THE ROYAL ENGINEERS JOURNAL.

Vol. XI. No. 4. APRIL, 1910.

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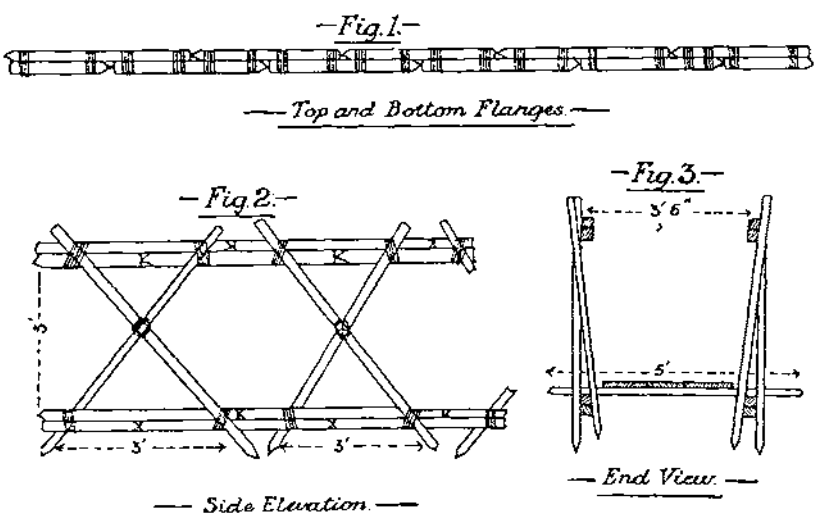
Authors alone are responsible for the statements made and the opinions expressed in their papers.

SOME IDEAS ON FIELDWORKS.

THE following extracts from the reports on the Annual Fieldwork Courses for the year 1908—1909 are published as being of general interest.

1. LATTICE GIRDER BRIDGE OF 5′ PICKETS (*Figs.* 1, 2 and 3).



The girders were 18′ long, and, after taking a certain sag were quite strong enough for a footbridge. The lashings were of spun-yarn. The time required for making one girder was 6 man-hours.

2. MASKING LOOPHOLES.

Amongst various attempts at concealing slit loopholes, the experiment was tried of placing a rough trellis work of brushwood at a gentle slope against the front of the parapet. The sticks were not so close as to impede the view or the fire from the parapet. Sods were laid on at intervals and, from a distance of 500 yards, the loopholes were very successfully concealed.

3. DRINKING WATER SUPPLY (*Figs.* 4, 5 and 6).

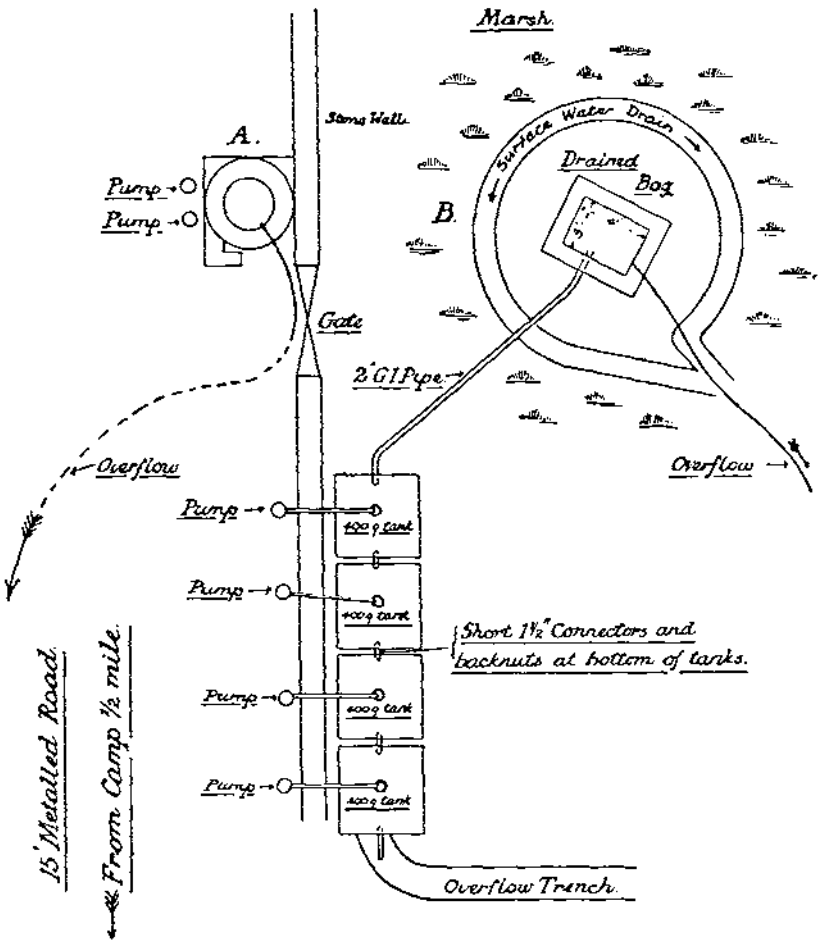
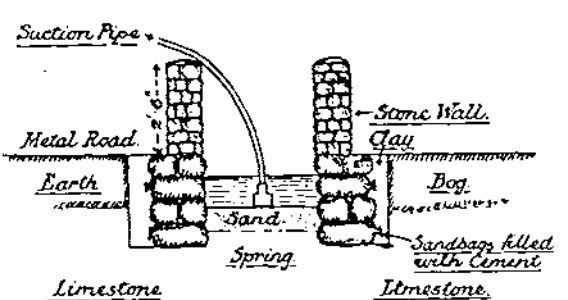
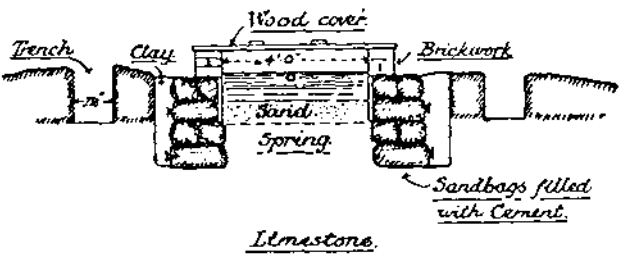


Fig. 4.
Scale—11' = 1 *inch.*



—Section at A.—

Fig 5.
Scale—5' = 1 *inch.*



— Section at B. —

Fig. 6.
Scale—5′ = 1 *inch.*

During the 6th Divisional Manœuvres the drinking water for a standing camp at Aglish was obtained from two springs on the top of a hill ½ mile from camp. The water was analyzed and was pronounced pure. The springs were dug out and protected from pollution by a lining of cement (in sandbags) and clay, carried down to the limestone stratum 1′ below the surface of the soil. The water from one spring was piped into four 400-gallon tanks connected at the bottoms, inlet and overflow being at the top. The other spring had a supply sufficient to keep two pumps going direct.

4. Plank Girder and Plank Trestle (*Figs.* 7, 8 and 9).

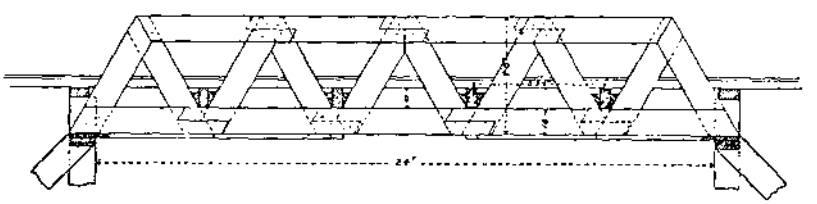


Fig. 7.—*Side Elevation.*

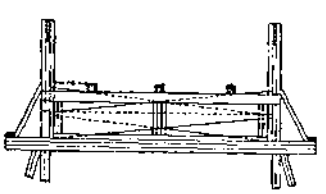


Fig. 8.—*End Elevation.*

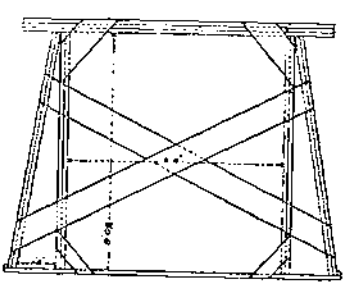


Fig. 9.—*Trestle.*

Trestles and Girder—13′ × 12″ × 2″ *planks.*
Transoms—9′ 6″ × 10″ × 5″ *sleepers.*
Baulks—5″ × 4″ *gunnels and* 4″ × 4″ *barrel-pier baulks.*
Fastenings—½″ *coach-screws and* 5″ *wire nails.*
Scale—7½′ = 1 *inch.*

This bridge was constructed to carry infantry in fours. It is sufficiently explained by the figures.

5. FIELD REFUSE DESTRUCTOR AND BOILER (*Figs.* 10 and 11).

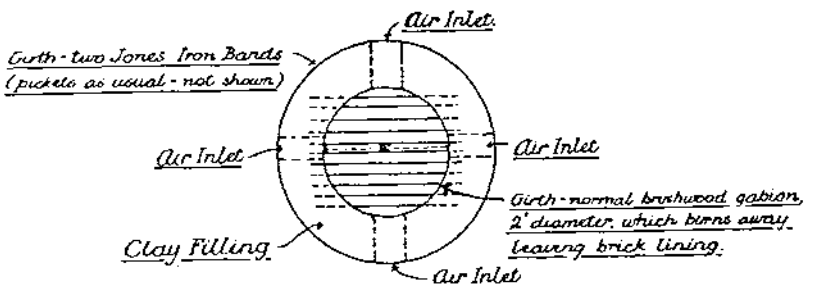


Fig. 10.—*Plan.*

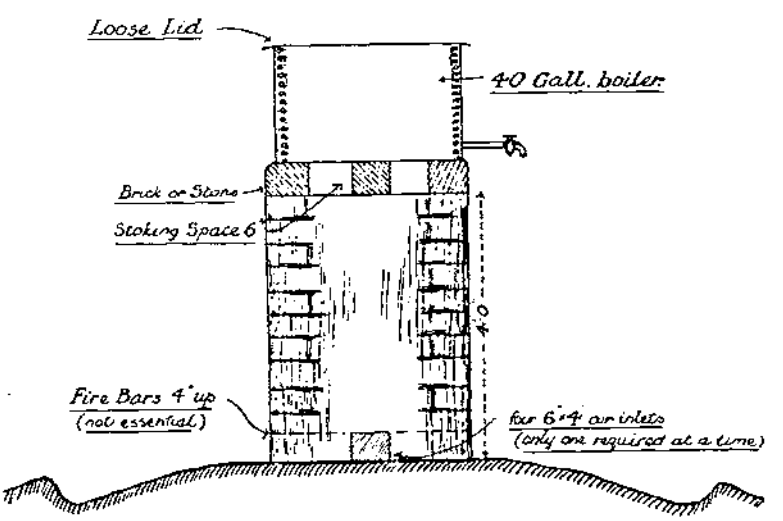


Fig. 11.—*Elevation.*

This was a successful type of destructor. The boiler was used to boil the drinking water for the company during the course.

6. Cantilever Bridge (*Fig.* 12).

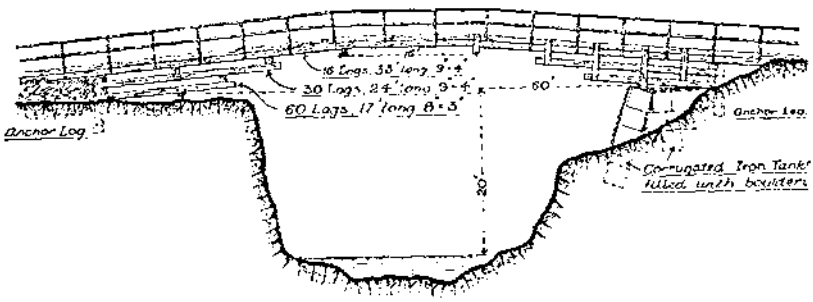


Fig. 12.

*Scale—*23′ = 1 *inch.*

The company was enabled to make use of a large quantity of timber which had been condemned as unserviceable for ordinary purposes. The bridge was erected for permanent use over a span of 60′, and was calculated to carry infantry in fours. The time taken was 2,110 man-hours.

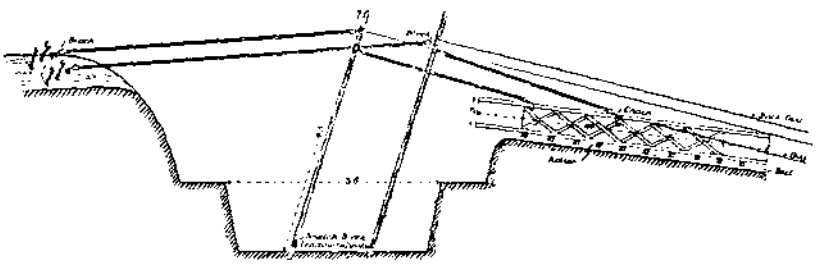
7. Notes on Night Attacks.

On the Attack.—When a flare goes off, the attackers must lie down and keep quite still, any movement is likely to be observed.

To prevent noise when wire is being cut, a man should hold the wire on either side of the cutter.

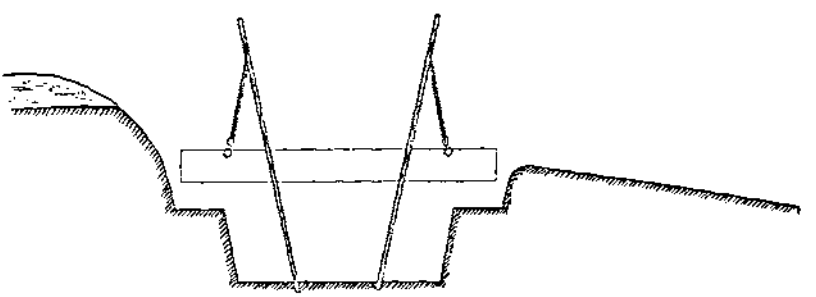
On the Defence.—No projecting poles, planks, etc., should be left in the trench. Steps should be provided freely, to prevent men falling down steep drops. Sound cannot be heard through a loophole so well as over the top of the parapet, if the wind is blowing through the loophole. Before a flare is ignited, the defenders should be warned as to which flare is going off. After a flare has been fired by electrical means the leads should be knotted or otherwise marked in order to prevent attempts at using them again.

8. PLACING 7-TON GIRDER IN POSITION (*Figs.* 13 and 14).



—*First Position of Derricks*—

Fig. 13.



—*Second Position of derricks and attachment to girder*—

Fig. 14.

Scale—32′ = 1 *inch.*

Two 40′ derricks were used, with guys of 2″ steel wire rope. The sketch shows the general arrangement. The attachment to the girder of the tackle of No. II. derrick was shifted to the rear end of the girder, when the latter was nearly at its balancing point on the rollers.

J.C.M.

THE EARLY ROMAN MILITARY CONSTITUTION AND OUR OWN.

By COLONEL S. A. E. HICKSON, D.S.O., LATE R.E.

THE interesting account of the Comitia Centuriata of early Rome, given by Colonel Ruck in the *R.E. Journal* for January, shows again very clearly how closely the early English military system, as constituted under the Assize of Arms of Henry II., resembled in some respects that of early Rome. In the case of Rome however the valuation of their fortunes was sworn to by the people themselves. In the case of England the wealth of the citizens was testified to, before justices of the peace, by legally appointed jurors, as representing the people; a measure which is looked upon as a first step, leading in the direction of our existing representative or parliamentary form of government.

A matter of further interest is the fact that both the Roman and the Saxon systems were originally tribal in form, the bonds of union being love of freedom and study of the use of arms; but whereas in all the early Germanic tribes, to which the Angles, the Jutes, and the Saxons belonged, military service was a personal duty owed to the State irrespective of land, in Rome the franchise and military service appear from the first to have been connected with the holding of land. In England it was not till after the invasion of the Danes that, by the custom of "commendation," the rendering of military service became specifically associated with land tenure. Then it was that, as a measure of security and necessary organization for mutual defence, Alfred the Great instituted amongst his Thegns what has been called a "Nobility of Service," and the poorer freemen, or ceorls, "commended" themselves to the service of the mightier Thegns in like manner as the Thegns commended themselves to the King; that is, the ceorl sought the defence and aid of the Thegn, "and as the price of this aid surrendered his freehold to receive it back as a fief laden with conditions of military service."*

Such was the Anglo-Saxon system 200 years before the Norman Conquest and the arrival in England of feudalism. With commendation crept in the oath of allegiance, which William the Conqueror

* Green, *Conquest of England*, p. 210.

was careful to preserve, as by it every man was primarily the King's man and owed *him* service before all. Thus it came about that the Anglo-Saxon military system, in the form of an English Landwehr (home defence force)—or defensive militia—in England survived feudalism, its creed being "National Service," as exemplified by the motto of the Prince of Wales, "I serve" (*Ich dien*). Throughout history "National Service" in the cause of common defence will thus be found to be the national creed, resulting from national disaster and invasion, as certainly as individual liberty becomes the cry after prolonged periods of peace and immunity from attack.

Perhaps the following account of the evolution of the constitution of Servius Tullius, or Comitia Centuriata, from the still earlier system of Comitia Curiata instituted by Romulus and referred to by Colonel Ruck, may interest your readers. It is taken from notes made by the writer 15 years ago, when reading Niebuhr and Mommsen, and perhaps the classical researches of Colonel Ruck may be able to throw further light on the matter, and correct or elucidate any imperfections. It shows how in Rome the original tribal system tended, as did the continental feudal system, towards local hostility and inter-tribal dissension, and how, in consequence, measures were taken under Servius Tullius to mix up all the various tribes together in the new centuries and legions.

Before the time of Servius Tullius the country about Rome was not united with the State. No patrician could acquire landed property in the country districts any more than a plebeian could at Rome; and, as Colonel Ruck points out, "only those Roman citizens who lived within the city, or were included in some Curio or Urban parish, had the right to vote." "But there now appeared," says Niebuhr, "a legislator who gave to the commonalty a contribution which was complete in itself, and devised forms by which this commonalty became united with the whole body of burghers. Servius Tullius divided the city of Rome, so far as it was inhabited by pale burghers (plebeians), into 4, and the territory around it into 26 regions."* The four *Roman* tribes were Palatina, Collina, Suburana, and Esquilina. But the divisions *now* made were purely geographical, and in no way connected with certain *families*. "Everyone received a name from the region in which he lived; but when he changed his abode he did not thereby cease to belong to the local tribe corresponding to the region in which he and his descendants were registered." This system was modified by time, but originally "the tribes contained only plebeians, the patricians being comprised in the curies, which also

* See Epitome of Niebuhr's *History of Rome*, by T. Twiss, pp. 102 to 114, etc.

included their clients." "There were 30 Curies of the Patricians, 30 Tribes of Plebeians, and 30 Towns of the Latins. The country tribes had names from heroes and common *sacra* with the tribes of the burghers." In the earliest times all possessed equal privileges, but later the city tribes became inferior to the country tribes. When a person became a Roman citizen without the suffrage he was not received into any tribe, nor could he be invested with any office or vote in the assembly. The qualification for voting in a plebeian tribe consisted in being a landed proprietor and agriculturalist; whoever supported himself by any other occupation was excluded.

The two corporations (Patrician and Plebeian) thus constituted, that is in their tribal form, regarded each other with hostile feelings. It was for the purpose of dispelling this feeling and effecting an accommodation that Servius created the Centuries, excluding all who had no landed property, and could therefore give no guarantee to the State. The Centuries thus included all the First Estate, all of the Second Estate who had the right of voting, and all of the Third Estate who had property equal to the Second, and, lastly, persons engaged in certain honourable occupations. Servius exempted the burghers from serving on foot. "He composed the cavalry of the three ancient double tribes or 6 Centuries of Tarquinius Priscus, and to them he added 12 other Centuries of the plebes." These 6 Centuries comprised the entire Patrician order. In the Plebeian order Servius Tullius separated the more noble and wealthy into two classes—"the Latin nobility, and those who did not belong to it." To the nobles (as Colonel Ruck points out) he assigned the 12 remaining equestrian Centuries, and this without any regard to property. All those not contained in the equestrian Centuries were again divided into such as possessed more than 12,500 asses and less. The former of these were subdivided into five classes, according to the value of their property.

The	1st	Class	comprised	those	of	100,000	asses, and had	80 Centuries.
,,	2nd	,,	,,			75,000	,, ,,	20 ,,
,,	3rd	,,	,,			50,000	,, ,,	20 ,,
,,	4th	,,	,,			25,000	,, ,,	20 ,,
,,	5th	,,	,,			12,500	,, ,,	30 ,,
						Total foot	...	170 ,,

The above details coincide with Colonel Ruck's account. The 1st Class contained all plebeians of property and the "Gerarians," *i.e.*, those who were not contained in the tribes, but whose property

placed them on an equality with them, and who, if they had acquired landed property, were enrolled in a tribe. "All persons from the age of 16 to 45 were counted as juniors; those from 45 to 60 as seniors." The seniors had no other duty than to defend the walls of the city, as, for example, in times when Rome was threatened by Hannibal, after the disastrous defeat of Cumæ.

Those whose property was less than 12,500 asses were again subdivided into two sections:—

Locupletes	...	...	... having over 1,500 asses.
Proletarii	...	...	... having under 1,500 asses.

The latter were exempt from taxes. Each of the above had 2 Centuries, and besides these there were *three* Centuries of the trades as engineers, etc. Colonel Ruck says "2 Centuries of Artificers," and adds that these were included by Livy in the First Class, or Classici. No doubt changes occurred at different times, but Niebuhr has the following remark:—"These *three* Centuries did not consist of plebeians, for no plebeian was allowed to engage in other occupations than agriculture; but there existed at Rome certain guilds, and their number was three times three, *i.e.*, pipers, goldsmiths, carpenters, dyers, saddlers, tanners, coppersmiths, potters, and the ninth included all other artificers." They were usually freed men and foreigners. Perhaps this note will help to elucidate Colonel Ruck's remark and doubts as to the position of these Centuries of Artificers. Niebuhr wrote a pamphlet, "Von den Comitien der Centurien im zweiten buch *Cicero's de republicâ*," which gives the clue to his sources of information. Lastly, Servius also took notice of those free people who did not belong to the commonalty. Many of them undoubtedly entered the service either by compulsion or of their own accord, for, says Niebuhr, "I cannot believe that the 'capite censi' and the proletarii did not perform any service at all; they did not fight against the enemy, but served only in the baggage train as lixæ and calones (sutlers and servants), as there is no reason for supposing that these were always slaves."

