasonable to suppose that space must be filled with a reality, the nature of which is not known, but is only beyond the present conception of man; the more so since matter is responsive, in many ways, to these waves which can actually be photographed. The ether for these reasons, one would think, must have some physical, though not understood, properties. At the same time it is marvellous that nature has so successfully concealed this medium from us, notwith-standing all the efforts of physicists and mathematicians to elucidate it. Perhaps it is too fundamental.

It would seem that, according to present evidence, we are entitled to look on matter as a manifestation of the ether, emerging, as it were by stages, from the discrete to the concrete—waves of light and heat; atoms, electrons and protons; and finally, concrete matter.

We are left with a feeling that the other itself must have some inner spiritual significance, perhaps with some intimate connection with the mind. Max Born refers to "absolute space as almost spiritualistic in character," while Sir Oliver Lodge says, "truly it (the ether) may be called the living garment of God." We seem to know so much that the whole must be known some day, especially with many able men at work on the problem. It would be great to live in the age when this knowledge comes.

There are many other interesting and fascinating problems dealt with in this book. For instance, speculations connected with the origin of the solar system, showing how unique our system probably is, and how only by the merest chance, in the vast ocean of space, our earth happens to be suitable for the development of life.

There was a theory, not referred to by Sir James Jeans, propounded many years ago, called the theory of pangermism, by which it was supposed that the germs of life were everywhere in space being propelled about by the action of light, which is known to exert pressure. Where these germs encountered suitable conditions as to temperature and atmosphere, such as exist on the earth, life developed. The other planets are probably either too hot or too cold for the germs to flourish and the chances are in favour of the earth being the only one on which life has developed. If this is the case, then the earth assumes an importance which is by no means warranted by its extreme insignificance in the system of the universe. If we were to speculate as to the future, it may well be that the ether will turn out to be, not only the sustainer, but the giver of life on the earth, and to have some intimate and fundamental connection with the spiritual nature of man.

We have, perhaps, in some of our remarks gone outside the limits of Sir James Jeans' book, but have said enough to indicate the nature of the interesting and fascinating topics so ably dealt with in *The Mysterious Universe*.

H. L. CROSTHWAIT.

THE COMPLETE SKI-RUNNER.

By ARNOLD LUNN.

(Methuen. ros. 6d.)

The International Ski Federation has recently recognized downhill racing as being a test of ski-ing, and, flushed with success, Mr. Arnold Lunn, President of the Ski Club of Great Britain, uncrowned King of Kandahar and Master of Mürren, has written a book on ski-ing which sets forth the most generally accepted modern British doctrine on downhill ski-running.

No one is better qualified than Mr. Lunn for such a task. He is in close touch with all branches of ski-ing and this publication is an up-to-date text-book of British downhill ski-ing. All ski-runners should read it, and the skier of two months' standing will benefit more than the beginner, owing to the restricted application of the book. For, although it is intended that the book shall march shoulder to shoulder with others of the Methuen Complete Series, such as the *Complete Yachtsman* and the *Complete Golfer*, yet Mr. Lunn has carefully stayed his hand when choosing the title. It is not the *Complete Skier*. It says nothing of ski-jumping, ski-mountaincering, nor spring snow. For these, you must search his earlier works, and even there you will sometimes scarch in vain. Ski-running is defined nowadays as downhill ski-ing, and this book outlines the modern British ideas on ski-running clearly and carefully.

Its great virtue lies in its up-to-date outlook, which is of immense value in a sport of such quickly-changing technique. All the usual turns are simply described, and there are short chapters on ski-racing, ski-laufing, and (how base l) stick-riding. The mathematically minded can probably learn most of the turns more easily from Caulfeild's *Ski-ing Turns*, while D'Egville's *Modern Ski-ing* gives the turns together with much fuller instruction on ski-laufing. It is disappointing to find nothing on the care of ski, nor on ski wax, an intriguing material in any branch of ski-ing.

Throughout the book, Mr. Lunn pauses to belabour certain foreign ski-runners :

[MARCH

and when this winter season is over, and the English ski-ing season bursts noisily upon us once again, the *Complete Shi-Runner* is going to be a deadly weapon. One can feel nothing but sorrow for the fate of any Arlberger or Norwegian trapped alone in an English country house. Far better for them (and much more intriguing for the ladies) if they call in the police at once, and admit bigamy. One would not be torn to pieces for bigamy.

O. S. YODEL.

REDISCOVERING ENGLAND.

CHARLOTTE A. SIMPSON.

(Ernest Benn, Ltd. 215.)

Geology has been for many years included amongst the subjects taught to the young officer of Engineers. Sometimes the course has been dropped, and then again, as now, has been revived. The reviewer, like many another Y.O., remembers how interested he knew he ought to be in the subject, and how completely he failed 'in his duty ; the whole of the instruction appeared to consist of crack-jaw names imparted by typical professors. Not much of geology can be taught in a fortnight, but it is to be hoped that the modern instructor succeeds, at any rate, in avoiding giving the neophyte a distaste for the subject. For all those feeling their way in the ABC of geology, here is a book which should succeed in arousing their maybe dormant interest, and help them to make a use of their powers of observation, both for their work and for their own pleasure and edification. What broad geological information do you derive from noting the nature of the woodland, the grass, or the wayside flowers ? What do you deduce from your observation on your chance of finding a water supply ? Why have villages followed a certain line with regard to the hills, and why have extensions taken place in certain directions and not in others? And what use can you make of your observations for work in the field, or for the more permanent works of peace ? The answers to these and many other questions are in this book, and presented as the subject is by Miss Simpson, geology cannot fail to interest and instruct, and you may be led in time even to master the repellent nomenclature of the orthodox geologist. A most interesting book, and one to be recommended : geology humanised.

P.H.K.

MAGAZINES.

BULLETIN BELGE DES SCIENCES MILITAIRES.

(1930. TOME II.-Nos. 4 TO 6 INCLUSIVE.)

Chronique d'Infanterie. Parts 9 to 11 of this article appear successively in the numbers of the Bulletin under notice. It was owing to the devastating fire effect of the armaments developed by the rapid progress made by "mechanization" that "motorization," *i.e.*, mechanically propelled vehicles, put in an appearance on the battlefields of 1917 and 1918. The necessity for employing artillery on an imposing scale in order to prepare the way for attacks in the grand style precluded the possibility of strategic surprise, without which the chances of a decisive success were remote. Resort had, in consequence, to be made to the use of a motor-driven armoured vehicle which carried a suitable armament and could accompany the infantry, step by step, in its advance. It was hoped by this means to re-establish, to some extent, the possibility of procuring effective interaction between the two also given therein of the plight to which the Dutch garrison had been reduced. The terms of the capitulation finally agreed upon by Chassé and Gerard are fully set out in the final part of the article, which concludes with character sketches of Chassé and his chief officers.

La Campagne Arabe. The original article is contributed to No. 4 by Captain Weber; it deals with the successful struggle of Belgium with the Arabs, the outcome of which was the establishment of the Independent Congo State. The story told by Captain Weber is a record of the acts of bravery of many Belgian officers, who were engaged in stamping out slavery in Central Africa. Figures which occupy a prominent place in the history of our own Corps flit across the stage, and find mention in the narrative : the death of Gordon at Khartoum is recorded; Kitchener's arrival at Fashoda in September, 1898, and his demand for its surrender to him by Marchand is mentioned; Stairs' visit to the Katanga territory in connection with the suppression of slavery is duly chronicled.

Les aspects militaire de la Révolution de 1830. The 7th and final parts of this article by Captain Wanty are published in Nos. 4 and 6 of the Bulletin respectively. In part 7, the events of September, October and November, 1830, at Maestricht, in Limburg, and on the Frontier, are described. In the early days of October there were many desertions in the Dutch units forming the garrison of Maestricht. Gen. Dibbets, the Military Governor, was, in consequence, placed in a most difficult position; he could not look to the civil authorities for effective assistance, and military action was made impossible owing to the number of troops remaining loyal to the Dutch cause having been reduced to a mere handful. It was not until November 21st that the War Department was able to meet Dibbets' repeated requests for reinforcements; on the date last mentioned, the garrison of Maestricht was reinforced by loyal troops of all arms numbering 3,350 of all ranks.

