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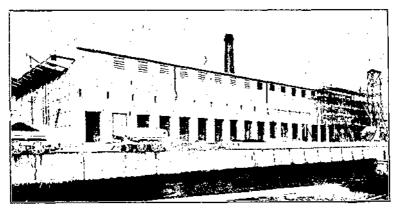
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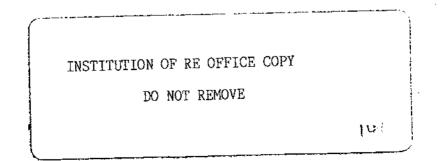
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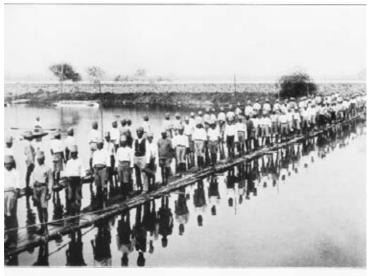
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Authors alone are responsible for the statements made and the opinions expressed in their papers.

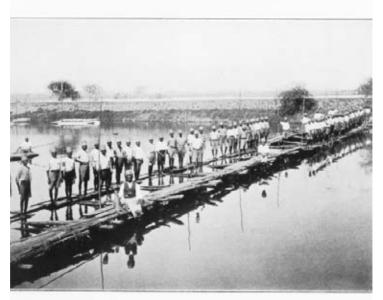
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1. Bridge loaded on both roadways.



-Bridge loaded so as to give maximum torsion to the centre of the system

IMPROVED INFANTRY FOOTBRIDGE



3.-Bridge in use for passing pack transport across a river.

IMPROVED INFANTRY FOOTBRIDGE

IMPROVED INFANTRY FOOTBRIDGE.

By Bt. Major R. L. McClintock, d.s.o., R.E.

An article entitled "Infantry Footbridge" was published in the July, 1909, number of the R.E. Journal, showing how a small number of casks, planks, and small spars could rapidly be converted into a footbridge for infantry.

This bridge however provided a single roadway in the centre of the piers only (*Fig.* 1), and a suggestion was made that it would be improved by having a track over each edge in place of the single track in the centre. This would allow traffic in both directions, and also admit of animals being more easily swum across by the aid of the bridge.

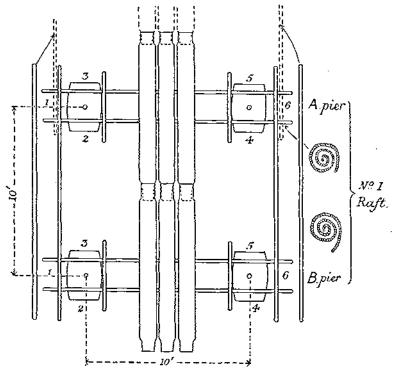


FIG. 1.—One Complete Raft of Cask Footbridge (Original Pattern).

An improved type (Fig. 2) was accordingly devised, and has answered the requirements perfectly. The only additional stores required are two chesses per 20' run, while—by a readjustment of the framework of the piers—two 36' lashings and four 4' cross-pieces are actually saved in the same distance.

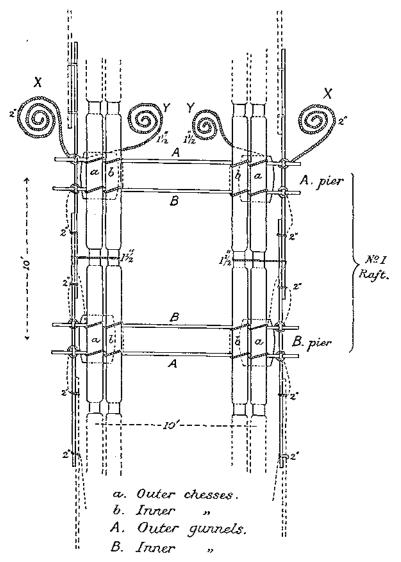


FIG. 2.-Diagram of one Complete Raft of Cask Footbridge (Improved Pattern).