Thus the system of the old Legion harmonizes precisely with the several orders of classes. The 5th Class were the skirmishers (Livy I., 43, fundas lapidesque missiles gerebant). In the 4th Class we recognize the light infantry (hastas et gaesa ferentes, Livy VIII., 8), who only carried the "hastam et verulum" without shield. These "Hastati" formed the front rank of the legion.* The front rank of the "Principés," or main body of the legion, was formed of the

* It might be more correct to say that the hastati formed a line in front of the main body of the legion.

juniors of the 1st Class (insignibus maxime armis). The Triarii (veterans) formed the third rank, or reserve. "Only such as belonged to a plebeian tribe came under the regular annual conscriptions; others were merely called out in extraordinary cases, and when civic legions were formed. If anyone was turned out of a tribe, he merely lost the right of serving in the legion. Levies were made according to the tribes, of which there were 30 (see Dionysius IV., 14), "for which reason, moreover, the Century of the original legion consisted of 30 men, and was reckoned by the annals at 20 for the time when the tribes were reduced to that number."* This principle of raising troops by the tribes lasted as long as there was any distinction between the plebeians and Gerarians (the lowest class). "It appears to me probable that the Centuries were so constructed as to include all who in any manner bore the name of Roman, although the exclusive obligation of the plebeians to serve leads us to suspect that originally they alone formed the classes. But the clients of the patricians must have been admitted into them very early, for by their means their patrons exercised great influence in the education."

I have ventured to give the above account in continuation of Colonel Ruck's valuable quotations, in order to illustrate and show how closely civil and military rights were associated in the early constitution of Rome, as they were also in England; also to show how much the question of landed property and agriculture entered into political organization and rights.

Readers of Mahan's *Nelson* will remember that Niebuhr was one of the defenders of Copenhagen against Nelson in 1801. The Prussians were at that time studying history, and more especially military history, with avidity. A little later, after the Battle of Jena, where Napoleon so effectually crushed them, they found it necessary to entirely reform their whole system. The first steps, immediately after the peace of Tilsit, was an edict revising their entire land system, with the view of increasing the number of small freeholders and freeing the cultivators of the soil from the landowners.

The avowed object was to stimulate patriotism and give independent interest in the welfare and freedom of the country to as large a number of people as possible. The introduction of universal military service at a National Congress at Kœnigsberg followed, when it was resolved to arm the whole mass of the people and send them to fight the French and free their country.

It is noteworthy that at the present time it is the avowed policy of both parties of our State to increase the number of small landowners and cultivators in this country, and nothing could promote national

* Perhaps Colonel Ruck can explain this passage of Niebuhr.

security and defence better than the improvement of agriculture, as it is notorious that there is no more patriotic or better soldier than the land cultivator or yeoman. In Rome, as Mommsen tells us, "The new organization of the army was accompanied by a more careful supervision of landed property on the part of the State. It was now either enacted for the first time, or, if not, at any rate ordained more precisely, that a land register should be established, in which the several proprietors of land should have their fields, with all their appurtenances, servitudes, slaves, beasts of draught and of burden, duly recorded, . . . and a revision of the register of landed property, which was at the same time the levy roll, was directed to be made every fourth year. The emancipation and the census thus arose out of the Servian military organization."

REINFORCED LIME CONCRETE IN INDIA.

By Lieut. C. F. Stoehr, R.E.

The present standard type of roofing for Military Works buildings in the Indian plains, viz., tiling of the Allahabad or a similar pattern, supported on sal rafters and battens, has had no serious rival in the Military Works Services for many years.

In the Public Works Department a roof composed of jack arches and kankar lime concrete, supported on rolled steel beams, has been largely used, but this system has some defects. Cracks are apt to appear, causing leaks, and it sometimes happens that echoes cause much annoyance. The internal appearance also is not very good.

In Europe and America reinforced concrete is being ever more widely used, but over the greater part of India the high price of cement—due to the great cost of carriage over long distances—renders the application of this system impracticable; for example, a barrel of cement, which costs Rs.8/8/- at Bombay, costs about Rs.14/8/- at Jhansi. A substitute for cement however, which fulfils the essential condition of cheapness, is to be found in kankar lime. So far as I can ascertain, the matter was first taken up by the P.W.D. in 1905, and in that year experiments were carried out at several stations in the United Provinces. The reinforcement consisted either of iron bars or of fencing wire, plain or barbed. In many cases the reinforcement was not laid so as to give the best result, while it was obvious that in some cases the test load must have arched during application, and thus given a quite false result. One broad fact however stood out clearly from these experiments, viz., that a slab of lime concrete, 6″ thick, reinforced with 7-ply No. 4 fencing wire at 1′ intervals, could safely stand any ordinary roof load over a span of 5′.

The first attempt by the M.W.S. at Jhansi was made during the cold weather, 1907–8, when Mr. Griffith, the sub-divisional officer, asked permission to try reinforced lime concrete over a portion of the verandah of a building which was undergoing reconstruction. Rolled steel beams, 5″ × 3″, buried in the concrete slab, were used as the supports, while the reinforcement consisted of barbed wire taken from the top flange of one beam to the bottom flange of the next one—four wires per foot-run being used. As in all work of this nature hitherto carried out in Jhansi, the depth of the slab was 6″, and the distance between supports 5′. The method of placing the reinforcement is obviously unscientific, for at the centre of the slab, where the bending moment is greatest, the effective depth of the

slab is halved. The experiment was, nevertheless, perfectly successful. During the next rains the roof was carefully watched, and beyond a slight dampness at one corner, due, probably, to imperfect connection between the slab and the wall, there was no trace of leaking.

In consequence of this successful result, some barrack verandahs, an office, and a godown, 30′ × 20′, were all roofed with a reinforced lime concrete slab during the cold weather, 1908–9. The system used for the beams of the last-named building, and the reinforcement of all of them, is shown in the drawings (*Figs.* 1, 2, 3). It may be

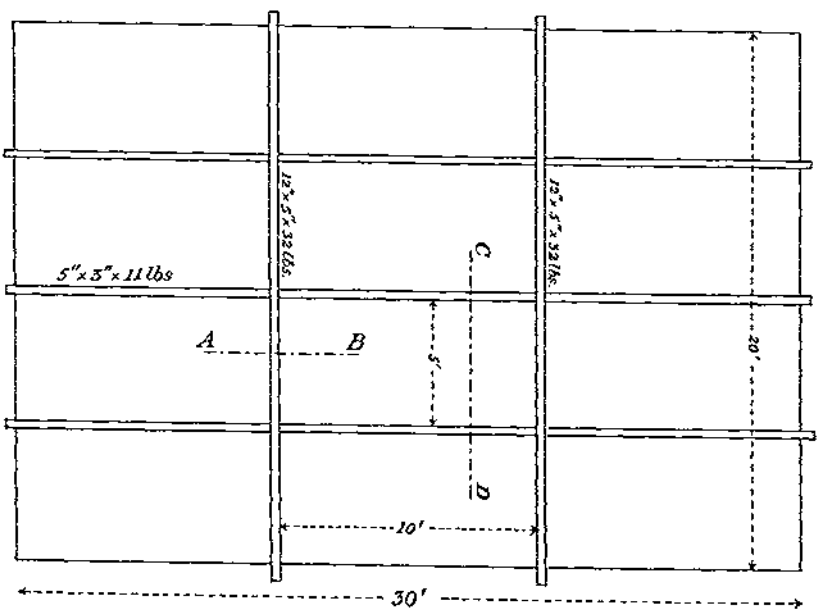


FIG. 1.

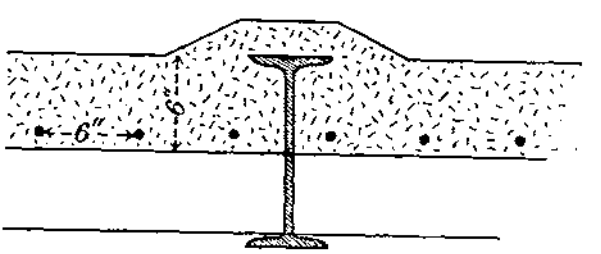


FIG. 2.—*Section and Elevation on AB.*

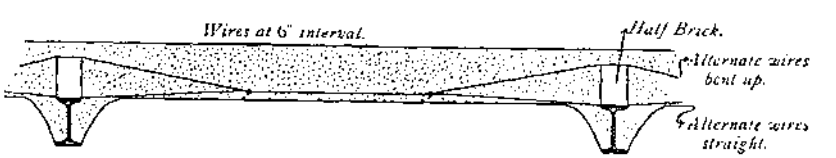


FIG. 3.—*Section on CD.*

noted that, with concrete 6″ deep and of 5′ span, the arrangement of main and secondary beams shown in the drawing is more economical for spans of 20′ and upwards, than a single row of beams would be.

The results have, on the whole, been very successful. Slight cracks have appeared in the godown along the line of the main beams, due to the thinness of the concrete covering these beams, and in the office verandah, for a similar reason, over the channel iron to which one end of the wire was attached (see below), while in the barrack verandah, cracks have appeared owing to the lack of expansion joints. These defects are easily avoidable, and this type of roof is now used at Jhansi whenever practicable.

While these works were in progress a series of experiments was carried out (*vide* Appendix I.), in order to find out the best amount and distribution of the reinforcement, and to obtain a guide for future progress.

The following figures show the comparative cost of tiling and reinforced concrete. The tiled roofs are typical examples of recent work; though only the estimated cost is shown, it may be accepted as accurate, for there is no item, such as centering, the cost of which it is difficult to foresee. The figures for the concrete show the actual expenditure incurred, including that on centering.

All the following rates, when given as percentage rates, are rates per 100 square feet of area roofed over.

Nature of Roof.	Internal Span of Building or External Width of Verandah.	Rate p.c.	Remarks.
	Feet.	Rs.	
Double Allahabad tiling ...	18	93	With cloth ceiling.
" " " ...	20	107	
Single " " ...	18	77	
" " " ...	12	74	
" " " ...	10	55	Verandah.
" " " ...	10	59	Verandah.
Reinforced lime concrete ...	20	60	Godown.
" " " ...	10	62	Verandah.
" " " ...	14	54	Office and Verandah.
" " " ...	10	65*	Office and Verandah.

* There has been no opportunity of checking this rate, which seems unduly high.

No figures showing the actual cost of a jack arched roof are available, and figures taken from estimates cannot be accepted as accurate, but the following comparison of items shows that there must be a considerable balance in favour of the reinforced slab roof.

Rolled Steel Beams.—The cost of these is considerably less in the slab roof than in the jack arched one, and this for two reasons :—(1). Because the weight of the roof is less. (2). Because the span of a jack arch is limited to about 4′ ; if larger, the arch becomes too flat, or the rise inconveniently great. The span of the slab however is limited only by its strength, and a 6′ span appears perfectly safe ; we can thus economize by using fewer and larger beams.

For instance, a certain jack arched roof at Jhansi (that of the Brigade Office) required rolled steel beams to the amount of 22,792 lbs. in the main roof and 10,406 lbs. in the verandah, costing—at Rs.8 per cwt.—Rs.1,630, or Rs.44 per cent., and Rs.743, or Rs.18 per cent. respectively. Had a reinforced slab roof (of 5′ span) been used the amount required would have been 12,767 lbs., costing Rs.24 per cent., and 7,623 lbs., costing Rs.13 per cent. respectively.

Centering, including Dismantling.—The cost will be about the same in either case, unless it is found possible to use the lower flange of the beams, as in *Fig.* 4, when the slab roof will have the advantage, for this method is impossible with jack arches, which rest on the lower flanges.

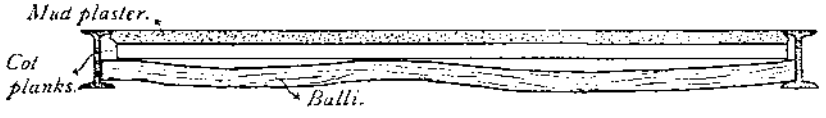


FIG. 4.

Brickwork.—Cost with jack arches, Rs.9 per cent.

Wiring.—Cost in reinforced slab, Rs.4 to Rs.5 per cent.

Concrete.—In concrete slab roof the cost is about Rs.10 per cent. In the jack arched roof about two-thirds the quantity of concrete is used, at a cost of, say, Rs.7.

Plastering Ceiling, Polishing Roof Surface, and Miscellaneous.*—The cost will be about the same. The slab roof may require Rs.1 per cent. more for oil and paper.

These results may be summed up in a table :—

	In favour of	
	Reinforced Concrete.	Jack Arch.
Rolled steel beams	Main Rs.20. Ver. Rs.5.	—
Brickwork	Rs.9	—
Wiring	—	Rs.5
Concrete	—	Rs.3
Miscellaneous	—	Rs.1

* Now abolished with reinforced slab roof, *vide* note at end.

In comparing the cost of tiling with that of reinforced concrete or jack arches for verandahs, it must be remembered that, while the first requires only stone posts to support it, the two last need pillars and arches. The cost of posts may be put at Rs.3 per cent., and that of pillars and arches at Rs.8 per cent., with an extra Rs.6 if a chajjha is added. On the other hand, it is probable that, as experience is gained, the cost of reinforced lime concrete will be reduced, perhaps considerably.* The directions in which this reduction may be sought for are indicated further on.

The following are the results of the experience gained about certain practical points.

The centering is an item that needs very careful watching, or its cost will grow to alarming proportions. For most works the best centering consists of old cot planks, doors, condemned table and bench tops, etc. The last named will of course be wanted for repairs to barrack furniture, but they will not be harmed if first used for centering. Condemned cot planks are particularly useful, and should always be kept. Earth, finished off smooth with mud plaster, is laid on the cot planks, and just before the concrete is put down sheets of paper are spread over the mud plaster—which becomes perfectly hard after a day's exposure to the sun—and it is moistened with kerosene oil. This paper is necessary in order to give a smooth under surface to the concrete; on the removal of the centering it is easily peeled off.

The whole rests on scaffolding, or better, on ballies supported by the lower flanges of the rolled steel beams, as shown in *Fig.* 6. In the case of several buildings, or of one very large one, it might be economical to use a pacca centering of planed boards nailed to a couple of ballies, with the top surface greased; this could be used over and over again.

The fixing in position of the reinforcement was a considerable puzzle. At the first attempt a framework of 1″ × 1″ angle iron was constructed to take the ends of the wires, but when these were strained the frame bent. Some old surplus channel iron, 4″ × 2″, was also used, but of course such material is not usually available. Moreover, experience proves that nothing should break the homogeneity of the slab, or cracks are likely to occur. The best solution appears to be to bend a piece of moonj ban (country rope) on to each wire, and tie it to a balli, which may either form part of the scaffolding outside the building or may merely hang down outside the wall up to which the roof is to extend, and be weighted. The wire may then be strained by hand until taut, and the other end fixed in a similar manner. With the former method of fastening the ends of the moonj ban, wire strainers may advantageously be used.

* *Vide* note at end.

Some methods of treating the rolled steel beams are shown in *Figs.* 3, 5, 6. If the centering is supported on the lower flange of the beams, the method shown in *Fig.* 6 may be used, or the beam may be merely painted or coal-tarred, if the appearance does not matter. The system of *Fig.* 3 has the advantage of reducing the unsupported span.

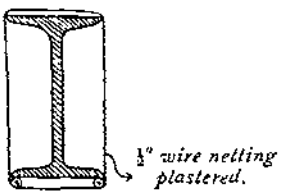


FIG. 5.

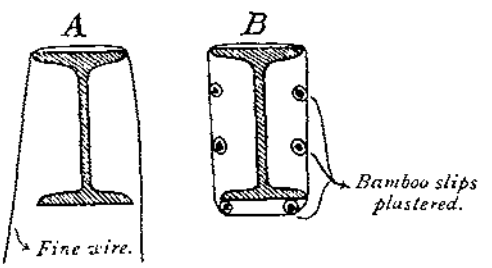


FIG. 6.

A. While centering is in position.
B. After centering is taken down.

The method of keeping the bent wire in position required some thought. The plan adopted, was to place a half brick on edge under the wire, where the latter passed over a support, while a strand of wire was passed along the support, under the half bricks and over the straight wires, to keep the latter down. At the point where the bent wire turned upwards a similar strand was passed over the bent and under the straight wires, and kept from rising too high, as it tended to do, by a couple of loops of wire or string, which were taken through the centering and tied to the ballies underneath.

The composition of the concrete varies in different districts. At Jhansi it consists of 40 parts by volume of pure kankar lime to 100 parts of broken brick or flint ballast.

In laying the concrete two points should be kept in mind. If the beams are to be embedded in concrete, this concrete should be laid first, and carefully packed. It is also necessary to see that the reinforcement is not displaced by the weight of the concrete. As the latter is being thrown down one man should stand by with a hook, pulling up the reinforcement into position.

After being laid, the concrete should be kept under water for 10 days. The water soaks through the concrete, carrying lime with it and depositing it in the minute interstices through which the water filters.

At the end of the 10 days the surface is treated in the way shown in Appendix II.

The centering should be left in position for 10 days. Finally it is worth considering in what direction to look for future progress, or, in other words, for greater economy. Probably the most important item to attack is the rolled steel beams. The cost of $5'' \times 3'' \times 11$ lb. beams at $5'$ intervals comes to about Rs.12 per 100 square feet of roofing. With a beam of $10'$ span we can use $5'' \times 3'' \times 11$ lbs. up to $5\frac{3}{4}'$, and $6'' \times 3'' \times 12$ lbs. up to $8\frac{1}{2}'$ spacing, provided the slab is strong enough. This considerably reduces the expense. The same principle is true of larger spans and heavier beams. It will always be found economical to use the largest, or nearly the largest, spacing which the strength of the slab allows. Efforts must therefore be directed to increasing the safe span of the slabs. Now in working with these slabs the point which has to be taken into account is that where the first crack appears. This point is reached with from a third to a half of the breaking load, and may be considered as analogous to the elastic limit of steel. With the ordinary reinforcement used, the cracking load may be taken as 220 lbs. per foot super, and half of this may be considered a fair working load. In fact, this is probably a conservative estimate, for in practice the slab is made continuous, half the reinforcement being at the top of the slab at the point of support, while the experimental slab was only supported. As the working load is 75 lbs. (60 lbs. for the weight of the slab and 15 lbs. for the external load), it appears that a span of $5 \times \sqrt{\frac{1}{75}}$ or $6'$ is perfectly safe. With a little corbelling it might be possible—by increasing the thickness of the slab to, say, $8''$—to dispense with steel beams altogether in verandahs. It is impossible to say, without experiment, how far this would hold true; theoretically the weight would be increased from 75 to 95 lbs., the effective depth from $5''$ to $7''$, and the permissible span therefore to $6 \times \frac{7}{5} \times \sqrt{\frac{75}{95}}$ or $7\frac{1}{2}'$. The rolled steel beams may eventually be replaced by reinforced ones; experiments are now proceeding with a view to ascertaining how far this is practicable. Improved systems of reinforcement may also be discovered, the extra cost of which will be more than compensated for by the saving on rolled steel beams. There is probably room also for improvement in the centering, an item the cost of which is only exceeded by that of the rolled steel beams.

Note.—The prediction about reduction in cost, which was written in March, 1909, has been amply fulfilled in the time which has elapsed since then. It has been found possible to dispense with plastering the underside of the roof, thus saving Rs.3 to Rs.4 per 100 square feet, while a very considerable economy has been made as the result of increased familiarity with the work by those engaged on it. As an instance it may be mentioned that the cost of re-roofing a barrack verandah was reduced from Rs.5,000 to Rs.3,000.

ADDITIONAL NOTE BY LIEUT.-COLONEL W. R. BRETT, R.E.

Lieut. Stoehr having asked me to peruse this article, I add the following notes, embodying the latest experience :—

1. It has been found best to build the concrete slab wholly above top flange of rolled steel beams, to avoid breach of continuity.

2. When the length of concrete exceeds 20′ in any direction an expansion joint must be given. This is simply done by leaving a $\frac{1}{2}''$ gap to be filled with asphalte or other bituminous substance.

3. When turning a corner, such as verandahs, it is best to carry the armouring right across in both directions, forming a network This avoids straining beams, which are a source of weakness.

4. Parapets are best avoided. They hold up water, as the outlets are liable to be choked. The edge is best finished with a drip course of brick or stone, well corbelled out.

5. If parapets are dispensed with, the treatment of surface, described in Appendix II., is unnecessary, as the roof is quite watertight without.

6. I do not think that reinforced *lime* concrete can be employed in place of the rolled steel beams, but I am inclined to think that the span between beams can safely be increased to 6′, using precisely the same thickness of concrete and the same armouring.

APPENDIX I.

SOME TESTS OF REINFORCED LIME CONCRETE SLABS.

Slabs.—5′ 6″ × 1′ × 6″.

Composition, of concrete, 100 of ballast of $\frac{3}{4}$″ or less, 40 of pure kankar lime.

Reinforcement.—1″ above bottom of slab, unless otherwise stated.

Load.—Rolled steel joists slung from a round steel bar placed across the centre of the slab.

Span.—5′.

First Batch (*made, 23rd October,* 1908; *tested, 5th December,* 1908).

Slabs kept wet for 14 days with damp grass.

1. *Reinforcement.*—Two strands barbed wire.
Ballast, flint.

External Weight.		Equivalent Distributed Load per foot super, including Weight of Beam.
192 lbs.	Hair cracks appeared	134 lbs.
492 lbs.	Deflection 1¼″; cracks had steadily widened	254 lbs.
520 lbs.	Broke	*265 lbs.*

2. *Reinforcement.*—Two strands No. 4 7-strand galvanized iron wire.

314 lbs.	Hair cracks appeared	183 lbs.
782 lbs.	Deflection 2″; cracks had widened considerably	371 lbs.
858 lbs.	Deflection 3″	401 lbs.
876 lbs.	Broke after about 30 seconds through piece of concrete dropping out and remainder crushing	*412 lbs.*

3. *Reinforcement.*—As shown below:—

192 lbs.	Hair crack in centre, which had only slightly widened at 782 lbs.	134 lbs.
314 lbs.	Bad shearing crack appeared near one end	183 lbs.
558 lbs.	Bending deflection almost *nil* ($\frac{3}{8}$″) ...	280 lbs.
642 lbs.	Shearing crack about $\frac{1}{8}$″ difference in level	313 lbs.
782 lbs.	Broke through shearing...	*371 lbs.*

SECOND BATCH (*made, 23rd November*, 1908; *tested, 4th January*, 1909).