A report that Dutch troops had discmbarked at Breskens (on S. bank of Scheldt opposite Flushing) on October 27th, caused disquietude. The activities of the insurgents now increased, and some fighting took place in West Flanders between them and Dutch regulars; owing to the difficulties of the terrain, the operations were confined to a small area.

On November 1st, the garrison of Antwerp consisted of 3,000 men, in addition to the two "corps," each of 900 men, under Niellon and Mellinet. The fighting in Flanders began to die down; but, at the same time, the "corps francs" of Antwerp marched out with the intention of invading N. Brabant, and playing havoc in that province. The Provisional Government, fearing that imprudent offensive operations carried out by the volunteers might render diplomatic negotiations difficult at a later stage, forbade the invasion of Dutch territory. In consequence, the corps under Niellon and Mellinet took up positions south of the Frontier; the former's headquarters were at Turnhout, and the latter's at Wuestwezel.

An armistice was arranged on November 15th by Dutch diplomatic agents who were paying a visit to Brussels; however, its terms were violated by the Belgian volunteers, and this gave rise to reprisals.

The Belgian cause made great progress in Limburg; Venlo was captured on November 8th. By the end of November, the Dutch Army was in a precarious position; it was incapable of undertaking offensive operations, and, if vigorously attacked, could have put up but a feeble defence.

An account is given in No. 6 of the measures taken in connection with the organization of the new Belgian Army; particulars relating to the several arms and departments are given in some detail. The article concludes with a brief review of the events connected with the Revolution. The following matters are dealt with: the Luxemburg question; the isolation of Belgium; Maestricht; the frontier of N. Brabant; the conflict of arms.

La Défense de la Position Fortifiée de Namur en août, 1914. The Historical Section of the Belgian General Staff has prepared for publication at the end of 1930 an official it was possible to reduce the annual expenditure on the Army and its establishments to 85 million francs. A general invitation was sent out by the Commission requesting those who were in a position to assist it with information on the subject to do so; the information furnished would, it was stated, be treated as confidential. The original article appears in No. 9; it contains a criticism of the terms of reference to the Commission, which, it is alleged, do not clearly indicate the nature of the problem to be investigated.

Protection individuelle contre les gaz de combat. This article is contributed to No. 9 of the *Revue* by M. S. de Stackelberg. A brief description is given therein of the chemical substances which play a part in gas-warfare, and the effects produced by them. A table is provided showing the casualties due to the principal German gasattacks on the various Entente fronts—it is difficult in some of the cases quoted to reconcile the figures given in the parallel columns, evidently there are some errors in them. Particulars are given of the requirements in relation to the design of protective devices for use against gas-attacks and brief descriptions are also given of the four kinds of protection introduced up to date in the military service.

Les troupes de radiographie dans notre armée. This article is contributed to No. 10 by Premier-lieut. E. Naef; it contains a brief historical review of wireless telegraphy in the Swiss Army, and describes the present organization of the Swiss Signal Corps, and its equipment.

Témoins. The original article, which is in two parts, is contributed to Nos. 11 and 12 by Col. F. Feyler; it deals with a volume of over 700 pages published, under the foregoing title, by Mr. J. N. Cru. The latter analyses and criticizes therein some 300 works and memoirs written by 246 combatants which have appeared in France during the years 1915-1928. In No. 11, Col. Feyler sets out the general scope of the volume under review, and indicates the character of the information extracted by Mr. Cru from the works and memoirs examined by him. Particular attention has been devoted to an investigation of what the combatants in question have to say on the subject of fear; in some cases, extracts are given by Col. Feyler from Mr. Cru's volume which bear upon this matter. Mr. Cru has made a classification of the various works examined by him from the point of view of their historical value; he considers the contributions of 21 authors as being entitled to be classified as excellent, and of 19 others to possess no value. He places the works of 66 authors in a category marked "mediocre." The results of Mr. Cru's analysis are dealt with in No. 12.

Aviation civile et aviation militaire. The original article is contributed anonymously to No. 11; its author states that he has read the work entitled La farce du désarmament by Gen. Denvignes. In this work Gen. Denvignes writes of the concern which is felt in France with regard to the possibility of Germany launching a "War of Revenge " against her western neighbour ; he is apparently one of the many who hold the opinion that it would be an easy matter to-day for Germany to pass rapidly from a state of peace to that of war. The author of the original article disagrees with the views propounded in La farce du désarmament ; he is of opinion that it would by no means be an easy task for Germany to utilize her resources in relation to civil aviation, so as to render them quickly available for military purposes. The situation is examined under two heads in the original article : (a) the aviation material which would be available in Germany for military purposes on the outbreak of a war; and (b) the probable position of affairs four to six months after the commencement of hostilities. The author of the original article is of opinion that it would take months, not days, to train civilian pilots so as to enable them to undertake military dutics in an efficient manner. He agrees that Germany is in a very strong position with regard to the production of aircraft, and possesses for this kind of work important branch factories in foreign countries ; on the other, France is, he thinks, also in a strong position so far as the production of aircraft is concerned, and six months after the commencement of hostilities she would not only be holding her own, but would possess " une super-W.A.J.O'M. iorité aérienne incontestable."
MILITAERWISSENSCHAFTLICHE MITTEILUNGEN.

(With this number the magazine makes a slight improvement by shortening its title.)

(January-February, 1930.)—The War Year, 1914. Major-General Kerchnawe has written this article as a tribute to Volume I of the Austrian Official History upon its completion. He runs rapidly over the contents of Parts 4, 5 and 6 of that work, which deal with the continuation of the autumn campaign against Russia and the beginning of the fighting in the Carpathians, the settling down of events on the Russian front after the "steam-roller" had been brought to a dead stop, the campaign against Serbia and Montenegro, the Carpathian campaign up to and including the battle of Limanova-Lapanov, and the dying down of the fighting in Western Poland.

Since the article is by way of being an advertisement, it is only natural that it should be a little more highly coloured than the Official History itself. So much, its readers would expect. There is further a natural inclination to praise one's own defeated troops, both in order to save something from the wreckage, and because only the victor can afford to state the bare truth and report events without the boasting which is an offspring of the inferiority complex. Thus, "We advanced at zero hour and captured such and such a line," is a bald statement sufficient for the victors. From the losers it would be too much to expect a statement on parallel lines. The whole article must be read with these points in mind.

History thus written is not without its dangers, as a good instance shows. In reading of the Austrian initial successes and of the alleged demoralization of the retreating Serbians, one is not prepared for the subsequent Serbian resumption of the offensive and the brilliant success of their northward sweep. These come upon the reader with something of the surprise with which the German public, fed upon glowing communiqués, must have received the news of the Marne. A history should, however, rise superior to communiqués.

There is also a good example of relativity, for, in praising the Austrians for having held up at Ivangorod numerically superior Russian forces, the writer enthusiastically compares this battle with Wagram. To the English reader, Wagram may mean several things : a French victory which led to the Treaty of Vienna; the forcing of the Danube by Napoleon after previous failures; Napoleon's defeat of the Archduke Charles before the Archduke John could arrive—a classic instance of Napoleon's method of dealing with enemy armies in detail, before they could combine and give effect to their numerical superiority. It is clear that the resemblance, claimed as existing between Ivangorod and Wagram, must be sought elsewhere. It appears, indeed, not to extend much beyond the facts that the Austrians, in each case, fought a stout fight against an enemy who had first to cross a large river, and that on both occasions they escaped tactical defeat.

The completion of Vol. I gives General Kerchnawe a fitting opportunity to pay a compliment to one who has been responsible for nearly half that work. He says: "Capt. Wisshaupt, already well-known by careful work on a smaller scale (vide R.E. Journal, June, 1928), has here most completely and worthily won his spurs as a war historian."

Memories of the Russo-Japanese War. This article starts with the principal events of the war clearly stated in two and half pages, and ends with a bibliography. In between, Col. Kuetnersheim considers the experiences of the Russo-Japanese war, compares them with those of the Great War, and shows how many lessons which might have been learnt from the former were overlooked in the Austro-Hungarian Army and had to be paid for in blood.

