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PERMANENT FORTIFICATION.

A Lecture delivered to No. 3 Senior Officers' Class, S.M.E., by MAJOR R. N. HARVEY, D.S.O., R.E.

The most cursory glance at the past history of our Army, and its employment in warfare with civilized nations, will show the reader that every campaign on European territory has included the siege of at least one important centre. The siege operations of the Peninsula resulted in the creation of the School of Military Engineering in 1812. Siege operations, which have always figured in R.E. text books, have now been recognized in the *Field Service Regulations*, the text book of operations controlling the action of *all* branches of the Service, and since this is the case, surely it is not out of place for all arms to know something of the nature of the works against which these siege operations are to be conducted.

Before discussing permanent fortification of the present day, I think it will be instructive to glance over the history of that branch of military science, for by that means alone can we really grasp the why and wherefore of the present-day ideas.

Historically, fortification can be most easily divided into periods based upon the radical changes in the nature of the weapons with which it was confronted, namely :---

- (1). The pre-gunpowder period.
- (2). From the invention of gunpowder until the introduction of rifled ordnance.
- (3). The invention of rifled ordnance to the present day.

r. First Period.—From the earliest times—as soon as man became able to build in stone—the wall has always been the most popular form of defence work. The most powerful engines that could be brought against such a form of defence was the battering ram or catapult. The introduction of a ditch limited the utility of the former, the damage caused by the latter was haphazard.

The form which the trace of the defences took was usually a rectilinear figure described round the object to be defended, strengthened at the angles and in long faces by towers which at once performed the duties of watch towers, sentry boxes and flanking defence. There was usually not much attempt at an active defence, for the possibilities of a successful sally through a narrow gateway and over a drawbridge were not inviting, and unless the reduction of a fortress was effected by stratagem or storm, the result of the siege operations usually depended upon the reserves of supplies and water of the garrison, and plague and pestilence in those days was also a force to be reckoned with by both sides.

2. Second Period.—With the introduction of gunpowder and guns firing cannon balls there came a change, but even then the change was very gradual, for the first terror produced by cannon was the moral effect of an iron ball rolling along the ground which could remove the arms and legs of those who got in its way; besides the early artillery was as dangerous to friend as to foe. After a while of course its effect on masonry was felt. In addition to this there was a desire on the part of the defence to take advantage of this new engine of offence. It was realized that the best effect was obtained by guns near the ground level, and that the plunging fire from a castle wall lost much of its potentiality as a destructive agent.

The result of this natural feeling was the introduction of low advanced works in front of the walls, generally near the entrances. In these works were placed the guns of the defence, from which both frontal and flanking fire could be obtained. These advanced works were the origin of the bastion.

As the guns of the attack gained in efficiency, so the popularity of lofty walls diminished, and the next great change in fortification is the disappearance of the wall into a deep ditch by which it was protected from direct fire and which in itself formed the main obstacle to the attack.

The Italians in 1540 were the first engineers to adopt the new system, and from that dates the bastion system of defence. We have an example of this earliest change at Berwick. The advantages of the system arc obvious. All faces are intended to give mutual support, the bastions flank the curtain and the curtain the bastion, at the same time being capable of frontal fire to some extent.

Later on there arose various engineers on the Continent who sought to improve matters, but they devoted their efforts to the solution of the problem of the defence of the ditch and other faces by *flank* fire, and to securing the place against successful assault by retrenching every likely face. By their continued seeking after flank defence in any degree of complexity, and by their step-by-step defence, they produced such a veritable maze of works that the science of the engineer was swallowed up in the genius of the draughtsman.

The most familiar names of the improvers to the bastion trace are those of Vauban and Cormontaigne. As Sir G. Clarke says: "Vauban has by the irony of fate come down to us as the creative genius of defence, but the great work of his life is hardly known. He was in fact the first engineer who reduced the attack to a wellorganized system which he demonstrated in a long series of successful sieges, which included fortresses of his own design, but this abstract science was almost completely eclipsed by the concrete fact that he covered France with fortresses, though half of them might be unnecessary and even undesirable."

That Vauban and his system dominated the science of permanent fortification from the 17th to 19th centuries, inclusive, there can be no doubt ; even as late as 1840 the defences of Paris were designed on his lines, and the enciente of Antwerp proved the *pièce de résistance* in the syllabus of permanent fortification at the R.M.A. in 1886, though at that time the system was nearly 100 years out of date. If therefore we count the foundation of the bastion trace from 1540, it retained its popularity for 300 years.

In this same period of construction we must include a certain break away from Vauban, foreseen in 1776 by Montalembert, but not actually brought into being till 1828. But before this new school of thought materialized, there was a most original break away from the traditions of fortification in the Peninsula. I refer to the construction of the lines of Torres Vedras, ordered by the Duke of Wellington. In this scheme a line of 29 miles was held by a series of detached works which did not flank each other, and in some cases were more than a mile apart. The flank defence of ditches was attempted in a few of the redoubts, but in most the trace was based on the ground alone. The garrison was 1,600 men per mile, but Massena could not be induced to attack this line.

The words of Colonel J. T. Jones, one of the executive engineers, may be quoted here as they enunciate clearly the principles of modern fortification : "Throughout the whole front there was not a continuity of artificial line necessitating a single brigade to be kept out of column, and the works may be regarded as so much additional strength given to the Army without subtracting a man from its effective force. Indeed, the artificial defences of the lines altogether present a most favourable example of the engineer not in furtherance of, but invariably subservient to tactics, creating pivots and supports but never a tie or restraint on field movements."

Montalembert, whom I have just mentioned, advocated a return to a simpler trace, and introduced the German, or polygonal, or modern French system which now obtains generally. This was combined with a system of caponiers and counterscarp galleries by which the flanking of the ditches was secured. Posen was the earliest example of the polygonal system. Between Waterloo and Crimea, Germany fortified a great deal on these lines, and here again the tendency to exaggeration was developed. Enormous caponiers were built, which in themselves were veritable fortresses, for the purpose of dealing with the batteries of the attack which it was supposed would be established on the crest of the main ditch, thereby obscuring the original simplicity of design.

The next great siege of history was the Siege of Sebastopol. Here the works on the south face belonged to a design of 1828, which had been only partially carried out; in fact they consisted for the most part of buildings, officers' quarters and barracks intended to be in the gorge of the bastions. These were supplemented by ordinary earthworks, and it was to them that the successful continuation of the siege is due. Sebastopol was a complete triumph of the fortification of the soldier Todleben as opposed to that of the draughtsman.

3. Third Period.—Having now reached the commencement of the period when guns became rifled and the explosive more violent, and consequently the range and accuracy of firearms generally made great advances, let us look back and see what lessons history had brought forward to govern the design of permanent fortification and how they have been put in practice.

From the Peninsula we should have learned :---

- The bastion trace was condemned because frontal fire was sacrificed to flanking the ditches.
- (2). That long untraversed faces were useless as positions for guns.
- (3). Bombproof cover must be provided near guns and parapets.
- (4). Embrasures were condemned as means of conducting shot into gun detachments.
- (5). Unprotected escarp walls carrying parapets were uscless.
- (6). That when breaches were made they could be easily defended
 - by extemporized retrenchments.

- There is no intrinsic defensive value attaching to monumental revetments or fantastic traces.
- (2). Good earthworks with sufficient bombproofs near guns and parapet were sufficient to hold off attack.
- (3). An obstacle under *close* fire is a strong obstacle.
- (4). Field guns brought to a parapet during assault arc very useful.
- (5). Guns should not be placed where the detachments can be injured by bursts back from a building (Malakoff).

With reference to (2), the Redan, Mamelon, and Malakoff were all successfully stormed during the temporary absence of their garrisons, and a few years later Drippel fell from the same cause. The siege also brought to notice that the strength of a defence lies in its capacity to attack.

The French forts prior to the Franco-German War had received little or no revision for about 50 years, and they naturally bring out the same lessons as detailed above, especially as regards the active defence as exemplified by the Siege of Belfort and Paris. But in addition the following were taught :—

- (r). That the enciente was impossible owing to the increased range and power of guns, and the damage to private property which induced the civilian population to bring unfair pressure on the commander of the fortress.
- (2). Guns in exposed positions were useless, and must be either hidden or covered with armour or concrete.
- (3). The reduit or keep was useless.

The second lesson was the commencement of the idea to put the guns outside works and conceal them, *i.e.*, the divorce of the distant defence from close defence.

In anticipation of a further development in explosives and ordnance the cupola first made its appearance in 1864, but it was not generally adopted until much later, 1886, when the idea was brought out by Schumann. The idea was that all guns should be mounted in cupolas either fixed or disappearing, thus obtaining the protection needed, but it takes little imagination to picture the difficulties attending such a system of defence even if adopted in a simpler form.

The cupola has been subjected to the ordinary run of madness, and one, Mougin, prepared a design for a fort entirely underground, a mass of concrete resembling an enormous mushroom, from different parts of the surface of which emerged cupolas with their guns ready trained to fire. There were no soldiers required for these forts only mechanics.

Practical difficulties connected with the control of fire, arc of view, and the reduction in the rate of fire are the arguments against the use of cupolas, for the cost of one heavy gun in a cupola six firing *en barbette* could be provided.

Now, as regards the separation of the distant from the near defence which I mentioned just now, it means that the infantry garrison rifle fire should be entirely separate from that of the heavy artillery, and the present tendency is to make the redoubts for infantry only, with a few light guns for flank defence, while the heavy artillery is placed behind in the intervals hidden from sight in works or open batteries. The recommendations of the French commission in 1887 will show the trend of modern Continental thought on the subject of permanent fortification, which shows a remarkable change from Vauban's system. Principal line of defence :---

- 1. Point d'appui 3,000 yards apart with intermediate works to flank intervals, each capable of all-round defence.
 - The *point d'appui* are self-contained works with concrete shelters, magazines, and barracks.

The ditches are flanked by caponiers or galleries.

- Flanking fire on the intervals is provided from light guns in cupolas, hidden caponiers, or traditor batteries.
- Wire entanglements hidden under crest of the glacis under close fire.

Armament :---Four 75-m.m. and two 6-in guns.

The intervals are occupied by troops in a position carefully selected beforehand but strengthened only by fieldworks.

In their Frontier fortifications the French have adopted this system in two long lines from Belfort to Epinal and from Toul to Verdun, with a view to presenting impenetrable barriers behind which mobilization and concentration can be completed, and at the same time the line of likely approach of an enemy is confined. The late General Langlois did not believe in this and compared it to the action of a beaten dog which hides behind a piece of furniture for safety. He advocated a system of large entrenched camps giving freedom for manœuvre for a large mobile force.

The Germans, however, have adopted a different system based no doubt on their confidence in their large numbers and their ability to find the men their system demands. Along their frontiers they are forming enormous fortified areas. The forts forming the defence line are called Feste, and are in themselves veritable fortresses; but how different from the old enciente or the detached work of former days. Here the area of each may reach 150 acres—five times larger than was considered desirable formerly—and we see the logical result of former teaching, the distant defence quite separate from the near, cupolas used where best suited, a strong obstacle round the entire group. No pains or expense are spared to make even these enormous works inconspicuous. A glance at the diagram of Metz will give a good example of the trend of modern continental ideas (*Plate* 1.). Feste 7,000 to 10,000 yards apart and 14,000 from centre of city.

The following is a description by a French officer of the sequence of works one might expect to find if one walked through the lines of defence of a modern fortified area from the outside :—

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- (I). Advanced posts in front of main line.
- (2). Forts and intermediate posts of main line.
- (3). Main artillery position with expense magazines and shelters for the men.
- (4). Lines of railways connecting every point.
- (5). Reserves and main magazines.
- (6). 2nd line. 1st revision of original defence.
- (7). 3rd line. The original enciente.

The last example of siege against permanent fortification is Port Arthur. Without going into the details of the siege, let us see what bearings the lessons of the past had on the design of the defences.

Looking at the map we see that in 1903 the work done was :-

- (1). An enciente.
- (2). Six large works and six intermediate, in most of which were placed the guns of the defence.

We have seen already that encientes were condemned in 1870-71 and also that the placing of guns in conspicuous works was condemned in the Peninsular War, Sebastopol, and 1870-71. This is only another instance showing how slowly lessons in fortification are learned.

The redoubts were of conventional type, polygonal trace, with deep ditches flanked by caponiers and counterscarp galleries. The works also were considerably strengthened by auxiliary works. The importance of the correct selection of the point of attack is fully brought out. East and West Pan Lung Shan being forts in the main line were taken by the Japs on August 22nd, but these were of no use to the successful attackers and the importance of 303-Metre Hill was not recognized till some time after. After its fall on December 5th events followed quickly, and the capitulation of the fortress was signed a month after.

- (1). Denied the occupation of important points by Japanese.
- (2). Compelled the enemy to resort to siege works to reduce them.
- (3). Housed their garrisons and they were supplemented by field defences of all sorts.

The following points have been collected as interesting detail of the siege operations :--

Guns on conspicuous skyline were quickly knocked out.

The Japs mounted 18 11-in. howitzers in the field.

The Russians had similar heavy weapons in their coast defence but did not move them to the front. 4 ft. 6 in. of concrete was proof against breaching, and sloping concrete surfaces induced ricochets.

Fieldwork bombproofs were opened out even when made with the heaviest timber, their value was increased by placing iron sheets below the baulks.

The value of a ditch as an obstacle and the security against assault of any work with a well-flanked ditch is brought home, and the efficiency of the defence of breaches by a retrenchment is again emphasized after 100 years.

The principles to be applied to all schemes of fortification are :--Permanent fortification can only be required to gain time, and time is only valuable in so far as

- (1). The fortified state possesses resources which can be developed during the delay.
- (2). The resources of the enemy can be so far exhausted in the process of capturing the fortifications that the balance of power sways to that of the defender.

As regards the defence, the successful defence of a fortress has in no case depended upon the peculiarities of the trace of its works but always

- (r). On the spirit and capability of the commander and his troops.
- (2). On their supplies and water reserve.
- (3). On their reserves of ammunition.

From my remarks perhaps you have gathered that ever since the inception of the lines of Torres Vedras there has been a general wish to get more elbow room on the part of the defence in order to be able to get room to move; this we recognize as the birth of the offensive-defensive which is to-day's creed, and by looking at the diagrams of the various periods we can see how that desire has developed till culminating in Germany's Metz.

The isolated fortress is abandoned except in one particular case, *i.e.*, the barrier fort. This is a work usually placed in a particular position to bar a particular route and is specially treated both in regards infantry defence and protection to guns.

Sir G. Clarke's Redoubt.—According to Sir G. Clarke the new type of permanent fortification redoubt will be something of the nature shown in *Plate II.*, and it is probable that it is the sort of work we shall find on the Continent, namely:—Works which cannot be taken except by regular siege operations and assault.

I hope I have made it tolerably clear that if we are employed on the Continent, siege operations either in attack or defence will fall to the lot of the British troops, but I may not have explained why such operations cannot be done by the R.E. alone. History will tell us clearly they cannot, but a few details of the corps R.E. on this subject may be interesting.

Among the many units which the corps R.E. is composed there are 30 fortress companies, but of these six are entirely coast defence electric light, and of the remainder only 13 are at home; two only are allocated to siege works. The strength of each company varies with its station, but if mobilized for European war it is reasonable to suppose they would be about 160 all ranks. If they were all available to go to the front at once we would have a force of about 300 Sappers, with the field companies of the army in addition. Now at Port Arthur the Japs made 17 miles of approaches and parallels and 640 yards of mine galleries, and it is easy to realize how slow the progress must have been. In the construction of these works they lost 2,000 infantry and 1,000 Sappers, a very large proportion of what we have assumed as available, and they only attacked over 2 miles of front.

In the Crimca out of a total of 1,000 N.C.O.'s and men who went out, one-third were killed, wounded or invalided; 122 killed and wounded before Sebastopol. The strength of the Sappers at any one time there was about 500 men.

These two records show that in anything like operations of the first magnitude, such as a European war, the R.E. available will not go very far, and we must remember that it is not only in siege works and active operations they are required.

It is more than likely that half of the men I have assumed as available for Siege Operations will be required for the less exciting, but none the less important work on the Lines of Communication or in camp.

It is easy to imagine that, when a large army is occupied in the sedentary occupation of besieging, there is lots of time for officers of all ranks and branches to look round and consider what work is necessary for the efficient running of their respective jobs. Thus the P.M.O. will require permanent hospital buildings and all the accessory buildings connected with it, with drainage and water supply and light laid on. The P.V.O. will want something in the same nature but less elaborate. The headquarters will want offices. The A.O.D. and A.S.C. will require stores built, and after they are all supplied the Chief Engineer might ask for a complete set of shops and stores and tool dcpôts.

Another work which will certainly develop is the construction of Siege Railways. These, as you know, are required to supply ammunition to the siege batteries every day along a light line. The construction of this line may well entail engineering problems of a high order and very heavy work.

Besides railways there are roads throughout the camp which we all know are absolutely necessary as soon as an army sits down. Who do you expect to do all this work? There are only two probable sources of supply of labour, and one improbable-the troops and the inhabitants, and our allies! Are the inhabitants likely to wish to take our 5s. a day for work directly connected with the starvation of their brothers? The troops alone will be available. For all the technical and trade work there is no one available but the R.E. We must have tradesmen. Every R.E. officer, N.C.O. and sapper must at any moment be prepared to turn his sword or rifle into a measuring rod, and to revert from soldiering to engineering and back again as necessity arises. We are now enlisting a class of recruit termed a "pioneer." He is usually a tradesman's assistant, but not a tradesman. Will these men be useful in such an operation as I have sketched ? I think not. With our limited numbers we require every man to be a tradesman.

The R.E. are therefore required as much "behind the battle" as in front. As the numbers available won't go round we must have help from the rest of the Army. This help may take the following shape :--Horses from the cavalry; horses and explosives from the artillery; large working parties from the infantry. Will you be prepared to do this?

Co-operation of all arms is absolutely necessary in siege operations; and that army will do best which first recognizes that, like the forts and redoubts it is attacking, its various branches require mutual support, whether it be in camp, parallel, sap, mine, or assault.

BOOKS CONSULTED.

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A SIMPLE METHOD OF PILE DRIVING.

By LIEUT. G. LE Q. MARTEL, R.E.

The following short description of a somewhat novel method of pile driving, used by the 9th (Field) Company in the construction of a light bridge in the Repository at Woolwich, may be of interest.

The method used was to slide the monkey up the pile itself, and to drop it on a chock clamped near the foot of the pile by grip straps; thus making each pile serve as its own pile driver. The piles were $6-in. \times 6-in.$ timber and 20 ft. long. The monkey, A, was also a piece 6-in. \times 6-in. deal with a cross-piece at the top to take the weight which was I cwt. Straps of 2-in \times 1-in, iron passed round the pile and were bolted to the monkey to guide it up and down the pile. The chock, C, was made of 6-in. × 6-in. deal, and 3 ft. 4 in. long; two notches were cut to take the grip straps as shown in the figure. The grip straps were made of $2\frac{1}{2}$ -in. $\times \frac{1}{2}$ -in, iron, and the shoes of $\frac{1}{2}$ -in. plate. An iron bracket, B, fitted over the pile, and served to support, on one side, a snatch block for raising the monkey, and on the other, a steel wire which passed round the bolt of the lower grip strap. The steel wire was not used at first but was found to be an improvement in that it prevented any slipping of the grip straps, which occasionally happened when the piles were wet. Iron bands were fitted to the bottom of the monkey and the top of the chock."