Slabs kept wet for 14 days by lime bunds full of water.

4. *Reinforcement.*—One barbed wire bent up 1′ 8″ from each end thus:—Ballast, flint.

External Weight.		Equivalent Distributed Load per foot super, including Weight of Beam.
Nil.	Two fine cracks	57½ lbs.
113 lbs.	Crack in centre	103 lbs.
235 lbs.	Crack widened; deflection ¾″	151 lbs.
291 lbs.	Beam broke after about a minute through crushing of concrete ...	*174 lbs.*

5. *Reinforcement.*—One 7-strand G.I. fencing wire arranged as for 4.

Nil.	Two cracks nearly ¼″ broad, probably through rough handling in getting beam into position	57½ lbs.
169 lbs.	Width of one crack slightly increased; deflection 1″	125 lbs.
357 lbs.	Beam broke through concrete crushing. Wire remained unbroken ... ... Deflection 3″, and crack nearly in centre had developed.	*200 lbs.*

6. *Reinforcement.*—Two barbed wires, one bent up as in previous case, the other straight.

Nil.	One hair crack	57½ lbs.
113 lbs.	A hair crack near centre	103 lbs.
235 lbs.	Another	151 lbs.
357 lbs.	One crack slightly wider; deflection ¼″	200 lbs.
479 lbs.	Deflection ½″	249 lbs.
601 lbs.	Deflection ¾″; centre crack opened perceptibly as load was applied... ...	298 lbs.
723 lbs.	Beam broke as the extra 122 lbs. was being applied	*347 lbs.*

7. *Reinforcement.*—Two 7-strand G.I. fencing wires arranged as above. Owing to faulty construction the wires were exposed at the lower surface of the concrete for the centre 2′ of their length.

113 lbs.	Crack under one cross wire (where wire was bent upwards)	103 lbs.
235 lbs.	Deflection ½″, crack ¼″ wide; second crack	151 lbs.
479 lbs.	Broke after 10 seconds, apparently from wires slipping	249 lbs.

8. *Reinforcement.*—As in 7, but ends fixed to L iron to prevent slipping.
Ballast, broken brick.

External Weight.		Equivalent Distributed Load per foot super, including Weight of Beam.
413 lbs.	Fine crack in centre, very fine hair crack under one cross wire; deflection $\frac{1}{16}$"	222 lbs.
479 lbs.	Deflection $\frac{1}{8}$"	249 lbs.
601 lbs.	Centre crack $\frac{1}{8}$" wide; deflection $\frac{1}{4}$" ...	298 lbs.
723 lbs.	Deflection $\frac{1}{2}$"	347 lbs.
779 lbs.	„ $\frac{3}{4}$"	369 lbs.
845 lbs.	„ 1"	395 lbs.
1051 lbs.	„ $1\frac{1}{4}$"	478 lbs.
1089 lbs.	Beam broke after about $\frac{1}{2}$ minute through concrete crushing	*493 lbs.*

9. *Reinforcement.*—As in 8.
Ballast, purple flagging broken up.

235 lbs.	Two fine hair cracks; deflection $\frac{1}{16}$" ...	151 lbs.
357 lbs.	Deflection $\frac{1}{4}$"	200 lbs.
479 lbs.	Crack in centre, $\frac{1}{8}$" broad; deflection $\frac{1}{2}$"	249 lbs.
601 lbs.	Deflection 1"	298 lbs.
723 lbs.	Broke after 5 seconds	*347 lbs.*

10. *Reinforcement.*—As in 8.
Ballast, flint.

535 lbs.	Hair crack in centre; deflection $\frac{1}{8}$" ...	271 lbs.
601 lbs.	Crack slightly widened	298 lbs.
723 lbs.	Deflection $\frac{3}{8}$"	347 lbs.
845 lbs.	„ $\frac{1}{2}$"	395 lbs.
967 lbs.	„ 1"	444 lbs.
1089 lbs.	Broke after about 10 seconds	*493 lbs.*

11. *Reinforcement.*—Expanded metal 6" mesh, metal strips $\frac{1}{4}$" × $\frac{1}{16}$".

Nil.	Fine crack from its own weight ...	$57\frac{1}{2}$ lbs.
255 lbs.	Crack $\frac{1}{16}$" broad; deflection $\frac{3}{8}$"	151 lbs.
357 lbs.	Broke at once	*200 lbs.*

From these experiments, so far as they have gone, several conclusions can be drawn.

First, and most important.—Well-made concrete slabs, 6" thick of 5' span, reinforced by two No. 4 7-stranded G.I. fencing wires per foot, are perfectly safe. The breaking load per foot super is 493 lbs., as against an estimated working load of $72\frac{1}{2}$ lbs., and external breaking load is 437 lbs., as against an estimated load of 15 lbs.

Second.—There is no fear of the reinforcement slipping provided that care is taken to bury it well in the concrete. No. 7 was the only instance where the wire slipped.

Third.—There is little or no reason to fear shearing stress.

Fourth.—Nearly all the beams broke through the crushing of the concrete. As the deflection increased and the cracks extended, the area

of compression grew smaller and smaller, till at the breaking point it was usually only about 1" deep or less.

The way to increase the strength of the beam is to increase its stiffness.

Fifth.—The strength increases with the amount of reinforcement. No. 11 does not seem to confirm this, but its lack of strength appeared to be due to imperfect bonding of the concrete through the mesh, which made the beam act like three separate superposed beams.

Sixth.—From the fact that No. 7 was the *only* one in which adhesion proved deficient, it seems probable that it is unnecessary to tie the ends of the wires, and that No. 7 should have been as strong as No. 10. If we assume this to be correct, then it follows :—

Seventh.—The concrete should be laid in two layers, well rammed and kept covered with water. The concrete of the second batch was denser and of higher quality than that of the first, to which I attribute the greater strength of Nos. 6 and 7, as compared with 1 and 2.

Eighth.—The ballast used should be of different sizes. That for Nos. 8 and 10 was so, while that for No. 9 was of approximately the same size throughout. Broken brick is preferable to the flint used, as it gives a perfectly solid concrete, while the flint appears to have some voids.

Further experiments are to be made to test the system used in No. 3, and to test a different kind of lime. For the present Nos. 7, 8, or 10 are the systems in use.

APPENDIX II.

TREATMENT OF SURFACE OF TERRACED ROOF.

When the water, under which the roof is at first kept, is drained away, the surface should be rubbed with small slabs of stone. Any paste of lime which forms should be at once removed; if allowed to remain, it is likely to swell during the rains and break the skin of the roof, thus causing leaks. When the surface of the roof is perfectly clean, the following mixture should be applied and trowelled well until a smooth hard surface is formed :—

Ingredients dry in the following proportion by weight :—

Fresh kankar or boulder lime...	1 maund.	Linseed	1 seer.
Pulp of bael fruit	1 seer.	Urd-ka-atta ..	1 seer.
Gur (country sugar), 2 years old	5 seers.	Catechu or kaththa	1 seer.

Preparation.—Slake the lime and grind fine by hand. Add water till the liquid is of the consistency of whitewash, strain it through a coarse cloth, and store in tubs or nands. Dissolve the gur in a chattie with cold water. Tie the pulp of bael fruit, Urd-ka-atta, linseed, and catechu together in a cloth, and let them soak in water for about four days, when they will have rotted. Squeeze all the juice from this into the chattie in which the mixture has been soaking. Mix the whole together, and the preparation is ready for use.

A NEW INTERNAL COMBUSTION PUMP.

By Lieut. G. L. Hall, R.E.

A paper was read before the Institution of Mechanical Engineers last November by Mr. H. A. Humphrey, dealing with a new type of internal combustion pump of his invention. The main principle of its action is the exertion of the explosive force directly upon the water itself, necessitating no rotating fly-wheel, solid piston, crank or other necessary adjuncts for converting reciprocating into rotary motion. So far, the action of the Humphrey pump is comparable to that of the well-known hydraulic ram, and in some degree also to that of the steam pulsometer pump. Internal combustion, direct-acting pumps on these lines have been tried experimentally as far back as 1868. But the Humphrey pump, as will be seen later, has one essential point of difference from all its prototypes.

Before proceeding further to describe the action of the new pump, it may be as well to consider the leading features of the hydraulic impulse ram and the steam pulsometer pump. The former utilizes the kinetic energy of a comparatively large volume of water, with small head, to raise a comparatively small quantity against a greater head. The kinetic energy of the water is commonly due to gravitation, as in the case of a stream.

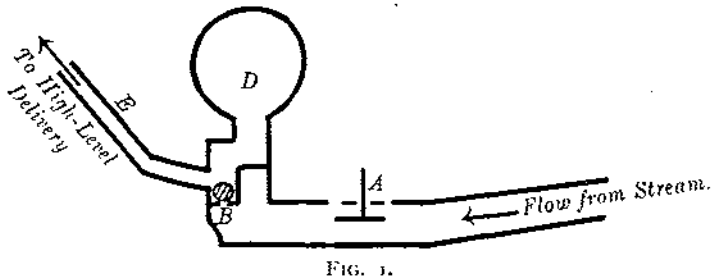


Fig. 1.

Fig. 1 will make the action clear. The valve A is of such a weight as to remain open against the static pressure of the stream water. The open valve A allows the stream to flow through it, and so to acquire kinetic energy sufficient to close A and to rush on through the ball valve B into the closed air vessel D, until the kinetic energy of the moving column of water is balanced by the pressure of air in D. The valve A then re-opens and the elastic air cushion in D expands, driving the imprisoned water up the delivery pipe E. Note the non-return valve B.

The steam pulsometer pump is similar in principle, except that in this case the elastic fluid is steam, deriving its initial pressure not from the force of gravitation, but from a steam boiler. Steam expands on the free surface of the water, driving it past a non-return delivery valve against the head. The necessary suction for supplying a fresh charge of water to be pumped, is caused by the condensation of the steam and the creation thereby of a partial vacuum.

It will be noticed that in both the above types of pump there are no moving parts beyond the column of water itself and the valves. They both however, in common with nearly every type of pump, contain as an essential part of their working gear a non-return delivery valve. It is on this point that the Humphrey pump differs, its action depending on the fact that there is no non-return valve, and that a portion of the water pumped on one stroke returns to compress a combustible charge preparatory to the next stroke.

The earlier internal combustion pumps were all worked on the non-return principle, and the operation of such a valve with the explosive force behind it has always been disastrous.

We may now examine the action of the Humphrey pump in detail. A mixture of gas and air, previously compressed, is fixed electrically in contact with the water to be pumped in a closed combustion chamber A (see *Fig. 2*). The pressure so caused forces a column of water along a pipe line D and up to the high-level reservoir F without the intervention of any sort of delivery valve. This column of water acquires kinetic energy from the explosion, and continues to move along the delivery pipe, until it finally comes to rest. Owing to the considerable kinetic energy required by this moving column of water, expansion of the products of combustion is carried out to below atmospheric pressure. This partial vacuum has two effects, viz.:—(1). It allows the exhaust valve C in the combustion chamber to open by its own weight. (2). It admits a fresh charge of water from the low-level tank E through valve G. As soon as the column of water moving in an upward direction has come to rest, it at once commences to flow back to the combustion chamber. This closes the valve G and drives the fresh charge of water up into A, forcing out the products of combustion through the exhaust valve C. When the water reaches the level L, it closes C by impact and compresses the remaining products of combustion in the small space between L and K. On the pressure in this space rising above that due to the static head of water in F, the moving column of water flows back again towards F, again causing a partial vacuum in the combustion chamber, and allowing the inlet valve B to open against a light spring and so admit a fresh combustible charge : the valve C is meantime locked shut. The condition of affairs being still unstable owing to the unbalanced head in F, the column of water

returns to compress the combustible charge at K, and a fresh cycle of operations is started.

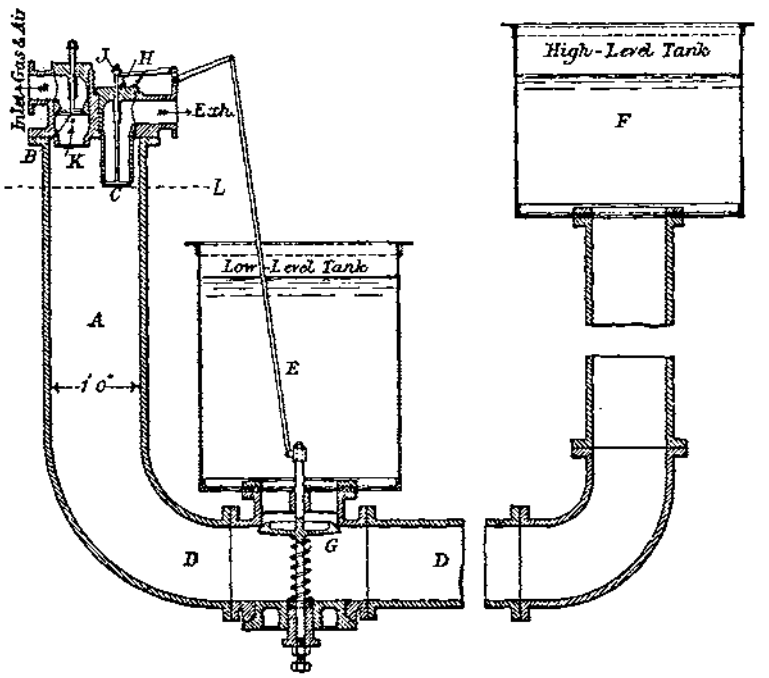


FIG. 2.—*Diagram of the first experimental Four-Cycle Pump.*

The action of the pump obviously depends upon the pendulum swing of the column of water backwards and forwards: in other words this column of water is a reciprocating fly-wheel. The expansion of the gases is carried out to below atmospheric pressure, a factor which contributes to a high thermal efficiency as compared with the Otto Cycle. Velocities are kept low to reduce skin friction to a minimum, and the movement of the water is used to control the pump instead of the pump controlling the movement of the water. A very ingenious ignition apparatus is fitted to ensure firing at maximum compression whatever this may be. By this means the head against which the pump works can be varied without any stop or alteration to the gear. Various interlocking gears are used between the suction and exhaust valves.

The above pump may be called a 4-cycle pump since there are two movements of the column of liquid in each direction for one complete cycle. Several types of 2-cycle pumps have been made, in which the cushion and suction stroke are suppressed. A diagram of one form of such a 2-cycle pump is given (*Fig.* 3), from which its action will be clear.

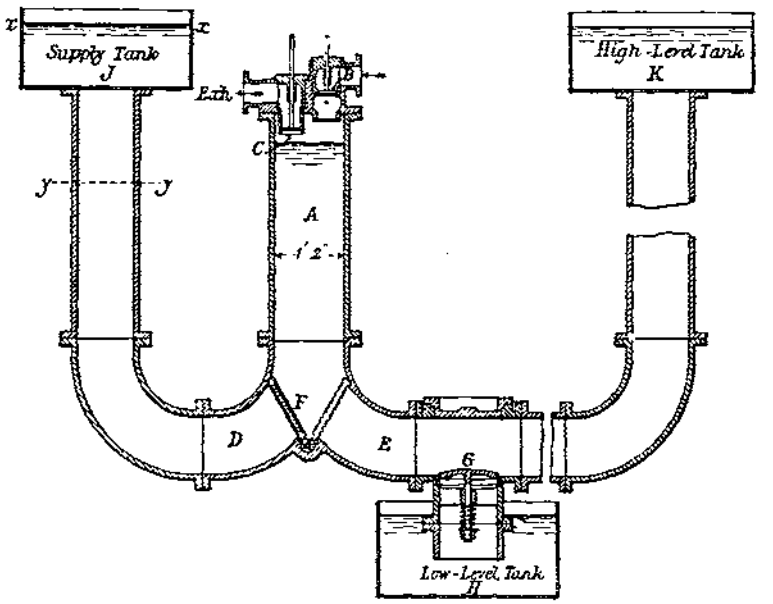


FIG. 3.—*Diagram of Two-Cycle Pump.*

The hinged valve F alternately places the combustion chamber in communication with the supply tank and with the high-level tank. It will be noticed that the supply tank J acts in exactly the same way as the high-level tank in the 4-cycle pump, in exhausting the burnt gases and drawing in a fresh charge of combustible mixture. No replenishment of the water in J is necessary as all pumped water is taken from H.

The fuel employed for the Humphrey pump is normally some form of producer gas: successful experiments have also been made with petrol supplied through a carburettor. Up to the time of the publication of the inventor's paper, neither town gas nor paraffin had been used.

THE FYERS FAMILY.

(Continued.)

By Col. Robt. H. Vetch, c.b., late R.E.

Children of Alexandrina Fyers, Wife of the Rev. James Reid.

By the marriage, which took place, it is believed, somewhere about 1782, of Alexandrina Fyers—third daughter of Thomas Fyers, Overseer of the King's Works in Scotland, and of Elizabeth Falconer, his wife—with the Rev. James Reid, minister of the parish of Kinglassie in Fifeshire, there was a family of four daughters and two sons :—

I. Elizabeth Reid ; died unmarried.

II. Alexandrina Reid ; died unmarried.

III. Joana Reid ; married the Rev. J. Hutton, and had issue a daughter, Elizabeth, who died at the age of 15 years.

IV. Rose Reid ; died unmarried.

V. William Reid, Major-General, R.E., G.C.M.G., K.C.B., F.R.S. (see below).

VI. James Reid, who, it is said, entered the Royal Navy ; died young at Jamaica, West Indies.

Of the above family of Alexandrina Fyers one member alone demands special notice ; but of all the numerous grandchildren of old Thomas Fyers and Elizabeth Falconer this one is of surpassing interest, and occupies by general consent the most distinguished position.

Owing to the loss of the family papers in the great fire at the Pantechnicon, Baker Street, where they were stored, no life of Sir William Reid has been written. Major-General Whitworth Porter, however, in his *History of the Corps of Royal Engineers*, has given a short sketch of his career ; and I myself wrote a memoir of him in 1895 for *The Dictionary of National Biography*. There were also several obituary notices in journals and newspapers at the time of

his death. Of these the notice in the *Proceedings of the Royal Society*, written by Major-General Sir J. H. Lefroy, K.C.M.G., R.A., is the most satisfactory.

On coming to his name in my article on "The Fyers Family," I intended to refer my readers to these sources of information about Sir William Reid, and I should have done so, had it not been for the remonstrance of my old friend, the late Major-General E. R. James, R.E., himself a member of the Fyers family. I went to see him last July just before he left town, and, as it proved, for the last time for it was but a few months before his death. He then urged me to take this opportunity to include in our own Corps Papers as complete a life of this distinguished officer as it might be possible to put on record. I told General James that I thought such a life would be too long for the *Royal Engineers Journal*, and would, perhaps, overweight the story of the Fyers family. However, he seemed to think that the history of the Fyers family with Sir William Reid's part omitted would be like the play of Hamlet with the part of the Prince of Denmark left out. So I left him saying I would consider what he had said. He wrote to me: "As regards my suggestion about Sir W. Reid, you may think Porter has sufficiently dealt with his memory, but the readers of your article will not take the trouble to look up Porter. . . . Sir W. Reid is one of my heroes. . . ."

Now, at best, Porter's sketch of Sir William Reid is a slight one. For particulars of Reid's brilliant services as a subaltern in the Peninsular War, which have seldom, if ever, been equalled by so young a soldier, the reader is referred to the history itself. He has in consequence a difficulty in realizing what those services were. He has to pick them out of the general narrative with some trouble, and probably fails to form an adequate conception of this important part of Reid's life. My own memoir in *The Dictionary of National Biography*, on the other hand, has the defects of a dictionary article in being greatly compressed. It is a bare narrative of dry facts and dates, probably suitable enough for its purpose, but necessarily omitting much that lends interest to a life when greater freedom is allowed to the writer. It assumes the reader's familiarity with the general course of campaigns and of events, and is only useful for reference as to Reid's part in them.

I was pondering over these considerations in connection with my friend's suggestion when, on taking up the newspaper, one morning I was shocked to see the announcement of his death. It was, I think, this rather sudden death of Major-General E. R. James in the autumn of 1909, before I knew that he had returned to town from a tour in the west of England, which decided me to do what he so greatly

desired. So, with the acquiescence of the Editor, I propose to give as full an account of Sir William Reid as the materials at my disposal will allow.

For several reasons I find it necessary to keep before the reader the general operations of the campaigns in which the subject of my notice was engaged, and to refer in some detail to the movements of the army. I have already adopted this course in my notices of Lieut.-General William Fyers in the American War of Independence and in the Walcheren Expedition; of Major-General Thomas Fyers in the retreat of Sir John Moore to Coruña; and of Lieut.-General Sir W. A. Fyers in the campaigns of Afghanistan and the Crimea. In the case of Major-General Sir William Reid it is equally desirable, because when not engaged at sieges he was attached to a division of the army, and his activities can only be properly followed by observing the movements of the division to which he was attached. It so happens that all Reid's papers having perished I have to fall back on official documents, diaries and letters of his brother officers, and the history of the campaign for information as to his doings. Although in the ordinary way the war experiences of a junior officer must be gathered from the performances of the troops with whom he served, fortunately in Reid's case he was so often brought into prominent positions—either at sieges as a leader of storming parties or by individual enterprise in the trenches, or in the field as the senior officer of Engineers with the force to which he was attached, and therefore in close touch with his general—that his merits were known to his seniors as well as to his brother subalterns, and his name appears both in the journals of sieges and the despatches of commanding officers.

Major-General Sir William Reid, R.E., G.C.M.G., K.C.B., F.R.S.

Major-General Sir William Reid, elder son of the Rev. James Reid, minister of the Established Church of Scotland, at Kinglassie, Fifeshire, by his wife Alexandrina Fyers, third daughter of Thomas Fyers, Overseer of the King's Works in Scotland, and of his wife, Elizabeth Falconer, was born at the Manse, Kinglassie, on the 25th April, 1791. The family of Reid, from which he sprang, was formerly of Barra Castle, Aberdeenshire, and a baronetcy had not long become extinct in the family. Barra and the adjoining property then passed from the Reids to the Irvines of Drum, Aberdeenshire.

William Reid received his early education at a private school at Musselburgh, in Mid-Lothian, and afterwards at the Edinburgh

Academy. In 1806, having passed the entrance examination he joined the Royal Military Academy at Woolwich as a Gentleman Cadet. Before leaving it he was sent, as the custom was at that time, to the Ordnance Survey, under the direction of Lieut.-Colonel William Mudge, Royal Artillery, where he learnt practical surveying. Reid was commissioned as 2nd Lieutenant in the Corps of Royal Engineers on the 10th February, 1809, and was ordered at once to Dover to take the place of his cousin, friend, and contemporary, Edward Fyers (*q.v.*), who was about to embark for the Peninsula.