Such lessons were : the extension of the modern battle front, eg., at Mukden, 260 Japanese battalions on a front of 120 km.; the duration of the modern battle—Liaoyang 7 days, Mukden 19 days; the enormous extension of field fortification to include concrete and armour, such measures being forced upon the combatants

MAGAZÍNES.

account of the Defence of Namur. A summarized statement dealing with the contents of the document referred to is contained in No. 6. The subject is treated in four parts, which deal respectively with: (1) a description of the fortress before the attack; (2) the attack; (3) the retreat from the fortress; and (4) general matters affecting the defence of the fortress.

W.A.J.O'M.

REVUE MILITAIRE SUISSE.

(1930.-Nos. 7 TO 12 INCLUSIVE.)

Des parachutes automatiques. This article is an anonymous contribution to No. 7 of the *Revue* : it gives a description of the "Metcor" parachute and deals with the military purposes for which it can be employed.

Les responsabilités de la guerre. This article is contributed to No. 7 by Col. F. Feyler, and is a review of a work under the foregoing title published by Payot of Paris (1930). The work in question contains arguments for and against the allegation that it is on the shoulders of France that the responsibility for the outbreak of the Great War must rest. M. Gérin, a former student of the *Ecole normale supérieure*, indicts France under fourteen heads; the challenge is taken up by M. Raymond Poincaré, who meets each of the fourteen charges made against his country, and puts up a vigorous defence. Colonel Feyler states that the controversy between these two disputants on the question as to the parties who were really responsible for the events of 1914 leading to hostilities, in no way disturbs the findings of the competent judges who have based their verdict on the evidence which was previously available; indeed, new matter brought to light by these disputants only confirms the correctness of the earlier findings: France was not guilty.

La défense d'après le S.C. 1927. Four parts of an article under the foregoing title by Major Montfort appear successively in Nos. 7 to 10 inclusive. In No. 7 the matters dealt with relate to fire-discipline; outposts; defensive positions; the counter-attack ; the employment of artillery. In No. 8, some of the features of the combat defensif are discussed (references are given by Major Montfort to the paras. of the Swiss Instruction sur le service en campagne upon which his views are based), and particular incidents which provide practical illustrations in support of various statements made in the original article are mentioned and described. Accounts are given of (1) the attack of the Austrians on June 15th, 1918, against the position occupied by the 1st Bn. 78th Regiment, of the Line at the "Doigt de Brutus "---this battalion formed part of the French troops which had relieved the Italian First Army on the Asiago Plateau in May, 1918; (2) the defence on July 15th, 1918, by troops of Gouraud's Army of the strong point named the " Duché " (in the Champagne) ; and (3) the attack made on March 30th, 1918, by the Régiment d'infantérie coloniale du Maror at the Plessier-de-Roye. The following matters are dealt with in No. 9; liaison in the case of troops on the defensive ; defence against tanks ; and special cases in relation to defensive warfare, e.g., defence of river crossings, of woods, etc. The treatment of subjects falling under the heading special cases is continued in No. 10; the following matters, inter alia, being dealt with : defensive warfare in mountainous regions ; defence (a) of bridgeheads, (b) at night time, (c) in " thick " weather, (d) against gas-attacks, (e) during a period of stabilization.

Manœuvres de division. This article appears in No. 8; it is mainly a reproduction of the Report of Col. Sarasin on the manœuvres of the Swiss 2nd Division, which took place in 1929.

Défense nationale ou économies ? At its sitting on April 4th, 1930, the Swiss Federal Council appointed a Commission with a view to its examining the question as to whether economies could be effected in the military budget without detriment to the efficiency of the Swiss Army, and, particularly, in order to ascertain whether

[MARCH

by the murderous effect of modern weapons, while the slow course of operations allowed the necessary time: hence the use and increased importance of position warfare.

It was for want of learning these lessons that the Austrians went into action in East Galicia, in August, 1914, imbued with the "mad" ideas of getting forward at all costs, and that all battles must be decided in the shortest possible time. A possible explanation of this neglect is furnished by a remark of Col. Csicseries, who accompanied the Russian forces as Austro-Hungarian attaché and who wrote two books embodying his experiences and making his deductions. "The authorities," he said to the writer, "regarded my deductions sceptically, because all the other attachés who had been through the war and written about it, saw in the victory of the Japanese a triumph of German (Austro-Hungarian) views concerning the conduct of war, tactics, etc., over the Russian system, which was known in many respects to differ. Had not the Japanese in these matters been the pupils of the Germans ! They saw, therefore, in this war a confirmation of the correctness and suitability of the ideas and teaching of the military school built up on the experiences of the Franco-Prussian War of 1870-71."

Hold on or Retire? A Chapter out of the Problems of the Great War, by Major-General Steinitz. This always extremely ticklish question concerns only the independent commander. The man in the ranks and the subordinate leader, whether in an attack that is held up or counter-attacked, or in defence, have only their duty to perform, i.e., to hold on to the last gasp. When is a commander independent in this sense ? At one time, in the War, it was laid down that no one below a Corps Commander could order a retirement at all. This was only a disciplinary measure. An independent commander might be defined as one who, as regards freedom of movement, is neither bound by his own task nor by respect for his neighbours. Actually, an independent commander might be a company commander, whose task it is to secure the flank of his brigade, and who finds that this can be done equally well from different positions ; while even an army commander is not an independent commander if his army is engaged with the enemy on the same front as neighbouring army commanders. It is admitted that this definition does not cover all possibilities. Generally, there will be a "miscrable" cable in existence which must be used for reporting and asking for orders, so that the independence question cannot be settled quite so simply. In any case, the responsibility still rests upon the officer who, by reason of his description of the situation, brought about the giving of the order to retire.

After these preliminary remarks, the author gives an example from the fighting in the Carpathians in the winter of 1915, when in the course of a fortnight's continuous attacking by the Russians the question of "Hold on or Retire?" had to be answered by the Austrians again and again. G.H.Q. had two good reasons for not permitting retirement. They wished to relieve Przemysl, which had been abandoned to investment, and they wished to preserve Hungary from invasion. Gen. Steinitz shows how ordering the troops to hold on at all costs, which under other circumstances may lead to brilliant successes, in this case led to destruction, because the army commander was obliged to use up all his reserves in filling the gaps in the line, and so was unable to put them in where he required for his counter-stroke.

The Use of the Reserves in the Battle of the Piave, 1918. Lieut.-Colonel Regele examines the operations from the 15th to 21st June, the distribution of the troops on both sides in the line and in reserve and the movement of the reserves, and makes out his case that Austrians and Italians alike, but each in their own way, failed to use their reserves to the best advantage.

International Review. The past twelve months are reviewed by Colonel Paschek, who records the chief events of 1929, having a bearing on international politics, and finds himself obliged to regard those events merely as episodes and mile-stones in a "year of transition." A collection of such events reads like a series of newspaper

MAGAZINES.

headlines, and would convey to the reader little more than his knowledge of national policies and tendencies in the past enabled him to understand, did not the author set himself to explain the connection as well as he can in the short space of twelve pages.

The whole forms a somewhat breathless, but still interesting and useful résumé.

China in 1929. After a glance at the end of the war against North China, General von Mierka deals in turn with the Central Government of the Kuomintang and its fight for authority; the recurrence of the war with the Generals; the revolt of the former Governor of Shantung, Chang-chung-chang; the seizure of Hankow and Changsha by the so-called Kwangsi-clique; the threat to Canton in May; the seizure of Southern Shantung and the Nankin-Tsingtao railway by Feng-yu-hsiang; and the "sad confession of impotence" by the Nankin Government's call to Japan for assistance. Then follows in the struggle for the Eastern Chinese Railway the " unedifying spectacle of two impotent nations, both incapable of action on a large scale, trying to swindle each other in an undignified squabble." More internal struggles complete the calendar, including Chang-fat-kwai's revolt and threat to Canton, Feng's evasion of banishment and his winning over the hitherto peaceful " model " Governor of Shansi, Yen-si-shan.