As regards strength, Photo No. 1 shows the bridge loaded on both roadways at the same time, with men going in opposite directions. Photo 2 shows the bridge with the east half of the upstream roadway and the west half of the downstream roadway fully loaded at the same time, so as to give the maximum torsion to the centre of the system. No derangement of any sort took place, and the bridge proved to be astonishingly elastic. Photo No. 3 shows the bridge in use for passing pack transport across a river. The animals are swum across by the aid of the bridge, and the loads and saddlery are carried over it by hand.

GENERAL PRINCIPLES OF ORGANIZATION AND EQUIPMENT, ROYAL ENGINEERS.

(Continued).

WIRELESS TELEGRAPH COMPANY, R.E.

Organization.—It has been decided that there is to be one wireless company stationed at Aldershot, belonging to the Cavalry Division.

This company is divided into 4 sections and 1 headquarter section, the wireless stations being allotted to sections as follows :—

	•••	•••	2 wagon stations.
No. 2 Section	•••		<i>11 71</i>
No. a Section (•••	•••	1 " station.
No. 3 Section		•••	I " station. I pack transport station.
No. 4 Section	•••		2 " " stations.

The wagon stations have a range of about 80 miles overland to each other.

The pack transport stations, which are designed to be carried on pack when required, but are ordinarily carried in limbered G.S. wagons, have a range of about 7 or \$ miles to each other, and of about 10 miles to the wagon stations.

In.	Officers.	N. C. O. 's & Men.	Horses.	Vehicles (Peace and War).	N0.
Peace	4	94	s6* (Bicycles Wagons, limbered, wireless Wagons, light spring	4 6 6
War	5	129	114† (Wagons, limbered, G.S Cart, water	3

Establishment of a Wireless Telegraph Company.

* Excluding officers.

† Including officers.

In addition, when mobilized, 1 A.S.C. driver for water cart, and 2 rank and file R.A.M.C., are attached.

The corporal (storeman) and the first reinforcement of 12 men mobilize with the unit, and are left at the base.

A detachment for the 80-mile station consists of 9 N.C.O.'s and men, who are carried on the wagons, with the exception of the senior N.C.O., who rides. They can, under normal circumstances, erect the station in half an hour.

A detachment for the pack transport station consists of 6 N.C.O.'s and men, who are all mounted. The station is erected in a quarter of an hour.

The trades required are telegraphists (office), telegraphists (line), fitters, who are trained to take charge of the petrol motors, and electricians.

Equipment.—Five of the wireless wagons carry, in the limber, all the instruments for transmission and reception, together with office stationery, etc. On the carriage are the petrol motor, alternator, mast, antenna, pickets, etc.

The sixth wireless wagon has no instruments in the limber, but is arranged to carry such of the accumulators of the pack transport stations as may need re-charging. The carriage of this vehicle is exactly similar to the other five, except that in place of an alternator a D.C. dynamo is provided for re-charging the accumulators.

Five of the light spring wagons carry petrol, oil, spare parts, men's blankets, forage, etc., for the 5 wagon stations, while the sixth is for the headquarters of the company, and carries such extra technical stores, as are not provided for each section.

The limbered G.S. wagons carry the pack transport stations, together with the blankets and one day's rations and forage of the detachments.

Each wireless station is thus entirely self-contained, and can move at any time independently of the rest of the company.

Duties.—The chief duties to be performed by the wireless company are :—

- (1). Maintenance of communication between General Headquarters and the headquarters of the Cavalry Division.
- (2). Maintenance of the internal communications of the Cavalry Division.

The 8 wireless stations of the company might then be employed somewhat as follows :—

Two 80-mile stations at Army Headquarters, of which one would be erected and at work, and the other ready to move at any moment.

Two So-mile stations at Cavalry Division Headquarters, of which one would be erected and at work, and the other ready to move at any moment.

One 80-mile station at Cavalry Division Headquarters, for work with the 3 pack stations, which would be allocated thus :—

One pack transport station with headquarters of each of 3 Cavalry Brigades, the Cavalry Division Headquarters being presumably with the 4th Cavalry Brigade, which would consequently not require a separate wireless station.