The procedure was as follows :- The monkey (without its weight) was slipped on the pile, and the bracket B, the block, and the fall put in place. Three guys were then fixed to the top of the pile, and it was raised vertical and put in its place. The chock C was next fixed a sufficient distance above the mud or water, so that it would not be submerged when the pile was driven home. The weight was then fixed on to the monkey and the pile driving commenced. The total weight of the monkey was 140 lbs, and the drop 4 ft.; the piles were driven between 5 ft. and 8 ft. down. In one or two cases when the pile started moving sideways, it was found possible to correct its position, by leaning the pile over with the guys, driving a short distance, and then straightening it again; this of course could only be done when the pile had not been driven very far in. Sixteen piles altogether were driven and no difficulty was experienced. The average time taken erecting, driving and sawing the pile off to the right height was two hours, and seven men were required.

The disadvantage of this method is that, unless the piles are required to finish some distance above the surface of the mud or water, they must be bought longer than is required. On the other hand the top part of the pile is not in any way damaged, and can be used for other purposes when it has been sawn off.



The advantages are :----

- (1). No temporary trestles are required for the support of a pile driver.
- (2). No brushing of the ends of the piles.
- (3). It takes very little time to set up the pile driver.
- (4). The piles are easily guided straight.
- (5). The parts of the pile driver are simple to make.

EARLY INDIAN CAMPAIGNS AND THE DECORATIONS AWARDED FOR THEM.

(Continued).

By MAJOR H. BIDDULPH, R.E.

The utter rashness of the Afghan War was demonstrated still more plainly in the years immediately following, for the British were involved in hostilities with the powerful states of Scinde, Gwalior, and the Punjab in rapid succession; and it was through these territories that the lines of communication of the army in Afghanistan ran.

SCINDE CAMPAIGN, 1843.

The relations of the British with the Amirs of Scinde had not been very happy since the opening of the Afghan War in 1839; and the unsatisfactory state of affairs culminated in a treacherous attack on the British Residency at Hyderabad on 15th February, 1843. The escort of the Resident (Major James Outram) consisted of the light company of H.M. 22nd Foot, and in the river there were lying close by the two small steamers *Planet* and *Satellite*, and a flat. Outram withdrew his men on to these vessels without much difficulty, and joined Sir C. J. Napier who was on the alert at Halla 35 miles north-west of Hyderabad, and was already marching to attack the enemy.

On the 17th February he came into contact with them on the banks of the Fulaili Nullah at Mecance, 6 miles from Hyderabad, and after a desperate fight against a foe five times as numerous as his own force, defeated them with immense slaughter. His small force did not permit of much tactics; he advanced in echelon across the flat ground, and as the troops closed on the enemy, the Baluchis made successive charges at close quarters, but were slowly driven from the field with the loss of all their guns, etc. Hyderabad was entered on the 20th February and Scinde annexed on 12th March; but one Sirdar, Mir Sher Mohammed, still remained in the field with 20,000 men at Dubba, some 4 miles from Hyderabad.

Having been reinforced Napier marched to the attack, and found the Baluchis (as before) posted behind a nullah.

A preliminary shelling from the artillery, followed by an advance of the infantry, compelled the enemy to give ground; and the turning of both flanks by the cavalry turned the retreat into an utter rout. Troops engaged at Mecanee, 17th February, 1843.

9th Bengal Light Cavalry.
Scinde Irregular Horse.
Poona Irregular Horse* (detachment).
2-2nd Battn. Bombay Artillery.
3rd Company Golundaz, Bombay Artillery.
Madras Sappers and Miners (half C Company).
H.M. 22nd Foot.
1st Bombay Grenadiers.
12th and 25th* Bombay N.I.

Casualties :- 6 officers and 56 other ranks killed. 13 ,, 181 ,, wounded.

Troops engaged at Hyderabad, 24th March, 1843.

The corps at Meeanee, as above. 1st Troop Bombay Horse Artillery.† 2-1st Battn. Bombay Artillery. Remainder of C Company Madras Sappers.† 3rd Bombay Light Cavalry.† 8th and 21st Bombay N.I.

Casualties :— 2 officers and 37 other ranks killed. 10 ,, 221 ,, ,, wounded.

Garrison of Entrenched Camp at Dubba, 24th March, 1843.

Detachment 6th Bombay N.I. 15th Bombay N.I. Details from corps in the field.

At the attack on the Residency, 15th February, 1843. the Resident's escort (viz. the Light Company of H.M. 22nd Foot) and a naval force of some 110 men were engaged, on H.C.V. *Planet, Satellite* and a flat.

The casualties were insignificant, but the naval detachment received the Meeanee medal for the affair, although none of them were present at the battle two days later.

In the same way the crews of the H.C.V. Comet, Meteor and Nimrod (115 men in all) received the medal for Hyderabad, although stationed in the Indus, off Dubba, several miles away.

It is extremely doubtful if the 15th Bombay N.I. and those details from the 6th Bombay N.I. and other corps which garrisoned the

* Recently with England in Afghanistan.

† Recently with Nott in Afghanistan.

entrenched camp at Dubba, received the medal, although actually nearer the field of battle than the Indus Flotilla.

The total number of Meeanee medals struck is much greater than is usually supposed, being as under :---

H.M. 22nd Foot	65
Artillery	63
Sappers	14
9th Bengal Cavalry	2*
Scinde Irregular Horse	90
Poona Irregular Horse	14
1st Bombay Grenadiers	148
12th Bombay N.I.	153
25th Bombay N.I.	206
Miscellaneous	8
Indus Flotilla (Naval)	110

Here again the comparative rarity of the medal must be gauged by the number of European recipients, which (including officers) was some 120, of whom 40 were naval.

The European Naval medals for Hyderabad numbered 60.

All the Naval medals for this campaign seem to have been issued with the "China, 1842," suspender, and were impressed.

The medals issued to the Company's troops (European and Native) were indented on the rim, as a rule (apparently in India); while those of the 22nd Foot have block engraving.

Scinde, 1843.

Three medals, 1.4-in. diameter, silver.

Obverse .-- Crowned head of Queen Victoria.

Legend " Victoria Regina."

- Reverse.—(a). "MEEANEE 1843" within a wreath, surmounted by a crown.
 - (b). "HYDERABAD 1843" within a wreath, surmounted by a crown.
 - (c). "MEEANEE HYDERABAD 1843" within a wreath, surmounted by a crown.

Mounting.—Steel bar and clip for non-commissioned ranks; silver ditto for officers.

Ribbon.-Military ribbon of India, 13 in. wide.

N.B.—The steel bars and clips of the medals issued to the 22nd Foot were replaced by silver ones, by Colonel Pennefather; and this was also done very generally by other corps, European and Native.

* Returns not available (say 90).

Engineer Officers employed in the Campaign.

M.H. *Lieut. E. J. Brown, Ben. Engrs., Secretary to the Resident.

M.H. Capt. R. Henderson, Mad. Engrs. C Company, Madras Sappers & Miners.

M.H. Lieut, A. J. M. Boileau, Mad. Engrs. (

M.H. Major C. Waddington, Bo. Engrs.

H. Lieut. T. Studdert, Bo. Engrs.

- Lieut, C. A. Orr, Mad. Engrs. (did not receive a medal).

M. signifies present at the Battle of Mecanec.

H. signifies present at the Battle of Hyderabad.

GWALIOR, 1843.

This campaign was occasioned by the disturbances which followed on the death of the Maharajah. To overawe the disputants the Governor-General (Lord Ellenborough) mobilized at Agra and Jhansi an "Army of Exercise" under Sir H. Gough, the Commander-in-Chief.

The peace manœuvres however changed so rapidly to operations of war that the Governor-General, and four ladies who had come to look on, came under fire from the Mahratta guns.

The two wings of the "Army of Gwalior" fought battles independently of each other at Maharajpore and Punniar respectively on the same day, 20th December, 1843.

The British losses at Maharajpore were very heavy, as the infantry made a frontal attack on an entrenched position held by an enemy with a powerful artillery.

At Punniar matters were managed better. An attack by the British on the centre and left of the Mahratta position was completely successful at slight cost.

For both these battles bronze stars with silver insets were given, and Lord Ellenborough gave the four ladies present at Maharajpore gold and enamel stars of a special pattern, bearing the Queen's head.

For the succeeding operations in 1844, in the southern Mahratta country, no medal was given, nor for the operations on the Scinde Frontier which were of a most arduous nature, and which lasted till 1845.

Gwalior, 1843.

Two medals. A six-pointed bronze star, with silver inset. Reverse.—Quite plain.

Obverse,—(a). "MAHARAJPOOR 29th Decr 1843."

(b). " PUNNIAR 29th Decr 1843."

Mounting .- A bronze hook at the back.

N.B.-The stars were made from the captured guns. Later on most recipients added mountings of varied designs, and wore the medal with the "Military Ribbon of India."

The medals as originally designed had a silver elephant in the centre; but, on account of the expense of manufacture, a star was

* Present also at attack on Residency, 15th February, 1843.

substituted; and it is believed that Lord Gough was the only soldier to receive and wear the bronze star of the original design.

As in the case of the 1st Afghan War, no medal rolls for this campaign are available either in India or England, but in the case of the Queen's troops it is possible to verify their medals in most instances from other official documents, and sometimes those of Europeans in the H.E.I.C.S. The engraving on the backs of the stars is very typical and shows readily whether a medal is worth paying attention to.

Troops present at Maharajpore, 29th December, 1843.

Right Wing, Army of Gwalior, Lieut.-General Sir H. Gough, C.-in-C. Cavalry :--Major-General Sir J. Thackwell.

- 3rd Brigade :—Brigadier C. R. Cureton, 16th Lancers. H.M. 16th Lancers. 1st Bengal Light Cavalry.
 - 4th Irregular Cavalry (in reserve).
- 4th Brigade :-Brigadier J. Scott, 9th Lancers. The Governor-General's Bodyguard. 4th and 10th Bengal Light Cavalry.
- 2nd Infantry Division :- Brigadier J. Dennis, 3rd Foot.

3rd Brigade :-Brigadier T. Valiant, 40th Foot. H.M. 40th Foot.

- 2nd and 16th Bengal N.I.
- 4th Brigade :- Brigadier L. R. Stacy, 43rd B.N.I. 14th, 31st, and 43rd Bengal N.I.
- 3rd Infantry Division :- Major-General J. H. Littler.

5th Brigade :-Brigadier T. Wright, 39th Foot. H.M. 39th Foot.

56th Bengal N.I.*

- 6th Brigade (in reserve) :- Brigadier S. D. Riley, 62nd B.N.I. 62nd and 70th Bengal N.I. (not engaged).
- Khelat-i-Ghilzie Regiment (only flank companies engaged).
- Detachments of the 5th and 8th Bengal L. Cavalry, and one com-
- pany 39th B.N.I. were also present, probably as escorts.

Artillery :- Brigadier G. E. Gowan,

Bengal Horse Artillery :-- 2nd and 3rd Troops, 2nd Brigade.

2nd Troop, 3rd Brigade.

Bengal Foot Artillery :-- 1st Company 1st Battalion.

1st Company 4th Battalion.

- 2nd, 3rd, 4th Companies 4th Battalion (in reserve), also Native Reserve of 5th, 8th, 9th and 10th Companies 6th Battalion.
- Engineers :-- Major E. J. Smith.
- 3rd, 4th, 7th Companies Bengal Sappers and Miners.

^o The 3rd Battalion of this brigade, viz., the 35th B.N.I., was left at Agra.

Casualties :- 5 British officers and 101 other ranks killed. wounded. 654 ,, 34 ... 56 guns were captured. Among the killed was Major-General C. H. Churchill, C.B., Q.M.G., Queen's Troops, a Waterloo veteran. Troops present at Punniar, 29th December, 1843. Left Wing, Army of Gwalior, Major-General J. Grey in command. 1st Cavalry Brigade :--Brigadier A. Campbell, 9th Lancers. 2 squadrons H.M. 9th Lancers. 5th and 11th Bengal L. Cavalry (2 squadrons each). 2nd Cavalry Brigade :--Brigadier D. Harriott, 8th L. Cavalry. 8th Bengal L. Cavalry. 8th Irregular Cavalry. Cavalry, Bundelkhand Legion. 1st Infantry Brigade :- Brigadier W. A. Yates, 51st B.N.I. H. M. 3rd Buffs. 30th and 51st Bengal N.I. Bundelkhand Legion. and Infantry Brigade :- Brigadier R. Blackall, 50th B.N.I. H.M. 50th Foot. 50th and 58th Bengal N.I. Artillery :- Brigadier E. Biddulph. Bengal Horse Artillery :-- 1st and 3rd Troops, 3rd Brigade. Bengal Foot Artillery :---6th Company 6th Battalion. Engineers :— 1st Company Bengal Sappers and Miners. Sipri Contingent :- Brigadier O. Stubbs, 24th B.N.I. Casualties :- 2 British officers and 35 other ranks killed. wounded. 175 ,, 7 24 guns were captured. Officers of the Bengal Engineers present at Maharajpore. Major E. J. Smith, Chief Engineer. E. Sanders, Deputy Secretary to Government of India, ,, Military Department (killed). Capt. H. M. Durand, Private Secretary to Governor-General. Lieut. W. Abercrombie, Brigade-Major. T. Renny-Tailyour, Quartermaster. ,, C. B. Young. ,, S. Pott. ,, D. Campbell. ,, W. D. A. R. Shortt. ,, J. E. T. Nicolls. ,, Officer of Bengal Engineers present at Punniar. Lieut. J. H. Maxwell. N.B.-This list is perhaps incomplete.

(To be continued).





MEDALS



Lueit Col Sir G A Leach KCB RE

MEMOIR.

LIEUT.-COLONEL SIR GEORGE ARCHIBALD LEACH, K.C.B.

By the death of Licut.-Colonel Sir George Archibald Leach, K.C.B., on the 18th of June last, the Corps has lost its oldest member, and one who, though he retired from the Active List as long ago as 1861, on receiving an appointment in the Inclosure Tithe and Copyhold Commission, always took the keenest interest in matters connected with the Corps and especially its charitable institutions, in the management of which his residence in London since 1880 enabled him to take an active part. He died on the anniversary of the Battle of Waterloo which occurred only five years before his birth, and although he had entered his 94th year he was at the time of his death in almost complete possession of all his faculties, and able to take an interest in current affairs and enjoy the society of his numerous friends. The following sketch of his career may therefore be of interest to members of the Corps.

Covering as it does nearly 80 years of active life it is difficult to do more within the limits of one of these articles than briefly outline the principal incidents of his life. Much of his work for the Corps of comparatively recent years will have been recorded in the pages of the R.E. Journal and will be within the memory of most of the members of the Corps, so that it is proposed to dwell more upon such of his work as from lapse of years may not be so well known now, and upon a few details of his private life which will tend to illustrate his character.

Born on the 25th of April, 1820, he was the fifth son of Mr. Thomas Leach, Deputy Keeper of the Records, under his brother, Sir John Leach, the first Vice-Chancellor of England, and subsequently Master of the Rolls. In his early boyhood he had a strong wish to enter the Navy, but this was not approved by his parents and he entered the Royal Military Academy at 14, passing high, and obtained his commission in the Royal Engineers as Second Lieutenant on the 14th December, 1837, just after he was 17. In his batch there were several who became prominent members of the Corps, of whom the most distinguished was Field Marshal Sir Lintorn Simmons, who was just above him and with whom he always maintained a close friendship. Sir Lintorn only a month before his death in 1903 wrote to him as " his oldest living friend," after he had paid what proved to be a farewell visit at Blackwater. One only of the batch now survives, Colonel H. B. O. Savile, R.A., whose acquaintance Sir George had recently renewed and who is still active and vigorous at Clifton and was able to act as A.D.C. to Lord Roberts when he inspected the Clifton College Corps in 1910.

After the receipt of his Commission and the completion of his course at, what is now, the School of Military Engineering at Chatham, Lieut. Leach was, in accordance with his wishes, posted to the Ordnance Survey under Colonel Colby, and in May, 1839, reported himself to Capt. Tucker at the Survey Office in the Foundling Hospital at Dublin. He received his Commission as First Lieutenant in December of the same year. In 1841 he came to England in charge of the trigonometrical branch to erect and fix the trigonometrical stations for detail survey of the six northern counties, which was ordered to be commenced on the completion of the Irish Survey, then rapidly drawing to a close. In 1843 he returned to Ireland and was engaged in introducing and carrying out the method of representing ground on plans by the system of contour lines, now generally adopted on all the national surveys of the world as the only method by which the form of the ground can be delineated on maps with mathematical accuracy. He was also engaged in the revision of the maps of the northern counties of Ireland which, being the first done, were much less perfect than those of the southern counties.

Although he had naturally a good deal of travelling, his headquarters were at Londonderry, and he soon made his influence felt in the promotion of various local improvements. Old friends have often pointed to the clock on the Town Hall as one of his earliest efforts to supply a want in the city. He also had a great deal to do with the arrangements for a show of the Royal Agricultural Society of Ireland at Londonderry in 1847, and received a handsome silver claret jug from the committee in recognition of his services.

Like many other members of the Corps he married young, and in 1844 he married the eldest daughter of Mr. Edward Leigh Pemberton, a prosperous London solicitor who eventually succeeded his brother Lord Kingsdown at Torry Hill in Kent.

In his wife, who when quite a girl had been obliged to take the management of her father's household and large family, he had a real helpmeet. With comparatively small means and a rapidly increasing family of sons, they commenced at an early period the system of self-denial and spending very little upon themselves which was a marked characteristic of both their lives. Expenditure for the benefit of the sons was a different matter.

At Londonderry they made several close and intimate friendships which they kept up during their lives. Living at first in the city itself, they subsequently moved into a large house, which was in Chancery and which the owners were only too glad to have occupied at a
nominal rent. The grounds extended to the river Foyle and the proximity to the river enabled Capt. Leach, as he then was, to take up again the amusement of sailing which he had commenced at Chatham and which subsequently became his principal recreation. He had a small boat built which, to the delight and astonishment of his man, he showed to be unsinkable, and was able to pass many pleasant summer evenings on the river.

While at Londonderry he was employed by the Office of Woods and Forests to hold various local enquiries in connexion with Town Improvements Bills which were numerous at that period.

Between 1846 and 1849 the failure of the potato crops in Ireland produced widespread distress and famine; and relief works were undertaken under the supervision of strong local committees appointed by the lieutenants of counties at the instance of the Public Works Commissioners in Ireland, with whom the expenditure of the large sums authorized by Parliament rested. To ensure that the works undertaken would be of public utility and in districts where relief was required, various officers were appointed to report upon the proposals submitted by the local committees in the various counties, to endeavour to obtain contributions from landowners whose estates would be benefited, and generally to furnish information as to the state of destitution in the locality and the necessity for providing employment for the labouring poor. A special feature of the relief works was that the workmen employed were to be paid in food for themselves and their families.

During these years Lieut. Leach was actively employed on this service, and from the records which he kept it is evident that the work of deciding upon the merits of the numerous and often unreasonable applications made to the Commissioners was no easy task. He was employed principally in the south of Ireland, and he obtained credit for the way in which he discharged his duties.

In 1847 he received his promotion as Captain.

