

"The Best is the Enemy of the Good."

ĩ.

SOME THOUGHTS ON FORTIFICATION AND OTHER CONSTRUCTION WORK.

By MAJOR-GENERAL SIR GEORGE K. SCOTT-MONCRIEFF, K.C.B., K.C.M.G., C.I.E.

It was recently announced in the newspapers, in a not very important paragraph, that the French were dismantling fortifications at Bayonne and at some of the detached works round Paris, that the former, built in the reign of Louis XIV., required dynamite to demolish the work, whereas the latter, dating from the days of Louis-Philippe, only required pick and crowbar. The inference was that the earlier engineers had done better, because more durable, work, and that the latter was the product of a decadent age, a period of compromise and outward show.

This started a train of thought in my mind, pondering the old French proverb, "Le mieux est l'ennemi du bien," and I venture to give to the readers of the R.E. Journal the result of my cogitations for what they are worth.

Bayonne was one of the best examples of Vauban's genius, and as it is situated on the southern frontier of France, and therefore not on the most important front, it is unlikely that thoroughness in constructing the works would be applied there if it were not also, to at least as great an extent, applied in Flanders and along the western frontier. Hence it is reasonable to assume that in the many other fortresses which the great French engineer built, there would be an uncompromising solidity as at Bayonne. Indeed, as far as one can judge from casual observation at the present day, the revetments of Lille, as solid and sound as ever, might be taken as samples of the perfection of brickwork and masonry. The amount of such masonry must have been colossal. ' If we take any reasonable length of the perimeter-say 100 yards, and think what a lot of revetments, passages, ramps, magazines, etc., were required in the bastions and their retrenchments, ravelins, covered ways, tenailles and all the other refinements of the science of fortification as then understood, it is evident that to attain " the best " (and apparently that was what was aimed at) there must have been enormous expense. And yet, no one knew better than Vauban himself that all this perfection of construction could not really render the fortress impregnable. Even

[JANUARY

Lille, his masterpiece, yielded to Marlborough in 1708, in four months, a heroic resistance, it is true, but with an inevitable end. Did the perfection of the work delay that end by a single day? or could the end in view not have been attained by less expense?

These are questions difficult to answer, and the only reply—and that a very unsatisfactory one—is, that at all events the strength of the fortress did not damage the French cause, beyond the relatively severe drain that it involved on the national purse, which in the days of the "Grand Monarque" was being sadly pinched. The presence of the fortress admittedly hampered the movements of the Allies in 1708, though it is at least possible that this end might have been accomplished with less costly means. "The good" in this case was at least not injured by "the best," though it is conceivable that the fortress might have swallowed up, as Metz did in 1870, so large a proportion of the fighting strength as to reduce the power against the enemy. In the case of Metz "the best" was assuredly the enemy of "the good," in this particular respect.

As regards the works round Paris, which now are being demolished with comparative ease, the resistance which they offered to the German attack in 1870 lasted as long as that of Lille to Marlborough. The end came, not from any want of solidity in the works, but from the famine blockade applied to the great city, a blockade which, as we know, was subsequently partially applied in the Great War to Germany as a whole, and declared by the Germans to be inhuman and barbarous.

To attribute the extreme solidity in execution, as well as elaboration of plan, to Vauban may, quite possibly, be mistaken. For he was not only a great soldier and engineer, but, as recent French research has shown, a wise statesman and administrator, and not the least likely to be led away to extremes of expense when a less costly plan would suffice. There were in his day, in France, many great soldiers who would not necessarily place too great a value upon fortresses. Turenne, Condé, Luxembourg were men who had learnt sufficiently well the lessons of the great master, Gustavus, to know that a mobile army must not be tied by its fortresses, though it may find them valuable pivots of manœuvre. But the general tendency of the day was to exaggerate their value, and to regard them as though they were in themselves offensive weapons, and it is at least possible that the weight of mediocre opinion in the war councils of Versailles insisted upon perfection of design and execution, regardless of cost. Thus it may be that Vauban, who no doubt had to submit his plans to the King and had to show in them the highest technical skill in design, was ordered to specify a greater amount of perfection in execution than he would have personally considered necessary. Whether he did so or not, it is certain that subsequent opinion gives . him the credit for both design and execution, as indeed is the case

1922.] FORTIFICATION AND OTHER CONSTRUCTION WORK.

with every engincer who builds a fortified work, whether he really approves of its details or not.

3

In our own country, after the Crimean War, there was a very justifiable apprehension that our principal naval bases were dangerously exposed to hostile attack. The recent experience of Sevastopol, situated far away from allied shores, yet attacked by land and sea, with a moderate amount of success, seems to have led to the conclusion that the same operations might be repeated on a larger scale on the shores of the English Channel. The committee that considered the matter was composed of eminent sea-captains as well as soldiers. of all arms, and their report no doubt reflected the mature military judgment of the time. Yet they do not seem to have recognized .the fact that a landing of hostile forces, followed by a deliberate siege, such as took place in the Crimea, involves command of the sea, such as the Allies had in 1854-56, and that the command of the sea to Great Britain is absolutely vital. If that supremacy at sea is lost to this country, there is no use talking about land defencesthe less is contained in the greater. Hence the design of a British naval fortress must be governed by resistance to craft coming over the sea, and attacking from the sea; in other words, all effort must be concentrated on the sea fronts, and for a power having naval supremacy that is all that is needed. It is obvious that the complete design of such a fortress would differ in the case of an island power with the command of the sea, from that of a continental power liable to attack both from land and sea (e.g., Russia at Port Arthur). "The best" that is the complete theoretical fortification of such a fortress includes, no doubt, complete land as well as sea defences, but it is " the enemy of the good," because it is far beyond what is necessary, is pro tanto a waste of public money, and requires, for its complete armament and garrison, guns and men that are much more useful elsewhere. The programme of defences which was begun under Lord Palmerston's auspices in 1860 was a huge and costly task, but it need not have been so large or so expensive had it been recognized from the first that permanent land defences might well be omitted, and also that celerity of execution was as essential as solidity, for defensive works, like battleships, rapidly become obsolescent. The works were hardly complete when the Franco-German War came on in 1870.

As an instance take the largest, at that time, of our naval fortresses, Portsmouth. The approaches by the Solent and Spithead were, rightly, guarded by many powerful works, by Hurst Castle, and the Isle of Wight forts on the West, and by other I.W. forts and the Spithead forts (each of which cost half a million) to the east, besides many inner batteries covering the nearer anchorages. But there was also a long line of land detached works guarding the Gosport side on the west, and the long ridge of Portsdown to the north, excellent designs and solid construction, but only of possible use in the event of what was really an unthinkable situation, viz. : the entire loss of the sea by this country, *i.e.*, utter national ruin. The landing of troops, siege trains, ammunition, etc., to deal with such works would have to be on a scale exceeding that of the Allies in the Crimea, and without the assured command of the sea it would be impossible. It is true that in the temporary absence of the fleet a raid might conceivably be made, landing a considerable force, with field artillery ; but to deal with such a possibility it was merely necessary to arrange for field defences, and to have sufficient mobile armament and mobile troops allotted to the fortress. The land forts, therefore, though "the best," were unquestionably "the enemy of the good," and the blame for this must be shared by the statesmen and the admirals aswell as by the staff of the Army and their technical experts, though the latter no doubt are generally blamed.

Although some other naval bases were defended in this unnecessarily complete manner (e.g., Plymouth and Chatham) it was not universal. At Gravesend, for instance, the defence of the Thames against hostile attack—a matter of great importance, considering the value of the commerce in London, a point fully appreciated by our encmies lately—was entirely on the water. Three powerful forts guarded a bend of the river some three miles below Gravesend, and in conjunction with them there were two belts of submarine mines. Provision against a raid, and possible taking of the forts in reverse, was made, by having a careful scheme of fieldworks planned and assigned for execution to a local volunteer Corps. This was one of the forerunners of the valuable Defence Schemes elaborated for every coast defence work prior to the late war, and which worked so well in practice.

The actual design of coast batteries at that time seems to have been based on that of a battleship of the period, *i.e.*, guns firing through port-holes protected vertically by steel armoury and massive granite piers, and by very solid concrete roofs above. I am not aware that this class of fort was ever tested by the experience of war, but (apart from the great cost of construction) it had the drawback of limits of traversing angle and of elevation for the guns, though it gave good security to the gun and detachment. There was no attempt at camouflage, except in the case of the Spithead forts which were painted in black and white check, which may have rendered them less visible than they otherwise would have been.

The most colossal of all the works carried out in that era, and, to my mind, by far the most conspicuous example of "the best," as opposed to "the good," is the Verne Citadel at Portland. The masonry here is of the most solid character, the ditches are stupendous, lined with cyclopean blocks of Portland stone, like the most massive of the Pyramids. Inside the citadel, where there are casemated barracks of similar massive character, even the humblest building is monumental, and any subsequent altering to bring them into line with modern sanitary ideas becomes a herculean task. While we do not forget that the Portland stone quarries are on the spot, and that convict labour was cheap, we may well enquire whether the purpose of the work, *i.e.*, to refuse the occupation of the summit of the peninsula to an enemy and prevent him commanding the waters of the harbour below, could not have been achieved with much less labour. It seems very much like using a steam hammer to crack a nut, when nut-crackers would do the work equally well, and probably better.

Towards the close of the nineteenth century our coast batteries went to the other extreme of protection from land, and of open working. The guns firing en barbette had no restriction of elevation and traversing, while the only protection to the batteries from land assault was a steel fence. This latter was frequently proved at manœuvres to be a surmountable obstacle, and consequently some attempt has been made of late years to enclose our coast batteries in works admitting of infantry defence against a landing raid. In the period before the Great War, little attempt was made to camouflage the batteries, but in the only case where it was attempted the Germans, curiously enough, attacked (it was at Hartlepool) and completely failed to damage the battery. The guns of the latter, in their turn, did useful work in returning the fire of the attacking battle-cruiser, the range being only some 2,000 yards. This was the only case where our coast batteries were actually engaged with the enemy.

On the N.W. Frontier of India there used to be an absurd rule that works which were intended to be held by regular troops, though designed locally, had to be examined and approved at Army Headquarters (the cost being borne by Army funds), but if the defences were to be manned and occupied by locally raised forces, such as frontier militia or border police, the cost was defrayed from local civil funds and the designs were approved by the Chief Commissioner of the Province and his engineer adviser. Thus (in my time, at all events) the works in the Khyber, Malakand and Kurram were of the former category and those in the Tochi, Gomal and Waziri country generally belonged to the latter. In the latter case, as funds were generally somewhat restricted, the result generally was to try and cut down the cost so as to achieve "the good " without necessarily having "the best," and the work was, relatively speaking, quickly done. One sometimes wonders what the tribesman of the frontier thinks of it all, and whether it puzzles him that in the Mahsud country there is rough masonry and rougher timber, while in the Khyber there is stone-walling of the best and steel loopholes and machicoulis. (I am speaking of 18-20 years ago, and doubtless meantime many

5

alterations have taken place.) There has been a lot of fighting of late years in those parts and I often wonder whether the works in the Tochi and Waziristan have stood the test of war; whether, in fact, they were good though not *the best*.

When I first went, as C.R.E. Punjab Frontier District, to visit the Malakand, in the days before the good old "Piffers" were done away with, I came across a superior person there who said that he supposed the works there were a specimen of the best fortification that could be devised for the place, that it seemed to him unnecessarily elaborate and that it was a pity that the R.E.'s could not exercise a little common sense in avoiding the best when the good was sufficient. Now he would have been quite right if, instead of being at the Malakand, we had foregathered at, say, Miranshah or Wana (only these places are too unhealthy for casual visitors). But as it turned out, the works he criticized had run the gauntlet of all the military hierarchy, up to the very top of the tree, at Simla. And although I was quite of his opinion as to the elaborate nature of the works, I knew it was certainly not the R.E. locally who had so devised them, though they had built them according to orders. Moreover, I felt pretty sure that, if another tribal rising should occur, we should be asked for more. And this actually happened a few months later, for there was a scare and the political officer and the O.C. troops both seem to have "got the wind up" badly. The latter ordered the local R.E. officer-a junior subaltern-to carry out an extension to the permanent works, which would have rendered the place more complicated, and really less defensible, than The R.E. officer wired to the headquarters of the Force for ever. instructions and got back a most peremptory refusal. The O.C. Troops ought, of course, to have sought the sanction of the G.O.C. before giving the order, and the G.O.C. was naturally very irate.

The principle of balancing "the good " and " the best " applies, of course, to all engineering works. When I was a subaltern in the 'eighties I went with two brother officers for a week's shooting to Karnal, halfway between Umballa and Delhi, and at one time a most important military cantonment. About the year 1842 it was found that the place had been so unhealthy for several years that it would be better to abandon the site and start a new cantonment at Umballa. using the old materials as much as possible. So the place was dismantled, and the new cantonment was built by Captain, afterwards Field-Marshal, Lord Napier. When I visited the spot, the site of the cantonment was covered with scrub jungle, full of game (we had excellent sport), and the only signs of former occupation were three huge cemeteries, full of crumbling monuments, and a few derelict buildings, not worth removing. Among these were a series of barracks for a British cavalry regiment, solid brick walls and arched brick roofs, and as I looked at them I understood why the cemeteries

were so large. The brickwork was excellent, the arches were perfect, nothing could be better technically; but life inside those barracks must have been too ghastly for words and, in the hot weather, the interior must have been like a brick kiln. One can only suppose that the original builders did not adopt cooler, if less permanent, materials on the ground that, with permanent construction there would be less expenditure on repairs. This is a bogey which has often stood in the way of real progress, an obsession which both in this country and in India, in civil life as well as in military, has had a baneful influence. The most perfect and permanent barracks I ever saw (from a purely technical point of view) were those built at Lucknow in the 'eighties. The design was rigidly that of the type plans sanctioned at Army Headquarters; the walls were of the best brickwork, the floors and verandah posts of the best cut stone, the roof timber and joinery of the best and most durable wood, and of the best workmanship. Everything was of the best; it was also very costly and, I should imagine, utterly and absolutely uncomfortable. Somebody described it as like living at the bottom of a narrow street. It was all of "the best," but it was not "good."