R.E. BALLOON UNIT.

Peace.—In peace time there is only one Balloon Unit of Royal Engineers, viz., the Balloon School, stationed at Aldershot.

The Peace Establishment consists of 7 officers (exclusive of a quartermaster), a warrant officer, 38 mounted ranks, 98 dismounted ranks, 4 riding and 32 draught horses and trains as 2 balloon companies. Of this establishment a certain proportion is detailed in peace as the nucleus of each of 3 balloon companies, which can be mobilized for war. The remainder (approximately one-third of the dismounted ranks with 3 officers) are not available for mobilization, as they will carry on instructional duties in the School.

The field training of the Balloon School starts with musketry at the beginning of March. Spring drills and fieldworks are carried through until the middle of April; then until June there is a recruits' course in ballooning and kiting. During June and July a company is generally sent to the Artillery Practice Camp at Lydd or Rhayader and Salisbury Plain, while one company is in camp at Aldershot. In August Divisional Manœuvres are attended, and in September the Army Manœuvres.

From the beginning of October to the middle of November two companies are employed with an officers' balloon course. During the remainder of the year, and whenever not employed in field training, the men are employed on public works, chiefly at their trades in the Balloon Factory.

The Balloon School is a school for training in ballooning. Young soldiers are sent there for two years for a complete course, and noncommissioned officers are appointed preferably from those who have already received instruction there. In peace time no portion of the Balloon School is sent abroad, except on special occasions. There is no foreign station where balloons are permanently kept up with the exception of India, where there is an experimental section.

War.—The War Establishment of a balloon company consists of 3 officers, 31 mounted ranks, 31 dismounted ranks, with 8 riding and 44 draught horses. Of the riding horses, a captain is provided with 2, and the subalterns have 1 each.

In addition, I A.S.C. driver for water cart, and 2 rank and file R.A.M.C., are attached.

The corporal (storeman) and the first reinforcement of 3 mounted and $_3$ dismounted men mobilize with the unit, and are left at the base.

All ranks except officers and R.A.M.C. are armed with the short rifle, and carry 50 rounds of animunition per man in bandoliers. Great coats are carried *en banderole*. Men actually employed with a filled balloon in the field have their rifles and great coats carried on the wagons. 50 rounds of animunition per dismounted man are also carried on the wagons.

Vehicles.—1st Line Transport.

The vehicles consist of :--

1 Bicycle.

1 Balloon and Kite Wagon, on which are carried a balloon, cable, and all stores common to both balloons and kites. This wagon is drawn by 6 horses.

² G.S., R.E., Wagons, one carrying equipment and one carrying baggage (each drawn by 4 horses).

6 Wagons Reservoir Gas (each drawn by 4 horses), each wagon containing nine 9' gas tubes, the capacity of each tube being 500 cu. ft. The gas is compressed to 120 atmospheres.

Kites are carried at present on the gas wagons. A new balloon and equipment wagon is under design, which will enable the kites to be carried independently of the gas wagons.

All these wagons form the equipment accompanying the company in the field.

Vehicles.—2nd Line Transport.

1 water cart, drawn by 2 horses.

The unit can put in the air at the same time only one observation balloon or one flight of kites, which are used alternatively. Usually only one observer is sent up.

The chief articles of equipment and tools carried, besides ordinary stores and repair material common to all units, are :--

Signalling stores.

Drawing instruments.

And the following special technical stores :--

- 2 balloons of 11,500 cu. ft. capacity.
- I signalling balloon of 1,000 cu. ft. capacity, with a set of 4 small spherical balloons for making signals.
- 4 pairs of binoculars and spotting telescopes, each of the latter furnished with 10 and 20-power eyepieces.

Complete equipment for 2 balloons.

Set of photographic gear.

Captive steel wire rope, 4,000' long.

A number of cotton ropes.

- 4 telephones.
- 2 telephone cables, each 4,000' long.
- 1 complete set of kites and equipment.