A year later Edward Fyers had returned home invalided, and Reid himself was ordered to Lisbon. He arrived there on the 28th March, 1810, in company with two captains and six other subalterns of his own Corps.* This large draft of Engineer officers was sent out on the urgent application of Lord Wellington for more Engineer officers. He had to send several officers of the Corps to Cadiz† and required additional officers for the construction of the famous Lines of Torres Vedras then in progress.

The object of these Lines was to enable the British Army to hold its own in front of Lisbon until the Spanish Army could be made a more efficient and useful ally than it had hitherto proved to be. After the Battle of Talavera (27th July, 1809), when General de Cuesta, commanding the Spanish Army, refused to co-operate with the British, Lord Wellington saw that the next campaign must be fought on the defensive, and that preparation must be made in the meantime for a future struggle with the enemy on more equal terms.

As no hope of successfully defending an extended and open frontier, like that of Portugal, against so superior and so skilful an enemy as the French could be seriously entertained, Wellington found a position in the lower part of Estramadura, which could neither be turned nor passed, and while it enjoyed an assured communication with the sea, also commanded all the approaches to Lisbon. This position he decided to re-trench in the strongest manner so that it might serve as a point of concentration for the whole of the defensive forces of Portugal, where the allied armies could be victualled and supplied to any extent and for any period of time, whilst, at the same time,

* Sir John Burgoyne writes in his journal: "3rd April, 1810. Capts. Squire and Holloway, and Lieuts. Meineke (King's Hanoverian Legion), Dickenson, Trench, Piper, Tapp, Reid, and Hulme, of the Engineers, arrived at Lisbon on the 28th ult."

† Burgoyne writes in his journal: "3rd April, 1810. Lefebure, of the Engineers, with the rank of Major, and Bird, Nicholas, Wells, etc., are gone to Cadiz."

they held the most favourable field for deciding the fate of the capital in a general action.

Whilst the army was cantoned on the Guadiana in October, 1809, Lord Wellington, with his Quartermaster-General, Colonel Murray, and his Chief Engineer, Lieut.-Colonel Fletcher, made a reconnaissance of this position in front of Lisbon. He gave orders for the construction of a chain of fortified posts across it from the Atlantic to the Tagus, leaving it to his Chief Engineer to work out the details. These works were in full swing when Reid and his brother officers arrived at Lisbon.

The Lines of Torres Vedras consisted of two distinct lines of defence from 20 to 30 miles in front of Lisbon. The outer line extended from Alhandra on the Tagus to the mouth of the Zizandra River on the Atlantic coast, and was nearly 30 miles long. The inner line, from 6 to 10 miles in rear of the outer, stretched from Quintella on the Tagus to the mouth of the St. Lorenza River on the Atlantic coast, and was some 24 miles long. There was besides an entrenched camp formed at Fort St. Julian at the mouth of the Tagus some 10 miles below Lisbon. This was intended to cover a forced embarkation of a large force in case of necessity.

Two months later Lieut.-Colonel Fletcher and his three senior officers—Capts. Chapman, Squire and Goldfinch—were recalled to Army Headquarters and to active operations on the Coa. Capt. (afterwards Colonel Sir) John Jones was then left in charge of the construction of the Lines of Torres Vedras. His officers were three captains, and eight subalterns, of whom Reid, who had been promoted 1st Lieutenant on the 23rd April, 1810, was one. Some 150 soldiers of the Line, principally artificers selected from the regiments at Lisbon, assisted these officers. These men were under the charge of a captain stationed at Mafra and a subaltern at Alhandra, but were divided into parties of two and three men each throughout the whole of the position. "In some of the districts," says Sir John Jones, "a subaltern officer of Engineers with that small number of English soldiers, utterly ignorant of the language, directed and controlled the labours of a thousand, or fifteen hundred peasantry, compelled to work, many at the distance of 40 miles from their homes. . . . The young officers now, for the first time, placed in charge of extensive districts, exerted themselves with a zeal which knew no limits, and everywhere throughout the Lines a spirit of honourable emulation proved highly advantageous to the progress of the work."

A young Scotsman, only 19 years old, full of life and energy, Reid was soon to make his mark. Among his comrades he was known to have a good head upon his shoulders, and was in other respects a general favourite. Among his seniors he was regarded as a youngster

upon whom they could rely in emergency, a hard-working, shrewd young officer, who would carry out his work strenuously, conquering, or ignoring, difficulties, and not at all afraid of accepting responsibility when necessary.

His duties lay at first at Fort St. Julian, covering the place of embarkation on the Tagus in case of defeat; at another time at Mafra and the Passes of Morugueira and the works along the ravine to the left. From these he went to the extreme left of the *outer* line to take charge of the redoubts and entrenchments at the position of S. Pedro da Cadeira, which rested on the Atlantic Ocean on the west, and extended to the eastward for some miles up the river Zizandra. The main redoubt was on a commanding eminence in the centre of the position, overhanging the river where it makes a bend of nearly a right angle.

In September, 1810, in addition to his own charge of the S. Pedro da Cadeira position, he was directed to take temporary charge of the district which embraced the works on the extreme left of the *inner* line, extending from Ereceira on the Atlantic Ocean inland to beyond Mafra, on account of the officer in charge, Lieut. Hulme, R.E., having been ordered to Lisbon.

The following is a letter from Reid to his Chief on the subject of this new charge:—

"ST. PEDRO DA CADEIRA, *6th September*, 1810.

"DEAR SIR,

"After I sent off my letter to you last night, I received a letter from Lieut. Hulme to say that he had received your orders, through Lieut. Stanway, to show me the mines and everything to be done in that district, and then that he was to go immediately to Lisbon; I therefore went over the Ereceira works with him to-day. You had desired him to form an abattis from Morugueria to Ribarmar: this I shall begin immediately, though I must say I have not all the confidence I could wish. If you have time, I would be much obliged to you for some further instructions; however, as I conceive that there is no time at present for delay, I shall go over the Morugueria ground to-morrow, and the instant I can collect cars and men I shall begin at that place, and form a connected line from one redoubt to the other, breaking it in such places as will give me the most advantageous flank in front of my trees. I shall most anxiously look out for a note from you to say if this is what you wish.

"I remain, etc.,

"(Sd.) WILLIAM REID, *Lieut., R.E.*

"CAPT. JONES, Commg. Engr.

"P.S.—The two redoubts of Lieut. Thomson, near this, I expect are this night completed with plank platforms."

At this time the premature fall of Almeida on the 27th August had compelled the British Army to fall back, and as it retired leisurely towards the Lines, every effort was made to complete the works. Various services had been left over to the last, such as levelling obstructions to fire, felling trees in front of the works, forming abattis, breaking up roads, destroying bridges, preparing and charging mines.

On the 7th October, Sir John Jones tells us, that "every preparation for defence was as complete as any longer delay could have rendered it," and on the following day the army, consisting of 22,000 British infantry and 3,000 cavalry, with about a similar number of Portuguese infantry, entered the territory thus prepared for their reception and support. The troops fully expected to be at once ordered to take up the ground to dispute the principal passes with the enemy. But in consequence of the steady discipline and assurance of the retreating British Army, and the lesson the enemy had received at Busaco, the French displayed no eagerness to press on. Lord Wellington therefore decided to halt at Sobral. He established his personal headquarters at Pero Negro in its rear, and was able to communicate with all parts of the Lines by signal from Monte Agracia. The redoubts and defensive works were garrisoned with Militia and the active army distributed as a field army.

As the subject of this notice took such an active part in the construction of these Lines I make bold to quote Sir John Jones and Sir William Napier on the state of preparation that had been attained in order to give the French a warm reception after the arrival of the British Army within the Lines. He says in his memoirs :—

"Happily every measure was complete, the new works armed, the ammunition placed in the magazines, with provisions and water in each redoubt, the abattis formed, the roads and bridges mined and charged for explosion, telegraphs established, and mounted guides held in readiness to meet the retiring columns and conduct them to their respective points of defence, when, on the day previous to their approach, the forerunners of the army, and immense crowds of fugitive Portuguese—men, women, and children—blocked every road, set all authority at defiance, and rendered further exertion impossible. The autumnal rains set in at this very moment, pouring down in torrents, accompanied by severe thunder and lightning, filling the streams and water courses, and rendering the roads deep and heavy, and furthermore putting the solidity of the field defences to the severest test. Notwithstanding this *contretemps*, and the pressure of the terrified and confused rabble which poured in on every point, no error of arrangement occurred, and each column reached the ground assigned to it with regularity and precision, and when the French

approached, presented such a formidable appearance that Massena, after making a close personal reconnaissance, ordered his army to halt."

Napier in his history writes :—

"These celebrated Lines were great in conception and execution, more in keeping with ancient than modern military labours. . . . But to occupy 50 miles of fortification, to man 150 forts, and work 600 guns required many men, and numbers were not wanting. A great fleet in the Tagus, a superb body of Marines sent out from England, the Civic Guards of Lisbon, the Portuguese Heavy Artillery Corps, the Militia and Ordenança of Estramadura, furnished a powerful reserve to the regular army. . . .

"Massena surprised at the extent and strength of works which he had only heard of five days before he came upon them, employed several days to examine their nature. . . . Romans never raised greater works in the time."

The French armies in the Peninsula, although overwhelmingly superior to the British in point of numbers, were in great distress at this time. The troops were months in arrears of pay and, in general, very badly clothed. There was a scarcity of horses, carriages, and equipments of every description ; they subsisted solely on plunder, either individual, or by way of requisition. Scarcely any money came from France and little from Spain. This state of affairs made Marshal Massena desire to remove the consequent evils, which threatened the discipline of his army, by an expedition into Portugal and the plunder of Lisbon and Oporto. In opposition to every military principle he continued to advance on Lisbon, driven by the pressure of financial difficulties. His army consisted of 55,000 men, while the effective strength of the British Army was 29,000. On the 13th October he reached the village of Sobral which, being just outside the line of defence, was abandoned to him without a struggle. He then closed up to the Line so as to threaten every part of it from Zibriera to Alhandra.

The development of Massena's dispositions caused a great deal of work in strengthening various positions which were threatened by the enemy, and Reid and his brother subalterns found as much to do as they could possibly get through. "Every morning, two hours before daybreak, the troops stood to their arms at the point of assembly of their several cantonments, as did also the garrisons of the works ; Lord Wellington, in person, being in the fort on Monte Agraçia, in readiness to direct any general movement according to the

exigencies of the moment. The army thus remained under arms till a communication from every portion of the Line, and ocular demonstration had assured the commander that no change had taken place in the disposition of the hostile troops, nor any preparation been made for immediate attack; the several divisions and brigades were then ordered to resume their daily labours of strengthening their respective fronts, making lateral communications, improving the roads, sheltering and securing their outposts, etc."

Massena made a close reconnaissance of the Lines on the 16th October in person; a shot fired at the party struck a wall on which the Marshal was resting his telescope, when he acknowledged the warning by taking off his hat and moving on. This reconnaissance convinced him that an army posted in such a strong position, supported by such formidable defences, would prove much too hard a nut for him to crack, and he turned his attention to subsisting his army till reinforcements could arrive. After exhausting the country his troops became sickly and he retired on the night of the 14th November towards Santarem, and next day was followed by Wellington. During the winter the two armies remained, one on each side of the Rio-maior, watching each other.

In his despatch to the Earl of Liverpool from Cartaxo, 21st November, 1810, Lord Wellington says:—

"Having advanced from the positions in which I was enabled to bring the enemy to a stand, and to oblige them to retire without venturing upon any attack, it is but justice to Lieut.-Colonel Fletcher, and the officers of the Royal Engineers, to draw your Lordship's attention to the ability and diligence with which they have executed the works, by which these positions have been strengthened to such a degree as to render any attack upon that line occupied by the allied army very doubtful, if not entirely hopeless. The enemy's army may be reinforced, and they may again induce me to think it expedient, in the existing state of affairs in the Peninsula, to resume these positions; but I do not believe they have it in their power to bring such a force against us as to render the contest a matter of doubt. We are indebted for these advantages to Lieut.-Colonel Fletcher and the officers of the Royal Engineers, among whom I must particularly mention Capt. Chapman,* who has given me great assistance upon various occasions."

On the 5th March, 1811, finding his supplies diminishing and the number of his sick increasing, Massena began his retreat. He was pursued by Wellington who, in the course of a month, for the second time drove the French out of Portugal. As Reid was still in the

* Afterwards Lieut.-General Sir Stephen Remnant Chapman, K.C.H., C.B., Colonel Commandant, Royal Engineers.

Lines of Torres Vedras, there is no occasion to do more than refer to this famous retreat. In the meantime the French under Mortier had captured Badajos and Wellington determined to retake it. Reid was one of the officers of Royal Engineers who took part in the siege operations. Lieut-Colonel Fletcher commanded the Corps and Capt. Squire was director of the attack on Fort Christoval. There were 8 other captains and 11 subalterns employed. One captain and 1 subaltern were killed and 1 captain and 1 subaltern were wounded in the course of the siege.

Badajos was a large fortified town on the left bank of the Guadiana River, having a bastioned trace all round its land front, with outworks in the centre of the south front and on the south-east. A castle stood on high ground within and on the west of the enceinte. Opposite, on the heights on the other side of the river, was Fort Christoval. Communication between the town and Fort Christoval was by a bridge, 600 yards long, with a *tête de pont* on the Christoval side.

It was decided to attack Fort Christoval first. Ground was broken on the 8th May, 1811, and a parallel and abattis were begun by Reid under the orders of Capt. Squire at a distance of 450 yards from the fort. Owing to the rocky nature of the ground progress was very slow and cover could not be obtained for the guard of the trenches, which had to be retired behind the reverse slope of the hill. The garrison soon became aware of the state of affairs and on the 10th made a daring and vigorous sortie. Reid was the Engineer officer on duty in the trenches at the time. He sent for the guard of the trenches at once, but in the meantime, he formed up the picquet and working party, and gallantly charged and drove back the enemy. In doing so he was wounded in the knee.

Colonel Harcourt of the 40th Regiment, who was in command of the guard of the trenches, came with his men to Reid's assistance as soon as he could and completed the rout of the enemy. He was himself wounded. He wrote a handsome letter to Capt. Squire, R.E., in praise of Reid's conduct on this occasion. The following is an extract from the report of the Commanding Royal Engineer on the subject:—

Extract from the Report of Lieut.-Colonel Richard Fletcher, R.E., to Lieut.-General Gother Mann, Inspector-General of Fortifications, on the first Siege of Badajos.

"On the morning of the 10th (May, 1811) the enemy made a sortie on one of the batteries under the direction of Capt. Squire (R.E.), and I have much pleasure in enclosing a copy of a most honourable testimonial as to the conduct of Lieut. Reid on that occasion."

Unfortunately the enclosure is missing.

On the 17th May, 1811, Capt. John Squire, R.E., wrote from Elvas to Colonel (afterwards Lieut.-General) William Fyers:—

"It is with the most heartfelt satisfaction I enclose the original letter which was addressed to me by Colonel Harcourt of the 40th Regiment, who was wounded in the sortie from Fort Christoval on the 10th May. It relates as you will perceive to your relative, Mr. Reid, whose excellent conduct is the subject of universal praise. I have preserved copies of the enclosed letter which I have also forwarded to some persons in England of high rank, who may perhaps be disposed to recollect this trait of zeal and gallantry. Mr. Reid has been slightly wounded, but in a day or two I hope he will be again on the effective list.

"The handsome testimony of Colonel Harcourt does high honour to himself as well as to the subject of his letter.

"The merits of Mr. Reid which are really great ought not to be passed over; he ought to be made a Brevet Captain; he has earned that honour.

"In our late attack of Fort Christoval we have had severe losses; poor Capt. Dickenson, my dear and intimate friend, torn from his country at the commencement of what I am sure would have been a brilliant career.

"But Badajos must yet be taken. I beg to be remembered to your family and am

"Your very faithful servant,

"JOHN SQUIRE."

His uncle, Colonel (afterwards Lieut.-General) William Fyers, who was then Deputy-Inspector-General of Fortifications, wrote from London to congratulate Reid:—

LONDON, *4th June*, 1811.

"MY DEAR WILLIAM,

"I have only time to thank you for your interesting letter of the 15th May (which has been read with much satisfaction by Lord Mulgrave, General Morse, etc.), and to congratulate you on the heroic *début* you have made when you 'flashed your maiden sword' at Badajos. The flattering testimonial of your achievement there, which I received enclosed in a friendly letter from Capt. Squire, brought tears from my eyes—and I doubt not the joy of having a son who so early distinguished himself will produce the same effect on your father and mother when they shall be informed of it—'*Perge decet.*' . . .

"I have made up a package of what newspapers I have and an Army List which I beg Lieut. Elliot to take charge of for you. My daughters are well, that is to say Anne and Louisa, the only two that are with me. Fanny is with her aunt at Maryfield.

"All friends in Scotland are well, but I am grieved to tell you that poor Edward (his younger son in the R.E.) has had a relapse of his brain fever, and was very ill with it at Jersey when the last accounts arrived. This was predicted as a probability by Mr. Webb, and was the reason of my not sending him to join the army in Portugal. I have however great hopes it will not be of long duration. Remember me kindly to Squire, and give him many thanks for his friendly and truly obliging attention in your business. Remember me also particularly to my friend Jones, to Colonel Fletcher, Boteler[o] and all of the Corps whom I am acquainted with. I trust by this time you are effective, though a hurt on the knee is likely to be troublesome. God bless and preserve you, my dear William, and believe me

"Your ever affectionate uncle,

"WM. FYERS."

The first Siege of Badajos was raised on the 13th May, 1811, on account of Marshal Soult's threatening movements, but after Soult's defeat at Albuera by Marshal Beresford on the 16th of that month, the second siege was begun on the 19th May by a partial investment of the fortress, which was completed on the 25th.

At this second siege Lieut.-Colonel Fletcher was again in command, with Capt. Squire as director of the attack on Fort Christoval and Capt. Burgoyne as director of the attack on the castle; there were besides 8 captains and 10 subalterns of the Corps employed, of whom 1 captain was mortally wounded, and 2 subalterns were killed. Trenches were opened in front both of Fort Christoval and of the castle on the 30th May. In spite of his lame leg Reid took his turn of duty in the trenches in front of Fort Christoval. The batteries opened fire on the 3rd June and an unsuccessful assault was made on Fort Christoval on the night of the 6th when Lieut. Forster, R.E., who led the ladder party, was killed. Another unsuccessful assault on Fort Christoval took place on the night of the 9th June when Lieut. Hunt, R.E., was in charge of the ladders and was killed. On the morning of the 10th June Wellington assembled the senior officers and told them he had decided to raise the siege. He gave the following reasons for this decision:—The impossibility of getting possession of Fort Christoval without sapping up to the crest of the glacis, the imprudence of attempting to storm the castle without first taking Christoval, and finally the approach of the French armies in such force that prudence would not allow him to be caught by them in the midst of a siege. The last reason was no doubt the most important.

[o] Lieut.-Colonel Richard Boteler, R.E., then a 2nd Captain. He was lost in the wreck of the *Calypso* in February, 1833.

In a despatch to Lord Liverpool he sent an appreciation of the work of the officers of Royal Engineers who had been employed at the two sieges. The British forces had no sooner retired with all their guns and stores to Elvas than Badajos was occupied by Marshals Soult and Marmont, who entered it on the 19th June.

After raising the siege Wellington retained his army on the Cayo to cover the Alemtejo provinces till the armies of Marshals Soult and Marmont should separate. When this took place on the 23rd July, Soult moving to Seville and Marmont re-crossing the Tagus, Wellington moved his army to Portalegre. In the middle of August he moved north and cantoned it between the Coa and the Agueda with a view to investing Ciudad Rodrigo. Reid was employed at first with the 3rd Division under Picton in strengthening the position on the heights of Guinaldo. On 1st September Burgoyne writing to Squire from Albergaria says "Reid and Wright are with me here." He was then preparing materials for the Siege of Ciudad Rodrigo.

Towards the end of the year Reid was attached to the force observing the Lower Agueda under Don Carlos d'España, who harassed the rear of Dorsenne's Army and captured provisions and money contributions it had raised. In December Reid was directed to mine the bridges of Yecla and Serrada, which spanned the Yebra, a branch of the Douro river between Salamanca and Ciudid Rodrigo. His working party consisted of Spanish miners with some sappers as overseers. Owing to the extraordinary hardness of the cement it required a fortnight's unceasing toil, day and night, to drive the shafts. When the mines were fired in the following spring they were most effective. One of the arches of the Yecla bridge was blown away, and a pier and two arches of the Serrada bridge were destroyed. General Don Carlos strongly recommended Reid to the notice of Lord Wellington for his zeal and skill. In consequence Reid was mentioned in his lordship's despatch. In November Capt. Squire wrote to Reid from Portalegre, and the letter breathes so thoroughly the spirit of a true friend that I give it in full :—

Letter from Capt. John Squire, R.E., to Lieut. William Reid, R.E.

"PORTALEGRE, *November 30th*, 1811.

"MY DEAR REID,

"I have received your letter of the 25th inst. I never mentioned to you that I had written to three or four persons of some consequence in England relative to your conduct in the sortie against our battery at Christoval. I frankly told them my real sentiments—that you ought immediately to be promoted to the rank of Captain. To these applica-

tions I have received no answer, and now probably never shall. To say the truth I was not disappointed, for such is unhappily our present system that noble birth and great interest have far greater weight with our men of power than real merit.

"Do not however be discouraged; continue in the line you have begun, and you will eventually succeed, and if you do not obtain great honours and great riches, you will have the sweet reflection—which nobody but yourself can cause, and which no one on earth can take away—that of having done your best for the service of your country. If you do not gain promotion you will have the consolation of knowing you deserve it. So that labour away, as hard as you possibly can; seek every sort of useful knowledge and try to become one of the first officers in the world.

"I should not have alluded to the subject with which you began your late letter, had you not first touched upon it yourself. Do not be sanguine in your expectations; if you do succeed I shall be quite happy, and I beg you to inform me if you find there is the least prospect.

"I thank you for your account of what is going forward in your neighbourhood; it will give me great pleasure occasionally to hear from you. I am glad you are with Don Carlos. You will find him a fine soldier.