As usual in these articles, which are so clearly thought out and so convincingly put as to deceive the less well-informed into thinking they at last understand something of China, General von Mierka throws many a sidelight. For instance, to anyone who wondered why the great Chang-so-lin withdrew his powerful army from Pekin before a threat by inferior forces, two reasons given in this article are illuminating; a campaign of national propaganda from Nankin among his troops had had most demoralizing effects, and he had received an ultimatum from Japan that his return to Manchuria with a beaten army would not be permitted. This is claimed as the only occasion on which intervention by Japan did not raise a storm of protests from one side or the other. For once, both North and South were entirely satisfied, albeit for different reasons.

Austria-Hungary's Sea War, 1914-18. The writer shows that, up to the advent of Italy into the War, the Austro-Hungarian Navy was very active, and included in its " bag" the torpedoing of the French flagship Jean Bart, and the sinking of the armoured cruiser Léon Gambetta. He considers the refusal of the Austrians to accede to the German request and send their fleet, and especially submarines, against the British fleet waiting to force the Dardanelles was completely justified. And besides, a considerably greater effect upon the Dardanelles undertaking might have been expected from an offensive of the German High Seas Fleet in northern waters.

The Mediterranean Policy of the Danubian Monarchy, taken from Part I of the Official History, issued by the War Archives (Naval Section), and having the same title as the preceding article. The whole is delightfully written and reads, one imagines, like a confidential Foreign Office memorandum, or the work of an old hand at the diplomatic game.

The chief points brought out are : Austria-Hungary's economic progress depended upon access to the oceans, hence she must have assured command of the narrow outlet of the Adriatic. The chief obstacle to this was Italy, whose economic rise and increasing population made expansion necessary. But Great Britain denied Egypt, France denied the heavily Italian-populated Tunis, while in Abyssinia, Italy had tried and failed. Her line of least resistance now lay across the Adriatic to the Balkan peninsula. These two directions of expansion thus crossed, and brought about an antagonism between Austria-Hungary and Italy, which almost brought two allied nations to war. To Italian imperialism, the Adriatic, which was essential to Austria-Hungary's future prosperity, became an Italian lake, *mare nostro*, and a part of the national programme for gaining *Italia irredenta*, the portions of Austria and of Hungary occupied by Italians. Albania accordingly became the focus of t Valona as immediate object. Anotaia was thus

political interest, with the port of Valona as immediate object. Austria was thus constrained to seek another outlet to the Mediterranean, and directed her attention to Salonica and to Macedonia as leading thereto.

Meanwhile, Russia, defeated in Manchuria, had turned its attention once more to the Mediterranean, only to find Great Britain still blocking its way on the Bosphorus. A line of less resistance was found through the Balkan States to the Adriatic, by enlisting Serbia and Montenegro, under the catchword of Panslavism, to look upon Russia as their natural protector and political adviser.

This intended direction of Russia's access to the sea crossed with Austria's designs on Salonica. The solution of the Macedonian question would have remained a matter concerning Austria, Russia and also Italy, but that the economic way of expansion of another power led through the territory in question, in the shape of the Berlin-Baghdad railway, a dream which should extend Germany's power as far as the Persian Gulf, while opening up to German capital Turkey-in-Asia and the Eastern Mediterrancan.

Great Britain was in no doubt as to the threats this railway implied to her supremacy, commercial and military, and set to work to create obstacles. The first barricade on the road from Berlin to Constantinople was erected in Macedonia. When the Austrian Foreign Minister announced, in 1908, that a railway was to be built from Sarajevo through the Sanjak of Novi Bazar and the Vardar Valley to Salonica, the project was opposed by both Russia and Italy, as well as by the noisiest dissent in Servia and Montenegro. Shortly afterwards, an Anglo-Russian agreement was signed at Reval, laying down a community of interests in the East and in Macedonia. An immediate result of this agreement was the breaking out of the Young Turkish Revolution. Austria's reply to the Young Turks, who claimed Bosnia and Herzegovina, was to annex these countries, of which she had been in occupation nearly thirty years. At the same time, Austria withdrew her troops from Novi Bazar. With this evacuation of Servia, Austro-Hungary's renunciation of Salonica was complete and her Mediterranean policy ceased to exist. Austria was henceforward content to associate herself with Germany's project of the Berlin-Baghdad railway, which equally necessitated that a portion of Servia should change hands. Europe and the world waited six more years for the spark which should set off this conflagration.

Tactical Experiences from the Great War. Major Nemeth takes examples of typical action of a small mixed force, sketches the course of events and reproduces all reports and orders. His object is so to interest his reader as to stimulate that "very important and indispensable attribute of the military leader—a good and healthy imagination."

The Development of Artillery Material Since 1914. So much has been produced since Major Heigl's first article on field howitzers, in 1927, that this month's instalment is devoted to innovations and additional information on field howitzers and other ordnance on splayed trail carriages. The following are described, with photographs and drawings of parts: British 3.7 in. mountain howitzer, designed for India, but now used as anti-tank and as infantry gun; Spanish 105 mm. field howitzer M22 Vickers; American 105 mm. field howitzer; Dutch 10.5 cm. Bofors gun M27; Greek 105 mm. gun, system Schneider; American 4.7 in. gun; British 5 in. Vickers gun, "a surprise of the first order." The photographs show that Vickers have not only completely adopted the Filloux principle down to details, but also French, mostly Schneider, arrangements. It would at the same time be quite wrong to speak of a copy of the Filloux and Schneider guns. The gun is, "so to speak, a good translation into English," which is the cause of the good impression it makes on the eye.

Three larger howitzers are also described, the new British 6 in., the Czecho-Slovakian 15 cm. M25, and the American 6 in. T.I. Major Heigl closes with the remark that there can be no longer any doubt that no wheeled gun will be mounted 1931.]

except on a splayed trail carriage—until such time as we invent still better automobile or light all-round fire carriages.

The New Pedersen Automatic Rifle (vide R.E. Journal, September, 1930, p. 555). Messrs. Vickers-Armstrong have communicated that the officially given rate of speed of this rifle, viz., 25 aimed rounds a minute, is a very low figure compared with that which can be attained by trained soldiers. Specialists employed by the firm have reached a rate of 60 aimed rounds per minute with 60 hits.

Increase in the Number of Automobiles. The following are taken correct to 2 per cent. from the Statistical Handbook of the Austrian Republic: in 1923, there were 10,000 cars, 4,000 lorries and 7,500 motor-cycles. In four years, the percentage increases were: cars 40 per cent. lorries 223 per cent. and motor-cycles 373 per cent. All cars and lorries are shown as petrol-driven, except quite negligible numbers with electric-drive.

(March-April, 1930.)—The Art of War and the Composition of Armies. An historical study by Major Drees of the War Office Staff, Berlin, in which the author traces the composition of armies by arms, and the relative importance of infantry, cavalry and artillery through the battles of the past to the present day. The article shows how now infantry, now cavalry, preponderated, and traces clearly the rise in importance of artillery. Major Drees concludes by projecting the development traced into the future, when "without an appreciation and knowledge of technics a modern army is unthinkable." Armies will then be linked on to the national life as never before, since for the service of such important war machines as modern ordnance, tanks, aeroplanes, etc., technically trained reserves are necessary such as only industry can supply.

Troop Transport at the Commencement of War, by General Ratzenhoper. The Instructions prov. sur l'emploi des grandes unités now recognize that railways have risen to become an "arm." The author deals with this arm by giving examples of troop movements, and showing how railways were able to meet military requirements, or not, as the case might be. In either case, it is interesting to trace the influence of railways in shaping the course of operations. The author's theme may be taken to be that railways, like all other military organized aids, have in war as first task to serve the will of the commander : they cannot, however, be exploited to an unlimited extent; exact knowledge is necessary, and errors in disposition and in calculation take their toll. "The technics of mass movements then dictates its iron laws."

An Attack in Precipious Mountains. Major-General Korzer describes some fighting on the Parubio, one of the Lessinian Dolomites, not far from Rovercto, in July, 1916. Both sides were full of fight, and the Austrian Mountain Brigade, which had been ordered to capture an Italian position, found all posts most fully manned, as the Italians were themselves just about to attack. To bump into a "set piece" or into a relief in process of being carried out, is a possibility of position warfare which brings home to both sides the meaning of the word "luck "—and the Austrian attack had to be called off.