(The chief items for one set of kites are as follows :---

- 1 fair weather pilot kite.
- 1 heavy weather pilot kite.
- 7 lifter kites.
- 2 carrier kites.

In addition to the articles carried in the field, the 1st Reserve of Technical Stores mobilizes with the unit and accompanies it as far as the Advanced Depôt.

The chief articles carried are :--

Four 11,500-cu. ft. balloons complete. Two 4,500-cu. ft. balloons complete. 146 gas tubes=6 fills. Spare cable. Complete set of kites and Spare fittings for same.

FIELD SEARCHLIGHT COMPANY.

In the event of this company, which is at present experimental, being mobilized for service it would form part of the Field Army as opposed to

- (a). Coast Defence E.L. Companies, for the defence of harbours and the night fighting of coast batteries.
- (b). Fortress or Siege E.L. Companies, which will have mobile plant, but are intended only for the attack or defence of fortresses on the land fronts.

The proposed organization is on the lines of a Royal Field Artillery battery, and consists of six "power units," divided into three sections of two power units per section.

The power units consist of a projector wagon and a generator wagon. The projector is carried on a limbered wagon, the projector itself being mounted on the trailer, and the drum of cable and spare parts and stores on the limber. The projectors are either 3' or 2' in diameter. This wagon requires a 4-horse team. The generator wagon contains dynamo, engine, fuel oil, and water for 10 hours' work, and requires a 6-horse team.

The dismounted detachment to work each light and engine, and to control it by telephone, is six non-commissioned officers and sappers, four of whom are carried on the projector wagon and two on the generator wagon.

In addition to its two larger projectors, each section of two power units has three or four smaller (1') projectors, to be carried on one or two carriages, which are not at present decided on. These three or four small lights can be used as an alternative to either of the large projectors, making use of its engine power.

	Officers.	N.C.O.'s and Men,	Horses.	Vehicles.	No.
Peace	3	88	45* {	Projector wagons Projector wagons, small Generator wagons G.S., R.E	6 12 6 3
War (proposed)	5	168	134	Projector wagons Projector wagons,small Generator wagons G.S., R.E	б 12 б 5

Establishment of a Searchlight Company.

* Excluding officers' horses.

The proposed war establishments of such a company includes a second relief of six sappers for each light. These men march on foot with the headquarters of the company.

Each section has also a stores wagon (G.S., R.E.) for such spare mirrors, etc., as cannot be carried on the projector wagons.

General Principles of Employment.—Field searchlights can be employed as follows :—

(a). On the defence.

- (1). To light with concentrated beams defiles across which the attackers must advance, so that they may be fired on with effect by the guns of the defence at ranges up to 3,500 yards.
- (2). To light up the attacking infantry with dispersed beams when advancing to the assault at ranges within 1,000 yards.

(b). In the attack.

- To prevent the defence from improving their entrench-ments and obstacles under cover of darkness.
- (2). To light up definite artillery targets, such as redoubts.
- (3). To assist the attacking columns by lighting up rough ground with diffused lights, so that the rate of advance in the initial stages of the attack may be as rapid as by day.
- (4). To help the attacking columns to keep direction by lighting with concentrated beams that part of the defenders' line selected for assault.
- (5). To assist in repelling the counter-attack.

Searchlights can also be used to assist with light all operations such as bridging, pontooning, and entrenching, when not in the face of the enemy and when it is desirable that these works should be carried on night and day.

Position.—Positions both in attack and defence which are suitable for guns to fire "over the sights" will generally be suitable for searchlights, but lights are usually more dispersed than guns.

Proportion to Other Arms.—A company of six lights can, as a rule, cover the frontage of two brigades in the firing line, so a proportion of one company per division would seem to be about right.

RAILWAY COMPANIES.

There are three railway companies, 8th, 10th, and 53rd, all these being stationed at Longmoor (Aldershot Command).

They are employed on the construction and maintenance of the Woolmer Instructional Military Railway, a 4' $\delta_{1}^{\prime\prime}$ gauge military line, some 6 miles in length, connecting Bordon (L.S.W.R.) with Longmoor Camp, including workshops for repairs to rolling stock, etc.