In 1849 he received a visit from Lord Macaulay, who had come to gather material on the spot for the account in his *History of the Siege of Derry*. In a letter which appears in *Lord Macaulay's Life* he refers to his introduction to Capt. Leach, "a sensible, amiable young officer so far as I could judge," and gives an amusing account of a visit to Boom Hall opposite the position of the celebrated boom, and his scepticism as to the origin given by his hostess of an iron ring fixed in a rock there, when he observed a similar one not far off. "I did not tell the good lady what I thought, but as soon as we had taken our leave I told Leach that these rings were evidently put there for the same purpose, that of securing shipping. He quite agreed with me and seemed to admire my sagacious incredulity a great deal more than it deserved."

Capt. Leach was moved to Belfast in 1853, but remained there

only for about nine months; long enough, however, to cement his friendship with Mr. John Mulholland, a keen yachtsman, afterwards M.P. for Downpatrick and the first Lord Dunleath. He was then the owner of a yacht called the *Hcroine*, but in 1865 built the celebrated schooner *Egeria* on which Colonel Leach, as he had then become, was a regular visitor whenever he could get away from his official duties, and with which his name was in consequence much identified. She was very successful, but her owner and Colonel Leach were never satisfied that some improvements could not be made; and after a season's racing the winter was much occupied in planning alterations and improvements. She was the first vessel to adopt the now universal topmast spinnaker, and Colonel Leach used often to describe the delight of the crew when it went up for the first time.

In the autumn of 1854 he was appointed head of the Irish Survey in Dublin, and moved to the delightful residence in the Phoenix Park at Mountjoy Barracks where the Survey work was done by about 20 Sappers and 100 civilians. He remained in Dublin for about six years enjoying the intimate friendship of Colonel Larcom, R.E., who was then Under Secretary for Ireland, and many other leading men in Dublin. He was employed a good deal in connection with surveys and the supply of maps for the Irish Encumbered Estates Court, and there first interested himself in the question of registration of title in connection with the sale of land.

While he was in Dublin the question of decorating the Wellington Memorial with bronze bas-reliefs commemorative of Wellington's victories was taken up, and three sides of the monument were done by eminent sculptors. The funds however were not sufficient to provide the fourth, and, at the suggestion of Sir Thomas Larcom, he was asked by Lord Carlisle—then Lord Lieutenant—whether he and his draughtsmen could furnish a design of a simpler and less expensive character. This was accomplished with marked success, and they received much credit for the work. The design now occupies the fourth side of the base of the column.

He took great interest in the Zoological Gardens there, and used frequently to attend the Saturday breakfasts of the committee at the gardens. He was also able to enjoy his favourite recreation of yachting with members of the two Kingstown clubs. The Royal Alfred Yacht Club was one of the first, if not the first, to establish Corinthian races where the crew was composed entirely of amateurs, and in these he frequently took part. With his old Derry friend, Mr. James Acheson Lyle, and others he began to discuss the possibility of a central association for yachting which should occupy the position of the M.C.C. at cricket and enable one code of rules to be framed instead of each club round the coast racing under its own rules. His family was now growing up. The three eldest boys had been sent to Highgate School where one of his brothers was a master, and it had been intended that the two elder should try for the foundation at Eton, for which their headmaster considered that they would have a good chance. A curious difficulty however arose at the last moment. The Statutes required candidates to be of English birth and both had been born in Ireland. They were therefore not eligible; but that the exigencies of the Service should produce such an effect was seen to be absurd, and an amendment of the Statutes was shortly after carried into effect.

The work which he had been able to do for the Landed Estates Court, and especially a report which he made as to improvements which might be effected in the system of registry of deeds and the work of the office, was regarded as of such importance that when he became Lieut.-Colonel in 1860 strong representations were made by the judges that it would be greatly to the public interest if he were allowed to remain in his position as head of the Irish Survey; and at their instance the matter was referred to the Duke of Cambridge as Commander-in-Chief by the Lord Lieutenant. The Duke, however, refused the application, partly on the ground that Colonel Leach's whole military service had been at home, and he was faced with the probability that he would have to go abroad, and in all likelihood as C.R.E. to Hong Kong.

This, with seven sons of whom the eldest was then fifteen, would have been a serious matter, as those of them who were at school would necessarily have remained at home without his aid and guidance ; and it was for his family one of the most fortunate events in his life that by the death of Colonel Dawson, R.E., a vacancy for an Engineer officer occurred in the office of the Inclosure Tithe and Copyhold Commissioners. He applied for and obtained the appointment and retired from the Army, commuting his half-pay for a cash payment under a then recent regulation. He was thus enabled to remain at home and direct and superintend the education of his children and the choice of their careers. He took up his residence at Highgate, and all his seven sons were educated at the school The holidays c devoted to the instruction of the schoolthere. boys in sailing, swimming, etc., frequently at Ryde, where one of his brothers was living, while his wife used generally to take the younger ones to her father's place in Kent.

At the Inclosure Office he soon made his influence felt. After the passing of Lord Westbury's Land Transfer Act, he rendered valuable assistance to the Land Registry Office in superintending the Survey and examination on the ground of properties which were registered and the preparation of the necessary maps. Shortly before his appointment, Mr. James Caird, an eminent agriculturalist and formerly M.P. for Stirling, had been appointed one of the Commissioners, and with him Colonel Leach formed a warm friendship which continued until the death of Sir James Caird, K.C.B., as he afterwards became, in 1892.

In January, 1878, Colonel Leach was appointed one of the Commissioners, joining Mr. George Ridley and Mr. Caird; and under their auspices with Lord Lyttelton, now Earl Cobham, who was appointed on the resignation of Mr. Ridley in 1880, the office acquired a well-deserved reputation not only for the work done by them in the administration of the numerous Acts of Parliament with which they had to deal, but for the assistance and advice which was always readily given to any one who had occasion to apply there. The importance of the Commission gradually increased as new duties were thrown upon them. Their title was changed in 1882 to that of the Land Commissioners for England on the passing of the Settled Land Act of that year, and eventually in 1891 the Commission was merged in the newly formed Board of Agriculture. The period had now arrived for Colonel Leach's retirement, but he was specially requested to remain to organize the new office as its first Secretary, with Mr. Henry Chaplin, M.P., as President. After serving for nearly a year under Mr. Chaplin he finally retired on the 31st December, 1891, though he continued to go to the office for some little time afterwards, to assist his successor who is now well known as Sir Thomas Elliott, K.C.B., and who only retired last year.

Almost immediately after his retirement he had the only serious illness in his life. He and his friend Sir James Caird, who retired at the same time, both had severe attacks of the then prevalent Russian influenza and the latter succumbed.

• In the Birthday Honour List of 1892 Colonel Leach's name appeared, and he received the honour of a Civil K.C.B. He had been made C.B. in 1889.

During the thirty years that Sir George Leach was at the Land Office he had taken an active part in many matters outside his official work.

On his connection with the two Engineer Charitable Societies, and the part he took in their management, it is hardly necessary to dilate as they are well known to officers of the Corps, but the Deed of Settlement of the R.E. Widows' Fund was largely due to his excrtions. He also interested himself in the incorporation under the Companies Acts of the R.E. Institute.

While at Highgate he became Churchwarden of the Parish Church, and a Governor of Highgate School, becoming Treasurer and Chairman in 1888. As the school was possessed of valuable property both at Highgate and in the City of London there was ample scope for his business capacity. He retained the chairmanship until 1908.

In 1875 the efforts of himself and his friends were crowned with success by the establishment of the Yacht Racing Association, to the Council of which he was elected as Hon. Treasurer, and held the office till 1887, subsequently becoming Chairman. The Association soon turned its attention to the framing of rules for the measurement of the tonnage of yachts, classifying them for racing and drafting a scale of time allowance so that yachts of various tonnages might compete together upon an equitable basis. The yachting editor of *The Field* and present Secretary of the Yacht Racing Association, in an obituary notice, has stated that the mathematical and scientific knowledge possessed by Sir George Leach proved of the greatest service to his colleagues on the Council in the construction of the tonnage rule and time scale in the years 1880 and 1881.

For a time the Royal Yacht Squadron continued to sail under its own rules, but after a few years adopted those of the Association, and when the Prince of Wales (afterwards King Edward VII.) became Commodore he became also President of the Yacht Racing Association. In that office he was succeeded, when he became King, by his present Majesty, who held it until he ascended the throne on the death of King Edward. Upon his resignation in 1910 Sir George Leach was unanimously elected to the office, an honour which he accepted with diffidence, but highly appreciated. On all the difficult questions which arose as to rules of rating and measurement of racing vachts he had been a frequent contributor to the columns of The Field and also on the one-sided conditions imposed with reference to the America Cup. He had contributed a chapter on schooner racing to the Badminton volume on yachting, and though never a yacht owner himself was through his association with Lord Dunleath and the Egeria a recognized authority on yacht racing. After serving for a good many years on the Sailing Committee of the Roval Thames Yacht Club, he filled at his death the office of cup bearer ranking after the three commodores.

In 1881 he had been asked to join the Board of the newly formed Taltal Railway Company, a nitrate railway in Chili, on which he served for over 28 years and for thirteen as chairman. After a good many anxious years he had the satisfaction of seeing it established on a firm financial basis and enjoying exceptional prosperity which it still continues.

His work with the Incumbered Estates Court in Ireland, and his connexion with the Land Registry Office in England led him seriously to consider the question of simplifying and cheapening the transfer of land in England, which, owing to the numerous interests arising out of the English system of land settlement, presents much greater difficulties than can arise in any other country. He gave valuable evidence before the Royal Commission on the subject and published a pamphlet setting out his views in 1878. Many points of his scheme have been adopted in the Land Registry Office.

At the election of 1865, when Lord George Hamilton and Mr.

Octavius Coope contested Middlesex against Viscount Enfield and Mr. Labouchere, Colonel Leach was Chairman of the Highgate Conservative Committee and Lord George Hamilton made his first political speech at his house.

In 1880, Colonel Leach left Highgate which had always been difficult of access from St. James' Square and moved to 6, Wetherby Gardens, South Kensington, where he resided till his death.

In 1889 his only daughter married Mr. Joseph Savory, then an Alderman of the City of London, who became Lord Mayor in 1891 and was most ably supported by his wife in the social duties of the office.

With the exception of a visit to Switzerland in 1869 Sir George had rarely left England. He had however been unable to refuse in 1885 an invitation from his friend and connection, Sir John Bateman Champain, R.E., to go out with him in a telegraph ship as far as Kurrachi, whence a line was to be laid in the Persian Gulf, and he was thus able to pay a visit to one of his sons at Roorkee and sec other places in India and Egypt on his way home.

His retirement from official life gave him the increased leisure to travel which he had always looked forward to.

In 1893 he paid a visit to his son Edward, then C.R.E. at Halifax, N.S., going on to an old Derry friend, Mr. Robert Orr, who had become President of the Chamber of Commerce at New York, and attended the races for the America Cup which resulted in the defeat of Lord Dunraven's cutter *Valkyrie*. He then went to Chili and made a thorough inspection of the line and works at Taltal which proved of use to him when he subsequently became chairman of the company. Always a good walker and fond of mountain climbing, he astonished the people there by his powers of endurance at 73, and returned across the Andes at a time when the non-completion of the Transandine Railway involved a long mule ride to connect the lines on either side of the Continent.

In 1894 he and his wife celebrated their golden wedding, and few couples can have been able to say with them that after fifty years of married life and eight children they had never had a break in the family. With sons in the Army, two of whom had seen a good deal of active service, it is even more remarkable. The first break occurred in the death of Lady Leach in 1896 after a short illness, to the great grief of her family. Quiet and unassuming, she possessed considerable strength of character, and her advice was often sought by members of her own and her husband's family, while her simple tastes and powers of management had proved invaluable to her husband in his carly days. In the lovely little churchyard at Sunningdale, near their daughter's home, they now lie together.

Possessed of wonderful vitality, Sir George continued during the next ten years his hold on the numerous associations and bodies

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with which he was connected, and made various expeditions including two visits to Switzerland, and a visit to Rome and Naples. His two last were an expedition to Sicily in 1905, and to Pau and Biarritz in 1906, in both of which he was accompanied by his two Sapper sons. Always of a hospitable nature, his house was available for friends and relations; and quite to the last he seldom heard of any old friends being in town without saying "We must ask them to dine " or " We must ask them to come and stay." Although his memory somewhat failed him during the last three years, he was always unwilling to give up any control over his affairs. In those of friends and relations he never ceased to take an interest. In fact his family found that the affairs of other people interested him in his later years much more than his own.

His last appearance in public was at the Corps dinner in 1910, when his son, General Sir Edward Leach, was the senior officer on the Active List, and Sir George replied to the toast of the veterans, laying stress on the importance of such gatherings not only, as the late Duke of Cambridge used to urge, in fostering *esprit de corps* but still more in keeping alive the brotherhood of the Corps. That the son who then and up to the time of his death was full of life and vigour should have been the first to go, no one who was present could have expected; and his sudden death cast a shadow over the last few weeks of the father's life.

This record of his life has, it is hoped, shown in some measure the special features of Sir George Leach's character, among which were pre-eminent the wideness of his sympathics, his conviction of the duty of personal service and the happiness conferred by it. Idleness or want of interest in life was incomprehensible to him, and if the work was for someone else, it was all the sweeter.

As regards the working of the Corps, he was a great believer in the system which prevailed in his early days of allowing any one who showed a special aptitude for any particular branch, to remain in it and acquire real proficiency in that branch, which was exemplified in his own case by his whole military career having been devoted to the Ordnance Survey. He often referred to what used to be the proud claim of the Corps, that if a man was required for any special work he could always be found in the Royal Engineers. He often interested himself in pressing the claims of members of the Corps and others whose services he considered had not met with due recognition.

A good judge of character, his sympathetic appreciation of honest work enabled him to inspire his subordinates with a similar spirit and to give him of their best, while his colleagues on the numerous boards and committees with which he was connected could always rely on any expression of opinion being received with courtcous consideration and good humour—which frequently disarmed opposition.

His powers of work and the care with which he studied all the circumstances of any subject that was to come under discussion, gave him a great advantage on all boards and committees and enabled him as a rule to carry his points. His chairmanship of one body was not inaptly described as a benevolent dictatorship which his geniality and the confidence he inspired in his colleagues led them cheerfully to accept.

Strong in his own opinions, he was always ready to admit that others were entitled to express their own, while his practical common sense and willingness to make concessions on matters which were not essential were invaluable to him. Combining tact with firmness and with a special facility for grasping the essential points of any topic under consideration, he was able to keep discussion within teasonable bounds; and, as one of his colleagues who had been intimately associated with him for many years wrote after his death, "When unexpected difficulties arose he at once met them with such skill, patience, and good humour, that they seemed quickly to lose their force, and he soon steered the ship into smooth water again."

In all the places where he lived his influence soon made itself felt in matters connected with local requirements or improvements, and in their social life he was always a welcome and leading spirit.

A striking characteristic of his life was his singular contentment with his surroundings and grateful appreciation of any service rendered to him, however small. The successes of his sons were a source of great pride and pleasure to him, and he took almost an equal interest in any promise shown or success achieved by other members of the family, particularly in the rising generation to whom he endeared himself by many kind and sympathetic acts. His love of children continued to the last and he had many little friends who always came to him with fcarlessness and confidence.

To conclude with a passage from the Masonic ritual, we may truly say of him that he nobly fulfilled the injunctions he received as a Freemason in his early days and that rising to eminence by merit he lived respected and died regretted.

G. PEMBERTON LEACH.

TRANSCRIPTS.

The following articles on "The Engineers of the Expeditionary Force" appeared in the April and October numbers of the Army Review. They are reproduced with the kind permission of the Controller of H.M. Stationery Office, as it is thought that they will prove of general interest to the Corps.

THE ENGINEERS OF THE EXPEDITIONARY FORCE. By LIEUT.-COLONEL F. B. MAURICE, General Staff, Staff College, Camberley.

THE DEVELOPMENT OF OUR ORGANIZATION.

The general policy upon which the re-organization of our Army, begun shortly after the South African War, has been based, may be summed up as, first, the provision of sufficient garrisons for our oversea possessions; secondly, the formation of an Expeditionary Force; and thirdly, the creation of a Second Line Army, primarily for Home Defence.

As soon as this policy had been formulated, the extent and condition of our military resources were investigated, and the functions of each part of our forces were examined with a view to creating an efficient and economical organization in time of peace which could be used with the minimum of change in war. As is well known, the broad lines of this re-organization have taken the form of divisions and brigades trained by those who are destined to lead them in the field.

The framework of this re-organization may be said to be complete in the sense that each division is composed of what is held to be the proper complement of the various arms and services, and that establishments have been worked out, both for the Expeditionary Force and for the Second Line Army. A great deal of work on matters of detail is, however, still going on. When our requirements had been determined and the existing material had been shaped to meet them, it still remained to consider whether we had obtained in every case exactly what we require in the most economical form.

If the history of the development of our military forces is recalled, it is not surprising that they should not in all cases fulfil this condition; indeed, it is astonishing that it should have been possible to create the new organization with so small a disturbance of existing formations and interests. Prior to the South African War, the Regular Army at home consisted of a reserve of military material of all kinds, from which expeditionary forces were created for each campaign as the emergency arose. The strength of this home reserve was determined much more by the requirements of our oversea garrisons, for whom reliefs had to be provided periodically, than by the conditions of any one of the military problems of the Empire. This system proved, on the whole, sufficient for our needs both during the Napoleonic Wars and the period of expansion which marked the latter half of the nineteenth century. In the

Peninsula, Wellington was able by the exercise of cautious skill to gain the time necessary to create and train the Army with which he eventually drove the French out of Spain. In the Crimea the theatre of war was so confined as to make small demands on the manœuvring power of our Army, and our lack of organization, serious as it was, could not altogether nullify the effect of the splendid fighting qualities of the British soldier. During the period of Imperial expansion which marked the latter half of the ninetcenth century we were engaged upon a long series of small wars, each fought under special conditions against an enemy with certain special characteristics. The impossibility of devising any one organization equally suitable for all of these cases made it a convenient policy to pool such of our military material as was not required for garrison duty abroad, and to form from this pool the force needed for each little campaign. Our enemies had little offensive power beyond their own borders, and in the majority of cases ample time was available to create the formations required. It was not until we were again faced by more serious military problems that the urgent necessity of having our military organization in such shape that it could be employed immediately upon the outbreak of war was everywhere appreciated.

In the meantime, a number of formations had grown up and developed which could not be placed as a whole in any modern military organiz-The cavalry regiments and infantry battalions had indeed ation. remained the fighting units for those arms, for the infantry regimental organization was purely administrative and in no way affected the war organization of the battalion. There was, therefore, little difficulty in grouping these smaller units together in formations of any desired size. But with the rest of the Army it was different. The remaining arms and services had been created in almost every case as corps, which included a certain number of military formations, but were never intended to take the field as a whole. These corps also contained a number of individuals not on the strength of any unit mentioned in war establishments. They had developed in most cases to meet the needs of the moment and not in accordance with any settled policy. Their subdivision therefore presented very considerable difficulties. All these difficulties have not yet been overcome, though most of them are in process of solution. The object of this paper is to examine this problem as it affects one of these corps which, perhaps, presents the greatest difficulties, namely, the Corps of Royal Engineers.