The Breaking-Off of the Fight. After preliminary remarks upon the breaking-off of action as affected by the role of the breaker-off, whether attacking or defending, as affected by the relative strengths of the two parties, and also by whether the decision arises from the will of the leader, acting in accordance with his commander's intentions, or arises from extreme necessity, Lieut.-Colonel Rendulic writes a chapter full of good points for arranging and carrying out a withdrawal from a position under attack. The case chosen is a freewill retirement; and many of the points are, obviously, from the writer's own experience. The article is written in the regular F.S. Regulations' style and reads like an amplification of our own F.S. Regulations on the somewhat scantily treated subjects of retirements, general principles and rear defensive systems. Arrangement and Conduct of Exercises without Troops, by Major Franck. All good and true, but elementary. The most noteworthy remark is that an exercise is well arranged and conducted when the participators therein look forward eagerly to the next exercise, and after it is over, discusses its events with passion.

Six simple schemes are given for application to suitable ground.

Tactical Experiences from the Great War. This translation from the Hungarian deals with one week's heavy fighting in Serbia, in September, 1914, and includes a retirement and a counter-attack.

A Peace Training Danube Crossing. Licut.-Colonel Kubitza starts a short account of this exercise, and of the military situation upon which it was based, by saying that what the attack and the assault are to the infantryman, the opposed crossing of a river is to the engineer. His skill and his dovotion to duty are the deciding factors in the success of this important battle operation, upon which the success of large operations may depend.

There had been two previous large river crossings since the War, viz., in October, 1925, at Kloster Neuburg, transhipping and construction of a normal Birago bridge, and in September, 1927, at Krems, transhipping and construction of a heavy war bridge of Herbert equipment, assumed later to have been partially destroyed by hostile fire, and completed with pontoons (vide R.E. Journal, June, 1930, p. 369). The second of these crossings was thus more ambitious than the first; and it was decided to continue the progression and make a third great crossing in August, 1929, more difficult still. A reversion was made to pontoons, and difficulty was sought in a particularly bad bit of river. The Danube was chosen at a spot, not far from Linz, which, owing to rapids and a whirlpool, had hitherto always been avoided for military bridging, and where, in olden days, valuable goods used to be taken out of river transport to be re-shipped farther down. River conditions, average breadth, 200 metres; depth 16 to 25 feet; bottom, rocky; flow, very rapid, 4.2 metres per second being measured on one day. The bridge consisted of 27 normal bays and 1 short one, and included a 41.5 metre cut for river traffic. The shore ends were two short ramps to trestles on pontoons. The upstream anchors were laid by each raft being taken to the anchor line by a motor-boat. The anchor hold was then tested, by raft and motor-boat being allowed to drop down into the position of the bridge. The motor-boats were also used for closing the cut. They showed that they were quite indispensable for a pontoon bridge in so swift a stream, quite apart from the time and labour saved. The total working time of assembly of the bridge, 179 metres water's edge to water's edge, was 2 hours 25 minutes. It was dismantled in I hour 6 minutes. The Birago equipment is reported to have done splendid service, as, indeed, it has done for nearly 90 years. When forming cut and when passing over troops, all anchors are reported as having held. This is perhaps less surprising, considering how well they were laid and tested, than it would be to hear that none had subsequently to be "written off charge."

Behind the Scenes in the Great Britain-United States Fleet Parity Question. The promise of diplomatic revelations implied in this title is not kept. General von Mierka means no more than that he has laid under contribution an article in an American magazine. He makes long extracts from "The Strategic Position of the United States," by Colonel Kilbourne, which appeared in the U.S. Coast Artillery Journal. It is unlikely that a military publication in any country would give away diplomatic secrets, even supposing that it knew any, and Colonel Kilbourne's article is above reproach in this respect. He makes abundantly clear, what is already known far beyond the ranks of the chorus, that the United States have nothing to fear from any direction, Atlantic, Pacific, Mexico, or even Canada; that the United States hold the Panama Canal, so as to be able to close or open it at will; that the building of the Nicaragua Canal will make their position still stronger; that the Philippines being incapable of defence would certainly be lost in war, and will most likely be given up; and, finally, that Great Britain, having realized that competition with the United States is no longer possible, must be "thankful for the gracious offer" of fleet parity.

Four Little Regarded Great Deeds. To the celebration of jubilees, centenaries and many other anniversaries, there is literally no end, especially in Austria, where this form of festivity and reminder of the past seems to make some particular appeal. The author of this article, Major-General Kirchnawe, thinks that the right events do not always get celebrated, e.g., insufficient notice was taken of the 400th anniversary of Vienna's heroic defence, which saved Eastern Europe from being overrun by the Turks. Further, he makes a typical old soldier's grumble by stating that the public is most unmindful of anniversaries having to do with soldiers. As evidence of which neglect, he produces four more great deeds which might have been celebrated in 1929. Even reserving the question of celebration, they are all four worthy of rescue from oblivion.

On the 5th August, 1829, a vessel of between 120 and 150 tons left the harbour of Trieste under her own steam, travelling at the rate of $6\frac{1}{2}$ sca miles an hour. The vessel was owned by a merchant called Fontana, and her engine and machinery were designed by an ex-artillery corporal called Ressel, whose technical training had been gained in the artillery shops and the regimental school. The steamer unfortunately came to a stop after half-an-hour's run, owing to a copper steam pipe having been soft-sweated. At the instigation of a shipping company, which feared competition, the police stopped further trials as "dangerous to safety." So that there was great astonishment in Trieste when, eleven years later, the first large English ship steamed into the harbour.

The second case has to do with one, Negrelli, and the sixtieth anniversary of the opening of the Sucz Canal. In 1840, at the instigation of Metternich (after Mehemet Ali of Egypt had been subdued by a British and Austrian fleet), Negrelli, a military surveyor, who had been trained at the Imperial Engineer Academy, drew up a complete project for a canal from the Mediterranean to Sucz. These plans were laid before the directors of the Sucz Canal Company in Paris, in 1845, accepted by them and recommended to the Khedive. When the work was put in hand in 1858, Negrelli, as chief engineer, was entrusted by de Lesseps with the carrying out of the work. He died at Trieste before the Canal was complete, and the statue on the mole is that of the financier and moving spirit, de Lesseps.

Another ex-artillery corporal figures in the third instance. This was a person of many parts, called Schwarzer, who had worked himself up, until, in 1849, he was Minister for Trade and by his powerful support of the engineer, Ghéga, was instrumental in building the first mountain railway in the world, over the Semmering Pass, 3,300 feet high, as part of the railway between Vienna and Trieste.

The last of the four anniversaries is, like the first, a centenary. Unlike the other three, it is purely military. In 1829, there was issued to the Pioneers for trial the standard bridging equipment devised by a Lieut. Birago, of the Quartermaster-General's staff, who had been taken over into the Austrian Army from the Military Engineers and Surveyors Corps of Napoleon's Kingdom of Italy. This equipment had all the characteristics and almost all the measurements of the patterns which were scaled five years later, and in 1843 were finally introduced into the army. The chief difference was that the original Birago equipment was intended for ordinary military bridges—and not for pontoon bridges, which were in the hands of a separate Corps of Pontoneers. After the introduction of the Birago universal equipment, the Corps of Pontoneers was absorbed into the Corps of Pioneers, and Lieut. Birago was transferred to the Pioneers, eventually becoming a Major-General.

General Kerchnawe calls attention to the fact that the military pioneers of the whole world are to-day equipped with bridging material, directly descending from that devised and constructed by an Austrian officer 100 years ago, that is after a lapse of time which has replaced Ressel's steamer by ships 400 times as large and four times as fast, that has replaced the first railway locomotive travelling $7\frac{1}{2}$ miles an hour by

monster engines conveying 120 axles at 60 m.p.h., and which has exchanged the needle instrument for the Hughes and wireless telegraphy and telephony. All of which is undeniable, but a bridge consists of more than material, and the pontoon bridges of 1829 were not built at the rate of 179 metres in 2 hours 25 minutes (vide penultimate article).

F.A.I.

HEERESTECHNIK.