Officers are also trained in railway reconnaissance and survey while at Longmoor, three N.C.O.'s and men per company being also instructed in railway survey work. Parties, each commanded by an officer, are sent out to carry out a reconnaissance and final location of a railway between two points about 40 miles apart, on the assumption that it is an unmapped country. Complete plan and sections are drawn out.

A certain proportion of the men undergo at present courses of "fitting" and "firing" on civil railways. The "fitting" course usually lasts nine months and the "firing" course six.

For service abroad the railway companies form part of the lines of communication troops.

In time of war the duties of a railway company would be to survey, construct, repair, and demolish railways, and to work construction and armoured trains.

The "working" of an existing railway, *i.e.*, the traffic and locomotive work on an open line, will seldom be required of a railway company in war time. For such work larger and differently organized units are necessary. War Establishments, 1908–09, include the following units intended for such work, but these have not yet been formed in peace time, viz.:—

Railway Control Establishment.

A Central Railway Establishment.	Forming one Railway
2 Railway Districts.	Corps.

When however a railway has been made, practice is given in working it.

1910.]

[FEBRUARY

The peace training is therefore on the following lines:—Reconnaissance, survey, and final location of a railway; platelaying; laying out station yards; laying out deviations; rapid laying of narrow-gauge tramway; railway bridging of all kinds; signal installation; water supply; repairs to telegraphs and telephones necessary for working construction lines; working of electric block instruments; armouring trains; construction of temporary platforms; working and maintenance of construction trains.—*Corps Memo.*, No. 620, Part II., Appendix V., p. 97.

Men enlist for three years with the Colours and nine years in the Reserve (*Recruiting Regulations*, 1909, p. 22), but those selected for special courses of instruction should invariably extend their service or re-engage if eligible, or, if not eligible by length of service, etc., must express their willingness to do so as soon as they become eligible. This should be stated on Army Form B 251, if they have less than three years to serve on their present engagements.— *Corps Memo.*, No. 620, Part II., para. 311.

The establishment of the railway companies in pcace and war is as under (" Regimental Establishments, 1909–10," pp. 22 and 23; " War Establishments, 1909–10," p. 134) :—

		(a). Peace.				
		Officers,	N.C.O.'s and Men.	Horses.		
Sth (Railway) Company	——İ 	3	76			
10th (Railway) Company		3	77	ļ —		
53rd (Railway) Company	•••	3	76	ļ —		

	(b). War.					
	Officers.	N.C.O.'s and Men.	Horses.	Vehicles.		
Sth (Railway) Company	 7	2.47	4	I O		
10th (Railway) Company	 7	2.17	4	10		
53rd Railway) Company	 7	247	4	°1		

* Cart, forage, for technical equipment.

C)ne Railway	y Comj	any.			Peace.	War.
- Blacksmiths					ļ	5	15
Boilermakers						2	Š
Bricklayers						_	4
Carpenters and]			•••			9	41
Clerks			-,			<u> </u>	2
Collarmakers			•••				I
Coppersmiths			•••	•••			.4
Draughtsmen (M			•••			_	2
Electricians	100 manna					ī	2
Engine Drivers,	Field					221	36§
Fitters and Turn						is	40
Instrument Repa							i i
Masons (Builder							6
Masons (Stonecu						_	2
Moulders						2	4
Painters							i
Platelayers						4	9
Plumbers and G							4
Riveters						9*	21
Sawyers							6
Shoemakers						-	L L
Signal Fitters						_	2
Surveyors	•••				1	-	47
Tailors					i		1
Telegraphists (C							i
	Permane	nt Lir	ie)				2
	Field Lin		•••				2
Tinsmiths		-, 					3
Wheelwrights				••••			2
Whitesmiths	• • •						3
	Total					69‡	230§

The establishments by trades of the dismounted rank and file of a railway company are as under :--

* Sth Company, Royal Engineers, to have 1 tailor and 1 shoemaker in lieu of 2 riveters.