The question in this case is the more complicated because the numbers of the *personnel* of the Corps maintained in peace have never been based solely upon war requirements. For many years past the Royal Engineers have been the scientific pioneers of the Empire. Geographical exploration, surveys, frontier delimitation, and the construction of roads, railways and telegraphs on our frontiers have been, to a large extent, initiated and carried through by them. Further, the administration and execution of a large proportion of the public works, even of the more settled of our oversca possessions, have fallen to their lot. The result of this has been the growth of a Corps, the officers of which are altogether and the rank and file to a great extent highly-trained experts, and paid as such. Further, when the formation of field units of engineers became necessary, it was found to be extravagant to employ experts upon work which did not require great technical skill. Thus the periods of military training were cut down to a minimum, peace establishments were kept as low as possible, and the expert knowledge of the *personnel* was employed on work which had but a remote connection with their rôle in war.

With the formation of divisions the various arms have been brought much more closely into contact than was formerly the case. It is now recognized everywhere that each arm has its limitations and requires the assistance of the others to a greater or less degree to enable it to exercise its powers to the full. Co-operation in the attainment of a common end is the keynote of all higher training in the present day. Training in co-operation is carried out by bringing the arms together as much as possible, both for theoretical instruction and for practical work in the field.

DEFECTS IN ORGANIZATION OF OUR ENGINEERS.

Now this process has brought to light certain defects in the existing organization of those Royal Engineer units which form part of the divisions. In their case such work as the maintenance of barracks, the care of land and ranges and the preparation of camping grounds occupies time which is available in other branches of the Service, either for training in their own special military duties or for training in co-operation with the other arms. The Royal Engineers being a corps d'élile composed of intelligent men who receive a very thorough preliminary instruction, have been able to overcome to some extent the disadvantage of this enforced curtailment of the periods of military training which they undergo. The field units of the divisions have always proved more than capable of carrying out such engineer duties as have been allotted to them. But this is not in itself sufficient. General Brialmont, perhaps the most distinguished of modern military engineers, used to say to his young officers, "To be an engineer it is first of all necessary to be a tactician." Now tacticians are rarely born. Of all branches of the military art, tactics requires the most constant theoretical study and practice, above all, practice. As a preliminary it demands an accurate knowledge of the requirements and capabilities of each part of an army, regular and close study of the use of ground under every variety of conditions, and constant training with troops. No one has recognized this more fully than the engineers themselves, and the most that is possible under the existing organization is now done; for the fuller training which is necessary the engineer officers of our field units have neither time nor opportunity. Further, when they come out on manœuvres their units are even more of a shadow of what they would be in war than is the case in other arms. Efforts have recently been made to overcome this difficulty by attaching men of other arms, such as spare numbers of the Royal Garrison Artillery, to the engineer field units during the periods of combined training. This is obviously a pis aller, which admits the evil but does not provide a permanent cure.

Nor are these the only defects of the present system. Owing to the difficulty of obtaining engineer officers to take part during the winter in regimental exercises and staff tours, and of employing the engineer field units at their proper work throughout the training season, officers

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of the other arms get very few opportunities either of studying theoretically or seeing with their own eyes the work of Royal Engineers in the field. The obvious remedy for these defects is to give the field units of the Royal Engineers more time for their purely military work. But in order to do this it is necessary to relieve them of their other duties that is to say, some one else must be found to do these duties for them, and this will entail a very considerable increase in expenditure. Before this increase can be justified it is necessary to consider whether an equally good result cannot be obtained without it under some form of re-organization of the engineer services. To answer this question we must put past history out of our minds and inquire first what functions the engineers have to perform in war, and secondly, how the necessary numbers of engineers to fulfil these functions can be provided and trained.

OUR REQUIREMENTS IN ENGINEERS.

Taking the cavalry first, we require with the cavalry division an engineer headquarters and a certain number of field troops-our present establishment says four-a signal squadron and a wireless signal company. The field troops are required to assist the cavalry in the improvement of roads and other means of communication, in the passage of rivers, in placing localities in a state of defence, in helping to interrupt the enemy's communications by the destruction of bridges, railways and telegraphs, and in the preparation and maintenance of watering arrangements. They are equipped with tools and appliances for these purposes. None of these duties can be considered to be of a highly technical nature. Many of them, such as the passage of rivers, the defence of localities and the simpler forms of demolition, the cavalry are already trained to carry out for themselves. There is no reason to suppose that men of the same type as the cavalry trooper could not, if they were free to devote the necessary time to training in these special duties, reach the same standard of efficiency as that now attained by the field troops in the reduced period of training. The signal squadron requires only a small proportion of experts, the majority of its personnel being obtained in the same manner as the regimental signallers. In the wireless signal company we have a highly technical unit, the great majority of the personnel of which must be experts. In this case, therefore, a higher rate of pay in order to attract men of superior education and intelligence is justifiable.

With the divisions we require an engineer headquarters and a certain number of field companies. At present two are allotted to each division, but it is a matter for consideration whether a more convenient distribution might not be devised. We also require a signal company. The duties of the field companies are very similar to those of the field troops. They are needed to assist in the construction of works of defence, in the allotment of working parties, to improve and occasionally to construct roadways and bridges, to strengthen captured localities, to prepare and maintain watering arrangements, and to carry out demolitions. Again, none of these duties can be considered to require a high degree of expert skill. As regards the most important of them, the construction of defences, it is an accepted principle that the fighting troops must themselves be able to carry out all except the most elaborate forms of entrenchment. The field companies are only needed to assist in the more difficult work such as drainage, revetments and bombproof cover, where field defences are likely to be occupied for a considerable period. As in the case of the field troops, it cannot be said that there is any justification for employing experts—paid at expert rates—on such work as has been mentioned above.

Besides the engineers with the divisions there are a certain number of engineer units classed as Army troops. These consist of cable and air-line signal companies, the majority of the *personnel* of which are required to be expert telegraphists. There is also a bridging train, which consists merely of a reserve of bridging material, the labour for the construction and repair of bridges being obtained from other sources.

Lastly, we come to the engineer units required on the line of communications. These include a signal company, various railway establishments and companies, a works company and a printing company. The greater part of all these units must be experts, though whether it is necessary to maintain the whole or even a large part of this expert *personnel* in peace will be considered later.

In addition to the above there are certain technical units of engineers maintained for special purposes, but which are not included in the normal establishments of the Expeditionary Force. These include fortress companies and survey sections.

It will be seen that these duties can be divided roughly into two categories, those which are chiefly military and only partly technical, and those which are chiefly technical and only partly military. It will also be observed that those units whose duties are chiefly military belong to the divisions, and that those units whose duties are chiefly technical are employed either with the Army troops or on the lines of communication. This is for our purposes a convenient arrangement, for it is to the former that we wish to give more time for their purely military duties. But if we propose merely to relieve field troops and companies of the work of barrack maintenance and construction, so that they may be able to co-operate more fully than at present with the other troops of the divisions, we may be asked why we should pay a comparatively high wage to troops whose duties are no more technical than, say, those of the Royal Artillery, and at the same time provide some one else to do the work which was the only justification for increased pay. Such an argument would be unanswerable. It cannot be said that the military duties of field troops and field companies require greater skill or intelligence than does the handling of an 18-pounder quick-firing gun. We are therefore driven to the conclusion that if the whole time of the engineer field units is to be devoted to field work we must change fundamentally the conditions under which they are at present raised.

REMEDIES SUGGESTED.

In considering what those conditions should be we have the experience of others to guide us. Both in foreign armies, and to some extent in our Indian Army, pioneers have long been a valuable complement of the other fighting troops. Pioneers may be defined as fighting soldiers, trained in field engineering, who co-operate directly with the other fighting troops; engineers, in contradistinction to pioneers, being

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experts who, although they are combatants, are maintained for technical functions, and whose employment on other than technical work must be regarded as abnormal and generally undesirable. It is suggested that we should raise our field troops and companies on a pioneer basisthat is to say, that they should be raised and paid as soldiers pure and simple and not as experts, and should devote the whole of their time to their military duties. If a body of officers and men, recruited in a similar manner to, say, the Royal Artillery, and paid at the same rates, are free to devote the whole of their time to the duties which have been described above as pertaining to field troops and companies, there is no ground for supposing that they will be unable to attain to the standard of efficiency in their special duties which is now reached by the engineer field units, and we shall gain the great advantage that there will be time available for the higher training in co-operation with the other arms which is at present, to a great extent, lacking. There is good reason to expect that the saving effected by raising the engineer field units in this manner will enable us to provide without loss of efficiency for the peace duties which they at present perform. Some of this work is already put out to contract and carried out by civilian labour. It is reasonable to suppose that, if the whole of it were handed over to those whose livelihood depends upon their skill, it could be carried out with at least equal efficiency and economy. It may be well to follow the example of the ordnance factories and to establish a small Inspection Staff of military experts to supervise the work of the civilian contractors. This is a point which can best be solved by experiment. If it is proved to be advisable the responsibilities of the Royal Engineers should end with such inspection, for the purely peace work of construction and maintenance can only be carried out to the detriment of their military work.

If the *personnel* of the engineer field units is to be raised and trained as pioneers, it remains to be considered whether the existing system of training of the young officers of the Royal Engineers is that most suited to the changes here proposed. At present those who are ambitious of joining the Corps of Royal Engineers as officers join a military college in which they meet only candidates for commissions in the Royal Artillery. The aspirant to a Royal Engineer Commission begins to specialize to a great extent at once, in that more of his time is devoted to the study of mathematics, mechanics and chemistry than to general military duties. When he has completed his course at the Royal Military Academy he passes to the School of Military Engineering, where for two years his time is almost entirely devoted to specializing in engineer duties. Since the goal of military training is co-operation, it is at least doubtful whether the way to it is best prepared by separating the cadets and young officers of the various arms at the outset of their careers.

The writer once happened to be in a small German town when a party of some 50 under-officers, who were on a tour of instruction, came in to pass the night. The party consisted of a batch which was approaching the end of the course of training for commissions as officers. The medley of uniforms was striking, all arms and most of the services appeared to be represented. One of the under-officers, when asked whether the whole went through the same course of training together, replied : "Oh yes ! you see we must each know all about the tactics of the others." There

can be little question but that this is the true foundation of that camaraderie between the various arms in which we as an army are to some extent deficient. If Brown of the Engineers has served as a cadet side by side with Jones of the Artillery, Smith of the Infantry and Robinson of the Cavalry, he is more likely to keep in touch with them and to take an interest in their professional needs than if he only meets them casually at a later period of his career. As long as engineers are regarded as experts first and soldiers afterwards there may be good reason for early specialization ; but if the principle of devoting the whole of the time and energies of the field units to military training is accepted, the corollary seems to be that the engineer cadets and young officers should first of all receive a general military training in common with the other arms, and should not specialize until they join their units But it may be argued that it has already been admitted that we require a certain number of experts for special duties with the Army troops and on the lines of communication, and that the officers who are to perform these duties must specialize. There does not appear, however, to be any reason why those engineer officers who elect to serve in the technical branches should not be allowed to make their choice, as is at present the case with the Navy, after, say, two or three years' service, and should then begin their special training. They will certainly perform their special duties more efficiently, if they are equipped with a sound general military education.

This brings us to the question of the raising and training of the technical units. The most important of these from the point of view of the Expeditionary Force are those concerned with various forms of telegraphy and with railway work. But both telegraphy and railway work in almost all the forms in which we require them in war are the means of livelihood of certain sections of the population. It is obviously more economical for us to obtain our experts ready trained from civilian sources than to enlist men who know nothing of these businesses and to train them ourselves. On the other hand, we must be certain of obtaining our requirements immediately on mobilization. Again, all who are employed with an army in the field in any capacity must be to some extent disciplined, and have some general knowledge of military organization and of the conduct of war. Lastly, we require a certain nucleus of experts, more especially of telegraphists, to assist in the peace training of the remainder of the army.

In order therefore to strike the balance between economy in peace administration and certainty in obtaining our requirements in war, the best method would appear to be to form permanent cadres for these technical units and to fill the cadres on mobilization from those whose civilian occupations give them the technical training we require. To be certain of obtaining these men when and where we want them they must be enlisted in peace on what is known as a special reserve basis—that is to say, they engage in return for a retaining fee to come out when required and receive in peace a small amount of general military training. This method has already been adopted, mainly in the railway units, and is capable of gradual extension to almost the whole of the technical branches of the Royal Engineers. The size of the cadres of these various technical units can only be determined by experiment, for it must to a great extent depend upon the number of special reservists of the several categories which is forthcoming. An exception must probably be made in the case of the Survey Section, which is required to prepare in peace the maps for all possible theatres of war. As long as large areas in which we may have to fight remain unmapped, the establishment of the Survey Section must depend rather upon the amount we can afford to pay annually towards completing such work as remains to be done, and keeping such work as has been accomplished up to date, than on our requirements in war.

SUMMARY OF PROPOSALS.

To sum up, it is proposed that the engineer field units required for duty with divisions should be raised and paid as soldiers and not as experts, that the whole of their time in peace should be devoted to training in the duties which they will have to perform in war; that the technical units required for duty with the army troops and on the lines of communication should be maintained in peace as cadres only, to be completed on mobilization from special reservists enlisted from those whose civilian training gives them the necessary technical skill; and lastly, that all engineer officers should receive a general military education in common with the officers of other arms, those required for duty with technical units specializing after they have received such an education.

It is not suggested that the whole of these changes can or should be carried out at once. In our voluntarily enlisted army such modifications can only be introduced successfully as the result of slow and careful experiment. The effect upon recruiting, both of officers and men, and upon the requirements of the various parts of the Empire, must be scrutinized. Further, we cannot follow too closely the analogy of continental armies, for we must remember that those armies, with compulsory military service, are able to select for duty with their engineer units those whose peace vocations specially suit them for such employment. It may therefore be necessary for us to enlist a small nucleus of experts, such as smiths and carpenters, for duty with the pioneer companies if it is found that the necessary degree of skill in these crafts cannot be obtained in any other way. Lastly, in dealing with a body of men of the splendid traditions of the Corps of Royal Engineers we must be prepared to make a considerable sacrifice of logic to sentiment, which in any army-but more especially in ours-has a very real military value.

One thing is, however, certain, and that is that the days are past when the duties of the fighting soldier can be learnt by any one in his spare time. The sapper on the strength of one of our divisions must be recognized as being as much a fighting man as the trooper, the gunner or the foot soldier. Each is an essential part of the complete fighting machine. The successful conduct of a cavalry charge or of an infantry attack, the successful co-operation of artillery with the other arms, are as much the result of technical skill and high training as the work of the engineer troops and companies. Each requires the entire time and application of those who have to carry it out. A system which requires a portion of the fighting troops to devote a part of their time and energy in peace to work which has little connection with their duties in war is difficult, if not impossible, to justify under the conditions of modern war.

THE ENGINEERS OF THE EXPEDITIONARY FORCE.

By LIEUT.-COLONEL R. H. H. BOYS, D.S.O., R.E.

"N.C.O.'s and men should be given every opportunity to improve their trade and other qualifications. efficiency as a tradesman being an important qualification of a good sapper."—Engineer Training, 1912, Chapter 11., Section 8, para. 2.

It was a somewhat curious coincidence that in the April number of *The Army Review* an article on "The Pioneers of the German Army" appeared with Lieut.-Colonel Maurice's article on "The Engineers of the Expeditionary Force," as the information given in the former is useful in considering some of the arguments put forward in the latter. One knows that the views expressed by Lieut.-Colonel Maurice are held by some officers in the Army, and when they are put forward by an officer holding the position of Instructor at the Staff College, more especially when that officer is Lieut.-Colonel Maurice, they must receive very careful consideration. There is no doubt a great deal which is correct in them, but it is by no means certain that the proposals he puts forward would furnish a remedy to the defects in the present system which he enumerates, or that they would assist in meeting the requirements which engineers are required to fulfil.

Lieut.-Colonel Maurice admits that the Royal Engineers, as at present raised, have not failed in the duties which they have up to now been called upon to perform in war, though he seems to think this may happen in future. Before, therefore, we proceed to change an organization which has not hitherto failed, it is necessary to examine very carefully in all its bearings the effect of any alteration in it. It does not seem that this has been fully done in Lieut.-Colonel Maurice's article. The rôle of the engineers in war time is to assist the other arms to secure success, and any alteration in their organization which will enable them to carry out this rôle more efficiently will be warmly welcomed by the engineers themselves. There is no intention to claim that their present organization is incapable of improvement, and in this article it is only proposed to deal with the alterations Lieut.-Colonel Maurice suggests in order that the full effect of them may be realized.

First of all let us see to what he is referring. The article is headed "The Engineers of the Expeditionary Force," but it is stated that: "the object of this paper is to examine this problem as it affects one of these corps which perhaps presents the greatest difficulties, namely, the Corps of Royal Engineers." Are the "Engineers of the Expeditionary Force" and the "Corps of Royal Engineers" synonomous terms? An examination of the Army List will show that there are in the Corps of Royal Engineers many fortress companies, some field, signal and survey companies, and a colonial survey section which do not belong to the Expeditionary Force. The engineers with the Expeditionary Force consist of field troops, field companies, divisional signal

companies, army troops signal companies, lines of communication signal company, bridging trains, works company, railway companies and printing company. In addition, some of the fortress companies already alluded to are allotted for duty on the lines of communication as field companies pending occasion arising for their use as siege companies.

Let us, therefore, be quite clear what we are talking about before we set to work to re-organize the "Corps of Royal Engineers." It would seem that Licut.-Colonel Maurice in his article proposes to deal only with the engineers of the Expeditionary Force, although he mentions that: "In addition to the above (viz., the engineers with the cavalry, the divisions, and lines of communication), there are certain technical units of engineers maintained for special purposes, but which are not included in the normal establishments of the Expeditionary Force. These include fortress companies and survey sections." These technical units, which are thus somewhat casually referred to, form a considerable portion of the Corps of Royal Engineers, and they cannot be left out of account in any change of organization which is under discussion.

We will, however, put them on one side for the present and deal first with those units of Royal Engineers which are required with the Expeditionary Force.

Lieut.-Colonel Maurice divides engineer duties into two categories : viz., those which are " chiefly military and only partly technical," and those which are "chiefly technical and only partly military," and he states that those units whose duties are chiefly military belong to the divisions, and that those units whose duties are chiefly technical are employed either with the army troops or on the lines of communication. The military duties referred to apparently consist in co-operation with other arms, and the object of the remedies suggested is to obtain this fuller co-operation. The view that this co-operation is necessary before engineer units can properly perform the work for which they are intended will be agreed to by every engineer officer ; it is insisted on in Engineer Training, 1012, and no one will be better pleased than the engineer officers concerned if such fuller co-operation can be arranged. If, then, this point is so generally agreed upon, why is it not carried out? Is the reason that which Lieut. Colonel Maurice asserts, viz., that the employment of these units in barrack maintenance and construction prevents it ? To answer this question we must subdivide the engineer units with the divisions, and consider the field troops and field companies separately from the signal units, as the latter are never employed on barrack work, so any failure on their part in co-operation with other troops cannot be due to this cause.

It will be well before we start on this subject to have clearly in our minds what is the object of employing these engineer units on "barrack maintenance and construction." It is that the tradesmen in these units may have opportunities of keeping themselves efficient at their trades. The question of the necessity or otherwise of having tradesmen at all will be dealt with later, but assuming for the present that they are necessary, opportunities must be provided during their period of service for them to work at their trades in order that on return to civil life they may obtain employment as tradesmen. If such oppor-

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tunities are not given, you will not get such men to enlist. It is clear that if these opportunities must be given, the most economical way of doing so is to employ the men on work which would have to be done by civilians if the engineers did not do it. It is not, therefore, out of consideration for the work that the men are so employed, but that the kind of man who has up to now been considered necessary for the efficiency on service of engineer units may be obtained and may be kept fully trained.