"The sailors did not tell you the truth about Capt. Nixon, of ye 85th; he has never been at Madrid; a few days ago he was exchanged from Badajos, and is now at Portalegre; he has lost his right arm.

"Castaños and his Staff are now with us; they set off to-morrow for Aldea del Bispo. Since our little enterprise against Girard,[o] nothing new has occurred here. The Conde de Penne (Villemur) is at Caçeres, and draws his supplies from the Department of La Serena. Marmont with Clausel's Division is at Abila. The enemy have made a lunette on the height where our battery was in front of Fort Christoval, and they have thrown out three countermines between the Pardaleras and the river. They have also raised the counterscarp in front of our breach in Fort Christoval.

"Believe me, ever very sincerely yours,

"JOHN SQUIRE."

On the back of this letter Sir William Reid has written "Squire died a Lieut.-Colonel, and is buried in Truxillo in Spain. . . . He was one of the most distinguished officers of the Duke of W.'s Army."

[o] Girard's Division was surprised by General Hill with the British 2nd Division from Portalegre and defeated on the 28th October at the little town of Arroyo de Molinos, when Generals Brun and D'Ahremberg with 1,300 prisoners, 3 guns, and the whole of the baggage were captured.

In view of his decision to recover Ciudad Rodrigo Lord Wellington had ordered a battering train and engineer stores to be sent from Lisbon by sea to Oporto, as soon as the Siege of Badajos was raised. From Oporto they were moved in boats up the Douro to Lamego and thence by land to Villa de Ponte. It was not until December that final preparations were made for the siege, and even then it was in the nature of a secret, and the French were quite unprepared.

Ciudad Rodrigo is a fortified town on rising ground on the right bank of the Agueda River; it is enclosed by a double enceinte, Lieut.-Colonel Fletcher commanded the Engineers and Capt. Burgoyne was director of the attack. There were 8 other captains and 9 subalterns of the corps employed at the siege. Of these 1 captain and 1 subaltern were killed, and 5 subalterns were wounded. One of these five was Reid.

The Upper Teson Hill, on which was a redoubt, facing the town on the north, was carried by assault on the night of the 8th January, 1812, when Lieut. Thomson, R.E., who led the ladder party, was wounded. Ground was at once broken and a lodgment made. On the following night a parallel and batteries were begun and Capt. Ross, R.E., was killed by a grape shot.

Between 10 and 11 a.m. on the 14th January the garrison made a sortie with about 500 men. The time selected was during the relief of the divisions, when a bad custom prevailed that, as soon as the division to be relieved saw the relieving division approaching, the guards and working parties were withdrawn from the trenches. The works were thus left unguarded for some time during each relief. The garrison had a look-out on the steeple of the Cathedral from which this custom had been observed. The sortie succeeded in upsetting most of the gabions placed during the preceding night in advance of the first parallel. Some of the enemy even penetrated into the right of the parallel and others would have pushed into the batteries and spiked the guns had it not been for Reid. He hastily collected some of the working party that was being relieved, manned the parapets and kept up such a steady fire as to compel the enemy to halt when within a few yards. On the approach of Lieut.-General Graham with the relieving division the sortie retired into the town with little loss.*

That same morning, Lieut. Skelton, R.E., who was superintending

* Major-General Porter, in a footnote to p. 283, Vol. I., of his *History of the Corps of Royal Engineers*, assumes that it was either Capt. Mulcaster or Lieut. Skelton, R.E., who was the hero of this incident. The letter from Capt. Squire of the 23rd February, 1812, given below, makes it clear that it was Reid.

the labour of opening and lining the embrasures of the batteries, under a heavy fire, was cut in two by a cannon ball; but in spite of delays the batteries opened fire in the afternoon.

On the night of this 14th January Capt. Mulcaster, R.E., was wounded in the thigh by a musket ball; on the night of the 16th Lieut. Marshall, R.E., was struck in the head by a bullet while instructing the sappers to break out the sap; on the night of the 17th Capt. M'Culloch, R.E., had his jaw broken by a cannon shot; on the 19th the breaches were effective and the assault was made that night on both the great and little breaches. Reid took part in the assault of the latter. Both assaults were entirely successful. In leading the column to the great breach Lieut. Thomson was wounded severely and Reid was wounded in the leg at the little breach by a bullet which was never extracted.

In his despatch to the Earl of Liverpool announcing the capture of Ciudad Rodrigo, Wellington refers to the conduct of the officers of Royal Engineers employed at the siege as worthy of being brought to Lord Liverpool's notice, and adds: "The ability with which these operations were carried on exceeds all praise."

By the 7th of February Capt. Burgoyne was able to write: "Mulcaster,* McCulloch,† and Reid are getting on well, but of poor Thomson‡ I fear there are little hopes, Dr. Gunning having declared that now his leg must be prepared for amputation."

After the ruined defences of Ciudad Rodrigo had been repaired and strengthened, the fortress was handed over to a Spanish garrison. Reid and his brother officers of the Engineers were then moved to Elvas, where preparations for the third Siege of Badajos were in hand.

Capt. and Brevet Major Squire, R.E., wrote to Reid from Portalegre:

Letter from Major John Squire, R.E., to Lieut. W. Reid, R.E.

"PORTALEGRE, *February 23rd*, 1812.

"MY DEAR REID,

"Though I have not written to you, believe me, I have made frequent enquiries after you, and am very happy to hear that you are likely soon to be recovered and to be again useful to the Service. I have heard that you distinguished yourself during the Siege (of Ciudad Rodrigo) by rallying the soldiers, and repulsing the sortie made by the enemy.

* Capt. E. R. Mulcaster was killed at the third Siege of Badajos on the 25th March, 1812.

† Lieut. William M'Culloch died at Athlone on 10th February, 1814.

‡ Lieut. Alexander Thomson survived, and died, a Captain and Brevet Major, in Edinburgh on the 20th June, 1830.

"Your letter describing the affair of Don Carlos with the French I received only about three weeks ago. I wish Lord Wellington could move to Salamanca and lay hold of the magazines, which the French have established there.

"We are now it seems preparing for the Siege of Badajos. Do you think we shall take it or not? Macleod* passed through this place yesterday on his way to Elvas; he gave me a long history of your proceedings before Ciudad Rodrigo. Let me hear from you, and believe me to be

"Yours very sincerely,

"JOHN SQUIRE."

Reid had now made his mark and shown of what metal he was made. He had on several occasions displayed conspicuous gallantry. His indefatigable energy, no less than his coolness under fire, had attracted the attention of his superiors. His Chief, Lieut.-Colonel Fletcher, wrote officially from Elvas, where headquarters had been established during the third Siege of Badajos, to the Inspector-General of Fortifications, to endeavour to obtain brevet promotion for him.

Letter from Lieut.-Colonel Richard Fletcher, Commanding Royal Engineer with the British Army in the Peninsula to Lieut.-General Gother Mann, Inspector-General of Fortifications.

"ELVAS, 15*th March*, 1812.

"SIR,

"I take the liberty to recommend to your consideration the peculiar merits of Lieut. Reid, of the Corps of Engineers.

"This valuable officer was mentioned in the highest terms by Lieut.-Colonel Harcourt, commanding the 40th Regiment, for his conduct during a sortie made by the enemy at the Siege of Badajos, in the month of May, 1811. A copy of the Lieut.-Colonel's report on this occasion I had the honour to forward to your office.

"About three months ago, Lieut. Reid was named to Lord Wellington in the strongest manner by General Don Carlos d'España of the Spanish Service, for his ability and zeal during an expedition under that officer, and he was afterwards particularly mentioned in his lordship's despatch.

"During the late Siege of Ciudad Rodrigo (at which he was wounded), his conduct was such as to add greatly to his former claims.

* Capt. (afterwards Lieut.-Colonel) George F. Macleod, C.B., R.E., died in 1851.

"On the whole, I feel Lieut. Reid's merits and services to have been so conspicuous, that I venture, Sir, to recommend him to your consideration for the brevet rank of Captain in the Army.

"I have, etc.,

"RD. FLETCHER,

"*Lt.-Col., Commanding Royal Engineer.*

"LIEUT.-GENERAL MANN."

This recommendation was submitted to the Master-General of the Ordnance, but he refused to entertain it as there was no precedent. Reid's uncle, Major-General William Fyers, before this decision was given wrote the following letter to Reid :—

Letter from Major-General William Fyers, Commanding Royal Engineer in Ireland, to Lieut. William Reid, R.E.

"DUBLIN, *30th March*, 1812.

"MY DEAR WILLIAM,

"I am afraid from my long silence you will think I have quite forgotten you. You know that I am not eminent for punctuality as a correspondent, and I really am quite ashamed when I think of the number of interesting letters I have received from you, unacknowledged by me. I have however not been so unmindful of you as you may suppose, having written twice about you to Lord Mulgrave, and sent to him two letters highly in your praise, which I received from your and my two good friends, Colonel Fletcher and Major Jones. Should I not be able to write to them before this packet goes, pray remember me in the kindest manner to them both. I have behaved almost as ill to my friend Jones, in the epistolary way, as I have to you.

"I received a letter the other day from General Mann. It was dated the 17th inst. and contained the following passage:—'Your nephew, Lieut. Reid, has come under notice; a difficulty arose about precedents, but some have been rummaged out of the War Office of the brevet rank of Captain being given, which I have produced, but I cannot yet say whether anything will be done.' Indeed, my dear William, I think they treat you with more coldness than they ought. But you must not let that discourage you; 'Persevere unto the end and you shall reap if you faint not.' That is, I think, as well as I can recollect, somewhere in the Bible.

"I suppose before the moment I am now writing Badajos has fallen. I cannot help thinking that you ought to have made it yours when last attacked. Perhaps I undervalue it too much. At any rate I hope you will not attempt a premature assault, and I trust you will escape without another touch.

"Your friend Edward goes on very well . . . and, thank God, enjoys most perfect health of body and mind. The two girls are also in high health and spirits; they have a great deal of dancing and visiting. Edward also has an abundance of festivity, and is in great request at the balls. I propose that we shall set out on some travels in about a week; but I do not expect that my first trip will be for more than 8 or 10 days.

"*9th April*, 1812.

"I have been prevented by various circumstances from setting off on my journey, and in the meantime have to thank you for your letter of the 20th, and for one to Edward of the 18th. Your letters are really interesting and are read with some attention by some of the higher powers here. I am really much concerned about your wound, and am persuaded you all along made too light of it. You must, however, not be discouraged, and I trust that before this reaches you, you are a whole man, and on your legs again. I long to be told so by you.

"Edward and my daughters are all well and beg kind remembrances to you.

"I remain, my dear William,

"Your ever affectionate uncle,

"WM. FYERS."

On the 16th March, 1812, the third Siege of Badajos was begun. The city was invested by Marshal Beresford and 12,000 men on its south side without opposition. It was decided to attack the bastion of La Trinidad at the south-east corner of the enceinte by breaching it from a distance; for this purpose it was necessary, first, to take the outwork Picurina to the south-east of the enceinte, and separated from it by the inundation.

The officers of Royal Engineers employed were:—Lieut.-Colonel Fletcher, commanding, Majors Squire and Burgoyne (directors of attack), M'Leod, and John Jones, 6 captains and 13 subalterns. Of these 24 officers, 3 were killed, 1 mortally wounded and 9 wounded. Reid was sufficiently recovered from his wound to do duty in the trenches, though it still gave him trouble. Ground was broken on the 17th March in front of Picurina. On the 23rd Fort Christoval was invested. On the 25th fire was opened on Picurina, the lunette of San Roque, and the bastions of La Trinidad and San Pedro, and at night Picurina was assaulted, Lieuts. Stanway and Gipps each leading a column of attack. The assault was brilliantly successful and a lodgment was formed. The siege then continued steadily, until the breaches were considered practicable, and the time for the great assault arrived. It is not very clear what part Reid took in that assault, but he was certainly at San Roque under Major Squire.

The writer's father, then Lieut. J. Vetch, R.E., had arrived from Cadiz at Badajos in charge of a detachment of Sappers on the 5th April to take part in the operations. He was accompanied by three other subalterns, Lieuts. Wells, Harry Jones, and Pitts. They found themselves only just in time for the final act, which was to have taken place that night. They were all in the trenches and Reid was with them when the assault was postponed until the following night. On the night of the 6th April Vetch, with a party of 200 men, was directed to attack the rear of the lunette of San Roque. It would seem that Pitts and Reid were with the party which attacked the faces and was directed to form a lodgment in it. Vetch had with him a junior subaltern, who has already been mentioned, Lieut. Wright, who had been wounded on the 20th March. As Reid probably shared Vetch's experiences on that famous night it may be interesting to quote the account which Vetch wrote of them at the time :—

"I was in the trenches from 4 o'clock in the afternoon until 10 p.m. on the evening of the 5th, and lost during the first half hour seven men of my small working party.

"The dispositions for the attack (on the 6th April) were as follows :—General Picton with the 3rd Division to escalade the castle, and the 4th and Light Divisions to attack the breaches, the 5th Division to escalade the works of the town on the left, a detachment to storm Pardilleros, and another of 200 men the ravelin of San Roque. The attempt on the castle was to be first, and to take place at 10 p.m.; the firing in that quarter was to be the signal for the rest. I was ordered with Lieut. Wright, R.E., to lead the party of 200 men at the ravelin of San Roque, where a lodgment was to be made. This ravelin is situated between the breaches and the castle, and I had therefore an excellent situation to observe what happened at both.

"A brisk fire opened from the castle at 10 p.m., and the enemy threw light-balls which gave them a great advantage. The firing at the castle had lasted about half an hour before that at the breaches commenced. That moment produced such a tremendous scene as can be better imagined than described. The night was dark. The castle was high on the right, the breaches low on the left. About 20,000 men were engaged in a small space, and the firing was kept up as quickly as possible, so that the whole scene seemed like a sheet of fire, a well-pitched light-ball now and then throwing a more steady light, and bringing the whole effect more fully to view.

"At the breaches the springing of mines, the bursting of large shells and barrels of powder, which the enemy rolled into the ditch from time to time, illumined the scene as brightly as daylight, but the light was so momentary that the objects were no sooner discerned than they were lost again in darkness. Some of our heavy batteries began to play, and the roar of the guns, the rattle of musketry, the explosion of shells and

mines, combined with the vivid light and the alternate darkness, produced an effect which will not easily be effaced from the memory of those who beheld it.

"But this scene lasted so long without any appearance of victory that our hearts bled to think of the number of our brave fellows who were momentarily falling at the points of attack. At last about 1 a.m. the glad sound of the bugle was heard from the castle, the signal of victory. The parties at the breaches were repeatedly repulsed. The 5th Division, on the left, succeeded about 2 a.m. after great slaughter. Fort Pardaleros was carried in gallant style by the Portuguese Light Infantry. My party of 200 men carried the ravelin of San Roque in a moment, Lieut. Wright, R.E., gallantly leading, and our prisoners were marched through the breaches.[o] We discovered the enemy had left a gate open near the ravelin, which three of our companies took possession of. I was in the town by 3 a.m., before daylight, but was sent out to give notice of the gate being in our possession, and did not get back until 5 a.m. in broad daylight to behold the most shocking scene of dead and wounded, and the soldiers pillaging the houses. We lost 4,000 men in killed and wounded in the storm, and another 1,000 in the siege; the French 1,000 in the siege and storm. Among our casualties were 230 officers; of Royal Engineer officers alone 4 killed and 10 wounded, besides Assistant Engineers. The prisoners amounted to 4,000. The pillage lasted two days and the town was completely gutted. Two gallows were then erected to show that it was over, and the punishment that awaited any who disobeyed. Not many of the inhabitants were killed during the pillage, but they were left with scarcely a rag to cover them or a morsel to eat; broken chairs and tables only remained. When looking about for quarters I was requested most earnestly by a lady to take my quarters in her house by way of protection, which I did, and remained there two days. She turned out to be the Marquesa Z., an acquaintance of Lord Wellington, and he called twice upon her ladyship while I was there. The poor lady had scarcely a gown to cover her back."

On the 27th April, 1812, Brevet Majors Squire, Burgoyne and J. T. Jones were promoted to be Brevet Lieut.-Colonels and we find Lieut. Pitts writing shortly after the news had arrived:—

"We hear there are such people as *Lieut.-Colonels* Squire, Burgoyne, and Jones! I am likewise in hopes we shall soon see Lieut. Reid

[o] Sir John Jones, in his *Sieges in Spain*, says: "The assault commenced at the appointed moment by the party allotted to escalade the lunette, St. Roque, moving into the rear of that work, whilst the guard in the sap opened a musketry fire on its faces. This front fire so completely occupied the attention of the garrison of the lunette, that the escalading party fixed the ladders and mounted the rear enclosure wall almost unopposed, and actually came into contact with those defending the faces before they were aware of the work being carried."

promoted to the rank of Captain in the Army; and if we can but get a precedent for a 2nd captain being made a major, the Corps will then be made. I think it a great shame if they make any scruple to promoting the 2nd captains, and as to Reid's promotion I fancy it is almost settled. He is an uncommon fine fellow, zealous to the highest degree, and *devoted* to the Service. With their promotion to look up to, and a good corps of Sappers and Miners (until we get which, we want our best half), we'll knock the dust in Johnny's eyes in a way that will make them wink. Burgoyne is a famous fellow, a captain and lieut.-colonel at 29. . . ."

But "want of precedent" stood in Reid's way. And yet, although no promotion, nor any other acknowledgment of his services came from home, his heart must have been even more greatly warmed by the generous, disinterested, and constant recognition of his merits by his brother subalterns, than by the commendations unreservedly bestowed upon him by the seniors under whom he served.

(*To be continued*).

MEMOIR.

COLONEL C. R. CONDER, R.E., LL.D.

CLAUDE REIGNIER CONDER, who was the son of the late F. R. Conder, Esq., M.I.C.E., was born at Cheltenham on December 29th, 1848. He was educated at University College, London, and, after passing through the Royal Military Academy, Woolwich, was commissioned as Lieutenant in the Royal Engineers on January 8th, 1870. While under instruction at the School of Military Engineering, Chatham, he distinguished himself in surveying and showed great talent for drawing; these qualities and his knowledge of archæology attracted the attention of his superior officers; and, when, in 1872, the services of an officer of Engineers was required by the Palestine Exploration Fund in order to carry out the survey of Western Palestine, in succession to Capt. Stewart, R.E., who had, unfortunately been invalided home to England, the choice fell on Lieut. Conder. He was a very young officer for so responsible a position, but the result most fully justified the decision of the Committee of the Society, who were guided by the advice of the late General Sir Charles Wilson, a good judge of men.

Conder had only just completed his course at Chatham, when he embarked for the East, and took charge of the survey party, which, at that time had reached Nablus in Samaria. Prior to his arrival, and after Capt. Stewart had been taken ill, the survey work had been carried on by Sergts. Black and Armstrong, R.E., of the Ordnance Survey, under the superintendence of the late Mr. C. F. Tyrwhitt Drake, whose knowledge of the country and people supplemented the topographical skill of the non-commissioned officers.

The survey was commenced by the measurement of a base line, about 4 miles in length, near Ramleh on the road from Jaffa to Jerusalem, and from this a network of triangles was extended northwards for 65 miles to the plain of Esdraelon, where a second base was measured. The length of the latter was also calculated from the Ramleh base, and the result proved the accuracy with which the triangulation had been carried out. The triangulation was then carried gradually over the whole country, the points of observation being fixed by cairns, which afterwards served as a basis for the topographical survey. Every village and ruin was carefully marked, and its name noted.

Besides carrying out the trigonometrical survey Conder did a great deal of valuable exploration in Jerusalem and other important places, and in studying the history of the country, as based on the geography.

The work went on steadily for three years by which time the survey of the greater part of the country west of the Jordan had been completed. In addition to the actual mapping, an enormous mass of information with regard to the topography and archæology of the country was collected, and a large number of places mentioned in the Bible, previously unknown, were identified. In June, 1874, Mr. Tyrwhitt Drake died of fever at Jerusalem, and his place on the survey party was filled by Lieut. Kitchener, R.E., now Viscount Kitchener of Khartum. In July, 1875, Lieut. Conder and his assistants were approaching the north of Palestine, and looking forward to the close of their labours, when a murderous attack was made upon them by the inhabitants of Safed, a town situated in the hills north-west of the Sea of Galilee.

Conder and Kitchener, with others of the party, were seriously injured, and it was decided to suspend the work for a time. With the assistance of the British Consul-General the assailants were duly punished by the Turkish authorities, and, after this had been satisfactorily arranged, Conder returned to England, and the plotting of the maps, and preparation of the Memoirs were taken in hand, a work which occupied nearly three years. In 1877, Lieut. Kitchener went back to Palestine and completed that portion of the map which had been left unfinished at the time of the Safed attack.

After the map had been completed on the scale of 1" to the mile, arrangements were made with the Director-General of the Ordnance Survey for printing it, while the Memoirs, containing all the valuable information collected by the survey officers, were published by the Palestine Exploration Fund. The results of Conder's work on the survey of Western Palestine were well summed up by the late Sir Walter Besant in the following words :—"It may be fairly claimed for the survey of Western Palestine that *nothing has ever been done for the illustration and right understanding of the historical portions of the Old and New Testament, since the translation into the vulgar tongue, which can be compared with this great work.* The officer whose name is especially associated with these maps and Memoirs has made himself a name which will last as long as there are found men and women to read and study the Sacred Books."

Lieut. Conder completed his work on the survey and Memoirs in April, 1878, and, besides receiving the thanks of the Committee of the Society for his services, was commended by the Secretary of State for War for the manner in which he had fulfilled his duties. This terminated his connection with the Palestine Exploration Fund for a time, and, in May, he was ordered to Edinburgh for duty in connection with the defences of the Firth of Forth. In the year previous he had married

Myra, daughter of Lieut.-General Edward A. Foord, Royal (Madras) Engineers.

He was stationed in Scotland for three years, building new batteries on the Forth, and, in his leisure hours, continued his studies in the history and archæology of the Holy Land and adjacent countries. In 1878 he published his first book, entitled *Tent Work in Palestine*, illustrated with his own drawings. This gave a popular account of the survey operations and contained much interesting information respecting the manners and customs of the inhabitants of Palestine, the various Bible sites, and the topography of the city of Jerusalem.

In the following year Conder brought out two books, one, the *Handbook to the Bible*, and the second, *Judas Maccabæus and the Jewish War of Independence*, the latter giving the history of the Jews from the fall of the Kingdom of Judah to the successful termination of the revolt of the Maccabees against King Antiochus Epiphanus. These works were very popular and have gone through several editions.