In like manner, about the same period, a barrack was built in Glasgow, three stories high, of the most solid stone masonry, and other permanent materials. Externally the buildings are gaunt and cheerless, inside they are dreary, comfortless and repellent. There are at the same place married soldiers' quarters of the same general description, and, when recently it was purposed to try and introduce some amenities of life to these comfortless dwellings, the expense of alteration was enormous, because of the difficulty of dealing with walls and floors of such uncompromising solidity. The Royal Barracks in Dublin, which are the oldest in the United Kingdom, were in their day (early-eighteenth century) the finest in Europe, but they have been the subject, in the late-nineteenth century, of innumerable sanitary commissions, and they are still, though solid and substantial, a very difficult sanitary problem. So also are many barracks built in such county towns as York, Ipswich, Exeter, Newcastle, etc., during the regime of awful administrative scandal, from 1792 to 1810, described by Sir Charles Watson in the third volume of the History of the Corps (pp. 142-147). The scandal apparently was hushed up, but the barracks, solidly built, still attest the iniquity of the period and are in use-the despair of the engineering reformer. It would be a sound policy to demolish them, but no Secretary of State would allow it as long as they provide accommodation of some sort.

In civil life, especially in connection with hospitals, we see just the same thing. Hospitals that are to-day considered the *dernier cri*, are in a few years anathema to the medical profession, and too often they are built not so much with the view of being suitable for healing

7

HANUARY

the sick as for giving an evidence of the architect's artistic skill. A few years before the war a hospital was opened in a northern city which cost \pounds 1,000 a bed. Conceivably it was necessary to have a building which was of monumental dignity and therefore it is reasonable to admit that some external treatment was desirable (a principle, however, which has been forgotten in London where a very ugly barrack is in close proximity to a royal palace). But during the war many hospitals were built, some of them of quite pleasing exterior, and in keeping with their charming surroundings, which cost only about \pounds 80 a bed, and where the sick were quite as comfortable, and the medical authorities and nurses quite as well able to do their work, as in the palaces which cost ten times as much. Moreover, the former could easily be altered, whereas the others are, and always will be, difficult to improve.

This question of temporary, but good, work was referred to by the present President of the Institution of Civil Engineers in his inaugural address this season, where he spoke of the policy of building railway bridges in Lancashire, during the early years of railway enterprise, of timber arches, replacing these some thirty years later, when weights and speed of locomotives had increased, by steel girders. This was an instance of "the good " being adopted from the first; and not a short-sighted striving after "the best."

Of course, where there is uncertainty as to weight or forces, or where there is certainty that any unsoundness may mean ruin, the engineer must from the first aim at the best. Reservoir walls, sea protection, magazines and many other such cases, will at once occur to one's mind. But where there is the prospect of altered conditions it is better to secure "the good" by the simplest means compatible with efficiency, and leave it to one's successors to alter one's work later, to achieve the "best." This is the policy underlying the light construction principle in military buildings which has been adopted of late years and which, although it has saved the country enormous sums in prime cost, has not entailed large expenditure in maintenance.

One has also to bear in mind to some extent the local conditions of works, the amenities of a countryside, or the conditions of climate. Some years ago, travelling up the Solent on a lovely summer afternoon, I saw what appeared to be a blot in the landscape on the fair scenery of the Isle of Wight. Turning my glass on to it I saw it was a row of recently-built married soldiers' quarters near Golden Hill Fort, of the regular standard plan, hideous and hopelessly at discord with all the surrounding scenery. There are similar rows of the same ugly buildings in the pine woods at Bordon and Blackdown. They are not cheap, they are not homelike or comfortable, but they are (as far as technicalities of construction are concerned) " the best." Royal visitors comment on their atrocious incongruity, and a

1922.] FORTIFICATION AND OTHER CONSTRUCTION WORK.

Parliamentary commission that visited Aldershot during the war stigmatized them as "more like prisons than houses," but it would be difficult to pick holes in the construction.

Let us hope that at least these and other similar atrocities will serve as a warning to future generations of R.E. officers, to strive after "the good" rather than "the best," where the requirements are not final and where other factors besides engineering construction have to be considered.

(In connection with the invasion of these islands, those who are interested in the subject are referred to an article by Rear-Admiral Sir S. Eardley Wilmot in *The Nineteenth Century and After* for December, 1921.)

9

A TRACTOR RAFT.

By CAPT. C. F. STOEHR, R.E.

About the end of February, 1918, at Felujah on the Euphrates, the writer was given two "C" class mahelas, or Arab boats, with a capacity of 23 and 24 tons, ten 9-in. by 4-in. R.S. joists 32 ft. long, and planks and ends 2 in. and 3 in. thick as required, and was ordered to make a raft to carry 15-ton tractors across the river, and to work day and



night at it. The load consists normally of 14 tons on the 4 ft.-long tractor wheel, and I ton on the round front wheel II ft. in front, but this front wheel is sometimes lifted, so that for purposes of calculation the load was assumed to be a concentrated one of 15 tons. As the load on the front wheel is small and the whole tractor is shorter than half the length of the joists, no further account need be taken of the front wheel.

It is clear that there will be no difficulty once the tractor is in the centre of the raft, but it is necessary to consider what happens while it is getting there.

The first idea was to put both boats close together and all ten joists across both boats (Fig. 2). Since each boat was II ft. wide



the ends of the joists would project only 5 ft. beyond the side of the boat. The small depth of water close to the shore caused a greater projection to be required, and there appeared to be no suitable means for making a gangway, or, if made, for temporarily joining it to the ends of the raft platform.

The next idea was to put the boats about 3 ft. apart (Fig. 3) with half the joists on each boat, the centres resting on the saddle and

1922.]

the ends lashed to the saddle of the other boat. This would give 10 ft. projection beyond the side of the boat, which was sufficient.



Assume first that before the tractor comes on to the raft the ends of the joists are just resting on the shore transom. As the weight moves from A to B, the whole raft must pivot about A, boat Y therefore sinks twice as much as X, and therefore takes about twice the load that X is taking.

When W reaches B then, if R is the reaction of X, 2R must be the reaction of Y, and, since AB = BC, reaction at A equals reaction of Y = 2R.

Hence W=2R+R+2R=5R and R=
$$\frac{W}{5}$$

The effect, therefore, is that of $\frac{4}{5}$ W, or 12 tons, in the centre of five 9-in. by 4-in. R.S.J. with a span of 30 ft. (allowing for width of saddle and overlap at A). This is too big a load; also both boats will tilt, and some different arrangement is required to get the tractor off at the other side unless the raft is deliberately tilted by putting the C.G. of the tractor over X, when X would be carrying 15 tons + 5 tons superstructure, which, with the boat tilted, is much too near the limit.

Now consider the end A as being unsupported by the shore transom. As the weight comes on, A sinks, X acts as the fulcrum of the lever AC and sinks, and Y acts as a counterweight, and is raised. Obviously the end A cannot be allowed to sink indefinitely, and this position alone offers no solution.

The idea, however, of combining these two positions by allowing the end A to sink a certain amount, during which time all the weight would come on X, and then supporting A, so that of the remaining weight twice as much would come on Y as on X, suggested itself as containing the germ of a solution. It would, however, be difficult, if not impossible, to calculate the depth to which A should be allowed to sink in order to take a given weight, but a further idea suggested itself, *viz.*, to pivot the centres of each set of joists on its own saddle (*Fig.* 4), leaving the ends on the saddle of the other boat free to rise. This has the following advantages :—

- (a) Exact calculations are possible.
- (b) Tilting is almost entirely eliminated.
- (c) All cantilever stresses, and dependence on lashings holding down the ends of the joists are eliminated.

The solution was now achieved (Fig. 4) and it only remained to get out the calculations and devise practical details.



Calculations.*—As the weight rolls on from A to B, B is depressed until the end C comes down on the saddle and boat Y begins to take the weight. The load continues on until it reaches B.

Now when the load is halfway between A and B, the bending moment is $\frac{WL}{4}$. (L=AB). When the load is at B, the effective length of the beam is AC, *i.e.*, 2AB. To ensure that the BM shall not exceed $\frac{WL}{4}$, the effective weight at B must not exceed $\frac{W}{2}$ when the load is at B. Therefore, in this position, Q, the reaction at B, must be at least $\frac{W}{2}$, and, since AB=BC:—

P (reaction at A) = R (reaction at C) = $\frac{W}{4}$.

Now, if d=depression of one boat under the full load of the tractor, the depression of B must be at least $\frac{d}{2}$ to produce a reaction of $\frac{W}{2}$ (this is only approximate, except with vertical-sided boats, but is quite near enough). The depression of C will be $\frac{d}{4}$, and since ABC is a straight line, the shore transom must be $\frac{3}{4}d$ below the saddle of the unloaded raft.

Since d can be found by experiment or calculation, we know exactly the level at which to place the shore transom.

Various Positions of Load.—Y will begin to take the load when B is depressed $\frac{1}{2} \times \frac{3}{4}d$, or $\frac{3}{6}d$, *i.e.*, when $Q = \frac{3}{6}W$; and since R = 0, $P = \frac{5}{6}W$. This will occur when the load is $\frac{3}{6}AB$, or about 6 ft. from A.

From this point Y takes twice as much of the extra load until the point is reached when P=0. At this point :---

$$Q = \frac{3}{8} W + \frac{1}{3} \times \frac{5}{8} W = \frac{7}{12} W$$

R = $\frac{3}{8} \times \frac{5}{8} W = \frac{5}{15} W$

* These calculations were worked out by Bt. Lt.-Col. J. F. Turner, D.S.O., R.E.

This is the highest figure that Q can reach, for as the load rolls on, Q diminishes and R increases.

If the load is at D when Q is a maximum, then

$$W \times BD = \frac{5}{12} W \times BC$$

. $BD = \frac{5}{12} \times 16 = 6\frac{2}{3}$ ft.

After the load passes D, the end A rises clear of the shore transom, so that there is no difficulty about shoving off, or bringing the raft in for disembarkation.

It may be noted that, if the joists are extra strong and the loading capacity of the boats small, then by making the level of the shore transom only $\frac{d}{2}$ below the saddle level, the load on either boat will never exceed $\frac{W}{2}$. Nothing is gained by making the difference of level more than $\frac{3}{4} d$.

Verification.—All movements, both for tractor coming on and going off, corresponded exactly to calculations. There was practically no tilting, and though the superstructure weighed 5 tons per boat, there was always a freeboard of 13 to 15 inches.

PRACTICAL DETAILS.

1. Strutting of Saddles.—The saddles had both vertical and side strutting so that the load was well spread out, and the saddle was at such a height that $1\frac{1}{2}$ -in. planks could be nailed from gunwale to gunwale under the saddle, so as to give extra cross-bracing.

2. Bracing of Raft.—The boats were kept apart by distance pieces and then well braced together with thin wire rope.

3. Balance of R.S. Joists.—The centres of the joists were put on on the outer edges of the saddles so as to make the see-saw as easy as possible, and were held in position by \lfloor -shaped spikes driven into the corner of the saddle. The outer ends were wired to a wooden cross-piece clear of their bearing on the shore transom, and the inner ends each had a lashing, by which they could be quickly tied down to a bar fixed below the saddle of the other boat, or cast loose.

4. Chessing.—This consisted of a double layer of 2-in. hardwood planks, which were hardly marked by the movements of the tractor. As the chesses between the saddles have to lift with both sets of joists, their ribands must be fixed to the chesses only, not to the joists. The inner ends of the joists must coincide with or be slightly inside the outer edge of a chess.

5. Anchoring of Raft.—The coming on of the tractor tends to push the raft out into the stream, so it must be securely held in position.

6. Abutment.—The height of this must be adjusted to suit any rise or fall in the river.

Passage of Tractor.—A $1\frac{1}{2}$ -in. steel cable was laid across the river, lying on the bottom, so that traffic up-stream was not interfered with, and was laid over the bows of the boats behind a bollard a few feet from the bow on the gunwale nearest the bank of departure, so that on pushing off the current helped to carry the raft across, the raft picking up the cable as it went. Half a dozen men on the raft pulled on the cable and the whole passage presented not the slightest difficulty. At Dhibban, where there was a bridge, instead of a cable, men walking across the bridge with one or two ropes to the bows of the raft took it across.

A TRACTOR RAFT.



The Tractor Raft.



Tractor on Raft, Felujah.

л,

SOME SUGGESTIONS REGARDING THE TRADE ORGANIZATION OF THE ROYAL ENGINEERS. WITH SPECIAL REFERENCE TO ELECTRO-MECHANICAL REQUIREMENTS.

By BT.-MAJOR H. S. BRIGGS, O.B.E., A.M.I.MECH.E., A.M.I.E.E., R.E.

EXISTING regulations were framed immediately after a period when the title of "tradesman" was perforce applied to any man with any pretensions to a trade and at a time when recruiting was slack. Groups D and E, in fact (referring to the recent Army Order), comprise men who in civil life are really little better than partially skilled labourers. It is suggested that the trade organization of the Royal Engineers might now be reconsidered.

Labour required for engineer purposes, and particularly for electro-mechanical operations, may be classified as follows :---

(a) Directional; (b) highly skilled maintenance or constructive;
(c) operative (semi-skilled); (d) labourers (unskilled).

In illustration of the above grouping the following table is presented for several branches of electro-mechanical engineering activity :---

GROUPING.	A Modern Engineering Workshop.	H.M. Navy.	Garage of a big Omnibus Company.	Locomotive Running Shed.	Royal Engineers.
(a). DIRECTIONAL (b).	Works Mana- ger & Staff.	Engineer officers.	Works manager. Etc.	Shed Foreman.	Commis- sioned ranks. Mechanists.
HIGHLY SKILLED	Foremen. Chargemen. Test bed men. Design men. Tool and jig men.	Engine-room artificers. Electrica] artificers.	Foremen. Chargemen. Repair mechanics. Test drivers.	Chargehands. Drivers. Shed Fitters. Boilermakers. Etc.	
(c). Operative	Machinemen. Crane drivers Etc.	Mechanicians Torpedo rating. (The latter are trained in searchights and wiring).	Drivers.	Steam raisers, Storemen, Etc.	Fitter-drivers Electricians. Etc.
(d). Labourers	. Shop labourers.	Stoker ratings.	Cleaners.	Cleaners.	Pioneers.

THE ONLY OBJECT OF MAINTAINING SOLDIER-MECHANICS IN PEACE IS THEIR EMPLOYMENT AS SUCH IN WAR. If mechanics were required only for the domestic service of the Army in peace time, the work

[]ANUARY

could be more cheaply and efficiently carried out by civilians.

The employment of a soldier-mechanic in war may occur under, generally, one of two conditions :---

(a) A war of such dimensions as to necessitate the wide expansion of the technical Services by voluntary or compulsory enlistment of civilian tradesmen, or (b) a small campaign in which the technical Services are not expanded by civilian recruitment and are self-supporting.

In case (a) the regular soldier-mechanic, by virtue of the military spirit with which he should have been imbued in peacetime, will be most probably selected for promotion, and will be placed in charge of enlisted civilian tradesmen. In case (b) the work will be of a general and all-round character and will be carried out by the regular soldier-mechanic himself.