Let us now take the case of the field troops and field companies. In Engincer Training, 1912, it is laid down that collective training begins on March 1st and ends on October 31st. The men are therefore only employed at their trades during the remainder of the year, and it is apparently these five months which are considered wasted as regards training for their military duties. What is the period of training of pioncers in the German Army? The middle of October to April 30th is with them occupied in recruits' drill, individual instruction, section, company and battalion drill, and only May 1st to the middle of October is spent in technical training. According to Engineer Training, 1912, March and April are with us spent in what may be termed purely military training, so it is clear that our units spend exactly the same number of months at their technical training as the corresponding German units If, therefore, this period is found sufficient in the German Army do. to acquire the necessary co-operation, why is it not so with us? It is difficult to understand how it can be due to the employment of the men of these units at their trades in the winter months.

I venture to suggest that the reason is very different, and lies in the difficulty of arranging effective co-operation with other arms in peace time. Those who have had to do it know the difficulty of giving the engineers any actual work to do on tactical exercises. Too often all that can be accomplished is the laying down of a tape to represent a trench, or the crection of a notice to say a bridge is blown up, the units waiting about all the rest of the day doing nothing, and the instruction so gained either by the engineers themselves or by the other arms with whom they are co-operating is of very little use. The way to overcome this difficulty is now receiving a great deal of consideration, not only from engineer officers, but also from the senior officers of the Army. It is a question beset with difficulties, owing to the conditions under which tactical exercises have to be conducted in peace time in this country. It is very rarely that ground can actually be broken, walls loopholed, or communications improved in peace operations; and when to this is added the fact that these operations are conducted so much more quickly than would be the case on service, and that, even when the necessary facilities exist, time does not permit of the actual work being done, it is clear that very little idea can be gained of what constitutes the work of the engineers. It seems probable, however, that since all those concerned are really endeavouring to overcome the difficulty, all that it is possible to do will be done. In any case the alteration in the class of man composing the units concerned will not affect the question of this difficulty one way or the other.

In peace time it is exceedingly difficult to realize what the work which

engineers have to do on service actually entails. This work is laid down in Engineer Training in general terms, but when it comes to carrying it out, matters present themselves in a different light. There is no doubt that a great deal of the work which field troops and field companies would be required to do-such, for instance, as the removal of obstacles, marking communications, etc.-does not require highly technical skill, and experts are not necessary for it. No doubt, too, that with sufficient training, men of average intelligence without any special trades would be quite capable of constructing a pontoon bridge. On the other hand there are very many of the duties in which technical skill is required. If a road on the side of a hill wants repair, a mason will be invaluable for running up a supporting wall. A pontoon is damaged : is not a carpenter necessary for its repair? In water supply is not a smith or fitter necessary to tap a main or repair a tap? Such instances might be multiplied indefinitely. Even a trestle bridge will be erected much more quickly and securely by men whose trade it is to deal with timber and fit parts together.

In this connection attention must be drawn to the present system of supply by mechanical transport. The supply columns are required to come close up to the divisions, and where mechanical transport is used many cases of improvement of roads and strengthening of bridges will doubtless occur. The demarcation of the limits of the lines of communication is not very clearly defined in this connection, but with divisions scattered over a considerable area the engineers of the lines of communication will be unable to follow up these supply columns everywhere, and any engineer work required to enable them to reach the troops will fall to the divisional engineers. This work must be done rapidly, and the advantages of men possessing trade qualifications with these engineers will then be great.

One of the many duties mentioned in *Engineer Training* is the organization of field workshops for the repair of tools, and tradesmen are a necessity for this.

Now let us see what is found to be required in foreign armies, and in doing so let us be certain that we are not making a mistake over the term "pioneer." Lieut.-Colonel Maurice gives definitions of "pioneers" and "engineers" referring to the duties which the two have to perform, and suggests that our field troops and companies should be raised and paid on a pioneer basis, that is, "as soldiers pure and simple and not as experts," by which presumably he means "as tradesmen." The question of pay will be dealt with later, but we must first see whether foreign armies consider tradesmen unnecessary in their "pioneer" units. Referring to the article on the pioneers of the German Army we find it stated that the majority of the men in pioneer units are "ferrymen, fishermen, deck hands, woodcutters, masons, bricklayers, smiths, carpenters and tailors." The Japanese lay down that a certain proportion of the annual contingents for their engineers must be of specified trades. In Russia, too, men with a trade are selected from each conscript contingent for service in the engineers.

If, therefore, foreign nations who have conscript armies make a point of putting tradesmen in their pioneer units, there must be a necessity for them. In such armies every arm will probably contain a number of tradesmen, and, provided the necessary tools are forthcoming, any unit, whether infantry, cavalry, or artillery, would be able to produce men capable of carrying out any ordinary job requiring technical skill. Unless, therefore, the need for tradesmen in the pioneers was specially felt, they would not take so much trouble to ensure that the large majority of these units were tradesmen. If this class of man is found necessary with them it will be more so with us. Are we to give no consideration to any warfare except in a civilized country in a temperate climate? Shall we always be fighting in a country where there is a community equipped with all the resources of civilization ? Lieut.-Colonel Maurice, in introducing the question of the functions which our engineers have to perform in war, says: "We must put past history out of our minds." Surely this is a novel and rather dangerous proposal. The British Army and the engineers with it have fought in nearly every country in the world, and is it certain that we shall never have to do so again ? In an uncivilized country the duties referred to as " chiefly technical and only partly military " become more than ever important, and the army whose engineers cannot carry them out will be badly off indeed. Of course war in a civilized country is our main consideration, but when those nations whose armies are organized solely for war in such countries find it necessary to fill their pioneer units by tradesmen, surely it is not sound for us, whose army is not unlikely to be required to fight in uncivilized as well as civilized countries, to alter our existing organization so as to abolish tradesmen from those of our engineer units which are required for the same duties as the " pioneer " units of foreign armies. Lieut.-Colonel Maurice seems to have overlooked the fact that a step in this direction has already been taken, and that a proportion of the men in our engineers at the present time are pioneers, that is, men without a trade. We must be careful to avoid any misconception on this point. When we speak of " pioncers " we refer to men without a trade, but this is not the case in foreign armies. The actual proportion of the strength of a field company in pioneers is not yet decided, but there is little doubt that it will be at least 33 per cent., and may be 50 per cent.

It is now necessary to see what it is proposed to gain by the remedies suggested. The advantages claimed appear to be two, viz :---

- (i.). That there will be more time available for training in co-operation with the other arms.
- (ii.). That the saving in pay between tradesmen and pioneers will be sufficient to cover the cost of executing by civil labour the barrack work done in the winter by the Royal Engineers.

As regards (i.), if the trade training is abolished, the only additional time gained will be the winter months between October 1st and February 28th. Training and Manœuvre Regulations, 1909, lays down that at home the first period of "individual training for officers and trained soldiers" consists of the four winter months of November, December, January and February. Infantry Training, 1911, Part I., Section 6, lays down the kind of training which is comprised under "individual training,"

and none of the headings are such that co-operation between engineers and infantry can in any way be practised. *Cavalry Training*, 1912, in detailing individual instruction, mentions field engineering as one of the subjects to be taught, but a reference to Section 156 will show that the training is to enable cavalry to carry out certain work "unassisted," so in this case co-operation is not wanted during this period. In *Field Artillery Training*, too, the technical engineering work to be taught under individual training is not such that co-operation will be of any use. It is difficult, therefore, to see how the proposal is going to assist matters in this respect.

As regards (ii.), we have to bear in mind that the conditions of our service are wholly different from those of conscript armies. In their case tradesmen are compelled to serve, whereas with us if we require to obtain such men we have to compete with civilian employment and offer such wages as will attract the class of man required. Even if we abolish tradesmen, the only saving effected will be the difference in pay between the sapper and the pioneer. There will be no saving in barrack accommodation, cost of rations, etc. Taking as an average that the sapper receives engineer pay at the rate of 1s. 4d. per diem (which is a fair average) as against the pioneer's 6d., the saving will be 10d. per diem, or £15 4s. 2d. per annum. Allowing for furlough of I month, the sapper works at his trade for 4 months, or say, 16 weeks. The amount saved over one pioneer will, therefore, not suffice to pay a civilian even fi per week during that time. The wages of civilian tradesmen are more than that, and in these days of trades unions the soldier will not get through less work than the civilian tradesmen in the same amount of time. It seems clear, therefore, that the statement that if the work now done by the sappers were "handed over to those whose livelihood depends upon their skill it could be carried out with at least equal efficiency and economy," is hardly borne out as regards the question of economy.

In his "Summary of Proposals" Lieut.-Colonel Maurice admits that "it may be necessary for us to enlist a small nucleus of experts, such as smiths and carpenters." In our Army we get no tradesmen to enlist as a general rule except in the Royal Engineers, and we shall not get them even in the Royal Engineers unless we afford them opportunities of working at their trades while in the service, so that when the time comes for them to return to civil life, they may be in a position to get employment as tradesmen.

The view that no tradesmen are necessary is clearly not the official view, as on reference to Engineer Training, 1912, Chapter II., Section 8, para. 2, there will be found the extract given at the head of this article, viz., "N.C.O.'s and men should be given every opportunity to improve their trade and other qualifications, efficiency as a tradesman being an important qualification of a good sapper."

It has to be remembered that so recently as IOII a committee presided over by Lord Kitchener was appointed to enquire into the organization and training of the Corps of Royal Engineers, and in their recommendations this committee put forward a proposal to introduce men of the pioneer type for a proportion of the strength of units, thus clearly showing that they considered tradesmen necessary for the remainder. A confirmation of the correctness of the official view will be obtained by asking engineer officers who have been on service whether they could have done the work they were called upon to do if they had not had tradesmen at their disposal.

Are we therefore once more " to put past history out of our minds ? " It is somewhat difficult to follow Lieut.-Colonel Maurice's argument when he states that the work of the field troops and field companies requires no greater skill or intelligence than does the handling of an 18-pr. quick-firing gun. Possibly it does not, but the two cases are not comparable. There is no trade in civil life that includes the handling of a quick-firing gun, so in any case that must be taught ab initio in the Service. No doubt it requires men of intelligence to learn it, but the skill is acquired in the Service. If there were such a trade in civil life, the Royal Artillery would surely enlist men of that trade. The question now under discussion is the amount of skill which is necessary in the engineers to carry out the duties required of them, and not when that skill is to be acquired. Lieut.-Colonel Maurice maintains that, as far as the field troops and field companies are concerned, nothing but the skill which can be taught in the Service is required. If any skill which is learnt in civil life is wanted, it is obviously cheaper to enlist the man with that skill than to teach it him after he has enlisted.

What has been said above refers mainly, of course, to the men, but there is also the question of the N.C.O.'s to be considered.

The engineer N.C.O. frequently finds himself on service in a difficult position, such, for instance, as the charge of a small party without an officer, when he is expected to carry out all the engineer work required by the troops with whom he is. More often still he is placed in the position of supervising large working parties, or he is sent to carry out some technical job without an officer being present to tell him what to do or how to do it, and similar situations such as these might be multiplied indefinitely. It is necessary, therefore, that these N.C.O.'s should be men of superior intelligence, good education and ready resource, and such men are more likely to be found from among the tradesmen class. Do away with this class and introduce solely the pioneer class and you will very soon fail to get the kind of N.C.O. you must have if engineer work is to be satisfactorily carried out. This is quite apart from the question of a N.C.O. being personally skilled in some special trade, and the advantage of this when it becomes necessary for him to lay out and supervise work to be done by others can only be experienced to be understood.

We have, so far, only dealt with the work of field troops and field companies, and as the question as regards the training of officers refers to all classes of units, we will leave it to the end, and consider next the question of signal units. Among these we have the signal squadron, divisional signal companies, the army troops companies and the lines of communication company. The divisional signal companies are not specifically mentioned, but must apparently be considered in the same way as other signal companies. These, Lieut.-Colonel Maurice does consider as "technical units," but he seems to think their duties are all of the same nature, and he states that all the forms in which we

require them in war are the means of livelihood of certain sections of the population, and that it is consequently only necessary to maintain them as cadres in peace time.

It is difficult to understand how such a statement could be made, and it would be very interesting to see a divisional signal company, composed solely of operators and linemen straight from the General Post Office, attempting to run the communications required by the divisional commander during some tactical operation. The work required of the N.C.O.'s and men of these companies bears no resemblance to the work which the men in the General Post Office do in their daily occupations. Divisional signal work requires the most constant training on the part of all ranks concerned before it can be efficiently carried out. What is still more important, unless all the three detachments of No. 1 Section of the company are available at the same time, a very wrong idea is obtained of the actual use to which such a company can be put in war, How then can useful peace training be got with such a company if there is only a certain nucleus of experts? The whole object of the proposals put forward is to obtain better co-operation between the engineers and the other arms, and yet their adoption in this case would absolutely prevent such co-operation taking place.

Then as regards the army troops signal companies, though their work does not always require to be carried out with the same celerity as that of a divisional signal company, it could no more be carried out by men straight from the General Post Office than could that of those companies. A visit to a signal office at headquarters on manœuvres will give anyone an idea of the amount of organization and training necessary before it will work smoothly. It is impossible here to enter into all the technical details which prevent the men of the General Post Office being fit for work in the field without previous training, but one point may be taken as an example : operators in the General Post Office have no knowledge of the connections of instruments, and when their circuits go wrong in the Post Office they wait till the testing officer or lineman comes to put them right. This, of course, is an impossible procedure in the field ; and many other examples might be given.

It is not meant to imply that the men of the General Post Office cannot be utilized in any way for work in the field, but it is certain that before they can be so used they must receive special constant training, and that if the army troops signal units depended on cadres made up to war strength by men direct from the General Post Office the Army Signal Service as now organized would break down. As with the divisional signal companies so with the army troops units, the proposal prevents any training in co-operation with the remainder It has never been claimed that an infantry soldier is of the army. capable without any training of doing a gunner's duties, or that a gunner is capable of doing a cavalryman's duties because they are all soldiers, and it is not clear why it should be thought that General Post Office officials can do the work of the signal units because they are all telegraphists. The mistake may be pardoned in the latter case, as no one who has not had intimate connection with both branches can really understand the difference, but that does not render it any less a mistake. What has been said as to the signal units mentioned up to now refers in an even greater degree to the units which use wireless telegraphy; these are the signal squadron and the army troops wireless company. The men of these units must not only be trained in the pattern of apparatus they are required to use, but must be kept in constant practice with it. Moreover, there is no source at present available from which wireless operators can be obtained on mobilization; so, even if the men to fill up the proposed cadres were suitable, they are not obtainable. Wireless working in the field requires much experience, not only on the part of the engineers, but on the part of those in higher command who have to utilize it, and to make either the signal squadron or the army troops signal company only a cadre in peace time would effectually prevent any chance of this experience being gained, or of any assistance being given in the peace training of the remainder of the army.

All signal units now include a proportion of pioneers, and there is also a special reserve of telegraphists enlisted on exactly the lines that Licut.-Colonel Maurice refers to. Our signal service is as complete as the communication service of any other nation, but no communication service will be efficient in war which is not maintained in peace time in a high state of training, not only on the part of those who have to work it, but also of those who have to use it, and the proposals put forward will effectually prevent any high state of training being obtained.

The bridging trains we need not refer to, as they are only a cadre in peace, and in war only consist of the necessary transport to move the bridging material about, with a small *personnel* to keep it in order. The *personnel* for the construction of the bridges is found by the field companies of the divisions.

We now come to the lines of communication units. These consist, as Lieut.-Colonel Maurice states, of a signal company, railway companies and railway transport establishment, works company, fortress companies and printing company. The signal company does not exist in peace time, so it need not be referred to.

The functions of the works company are to provide a skeleton military organization for work on the lines of communication, which would include all engineer works services, such as road-making, hutting, sanitary or water supply along the lines of communication. This company also forms workshops and works depôts for dealing with special engineer material. Lieut.-Colonel Maurice agrees that this is one of the units of which the greater part must consist of experts, and as its peace establishment is not large, it does not seem that any considerable change is proposed with regard to it.

The printing company is organized to carry out the printing, lithographic and photographic work required by the army in the field and on the lines of communication. The conditions under which such work is done in the field are very different from those in civil life, and the *personnel* must be thoroughly trained in peace time. This is arranged for by their being split up among the different stations where such work is mainly required. The number of the peace *personnel* is small, and as it is largely employed doing work which would otherwise have to be given out to civilian firms to do, there would be little saving in expense if this *personnel* were reduced, and the advantage of the necessary training would be lost. It is obvious that no one but experts could be employed in such a company.

As regards the railway companies, their work is of a highly technical nature for which experts are a necessity, and the problems which face the railway engineer in war are not altogether similar to those which have to be solved by the civilian engineer in peace time. Training in peace is therefore a necessity, and as the peace strength of these units is small compared to their war strength, they are but little more than cadres.

The railway transport establishment does not exist in peace time, so would not be concerned in the proposals under consideration.

The fortress companies are not specially organized for lines of communication duties. They are trained for siege work and are employed on general engineer work on the lines of communication only so long as they are not specially required for the work for which they particularly exist. Siege work is of an exceptional nature and obviously requires men of various trades specially trained, so that the proposals now under consideration are not applicable to these companies.

As far, therefore, as the lines of communication units are concerned, we see that the conditions which Lieut.-Colonel Maurice desires to have adopted are already to a large extent fulfilled, and that loss of efficiency would occur if further alterations on the lines he suggests were made.

We must now consider those other engineer units which do not form part of the Expeditionary Force, and to which reference has already been made as forming a large part of the Corps of Royal Engineers. As before stated, it is not very clear whether Lieut.-Colonel Maurice proposes to refer to these, but they seem to be all swept into his general proposal to have nothing but cadres for all units except the field units. If this is so, the proposal does not seem feasible, as it brings in the difficult question of service abroad apart from that of technical requirements. Of the units in question r signal company, 3 field companies, 15 fortress companies, and the survey section are serving abroad, and it is obvious that these cannot be reduced to cadres. There must be a number of similar units at home with which the *personnel* can be interchanged, and it follows, therefore, that as far as these units are concerned, the proposal to form them into cadres falls to the ground.

The survey companies are in peace employed on the Ordnance Survey, doing work which would otherwise have to be done by civilians, so that there would be no financial gain by converting them to cadres.

There only remains to consider whether the *personnel* of any of these units could with advantage be changed to pioneers.

As regards the signal company and field companies, the same arguments apply as in the corresponding units of the Expeditionary Force, and clearly it cannot be done in the survey units.

As regards the fortress companies, a large part of their duties consists in maintaining and working the defence searchlights of fortresses, and this work requires technical skill of a special nature which the pioneer the man with no trade—could not perform. The remainder of their duties are concerned with the maintenance and repair of barracks and fortifications. The conditions abroad are entirely different from those at home, and even in those places abroad where civilians could be employed on the execution and repair of the defence works in war, these civilians would usually be natives who must work under military supervision, and a man with no trade will be little use in supervising the work of a native tradesman. In some places it might not even be possible to employ civilians at all in war time on such work, so in any case tradesmen are a necessity in these units.

The question of the N.C.O.'s is the same with regard to all these units, as it is in the case of those units we have already considered, so it is unnecessary to refer to them again.