In 1881 Lieut. Conder was asked by the Committee of the Palestine Exploration Fund to undertake the survey of the country east of the river Jordan, and, on this occasion, was accompanied by Lieut. Mantell, R.E., and Sergts. Black and Armstrong, R.E., the same non-commissioned officers who had done such good work on the western survey. The party landed at Beyrout in March, and, in the first place, made an expedition to the Lake of Homs in the valley of the Orontes, near to which Conder discovered the remains of the ancient city of Kadesh; then going south they crossed the Jordan, and commenced the survey by measuring a base between Heshbon and Medeba. A number of the trigonometrical points west of the Jordan which had been fixed when the original survey was made, were also observed and proved of great use as a basis for the new survey. This part of the country was full of interest, and it contained many ancient remains which were but little known. There was one point to which Conder devoted special attention; this was the description of the rude prehistoric stone monuments, which abounded in the district east of Jordan; the stone circles, cromlechs, and menhirs, etc., relics of the inhabitants of a bygone age. These were carefully planned, and photographed.

The work was proceeding satisfactorily, when peremptory orders were given for it to cease by the Turkish governor of Es Salt, who declined to recognize the old permit as giving authority for making a survey *east* of Jordan. Conder succeeded in completing about 500 square miles, and was then obliged to withdraw his party to Jerusalem; he had succeeded, however, in collecting a great deal of important information which was published with the map a few years later.

On his return to Jerusalem in March, 1882, Conder was requested

to accompany Their Royal Highnesses Princes Albert Victor and George of Wales upon the tour which they were making through the Holy Land, under the guidance of the Rev. Canon Dalton. On their arrival in Jerusalem the Royal party proceeded to Hebron where the Sacred Haram, which as a rule is wholly forbidden to Christians, was, by command of the Sultan, opened for inspection. They then travelled north through the country by way of Samaria, Nazareth, and the Sea of Galilee to Damascus, and thence by Baalbec to Beyrout. Capt. Conder (he had been promoted Captain in January, 1882) wrote two interesting reports, one on the Haram at Hebron, and the second on the Palestine tour, for the information of the Prince of Wales (His Majesty the King) and these by order of His Royal Highness, were forwarded to the Committee of the Palestine Exploration Fund, and were published in the Quarterly Statement for October, 1882.

Soon after returning to England, Conder was selected for employment on the Staff of the Intelligence Department with the force which was sent to Egypt under Sir Garnet Wolseley to suppress the rebellion of Arabi. Here his knowledge of Arabic and of eastern people proved of great advantage for intelligence work. He landed at Ismailyeh in August, was present at the Battle of Kassassin and Tel-el-Kebir, and in the advance to Zagazig on September 14th. Soon after reaching Cairo, he was unfortunately taken seriously ill with typhoid fever, and was invalided home. After being on the sick list for some months he returned to work with the Palestine Exploration Fund and completed the map and Memoirs of the survey of Eastern Palestine.

Conder's next station was Chatham, but he had only been there a year when he was chosen for service under General Sir Charles Warren in South Africa and took part in the Bechuanaland expedition against the Boers. He was graded as Deputy-Assistant Adjutant and Quartermaster-General, and did good work in the Intelligence Department and in the survey of Bechuanaland. He was also British Commissioner on the Transvaal border, and was highly commended by Sir C. Warren for his services.

On the conclusion of the expedition Conder returned to Chatham where he remained for two years in command of a company. During his time at Chatham he published four books :—*Heth and Moab*, a popular account of his second expedition to Palestine, and descriptive of the districts east of the Jordan ; a *Primer of Bible Geography*, specially intended for the use of students ; *Syrian Stone Lore*, giving an interesting account of the ancient stone monuments of the country and of the buildings from the times of the Canaanites to the Crusaders ; and *Altaic Hieroglyphs*, in which he dealt with the decyphering of the puzzling Hittite characters in the inscriptions found at Hamath, Carchemish and other places in Asia Minor.

In July, 1887, Capt. Conder joined the Ordnance Survey at Southampton, and remained on the Survey for seven years. He was promoted Major in July, 1888. He did excellent work on the Survey, of which the late General Sir C. Wilson was at that time Director-General, and received the thanks of the Office of Works for improvements which he introduced as regards double printing on copper plates. Conder gave much assistance to Sir C. Wilson with regard to the publications of the Palestine Pilgrims' Texts Society, of which the latter was the Director.

In 1891 Conder published a work entitled *Palestine*, giving a useful *résumé* of what was known of the history and geography of the country, and, in 1893, he wrote *The Tel Amarna Tablets*, being a translation and description of the letters in cuneiform character, written about 1480 B.C. from Palestine and Syria to the then King of Egypt, letters which throw a flood of light on the connection between the countries, and which were of special interest to Conder in his studies with regard to the history of Palestine.

After the conclusion of his term of service on the Ordnance Survey, Major Conder was sent to Ireland for employment on the fortifications of Berehaven. He was also employed on the Irish relief works in 1895, and received the thanks of the Government for the services he rendered in connection with the latter. In August, 1895, he was promoted Lieutenant-Colonel and was appointed Commanding Royal Engineer at Weymouth where he remained five years. At this station he had much to do in connection with the fortifications of Portland, the submarine mining defences and the installation of searchlights. The books which he published during this period of his service were the following:—*The Bible and the East; The Latin Kingdom of Jerusalem*, which gives an account of the history of Palestine from the first crusade to the final expulsion of the Christians in 1289; *The Hittites and their Language;* and *The Jewish Tragedy*. He was promoted Brevet Colonel in 1900, and was again employed on the Ordnance Survey until 1904. He retired from the Service on November 2nd, 1904.

After leaving Weymouth he published the following works:—*The First Bible*, in 1902; *Critics and the Law*, 1907; *The Rise of Man*, 1908; and *The City of Jerusalem*, 1909. The latter book gave an account of all the recent results of exploration and research as regards Jerusalem, and traced the history of the sacred city for 4,000 years. Besides the separate publications which have been referred to, Colonel Conder contributed a very large number of valuable reports and papers to the quarterly statement of the Palestine Exploration Fund from 1872 up to January of the present year. He also wrote articles respecting Palestine for several of the encyclopædias, embodying the results of his researches.

It is impossible in a short article like the present, to give even a

résumé of the contents of the many interesting books written by Colonel Conder, as they contain information on every possible subject connected with the history and geography of the Holy Land from the earliest times. To the student the Memoirs written in connection with the survey are perhaps the most valuable, on account of the details they give respecting every place in Palestine, arranged for the use of scientific readers.

Colonel Conder died at Cheltenham on February 16th, greatly regretted by his many friends. One cannot but feel that it was an honour to the Corps of Royal Engineers that his name is enrolled on the list of our officers.

It is a curious coincidence that Sergt. Armstrong, who was Conder's faithful assistant on the survey of Palestine, and who for many years had been the acting secretary of the Palestine Exploration Fund, died on January 7th, only a few weeks before his former chief.

C. M. WATSON.

TRANSCRIPT.

WIRELESS TELEPHONY.

(Adapted from the *Bulletin of the International Railway Congress* by 2nd Lieut. A. H. Scott, R.E.).

(1). Introduction.

The term "wireless telephony" is generally taken to imply the method of transmitting speech by means of electric waves. The first wireless telephones transmitted speech by means of light waves, but as these two methods present a certain number of analogies, and moreover, the fundamental principles of wireless telephony by means of electric waves are closely related to those of telephony by means of light waves, it is interesting to glance at both methods. Graham Bell's photophone, invented in 1880, was the first attempt at light-wave telephony, and made use of the singular properties of selenium. It made telephonic communication possible over a distance of about 220 yards.

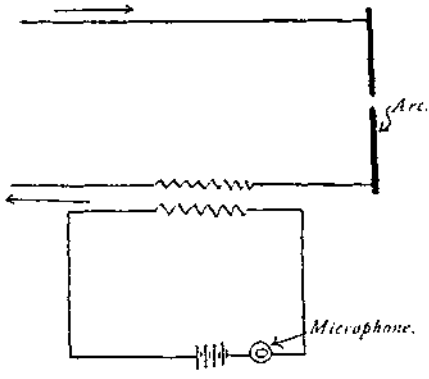


Fig. 1.—*Simon's Singing Arc.*

Ruhmer improved upon this, and succeeded in transmitting speech over a distance of about 9 miles. For his purpose, he made use of the properties of Simon's singing arc (*Fig.* 1). This device consists in superposing on the continuous feed current of an arc, the current induced in

the secondary windings of a transformer by a microphone circuit connected with the primary. The microphonic transformer can also be arranged on a branch at the terminals of the arc, by inserting a small auxiliary condenser. The arc faithfully reproduces any sounds produced in front of the microphone and acts like an excellent telephone receiver. This phenomenon is due to the fact that it responds to the smallest variations in the wave current in its circuit. These variations, which give rise to the sounds, are represented by corresponding variations in the temperature of the arc and involve variations in the brilliancy of the light. The arc thus acts, not only as a telephone receiver, but also as a photophonic transmitter. It is merely necessary to place it in the focus of the mirror of a searchlight, and to direct the pencil of rays on to a similar one, having at its focus a selenium cell arranged in the circuit of a telephone, in order to obtain a reproduction of the words at the receiving station. This property of the arc is most important, as it forms the basis of a large number of devices which are used for telephonic transmissions by electric waves.

In the case of electric-wave telephony, the transmitter includes a microphone circuit, together with a source of emission, which generally consists of an oscillation circuit similar to those used in wireless (electric-wave) telegraphy, in connection with a tuned radiation system. Considering the transmission antennæ as a source of emission of the electric waves, which travel through intervening space in the same way as the light waves, it may be conceived that it is possible, just as in the case of light-wave telephony, to proceed in two different ways in order to make the sound affect the emission of the electric waves. These ways are:—(1). By modifying, by means of the microphone circuit, the intensity of the oscillations, their period remaining unchanged. (2). By keeping the intensity constant, and modifying the mutual reactions of the connected systems by the microphone circuit. This involves variations in the syntony of the apparatus. This plan can be very effective.

If conditions are arranged so as to be most favourable to selective effects, that is to say, if feeble damping is used, very slight alterations in the condition of resonance result in considerable modifications in the intensity of the effect received. Electric oscillations have a period which is not of the same order of magnitude as that of sound waves, and thus the sound waves cannot be made to act directly on the oscillations themselves. The electric oscillations succeeding one another with a certain rhythm give rise to wave trains; it is this rhythm which is capable of modifying the sound waves. In principle, the transmission is always affected by the undulations in the whole wave trains.

In constant-period transmission, this undulation results necessarily and directly from the variation in intensity of the waves sent out, *i.e.* from the variations in the intensity of the source. In constant-intensity transmission, it results from the variation in the number of wave-trains acting on the receiver.

Although the number of wave-trains sent on may be invariable, these trains may act in a different way on the receiver, if they correspond to differently tuned waves.

(2). The Relation between Wireless Telegraphy and Wireless Telephony.

As soon as wireless telegraphy began, attempts were made to utilize its apparatus for transmitting speech. As long as only a coherer was available, *i.e.* a wave detector incapable of registering continual variations in the intensity, it was evident that there was no hope of obtaining any result. When auto-decohering detectors became available, attempts were first made to act on the spark itself by means of a microphone circuit. Later an attempt was made to obtain variations in the length of the spark by the rhythm of sound waves, by connecting one of the electrodes with a vibrating membrane, mechanically actuated by the microphone. All these devices were successively proposed and abandoned, the one definite obstacle to their application for the transmission of speech being the use of discontinuous and damped discharges for producing electric waves in the sending antenna.

In wireless telegraphy, whatever the device used, the discharges are obtained by connecting the balls of the oscillator with the secondary of an induction coil, or of a transformer excited by low frequency alternating current. The successive wave-trains are then always damped, and as a rule very far apart. This renders the use of devices on this system totally unsuitable for the purposes of telephonic communication.

It is not on each individual wave-train, that the sound vibrations act, but on the trains as a whole. In order therefore that these modifications may convey differences of sound, it is above all necessary that they affect a sufficient number of trains.

To take a definite case, let it be assumed that it is required to transmit the standard note A, which has 435 vibrations per second. The series of trains sent out in a second must have 435 perturbations or beats, and this will evidently be only the case, if the number of trains sent out exceeds 1,000. Now, in the ordinary processes of emission by sparks, the number of trains sent out hardly exceeds 100 per second, and is often less. The phases of activity are thus interrupted by long intervals of rest.

Consider the emission of a wave of wave-length of 330 yards, which corresponds to oscillations with a period of one millionth of a second. Each train consists of about 20 oscillations, and therefore covers $\frac{1}{50000}$ second. Assuming there are 100 per second, it is only after an interval that is 500 times longer, that a new train will succeed it. If one train in *Fig.* 2 be represented by a length of 1 centimetre, the distance between two successive trains will be represented by a length of 5 metres. Notes of much higher pitch than the one chosen are often used, so it is at once

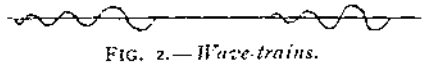


Fig. 2.—*Wave-trains.*

evident, that, no matter how ingenious the arrangement of the microphone circuit, the method of excitation by sparks is hardly suitable for wireless telephony. The only way of obtaining any result is to modify the system of emission so as to increase the number of wave-trains. This has been done by the use of Duddell's arc, by means of which it is easy to obtain 20,000 and even 30,000 vibrations per second, *i.e.* to attain the limit of audible sound.

(3). DUDDELL'S ARC.

Fig. 3 shows the practical adaptation of this method, which is a development of the well-known phenomenon of the singing arc; the explanation is as follows:—While the sound is produced by the singing arc, an alternating current is being produced in the condenser circuit. This current has the same frequency as the sound waves, and exercises an energetic inductive action on neighbouring circuits. The primary of a transformer is fed by this current, which has a frequency that is already considerable in comparison with the alternating frequencies generally used, and discharges are obtained in the circuit of the secondary of the transformer, which succeed each other with the same rhythm, (that of the

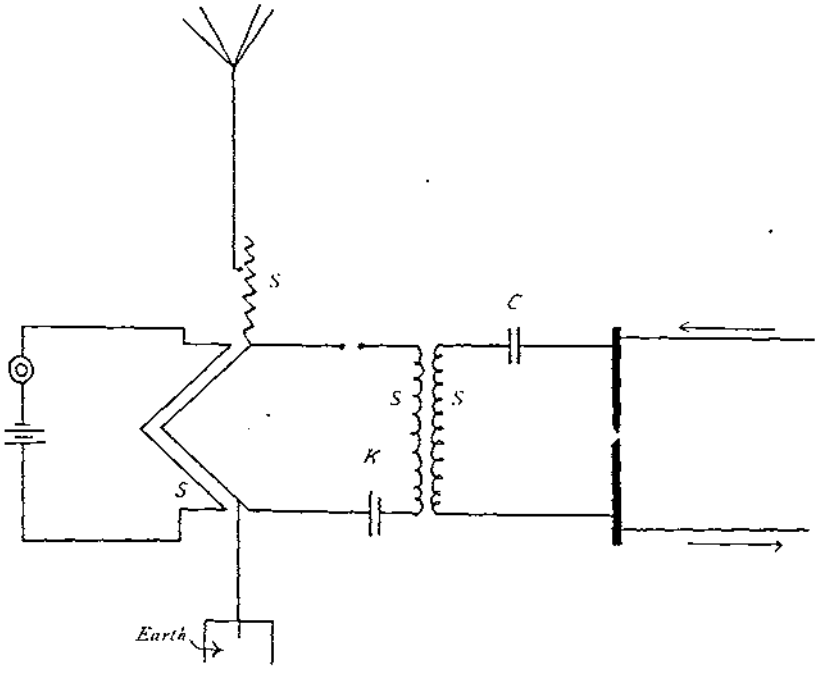


FIG. 3.—*Utilization of Duddell's Arc.*

sound). In order to utilize this phenomenon, a condenser C and a self-induction S, which forms the primary of a transformer (without iron), whose secondary feeds the discharge circuit connected with the antennæ, are arranged on a branch from the arc A. The secondary circuit includes a condenser K, and the primary turns of a tuned resonator on the antenna. The capacity of the condenser K is determined by the condition, that it must be in tune with the secondary of the transformer S. The primary of S has only a few turns of wire and the condenser C is designed so that the note given by the arc is extremely shrill. The sound wave acts by means of a small coil with two windings, the primary forming part of a microphone circuit. The receiving circuit is the ordinary receiving circuit used in wireless telegraphy by sound.

(4). Poulsen's Method.

By means of Poulsen's method it is possible to multiply the number of trains sent out, and diminish the amount of blank space between the successive trains, till finally, instead of a discontinuous succession of damped discharges as are obtained in the case of sparking, a single and continuous wave-train is obtained. Poulsen has succeeded in increasing the rate of vibration of the singing arc from 30,000 to over 500,000 per second.

The principle of his method is to produce the arc in an atmosphere of hydrogen or of coal gas, and the phenomenon is the more readily produced if the cooling action of the hydrogen is assisted by an electric blow-out, *i.e.* by placing the arc between the poles of an electro-magnet. The arc should be fed with a high tension current of at least 400 to 500 volts. The arc must also have a certain "effective" length which increases with the current, and decreases with the frequency. The cooling of the electrodes is effected by placing them in hollow tubes, through which cold water is circulated. The best results are obtained if dissimilar electrodes are used, the anode consisting of a hollow copper tube having at its end a concave hemispherical wall (*Fig.* 4).

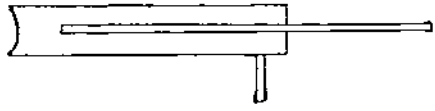


Fig. 4.—*Metal Electrode, Water Cooled.*

The effect of cooling the electrodes, and of the magnetic blow-out, is to make it possible to materially increase the intensity of the current in the arc, without stopping it from acting.

With the Duddell arc, the capacity of the condenser on the branch can scarcely fall below 1 microfarad; in this case, it can be given a much lower value. The production of the vibrations does not make a sound, the number of vibrations being far beyond the limit of audible sounds, but it can be made evident by the intense inductive action on neighbouring circuits.

Figs. 5 and 6 show the principle of this method. The oscillation circuit should be arranged to contain a condenser and a self-induction. It should be arranged on a branch from the electrodes, and be connected

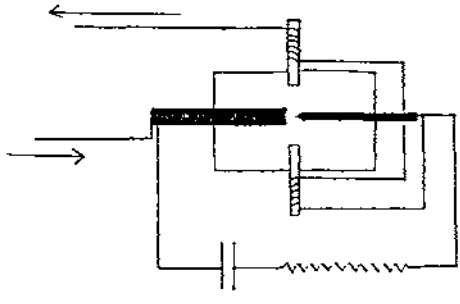


Fig. 5.—*Poulsen's Arc.*

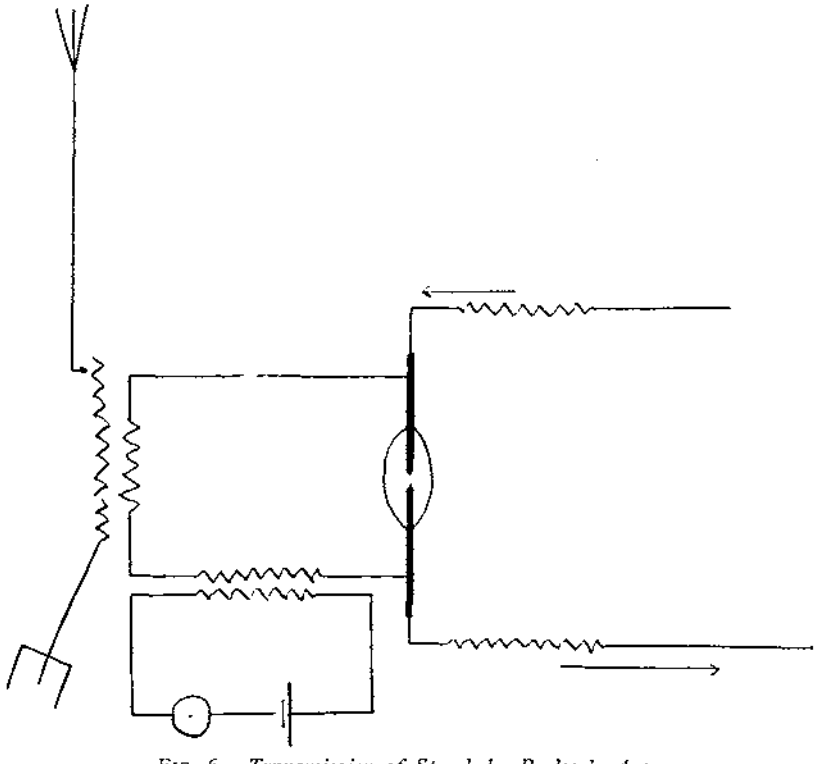


FIG. 6.—*Transmission of Speech by Poulsen's Arc.*

to the antenna, either through some turns which form the primary of a Tesla, or by means of an Oudin resonator. It must be tuned to the antenna. The sound waves act by means of a microphone circuit, on a coil whose primary forms part of the feed circuit.

The receiving end consists of any suitable automatic decoherer, (generally electrolytic) which is on a tuned circuit on the receiving antenna, as in the case of wireless telegraphy (*Fig.* 7).

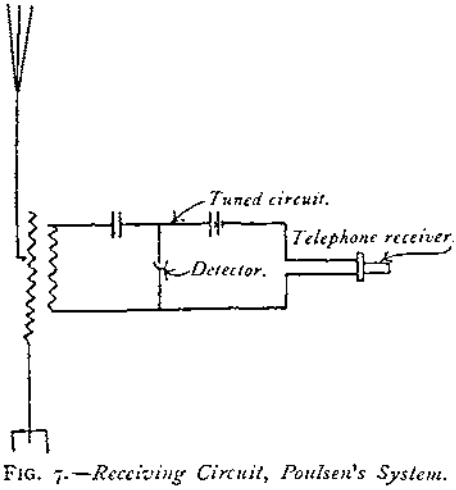


FIG. 7.—*Receiving Circuit, Poulsen's System.*

(5). De Forest System.

In De Forest's system, the source of emission is a Poulsen arc, which instead of burning in hydrogen, burns in the gases produced by the burning of a spirit lamp. The other difference, is that the microphone is placed at the bottom of the antenna, directly in series; this greatly improves the conditions of emission.