From both the above requirements it is evident that the regular soldier-mechanic should be highly-skilled, and should have indeed superior trade qualifications to those of the enlisted civilian. In this connection it may be noted that the standard of personal craftsmanship in civil life is continually decreasing owing to mass-production and the specialization of industrial operations.

It is suggested that a Royal Engineer trade organization is required, at any rate for electro-mechanical purposes, almost exactly analogous to the Engineer branch of the Navy. Under this system the multiplicity of trades now obtaining of analogous and in some cases identical character, would be abolished and a clear-cut series of trade ratings adopted as subsequently set forth.

The ideal of having in a unit men capable of doing any class of work that can possibly turn up, from paper-hanging to precisiongrinding, though a long-cherished tradition, is one impossible of fulfilment under modern conditions. Units must be organized in the main for some definite class of work; a field company is organized chiefly for work of a "civil" engineering nature; an E. and M. company is organized for work of a mechanical nature, and so on. The trades comprised in each must, in a general way, suit the character of the work expected of the unit.

For Royal Engineer purposes, trade ratings could profitably be classified into the following main divisions :—(a) Constructional ("civil" engineering); (b) Electro-mechanical; (c) Miscellaneous (survey, etc.).

The first two groups comprise most of the trades required by the Corps. In these notes only the second group (electro-mechanical trades) will be considered, but it is probable that a similar organization could be worked out for the other two. The attainment of a

1922.] TRADE ORGANIZATION OF THE ROYAL ENGINEERS.

high degree of proficiency, both Military and Technical, will always be the aim of the Corps. Technical proficiency in a high degree cannot be acquired and retained by the individual unless he has the opportunity of (a) satisfactory training; (b) continuous employment on technical work of a varied and progressive nature; and (c) an open avenue of advancement for himself.

In order to fulfil the above requirements and thus to provide an expert nucleus—a nucleus which, it is suggested, at present does not exist—the "Establishment for Engineer Services" should be expanded and re-organized in such a way as to put the bulk of the technical electro-mechanical work of the R.E. on their shoulders. They would then be to the R.E. what the engineer branch of the Navy is to the Navy. At the same time, their status should be improved, their personnel should be more closely incorporated in the regimental organization of units, specialist officers should be selected from the same sources as other R.E. officers, and the title "Establishment for Engineer Services" should be dropped.

So far as electro-mechanical work is concerned, the foregoing proposal chiefly involves filling up the gap between the Staff-Sergeant Mechanist and the Sapper with the following ranks:—" Sergeant Mechanist," " Corporal Mechanist," " Lance-Corporal Mechanist."

Under this new system a man, instead of being promoted direct from the ranks to S.S. Mechanist, would have to work his way up. through the various grades, gaining experience all the time until hereached the higher supervisory positions. It is probable that under present conditions the only way in which a satisfactory supply of Lance-Corporal Mechanists could be obtained is by training boys in exactly the same way in which the Engine-room Artificers of the Navy are trained. Once the foregoing principles are admitted, the principle of "combined" trades can be introduced. The "combined trades " suggested for electro-mechanical purposes are :---(a) fitter and turner; (b) boiler and engine smith; (c) electrical artificer; (d) iron and brass moulder; (e) sheet metal worker; (f) patternmaker and draughtsman. With five years' training mechanists of combined trades could be expected to possess sufficient. qualifications in several of the individual specialist trades set forth in Army Order 362/20.

(a) Mechanist Fitter and Turner would have sufficient qualifications in the following A.O. 362/20 trades:—Fitter; Fitter (Caterpillar tractor); Fitter (steam tractor and Foden); Fitter Driver; Fitter Driver (internal combustion, lorry and car); Millwright; Toolmaker; Turner; Grinder (precision); Miller and Machinehand; Motor-cycle Fitter; Driver, I.C. (R.E.); Driver, I.C. (lorry and car); Driver; I.C. (Tank Corps); Driver, I.C. (lorry and steam tractor);

17

Driver (steam engine); Engine Driver (Marine engineers, etc.); Engine Driver (stationary, steam, etc.).

(b) Mechanist Boiler and Engine Smith :---Acetylene Welder; Boilermaker; Blacksmith; Riveter.

(c) Mechanist Electrical Artificer :--Electrician; Fitter, (secondary battery); Instrument-maker (fortress); Lineman; Lineman (power); Cable Jointer; Searchlight Operator; Secondary Battery Attendant; Switchboard and Dynamo Attendant; Wireman (indoor); including three years' training in bench fitting and on lathes and machines.

(d) Mechanist Iron and Brass Moulder:—Iron Moulder; Brass Moulder; Fettler; Coremaker.

(e) Mechanist Sheetmetal Worker :-- Acetylene Welder; Coppersmith; Plumber; Tinsmith.

(f) Mechanist Patternmaker and Draughtsman :--Patternmaker and Draughtsman (mechanical), with a general training in works practice.

Since, especially so far as the higher ranks are concerned, electromechanical work has to deal chiefly with the operation and maintenance of machinery, it would probably be necessary to limit promotion to and above, say, the rank of Staff-Sergeant Mechanist, to Mechanist Fitter and Turners and Mechanist Electrical Artificers, since these are the two trade groupings most intimately concerned with work in connection with plant. As regards the other trade groupings, whereas possibly some few promotions to the higher ranks might be provided in cases where technical employment could be found in supervisory positions in the larger workshops, etc., it would probably be necessary to arrange some other avenue of advancement. The lure to appointment in the Mechanist ranks would be accelerated promotion.

Mechanists should be appointed in the first place as Lance-Corporal Mechanists, and this and subsequent ranks should be made to correspond as regards pay and promotion, age for age, with the Engine-room Artificer grades in the Navy. The general age for appointment of Lance-Corporal Mechanists should be about 20. This allows of five years' training from the age of 15, corresponding to Naval practice in this respect.

Some Mechanists might be enlisted direct if they were up to the high educational and technical standard contemplated, but the only entry to the Mechanist branch should be as Lance-Corporal Mechanist with an age limit of 23 or 24. Besides the skilled Mechanist ranks, a limited number of semi-skilled ranks are required to dilute the former and also to provide an outlet for the technical advancement of Sappers of mechanical inclinations. Such grades would correspond to the Mechanician ratings in the Navy. For electro-mechanical purposes the following would be sufficient :--Fitter-Driver (Classes I, 2 and 3); and Electrician (Classes I, 2 and 3). These would be recruited from enlisted men, and it would not be worth training boys for these grades.

Promotion from class to class of Fitter-Driver or Electrician should be dependent on the man's passing successfully a course arranged for each. Thus, Class 2 or 3 would be given after a preliminary three months' training.

He should then join a unit for a period, and if he had enough colour service to complete he would be eligible for a further course for Class I. The present system of granting trade qualifications within the unit should be abolished, for these particular ratings. In order to open up an avenue of advancement for the Fitter-Driver and Electrician grades it would perhaps be desirable to establish a separate system of grades, the candidates for which would be long-service men of mechanical inclinations, who would be trained for two years in one or other trade groupings, as is done in the Navy. On examination of the present limited requirements of the Corps, however, it would probably be found that this series of grades was not required.

19

PROFESSIONAL NOTE.

THE TECHNICAL TRAINING OF ENGINEER OFFICERS.

(COMMUNICATED BY THE COMMANDANT, S.M.E.).

At the present time a certain number of R.E. officers are undergoing a portion of their Engineering Courses at Cambridge instead of the S.M.E. This arrangement is a temporary one designed to expedite the technical training of the officers who were commissioned during the war, but the question of whether it would be desirable to convert it into a permanent system for all officers commissioned in future from the R.M.A. is now under consideration at the War Office. The question of whether or not any change in the present methods of technical training for engineer officers is desirable, and whether the suggestion to give part of that training at a University offers any advantages, is one on which various opinions will no doubt be held. The following memorandum is published with a view to showing what are the principal arguments in favour of the proposal and drawing criticisms from those who are opposed to the idea.

The series of courses which all officers on first appointment to the Royal Engineers undergo at the School of Military Engineering, with a view to fitting them for their technical duties, amounts to a total period of rather less than two years. Fifty years ago these courses were of the same duration. Yet in this interval the whole range of the science of engineering, both in its civil and its military applications, has been enormously extended; engineering and mechanical sciences generally are now taking a large and increasing part in war and their influence on future military operations is likely to be greater than ever. The standard of engineering knowledge required of engineer officers has therefore greatly increased and it is more than ever necessary that they should be kept abreast of modern developments in engineering theory and practice.

It is evident that the technical training of engineer officers must be continually improving in order to keep pace with the increasing demands that will be made on their knowledge and ability. If we remain satisfied with the standard which was considered good enough before the European war for our military engineers, while the engineering sciences and practice of civil life are advancing by leaps and bounds, the inevitable result will be that the engineer services of the army in peace and war will fall off greatly in efficiency, and this will in turn seriously affect the efficiency of the army as a whole.

To improve the technical training of our engineer officers several courses are open to us. One is to extend the period of instruction at the School of Military Engineering so as to be able to include adequate instruction in all branches of engineering practice that it is desirable for engineers to be capable of undertaking. Another is to aim at a much greater degree of specialization among engineer officers, namely, after a moderately short course of instruction in the general duties of military engineers, to allow them to divide into separate branches undergoing specialized and advanced training in one particular subject only, e.g., constructional engineering, mechanical or electrical engineering, field engineering of " pioneer " level, survey, railway engineering, etc., and to employ them subsequently only in their special branches of work. A third, which has been recommended by Lord Rawlinson's Committee on Engineer Organization, 1919, is to give all engineer officers their training in engineering subjects at a university in such a manner as to ensure their getting the same training as civil engineers. Before discussing these alternatives in detail, it is desirable to consider what are the ends to be aimed at in training engineer officers under the conditions that are likely to prevail in the future.

In past times the career of an engineer officer has generally been remarkable mainly for the variety of the experiences and problems which have presented themselves to him. To a civil engineer the system seems a surprising one which permits of an individual military engineer finding himself at different periods of his career employed on such diverse occupations as design and construction of barrack buildings, command of a field company, lay out and construction of railways or roads in new countries, organization and running of workshops, colonial survey work and perhaps also employment on the staff of the Army. At first sight it may seem that this practice would produce officers who are " Jacks of all trades" but with no more than a limited knowledge of any of them and that such a system would lead to failure in the execution of technical work through want of men with specialized knowledge. It has to be remembered, however, that the problem of the army is very different from that of commercial undertakings.

In the late war the immense engineering requirements could only be met by the enrolment in the Royal Engineers of the greater part of the civil engineering personnel of the country. Most of these engineers were men of more or less specialized training and experience, and many were experts of standing in their particular branch of the subject. It was natural and fitting that they should be employed as far as practicable on their own special subjects. Moreover, the

1922.]

vast scale to which the whole of the operations developed made it economical and efficient not only to organize engineer units for specialized work, *e.g.*, field, railway, tunnelling, electrical and mechanical, inland water transport, gas, forestry, etc., etc., but also to avoid interchange of their officer personnel, *i.e.*, to put each man into the line of work for which he was best suited and as far as possible to keep him at it.

This experience has led to the suggestion that the permanent organization of the regular engineers should follow the same system. Some have proposed that there should be separate corps of field engineers, mechanical engineers, constructional engineers, railway engineers, etc., each specially trained for its own special line of work only, and the personnel not interchangeable. Others have suggested that, although the engineer units should be, as they always have been. organized for special classes of engineer work, and that the rank and file personnel should be, as it is now, interchangeable, thus retaining the general organization of a single "Corps," the officer personnel should be trained on specialized lines, e.g., as field engineers, constructional engineers, mechanical engineers, etc., and not be generally interchangeable. In considering such proposals it is necessary to ask whether the functions and the requirements of our very small regular peace army are similar to those of the great national army which was employed in the late war.

Actually, the difference between the two cases is of a similar nature to that between a manufacturing business organized for mass production on a huge scale and another one organized for a very small out-turn of goods of variable type. In the former case great economy is obtained by pushing specialization and standardization to the utmost lengths. Each factory is organized to produce one pattern of article only in endless repetition. In each shop only one operation is undertaken. But in a small business with variable types of work, the shops must be prepared to undertake various tasks; too much specialism will lead to plant and personnel being frequently idle and unproductive.

The functions of our small regular army in war are two-fold :---

- (i.) in the case of small wars and expeditions, to carry them out with the peace establishments of the Regular Army expanded to war establishments by the inclusion of the Army Reserve, but with little, if any, further expansion from civil sources.
- (ii.) in the case of great wars against highly organized powers to form a nucleus round which the entire national resources in men and material will be organized for the prosecution of the war; to train and instruct the national levies in their duties and to organize and direct them in such a manner that their capacities can be utilized to the fullest extent.

For both of the above cases to have the engineers of the regular army trained on specialistic lines and non-interchangeable would be uneconomical and inconvenient. It is impossible to forecast which branch of engineering will be most in demand in any future small war and to maintain sufficient personnel to meet all probable requirements in each branch is impracticable. It is essential that, on occasions when a certain class of work becomes temporarily the predominating factor, it should be possible to concentrate on it all the available engineer personnel. In every one of our minor wars this state of affairs has arisen, e.g., in South Africa, 1900-1902, there was a time when the extension and maintenance of the railways became so important that practically all the engineer personnel was turned on to it. At a later stage it was all turned on to building blockhouses. In the European war the same thing was seen. At the outset the biggest demand on the engineers of the regular army was for officers who could raise and train the field companies of the Every available officer who could be spared from New Armies. service with the expeditionary force was allocated to this. On the Western Front the high proportion of casualties made the supply of officers to field units at the front for some time the predominating demand. When this happened it also became necessary to take officers from technical duties on the L. of C. and elsewhere and send them to the front line units, and to replace them in their technical duties by officers who had been with field units, but who were disabled by wounds or otherwise from front line service. Had the Corps of Royal Engineers been organized in water-tight compartments of non-interchangeable specialists, very serious difficulties would have arisen in distributing officers to different classes of work.

For the above reasons it is important that engineer officers should be capable of undertaking any of the principal branches of the work that may fall to a military engineer. This does not preclude a certain amount of specialization. It will always be necessary to have a small percentage of officers who have specialized in mechanical or electrical engineering, survey, railways, etc.; they are required primarily for the purpose of carrying out the duties of the above natures in connection with the wants of the army in peace. Only a comparatively small number, however, are required, and the majority of engineer officers require to have "general service" qualifications. By this is meant that, besides having had a complete military training, experience in regimental duties and knowledge of the characteristics, mode of operation and requirements of the other arms, they should be capable of being employed on any of the ordinary engineering work that may be required in connection with the accommodation of troops, both in peace and war, or with water supply, provision of power and light, road and railway construction and on ordinary geographical survey work. Their military training

(922.)