There now only remains the question of the officers. Lieut.-Colonel Maurice proposes that all engineer officers should receive a general military education in common with the officers of other arms, those required for duty with technical units specializing after they have received such an education. Again we suffer here from want of explicitness. What exactly are the units referred to in which it is proposed that officers with no technical education should serve? Presumably the field troops and field companies. The proposal apparently is that the officers for these units are only to receive a general military education, and then to pick up their technical education as best they can in their units. It cannot surely be denied that technical knowledge is necessary on their part, as even if technical skill were not required from the N.C.O.'s and men, the officers who have to decide on and direct their work must have technical knowledge. For instance, before you can encroach on or extend an existing water supply the officer concerned must have a knowledge of water systems, otherwise serious results may ensue to the supply on which the Army depends. It is the same with drainage. Does the making or repairing of a road require no technical knowledge ? Similar instances might be mentioned in nearly every piece of engineering work which has to be carried out. The control of all such work, whether in the field or otherwise, requires a knowledge of principles-principles not only of one kind of work, but of all kinds of engineering work, and those principles cannot be picked up. It is somewhat interesting to hear it suggested that engineer officers have too much technical knowledge, as one so frequently hears many witticisms directed at them and their work on account of their supposed deficiency in such knowledge.

The officers of field troops and field companies are apparently the only ones which it is proposed should not be technically trained. It therefore follows, if this proposal were adopted, that officers once in these units would have to remain in them. They would not be interchangeable with the officers of what are referred to as technical units. Here, then, we are face to face with that difficult question of a small body of officers who have to be kept to special work forming practically a separate corps by themselves. Surely the undesirability of such a condition is sufficiently well known by now to need no further elaboration here.

All other officers are to receive technical training, though whether that of the signal units is to be separate from, for instance, that of the

railway units, is not clear. If that is the intention you are evidently forming more separate bodies of officers, until the whole of the officers of the Royal Engineers will be divided up into several small classes, none of which will be interchangeable. Is there anyone who will say that such a condition of things will be a change for the better?

The question as to whether it will be preferable to commence the training of the cadets for all branches of the Army at the same institution is a matter of opinion. It may be so, though it seems doubtful whether the advantages claimed by Lieut.-Colonel Maurice will be obtained. Cadets of the Royal Artillery and Royal Engineers are now trained at the Royal Military Academy together, but there is no clear indication that when these cadets become officers the Royal Engineers take more interest in the professional needs of the Royal Artillery than they do in those of the other branches and vice versa. The proposal would cause a complete re-organization of our present system of training cadets and involve a considerable sum of money, but the desirability or otherwise of it is hardly a matter which concerns this article. One thing alone remains clear-that no matter at what period of their service it is given, officers of the Royal Engineers must receive a thorough technical training.

We have now dealt with all the questions raised by Lieut.-Colonel Maurice. It may safely be said that the Royal Engineers do not want a "considerable sacrifice of logic to sentiment" in such a case as this. They want the question judged by hard facts, but before it is judged they want the whole of the issues involved made clear. If, when this is done, it is proved that the Service will gain by such changes as are proposed, no one will be readier than they will be to see them adopted.

It is difficult to see how the proposals put forward will help to solve the question as regards the co-operation between the engineers and the other branches of the Army, and they will undoubtedly raise many other difficulties and involve consequences which will have very far-reaching and damaging effects. The Corps of Royal Engineers must be considered as a whole and not as so many separate compartments. Let us, therefore, be very certain, before we alter the organization of the Corps with a view to obtaining an improvement in one particular point, that we are not imperilling the efficiency of the whole. This is what seems likely would be the effect of the suggestions put forward, without any guarantee that the improvement in the one particular point desired would be attained.

REVIEWS.

"VESTIGES OF OLD MADRAS."

(THE INDIAN RECORD SERIES).

By COLONEL H. D. LOVE, R.E.

THE Government of India, in determining to publish, for general information and without reservation, the records of the oldest of the Presidency towns, has been exceedingly well advised. Sir Richard Temple's handsome volumes on the administration of Streynsham Master have now been followed by Colonel Love's monumental work, and it is difficult to speak of this too highly. It has evidently been a most laborious undertaking, requiring years of research and entailing much wearisome copying of old documents; but in the end the author has succeeded in producing volumes which will form a standard of reference for all time. Confronted with an enormous mass of documents relating to every conceivable subject, he might have given us a volume of excerpts bearing on the historical and political occurrences of the period concerned (1639 to 1800 A.D.); another dealing with the topography of the city of Madras; another on military subjects, fortification, the army and the like. Each of these would no doubt have been of great value in itself and for its own purposes; but the effect on the public mind would have been different to that produced by a perusal of the present volumes. There would have remained a feeling of selection-a feeling that though much had been learnt much remained to be learnt-an impression that the reader had not quite got behind the scenes. This has all been removed by Colonel Love's judicious procedure. He proceeds chronologically for the most part, only grouping subjects together for a few consecutive years so as to avoid overmuch patchwork, and he publishes everything with merely a running comment and without any attempt at criticism or explanation. Each individual is left to form his own opinion on the facts; and it is exactly this quality which will make the work of such value to the Indians of to-day. They may distrust the statements of a historian and may doubt his accuracy or traverse his conclusions, but in this case they are introduced to the innermost minds and thoughts of the English merchants who dwelt in their midst, and the reasons for their actions ; and they will be enabled to trace the growth of

British power from its inception equally with the growth of every street and suburb of the city of Madras, not because someone *tells* them how these grew, but because they can see it with their own eyes. For in these volumes we have the original records, nothing is concealed, nothing brought into undue prominence; and after a perusal of them the reader is left with the satisfactory sensation that now at last he has clear vision, and can understand the reason for many things that hitherto have remained insufficiently explained.

From the point of view of politics it is not too much to say that the old Madras Records will stand as a sort of message to the world. A number of well-meaning but ill-informed philanthropists are never tired of asserting that the English went to India filled with the lust of conquest, and that their behaviour to the people of the country has always been that of conquerors towards the conquered. They affect to believeperhaps they do honestly believe-that our empire in India is only maintained by what they call "British bayonets." And almost to a man the Indians themselves, being an entirely unhistorical race and absolutely ignorant of the truth, believe that up to the time of the arrival of the English all India lay under the government of a magnificent Hindu emperor, that all the arts and sciences flourished in the country, that all the people were happy, and that all were prosperous and well-This glorious condition, they say, was put an end to by an to-do. English invasion which effectually ruined the country. Filled with these ideas and naturally disliking the government, however beneficent, of an alien race, it is no wonder that they dream of a possible Utopia when this splendour shall be returned to their beloved land. This false belief is at the bottom of the unrest that has done and is doing so much harm in India.

The volumes before us afford a complete and triumphant answer to such vain imaginings. For more than a century and a-half after they had obtained from the local Hindu Governor, or Naik, a grant of land with a village or two standing on it, on which they constructed their first fort for the protection of their merchandise, the English relations with the Indians were such that their settlement became a place of refuge for all grades and classes, a place to which they fled for relief from the insufferable chaos and anarchy existing in all the country round them. One of the reasons which influenced the Naik in making the original grant was that he might have such a place near at hand to which he might resort when hard pressed by his foes. For all that long period the people of Southern India lived as best they could under conditions of almost inconceivable political confusion ; and they flocked to Madras in such numbers that the population of that place increased in 50 years from 7,000 to 400,000 souls. Is it likely that they would have done so had they not looked on the English as their friends? Time after time the struggling rulers sent their families there for safety, and in the later years the Muhammadan Nawab himself took up his residence there and built himself a palace within range of the guns of the fort. As regards the Naik's original grant in 1639 we have his own reasons given for permitting the English to settle. The merchants write to the "Honble. Company" in London stating the terms of the grant, and adding (Vol. I., p. 20) :--

"They are fayre priviledges; and may be questioned why hee should make us these fayre proffers. 'Tis Answered by himselfe. First, he desires his Countray may flurrish and grow rich; which he Conceives it will by Draweinge Merchants to him. Secondly, hee desires for his money good Horses from Persia. Thirdly, that yearly upon our Shipps hee may send a servant into the Bay Bengalla, to buy him Hawks, Apes, Parratts and such-like bables [baubles]; . . And lastly, the fort, being made substantiall and strong, may bee able to defend his person on occasion against his insultinge Neighbours."

In 1692 the President at Madras reminded the then Grand Vizier of the Mogul Emperor of the terms under which the villages had been acquired—" Wee did not take them by force you well know : it was by your Order " (Vol. I., p. 579).

In order thoroughly to understand the appalling confusion and misery that prevailed in the country during the entire period from 1639 till peace and good order were established by the English after the defeat of Tippoo Sultan, it will be well to summarize in a few words the progress of politics. Full and interesting details will be found in the Records themselves. The territorics now comprised in the Madras Presidency, measure about 150,000 square miles and are therefore about a third larger than the British Isles. Down to the 14th century they had been governed by several different Hindu monarchies, but never by one sovereign. In that century all the Hindus of the south were drawn together, terror-stricken at the near approach from the north of the dreaded Muhammadan conquerors. United under the Hindu sovereign of Vijayanagar they kept the foe at bay for two centuries, but in 1565 were completely defeated and their capital destroyed. The King, generally called "The Rāya," fled southwards and took up his residence at the fortress of Chandragiri about 70 miles N.W. of Madras, reduced almost to the position of a mere titular monarch; while the whole country was plunged into confusion and anarchy by the wars of a number of local chiefs, each striving for independence. When the English merchants arrived on the coast they found Southern India seething with strife, and in this condition it practically remained for a century and a-half. North of the Krishna River were five distinct Muhammadan kingdoms tearing at one another's throats. Supreme over them in name, but with little power, was the Mogul Emperor of Delhi, who was opposed to them all as being rebellious vassals. South of that river the whole peninsula was a battle ground for the levies of the several Hindu leaders, who also were often opposed by their own sovereign. Each of these contending parties had his own army, which wandered over the country plundering the villages and living by exaction. The principal Moslem armies whose doings affected the south, were those of Golkonda and Bijapur. Golkonda had seized territory north of Madras and was pressing southwards, being opposed by local Naiks (chiefs) and the Army of the Rāya.

The principal chiefs, holding their territories nominally from the Rāya, rented out the several tracts to "Naiks." These in turn farmed out the villages. When in want of money the Rāya pressed the Naiks, and these harried the village farmers for the Rāya's as well as for their own supplies. The village headmen could do no less than plunder the villagers, so that these lived in misery and destitution. Writing about the English settlement at Armagon north of Madras in 1639 the Agent told the Directors that the Hindu merchants there were "miserable poore" *owing to "the Naigue's continuall forcings"; and again in a later letter said :--

" That Naigue soc pills[†] and pols the merchants that they are not able to Comply with their Contracts."[‡]

To add to the confusion the Mogul Emperor Shāh Jahān took the field against the rebellious Shāh of Bijapur and defeated him in the north, while the latter's southern forces ravaged the country of the Hindus and seized part of Mysore. He granted a large estate to the father of the great leader Sivaji, and so laid the foundation for the power of the Mahrattas. This was in 1637. It was in the midst of all this turmoil that the English obtained their first settlement at Madras in 1639. Three years later the Golkonda Muhammadans advanced southwards towards Madras annexing territory as they came, and the Madras Councillors write of "Warrs and broyls increasing in this Countrey" and drawing near to them. In January, 1643, they report :

"This Countric being all in Broiles, the old [Hindu] Kinge of Karnatt [Carnatic] being dead; soe is the Naique of Armagon, whose Countrie is all in the hands of the Moores . . . The warr draweing soe nere hath caused us to take ashoare . . . 4 small peice of Ordnance"§

The Naik who was friendly to the English was deposed and his territory was given to a noble who opposed them. The latter attacked the Dutch settlement, a little north of Madras, in 1645, and making peace with them, collected an army of 50,000 men to keep off the Golkonda troops. This army lived on the country. All the efforts of the Hindus were in vain. The Muhammadan King of BIjapur conquered the country as far south as Tanjore where he established a Mahratta dynasty; and the King of Golkonda openly assumed control of the territory in which Madras was situated, but remained on friendly terms with the foreigners. A year or two later the armies of the Mogul Emperor entered the peninsula seeking to subdue his vassals, while the Mahrattas, now in great strength under the renowned Sivaji, attacked the new territories acquired by the King of BIjapur. We find the Madras merchants writing to the company in London in 1654 :---

- "It hath been no small miserie that this poore . . . Country hath suffred any time these ten years almost . . . What the issue of theis things willbee, the Almighty onely knoweth. . . "¶
 - * Vol. 1., p. 16. † Pillages. ‡ Vol. I., p. 53. § Ibid, p. 21. # Ibid, p. 76. ¶ Ibid, p. 115.

And in 1661—" Wee have 5 or 6 Armies within the Compasse of 100 miles about us."*

Previous to this, however, in 1656, there was fighting close to Madras between the Hindus and Muhammadans, the latter plundering and burning the houses in the vicinity of the town, and in the following year the place itself was besieged for seven months. At this time, the English in the fort who could bear arms were only about a dozen in number and the company took into their employ some of the Indian townsfolk, paying them to assist in the defence.[†] Sivaji now assumed the title of Rajah and warred against both Hindus and Moslems. In 1662 the Golkonda Army attacked the Portuguese settlement at St. Thomé, 4 miles south of Madras. The next few years saw fighting all round, and the position of the English was rendered very precarious by their being for a time at open war with the Dutch who attacked them by sea. In 1670 the Army of Golkonda blockaded the fort, while other armies hovered in the neighbourhood, and the company were pestered by demands for money made by "Flyinge Armies hatchinge Rebellion "+ each of which seemed to be acting independently.

To increase their difficulties still further France declared war against England in 1672; and the French drove out the Golkonda garrison from St. Thomé and seized it, while the Dutch blockaded the coast. The latter then expelled the French from St. Thomé and handed it over to the Muhammadans, whose king befriended and assisted the English and gave them a charter for their small possession. The Mahrattas now raided over to the east coast, took many neighbouring forts, and at the sword's point demanded aid from Madras against both Golkonda and the Moguls; and in 1684 there arose a new terror in the fact that the Mogul leaders in Bengal were making war on the English settlements there, and for a time succeeded in driving them out of the country; a situation which placed Madras in a position of antagonism to the most successful of its warring neighbours. It is not surprising that at this juncture the company strengthened the fortifications of Fort St. George, and raised some levies amongst the native Christians, the garrison now numbering about 400 men.§

The Mogul Emperor Aurangzīb succeeded in crushing down the kingdoms of Golkonda and Bījapur in 1686 and 1687, but rebellionssprang up on every side, and the country remained under the oppression of a lawless soldiery and distracted by their excesses and exactions. Madras, however, was protected by the Mogul's Governor, and the Emperor renewed the charter. The Mahrattas at Ginji and Vellore were then attacked and years of strife followed, the Mogul Army not finally gaining the upper hand till 1698. Meanwhile in 1690 war again broke out between France and England and a succession of sea fights took place. Between 1700 and 1717 Madras was threatened on several occasions. The Moslem Nawāb of the Carnatic came down on it with 10,000 men in 1701, but retired. In 1702 he blockaded it and only raised the blockade on receipt of a heavy bribe. In 1703 the Nawāb's

> * Vol. 1., p. 197. † *Ibid*, p. 167. † *Ibid*, p. 280. § *Ibid*, p. 371.

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superior, the Subahdar of the Dekkan, only refrained from seizing the Madras villages on being boldly told that the company would defend their property by force.* Similar attempts were made by the Nawāb in 1709, 1710 and 1712, while in 1717 a body of his troops had to be driven out by the garrison.

About this time the Mogul Empire began to show signs of weakness and the Emperor's Viceroy, the Subahdar of the Dekkan, revolted and in 1724 established himself as an independent sovereign.

The south of India was now under the heel of the Muhammadans, and the Nizam was at feud with the Nawab of the Carnatic; so much so that he induced the Mahrattas to attack the latter's territories, and in 1735 they ravaged the country. The anarchy everywhere became worse than ever when, in 1739, Nadir Shāh captured and sacked the Mogul capital Delhi, shaking the Moslem Empire in India to its foun-There was another invasion of the Nawab's country by the dations. Mahrattas in 1740; the Nawab himself lost his life, and his successor, Safdar Ali, sent his family for safety to Madras, which had become a place of refuge for everybody in times of difficulty and danger. Two years later Safdar Ali was assassinated by Murtazā Ali, who, against the wishes of the Nizam, tried to usurp the Nawabship. The Nizam then took the field with 120,000 men, secured the person of Safdar Ali's son, Sahib Jadda, then a minor, attacked and defeated the Mahratta invaders, and made Anwar-ud-din " Nawāb of Arcot," instead of " Nawāb of the Carnatic "-an appointment that was followed by the murder of the unfortunate youth, Sahib Jadda.

In 1744 there was again war between France and England, and the Madras garrison was therefore once more strengthened. Two years later the place was attacked by the French both by sea and land, the French ignoring the Nawāb's warning, issued both to them and to the English, to keep the peace. The garrison only numbered about 200 effectives and the English were forced to capitulate; upon which the Nawāb's son, Mahfūz Khān, unwilling to allow the English to be driven out, attacked the French, but failed. Madras was restored to the British Company in 1749 by the treaty of Aix-la-Chapelle.

Enough has been said to show that for over a hundred years the English in Madras never dreamed any dream of conquest, and that their relations with the people of the country were of the best. The story could be continued and the reasons shown why the Nawāb favoured them instead of the French; why the English assisted him; and why, after peace was made between the French and English, he gave at last a large tract of country into their charge; how, after the terrible events in Bengal culminating in the tragedy of the "Black Hole of Calcutta," Clive was sent up from Madras, and decisively defeated the Muhammadan Army; how this led to the English at last realizing their power and strengthening their position; how they were compelled by the atrocities of Hyder Ali and Tippoo Sultan, the usurpers of Hindu Mysore, to take the field against them; and finally how, with the capture of Seringapatam and the death of Tippoo, they, by agreement with the Nizam, REVIEWS.

became possessed in 1800 of the territories conquered from the Hindus by Hyder and Tippoo, having previously received some districts from the Mogul Emperor. These things and much more are made plain by these Records, but space does not permit of the details being given here.

We have used the volumes so far for one purpose only. They may be used for many others. Thus, in order to convey some idea of the sufferings of the Hindu population of the country at the hands both of their own leaders and of the conquering Muhammadans a few extracts may be given. In perusing them it will be well to remember that since 1800, when Southern India practically came under British control, the country has been at perfect peace, good order has been everywhere introduced, taxation enormously reduced, and justice done, or attempted to be done, between every man and his neighbour. As regards taxation. it will suffice to say that immense hists of separate taxes are mentioned in the old Hindu records, whereas under the English Government all have been abolished except agricultural rent, a cess for local roads, hospitals, and the like, and an income tax on merchants. The extracts are from the original letters and reports.

- A.D. 1640.—" The froequent inforcements of those tyranous [Hindu] governors . . . mischeivous Attempts [of the] . . . treacherous . . . Inhabitants of that Country . . ."*
 A.D. 1642.—" The [Hindu] Naique of Tanjour . . . puts in
- almost monthly (to him that will give most) a new Governor. ."†

Each new Governor, of course, sought to make what he could out of the people before he in turn was ejected.

They were, that is, entirely beyond the control of their nominal sovereign.