(March, 1930.)—This is a gas number, consisting of a single article of 36 pages (23 photographs in the text) and notes on the same subject. The article is of so high a standard, that the number would be worthy of preservation for reference, but for an unfortunate accident, which gives an Iceland Spar effect to eight of the pages and makes reading so difficult as to re-associate it with tears. Was the printer under notice that he could afford to work off a lachrymatory joke? The article is : Gas in War. Medical Means of Enlightenment, Protection and Treatment, by Dr. Büscher.

The author starts by telling us his qualifications for writing on the subject. The poison gases used in war have for years been "his daily bread." This is his playful way of introducing us to the fact that he was employed as the medical officer of the German Government Gas Establishment at Breloh, on Lüneburg Heath, an institution covering 16,000 acres, and in its palmy days employing 4,000 workmen.

The products of Breloh were gas shell, green cross, yellow cross, and blue cross, of all calibres. Under the Treaty of Versailles, between 1919 and 1925 there had to be laboriously destroyed at Breloh 48,000 tons of gas shell, many containers of various gases and a large quantity of captured gas ammunition. An accidental explosion, in October, 1919, disposed of about 1,000,000 gas shell—and 48 buildings! This wholesale riddance, instead of simplifying the work of clearance, actually complicated it. Henceforth, the confusion in which everything lay about, cylinders, shell, fuses, etc., was so great, that the work became more difficult and more dangerous. On some days the writer had to treat as many as 30 to 40 cases of gas poisoning, of widely varying kinds. The picture he presents forms Dr. Büscher's credentials—five years of treating gas casualties—not animals in a laboratory—but human beings, poisoned in different ways, when sometimes even the foremen could give no help as regards the gas in question.

Dr. Büscher emphasizes the fact that enlightenment about gas is the first condition of all efficient protection. He contrasts the quiet, business-like way the trained gas personnel went about their work among the poison gases with the behaviour of the civil population for miles around the factory, who lived in a perpetual state of nerves and scares. The public must be both instructed and trained, so that they know what to do and how. Under pressure of the authorities at a time of scare, gas masks were issued to the public without the latter having been trained in their use. It was then that a man came to Dr. Büscher, handed him a metal gas mask container, and said he could not get it to stick on his face at all. On being pressed as to possible contents of the tin, he admitted to having thrown away some " rubbish."

For instruction purposes, a portable case, manufacted by Stoltzenberg, of Hamburg, is strongly recommended. It contains a pamphlet, "What Everyone Should Know of Chemical Warfare and the Substances Used," a three-barrelled pistol, 60 cartridges in 12 rows of five, and 60 small scaled test tubes, in 12 rows of five. Each test tube contains 1 to 2 c.cm. of a substance used in chemical warfare. The twelve different substances, samples of which are contained in the case, have been chosen as being the twelve most important chemical warfare substances. They are classed by the Germans as eye irritants, green cross, yellow cross and blue cross " battle substances." It is not easy to classify poison gases, since their actions are not distinctly defined, but, roughly, yellow stands for blistering, green for lung irritants, and blue for sneezing. The composition of each substance in the case is shown by its name, in the following list, while popular names are shown in brackets.

Class 1—lachrymatory; four substances, viz., xylyl bromide (the German T-stoff), bromium acetone (the German B-stoff), benzyl bromium cyanide (the French camite, American CA), and chloracetophenon (American CN).

Class 2-green cross or lung irritants; three substances, viz., carbon monoxide chloride (phosgene), trichlormethyl chloroformate (the German per-stoff, French surpalite, English diphosgene), and nitrochloroform (the German chlorpikrin).

Class 3-yellow cross or skin irritants; two substances, viz., dichlor diethyl sulphide (mustard gas, French yperite), and dichlor divinyl arsenic chloride (Lewisite B).

Class 4—blue cross or irritants of the nasal passages; three substances, viz., diphenyl arsenic cyanide (known by the Germans as Clark 2), diphenyl amin arsenic chloride (or Adamsite), and ethyl dichlor arsine (which the Germans called Dick).

Dr. Büscher's classification associates all the arsines, aliphatic as well as aromatic, under blue cross, but this was not the practice when Dr. Hanslian's book on chemical warfare was written (reviewed in R.E. Journal, March, 1928). At that time, 1927, ethyl dichlor arsine figured as green cross, with which the French, who were shelled with it from May, 1918, appear to agree, for they label it sternutatoire et toxique instead of sternutatoire only, like the aromatics.

In addition to the instructional case with pistol and twelve samples, Stoltzenberg, of Hamburg, has also produced hoxes of instructional matches. In these matches, the gas substances are present in such small proportions as not to be dangerous to life, and thus they have the great advantage over the pistol charges that they do not need a gas chamber and gas masks, but permit those under instruction to note the characteristic smell and effect upon eyes, nose, throat or lungs of each substance.

Pill boxes containing artificial smoke producers can also be obtained from the same firm.

As regards protection, the author is very much against the Russian idea of large protected shelters for numbers of people to collect in. He thinks such places could only lead to panics, and that the proper place of safety for each person is the cellar of his own house. In the case of the soldier, the true value of gas protection lies in its support of his offensive power. If he is protected from head to foot, by mask, gas-proof sheeting and overshoes, his rifle and pack must also be included. Such a costume might be worn by sentries, but it is unthinkable for moving fighting. Even the gas mask must not hinder. The mask has its psychological side, and for this reason must leave the features visible. Not only does the mask wearer feel relief from imprisonment, but for human intercourse to be anything like natural, the human features should be seen. This point is even more necessary when it comes to the civil population wearing masks, or we shall have what has often been seen at Breloh-terrified children running away shricking from their own mothers. The "International Experts Commission for the Protection of the Civil Population Against Gas Warfare," at their last meeting in Rome, decided to offer a prize for the best filter mask, costing not more than three dollars to make. The photograph of a lady wearing such a mask is shown as evidence that the features can be entirely visible, and Dr. Büscher says no other kind comes into the question.

Many good points are given under the sub-heading "Treatment," but these chiefly concern doctors and medical personnel. The author promises more information in his forthcoming book, Five Years' Experience of Battle Gases.

Protection from the Air of the Civil Population in Foreign Countries. This note is complementary to the foregoing article, and is written in reference to a stricture, passed on the German Government, for neglecting air protection measures for civilians.

In France, in spite of the extraordinary increase in aircraft which will make France the most powerful air power in the world, a fresh impulse, full of energy, in the measures for protection of the civil population has brought about the formation of an Air Protection Committee, of which Marshal Lyautey is the president. One of the first items on their programme is the education of the public in peace. The Air Minister promised his support and included in the budget a first instalment of 400 million francs for practical air defence measures. The Government has also decided to decentralize the aircraft industry and to assist in the removal of aircraft and engine factories from Paris to smaller towns in the neighbourhood.

In Hungary, an Air Protection League has been formed among the people, which includes amongst its activities the provision of a course of 26 lectures at the People's University.

In Austria, the Carinthian Air Protection Union, which has existed for several years, has now been followed by a similar union for Vienna, Lower Austria and Burgenland.

In Poland, the League for Air and Gas Protection utilized the Polish National Exhibition for propaganda work. This League has started building a school which will cost 2,000,000 zloty.

In Japan, the new Air Ministry, in addition to military and civil aviation, includes in its duties air and gas protection of the civil population. A sum of 10,000,000 yen has been voted for the latter purpose.

(April, 1930.)-The Question of the Increase of Performance of Infantry Weapons. A series of four articles on the influence of the technical development of firearms on infantry tactics, which appeared in Heerestechnik and were reviewed in the R.E. Journal, March and June, 1930, awakened wide interest and called forth a number of articles on the general subject of increased performance of infantry weapons. Four of these articles, which were reviewed in the R.E. Journal, September and December, 1930, are now summarized. The writer avoids committing himself as to whether the rifle is to remain the chief weapon of the infantry, with other weapons subsidiary, or whether the rifle's day is done and the machine-gun must take its place. Out of the wealth of material published, he is careful to draw only one conclusion, viz., that the infantry armament question presses for a solution. And yet, the less angel-like might be tempted to rush in with some such patent solution as this : chief infantry weapon, the rifle, but to be automatic and the lightest possible ; subsidiary infantry weapon, the light machine-gun, but stabilized for use as heavy machine-gun for infantry purposes. So far the ammunition to be universal. The heavy machine-gun proper to be a non-infantry weapon.