JANUARY

should, of course, include training in field engineering and military bridging and in the co-operation of engineers with the other arms.

Such officers will be capable of carrying out all the engineering works of the improvised type that are necessary in the fighting zone. Of the more permanent and more elaborate works required behind the fighting zone they will be able to design and execute all the normal ones in connection with accommodation for men and horses, hospitals, roads, railway construction, provision of water, light and power, in any campaign of moderate dimensions. When, however, any of these branches of work becomes of such a magnitude or complexity as to make it advisable to obtain the services of specialists from civil life, or preferably from a "Special Reserve," the regular engineer officers will know sufficient of the subject to enable them, if in positions of responsibility (e.g., as Chief Engineers or Directors of Works) to make full use of the services of the specialists, to comprehend their proposals and to realize the extent and the limitations of the assistance they can give the Army; at the same time the engineer officers in junior positions will be capable by their training of working to advantage under the control of the specialists if so required.

The branches of engineering mentioned above do not embrace all the classes of work that may fall to the lot of an engineer officer. Not only are the engineering and technical requirements of the Army continually increasing, but new scientific and technical services are constantly being born. It generally happens that these have to be executed by the engineers until they acquire sufficient importance to warrant a separate organization. Thus the Signal Service, after many years of existence as a branch of the engineers, has only lately been forced into an independent organization. The work of the Royal Air Force was originated and first developed by the Engineers, and mechanical transport similarly began in the Engineers until it was transferred to the Army Service Corps. Gas warfare began in the late war as an Engineer organization. Individual officers are frequently called upon to undertake technical works of most diverse types dealing sometimes with subjects of which they have had no previous experience or training.

The determination of a training which will fit an officer for such varied duties is obviously a matter of considerable difficulty. It is hopeless to try to give him instruction in detail in every type of engineering problem which he may encounter in his subsequent career. In fact, it is evident that the training which will enable an engineer to undertake any kind of work which may come his way cannot be completed by instructional courses alone, but only by a wide practical experience in after life. The wider and more varied this experience can be the greater will be the officer's breadth of outlook and his readiness to accept without dismay, and to solve with intelligence, whatever problems may confront him. For this reason it is very undesirable to allow engineer officers to perform the whole, or even the greater part, of their service in one branch of engineer duties. It is particularly necessary that they should obtain experience in the design and execution of engineering works and in the organization and handling of labour. At the same time they should return at intervals to regimental duty with a unit and avail themselves of all opportunities to take part in field manœuvres with other arms.

Since it is not possible, in the short time available for the technical training of the engineer officer, to give him detailed instruction in all the types of engineering problems that he may meet, it is evidently necessary that his training should consist mainly of a thorough grounding in the general theories of the three main branches of engineering, i.e., constructional, mechanical and electrical, to such an extent as will enable him to study intelligently and master without difficulty the details of whatever branch his subsequent career requires him to practice. Specialism of all kinds should be deferred to a later period. This training in theory pre-supposes a knowledge of mathematics, mechanics and physical science of a degree sufficient to make the engineering theories intelligible. At the same time the practical application of theory to the problems which the military engineer may meet should not be neglected. Without some training in such applications, without having been exercised to some extent in working out engineering problems, he may find himself unable to set about even a simple engineering job when called upon to do so. Similarly it is very desirable that he should obtain during his period of training some knowledge of elementary workshop practice, of the processes of filing and shaping, forging, moulding, casting, acetylenewelding, etc., and the use of the usual machine tools, also a similar knowledge of the principal building trades, and of the present day types of steam and internal combustion engines.

This practical teaching can only be given to such an extent as will enable the officer to distinguish good work from bad and to realize the properties and capacities of the various materials and machinery used. It is very desirable that in certain subjects theoretical teaching and practical application should proceed hand-in-hand, but in view of the shortness of the time available care must be maintained to resist the temptation to increase the practical instruction to such an extent as to reduce the theoretical and educational portion of the courses. An engineer who has been well and truly grounded in theory will have little difficulty in making up later on the deficiencies in his practical knowledge; one whose theoretical training has been stunted in order to widen the scope of his knowledge of detail may never get another opportunity of acquiring the theory and may be seriously hampered for want of it. The teaching given at a university is mainly of a theoretical character. A man who has been through the Mcchanical Science Tripos Course at Cambridge or the engineering course at any of our modern universities has certainly received a very thorough grounding in the theories of the main branches of engineering and also in the mathematical, mechanical and physical sciences which form their foundation. It would no doubt be better if a greater degree of workshop or other practical teaching could be carried out simultaneously with the theoretical teaching than is possible at most of the universities, but this defect, to such an extent as it may be considered to exist, is, in the opinion of many leading practical engineers of the present day a far less serious one than its converse, namely a deficiency in theory caused by too much attention to practice.

It is becoming more and more the practice among the leading engineering firms at the present day to select for appointment to their higher grades young men with a university training rather than with a specialized training. They look on premature specialization as pernicious, and they consider that whatever specialization they want they can teach to their employees, provided they have had a thorough engineering education, much better in their own works than could possibly be acquired in any training school. A similar argument applies to military engineers. The technical details of their engineering work they will pick up better when they come to practice it in after life, than they would if attempt were made to teach them in their training school period, always provided they have acquired a familiarity with the underlying theories, and have been accustomed to the processes of thought required for the solution of engineering problems. These latter qualifications military engineers require in all respects to the same degree as do young men destined for the civil engineering professions, and there can be no doubt that their engineering education must be of the same standard as that of civil engineers.

The engineering education of our Royal Engineer officers consists of a portion of their courses at the Royal Military Academy, Woolwich and the School of Military Engineering, Chatham. Each course is of approximately two years' duration including vacations, etc., but comprises much other education besides that in engineering. At the Royal Academy, cadets receive instruction in mathematics and mechanics, physics and chemistry of the nature suitable as a foundation for the education of an engineer, but the time available for these subjects is limited by the fact that the Academy course must also include military training of the cadets and their preparation for their duties and responsibilities as officers. Nevertheless it is probable that all the cadets destined for the Engineers reach, or could be made to reach, by the time they leave the Academy a standard of scientific education equal to that of the Intermediate examination for Honours in engineering at a university or civil engineering college, or that of the Cambridge Mechanical Science Tripos Honours Students at the end of their first year at the university.

The course at the School of Military Engineering includes the remainder of the technical training of the engineer officer in engineering, which is given in the form of courses in constructional and electrical engineering and in machinery and workshops. Here again the time for these subjects is limited by the fact that the S.M.E. course must also include military training, survey, field fortification and military bridging. The three engineering courses occupy about a half of the total course of two years, and, although they include a certain amount of theory, particularly in the construction course, they are in the main of a practical, rather than of a theoretical nature. It cannot be said that these three courses, occupying an aggregate of eleven months, are equivalent to the second and third years of a university training for an honours degree.

The difference lies mainly in the fact that the university course provides considerably more of the theories, particularly of the mathematical theories, underlying engineering practice, whereas the S.M.E. course aims more at familiarizing the officer with the formulæ he can use, the practical technical methods he can employ, and the types of construction and machinery and electrical plant that he is likely to meet in the army. But from what has been said before it will be evident that with the constantly increasing range of work with which the engineer officer may find himself called upon to deal it cannot be possible to familiarize him, during the comparatively short period available for his engineering training, with all, or anything approaching all, of the practical technical methods he may require to use, or of the types of constructional work or of machinery, etc., that he is likely to meet. He will be in a much better position to solve the practical problems that come before him later on if he has had a training in theory equal to that of the university-trained civil engineers, rather than if this type of training has been to a considerable degree neglected in favour of practical technical teaching. Thirty to fifty years ago it was assumed, and probably rightly, that the theoretical and educational training required for the engineer officer was practically all given at the R.M.A. Woolwich and that the S.M.E. course should be mainly practical and technical. As engineering science in all the three main branches developed, endeavours have been made from time to time to include in the S.M.E. course-which has not expanded in total length-instruction in the application of many new engineering developments. The result has been that certain courses have become congested with technical details beyond the power of the average officer to assimilate in the time available. The time has come to abandon the vain endeavour to teach an ever-increasing number of practical applications of engineering without a good basis of knowledge of theory to found them on, and to realize that the greater the developments of engineering and the wider range of the applications of it which the military engineer may encounter, the greater is the necessity for ensuring to him this foundation of theory.

It is not suggested that instruction in the practical applications of engineering theory should be neglected. It is essential that the military engineer should not only be exercised in working out engineering problems and receive practical instruction of the nature mentioned above, but also that his courses should include certain examples of the special applications of engineering to military requirements, e.g., principles of design of barracks, hospitals, camps, military roads, water supplies, the chief uses of machinery in the war zone, search-lights, etc., etc. The applications of engineering to the operations of war (as distinct from those to the accommodation, health, comfort, and movement of troops) will of course be taught, as they are now, under the head of fortification and military bridging.

To introduce the increased amount of theoretical training advocated above the possible alternatives are either to alter the nature of a good deal of the course at the S.M.E. and also to lengthen it, or to adopt the suggestion of Lord Rawlinson's Committee that all officers commissioned in the Royal Engineers should undergo their training in engineering subjects at Cambridge University. The latter proposal has certain very great advantages. The value of theoretical teaching depends largely on the efficiency of the teachers. It is more than doubtful whether it will be possible to obtain from the Corps of Royal Engineers a succession of officerseach holding his office for four years at the outside-with the requisite special qualifications. At a great university on the other hand the professional staff are specially selected for their qualifications in the art of teaching and have an experience and an acquaintanceship with the educational standards of the country which few, if any, engineer officers can possess. Moreover, the teaching at a university can be relied on to keep pace fairly closely with the developments of engineering science and practice in the commercial world, whereas it is by no means certain that an institution like the School of Military Engineering will always do so. If the former fails to turn out graduates well qualified to take their place in the engineering world, the fact will not long remain undiscovered, and the number of students seeking entrance at its schools will diminish. In the case of a military institution, it may be a long time before the inadequacy of the tuition is recognized, and the effects may be most injurious to the country's vital interests. When the necessity is recognized for an improvement in the system of training in order to keep pace with outside developments it is nearly always financial considerations which prevent its realization. A university obtains

its funds from numerous sources, such as the fees of its students, ancient endowments, gifts and donations from the wealthy and benevolent of the present day, and in some cases from firms and commercial corporations belonging to the professions which benefit by the researches and studies carried on there.* It is needless to ask which is more likely to be able to overcome financial difficulties, an institution of the above nature or a government military educational establishment which has to struggle for its funds with the Treasury.

The engineer officer who obtains his engineering training at a residential university, such as Cambridge, enjoys the great advantage of mixing in the society of young men of his own age destined for all kinds of civil professions. Many of them are men of intellectual power or originality. Some will in the future make their mark in public life, others in the scientific and learned professions or in the commercial world. To mix with these men by residence in the colleges and to take part in their recreations as well as their studies is bound to have the effect of broadening the mental outlook. The members of any profession which lives and works in a circle of its own are bound to have a tendency to narrowness, and neither the Army as a whole nor the Royal Engineers in particular are any exception to this rule. As matters stand, the Royal Engineer officer undergoes four years of training at Woolwich and Chatham during which. except for his association at the former place with cadets destined for the Artillery, he is quite aloof from the rest of the Army and from men of his own age in civil life. The opportunity for mixing intimately with the latter, learning their point of view and measuring himself by their standards is certain to be of great value to himself and to the Army.

An objection that has been raised to this proposal is that officers who have been to a university for part of their training will deteriorate in military spirit and discipline by having been withdrawn for so long a time from military surroundings and atmosphere. Fears are also sometimes expressed that at the university some of them may run wild, neglect their studies or develop undesirable eccentricities of thought and behaviour. The dangers of any of these things happening can be guarded against without difficulty. All the officers who go to Cambridge will be required to undergo, in addition, courses at the School of Military Engineering in military

* The Natural Science Schools at Cambridge University recently received a donation of $f_{210,000}$ from certain associated firms in the oil industry for the expansion of the schools in order to encourage research and study on the chemistry of oils. The Engineering Schools have also received considerable donations towards their new building scheme and gifts of up-to-date machinery from manufacturing firms. Their capital expenditure last year from University and various sources amounted to $f_{95,000}$.

[932.]

[JANUARY

training, survey, fortification and military bridging and in the practical applications of engineering to military purposes. These courses would last at least a year and a considerable portion must be subsequent to the Cambridge course, thus providing an opportunity for a corrective being applied to any signs of deterioration in military qualities. Moreover, the continuance of the system which exists in the case of the officers who are now at Cambridge, *i.e.*, of putting them under the administrative control of the Commandant, S.M.E., who exercises this control through *liaison* officers resident at the university and watching progress in studies, etc., of the officers, affords a ready means of intervention if any symptoms of the nature referred to above should appear.

It has been asked why this proposal has been raised in regard only to Cambridge University and why advantage should not be taken of the facilities available at some of the other universities, more particularly some of those which specialize mainly in scientific and engineering subjects. The number of officers who, when the post-war Army Establishments are fixed and have been built up, will be required to undergo this training each year will not be great. It will only be such a number as is required to make up the normal wastage. Before the war this was thirty to thirty-six per annum. Even if it is greater than this in the future it is not likely to be much greater. To divide up so small a number in little packets among a number of universities each of which has different rules, systems of education, fees, etc., would give rise to extreme inconveniences of administration, inequalities in the training given and great difficulties in watching the progress and in dealing with the university authorities. Hardly less inconvenient would be any system of sending each year's batch to a different university. Any idea that by sending them all to one university the War Office is showing partiality or failing to distribute its favours equally may be dismissed. The favour is on the other side. The course of study and the conditions of residence in the case of the officers are bound to differ in some respects from those of the ordinary undergraduate. By putting themselves out to receive our officers and thus to exclude civilian students, the university and college authorities at Cambridge have conferred a marked obligation on the Army Administration. It is also of great importance that the university to which the officers go is one with a residential collegiate system such as exists in the old universities only. The opportunities of mixing intimately in the college life is, as has already been said, one of the great advantages claimed for the proposal. To send a batch of budding officers who are being educated at the public expense to an institution where they would have to live in town lodgings and where their actions outside the class-room would be uncontrolled and unobserved would have obvious serious disadvantages.

It is contended, therefore, that the advantages, which have been described in the foregoing, of a university training in engineering for the future officers of the Royal Engineers, greatly outweigh any possible disadvantages and that they are such as to warrant the acceptance of the principle that such a training is *per se* a desirable thing. Much consideration will have to be given in detail to the conditions under which the university authorities might be disposed to receive them; to the length and scope of the course (which will not be the same in all respects as that which is being undergone by the more senior officers who are there now); to the financial aspects of the proposal and to the changes entailed at the S.M.E. by the reduction and alteration of the junior officers' courses there. None of these questions are touched on in this memorandum which deals only with the broad aspect of the desirability of the proposal.