In A.D. 1676 we read of a Hindu minister " pilling and squeezing the people,"§ and, enlarging on this, the agent at Fort St. George writes :

"The Government of the country is now in so bad hands, nothing but fraud and oppression, and so voyd of shame that no Creditt can be given to either agreements, [or] promises . . . These Bramanys now in power are so wholly sett upon treachery and surprisall that there is no relying nor confidence can be put in them."

This state of things continued. In 1714, the company at Madras, hoping to obtain a concession of the Island of Divi, state that they think that the island will speedily be well populated when in their hands, owing to "the insufferable usage under the Moors Government upon the main land."¶

* Vol. I., p. 37. † Ibid, p. 45. ‡ Ibid, p. 46. § Ibid, p. 356. || Ibid, p. 357. ¶ Vol. II., p. 155.

In 1737 the state of the people was as bad as ever.

"There have been frequent Robberys in the Great Townes as well as in the Roads, and the exactions of the Havildars has been so vexatious and intolerable to the Natives that several Towns and Villages have been deserted by the Inhabitants. In a word the Confusion and Disorder of the Country is exceeding great."*

When in 1725 the English authorities rented out one of their villages to a Hindu, one Mahādeva, the complaints of his tyrannies became so urgent that they withdrew his lease and turned him out.

That Madras really was a place of refuge for the people of the country and that they preferred to live under the protection of the English instead of under the iron hand of their own chiefs is well shown by the fact that when, in 1681, Madras was threatened with attack by a Hindu leader and was for a time actually blockaded by him the Hindu residents came forward actively to assist the defence—

"Allsoe the Gentue and Malabar Inhabitants came and offered to maintain at their owne charge 215 men for the defence of the Towne, which was accepted of . . . The Mallabars alsoe came and offered to entertaine 150 men for the defence of this Towne, and the Washers 25 men, which was accepted . . ."[†]

The enormous and rapid growth of the population of Madras has already been mentioned.

In 1707 when some of the Hindu residents declined to pay a certain cess for local purposes they were compelled to do so not by any legal proceedings or by force, but by the threat that if they did not they would have to *leave the town and go back to their people*. This was guite sufficient. They submitted at once.

"'Tis therefore unanimously agreed that they are made to pay the duty as formerly, or to leave the Place."[‡]

That the attitude of the English towards the people of the country was entirely peaceful till events beyond their control forced them to increase their garrison and take the field, in the face of overwhelming danger originating in the attacks of the French, is easily shown. So far from having entertained any ideas of conquest or annexation of territory we find that their soldiers numbered 33 in 1647, 26 in 1652, 10 in 1656. In 1662, after Madras had actually been besieged, they wrote home begging for 100 swords, and some good muskets, their own being so rusty that 53 of them burst on being tested. In 1678 they owned only seven horses.§ Even so late as 1744 the councillors of Madras wrote that they were very deficient in European troops :

§ Vol. I., pp. 80, 109, 121, 170, 210, 211, 215, 452.

^{*} Vol. II., p. 278.

[†] Vol. I., p. 439 † Vol. 11., p. 112.
The volumes teem with passages showing that the English dealt with the Indians in a constant spirit of good will and sympathy. They tried their utmost, for instance, in times of famine and disaster to minimize their terrible sufferings by procuring food and help; for which purpose private subscriptions were raised as well as assistance given from the public purse.

Colonel Love has, in giving us the whole of the original records worthy of publication, also included many very interesting passages bearing on the manners and customs of the times, as well as details of the many local squabbles and disagreements that took place amongst the leaders. Very quaint and amusing reading some of these. There is an account of the visit paid to Fort St. George in 1701 by the Nawāb, Dāūd Khān. Those who have read the autobiography of the valiant Emperor Bāber will remember how often and how sadly he departed from the tenets of the Korān with reference to the use of "strong waters." Dāūd Khān followed his example, and so, it is to be feared, did many of the English in those days. The Nawāb was received with great honour and entertained at a great banquet. At his reception—

"The Governour sett by him two Cases of rich cordiall waters and call'd for wine, bidding him wellcome . . . The dinner consisted of about Six hundred Dishes small and great, of which the Nabob . . . eat very heartily . . ."

Next morning he was to have paid a visit to the ships,

" but he having been very Drunk over night was not in a condition to go . . ."

He, however, asked permission to visit the company's garden instead, and after some delay the Governor proceeded thither to meet his guest. It seems that the Nabob was kept waiting for a reply from the Fort—

"But before the Answer came to him the Nabob was got into a Portuguez Chappell very Drunk, and fell a Sleep."

Sleeping till the afternoon he sent his excuses to the Governor—" and desired him to send a Dozen bottles of Cordiall waters; which were sent him."

Some years later he wrote to the Governor and asked for "one thousand Bottles of Liquor," but received only 250.[†]

That the English residents very often dined too well is clear from many passages in these volumes; so much so that in 1659 a certain Roger Myddleton writes to his relations at home: "This is an expensive place, and from the drunkennesse thereof good Lord deliver me."

As before mentioned this work is very complete. It contains the

- * Vol. II., p. 299.
- † Vol. 11., pp. 15-18.

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history of every institution in the city, shows how the place grew, the laying out of its streets, even the names of its residents at different times, their characters, and their adventures. Many Englishmen of to-day will find a notice here of some bygone member of their family. Special attention is given to the fortifications and to military details connected with the garrison. As an exhaustive narrative of the growth of a place, no less than of the growth of its institutions and its history, the work is probably unique. Many maps, plans, reproductions of pictures, drawings, and portraits enrich the volumes.

And, last but not least, allusion must be made to the elaborate index, which is so lengthy that it had to be bound up by itself as a fourth volume. The preparation of an index is always a very wearisome task, more especially so when the indexing of three large volumes has to be carried out. But for a work of this kind it is absolutely indispensable, and the public must be grateful not only to the author himself but to anyone who helped him. Colonel Love tells us in a little note on p. 575 of Vol. III. that much is due to the devoted assistance rendered him by his daughter; and we venture therefore to express our thanks to her as well as to himself.

> ROBERT SEWELL (Late Indian Civil Service).

ELEMENTARY THEORY OF ALTERNATE CURRENT WORKING.

By CAPT. G. L. HALL, R.E.

An Engineer officer is always liable, in the course of his multifarious duties, to be called upon to instal electric lighting or electric motors in connection with barracks, cantonments or workshops, and it may frequently happen that the only source of supply available is of the alternating current variety; in these days, with the tendency towards large centralized generating stations and long transmission lines, this is becoming more and more likely to be the case. An officer confronted with a problem of this sort, assuming he has no previous experience to guide him, will naturally turn to a book for information.

There are of course many excellent treatises on alternating currents, but they are practically all calculated to appal the casual enquirer, who desires to get at the salient points without wading laboriously through abstruse mathematical investigations; such books, in fact, contain too much, and the searcher after knowledge is discouraged by a mass of detail, much of which he feels he does not require.

It is to meet the wants of such a one that Capt. Hall's book has been written; as he says in the preface his aim has been " to put before the reader the elementary principles in as simple a form as possible and to endeavour to rob electrical phenomena of the mystery with which they

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are often associated in the mind of the beginner by reducing them as far as possible to every-day mechanical equivalents."

In this laudable attempt Capt, Hall has been very successful; he has assumed a knowledge of elementary electro-magnetic phenomena and continuous current work and starting on this basis commences by a consideration of the factors which differentiate alternate from continuous current working, the first four chapters being devoted to a general description of the effects of inductance and capacity.

Power measurement in alternate current circuits is discussed in Chapter V. up to which point only single-phase working has been dealt with.

Chapter VI. treats of polyphase currents including methods of distribution and power measurements in such circuits, after which Chapters VII. and VIII. deal with transformers and alternating current generators.

The last three chapters are devoted to alternate current motors, synchronous motors being taken first, then induction motors and finally commutator motors of various types.

The subject generally has been treated diagrammatically rather than analytically, vector diagrams being freely employed, while the absence of reference to details of design or testing has enabled mathematics to be reduced to a minimum.

The book is characterized throughout by admirable lucidity and clearness of analogy. It can be confidently recommended.

A.H.D.

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NOTICES OF MAGAZINES.

DRESDNER NACHRICHTEN. 8th October, 1913.

THE COAST DEFENCES OF THE NETHERLANDS.

The controversy in connection with the defences of the Dutch coast has raged for some time, and at length the works are to be put in hand at once, in spite of the protests by England and France. A strong fort is to be built at Flushing, which will be armed with 28-centimetre guns in revolving armour-plated turrets. The old fort Kiykduin is to be brought up to date and is also to have a heavy armament. Finally, the modern-built forts at The Hook of Holland, Iymuiden and Harssens, are to have heavy guns of the latest pattern. The firm of Krupp at Essen has been selected after the merits of all other firms had been considered.

LES ARCHIVES MILITAIRES.

GERMANY.

(I). School of Military Telegraphy.—A new school of military telegraphy has been formed for the purpose of having a central establishment to instruct and organize all forms of communication used in the German Army. Special attention is paid to wireless.

FRANCE.

Flying Units.—The term "escadrille" is given to mobile flying units attached to staffs and headquarters, and which are capable of keeping up with troops on the march. Normally the six aeroplanes of the unit will fly, but a tractor and lorry is provided for each to drag them along in case of breakdown. Three motor lorries for spare parts and a movable workshop complete the unit. The latter four vehicles compose the train vehicles of the unit. A motor car is supplied for the use of the unit commander.

Wircless on Aircraft.—Great importance is attached to the provision of wireless on airships. It is pointed that all the French ships stationed on the Eastern Frontier are provided with it. Messages have been sent about 300 kilometres from a Zeppelin, the intention of the Germans being to fit these ships now with 500-k.m. sets and aim later at being able to send 1,000 k.m.

Military Ski-Men.—Men who can pass the requisite test may be given a certificate of ski-men and will on mobilization be employed as such if required. The tests which have to be passed are as follows :—

(1). Endurance Test.—The candidate carrying a Tyrolian knapsack with 5 kilometres weight in it, has to accomplish a march of 25 to 30 kilometres over a total difference of level of 800 to 1,000 metres at an average rate of 5 kilometres per hour. Failure to pass this test disqualifies the candidate. 1913.]

(2). Speed Tests.—The candidate has to cover about 4 kilometres of fairly level ground in any kit at a speed to be fixed by the examining board.

(3). Test for Style and Jumping.—The candidate has to do certain figures on a slope of one in five to one in seven, 300 metres long. The candidate next has to do two out of three 7-metre jumps off a 70-c.m. platform.

(4). Repair of Gear.—The candidate must be able to effect such small repairs as he might have to do for himself in the field.

Aeroplane Observers.—Arrangements are made to train special officers as observers; these come under the following headings:—(1). Staff college officers who have already undergone a period of training as aeroplane observers and are allotted on mobilization. (2). Officers of Class I but unallotted on mobilization. (3). Staff college officers as yet untrained in observing. (4). A certain number of cavalry officers.

Preference is given to officers who hold a Staff College certificate. These officers are specially considered for recommendation for the Legion d'honneur.

RUSSIA.

New Cavalry Training.—The front ranks of squadrons having recently been re-armed with the lance, the tactical use of this weapon is dwelt on. A new feature is "firing from horseback" which is only to be used in the "lava." The latter is a form of fighting hitherto only used by the Cossacks, but now made general for the cavalry. This manœuvre is employed to deceive the enemy and make reconnaissance more difficult for him, and consists in surrounding the enemy with a large number of small units who employ fire action either mounted or dismounted to harass the foe.

A. H. Scott.

NEUE PREUSSISCHE ZEITUNG. 5th October, 1913.

THE LAND DEFENCES OF FRANCE ON HER EASTERN FRONTIER.

By Major Oberlindober.—Senator Bérenger has written an article in *The Matin* which has attracted much attention, about the French land defences against a German attack, under the heading of "Lastrouée du Luxembourg n'est ni couverte ni fermée." After the war of 1870-71 the French generals laid themselves out to evolve a scheme to check a new German invasion, even though the mobilization of the latter should be on a far larger and more rapid scale. The general idea was to provide a line of resistance in the shape of strong frontier fortifications to cover the mobilization of their own army, which would be accelerated by the construction of a carefully thought-out network of railways.

The protection of the mobilization and the task of checking the enemy's advance, necessitates the defence of an extended line, or the defence of certain suitably defended sections at a convenient distance from the frontier, while the remainder of the task is to provide the necessary depth by the arrangement of defended fortress groups behind each other. The recommendations of the committee, which was formed to consider the defence scheme under the presidency of General Séré de Rivieré, were :— (1). Construction of two defended sections between the Swiss and Belgian frontiers on the upper Moselle and middle Meuse.

(2). The construction of two groups of fortresses each consisting of three fortresses behind the gap between the two defended sections, as well as between the northern section and the Belgian frontier (Besançon-Dijon-Langres in the south; Reims-Laon-La Fére in the north).

(3). Reconstruction of the capital (Paris) as central fortress and "keep" for the whole defence scheme.

In addition to these arrangements, directed against Germany, the most important forts and fortresses on the Belgian frontier were to be kept and a few less important ones given up. The defended sections (*Rideaux defensifs*) consist of a line of mutual, supporting detached forts and batteries while the wings are formed of large defensive areas (camps retranchés). As a rule these forts are placed in naturally strong positions, and on the whole are pretty modern, though some are getting out of date. The searchlights and means of communication are of the most modern type and many of the guns are armoured. Their garrison averages one or two companies of infantry, or one battery of foot artillery.

The large defences on the wings are composed of a double ring of up-to-date forts enclosing a defensive area of 45-50 kilometres in circumference with long-range guns and a garrison of forty-five to fifty thousand, which is also available for offensive measures on a considerable scale.

Of the southern section, the line of the upper Moselle is taken as a natural obstacle. All roads leading to this valley are covered by forts situated on the ridge of the Vosges. The strong right wing is formed of the defensive area of Belfort and the fortress groups of Mont Béliard and Loment. The front consists of the forts Giromagny, Ballon de Servance, Chateau Lambert, Rupt, La Beuille, Remiremont, and Arches, whilst the left rests on Epinal. The northern section has its right on the mighty fortress of Toul, Bourlémont and Pagny and the fortifications on the plateau of de la Haye. The front consists of the forts Gironville, Jouy, and Liouville, Camp des Romains, les Paroches, Troyons, and Gémicourt. The first three lie on the eastern face of the Côtes Lorraines, commanding all the approaches from the Woëvre Plain, while the others are on the western slope of the Côtes and cover the crossings over the Meuse; the left rests on Verdun. There is no doubt that these form a very real obstacle to any German invasion.

Two gaps (*trouées*) have been left on purpose—one between the north and south section and the other between the north section and the defences against Belgium on the N.E. Frontier. These defences consist only of the two antiquated fortresses Longwy and Montmedy, and the old forts (*Sperren*) of Les Aynelles, Charlemont and Hirson. These gaps are not wide enough to let any considerable force through, and there are no railways to help a force. Should a German army venture on these gaps it would be in great danger of being attacked on both flanks by French armies who can move in safety behind the *rideaux defensifs* and, thanks to their network of railways, move rapidly from one side to another. Until a few years ago the gaps were considered to be the key (*clou*) of the whole scheme. It was considered that even in the event of the first line being broken, there was still sufficient protection, as the second line has some very good points behind which the army could rally. Latterly in military circles there has been an opinion that the gap north of Verdun is not sufficiently protected against an attack made either simultaneously with, or immediately after the declaration of war. Such an unexpected incursion would have the gravest possible results on the mobilization. The possibility of such an *attaque brusquée* is taken by several military writers (notably General Maitrot) to point out the urgent necessity of closing the above gaps. To emphasize this necessity on the French nation, the most impossible assertions are made, which are by way of showing the absolute certainty of this *attaque brusquée*. Senator Bérenger's achievement in *The Matin* is an instance of this.

The "Old Camp" at Wasserliesch was used by General Crépug as a camp, and hence the name. Bérenger makes a *camp de concentration* out of this and shortly afterwards describes it as a *camp retranché*. A winter exercise which is said to have taken place in February is the innocent cause of the reputed origin of a new German fortress.

The fcar that the enlargement of Ehrang Station is being done with offensive motives is more comprehensible. The necessity for this enlargement can be found nearer home. Ehrang is the centre of three important railway lines (Cologne-Gerolstein-Treves; Coblenz-Treves; Saarburg-Metz-Bittburg-Treves), and with the increasing development of the Rhine province large stations with many platforms and lines of metals are necessary to cope with the increasing traffic. For the same reason it is not surprising that there are eight large bridges over the Moselle in the sixty kilometres between Treves and Diedenhofen, and that they have not been built to facilitate a rapid crossing of the Moselle by a German invading army.

M. Bérenger's fears that the Luxembourg railways may be used are also groundless, as conditions have been made that they cannot be used by the German military authorities on mobilization. The French people must not take the revelations about Luxembourg in *The Matin* too seriously. But still we cannot blame the French for their fear of an *attaque brusquée*. The warning sounds to them like the "Hannibal ante portas" of old.

It is of interest to note, however, that the French themselves refute Senator Bérenger's alarmist article. The *France Militaire*, which cannot be accused of an undue love for the Germans, has an article pointing out that Bérenger has based his' announcements on false premises. They point out quite correctly that the "Old Camp" at Treves—the manœuvre ground of Elfenborn is meant—can be of no offensive use. Even if the Germans did want to take the offensive through Luxembourg, they would not concentrate 250,000 men in one camp, who would be separated at the beginning of the advance. The "Old Camp" can only be used for defensive purposes during the advance. In the same way the newly-made railway centres in large garrisons or fortified places only serve for defensive purposes in order to send the covering troops well forward. The newly built bridges over the Moselle undoubtedly help the crossing of that river, but there are still several marches to the French frontier, and before these can be made the

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French can complete their mobilization. So there can be no question of a surprise. It is a physical impossibility to move an army of 250,000 men to the French frontier on one through railway line such as the Luxembourg railway. German military writers have often pointed this out, but hitherto unfortunately in vain. Hence it is significant that so distinguished a paper as the *France Militaire* should have taken it up.

REVUE MILITAIRE SUISSE.

June, 1913.

THE USE OF NEUTRALITY IN OUR FOREIGN POLICY.

By Cuno Hofer, First Lieut. of Cavalry.—The author regrets that constant and absolute neutrality should be one of the fixed principles of the Swiss Constitution. Such an attitude should be one of foreign policy only, to be assumed or not as circumstances demand at the time, and not an inviolable rule.

But in the case of Switzerland neutrality has become such a maxim that an independent foreign policy seems impossible, a state of affairs somewhat derogatory to the country. Swiss neutrality is, however, not like that of Belgium, guaranteed by the European Powers, but only recognized, and there is no reason why it should be adhered to if such a course were prejudicial to the country. This point of view is argued out from tradition and history, and is continued in the July and August numbers.

FIELD HOWITZERS.

By Colonel P. van Berchem.—An examination of the characteristics, organization and employment of field howitzers by other nations, written in anticipation of the early introduction of these weapons into the Swiss Army. In order that artillery officers may not be behindhand on their arrival, he recommends the study of a work by Capt. H. Friederich, "Die Taktische Verwendung der schweren Artillerie."

THE ATTACK AND DEFENCE OF FORTIFIED POSITIONS.