The Development of the Cross-Country Six-Wheeler. This article refers only to Germany, where the six-wheeler, having an origin quite different from its origin in England and in France, has also had a different development. Whereas in the lastnamed countries the six-wheeler was produced in response to a military demand for a lorry able to travel across country, in Germany its origin was the desire to obtain on the roads an increase of lorry load without exceeding the maximum axle load permitted by law. Consequently, the first German six-wheeler, built by Friedrich Krupp & Co., in 1925, was a heavy one, of eight tons useful load. As this lorry was developed from a chain-driven four-wheeler, it had also chain-drive, both rear axles being driven from cross driving shafts having a common gearing firmly mounted on the frame. Axle play was so small, that this lorry never came into consideration as a cross-country vehicle. As speed was demanded, the eight-tonner, with its 12 to 15 m.p.h., could not fill the bill, and the next development was much smaller, a two-tonner shown by Krupp's at the Berlin Exhibition, in 1926. This light lorry was found to possess certain capabilities, if not across country, at any rate on dry meadows and fields, but it was not an economic proposition, and the smallest lorry shown by Krupp's, at the Leipsic Fair, in 1928, was their 3-1-tonner, designed in the light of the two-tonner's experiences. By reason of its springing, it is able to "swallow" the uncvennesses of the ground. This great development has been brought about notwithstanding the economic principle of using in its construction as many parts as possible of the two-axled three-tonner. Where such use was

impossible, *i.e.*, with the rear axles and their suspension, standard parts were obtained elsewhere, while the specially sprung worm axle was the same as used by Krupp's for a low omnibus chassis.

A photograph shows the chassis in question, and another the complete bus. Three photographs show Krupp's six-wheeler with high-frame chassis negotiating difficult country fully loaded, with and without caterpillar attachment.

(May, 1930.)—The Motorization of Bakery Columns. Based upon the result of trials in Austria, a strong case is here made out for motors against the horsed column. A great advantage of the change would be that it includes mechanization, in that electrical heating of ovens is substituted for wood-burning.

The Schneider Distant Indicator for Command Posts. A translation of "Le nouveau système de téléindicateur Schneider, type Strobonéon," from the Mémorial de l'artillerie française. Schneider's claim with synchronous motors, the stroboscope and a neon lamp to have solved the troubles which affect the telegraph for conveying orders to a distance on board ship or in coast fortresses, viz., the inertia of the indicator arm, alterations of resistance in sliding contacts, the effect of dirt, etc., in addition to reducing the number of circuits necessary between sender and receiver. As regards the last-named trouble, the Schneider system is simple enough, requiring for single orders to be conveyed only the lamp circuit containing interrupter, battery and step-up transformer.

The Screwing-in of Piles instead of Ramming for Military Bridges. By far the greater number of war bridges made of extemporized material, rested on pile trestles whenever the bottom permitted, and pontoons could not be used. For heavy bridges, there is nothing for it but ramming, and progress is slow. From the use of the screw picket for wire entanglements came the idea of a screw pile for light military bridges. A report comes from Russian sources of the use of light screwed piles in constructional timbering at Kertsch and at Baku. The piles were wooden and had either iron threads or wooden threads. The latter are of military interest. The piles were sharpened into a conc. Above the conc a length of 2 in. hoop iron was wrapped round the pile in a spiral. The position of the iron was then marked and the iron removed. A groove, 22 cm. deep and 5 cm. broad, was then taken out. This groove was filled with pieces of board, secured by 7-in. nails, for which holes had been previously bored. The boarding was shaped to project 10 cm. at the top of the spiral and gradually decrease in projection until it was flush at the edge of the cone. All edges were then rounded off. A carpenter made three such points in a day. The pile for screwing was held in position by light staging with cross planks shaped to the pile and nailed. It was then windlassed in by three men.

Russian figures claiming 3.5 metres drive in 20 minutes, or "three piles to the hour," were suspect. German trials were made accordingly, and record that a pile 6 metres long, 22.5 cm. diameter, was driven through sand and clay 2 metres deep by 132 complete turns in 30 minutes. Further experiments showed great advantage gained by continuing the screw thread round the surface of the cone to the apex.

F.A.I.

REVUE D'ARTILLERIE.

(September, 1930.)—Article on protection against gas—a review by A. R. Grenoullett and Licut. A. H. Dubourdieu of an article in the March, 1930, number of Heerestechnik by Dr. Hermann Büscher.

This article deals mainly with the protection of civil populations against gas attacks, but the following points dealt with by the author are equally applicable in the military sphere.

(I) The importance of knowing the qualities and mode of action of the gas being used by the enemy in order that

(a) Protective measures evolved may be effective.

- (b) Treatment of casualties may be on the right lines—e.g., phosgene casualties require above all complete rest; other treatment may prove fatal.
- (z) Protective measures will not be effectively taken unless
 - (a) Personnel are given practical instruction and training in protective measures.
 - (b) Personnel are given practical instruction in the effect of gases, and the results of not taking protective measures.

From these premises, the writer deduces the need of, and gives a description of

- (a) An instructional case, containing samples of gases.
- (b) A set of matches, which, when struck, produce a slight concentration of various gases, strong enough to give instruction in the recognizing of gases by smell, but not strong enough to be harmful.

As regards collective measures for the protection of civil populations, the writer condemns the provision of large gas-proof shelters owing to the likelihood of casualties from panic, and recommends the use and adaption of existing cellars in houses.

The article states that military protective measures cannot be as effective as those which can be adopted by civil populations, owing to the need of preserving the soldier's offensive powers. Hence, protective clothing as a means of preventing contamination from liquid gas will be of little use militarily owing to its hampering effect on the wearer's movements.

An interesting type of transparent face piece for the respirator is illustrated and described. The advantages claimed are

- (i) Moral value, since soldiers will be able to see the expression on the face of their comrades.
- (ii) Wider field of vision.
- (iii) Elimination of the feeling of confinement engendered by wearing a face piece with goggles only.

Bleaching powder is considered to be the best decontaminating agent for dealing with mustard. R.H.M.

REVUE DU GÉNIE MILITAIRE.

(August, 1930.)—In "The role and employment of Divisional Engineers," Commandant Cabasse, drawing on the experiences of the 27th Division, describes in a general way the part taken by the Divisional Engineers in the Great War.

At the outbreak of the War each division included one company of sappers and miners, but towards the end of 1915 the divisional complement was increased to two companies and a field park.

The regulations of August 22nd, 1925, embody post-war ideas about the strength and employment of Divisional Engineers.

They are now organized as a battalion of two companies and a field park company, under a Licut.-Colonel. At some future date there will be added a Bridging Company which will be provided with equipment for a new type of bridge called "The Light Bridge of Four Tons."

The instructions regarding the employment of the Engineers as such, and as combatant troops, seem to be much the same as our own, but the accompaniment of assaulting troops by Engineers is particularly indicated.

(September, 1930.)—In the September number there is an account by Lieutenant Fourtanier of the partial removal of a limestone reef in the Rhone. This reef projected from the right bank of the river at a point situated in the commune Bourg-Saint Andéol and was a serious hindrance to navigation.

Between 1921 and 1926, attempts had been made by the Service des Ponts et Chaussées to reduce the reef, but without success. In 1929 the assistance of the 7th Regiment of Engineers was obtained.

The reef had to be lowered by 50 to 60 cm. over an area of about 32×15 metres : this necessitated the boring under water of some 300 holes about 1 m. 40 apart, of a

minimum depth of 20 cm. The holes were bored from a floating platform consisting of a decking over two boats side by side fastened to a tow-boat which was secured to the shore by cables.

For boring the holes an ordinary miner's boring bar was used. It was worked inside an iron tube as a guide, which was fixed by two collars to an iron picket about 2.50 metres long driven into the rock.

The explosive used was melinite. Work had to be stopped owing to the floods after 130 holes had been driven, but as far as it went it was successful.

In an article by Colonel Beyer a description is given of a pump for concrete made by Max Giése of Kiel, and of the construction of a large building, the Deutsches Haus at Flensburg, Schleswig, by its means.