LORD KITCHENER.

By Lieut.-General Sir Henry M. Lawson, K.C.B.

(Reproduced by kind permission of the Editor of THE NINETEENTH CENTURY AND AFTER).

The difficulty, if not the impossibility, of arriving in the present at anything like a complete judgment on Lord Kitchener and on his achievements is very well illustrated by Lord Esher's latest production, *The Tragedy of Lord Kitchener.* The main facts of the great career are of course clear, and were well brought out in Sir George Arthur's interesting volumes, but when one tries to go a little deeper and forecast what his final position will be among the world's really great men, the present-day obstacles to doing so at once become patent.

Apart from the fact that we are still too close to recent tremendous happenings, the great difficulty in publishing any well-balanced appreciation of Lord Kitchener lies in the fact that at various stages of his carcer before, but especially during, the Great War, he crossed swords with many eminent men now living—statesmen, soldiers, politicians, newspaper proprietors, and journalists. There were doubtless two sides to the differences and combatings, but no real conclusion regarding some of the most important of them can be reached without the readiness to pass adverse sentence if necessary on the judgment, foresight, and in some cases the good faith of many living men. Anything else may involve injustice to the dead.

What would be for anyone a distasteful task was well-nigh an impossible one for Lord Esher. As a courtier and a man of affairs in the years preceding the war, Lord Esher was in close touch with many of those referred to, and in some cases was united to them by bonds of friendship and sympathy. Further, Lord Esher, who had had a memorable share in reforming the War Office and inaugurating a General Staff, was also a member of the Committee of Imperial Defence which was responsible for working out that war policy that Lord Kitchener ultimately overturned. For one so placed it was difficult to dispense even-handed justice as regards Lord Kitchener and to give their full weight to criticisms which involved not only his friends but himself. It makes one wish that Lord Esher had preserved silence and had been content to leave his journals to the judgment of the Mr. Lytton Strachey of sixty years hence. The book, however, has been published, and it gives Lord Kitchener much less than his due; it accentuates, moreover, views at present current in certain quarters which seem so mistaken that this article is written in the endeavour to give the reader a truer presentment of certain characteristics of a great public servant.

As a commencement the writer disagrees with the opinion held by some and given expression to by Lord Esher as to the predominating share which the East had in moulding Lord Kitchener's character. From reading Lord Esher's pages one draws the impression that most of our hero's early life was spent in the desert with Arabs for his companions, and removed from the influence of the civilized world. Palestine, Cyprus, and Egypt may seem a long way off to some of us, but they are by no means removed from Western influences or out of touch with European politics. Lord Kitchener's work in all that involved higher direction lay for the most part with his own countrymen and in an atmosphere less out of the civilized world than India or our outlying dependencies.

It has been said that there is no provincialism so ingrained, so unconscious as that of London, and to a trace of it perhaps we owe the view that Lord Kitchener's sixteen years in Egypt had turned him, if not into a yellow, brown, or black man, at any rate into a confirmed and thorough-going Oriental. What Egypt and the East did for Lord Kitchener was to give him in his early years a field for work where the individual had fuller scope for growth and for achievement than was possible in the more complicated and restricted conditions at home. There seems nothing to lead to the belief that during these years Lord Kitchener neglected wider home and European conditions, or that he acquired qualities and habits that unfitted him for dealing with affairs in this country.

Another point which Lord Esher labours and on which the writer differs with him is that Lord Kitchener reached his zenith in 1898 when he reconquered the Sudan, and that the man who became Secretary of State for War sixteen years later was a feebler and less dominant personality than the victor of the Atbara and of Omdurman. It was only a year ago that the writer was discussing Lord Kitchener with one who knew him as well as, if not better than, anyone now living, who went through the Omdurman campaign with him, and who remained in constant touch with him from then up to the end. The point he made was that Lord Kitchener was a man who was always developing and always imbibing new ideas. Admiring him from the first he remarked how crude in some respects was the victor of Omdurman and how immensely he developed in South Africa, in India and in his later administration in Egypt. Every time he met the great man he seemed to find some new growth in one whose experience and horizon were constantly widening. Lord Kitchener, in his opinion, was always learning, and he never had to learn the same lesson twice.

From the first he developed slowly: as a boy at Woolwich his comrades saw no signs of his future greatness, and some of them laughed at the angularities of his then character, the strong individuality of which was just beginning to show. His intellectual talents judged by standards of books and examinations were not great, and in this respect he was outclassed by most of his Woolwich contemporaries. At Chatham it was much the same, but one at least of his instructors there saw signs of the future greatness.

When in 1881 the writer first met Kitchener, then head of the Survey

and Registrar of Lands in Cyprus, his reputation as an administrator, a man of character, and one with a future before him had been made. Later on in 1883 the writer was in Egypt when Kitchener joined the Cavalry of the Egyptian Army as its second in command, and in the following year he was told by an English cavalry officer, then one of Kitchener's comrades, that he looked upon their second in command as the most efficient cavalry officer he had ever met. Growth in mind and character developed steadily in circumstances which admitted and favoured it, and carried him in fifteen years to what Lord Esher has termed his zenith—the conquest of Omdurman.

But neither then nor at any later stage was Kitchener quick at intellectual fence or in mental gymnastics, and this fact, coupled with his obvious force of character, has always caused some observers to depreciate his powers of mind, whilst more nimble-witted folk who did not know him well were inclined to think that he came to hasty judgments and did unconsidered things. In reality nothing could be further from the truth. He had to a pre-eminent degree the power of recognizing and summing up the essential factors of a situation, giving to each its due value. His view was always a large one, with a genius for recognizing and holding fast to the important things and of seeing the minor points in their true perspective ; in settling details he never forgot the whole of which they formed a part. His eye was ever on the future, which he visualized with astonishing accuracy. Many of his fellow-workers have evidenced the long view he took even in smaller matters. Patience in thought was one of his great qualities, and in a question of primary importance he was generally slow, to form a judgment. Above all things a thinker, he considered the problem from every point of view, heard what anyone and everyone had to say about it, and then at length, by what to some seemed intuition or instinct rather than reasoned thought, he arrived at a conclusion that was rarely mistaken.

It was when his mind was made up that his character came to his help. "Mens aequa in arduis" was his, and in no common degree, courage, physical, moral, intellectual. His opinion once formed he carried it through because he had the courage to believe in its correctness, and the fact that sometimes able minds did not agree with him never shook his belief in what his patient reasoning had told him was right. This intellectual courage was perhaps his greatest asset, and, as will be seen later, it was this quality that served him so well at the supreme crisis of his life, in August 1914.

In the translation of decision into action his indomitable will and resolution came to his aid. Once he had made up his mind that some end had to be reached, nothing turned him from his purpose, and with his eye ever fixed on the goal, sometimes a very distant one, unhasting and yet unresting, he worked towards it. Nothing tempted him to deviate.

The difficulties in the way of accomplishment seemed so much less to him than to his agents that he was always asking of them more than they thought they could perform, and, as a result, they generally achieved, not all he asked, but much more than they had ever thought

35

feasible. If an obstacle barred the road, he passed round or over it, if possible, but if this proved impracticable and there were no other way, why then the obstacle had to go to enable him to arrive, for arrive he must. No wonder that he sometimes seemed to achieve the impossible.

Space does not allow of following him in detail between 1898 and 1014, but everywhere there was growth in character and judgment, together with unfailing success in execution. There was always, however, an accompaniment of foreboding, and depreciation by those who underrated his intellectual power to grapple with a new situation.

The writer remembers how when Kitchener's first step in South Africa was to "scrap" the then Army system of transport, people said "K. does not know and is just upsetting the English system because it is different from the Egyptian." Results of course proved that Kitchener's conclusion was right and that the critics were wrong.

That the first success of the war, Paardeberg, happened at all was due to his rapid seizing of a fleeting opportunity (not at all in the manner of Darius and his slowly-moving hordes), and to the way in which he urged on our tired troops to catch Cronje within the net.

With due deference to Lord Esher, who talks of Paardeberg having been mismanaged, Kitchener's instinct to attack there was absolutely right, as was borne out in the German Official Account of the war, and whatever mistakes or mischances there were in execution will be pardoned by any soldier who has been over the ground and has visualised the situation with which Kitchener had to deal. His loyalty and nobility of character, his true magnanimity, were evidenced by his actions after Lord Roberts arrived on the scene and disapproved of what seemed to him an unnecessary loss of life. Kitchener never sulked, argued, or showed disappointment, but did whatever lay nearest his hand to do, often in circumstances which would have tried the majority of men. His attitude to Lord Roberts was that of a good son to a good father.

Later on, when, after Lord Roberts had gone home, Lord Kitchener assumed chief command in South Africa, fears were expressed as to his capacity to deal with the military problems before him. "K. does not know," "He is ignorant of the British Army," were phrases on some people's lips. Mistakes were doubtless made, but the matter was adequately summed up by one who said "K. may have made mistakes, but I cannot think of anyone else who would have carried through the task at all."

The view he took of the peace and his share in bringing it about showed how well his mind could size up a situation which called more for the instincts of the statesman than of the soldier. His success in dealing with the Boer leaders and the trust they reposed in him were due to his capacity to see their point of view and to the effect of his great personality. Whilst Lord Milner was out for an unconditional surrender, Kitchener, with longer vision, saw the wisdom of a " peace on the basis of mutual agreement which he believed would serve to form an indissoluble bond." We owe our present united South Africa to the fact that his view prevailed.

1922.]

Forebodings were again heard when Lord Kitchener went to India as Commander-in-Chief, sinister auguries that he would be handicapped by his masterful temperament, by hasty judgment and by his lack of Indian experience. He waited a year, however, before he settled on what were necessary changes, but having once made up his mind, he pressed his reforms through, although at one time the effort to give effect to some of them seemed to him to mean his own downfall. As a result he placed the military position in India on a thoroughly efficient and modern basis; whilst still a learner he imbibed new lessons and experience in his own profession, and his wide outlook continued to broaden.

It is a matter of regret that Lord Esher, although the doing so may have poured balm on the wounded spirit of "one of the most justly famous of our Viceroys," should have implied that Lord Kitchener used in connection with his altercation with Lord Curzon "methods which the Israelites inherited from Jacob and the statesmen of the Renaissance from Machiavelli." The writer believes the suggestion to be without foundation, and an onlooker who had the closest knowledge at the time of all the facts assured him years ago that in this painful episode Lord Kitchener behaved with exemplary moderation, patience, and straightforwardness.

(Lord Esher makes the same insinuation in respect to the Vereeniging negotiations, and with, if possible, even less excuse.)

The three years in Egypt which followed Kitchener's Indian Command were marked by no signs of decay. His industry and his vigour were just as great, the reforms he introduced indicated the same shrewdness of perception, and the immense success of his administration was beyond question.

This rapid survey between Omdurman and 1914 has been made because the facts seem so clearly to point to a great development in the sixteen years which had elapsed since the time when, according to Lord Esher, our planet had commenced its descent towards the horizon.

He was of course sixteen years older when he went to the War Office than he was at the battle of Omdurman, and there doubtless had been some physical weakening, but in 1914 there was nothing to suggest rather the contrary—that Lord Kitchener was then old for his years. Whether the vigour had lessened which inspired the purpose and fixed determination so marked in the re-conqueror of the Sudan will be seen from a consideration of what he did in the early days of August 1914.

For some years before 1914 the principal members of the Cabinet, the Committee of Imperial Defence, the Admiralty, and the War Office had realized that in certain circumstances it might be our duty to engage in war in support of France and Russia against Germany and Austria, and had made their preparations accordingly. In such an eventuality they had promised France to send her an Expeditionary Force of Six Divisions and a Cavalry Division, with the possibility of one or two more Divisions later. The Territorial Force was to take over the Military Defence of the United Kingdom and the Special Reserve was to feed the Expeditionary Force with men; on this basis the business of the War Office in the event of war was limited to keeping 1922.]

the force up to strength and perfecting the arrangements for Home Defence.

As the Government and their military advisers saw it, we were to engage in the war, as Lord Esher says, on the plank of limited liability, and they never seem to have realised the colossal risks of doing so or never visualised the possibility of finding that the only chance of bringing such a war to a successful conclusion lay in throwing every ounce of national strength into the struggle. World financiers had stated their belief that for economic reasons no world war could last for more than a few months, and it was known that Germany—although probably for very different reasons—also believed that the struggle would be short and sharp. These views had probably their weight with the Government, whilst their military advisers had never contemplated it as possible, once war was declared, to improvise new military forces in time to affect the results of the struggle.

Neither civilian nor soldier perhaps realized what effects a declaration of war would have on the nation at large, rendering impossible in itself a policy of limited liability.

Be this as it may, we went to war with no army but the Expeditionary Force and with no intention of, or no preparedness even on paper for, developing the military resources of the Kingdom, or bringing the forces of the Dominions into the struggle. It is no answer to say that motives of secrecy or expense were a justification for this unpreparedness, for it would have been perfectly feasible, if our General Staff had arrived at opposite conclusions, to have had, without the expenditure of an additional penny, secret plans for rapid development of our forces once war was declared. But there might have been such schemes in the War Office ready for immediate translation into action, including among other things how best to set about getting the munitions of war, the clothing, blankets, etc., required for the great expansion-in fact, there might have been some such plans drawn out in peace as Lord Kitchener and the War Office Staff had to improvise in August 1914. There was nothing of the kind, and there can be no doubt that no such expansion had been contemplated by the Government or by its military advisers.

The details of the "limited liability" plan had been admirably worked out, and a perfectly equipped and trained Expeditionary Force was the result, and for this the pre-war War Office are entitled to our everlasting thanks. But that the Committee of Imperial Defence and the newly constituted General Staff specially charged with the consideration beforehand of plans and problems of war should have had so little grasp of the larger perils and actualities of the situation is an interesting proof of the fallibility of clever, industrious, and wellmeaning men.

Such, in general terms, was the situation which Lord Kitchener found and which caused his first remark on visiting the War Office to be "There is no Army." Then what seems nearest to a miracle in these modern days happened. This pronounced Orientalist, ignorant of Western ways and problems, this worn-out man who, in Lord Esher's opinion, even then realized "that the qualities of mind and character which had served him well through life were under entirely new conditions out of place," saw the truth at a glance; that a life-and-death struggle was before us, that, unless we were to lose, the struggle must be a long one, and that our only hope of successful conclusion lay in abandoning our policy of limited liability on the chance of being able at the eleventh hour to produce in time a new army sufficiently large to count in a European War. In Lord Kitchener's own words to the House of Commons a few days before his death:

Such an idea was contrary to the theories of all European soldiers. Armies, it had always been argued, could be expanded within limits but could not be created in time of war. I felt myself that though there might be some justice in this view, I had to take risks and embark on what may be regarded as a gigantic experiment.