The receiving circuit is shown in *Fig.* 8. Its main peculiarity is the audion (*Fig.* 9). This is an ionized gas detector, invented by De Forest, and

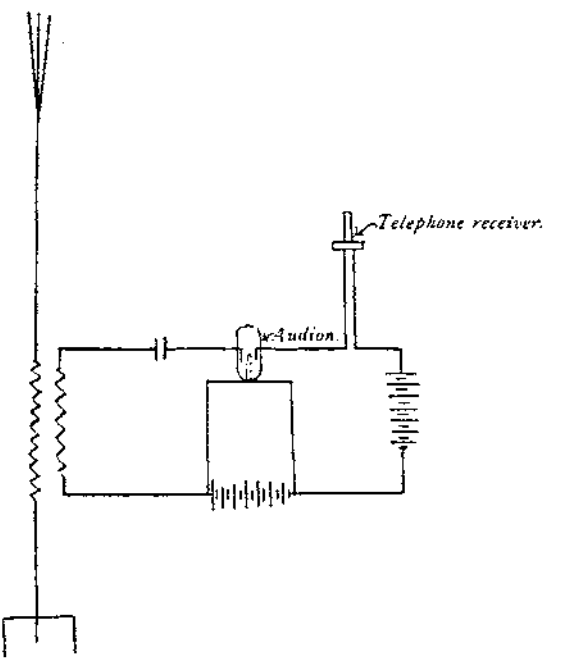


Fig. 8.—*Receiving Circuit, De Forest's System.*

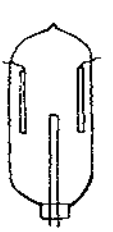


Fig. 9.—*De Forest's Audion.*

based on the Edison effect. Edison discovered as far back as 1881, that if an extra auxiliary electrode is placed on the wall of an incandescent lamp, there is a current in a circuit connecting that electrode with one of the terminals of the lamp, preferably the negative terminal. This phenomenon has been explained by the projection of a flow of negative particles escaping from the incandescent filament. This enables the

audion to act as a valve, when it receives alternating oscillations, and thus it allows only the discharges of one sign to pass.

The trials of the De Forest instrument were so good, that the U.S.A. Government ordered it to be installed on all the vessels of Admiral Evans' fleet.

(6). The Remaining Difficulties.

The principal difficulties in a wireless telephony system using an arc arise from the irregularity of the source itself. The arc produces a discontinuous succession of undamped wave trains, rather than a single wave train. Moreover, as a rule, not only is a single oscillation of one period produced, but a mixture of oscillations of different periods. The problem would be solved if instead of using an arc to produce the oscillations, some purely mechanical means were available, *i.e.* an alternator of high frequency. Many attempts have been made to produce these. Tesla and Elihu Thomson have constructed alternators giving a frequency of 10,000 to 15,000 periods. These machines consist in principle of a slotted disc, with a large number of slots, revolving inside a ring of field poles. Centrifugal force makes it impossible however for these discs to revolve at over 10,000 revolutions per minute.

Duddell and Ruhmer have recently invented machines consisting of small discs from which they were able to obtain frequencies of 120,000 and 300,000 respectively, but unfortunately, these high frequency alternators only give a very low power (Duddell, 0·2 watt; Ruhmer, 0·001 watt).

Fessenden has an alternator, which, running at 139 revolutions per second, gives a frequency of 50,000 periods, and the power of which is 40 watts.

(7). Present Position of Wireless Telephony.

Wireless telephony can now be said to have passed the laboratory stage and to have entered the domain of industrial application. The Poulsen arc system is much used. Poulsen has succeeded in obtaining telephonic communication over a distance of 105 miles; and the same distances have been obtained by officers of the French Navy in the course of experiments (Paris to Melun).

The record is at present held by the Italian Navy, as last November (1908) the torpedo boat *Lanciero* succeeded in exchanging messages firstly between Rome and Gaeta, (120 miles) and then between Rome and Caprera, a distance of 250 miles.

NOTICE OF MAGAZINE.

KRIEGSTECHNISCHE ZEITSCHRIFT.

January and February, 1910.

HAND GRENADES.—The hand grenade so extensively used in the Russo-Japanese War is no new weapon. At the beginning of the 16th century one Baptista della Valli wrote a pamphlet on the manufacture and use of hand grenades. In the Netherlands in 1606 they were also frequently employed. In the course of the 17th century their employment became even more general.

These old hand grenades were usually hollow iron balls filled with powder and fired by a fuze. They were uncertain in action and to avoid accident as far as possible special men of considerable strength and coolness were selected to use this weapon.

Louis XIV. in 1667, ordered every company in the French Army to provide four such men who were called grenadiers and received a higher rate of pay. Later on they were formed into separate companies and battalions. This arrangement was followed in the English Army. Even cavalry regiments were equipped with this weapon and called horse grenadiers. Their services were chiefly employed during the storming of a fortress, when they rode at full speed up to the works of the defence, halted while they lit the fuze, threw the grenades into the work, and galloped back.

However as artillery improved and shell fired from guns came into use the value of hand grenades diminished and they are hardly mentioned in the accounts of the Napoleonic Wars. They are not heard of again until the Crimea, where they were used on both sides. The Russians in the absence of cast-iron grenades made use of bottles filled with powder, with the fuze coming out at the neck. They were also used in the American Civil War but after this sank into an oblivion from which they did not emerge until the desperate struggle about Port Arthur called them into being.

The Japanese, who adapt themselves so easily to circumstances, were the first to resort to them. The earliest patterns were simply tins filled with dynamite and provided with a piece of quick match, which projected from the tin and was lighted by the man just before he threw it. This was a very primitive affair which not only often failed but also occasionally provided the enemy with an extra weapon. The quick match owing to damp or other cause burnt too slow and the Russian soldier picked up the grenade and threw it back. Later on the Japanese adopted the "Martin Hale hand grenade" made by the Powder Company at Faversham.

This resembles the one in use in the British Service and needs no detailed description.

To throw a hand grenade effectively requires considerable skill. After long practice a distance of 50 yards may be covered, but it is reported that in the Russo-Japanese War 50 per cent. of the men who used hand grenades were wounded at one time or another by their own grenade.

The Japanese also tried a rifle grenade made by the same company. The grenade itself is similar to the hand grenade but the handle is made to fit into the muzzle of a rifle, and is fired by an ordinary cartridge. The initial velocity is naturally very low averaging only 100 yards; but with an increased charge a range of 250 yards has been obtained. The low final velocity or velocity of impact is an advantage as it allows the explosion to take effect to the rear instead of entirely in a forward direction.

The effect of the rifle grenade is slightly less than that of the hand grenade but greater accuracy is obtained The flight of the grenade can be watched by the firer and his aim corrected for the next shot if necessary.

To shoot the grenade to any distance at all the rifle must be so elevated that the sights are useless. Thus to obtain accuracy considerable practice is necessary. The danger to the man firing is far less than to the man throwing a grenade. The highest rate of fire at present reached is three shots a minute, but the soldier cannot well carry more than four of these grenades so that a high rate of fire is hardly desirable.

The Russians and Japanese used hand grenades not only at the Siege of Port Arthur but also in field warfare, but the author of these articles considers that they should be confined to fortress warfare only. To throw a hand grenade or to fire a grenade from a rifle, a man must stand up. It would be suicidal to do this within 100 yards of the enemy's trenches unless the man is also under cover himself. Therefore for the attack at least they seem hardly worth carrying.

For the defence the use of grenades in field warfare is more favourable, because the man can throw or fire them from behind cover, and it is also possible for him to keep a greater number of grenades at hand under cover. Even then it seems probable that accurate rifle fire would have far greater effect against advancing troops than the uncertain and ill-aimed grenade.

Hand grenades will undoubtedly be useful to the storming columns in fortress warfare, as, if thrown amongst the defenders behind cover, they will do considerable damage and there will be no risk of splinters flying back and injuring the stormers themselves; moreover at these very close ranges they will be able to search out the defenders much better than rifle bullets can do.

The French have also introduced a hand grenade into their army. It consists of a hollow cast-iron shell 8·1 c.m. in diameter loaded with ·11 k.g. of powder. The fuze consists of a metal tube containing quick match and then a slow fuze burning five seconds, which is fired by a cap and striker, the latter ending in a loop which is normally sealed down with paper.

To use the grenade the seal is broken and the ear of the striker is placed over the hook of a leather strap fastened to the man's arm. The

grenade is then thrown and the striker, pulled out by the arm strap and the fuze thus fired, and in five seconds the grenade explodes. With the French grenade also the man who throws it is liable to be injured by back splinters and men are forbidden to use it except from behind cover.

The range when thrown by hand is only some 20 to 25 yards, but if a sling is used 50 yards can be covered. Considerable skill appears essential for the successful use of these grenades and six practice patterns have been issued to every company and battery.

As in the time of the first grenades it appears likely that special men only will be able to use them with advantage, so that in the near future the term grenadiers is likely to have its old meaning restored to it.

The French pioneer battalions have also been ordered to practice themselves in the construction and throwing of improvised hand grenades.

Spain.—Spain has adopted the Martin Hale grenade and these were largely used at Melilla. The regiments recruited from mountainous districts are given the greatest practice because they are naturally skilful in the use of slings. Each grenadier carries four grenades.

The Lack of Proper Instruction and Training in Field Fortification.—In an article under this heading the author discusses the lessons of the Russo-Japanese War, in which field fortification was used to an unprecedented extent. The technical troops on each side, by universal opinion, deserve the highest praise for what they accomplished, and if in some cases field fortification was apparently a failure it cannot be laid entirely to their account.

In the Russian Army the commander of the sapper battalion allotted to an Army Corps becomes on mobilization the Corps Engineer. The fortification of positions in Manchuria however was taken out of the hands of the Corps Engineers and transferred to a number of young engineer officers working under the direction of General Wjelitschko on the Headquarter Staff. This may have been due to the desire to construct the elaborate defences of Liaoyang, etc., on harmonious lines, but it resulted in considerable friction and misunderstanding, as the commanders of sections had often quite different ideas on the subject to those of the engineers. Their disapproval communicated itself to the troops, and no one had confidence in the siting or design of the defences. It is hardly to be wondered at that in such circumstances the defences were sometimes lightly abandoned, and that spade work generally lost credit in the eyes of the troops, who resorted to it with very ill grace even when circumstances rendered a speedy provision of cover very essential. Another consequence was that entrenching tools were lost in very large numbers.

Undoubtedly the chief value of field fortification was considered to lie in the preparation of elaborate defences, the idea being to create in this way a very strong position which the enemy would run up against. This hope was doomed to disappointment. The Japanese contained the front and, by enveloping one of the flanks, compelled an immediate retirement, either after a short resistance or sometimes without any fighting at all. Hasty field defences as opposed to the elaborate defence of positions were

practically neglected, because the Russians wished to wage a "war of positions."

On the occasions when hasty field defences were resorted to, they were seldom of great value because the ruling principle that field fortification is the handmaid of tactics was disregarded. In order that this truth may be universally acknowledged it is necessary for troops to be thoroughly trained in field fortification during peace. Liaoyang is a classical example of the failure of elaborate defences, owing to the fact that the troops were insufficiently trained in this branch of war and were unacquainted with the true *rôle* of fortification in field warfare.

The theatre of operations was generally mountainous, and in such country theory and practice are somewhat antagonistic. Theory requires that the trenches of the firing line should be pushed so far down the forward slope of a position that no dead ground exists. The disadvantage of this system in practice is that the troops occupying the trenches are more exposed, and covered communication to the rear is often impossible where the time available for the preparation of the position is limited.

When the Russian infantry had to entrench themselves they always—unless an engineer officer was at hand—sited their trenches near the crest. The field of fire was very limited, and there was a deep zone of dead ground, and then another field of fire—but at long ranges. This explains why in many cases the Japanese were able to get within 50 yards of the Russian trenches and lie down and open fire; it also explains why the Russians frequently expended all their ammunition while the Japanese were at distant ranges.

In striving to reconcile the conflicting demands of theory and practice the following conditions should be complied with :—

(*a*). The importance of strong works on those points of the position whence enfilade fire can be brought to bear on belts of dead ground must be recognized.

(*b*). The practice of distributing troops equally along the entire position must be abandoned.

(*c*). The defences must be most complete at the strong points of a position, and here the trenches should be traversed and recessed and provided with head and overhead cover.

(*d*). The work must be carried out without intermission by the employment of successive reliefs.

(*e*). At other points time will only admit of simple trenches and here concealment is of vital importance.

The faulty principles which prevailed in the employment of field fortification in Manchuria would have been avoided if the lessons of the campaign of 1877 and 1878 had been taken to heart.

That the experiences of this campaign were disregarded appears to have been due to Dragomiroff. It was due to him that the Russian infantry was taught to believe that success was best obtained by an impulsive advance, and that no time should be wasted in procuring superiority of fire. Spade work was abhorrent to Dragomiroff and the

individual who entrenched himself was considered to be digging his own grave. Progress in field fortification was confined to the sappers, and they entirely neglected to work in co-operation with the infantry. They trained apart by themselves and wasted much time over unimportant details and unnecessary finish. During manœuvres the higher commanders had no notion how to employ their sappers, who were either used as infantry pure and simple, or else entirely ignored, and all opportunity of instructing infantry in the value of entrenchments was lost. In the theatre of war the consequences were soon apparent, and the following remarks of various officers on this subject are rather illuminating.

On one occasion "the men left all their tools behind at their last position." Again "the infantry look on their entrenching tools as an unnecessary burden and take the first opportunity to throw them away."

"The constant friction between the sappers and infantry arose entirely from the dislike the latter had for spade work."

"The works constructed by infantry under their own officers were not only useless, but a source of danger."

The utter indifference of the higher commanders for their technical troops is shown by the following remarks:—

"The corps retired by a different line, without the sappers being informed of the retreat at all."

"When several divisions were bivouacked together for the night no place was allotted to the sapper companies and no Corps or Divisional Orders were communicated to them."

Such a state of things is obviously fatal. Field fortification must be immediately in accord with the tactical requirements of the situation, and the infantry must be thoroughly trained in this branch of war. The sappers must not be kept uselessly in rear but must work with the infantry in the firing line when required; and the closest co-operation must exist between sappers and infantry both in attack and defence.

The condition of affairs in the Russian Army during the war is not without its lesson for us, and the following suggestions of the author for improving matters are also of interest. He recommends that sappers and infantry should spend some of their training together; and that on occasions task work should be discarded and the energies of the men be stimulated by competition.

When trenches are constructed on manœuvres, any company or regiment which has not finished them in the allotted time should be ruled out of action, and held to have disgraced itself.

The summer training of sappers should be divided into three periods:—

1st. On very technical training by themselves in demolitions, mining, etc.

2nd. All training in field fortification to be done in conjunction with infantry.

3rd. Manœuvres during which the sappers should work with the infantry and be always actively employed instead of being left with the Reserve or in camp.

C. Otley Place.

RECENT PUBLICATIONS OF MILITARY INTEREST.

JANUARY, 1910.

(Published Quarterly).

THE following extracts from the list compiled by the General Staff, War Office, are published in the *R.E. Journal* by permission of the Army Council.

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PART II.

SECTION I.

AERIAL NAVIGATION.

THE CONQUEST OF THE AIR. By Alphonse Berget. 295 pp., with numerous photographs and diagrams. 8vo. London, 1909. Heinemann. 12s. 6d.

We owe Monsieur Berget a debt of thanks for having produced this translation of his French work. The extraordinary development which has taken place during the last eighteen months in the science and practice of aviation is hardly yet fully realized in England. The appearance of this book comes, therefore, at an opportune moment; and, while the author makes no claim for it to be a treatise on aeronautics, he describes clearly the bases of aerial navigation in its two actual forms.

Part I., which consists of 115 pages, deals with dirigible balloons and shows how the modern form has been evolved. At present a dirigible can hope to cope with the wind and steer in any direction on an average of 300 days in the year. To increase this number to some 350 days a considerable increase in horse-power, and consequently in weight, will be necessary; such, in the opinion of the author, must be the aim of future designers.

Part II. is devoted to aviation apparatus. The first three chapters explain the principles of aviation and their application in the construction of aeroplanes.

In subsequent chapters the essential differences between monoplanes and biplanes, as well as between the American and French schools of aviation, are clearly described.

The last chapter discusses the future of both forms of aerial navigation. The conclusion reached, so far as their military uses are concerned, is that their principal utility will be as scouts.

Anyone, however, who is interested in this subject should read the book for himself and make his own deductions as regards the future of aviation.

WRIGHT AND ZEPPELIN (Wright und Zeppelin). By Rudolf Martin. 22 pp. 8vo. Berlin, 1909. Mickisch, Segler & Co. 3d.

The object of the author is to show that greater advantages must accrue to Germany from the inevitable progress in the science of aviation than to any other country. In fact this science has come as a saviour to the Fatherland. Germany is strong on land, he continues, but weak on the sea. In future, however, no one in Germany need be afraid of defeat in war by either land or sea.

Martin then proceeds to weigh the various merits of the heavier, and lighter, than air flying machines. If war were to break out in five years' time, hundreds of giant airships and thousands of aeroplanes, he asserts, would move into the field on the German side.

Finally, Martin affirms that the greatest change that progress in aviation has brought about is the fact that England is no longer an island. He then endeavours to show how month by month a German invasion of England becomes more feasible and how ill the British Navy would fare in a contest with the German airship fleet.

He sums up in conclusion by stating that Wright and Zeppelin are thus a guarantee of peace between England and Germany. Why this follows from what he has written is not explained.

FORTIFICATION AND MILITARY ENGINEERING.

TEXTBOOK OF FORTIFICATION, DEALING WITH ENGINEER AND TRANSMISSION SERVICES AND FORTRESS WARFARE, USED IN THE ROYAL WAR SCHOOLS (Leitfaden für den Unterricht in der Befestigungslehre im Pionierdienst, Verkehrswesen und im Festungskrieg auf den Königlichen Kriegsschulen). Official. 199 pp., with numerous diagrams and plans. 4to. Berlin, 1909. Mittler. 6s. 6d.

This very comprehensive manual is divided into five parts and six appendices.

Part I. deals with transmission services and includes railways, motor tractors, all means of transmitting information in the field, bridging, waterways and roads; Part II. with obstructions and demolitions, both in connection with roads, bridges, railways and telegraph lines and with navigable waterways; Part III. with camps and bivouacs; Part IV. with field and permanent fortification; and Part V. with the attack and defence of fortresses.

In the appendices useful tables are given, showing the number of entrenching tools carried by German units in the field, penetration of bullets and projectiles, carrying capacity of pontoons and pontoon bridges in the German Army, demolition stores carried in the field, etc.

THE COAST DEFENCES OF SEA POWERS OTHER THAN GERMANY (Die Küstenbefestigungen der ausserdeutschen Seemachte). By Capt. W. von Stavenhagen (retired). 88 pp., with seven plans. 8vo. Berlin, 1909. Mittler. 3s.

The author commences by giving a comparative statement of the strength of the navies of the Great Powers dealt with, in tabular form. He then discusses the coast defences of the Powers under (1) *Great Sea Powers*, in which he includes Great Britain, the United States of America, France, Japan, Italy, Austro-Hungary and Russia, and (2) *Small Sea Powers*, in which he includes Norway, Sweden, Denmark, Holland, Spain, Portugal and Turkey in Europe.

The seven plans show the naval bases of Portsmouth, Dover and Portland, the Thames and Medway Defences, Copenhagen (2) and the Bosphorus.

THE STUDY OF FORTIFICATION (Le thème de fortification). By Capt. Lenoble. 64 pp. 8vo. Paris, 1909. Chapelot. 1s. 3d.

This short treatise is of interest to the engineer and to the infantryman alike, for it deals especially with such engineering work in the field as is likely to come within the cognizance of an infantry officer. The author holds that engineers, no less than cavalry and artillery, are auxiliaries of the infantry, and that the frequent use of such expressions as "the combined action of the *three* arms" has tended to keep the Sapper in the background, and has prevented the realization of the necessity for his action being in complete accord with tactical requirements. After discussing the utility of field fortifications under varying conditions, he goes closely into the question of how the labour involved in their construction is to be divided between the infantry and the engineers.

There are two short appendices. The first deals with the trace and siting of entrenchments, and the provision of head-cover; the second with calculations for working parties, demolitions and bridging.

HISTORICAL.

THE MILITARY HISTORY OF GERMANY IN THE 19TH CENTURY. PART I. (Kriegsgeschichte Deutschlands im Neunzehnten Jahrhundert, Part I.). By Colmar Freiherr v. d. Goltz. 516 pp. 8vo. Berlin, 1909. Bondi. 11s. 6d.

This volume deals with the Napoleonic era. The first chapter contains a review of the Prussian Army organization and tactical training from the days of Frederick IInd to the year 1806. The second chapter deals with the disasters of 1806 and 1807, concluding with the Treaty of Tilsit. The third chapter describes the measures taken to introduce reforms and to reconstruct the military system.

The fourth chapter, which is much the longest, embraces the whole period of the War of Liberation, including the campaign of Waterloo. The book contains numerous sketches illustrating the chief military events.

LETTERS FROM THE PENINSULA, 1808—1812. By Lieut.-General Sir William Warre, C.B. Edited by the Rev. E. Warre, D.D., C.B. 298 pp., with map and index. 8vo. London, 1909. Murray. 10s. 6d.

This series of letters commences prior to the despatch of British troops to the assistance of the Spaniards in the Peninsula, and concludes shortly after the Battle of Salamanca. Though written without any idea of publication in the future, they give a simple and yet interesting description of the life of an officer on the staff during the greater portion of the war. Of special interest are those letters dealing with the characteristics of our Allies and the reorganization of the Portuguese Army, with which the writer served in the capacity of staff officer to Marshal Beresford. Owing to the scarcity of officers having a knowledge of Portuguese, the author's acquaintance with this language, acquired during childhood, was of special service to the army at the commencement of the campaign and during the reorganization mentioned above.

A short introduction to each chapter by the editor gives in outline the main features of each period of the campaign and, together with a chronological table of events, assists in recalling the most important events to memory.

CLEBURNE AND HIS COMMAND. By Irving A. Buck. 382 pp., with illustrations. New York and Washington. 1908. The Neale Publishing Company.