[†] From the Ordnance Survey. They should be men thoroughly acquainted with the theodolite and level, ordinary topographical work, and drawing.

and drawing. ‡ In addition to the engine drivers, 8 sappers of suitable iron trades to be trained in "firing" duties.

§ In addition to the engine drivers, 14 sappers of suitable iron trades to be trained in "firing" duties.

The question of stores, other than technical, to be carried by the railway companies in the field depends entirely on the theatre of operations, and would be varied to suit the conditions of each locality, from information obtained beforehand.

For peace training a supply of all plant required for railway work is sanctioned and maintained at Longmoor.

For instance :---

Broad Gauge.—Locomotives, 3; rolling stock, 59 vehicles. Narrow Gauge.-1: various. " Rails.-9 miles (60 lbs.), single track. Sleepers.—18,000. Bridging Timber. $-12'' \times 12''$, 10,000 F.R., together with a liberal supply of other timber, such as $18'' \times 9''$, $16'' \times 9''$, $9'' \times 3''$, $12'' \times 3''$, $12'' \times 6''$, and $6'' \times 8''$.

ROYAL ENGINEER L. OF C. UNITS.

Unit.	Place of Mobilization and Personal Equipment.*	How Allotted on MoLifization.'
Railway Company	Longmoor Camp.	L. of C. Troops.

* Owing to lack of storage accommodation at Longmoor, the Reservists' clothing, etc., is at Aldershot; the arms, accoutrements, and technical equipment are at Chatham. Ultimately these will be stored at Longmoor. A.F.G. 1098-36 is the Mobilization Store Table for a railway

company.

R.E. WORKS ABROAD. A SUGGESTION.

By CAPT. E. H. HARVEY, LATE R.E.

In the course of an R.E. officer's service in peace time, as well as during active operations, one of the most notable features in his work is the great diversity of the local conditions affecting the method of its execution and of the materials employed, especially on foreign service. Whenever he joins at a colonial station he is called upon, at comparatively short notice, to deal with conditions and local necessities more or less new to him, and until he actually arrives at the station itself there is not, so far as I am aware, any compact and easily accessible source of information, such as exists at home in the form of numerous builders' handbooks, and of the Barrack Synopsis.

Accounts of great interest and value of recent works in India and elsewhere are published at times in the R.E. *Journal* and *Professional Papers*; but the idea of helping officers proceeding abroad for division and ordinary duties, by publishing a series of short compact accounts of the "works conditions" of the various stations, similar to the Descriptive Accounts that deal with more general and personal information, seems to be well worthy of consideration.

I should not suggest that India be included in such a compilation as that country has its own varied conditions, but that the accounts should be drawn up for the other colonial and foreign stations where the R.E. are normally stationed, leaving the question of works in India to those in authority there, and to the officers employed by them.

The form in which the information might perhaps be published would be in a book somewhat similar to the Barrack Synopsis or Drainage Manual, as being preferable to a series of small pamphlets, and more suitable for a D.O.'s office table. The book including various sections for the various stations—might, if necessary, be in two parts, say "Eastern" and "Western." It might include a few line plans and elevations of local types of building, if space allowed, and in the case of the smaller stations a rough sketch-map to indicate the relative positions of the military stations and R.E. offices (omitting of course detail and information shown in the regular maps).

In regard to the headings under which the information is collected, I should suggest the following :--

Climate and soil, the former with special reference to siting questions; the prevailing winds; the general character, seasons, and duration of storms, as affecting the aspect of buildings on exposed

sites; the special liability of any localities to frequent damage by wind or lightning; and the rainfall.

The general type of European houses as provided by local authorities or built privately, with regard to size of verandahs, cubic air space, and usual dimensions of rooms, etc. The importance of ample verandah space—well known to all who have served in the tropics—with room for sleeping, might be most strongly emphasized, and also the absolute necessity in many cases of "chicks," and, in exposed sites, of strong shutters to keep out violent rains. Again, the need in certain localities of each quarter having its own bathroom, and the nature of the sanitary arrangements and drainage. I do not mean that such requirements are not largely known, but I venture to think that they might be very clearly laid down, for the stations that are concerned, as a guide to officers entering upon new duties in a strange locality, and having perhaps to prepare designs at once.