Lord Kitchener formed this opinion and seems to have been alone in it, and that he succeeded in getting our Government at once to alter their policy was a tribute to his power and personality. It is to be remembered too that practically all the best military opinion in this country was against him as regards the practicability of raising the New Armies. One distinguished soldier after another came to him to try to convince him of the futility of the idea. It was Lord Kitchener alone against the military thought of England. Here indeed was a situation to test the courage and the vigour which inspired purpose and fixed determination, qualities which Lord Esher would have us believe he had left behind him in the descrts of the Sudan.

That the views alluded to regarding the raising of the New Armies were held by the Headquarters Staff that went to France in August 1914 is illustrated by the following incident. One of the first steps which Lord Kitchener took towards the forming of the New Armies was to order each battalion of the Expeditionary Force before it left for France to send to its depôt a small cadre of officers and N.C.O.'s to help in the formation of the new units. To one of the meetings of the Staff held before they went to France, the news of this was brought by one of its most brilliant members, who declaimed against it as damaging to the efficiency of the Expeditionary Force and as a proof of Kitchener's ignorance and lack of understanding. And now we are thankful for this ignorance and lack of understanding !

The opinion above expressed was doubtless a genuine one, and it illustrates the view then held by some soldiers that Kitchener was not fitted to grasp the military problem before him.

The following testimony from a "Dugout" artillery officer indicates how conscious Kitchener was of the views opposed to his. In May 1915, on the day of the Cabinet crisis before the first Coalition Government was formed, Kitchener made a hurried visit to inspect some of the newly formed Divisions on Salisbury Plain. It fell to the lot of our informant to command the Artillery of one of the Divisions, and he records the incident as follows:

One of the brigades had gone out for the day and could not be recalled in time, but the other three brigades and the Divisional Ammunition Column paraded for inspection. The batteries were splendidly horsed and the men after several months' training on the Plain rode very well, and as they trotted past Kitchener in column of sections presented a fine appearance. The Field Marshal, as pleased as a schoolboy, was delighted and as I stood alongside of him said, "We've done it, we've done it, they said we could make Infantry but could not make Artillery, and yet we have done it all ourselves, we have trained the men, made the guns and the harness, and bought the horses. We've done it !"

The conclusions which Lord Kitchener put into practice in the early days of August 1914 were arrived at, not by instinct or by a hasty summing-up of a new problem but by a study in the previous years of a situation which he knew would present itself; by thinking over the facts as they appeared to him, and not as seen through the spectacles of politicians and financiers. Lord Esher himself tells us that, in the days that followed the opening of the battle of Ypres, Kitchener repeated bis conviction as to the length of the war's duration.

He pointed out how the prophecies of politicians and soldiers had been falsified. How could it be supposed, he asked, that a nation of 65 millions, highly organized as Germany was, would be beaten to its knecs under years of fighting? Her internal resources, her food supplies, her man-power, had all been worked out and showed margins far beyond those of the North in the American Civil War, and it was certain that before relinquishing the struggle Germany would exhaust every possible supply of material and men.

In a letter to Lord French written on August 27th, 1914, Kitchener writes :

Believe me had I been consulted on military matters during the last three years I would have done everything in my power to prevent the present state of things in which this country finds itself.

There are some who, believing in predestination, hold that all Lord Kitchener's previous life, its successes, its trials, its various incidents, were but a training to enable him at the supreme moment of his life to take the step which saved his country. They even go so far as to believe that a Divine Hand guided Lord Morley when by rejecting Kitchener for the Viceroyalty of India (on other grounds apparently a most unwise proceeding) he left him available for his predestined work.

Let us recollect, moreover, that the insight which grasped the essentials of the situation could not have availed without the confidence which his previous career had inspired in the British people, and neither the insight nor the confidence would have sufficed without the driving power which carried out vast schemes and overrode all difficulties.

It is doubtful if history furnishes a more dramatic incident, or one more fraught with results, than this action of Kitchener's in the early days of the war, and it justifies Lord Haig's words, "Who can doubt that but for this man and his work Germany would have been victorious?" This, and not the Atbara and Omdurman, was the climax of Kitchener's career, and it was incomparably his greatest achievement.

It would take too long to follow our hero's actions through the war, or to tell how, with his home burdens upon him, he kept his eye on, and evinced extraordinary insight into, the strategy of the war. He

. ÷

was the first to divine the direction of the main German advance, and it was he who saw the supreme necessity of our working hand in hand and side by side with the French, causing his famous interview with Lord French on September 1, 1914. His influence was far-reaching and extended to every Allied country. In France his picture was to be found alongside of that of Joffre in almost every cottage, while in Russia his name acted as a talisman to all.

It seems difficult to exaggerate what Lord Kitchener did for his country and its Allies whilst he lived, and the facts justify the statement that so far as individuals on the Allied side are concerned, he must be given the predominating place. This, however, appears to be imperfectly appreciated in England, and explains why we hear so much minor criticism (mostly uninformed and capable of refutation), with a strange ignoring of the services rendered. The absence of a sense of proportion is surprising, and the critics seem in the position of a shipwrecked crew who, when rescued, commence to cavil at the methods adopted for their deliverance before rendering thanks to their saviours.

Take as one instance the criticisms over what may be called the munitions incident. Lord Kitchener from the first took the long and the large view not only in regard to men but also in respect to munitions of war. While other men thought in tens, he acted in thousands. In the very early days of the war orders were put out for machine guns and ammunition, not based on the requirements of the then tiny Expeditionary Force, but on what would be wanted for the New Armies when they came into being. Provision was an enormously difficult question, but no one who was behind the scenes, or indeed who has read Sir George Arthur's volumes, can doubt that Lord Kitchener realized the difficulties before anyone else, and did all that was humanly possible to obtain at the earliest date what was required.

The writer believes that history will record that the attack which Lord French and the Press made on Lord Kitchener over the ammunition question was absolutely undeserved. We can only surmise how it came about.

There is little doubt that a feeling existed at the time in G.H.Q. in France, due to misconception or to misrepresentation, that Lord Kitchener and the War Office were not sufficiently studying the interest of the Army in France and realizing its difficulties. Never was a. feeling more mistaken, and anyone who had experience of the War Office in the autumn of 1014 appreciates that the one aim and desire of Lord Kitchener and his band of workers was to help our troops and their commanders in every way they could. How the opposite belief arose it is difficult to say, but there can be no doubt as to its existence. To some extent perhaps it was due to a certain jealousy of Lord Kitchener and to a distrust as to his capacity to understand and handle modern war. That it was even shared in at one time by Sir William Robertson is shown in an extract from one of his letters quoted by Lord Esher : " I feel remorseful of my brutal bargain ; it was never necessary, and was made only because I was misinformed of the man's nature." When to such feelings we add the high mental tension on the battle front, it is not hard to see, when once the idea was suggested that Lord Kitchener

was responsible for the inevitable shortage of ammunition, how it spread amongst those who talked, and every soldier of experience knows how much "talk" there is among his brethren in the field. Lord Kitchener himself scented intrigue, and was convinced that the clamour for shells and munitions was exaggerated and wantonly factious, and he was admittedly slow to take offence or to impute motives. There were undoubtedly pressmen anxious for a stunt, and so an attack was made with no foundations so far as Lord Kitchener was concerned. His real bigness of character was never more clearly shown than in the way in which he took this wholly unmerited onslaught, and the message which he subsequently sent to Lord French, as related by Lord Esher, is evidence of his real magnanimity and of his characteristic determination never to let personal matters obscure those of larger import. "I am out to fight the Germans and not to fight Sir John French."

A few words may perhaps be added as regards Lord Kitchener and the Cabinet, although it is admitted that the information at present disposal is necessarily incomplete.

It is to be remembered that when Lord Kitchener joined the Cabinet he did so on a non-political basis and solely for the prosecution of the war. Further there is no question that at the outset, and until early in 1915, his word was law in all that concerned military operations. Later on, however, when the imminent dangers that at first beset us were past and members of the Cabinet and people outside it had recovered from early apprehension, a vein of criticism of Lord Kitchener grew in certain quarters both in the Cabinet and outside it.

> Damn with faint praise, assent with civil leer, And without sneering, teach the rest to sneer; Willing to wound, and yet afraid to strike, Just hint a fault, and hesitate dislike.

That Lord Kitchener and some of his colleagues should have had difficulties with one another is capable of comprehension. The War Secretary had not the gift of exposition, and he was chary of divulging his plans; he probably did not take kindly to a flow of verbiage from men trained to talk, anxious to know, and doubtless anxious too to be doing something when perhaps in Lord Kitchener's province there was nothing for them to do. It may be taken too that he was not a willing witness when cross-examined by some of the famous advocates among his colleagues. All this is perfectly likely, especially when it is remembered how different was his previous training and mode of life from theirs. But when Lord Esher talks of Lord Kitchener having destroyed the admiration, the affection, and almost the respect of the statesmen who were his closest colleagues, one begins to wonder.

That there were early intrigues to get rid of Lord Kitchener is hinted at in Lord Esher's pages, and one gathers that those intrigues reached their height when he started on his mission to the Dardanelles, but the actual truth concerning these happenings will never be known until the memoirs of men like Mr. Asquith are given to the world. As things stand at present, it is well to remember that some at least of those concerned cannot be looked upon as wholly disinterested : some had crossed swords with Kitchener and failed, others had old scores to settle, whilst possibly others had axes of their own to grind. In any case far more evidence than Lord Esher has produced seems required before delivering judgment against Lord Kitchener. In the absence of more authoritative testimony the writer prefers to hold to what is known as against the unexamined impressions of men swayed by many motives, as against in fact what may be termed Cabinet and society gossip.

- The unsuitability of a Cabinet of twenty-three members to discuss questions of strategy and military operations is patent, and the discovery of this fact led to the ultimate formation of a War Council. The most that can be said against Lord Kitchener as a Cabinet Minister is regret that he should not have used the vast influence he possessed to rid himself summarily of the need of lengthy and barren discussions on purely military matters. On the other hand he was assuredly loath to use this power unnecessarily, and perhaps thought it better policy to endure the inconvenience so long as it did not jeopardise matters of real moment.

. It is needless to say that the writer is not among those who hold that for Lord Kitchener's fame it was well that the end came when it did-at a time when his opportunity of useful service was over. The facts seem to point to a directly opposite conclusion. Had he survived, he would assuredly have held the post of War Secretary to the end. No Premier would have displaced him; the combination of Lord Kitchener and Sir William Robertson, supported by public opinion in this country and among our Allies, would assuredly have defeated assaults from whatever quarter. When in due time the real history of the doings of the War Council from 1916 onwards can be written, the narrative will demonstrate how much we lost when the Hampshire went down. But for this tragedy our commanders in the field would have had more consistent and better instructed support; the varying strategy and the lapses in the matter of man-power which nearly brought us to disaster in March 1918 would have been avoided, and to quote Lord Haig once more, " Perhaps the victory would have come to us sooner had he been with us to the end."

He who saw so clearly at Vereeniging would have been a great asset at the Peace Conference; whether his view would have coincided with that of Marshal Foch, as Lord Esher suggests, the writer is disposed to doubt.

The thought arises too of the position Lord Kitchener would occupy among his fellow-countrymen were he still alive, similar to that which, as recorded in the pages of Greville; the Great Duke held in the closing years of his life. Alas ! that the Fates willed it otherwise.

Space is limited, and the time has come to take leave of the latest of England's great men. To those who knew him the memory will always remain of the tall figure, the commanding personality, and the inscrutable countenance, reminiscent of that face which overlooks the land where he first found fame, and, like it, suggestive of the great attributes of Wisdom, Foresight, and Strength. The happiest recollection perhaps recalls him when inspecting the men he loved so well, the Volunteers of 1914–15, with their eager responsive faces, the flower of England who had so readily responded to the call; as they swung past him how little did they think that his warfare would be accomplished before theirs had well begun 1

Let us hope that ere long the 5th of June, the date on which this noble life was lost, will become a Kitchener Day on which Englishspeaking folk throughout the Commonwealth will celebrate the memory of a great man, and will thank God for the instrument provided in their day of need.

Musing on these things, another Horatio comes to mind, one famous in Roman legend and in English ballad. Our feelings towards our great departed should be akin to those which the men and women of Ancient Rome entertained for their Captain of the Gate:

> And still his name sounds stirring Unto the men of Rome,

As the trumpet blast that cries to them

To charge the Volscian home; And wives still pray to Juno

For boys with hearts as bold

As his who kept the bridge so well

In the brave days of old.

When the goodman mends his armour And trims his helmet's plume;

When the goodwife's shuttle merrily Goes flashing through the loom;

With weeping and with laughter Still is the story told,

How well Horatius kept the bridge In the brave days of old.

WATER SUPPLY IN THE GREAT WAR. Work of the Royal Engineers.

(Reproduced by the kind permission of the Editor of WATER AND WATER ENGINEERING).

A RECORD of the work of the Royal Engineers on the Western Front of the theatre of the Great War has just been published* by the Secretary of the R.E. Institute, Chatham, as one of a series of volumes dealing with the various branches of military engineering connected with the campaign. The account here given of the development and evolution of a system of water supply on a scale commensurate with the needs of an immense army in the field is of the greatest interest as a military document, and is of no less importance in other spheres of activity where large concentrations of men and animals are necessary for temporary purposes. So perfect had the water supply organization become towards the close of the war, that concentrations of military forces of any magnitude could be undertaken at the shortest possible notice, without any danger of breaking down owing to inadequate water-supply, and without reference to the hydrological conditions of the area concerned. The importance of this fact is evident, since it enabled the military authorities to eliminate the water-supply factor from serious consideration, and to conduct operations purely on stragetical or tactical grounds. The main features of this organization included the creation of a water-supply staff, the provision of mechanical plant for obtaining and purifying water, and of suitable means for its conveyance to any desired locality.