By L.—The writer draws attention to the fact that most wars in Switzerland must sooner or later develop into the attack and defence of fortified positions. He is of opinion that such warfare is insufficiently . studied and practised, especially by the intermediate ranks such as commanders of battalions, groups, regiments, and batteries. He considers that the reason for this is, perhaps, the difficulty of reconciling the various books of regulations, which, published at different dates from 1904 to 1912, do not altogether agree with each other. His article is written with a view to diminishing this apparent disagreement. He considers that the attack of a fortified position will require at the least 36 hours. During the first day the foreground should be swept clear of the enemy, during the night the artillery and infantry will be methodically deployed, while on the next day, if the enemy has been sufficiently shaken, the assault may be delivered, but as a rule this period will be insufficient.

July, 1913.

FROM KIRK KILISSEN TO LULE BURGAS.

By A.—This is a fairly detailed account of the occurrences from the 24th October to the 3rd November, and includes an account of the Battle of Lule Burgas. Only the movements of the larger units (regiments) are chronicled, but the article is interesting, and gives a very good general idea of the character of the fighting and of the country over which the operations extended. It is accompanied by a map.

ARTILLERY IN WAR,

By Commandant X.—An examination into the ideas which seem to prevail in France as regards the tactical employment of artillery in the battle of encounter, which it is considered will be the most probable form of engagement, considering the feeling on either bank of the Rhine.

The new Artillery Regulations of 1910 give the latest official ideas on the employment of artillery, but the compilers seem hardly to have expressed themselves with desirable clearness. They come into collision with those ideas of which General Percin is the most ardent advocate. Theorists consider that the advent of rapid fire and shields have rendered all the old ideas out of date, and that the artillery duel will no longer take place. That concentration of fire, besides being technically unrealizable, is now perfectly useless, rapidity of fire takes its place. Hence it is deduced that the number of batteries to bring into action does not depend on the nature of the objective but on the extent of front, whence the simple rule, one battery per 200 metres. Batteries not brought into action under this rule are referred to not as " in reserve " but as " disposable." Again it is considered that batteries can better support the infantry if distributed along the front; some would even distribute the guns. This was all very well against guns of merely accelerated fire, but all nations now use rapid fire and masked positions. On one point, however, all are agreed, and that is that infantry must be given all possible support by artillery.

The great point insisted upon in the regulations is the necessity for being in position before the enemy. Often, especially with important advanced guards, the guns of the main body may be sent on ahead of the infantry under the advanced guard only. General Percin holds that the infantry will always begin the attack unsupported by artillery, and will only ask for guns when they find themselves checked, but this is to fight with one arm against two. Elsewhere the General writes ; " The regulations ought not to insist upon priority of position, as it leads to artillery taking position with no definite object, independently of the needs of the infantry." But this will not be the case, the guns should be ready to fire before those of the enemy, and to support the infantry from the outset. General Davignon rightly says that the first object of the artillery should be to relieve the infantry from the pressure of the enemy's guns, and secondly to support the infantry by detailing batteries to assist them directly by fire. The latest corrections to the German Regulations leave no doubt as to their insistence on first smashing the enemy's artillery; they would even use large calibre guns.

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It is doubtful whether any artillery would long remain inactive, each would seek to destroy the other prior to supporting their own infantry. It has been stated that under present conditions artillery cannot destroy, but only neutralize, the opposing artillery, surely a too modest conception. The regulations insist on destruction. It is too much to believe that the sole result of recent improvements is to leave the two artilleries powerless against each other. Opposing batteries both in masked positions and firing only shrapnel will do each other little harm, but in battle such positions cannot be counted upon. To reach dead ground it may be necessary to take up positions more or less in the open, and again, a position masked in one direction may be open in another, or exposed to enfilade, if not reverse, fire. Many batteries may be defiladed from view but still capable of destruction, especially by high explosive shell, the number of which carried in the field tends to increase.

Again, since 1010 the aeroplane has arrived to extend the radius of vision of the artillery, and the side which wishes to win should not hesitate to engage from the outset with all available batteries, detailing for direct support of the infantry such as can be spared as the enemy's Partisans of neutralization claim that with their method fire slackens. batteries can be detailed from the commencement directly to support the infantry, and, as it is more economical, more batteries will be available to meet unexpected events. But that method will not wear out the enemy, and it is questionable whether the batteries would be available just when and where required by the infantry. On the other hand, if the enemy's artillery is destroyed, more and more batteries will be available to help the infantry right up to the final assault, when all will be available to pave the way to victory. It is often said that the artillery fight will start over and over again. This may be true with the neutralization method, but the results of destruction are definite and durable. This is the old artillery duel revived, but it is probable that no infantry attack can develop until one side has the advantage in artillery.

VISUAL SIGNALLING.

Means of communication in battle are insufficiently developed. Various methods of transmitting orders are mentioned in the new F.S. Regulations, the last of which is visual signalling, which, thoroughly practised in other armies, is little appreciated in the Swiss, or only considered of use in mountain warfare. That this is an error, is evidenced by the use made of visual signalling in South Africa by the British, and in the Far East by the Japanese, while the Russians took to it during the campaign. The practical impossibility of arranging a fan of telephones during the changing phases of an attack makes visual signalling of peculiar importance. The writer advocates the Morse system, though the Federal Council considers that a militia army has not the time to spend on the necessary training. Means are suggested for overcoming this difficulty, and a rapidity is hoped for of 4 or 5 words a minute, at 4 or 5 kilometres and 6 or 7 words at 1 kilometre or less.

The organization suggested is eight men per company, grouped in patrols of two men distributed to sections. Each group to carry red and white flags for signalling and six pieces of coloured cloth corresponding to the six battalions of a brigade. A mnemonic system for remembering the Morse alphabet is given. In sending by day both arms raised and carrying flags = a dash, one arm and flag = a dot. At night long and short flashes are given with a lamp. Dashes and dots are written down at the receiving end and then deciphered with the help of an ingenious key. Each letter is acknowledged by a dot if understood, and by a dash if not understood, and ends of words and messages are signalled by appropriate signs. The flags can be used by a man lying on his back.

August, 1913.

THE QUESTION OF OFFICERS.

This article criticizes, not altogether unfavourably, a pamphlet written by Capt. Bruno Zschokke, of the Engineers, in regard to the difficulty of obtaining officers suitable for filling the higher commands in an army mostly composed of militia, and suggesting remedies.—(*To be continued*).

ARTILLERY IN WAR.

By Commandant X. (concluded).—If the artillery duel is now, as formerly, the necessary prelude to every battle, it is no less the bounden duty of the artillery to support, at all hazards, the infantry during the successive phases of the combat. This requires co-operation, which can only be properly secured by the skilful dispositions of the G.O.C.in-C. To split up the battle into small independent infantry engagements, supported by artillery detailed for the sole support of each, is fatal. The regulations make it clear that the enemy must be held all along the line by a minimum of troops, the principal effort being made against a selected point. This attack must be vigorously pushed home, and all available artillery must be prepared to participate in the final assault.

The artillery should be under the orders of a commander in close touch with his chief, who must also keep careful watch on the infantry advance, and of its effects on the enemy. Time is wasted if the infantry is depended upon to point out the objects they wish the artillery fire directed upon. The infantry advance will cause the enemy to show himself and afford targets for the artillery, unless he is himself determined to attack, in which case he must show himself to advance. The artillery commander must be ready, on his own initiative, to seize these fleeting opportunities. This refers to field artillery only.

The Germans claim that their long-range guns and howitzers can be used from the commencement of a battle, not only to engage the enemy's guns, but to fire on formed bodies of troops or columns on the march, and to cover the deployment of the field artillery when this has to be undertaken within range of the enemy's guns. The German 13-c.m. guns appear the best adapted for this purpose, but at 12 k.m. the angle of descent of its shell is 42 degrees, the probable error in height of burst 40 m., and the probable error in range 90 m., so that its effect on artillery in position is likely to be small. At short ranges, say up to 3,000 yards, the flat trajectory will leave a large dead angle, and most of the shrapnel bullets will fly harmlessly into space.

The Battle of Chatalja offers an example of the rational use of heavy guns. The opponents were separated by a wide valley, and their guns

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were out of range of each other and could only act against the infantry. On the whole the Balkan War does not furnish many arguments in favour of heavy guns. At Monastir the Turks could use their field guns after they had been bombarded for two days by the Servian heavy artillery, but this may have been due to causes at present unknown. It would be rash to say yet that long-range guns are a necessity. Fire is seldom required at over 7 or 8 k.m., and the latter is the limit of range of the 75-m.m. field gun. It would be better to improve this weapon by giving it a large vertical field of fire without the necessity for sinking the trail, and to have a smoke-producing compound in the shell to facilitate observation.

September, 1913.

THE QUESTION OF OFFICERS.

This article is concluded, and suggestions are made under which officers might find more favourable opportunities than exist at present for studying their military duties and fitting themselves for the higher commands.

FROM LULE BURGAS TO CHATALJA.

A clear general account of the Turkish retreat after their defeat at Lule Burgas, and of their occupation of the lines at Chatalja. Also of the movements of the Bulgarian armies during the same period, and of the principal features of the Battle of Chatalja. The result was a severe check to the Bulgarian arms, and it is not quite clear what General Dimitrieff's intention was in attacking as he did.

VISUAL SIGNALLING.

Capt. Friedrich makes some further suggestions on this subject. Instead of distinguishing the longs and shorts of the Morse alphabet in the way proposed by Lieut. Decolligny in the July number of the magazine, he would make dots and dashes with the flags, as is done in Germany. A scheme is put forward for the organization and training of signallers in each company of infantry. A rapidity of five to eight words a minute is anticipated, and hopes are expressed that a general system, suitable to the whole army, may shortly be introduced.

DIRIGIBLES IN THE FIELD.

By H.F.—The first real tests of the tactical employment of dirigibles were made in Tripoli. Two machines arrived in December, 1911, and made 91 ascents, gathering much topographical and tactical information. The aeronauts made a map of a large area of country on a scale of 1/40,000, and took many photographs showing the shape of the ground, roads, habitations, etc., which were of great use to the staff of the army. Some reconnaissances at a low altitude, with a telephotographic apparatus, showed trenches, camps and magazines.

The crew consisted of three officers and a mechanist. The results obtainable depended on several factors; the altitude of flight, condition of the atmosphere, nature of ground and the nature of the objects sought for, the possibility of employing optical instruments, and the visual and intellectual abilities of the pilots. The altitude at first chosen was 900 metres, but this brought them under effective fire, and was raised to τ ,000 metres for reconnaissances and τ ,200 metres for offensive action. The atmospheric conditions were very favourable, the country was very open, and even isolated men could be clearly distinguished. 330 bombs were dropped; the results were not particularly satisfactory, but a fund of information was obtained on their employment and construction.

Several experiments were tried on termination of the campaign, but neither details nor results are described.

October, 1913.

THE MILITARY AID SENT BY GENEVA TO WILLMERGUE. This is only of historical interest.

MANŒUVRES OF THE 2ND DIVISION.

These manœuvres took place between the 8th and 11th September. The events of each day are described and shortly criticized, but as no map is published are somewhat hard to follow. The criticisms are clear and appear to be very sound and instructive.

THE BATTLE OF CRESSIER.

By L.—In a recent article the writer summed up the principles of the attack and defence of fortified positions. In this article he develops these principles by describing an imaginary battle, choosing for his ground that shown in the "Fortification in the Field of Battle," exemplifying the defence of a position. The map is reproduced, and the scheme is carefully and scientifically worked out, and is instructive and well worth studying.

A.R.R.

RIVISTA DI ARTIGLIERIA E GENIO.

July-August, 1913.

TECHNICALITIES AND TACTICS FOR THE CROSSING OF RIVERS.

Under the above title, Colonel Martens, of the German Engineers, has published at Berlin a very interesting paper from which the following extracts are taken :---

The bridging of rivers in war is a work of the greatest importance, and is entrusted to the pioneers who are practised in times of peace, sometimes with regular bridging material and sometimes with improvised material. It is not, however, necessary to consider the matter only in a technical light; the greater difficulty presented in the crossing of rivers is the adaptation of the technical operations to the requirements of the tactical situation in front of an enemy prepared to defend the passage. Only exercises of an absolutely practical character, similar to those required in true warfare and effected in union with the other arms, can give an idea of the difficulties presented in crossing a river in the presence of an enemy.

The bridging of rivers within the radius of the enemy's operations is not an essentially technical duty for the pioneers, but all the arms should take their turn; and it should be taught that the technical skill of the pioneers and their efforts for the completion of their special duty are not sufficient, but that success can only be gained by the satisfactory co-operation of the various commanders, and by the vigorous action of all the troops. The experience drawn from military history and from

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peace manœuvres proves that tactics and technical considerations should follow the same lines, but unfortunately there is often a tendency for the latter to prevail in the presence of the enemy; doubtless technical details must be considered, and in many cases must influence a decision, but this should not be given too prominent a place.

Now, in the passage of rivers, moral factors as well as the varying proximity of the war, must be considered; the real site of the bridge can be kept a secret, and greater efforts can be made in places where the enemy is not prepared to meet them. The most difficult examples of crossing a river should frequently be practised for instruction, but it must not be assumed that these could always be adopted in the face of the enemy. This idea, however, is not supported by the regulations. "Instructions for Pontooneers" (*Pontonier-Vorschrift*, 1911) accentuates the importance of celerity and forcible action (viva forza) in the passage of a river. In the new "Instruction in Fieldworks for all Arms" (*Feld-pionierdienst aller Waffen*) the view is expressed as follows :—

"Whenever it is intended to occupy a river-bank before the enemy and to defend it, it is especially necessary to profit by the advantage that would thus be obtained, and to effect a surprise by a crossing with unattached boats or rafts. A river can be forced when, by a preponderating fire, the adversary can be prevented from defending the places of passage. Such a proceeding presents very great chances of success against an enemy weakened by preceding combats, but should not require long preparation nor be attempted at night, as it must be carried out with promptness and energy. If a commander is confronted by a river which impedes his operation, and which must be quickly crossed, this can only be effected when the enemy is at a distance."

In cases where an energetic opposition on the part of the enemy is foreseen, technical methods and tactics should be combined so as to ensure the success of the attempt, however difficult it may prove. The responsibility of the tactical dispositions for the actual crossing lies with the commander of the troops; the technical arrangements, only, are under an officer of superior rank in the corps of pioneers.

The pioneers are especially instructed in technical work in connection with the passage of rivers. Although their energy and efficiency is beyond question, their physical powers are not unlimited, and not only the troops themselves, but also the commanding officers of the pioneer may find themselves overwhelmed by the mass of duties imposed upor. them. A commander would commit a grave error should he not arrange to have at his disposal the necessary force of pioneers. It should be the duty of officers of pioneers of superior rank to represent at an opportune time, and with firmness, any insufficiency in the number of technical troops, and to procure reinforcements from other troops should the number of pioneers assigned be insufficient. Referring to the employment of pioneers at the Battle of Woerth, special mention is made of the delay caused in the construction of bridges over the Sauer.

The selection of the commanding officer of the pioneers, attached to an army corps, is a matter of great importance. This officer should be possessed of special energy of character, so that in critical moments of a battle he may be able to represent resolutely to the officers in high command, the necessity or otherwise of bridging a river at an opportune time. It is always of great importance to have the largest possible quantity of regular bridging material ready at any moment, otherwise it is impossible to construct rapidly and without special preparation, bridges hat will satisfy all the conditions of war. Improvised bridges over small rivers take a long time to construct, as the provision of the materials for construction is a matter of difficulty.

The author, after the general considerations referred to above, observes that the scope of his work does not touch upon the strategic view of the passage of rivers by bridging in relation to the great operations of war. He limits himself to the more restricted field of the relations between tactics and technicalities in cases of offensive operations, involving the passage of rivers over which there are no permanent bridges.

The author in the new "Instruction in Fieldworks," for all the arms, considers four distinct cases :---

Ist. When the construction of a bridge is at a long distance from the radius of the enemy's operations, and he cannot interfere with the operation in strong force and can only molest patrols and small detachments.

2nd. When the enemy, owing to the rapid execution of the work, has not been able to take measures for the security of the place of crossing; in such a case it is necessary to seize the other bank of the river and to take advantage of the ground thus acquired.

3rd. When the enemy in weak force opposes the position by fire action and seeks to draw the attack to the river; in this case the passage must be attempted *di viva forza*.

4th. When the enemy has organized a more or less extended surveillance over a long course of the river and can intervene with a strong force against the attack; the assailants then, after accurate preparation, endeavour to draw away the greater part of the enemy by a rapid attack ensuring the possession of the opposite bank; at the same time, if necessary, an active demonstration is made against the enemy's front.

The second part treats diffusively of rivers in general, and considers the various eventualities presented in time of war, with many practical examples.

The third part is dedicated to a valuable study recently published in Germany by General v. Falkenhausen on "The Manœuvring of Modern Armies in Great Masses." This treats of the operations of what may be called the great armies of the future. The author refers to the example of the Battles of Leuthen, where Frederick the Great, with weak forces, by means of an energetic action on the flanks, obtained a victory over an adversary with greatly superior numbers. The question is discussed in an able and exhaustive manner with abundance of dates and details, many of which refer to the passage of river.

The fourth part refers to the defence of rivers and treats practically of the defence of the Oder.

Colonel Mertens's work closes with two appendices. The first may be called a photographic illustration of the matter contained in the "Instruction in Fieldworks for all Arms" as far as it relates to the rapid passage of rivers. The second appendix treats of the bridging equipment assigned to various armies, and particularly to the German Army.

BOOKS RECEIVED.

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POCKET-BOOK OF USEFUL FORMULE AND MEMORANDA FOR CIVIL, MECHANICAL AND ELECTRICAL ENGINEERS. By Sir Guilford Molesworth, K.C.I.E., and H. B. Molesworth. 27th edition. With an Electrical Supplement by W. H. Molesworth. 5s. net. E. & F. N. Spon, Ltd., 57, Haymarket, S.W 1913.

- BUILDING SUPERVISION. By Geo. W. Grey. 25. 6d. net. E. & F. N. Spon, 57, Haymarket, S.W. 1913.
- DYNAMO LIGHTING FOR MOTOR CARS. By M. A. Codd. 128 illustrations. 28. 6d. net. E. & F. N. Spon, 57, Haymarket, S.W. 1913.
- PORTLAND CEMENT: ITS MANUFACTURE, TESTING AND USE. By D. B. Butler. 16s. net. E. & F. N. Spon, 57, Haymarket, S.W. 1913.
- GENERAL SIR ALEX. TAYLOR, G.C.B., R.E.: HIS TIMES, HIS FRIENDS AND HIS WORKS. By Alicia Cameron Taylor. 2 vols. 25s. net. Williams & Norgate, Henrietta Street, W.C.
- PEMBA, THE SPICE ISLAND OF ZANZIBAR. By Capt. J. E. Craster, R.E. With 30 illustrations. Price 125. 6d. T. Fisher Unwin, Adelphi Terrace, W.C. 1913.
- THE FLAW IN OUR ARMOUR. By Major-General Sir W. G. Knox, K.C.B. With an Introduction by Field Marshal Earl Roberts. Price 1s. net. Herbert Jenkins, Ltd., Arundel Place, Haymarket, S.W. 1913.
- LIST OF ANNUAL SUBSCRIPTIONS TO ENGLISH, COLONIAL AND FOREIGN NEWSPAPERS AND MAGAZINES. Wm. Dawson & Sons, Ltd., Bream's Buildings, London, E.C. 1914.
- ELEMENTARY THEORY OF ALTERNATE CURRENT WORKING. By Capt. G. L. Hall, R.E. 3s. 6d. net. "The Electrician" Printing & Publishing Co., Salisbury Court, Fleet Street, E.C. 1913.

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