During the construction of part of the building the pump delivered concrete at the rate of 10 cubic metres per hour over a distance of 50 metres with a lift of 3 metres. The greatest height it delivered to was 27 metres. It is claimed that the concrete transported through the pump arrives more perfectly mixed than when transported by hand. It can be delivered in any state of consistency. Results show that the resistance of the concrete delivered through the pump is higher than that of concrete taken straight from the mixer.

There is the first instalment of a long article by Chef de Bataillon du Génie Decoufié on a new type of military bridge. The essential feature is that all tensile members should consist of cables.

(October, 1930.)—There is an interesting article by E. Kast, Reserve Lieutenant of Engineers, called "Foundations on reinforced concrete piles with bases enlarged by explosion or upsetting."

Colonel Beyer contributes an article on "Breaking up Ice." The best way of preventing the piling up of ice floes in a river is to clear a channel by which the floes can be carried away by the current. This channel should be made by working in an upstream direction. Holes, through which the charges are introduced, should be made in the ice about 15 metres apart, in rows or in quincunx formation. For this purpose ice axes or ice chisels can be used, or an explosive. A hole can easily be made in ice 30 to 40 cm. thick with a cartridge of 200 grams (7 oz.) of nitro-gelatine. The charges are placed under the ice; this can conveniently be done by using a wooden pole about 5 metres long, to the end of which the charge is hung by a bit of loose wire. The amount of the charge is obtained by experiment; for thicknesses up to 30 cm. half a kilogram of nitro-gelatine is enough, and double that amount for thicknesses of 30-40 cm. If powder is used the charge must be trebled.

There is a continuation of the article on "A New Type of Military Bridge "; it deals with calculations for anchorages.

A.H.B.

CORRESPONDENCE.

HOW WE WON THE WAR.

The Editor, R.E. Journal.

Amherst House, Chatham,

3.12.30.

DEAR SIR,

A request has recently been circulated throughout formations and units that officers who participated in the Great War should examine their private papers and see if they had inadvertently retained any official documents that might be of historical value. In common with many others I sifted through a number of mementoes.

A generation has now sprung up that hardly realizes how it was that we managed to win the War, so you may consider the following correspondence* that I unearthed amongst my papers of some value to this end.

It will be observed that the correspondence terminates abruptly at minute 14. At this stage a new Brigadier was appointed to command the Royal Artillery of the Division concerned. This Brigadier had spent 30 odd years bickering about the Frontier of India, and was utterly unversed in the paper warfare euphemistically termed "Staff Duties." When this correspondence was laid before him he had the extreme temerity to come to a decision himself, and instead of writing "Forwarded," he scribbled a huge YES in blue pencil right across the page.

I am, Sir, Yours faithfully,

R. H. ALLEN, Major and Bt. Lt.-Col., R.A.

* Authentic.-ED., R.E. Journal.

15th February, 1916.

(I)

The Adjutant, *** F.A. Brigade,

I have the honour to request that I may be granted leave of absence for the purpose of proceeding to Cairo or Port Said for the purpose of having my teeth attended to in accordance with Routine Order No. 97 dated 6th February. I enclose a certificate by the Medical Officer.

If leave is granted I would like to go on Friday, the 18th inst.

I have the honour to be, Sir, Your obedient servant,

***, Major.

(2)

D.A.A.G., *** Division,

Forwarded and recommended that Major *** be given leave to proceed to Cairo or Port Said to see a dentist.

***, Lieut.-Col. R.A.,

Commanding *** Brigade, R.A.

***, 16.2.16.

(3)

Headquarters, *** Army Corps,

Forwarded. 7 days leave to Cairo is recommended.

***, Major-General,

Commanding *** Division.

***, 17.2.16.

(4)

*** Division.

With reference to attached application; please note that in this and similar cases leave cannot be granted to go to Cairo for dental treatment.

The A.D.M.S., *** Division, on application, will make the necessary arrangements with D.D.M.S. *** Corps for treatment in Suez.

***, Major,

D.A.A. and Q.M.G., *** Army Corps.

18.2.16.

(5) Officer Commanding, *** Brigade, R.F.A. (thro' A.D.M.S., *** Division). Forwarded for note and return.

> ***, Captain. D.A.A.G., *** Division.

19.2.16.

(6)

Officer Commanding, *** Brigade, R.F.A.,

The officer in question should arrange for dental treatment by direct communication with Dental Surgeon, Suez. This officer is in the former Egyptian Club, first house beyond Hotel Belaw, Suez.

***, Lieut.-Colonel,

A.D.M.S., *** Division.

19.2.16,

(7)

Reference attached correspondence and your note of this date.

The Dental Surgeon *** at Sucz informs me that he has only instruments for extraction.

The stopping has come out of one of my teeth and is causing me considerable pain, and I would very much like to get this attended to at once. I know there is a good dentist at Port Said, and I am quite willing to pay my own expenses if I can get leave to attend to this, please.

> ***, Major, *** Battery, R.F.A.

(8)

D.A.A.G., *** Division.

Reference minute 7, can this matter be reconsidered. The dentist at Suez apparently cannot stop teeth. Major ***

would like to go to Port Said. ***, Lieut.-Colonel, R.A.,

Commanding *** Brigade, R.F.A.

21.2.16.

(9)

A.D.M.S., *** Division.

***, 21,2.1016.

In view of the fact that the dentist at Suez is not in a position to carry out the work required in Major ***'s case, would you please say what other arrangements can be made for his treatment.

***, Captain,

D.A.A.G., *** Division.

(10)

Headquarters, *** Division,

22nd February, 1916.

To :-- The D.D.M.S., *** Army Corps, Memorandum.

Please see letter 7 regarding D. and Q.M.G.'s letter *** of 18th February, 1916 (marked 4). THE R

Will you kindly get authority for Major *** to proceed to Cairo or Port Said on seven days leave for Dental Treatment.

In future I think it would be as well, if an officer obtains a certificate from Dental Surgeon, Suez, stating he is unable to carry out the work required, that the officer should be allowed to proceed to Cairo at his own expense.

Please return this correspondence.

***, Lieut.-Colonel, A.D.M.S., *** Division.

(11)

A.D.M.S., *** Division,

With reference to previous correspondence, will you please arrange for this officer to visit the Dental Surgeon at Sucz.

The Dental Surgeon to report if he cannot undertake the work, and the application to be re-submitted with the report attached.

*** D.D.M.S.,

*** Army Corps.

23.2.16.

(12)

Major ***, R.F.A.,

(through Adjutant, *** F. A. Brigade),

Kindly see D.D.M.S. letter 343 of 23.2.16. Kindly re-submit your application with report asked for.

I hope if you have infinite patience and perseverance you will in due course be allowed to have your teeth attended to. I hope it is not a very urgent dental matter.

A.D.M.S., *** Division.

24.2.16.

(13)

***, 7th March, 1916.

From :----Major ***.

To :---Adjutant, *** Brigade,

Reference previous correspondence and particularly the letter dated 23rd February, 1916, from D.D.M.S., *** Corps.

I visited the Dental Surgeon's room on 3 different days, but he was not there. I was told that he was away on leave. I was unable to attend again, being under orders to move here. My teeth are still troubling me very much--will you please forward my application again.

***, Major,

*** Battery, R.F.A.

(14)

Staff Captain, R.A.

Can Major *** have leave to go to Cairo or Port Said? He is in pain.

***, Lieut.-Colonel,

Commanding *** Brigade, R.F.A.

7.3.16.

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- (2) The maximum duration of a visit is 28 days.
- (3) R.E. officers on the active and retired lists, their families (with the exception of children under 16), and the widows of R.E. officers are invited.
- (4) Those who wish to go to Coombe House during a period of convalescence must have reached such a stage of recovery that they are able to return to normal diet, and do not require meals brought to their rooms.

The accommodation limits the number of guests to four at one time. With this limit it is necessary at times to arrange for selection among applicants, and adjustment of the dates for visits. The responsibility for these arrangements rests with the R.E. Corps Committee. Applications should therefore be made to the Secretary of that Committee in person, by telephone, or by letter. The address is Room 231, War Office, and the telephone number Victoria 9400, Extension 467. No particulars are normally asked of applicants, other than the dates which would be most convenient to them for their visits. Applications are, of course, treated as confidential.



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