The various phases in the evolution of this system were naturally controlled by the exigencies of the situation in the various areas of operation, which covered a wide district extending from Flanders to the valley of the Somme. The initial difficulties were considerable, since the ordinary sources of supply, suitable for the needs of a normal population in times of peace, were quite inadequate for an army in the field. In Flanders especially the conditions were distinctly unfavourable. Surface supplies were liable to contamination, and deep-well borings were of an unpromising character. The chalk in that area is not water-bearing, owing to its argillaceous character, and the beds below the chalk are usually impregnated with soluble mineral matter and yield an unpotable ferruginous water. Public supplies in the neighbourhood of Ostend and Bruges are dependent solely upon shallow wells and canals. was therefore necessary to make adequate provision for sterilizing such water as was procurable from these sources. Further south, in the area south of the Boulogne-Aire-Valenciennes line, conditions were

* The Work of the Royal Engineers in the European War, 1914-19-Water Supply (France). Published by the Secretary, R.E. Institute, Chatham. W. & J. Mackay & Co., Ltd. 1921. Price 253.

more favourable, since water-bearing chalk is generally to be found at depths ranging from 100 to 200 feet below the surface. Still further south in the Lys area the depth of the water-bearing chalk is greater, but the wells are artesian and supplies can be readily obtained by boring. Coming to the chalk area between Arras and the Somme, and between

Coming to the chark area between Arras and the bound, and even the Ancre and the Escaut, an almost complete absence of surface water was an important consideration in any projected advance of the armies. This difficulty was met by the establishment of water supply points at suitable places along the Front, the installation of pumps and piping and the establishment of a system of motor transport for conveying the water in tanks, holding 600 gallons each, supplemented by water carts. The requirements of six corps involved the provision of 191 motor lorries and 480 water carts, with the necessary purification plants.

The purification plants included six filtration barges, on which plants by the Ransome VerMehr, Messrs. Bell Brothers and United Water Softeners were represented. These barges were fitted with well-equipped laboratories, qualified chemists and pumps. They did excellent service on the Lys, Iser and later on the Somme, pumping purified water into pipe-lines which reached lengths up to nearly five miles. Later, similar barges were ordered for use in Mesopotamia.

The Water Tank Companies had special purifying sections, supplied with Wallace and Tiernan liquid chlorine apparatus, rendering it possible to reach an output of over 1,000 gallons of purified water per hour from each sterilizing lorry.

For the comparatively waterless chalk plateau, in order to provide adequate supplies as far forward as possible in the event of an advance, power pumps were installed, with capacities ranging from 2,000 gallons to 7,000 gallons per hour against heads from 200 to 350 feet. These, together with 120 miles of 4-inch steel piping, made a heavy demand upon the available resources in England for plant of this kind. When an advance took place pipe-lines were laid forward as soon as possible, and new water points were established at their head.

These arrangements, however simple they may appear, thus baldly stated, involved a very considerable amount of military organization, the details of which are duly recorded in the volume before us. By the time of the opening of the Somme operations on July 1, 1916, over 100 power pumps had been installed in the Fourth Army area, and nearly 120 miles of water mains had been laid. These were continually increased as the operations proceeded, and suitable arrangements were made for the care and repair of the power machinery, which included semi-Diesel and petrol engines, as well as Hornsby oil engines. The boring plant, which was in use in the chalk area from early in 1915, was rendered more efficient by the adoption of the air-lift pump. The maximum quantity of water raised from a 6-inch borehole by an ordinary pump was about 3,000 gallons per hour. With an air-lift this was increased to 6,000 gallons, and in suitable positions to 10,000 gallons per hour. In the Ancre valley it was found possible to raise as much as 30,000 gallons per hour from one bore by using two air-lifts simul-As the demand for boreholes increased it was found necessary taneously. to augment the water-boring sections with a crew of 12 men each.

1922.]

Rates of drilling up to 100 feet per day were achieved, and about four days sufficed to complete a 6-in. bore, 350 ft. deep. The success of the water-supply organization was greatly assisted, both in the saving of time and labour, by the appointment of a geologist, who prepared a valuable series of water-supply maps for the various areas concerned. The work carried out in this department is to be described in detail in another volume,* in course of preparation, which we shall hope to notice in due course.

In Part II. an account is given of actual operations, beginning with the Somme. In this area, where the Fourth British Army was established in March 1916, arrangements for an advance had necessarily to provide for the supply of troops and horses on a practically waterless plateau, for which purpose a Memorandum on Advanced Water Supplies was issued, and the chief part of it is here reproduced in full. The careful attention that was given to the smallest detail will be a revelation to many who have not had experience of military operations of this magnitude. The results of actual practice under war conditions are carefully recorded and will be of invaluable service for future reference. There were inevitable miscalculations owing to the unexpectedly large number of horses required for moving ammunition and supplies, and it was found necessary to supplement the pumps with a number of London County Council fire engines. The magnitude of the task may be gauged from the fact that at some horse watering points as many as 20,000 horses were watered daily, and at one trough a L.C.C. fire-engine was seen pumping 10,000 gallons per hour direct into the troughs without ever getting them filled. Space considerations prevent us from mentioning many interesting episodes in the advance in this area, where at the height of the battle water had to be provided for about 300,000 men and 150,000 horses, for which purpose it was necessary not only to pump 1,250,000 gallons a day, but to carry in addition 100,000 gallons by road. Another interesting point is that the French system of water supply differed from the British in having a very large number of small local pumping stations instead of a few large capacity stations with extensive pipe systems. Hence when the British Army took over a portion of the French lines there was at first some difficulty in adjusting the skilled personnel to the new conditions.

The conditions in the Arras area were specially interesting because this district is in Artois, from which the name "artesian" is derived. The whole area, in fact, is prolific in artesian supplies, nearly every large farm possessing a well of this character. The rapid extension of this supply was greatly helped by the preparation in advance of subsurface water contour plans by the geological staff at General Headquarters, so that an indication of the depth of the water table was available. Thus, on the summit of the Bapaume plateau, many miles from any surface water, five boreholes, put down in the course of a couple of months, yielded about 400,000 gallons a day with no apparent reduction of the level of the ground water, 100 metres below the surface. We must perforce pass over the history of the various episodes of the war chronicled in this volume, each one of which involved some

* Work in the Field under the Engineer-in-Chief, B.E.F.: Geology.

interesting problems of water-supply. The conditions varied greatly in the different sectors of the front, and the success with which the difficulties were overcome is a monument to the perfection of the organization of the special service responsible for this vital task.

We have selected but a small fraction of the detailed information set forth in this interesting record. The experience alone is well worth the careful study of every water engineer. The book contains a large number of photographic illustrations, and many plates and maps. It furnishes a fund of information which for all time will be of inestimable service as a guide to practice under emergency conditions, such as may easily arise, although perhaps on a small scale, at any time and in any country.

1922.]

REVIEWS.

TWO ART BOOKS.

- I PRINTS OF BRITISH MILITARY OPERATIONS. By Lt.-Col. C. de W. CROOKSHANK, late R.E., H.M. Bodyguard. (Adlard and Son, and West Newman Ltd. Price £2 2s., or with Portfolio of 16 Plates, £10 105.)
- 2. YPRES TO VERDUN. A Collection of Photographs of the War Areas in France and Flanders. By Sir ALEXANDER B. W. KENNEDY, ILL.D., F.R.S., Past President of the Institution of Civil Engineers, Associate Member of the Ordnance Committee. (Country Life; Price, 15/-.)

In "Prints of British Military Operations," Lt.-Col. Crookshank has produced a Catalogue Raisonné of prints covering the period of British military history from the Norman Conquest to the Abyssinian Campaign of 1868, which will appeal not only to lovers of beautiful books, but also to all those, and their number is legion, who at some period of their life are interested in old engravings, and more especially in old battle scenes. The book contains some beautifully executed reproductions, notably Orthes and Bhurtpore, and forms a worthy companion to the catalogue of Commander Sir Charles Custs' Naval Collection. To some extent it also justifies the author's hope that it may help to illustrate the pages of Fortescue. We are not aware that any enthusiast has yet attempted the task of extra-illustrating Fortescue, but the volume under notice gives us some idea of the interest which might be found in that gigantic task and we can fully appreciate the zeal and industry with which Lt.-Col. Crookshank has completed this lengthy catalogue. The plates in the portfolio include some fine specimens of British colour The book has been accepted by H.M. the King. printing.

In "Ypres to Verdun" Sir Alexander Kennedy, with the help of over one hundred and twenty excellent photographs, takes the reader on a very interesting tour of the French Battlefields and enlivens the way with pleasant discourse and many interesting anecdotes. His motto is rather" Lest we Forget," than the passage which he gives from Colonel Bramble, and his quotations from the *Journal of Sister Marguerite of Ypres*, together with his pictures of the desolation of Hooge and Gheluvelt and the pitiful ruins of Ypres and Albert should well preserve the memory of what our neighbours suffered from the appalling destructiveness of the methods of modern warfare and of the heroism with which these methods were met and conquered.

F.E.G.S.

NOTICES OF MAGAZINES.

MILITÄR WOCHENBLATT.

No. 18.—The Downfall of the Central Powers, by Karl Nowak, is reviewed with crushing moderation by Gen. von Kuhl (Chief of Staff to von Kluck in 1914). The author attacks Ludendorff and exalts Hoffmann, whose share in the Tannenberg victory has, he says, never been properly appreciated. Among other things of which Ludendorff is accused is half-heartedness in the March 21st attack ! He is also declared to have been lacking in imagination and to have been merely a man of statistics and figures. By way, presumably, of showing what imagination really is, the author says that Ludendorff threatened von Arz, the Austrian C.G.S., with a declaration of war in August, 1918, and complains that Ludendorff could never grasp the idea of an attack on the Western Powers by way of the Italian plain, with its base at Genoa. The interest lies, not in the book, but in the fact that such a big gun as yon Kuhl should think such nonsense worth a shot.

Austria.—Herr Baugoin, who has been Defence Minister for the last six months, is retiring in accordance with an agreement between the Christian-Socialist and National parties. He is said to have done good work. Col. von Wachter, an infantry officer who did very well in command of a regiment during the war, succeeds him. The M.W.B. hopes great things from this appointment and especially looks forward to close *liaison* between the German and Austrian defence ministries with a view to their helping each other to deal with difficulties common to both.

French Casualties.—The following figures of deaths are given for the -French Army:—1914, 301,324; 1915, 348,867; 1916, 252,286; 1917, 163,716; 1918, 235,374; total, 1,301,567.

These were distributed as follows :--

Arm.			-	Total Deaths.	Р	ercentage of Strength.
Infantry		••	••	1,142,238	••	18
Cavalry	••	••		20,636	••	5
Artillery		••		79,678	••	2
Pioneers	••	•• .	<u>`</u> .,	26,832	••	3
Air Servic	e		••	3,696	••	2
Train		• •	2.	10,243	••	2
Others	•••	•••		15,233	• •	I

Arrest of Officers.—Some 40 ex-officers of the former 56th Infantry regiment were rash enough to hold a meeting at Krefeld and were promptly arrested by the Belgian troops in occupation, much to the annoyance of the M.W.B. The number of such meetings in the rest of Germany seems to be increasing and in this number about 35 are announced.

No. 19 contains little of interest.

No. 20.—More Officer-baiting.—Some time ago a Brunswick minister Herr Sepp Oerter, speaking in his official capacity, said in a Brunswick paper: "We have had to pay a householder 15,000 marks, largely on account of stolen silver. The payment covered the period when Gen. Maerker and his officers were quartered in the house. About roo silver spoons and forks were missing." On this Gen. Maerker took action and declared that Oerter himself was quartered in the house during the period in question. Oerter replies: "I torgive Gen. Maerker the lies he tells, because I know that it is the nature of 'Kaiserlich' generals to lie.' There seems to be very little redress in the courts for such remarks and the M.W.B. thinks so long as they continue there is little hope for the country.

The Railways on the German Right Flank during the Battle of the Marne.—In the allotment of blame for the Marne, the railways have naturally come in for a share, and Major Kretschmann now defends them. He says that, thanks to the absence of any extensive demolitions, it was possible on 30. 8. 14 to have a railhead at Cambrai, with a double line back from it via Valenciennes, Mons and Brussels.

On 4. 9. 14 the service reached St. Quentin but could get no further south, owing to the destruction of the bridge over the Crozat canal.

On 3. 9. 14 Peronne, on 4. 9. 14 Roye, and on 5. 9. 14 Chauny were reached; the first troops being detrained at Roye on 7. 9. 14. Compiègne was receiving trains on 9. 9. 14, and on the same day a railway construction company was working on restoring the Compiègne-Creil line. There was therefore a complete and independent line right back from the right wing to Germany, in working order by the time the Marne was fought. Of course it was not perfect, because numerous small demolitions, and especially lack of water-supplies, limited its efficiency. Though demands for troop movements could not always be met, it was always equal to the supply situation, thanks to the hard work of the railway troops.

The Lepel (43rd Inf.) Brigade during the Battle of the Marne.—This brigade consisted of the 72nd and 94th Reserve Infantry Regiments, under command of Gen. von Lepel. It was in Brussels up to 30. 8. 14, on L. of C. duty, but marched on that day to the south. On reaching Hal it was alarmed an hour after arrival and ordered north on Ninove. After a trying night march the alarm turned out a false one and the brigade resumed its move southwards. By this time it was entirely on its own, and continued so till on 8th September it reached the Army in Verberie and was allotted a few cavalrymen for reconnaissance. It had marched 40 kilometres on the 8th, but nevertheless was alarmed at 2 a.m. on the 9th and told that it was to act as flank guard to the First (von Kluck's) Army. A little later, at daybreak, it received orders to act against the flank and rear of the enemy, while the First Army attacked on the front Crepy-en-Valois-Meaux and southwards.

Accordingly at 5 a.m. a move due south via Racy-Rully-Ducy was begun and by 8 a.m. the high ground between Ducy and Baron was reached. At about 10 a.m. some French cavalrymen were sighted and dispersed after a few shots, the first which the Lepel brigade had fired. Shortly afterwards the brigade came under heavy rifle fire from the village of Droiselles and deployed for attack. After a stubborn fight the village was taken at about 3 p.m. and the enemy pursued for 2 km. south of it, till at 4.30 came the order to retire. There seemed to be no reason, locally, for the withdrawal which was carried out in perfect order and unmolested *via* Roxier and Rully.

order and uninforced that a French medical officer captured during the The writer states that a French medical officer captured during the day was by order of Gen. Lepel provided with a horse and complete equipment and released " in accordance with international law."

Another account of the attack made by the brigade says that the fight was for long undecided, and, late in the afternoon, when the sounds of the First Army battle had nearly died away, only two companies remained in hand. About this time a French cavalry division (? Gillet's) with artillery was reported in rear of the brigade and one squadron threatened the two Landsturm batteries supporting the brigade. Von Lepel concluded that the First Army had been victorious, but for some reason unknown to him was unable to follow up its success. As for this brigade, it was in a tight place and if it remained where it was would certainly be wiped out or captured. He decided at 6 p.m., as the moment was favourable to break off the fight, to retire and did so in good order. The enemy infantry had been too roughly handled to follow, but the audacity of the French cavalry was, it is said, astonishing. However, von Lepel got away his brigade almost intact, only a few detachments failing to receive his orders and lying out facing the enemy all night. The writer thinks that the fact that the brigade took prisoners from six different regiments shows that it materially lightened the task of the First Army.