Patrick Cleburne, the future Confederate general, came of an old Irish stock on both sides, and enlisted in the Forty-First Foot at the age of eighteen in disgust at his failure to

pass a professional examination. He served with the regiment for three years, but as there seemed no prospect of it being ordered on foreign service he bought his discharge, and in 1849 emigrated to America, finally settling at Helena, Arkansas. The outbreak of the Civil War found him a large landowner with a good legal practice and a man of considerable note in his adopted home, and he was chosen Colonel of the Fifteenth Arkansas Regiment. Within a few months he was promoted Brigadier-General, and at the end of 1862 Major-General. He would probably have succeeded to the command of Hardee's Corps if he had not during the winter of 1863-4 advocated the enlistment of negro troops, a step eventually adopted by the Confederate Government when it was too late. Had he been in command of that corps in November, 1864, it is not likely that Schofield's Army would have been allowed to escape at Spring Hill. There would then have been no Battle of Franklin (where Cleburne fell), and Hood's invasion of Tennessee might have had a very different issue.

Cleburne won the proud title of the "Stonewall of the West" by his remarkable personal courage; "men seemed to be afraid to *be* afraid where he was." He was certainly one of the ablest tacticians in the Army of the West, and unsurpassed as a division commander. That no leader could strike a more staggering blow was proved at Murfreesborough, and his splendid stand at Ringgold, which earned him the thanks of Congress, saved Bragg's Army from utter destruction after the rout on Missionary Ridge.

The writer served as A.A.G. in Cleburne's Division, and displays unbounded enthusiasm for his great commander. The descriptions of the various battles are somewhat unsatisfactory, because the author confines himself to narrating the part taken in them by Cleburne's Division only. Thus the account of the Chickamauga Campaign leaves a great deal untold, which is nevertheless essential to a proper appreciation of the military operations.

In spite, however, of defects of style, this work will serve to keep green the memory of one of the most remarkable soldiers of the Civil War, and can be cordially recommended to the attention of the military student.

MAJOR-GENERAL J. E. B. STUART. By Theodore S. Garnett. 61 pp. New York and Washington. 1907. The Neale Publishing Company. 4s.

This address was delivered on the 30th May, 1907, on the occasion of the unveiling of the equestrian statue of General Stuart in Richmond. The orator, Judge Garnett, served during the Civil War as Stuart's aide-de-camp, and his address is naturally an enthusiastic eulogy of his great leader. He considers that Stuart attained the climax of his career on the second day of Chancellorsville, when he was appointed to the temporary command of Jackson's Corps, and he quotes General Alexander in support of the view that Stuart on the reorganization of the Army of Northern Virginia should have been Jackson's successor. He takes some pains to clear Stuart of the responsibility of the failure of the Gettysburg Campaign, but ignores the fact that Lee's consent to the movement round Hooker's rear was conditional upon Stuart's ability to cross the Potomac in advance of Hooker. The account given of Stuart's fall at Yellow Tavern differs considerably from that given by Colonel Gus Dorsey in the Southern Historical Society Papers, Vol. XXX.

OFFICIAL HISTORY OF THE RUSSO-JAPANESE WAR. Part III. Siege of Port Arthur. (Prepared by the Historical Section of the Committee of Imperial Defence). 4s. 6d.

The present volume deals with the Siege of Port Arthur from the Battle of Nan Shan to the fall of the fortress.

In a short introductory chapter, the history of Port Arthur as a modern fortress and naval base is briefly described. This is followed by an account of the operations culminating in the capture of the so-called "Position of the Passes," and the commencement of the siege. The next four chapters deal with the organization of the 3rd Army as a siege force, and with the three general assaults.

It is, perhaps, open to argument whether any of these attempts was justified in the conditions under which they were made; but the evidence as to the necessity of making the first attempt would appear to exonerate the Japanese from the charge of headstrong folly with which they are sometimes accused.

Subsequent chapters are devoted to the assault and capture of 203-Metre Hill and to the different attacks on the permanent forts of the north-east front which led finally to the surrender of the fortress after eight months' siege. The descriptions of the Japanese assaults and of the conflicts waged by the opposing forces, when actually within the forts themselves, and often far below ground level, give a remarkable indication of what we must be prepared for in the future, should we at any time find ourselves opposed by troops trained and disciplined to an equal power of endurance.

A SCAMPER THROUGH THE FAR EAST. By Major H. H. Austin, C.M.G., D.S.O., R.E. 322 pp., with 30 illustrations and 2 maps. 8vo. London, 1909. Arnold. 15s.

The author gives an entertaining and instructive account of a rapid journey from England to the Far East and thence to Simla. The topographical details given by him of the Manchurian battlefields which he visited are full of interest. Many useful hints on travel in Japan are contained in the chapters in which the author describes his walking tours in the Japanese *highlands off* the beaten track of European travellers. Chapter XIV. contains a brief and graphic sketch of the Japanese Grand Manœuvres at Nara. The whole account of the journey demonstrates how much can be accomplished in a limited time, provided plans are carefully made beforehand.

MEDICAL.

AUSTRO-HUNGARIAN ARMY REGULATIONS FOR THE CONVEYANCE OF SICK AND WOUNDED BY RAIL (Vorschrift für Sanitätszüge des k. u. k. Heeres). Official. 197 pp., 7 plates, with drawings in text and tables. 8vo. Vienna, 1909. k. u. k. Hofund Staatsdruckerei. 1s. 10d.

This work is the official manual of hospital trains for the Austro-Hungarian Army; it consists of two main divisions with numerous plates, drawings, and tables. The first division is devoted to "Spitalzüge," which we would call hospital trains. This class of train is fitted up as a travelling hospital capable of supplying all the needs of 144 seriously sick or wounded patients lying down, during a journey of several days if necessary, while being transferred from the area of operations to the hospitals in the home territory. These trains are composed of specially-constructed goods wagons which are employed for traffic during peace time, but are not allowed to be sent out of the country.

The second division deals with "Krankenzüge," *i.e.*, ambulance trains of an improvised nature and primarily intended to carry sick and wounded short distances, and only to afford such medical attendance as may be absolutely necessary during the journey. These trains may be permanent or temporary, and are made up of ordinary goods wagons.

Each army corps has three of the permanent type of improvised ambulance trains in which the wagons are fitted with some apparatus to support stretchers, and with sitting accommodation. The temporary type of train is made up as required of additional goods wagons with improvised accommodation, when a very large number of cases have to be evacuated rapidly.

In the case of both kinds of train, the directions given enter minutely into every detail concerned with the formation, adaptation, equipment, and *personnel*.

The duties of everyone on the train, from the Commandant downwards, are clearly laid down, and all probable contingencies are provided for. The work affords an excellent guide to those who may in any way be concerned with the formation of a hospital train.

ORGANIZATION AND ADMINISTRATION.

POCKET-BOOK FOR THE TRAIN AND SUPPLY OFFICER IN THE FIELD AND AT MANŒUVRES (Taschenbuch für den Train und Verpflegungsoffizier im Felde und im Manöver). By Lieut. C. Hummel. 134 pp., with diagrams and sketch maps in the text. 8vo. Berlin, 1910. Mittler. 2s. 6d.

A most useful little book containing everything the train and supply officer requires to know as regards organization, lines of communication, orders, supply and reconnaissance. The last chapter but one is devoted to a supply problem in the field.

Paragraph 42 is of interest; it deals with the treatment of hostile inhabitants and reads thus:—

"*Punishments for Hostile Inhabitants.*

"Towns or villages lying on the line of march are to be held responsible for any casualties to *personnel* or injuries to material brought about or committed by hostile inhabitants in their neighbourhood, only the infliction of severe punishment to life and property will induce the authorities and landowners to take action against their own countrymen. Bridges which have been demolished are to be restored by the local authorities under threat of punishment, and obstacles and barricades are to be removed.

"Buildings from which armed inhabitants have fired, or which have served as places of concealment for partizans are to be burnt; every endeavour is to be made to guard against such a fire being put out.

"All hostile citizens found in *flagrante delicto* with arms in their hands have forfeited their lives according to the law of war, and are consequently to be shot without mercy."

THE PEOPLES OF SOUTH-EASTERN EUROPE AND THEIR POLITICAL PROBLEMS (Die Völker Südosteuropas und ihre politischen Probleme). By P. Dehn. 98 pp., with a coloured map. Halle on the Saal, 1909. Gebauer-Schwetschke Druckerei. 2s. 6d.

In this book the author first of all describes the various races which inhabit South-Eastern Europe and then considers their position, aims and aspirations. He points out that most of the nationalities are dissatisfied with existing limits of territory or power and that they either desire independence or, where they have independence, an expansion of territory or conjoint grouping. It is, however, difficult to reconcile the different demands, and in point of fact the "struggle of all against all has only hitherto been held back by pressure from the Powers."

Herr Dehn adopts the following race-grouping:—

(*a*). North Slavs—Czechs, Slovaks, Poles and Ruthenes.
(*b*). South Slavs—Bulgars, Serbo-Croats and Slovenes.
(*c*). Non-Slavs—Magyars, Roumanians, Turks, Greeks and Albanians.

He considers that among these races the people the least entitled to their demands are the Czechs. In this respect, however, the author writes perhaps from a somewhat partial point of view, for he regards their aspirations mainly in the light of the effect which, if granted, they might have on "German" development.

The later chapters deal with the new Pan-Slavism, "a Balkan confederacy," the Austrian Monarchy as a Slav force, the Eastern Crisis in 1908—1909, the future of Turkey and the position of the Powers.

AMERICA AND THE FAR EASTERN QUESTION. By Thomas F. Millard. 576 pp., with appendices, 2 maps, and numerous illustrations. 8vo. New York, 1909. Moffat, Yard & Co. 16s. 8d.

The author commences with a brief general outline of the present situation in the Far East and the relationship of the various interested Powers to each other, and gives his opinion that "Japan is now the most virile disturbing factor."

With this as a starting point the author proceeds to investigate at length Japan's economic and political *régime*, both internal and external, dwelling more particularly on Japan's dealings in respect of Manchuria and Korea.

One of the leading features in connection with Japan's economic *régime*, as described, is the active financial support given by the Government in developing her commercial undertakings, and a full analysis of the various methods employed is given.

In regard to Japan's exploitation of Korea and Manchuria, the author's comments are in the nature of an *exposé* of alleged Japanese methods, as a result of which the author attributes the cause of a growing suspicion and resentment in the West.

As regards Korea, he sums up the condition in that country as deplorable.

The writer, before leaving this part of his subject, expresses the opinion that "unless certain points are definitely adjusted by means of, if necessary, international pressure upon the Powers in occupation, the 'open door' in Manchuria will continue to be a hollow sham and may lead to the dismemberment of China."

From this the writer discusses the situation as it affects Russia, both politically and economically.

Chapters XXII. to XXIV. are taken up with a description and investigation of the reform movement in China.

The next four chapters are devoted to an analysis of American commercial and political relations with China and the position of foreign residents in that Empire.

The writer is of the opinion that it requires only circumspect diplomatic activity for the United States to become the most influential foreign Power in the Chinese Empire, and that only by direct intervention of the United States can the "open door" be preserved.

Some 100 pages are devoted to the Philippine question from an American standpoint, including a comprehensive review of Philippine affairs generally, both political and economic.

In the closing chapter the writer considers America's strategic position in the Pacific, and discusses at some length the various factors which would enter into a struggle with Japan for supremacy in the Pacific.

The several treaties, conventions and agreements (thirteen in number) between the various Powers which bear on the situation in the Far East are given *in extenso* in the form of appendices at the end of the book.

STRATEGICAL AND TACTICAL.

A THEORETICAL STUDY OF THE DECISIVE ATTACK (Étude théorique sur l'attaque décisive). By Major Buat. 131 pp., with 11 maps and numerous diagrams. 8vo. Paris, 1909. Chapelot. 4s. 2d.

Major Buat does not make use of the term "decisive attack" as in contradistinction to a "holding attack." In his opinion a "holding attack" pure and simple is contrary to all the laws of war, as it must be the aim of each and every attack at least to drive the enemy from his fire position. He does, however, employ the phrase "partial attack," and affirms that the object of such an attack is to attain success in one particular locality, whilst the "decisive attack" on the other hand must aim at securing such a success as will ensure the complete rout of the whole of the enemy's forces engaged. The distinction between the two is thus one of degree and not of kind: each endeavours to thrust back the enemy from the position which he is holding, but to the "decisive attack," involving the employment of greater masses, falls the task of pushing the initial success to the utmost, till by the repelling of counter-attacks, and by the rout of the enemy's reserves, complete and undisputed victory is assured.

As regards the attack itself, the writer's theory is that preparation for it consists solely in obtaining superiority of fire, and that the actual attack cannot be launched till such superiority has been obtained. The advance to a fire position, which he considers in the

case of infantry should be at about 800 yards or less from the line occupied by the enemy, is thus regarded by him as a merely preliminary measure.

The first chapter is devoted to the theory of the attack, and explains very clearly the principles which he advocates, and the formations he suggests. Each of the remaining three chapters gives a concrete example of a decisive attack, the various movements of both sides being followed out in detail, whilst the positions occupied during succeeding phases are indicated on the maps which accompany the volume.

HANDBOOK OF TACTICS (Handbuch der Taktik). Major Immanuel (German Army). 2 vols. Vol. I., 433 pp. Vol. II., 299 pp., with numerous diagrams in the text. Berlin, 1910. Mittler. 13s. 6d.

This is a revise of the first edition published in 1905. The author, who commands an infantry battalion and is a well-known writer on tactical subjects, states in the preface that the object of his book is not to improve on the teaching of the German regulations, but to give in a compact form a *résumé* of modern tactical ideas. With this object, each chapter, after dealing at length with the German teaching on any subject, concludes with a short summary of the views held in the chief military States on the same question.

The first volume deals with army organization, issue of orders, reconnaissance, marches and tactics of the several arms; the second volume treats of the battle, transport, supplies, communications, medical service and field fortifications. The book concludes with an index.

TRAINING AND EDUCATION.

OPERATION ORDERS (Gefechtsbefehle). Part III. A Study in Orders for a Retreat. By Capt. von Kiesling, German General Staff. 140 pp., with 2 maps. 8vo. Berlin, 1909. Eisenschmidt. 4s. 5d. (For Part II. see No. 8, p. 27).

This is the third of a series of studies in applied tactics by this author. It deals with the operations of an army corps and an infantry brigade forming the right of the IInd Army of a main Red force opposed to a Blue invading force. The imaginary theatre of operations lies south of the Danube, and north of Munich.

The opening pages are devoted to the general and special ideas; the latter sketches in detail the course of the first day's fighting, and the situation at its conclusion. Full particulars are given about headquarters, combatant units, ammunition columns, medical and supply units, and methods of intercommunication. The exhaustive description of the work of one of the divisional staffs begins with the receipt of army corps instructions directing withdrawal to and across a river line, and notifying the approach, from a flank, of hostile forces capable of impeding the projected operation. The G.O.C. Division thereupon decides to assemble, reorganize and rest his command as far as possible before attempting any general movement. The orders which are issued as a result of this decision are given. They take the form of special instructions to the cavalry, and a general divisional operation order. Means of transmission, and other details, are described in each case. The situation opposite one of the infantry brigades at the moment when divisional orders reach it is next described, and all arrangements by the brigade staff are given. A preliminary order sent to regiments, etc., by a mounted non-commissioned officer names the officers commanding sections of defence, gives directions as to patrolling, meals (field kitchens), and issue of further orders. These orders allot bivouacs and billets, name areas whence supplies, wood, water, etc., may be drawn, and give instructions as to protection. A noticeable feature in these divisional and brigade operation orders is the addition, in appendix form, of "special instructions" dealing with distribution of supplies, replenishment of ammunition, disposal of wounded, postal matters, etc.

Next follows a description of measures taken by two infantry regiments on receipt of brigade orders, one regiment having lost all except one of its field officers, most company commanders, and many others. The reorganization of battalions and companies, reports to neighbouring units, arrangements for bivouacs, supplies, water, ammunition, and care of wounded, are all minutely described.

Then comes a description of the action of the artillery "*brigade*" (*i.e.*, two 6-battery regiments) with the division, when divisional orders reach it, as well as a summary of the situation at this moment. The positions of battery wagons (*Staffeln*) and light ammunition columns are explained. "*Brigade*" orders follow, containing directions for getting guns and all ammunition échelons to the positions ordered. The orders by one regimental commander (six batteries) are given, as are also the arrangements for replenishing regimental supplies from the approaching divisional ammunition column. This closes the orders dealing with the first phase.

Returning to the divisional staff, the author deals with orders and arrangements for the retrograde movement which takes place in composite columns under specially appointed commanders. He then turns to one of the two columns formed, describing the methods whereby its leader communicates with scattered—and in some cases newly appointed—subordinate commanders. We learn, too, the methods by which units are brought to their appointed places on the march, and how transport, etc., is re-distributed. Similar details are given regarding the rear guard which covers the retiring columns. The action of different units which have to break away from the enemy is considered, as is also that of medical officers in charge of retreating columns as far as wounded are concerned. The action of two companies in close contact with the enemy is now described. Their position is attacked just as the order to retire arrives. After a vividly portrayed picture of the loss and re-capture of a bridge, the book gives the decision and consequent measures of a subaltern who, suddenly succeeding to the command here, feels bound to disregard the orders just received. Succeeding pages are devoted to the work of the colonel appointed to command the divisional rear guard, and give arrangements for supplying its foremost units with food and ammunition. Lastly comes a description of the withdrawal of these same units. In a conclusion the author explains the objects of the work, viz., to call attention in a simple manner to the different phases and forms of duties in action, to teach the art of giving orders, and to lay weight on the "positive" as opposed to the "abstract" side of military education. He considers that young officers are placed in command of unduly large bodies in theoretical exercises, and that consequently the elementary basis of their military knowledge is often lacking.

The lifelike pictures of the situation which precede the examination of tactical decisions, and administrative measures in every instance, add greatly to the usefulness of the book. Especially noteworthy are the arrangements for communication between all commanders and units, and for the movements of transport.

A careful system of cross references facilitates the comprehension of a necessarily complicated situation. The extraordinarily clear and short phraseology is rendered possible by the scientific military vocabulary which Germany possesses. The orders are, in fact, models, and the book presents a useful, attractive, and to English readers novel method of teaching tactics and administration. In order to derive full benefit from the book a thorough knowledge of German Army organization, and of the abbreviations so plentifully used in their service, is necessary.

The 1/100,000 tactical map is well suited for the study of the subject matter.

MODERN RIDING. By Major N. Birch. 262 pp., with index. 8vo. London, 1909. Hutchinson. 6s.

Major Noel Birch gives in this book his reasoned opinions as to the best way to train and educate a horse and the man who is to ride it. His views are based on a careful study of the literature which exists on the subject and on the methods employed in other countries, combined with several years' practical experience in the Riding Establishment at Woolwich.

The late Inspector of R.H. and F. Artillery bears witness to the successful results of Major Birch's system, an opinion with which all who saw the performance of the

Rough Riders of the R.A. Riding Establishment at the Military Tournament will fully agree.

The author addresses his pages especially to the members of the Territorial Force, whose opportunities for passing through riding courses are limited; but the book should appeal equally to every soldier who has to do with horses, and is anxious to improve the efficiency of the men and horses committed to his charge.

NOTES ON ORGANIZATION AND EQUIPMENT. (6th Edition). By Lieut.-Colonel H. M. Brunker. 309 pp. 8vo. London, 1909. Clowes. 7s. 6d.

The last edition of this book was published in 1907, since when numerous changes in the organization and constitution of the Army have taken place. These are shown in the present edition, which otherwise retains the main features previously adopted, and will be found of assistance to candidates for the Staff College and Promotion Examinations.

Examination papers for the Staff College from 1898 till 1907 and for promotion from 1901 till 1909 are given.

The composition of the larger formations and the system of food supply and ammunition supply in the field are clearly shown by means of plates at the end of the volume.

MISCELLANEOUS.

THE ECONOMIC POSITION OF GERMANY IN THE CASE OF WAR (Die deutsche Volkswirtschaft im Kriegsfall). By Dr. Voelcker. 158 pp. 8vo. Leipzig, 1909. Dr. W. Klinkhardt. 3s. 9d.

The object of the work is to determine the effect of war on German commerce, the extent to which the economic system of the country can guarantee its preparedness as regards equipment, rations, etc., and further, by a glance at their probable condition, to draw conclusions as to what precautionary methods should be taken during time of peace to ensure the maintenance of the normal, economic position.

Under the heading of "The War Crisis," the effect on the economic situation during three periods is dealt with. The three periods are:—

(i.). Directly before the expected declaration of war, and during the mobilization and concentration of the army.

(ii.). During the operations.

(iii.). During the armistice and peace negotiations. The arguments are based on statistics during the Franco-German War, 1870–71.

The author then passes on to the discussion of the commerce of the German Empire, which takes the form of a general survey of the home resources and the extent to which the country is dependent on other nations. He devotes some pages to the production and sale of goods, entering into details, with statistics, as to the probable number of working hands available, the industries affected, the possibilities of trading inland and through neutral ports, the mercantile navy in general, and the means of coping with a blockade. This part is supplemented by a survey of the economic condition of some branches of German industry, dealing with the effect of war on the working of coal mines, and on the iron, textile and leather industries.

Under the heading of "German Agriculture in the Case of War," he deals with the possibilities of maintaining the army and the population during the period of hostilities. After a further discussion on the economy of food stuffs, in which he aims at distinguishing between dispensable and indispensable foods as regards human beings and animals, he concludes with the opinion that, owing to her independence from the import of raw products, Germany is in a position to maintain herself for a long period, independently of other countries, notwithstanding her large requirement of imported bread cereals. Owing to her great commercial position, the effect of hostilities would react in a greater degree on the economic systems of her enemies than on her own.

THE AIRSHIP CRUISER SPY (Der Luft Kreuzer Spion). By J. von Adlerskron. 213 pp. 8vo. Leipzig, 1909. Kummer's Verlag. 4s 6d.

In the preface the author tells us that the editing of these experiences of a French officer of the General Staff, employed on intelligence work in connection with airships in Germany, was confided to him by that officer himself when dying of consumption at Davos.

In an introductory chapter the author enters, in some detail, into the methods of espionage carried out by different States and discusses the various classes of people employed in this service. He lays special stress on the class of information *required* and the ways and means of getting it. This chapter is perhaps the most interesting of the whole book.

The story itself describes the way in which the French officer is temporarily removed from active service; how he serves an apprenticeship at a wine merchant's in Bordeaux for three months with a view to carrying out his task in Germany under the guise of a travelling agent of the firm; the means he adopts for *getting to know* individuals connected with the balloon establishment at Tegel; his successful transactions with an assistant paymaster with regard to the purchase of secret information; his methods of securing secret plans of airships; and finally, his hurried departure *from* Berlin.

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