No. 21.—The Road to Revolution.—By Gen. von Wrisberg.— Sets out " to show the thinking portion of the German nation who it was that handed it the cup of poison." The hope, which was held in 1914, that the social-democratic party would become a truly national party, vanished in 1915, when it became clear that a short war was out of the question, and in 1916 the break-off of the left wing of the party laid the foundation of what soon became the "Independent Socialists' Party" which conducted energetic peace propaganda. The two chief factors leading to this were the delay in the Prussian Electoral Reform Bill and the increasing pressure of the blockade. Gradually the idea was spread through the masses that Germany had but to submit and her "comrades" in other countries would see that she came to no harm. flash, which revealed the coming storm, was provided by the mutiny in the fleet in July, 1917, which was repressed, two of the ringleaders being shot and 50 sent to penal servitude ; but the real business began when on 9th February, 1918, Emil Barth took control of the Independent Socialists and worked steadily towards his objective, an armed uprising against the Government. Ceaseless propaganda on the L. of C. directed chiefly against men returning from leave and the younger recruit classes carried the poison into the Army and weakened its powers of resistance. Hitherto the Government has always refused to face the truth concerning these doings, but sooner or later it will have to do so and von Wrisberg's book will be of great value in creating a demand for full investigation.

Training of Officers and N.C.O.'s in the Austrian Army.—This seems to go badly; an attempt to obtain uniformity by establishing schools for N.C.O.'s was put down by the mission of control, while the scheme for producing officers has fallen under the ban of the Socialists. The intention was to take youths with a good education and train them for two to three years to be officers. The Socialists say that this will result in the officers all coming from the *bourgeois* class, since the proletariat cannot afford education up to the necessary standard. They demand that the education shall be given in the Army, though it is admitted that this will involve six to eight years' training in all before a candidate can become an officer. At present things are at a deadlock. In other respects the national feeling towards the Army scems to be improving, and the long spell of duty on frontier guard seems to have brought officers and men more closely together.

L. CHENEVIX-TRENCH, Major, R.E.

REVUE MILITAIRE GÉNÉRALE. September, 1921.

The Revision of the Regulations.-By Lucius. (Continued).

The German Atlack on Verdun.-The Germans regarded Great Britain as their principal enemy, but it would require 30 Divisions to attack on her front, and to concentrate these would mean unduly weakening their lines elsewhere. Falkenhayn estimated that France was militarily and economically exhausted, and recommended the attack on Verdun, not so much in the hope of breaking through, but in order to inflict on France such a blow, in a spot where she must employ her last man, that Great Britain would be left practically single-handed. Impressed by the rapid reduction of the Belgian and certain French fortresses early in the war, the French had decided to organize the defence of their remaining strongholds well in front of the permanent works, to withdraw the infantry garrisons of the forts and to place all the troops under the C.-in-C. of the field army in which they happened to be situated. As already stated, the defences of Verdun were organized by centres of resistance separated sometimes by considerable intervals and with no communication trenches to the rear, the shelter of woods and hedges being relied on for concealment of movements. On perceiving indications of an attack two infantry divisions were sent up to help in the completion of the new works of defence.

The Germans strove to attain strategical surprise (I) by leaving it uncertain whether they would attack in Champagne or in Lorraine, (2) by not constructing parallels of departure (some of their trenches were 600 to 800 yards away), (3) by camouflage, (4) by refusing to reply to any French bombardment however heavy. Tactical surprise was secured by the rapidity and weight of the artillery preparation, by bombarding on a front of 22, and attacking on a front of $7\frac{1}{2}$ kilometres only, and by furious infantry attacks scarcely leaving time for the defenders to issue from their shelters. The tactics aimed at inflicting heavy losses

52

. []ANUARY

1922.]

on the defenders and economizing the attacking troops by strictly limiting their objectives. The guns shelled to a great depth, and after several hours increased their intensity on the point of attack without relaxing on the others ; after the assault they continued to fire beyond and on the flanks of the point of attack, then concentrated on a fresh section of the bombarded front where a new infantry attack was launched. Aimed fire was not used and the counter-battery guns fired gas shell to neutralize, instead of attempting to knock out, the French The infantry was distributed in depth with orders to occupy the guns. captured position in great depth, and not to advance beyond a prearranged line unless very exceptional circumstances clearly justified such a course. The German division attacked on a front of 1,000 to 1,200 metres as against the 1,500 to 2,500 metres of the French, but when the enemy position was not to be penetrated to a great depth the divisional front was sometimes extended to 2,500 metres. Orders were given to manœuvre the defenders out of their centres of resistance by infiltration into the passive zones, in fact, always to effect a lodgment in two or more points and then carry the intervals by combined frontal and flank attacks. Strong reconnaissances of 2 officers and 50 men preceded. attacks to see if the artillery preparation had been sufficient, and no attack was to be delivered until the position had been reduced to powerlessness. Such rigid commands left nothing to initiative or to the unforeseen, and did not go so far as to give instructions on the exploitation of a success.

Owing to uncertainty as to the point of attack the troops covering Verdun had not been reinforced, but early in February an army of four Corps with some heavy artillery was collected in rear. There were nine Divisions of infantry in line, and six regiments of heavy artillery dispersed over the two banks of the Meuse (612 guns, of which 244 heavy) against 17 and soon 19 German divisions and 2,000 guns of which the larger proportion were heavy. The battle consisted of two phases, the first a step-by-step defence unable definitely to stay the attack, the second commencing when the offensive on the Somme checked the attack on Verdun and again gave the initiative to the French. The causes of the eventual German defeat are, first, Falkenhavn's mistake regarding the exhaustion of the French ; others are the too narrow front of their infantry attacks, and the formalism of their orders. On 24th February the road to Verdun was open and a bold advance would have carried the Germans at least to the heights of Belleville. Again their attack on the left of the Meuse was delivered too late, and the coolness and energy of the French commanders of all grades was of enormous influence on the result. Nor was France weakened to the extent expected. Two-thirds of her army passed through the fire, and at the beginning of the battle of the Somme she could only send 12 infantry divisions and 700 heavy guns instead of the 39 and 1,700 respectively promised, but by the end of August she sent up 13 more divisions and 500 more guns. The Germans were almost as much weakened, and Ludendorff afterwards described Verdun as "an ever-open ulcer devouring our forces."

A. R. REYNOLDS.

REVUE MILITAIRE SUISSE.

No. 7—July, 1921.

The Franco-Swiss Military Convention of 1917.-The original article is from the pen of Colonel Feyler, who gives details of the scheme which was worked out jointly by the General Staffs of the French and Swiss Armies in the beginning of 1917 to meet the contingency of a violation of Swiss neutrality by the Central Powers. Colonel Feyler points out that the possibility of the Germans invading France via Switzerland first came under serious consideration at the French G.H.Q. in the winter of 1015-1016. A reconnaissance of the routes of the Juras was accordingly ordered and carried out by the automobile service. During the winter of 1916-1917, the matter came into prominence again, and the problem was studied afresh. Finally, in the winter of 1917-1918, the Germans having succeeded temporarily in obtaining a numerical superiority on the Western Front, it was expected that they would attempt a deployment upon a grandiose scale, and for the third time, the French General Staff returned to the consideration of the problem. Colonel Feyler discusses more particularly the plan worked out in the winter of 1916-1917; this plan was based upon the assumption that the Swiss Army would have to hold its own against the Germans for seven days before it could receive support from the French. The general idea was that the Swiss Divisions should take up a position on the line Lausanne-Chaux-de-Fonds, where it might expect to be reinforced by four French Divisions in from four to seven days - in the case of 1917-1918 plan, a much shorter time was allowed for the arrival of the French reinforcements, namely, two days for the arrival of the first four Divisions and a third day for two additional Divisions. Colonel Feyler discusses the courses which would have been open to the Swiss had they been obliged to retire from the frontier, and compares the situation with that which actually came to pass in Belgium when the Belgians had to fall back from the Meuse.

Military Bridges.—The original article is based upon one on the same subject appearing in the Royal Engineers Journal for February, 1921.

The Reichswehr .- The original article is contributed by Major de Vallière who gives some important information, based upon the utterances of General von Seeckt and others, as to the manner in which the Teutons hope to defeat the provisions of the Treaty of Versailles, the object of which is to limit Germany's armed forces and to keep a check upon their expansion. General von Seeckt is stated to have announced in an Order of the Day that the Reichswehr was " destined to form the back-bone of our national forces in the hour of danger." In accordance with the terms of the Peace Treaty this force was reduced to 100,000 men of all ranks some time ago ; but of its 4,000 officers no less than 54 are generals (approximately one general for every 1,800 other ranks) ; it is said also that non-commissioned officers are mustered as privates. Further, it would appear that a number of organizations have sprung up in Germany, which, although nominally non-military, are nevertheless capable of being easily transformed into a fighting force and could be readily incorporated into Germany's small standing army.-(To be continued).

NOTES AND NEWS .- France .- A special correspondent refers to the

NOTICES OF MAGAZINES.

provision made in the draft of the new Military Law for the assimilation of the officers of the various "services" with those of the combatant arms: the scales of pay are apparently to be unified, but the officers of the "services" are still to retain their former titles. A new scheme in relation to promotions is also mooted, as well as new regulations relating to entry into the commissioned ranks. In order to obtain a commission a young man will have to spend at least two years at one of the cadet schools and to pass the examinations of the school : alternatively he may serve three years in a Corps, at least two of them as a non-commissioned officer (i.e., in a rank higher than that of corporal), and he must go through the course of instruction at one of the schools for non-commissioned officers and give satisfactory evidence that he has reached a sufficient standard of proficiency ; in the further alternative, he may serve for six years in a Corps, at least four of them as a noncommissioned officer, and he must hold the rank of "adjudant" or "adjudant-chef" (the latter is the highest grade in the N.C.O. ranks). The foregoing periods may be halved in the case of men on active service. The rank of major has been abolished in the French Army. In future, two-thirds of the battalion commanders are to be promoted by a process of selection, the remaining one-third will be appointed on the principle of "seniority tempered by selection." The promotion of subalterns is to be carried out on the recommendations of Regional Commissions which will be presided over by the Corps Commanders. These Commissions are required to keep lists showing the qualifications of the officers of the Command and to transmit such lists periodically to a Central Commission. The Central Commission will be presided over by a member of the Conseil supérieur de la guerre and the Inspectors General and the Directors of the various arms and services will be members at the meetings of the Commission to adjudicate upon the claims to advancement of the officers of their own arm or service.

No. 8.-August, 1921.

The Fate of a Great Army .- The author of the original article, Capt. Cuno Hofer, calls attention therein to articles, from the pen of F. de Bolgar, the Hungarian politician, published in the Pester Lloyd of 14th and 15th May, 1921, doing homage to the memory of the late Marshal Boroévics, one of the most distinguished of the Commanders of the Hapsburgian Armies during the Great War; the death of this brilliant soldier occurred shortly after the crumbling to pieces of the old Danubian Monarchy. Boroévics first came into prominence as a Corps Commander in the Carpathians; subsequently, he fought a dozen celebrated battles on the Isonzo, and by his leadership on these fields has won for himself immortal renown. De Bolgar's articles are based largely upon letters written to him by the Marshal, wherein the latter discloses the chaos and ulter state of unpreparedness in which he found the forces in command of which he was placed on his arrival at the Italian Front. It appears to have been largely due to the divided counsels which prevailed at the Austrian G.H.Q., the petty intrigues, and a total lack of material support that Boroévics was compelled to retreat from the Piave in the summer of 1918, after his brilliant stroke which placed in the hands of his Army 12,000 prisoners of war; an occasion upon which the Hungarians fought

1922.]

like lions. Capt. Hofer appears to be of opinion that Hungary has been somewhat severely dealt with by the conquerors, in that her military forces have been reduced to seven mixed brigades, with an establishment all told of 1,750 officers and 2,334 N.C.O.'s; he expresses sympathy for the Hungarian soldiers, who, after having fought with conspicuous gallantry on the Isonzo, in Galicia, and in the Carpathians, have now to be content to live the humdrum life of a village policeman or of a customs' official.

NOTES AND NEWS.—Belgium.—A special correspondent contributes a few notes relating to the Belgian Army, the strength of which has been reduced to 115,000 men, but which continues to be organized in six Army Divisions, each containing two infantry divisions of three regiments. The other combatant troops consist of 21 artillery regiments ; one heavy artillery division (three regiments); a cavalry division organized in three brigades (12 regiments); and six regiments of engineers. Provisionally, the periods of colour service in the different branches are as follows :---infantry, 10 months ; cavalry, 13 months ; artillery, engineers and the technical branches generally, 12 months. Largely owing to the efforts of a group of patriots, civil and military, the Air Force is being placed upon a satisfactory footing and things are going well with the "fifth arm." Schools of instruction in aviation are growing in number; they are run under civilian auspices, but the Department of National Defence patronizes and also subsidizes them. The Tank Corps is not so well off as the Air Force. The personnel is kept up to establishment ; it is alleged, however, that there is a shortage in equipment and much of that in the hands of the troops is of an obsolete type.

France.-Another special correspondent furnishes some particulars concerning the reorganization of the French Army: the chief points to which attention is called are as follows :- In future there will be 12 different kinds of infantry regiment, classified in main groups as infantry properly so-called, chasseurs-à-pied, zouaves, tirailleurs, foreign legion. "light tanks" and " heavy tanks;" each with varying establishments. The establishments of these various kinds of regiments are briefly set out in the original notes. The cavalry is to be provided with a more homogeneous organization : except in the case of the Spahis, a regiment will consist of 22 officers, 650 other ranks, and 657 horses. The establishment of a Spahi regiment will be 23 French officers and 8 native subaltern officers; the other ranks will contain 130 Frenchmen and 620 natives; these regiments are to be provided with 700 horses and mules. There, will in future be a great variety of units in the artillery ; in some cases the guns will continue to be horse-drawn, but in others tractors will be utilized for this purpose. The engineers will continue to be organized in specialized units as heretofore. The Air Force will also retain the organization evolved for it during the War : particulars are given in the original notes of the various types of aviation squadrons. France is much perplexed on the question of its temporary officers; there are to-day some 14,000 of them, of whom about 8,400 were promoted from the ranks. The question of what shall be done to deal equitably by them is discussed at some length in the original notes.

W. A. J. O'MEARA,

56