Local building materials would naturally claim an important section; the names, nature, and characteristics of local timber, the quality of brick and stone procurable locally, and any special local roofing materials, such as "attap," for instance, with its average "life" and cost. The district "Schedules" of course contain this, but a good deal of the information (in general terms) might conveniently exist in the form I suggest, not only for the private use of officers when changing station, but also for the use of those whose duty it is to overlook projects from a distant station.

Suitability of special building materials, patent roofings, wall coverings, etc., to the climate in question might be a useful heading if the information could be conveyed without prejudice to the manufacturers.

Information in regard to any local colouring materials, paint, and so forth, roadmaking materials employed, nature of existing local drainage, water supply, fire protection, and conservancy might be briefly mentioned; where barracks exist in, or close to, large cities and towns; also the lighting in use, whether gas, oil, etc., and whether coal or wood is used for fuel.

The approximate time of transit of *stores* from home, and their method of delivery to the R.E. divisions. The local means of transport, with any peculiarities.

Finally, the *working hours* and general customs of the natives who may usually be employed on the works—a matter of some importance where different races find employment side by side in the same division. The trades in which special skill or otherwise is found locally.

These points could of course only be touched upon very brielly, much in the style of the Descriptive Accounts which I have referred to; but I think that such a compilation as I have suggested might be prepared locally without great difficulty in most stations, sufficient at least for the purpose of giving officers a reference book, and if interleaved with plain paper to a limited extent, could be revised or corrected as necessary by those using it, and generally kept up to date.

WIRELESS TELEGRAPHY.

By LIEUT. A. C. FULLER, R.E.

My excuse for writing this article is as follows:—There must be several officers who, having passed through the R.M.A. and the Chatham courses before wireless telegraphy was of practical importance, have since been unable to give up the necessary time to enable them to acquire a working knowledge of this most interesting subject. There are of course several excellent and standard works on the subject written by the most able scientists of the day, but most of them are of an advanced nature and deal largely in mathematical proofs of theories now universally acknowledged.

To extract the main practical points from such works requires a considerable outlay of time and trouble, and the object of this article therefore is to save this by attempting to bring them out—generally without proof or detailed explanation.

Whenever a spark (which may be termed a snap spark in differentiation from an arcing spark) occurs, electric waves are propagated through the surrounding medium. These waves travel with the velocity of light, and they can be refracted, reflected, and brought to a focus, as light waves can, by the interposition in their path of suitable arrangements, but these properties have not at present any very direct bearing on the principles of wireless telegraphy. A fact of primary importance however is that every electric wave has a definite length, and waves have been produced with a length of a few centimetres only, and can be created with a length of several hundreds of miles.

The length of wave depends on two properties of the circuit in which the snap spark occurs, viz., on its capacity and its inductance. The wave lengths in common use are of 600 and 300 metres, and these are the lengths laid down for universal use by the Berlin Radiotelegraphic Convention.

The next point to consider is how these waves are produced for practical wireless telegraphy. The essential point is that the discharge made manifest by the snap spark should be oscillatory.

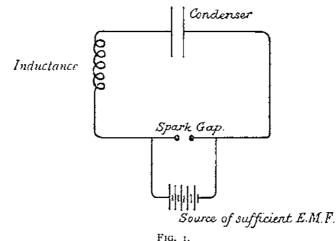
To obtain a physical oscillation, what Dr. Fleming terms a "selfrestoring displaceability" is required, and this displaceability must have mass or inertia. A weighted spring, for example, is capable of oscillation since it has both these elements. In a similar way for electrical oscillation, electrical stretchability—if the word may be used—is required, and also electrical inertia, and these two are the equivalents of capacity and self-induction—or inductance. The behaviour of a weighted spring is worth attention, and its oscillations under varying weights and displacements give an insight into electrical oscillation under varying conditions of inductance and capacity.

Further, in order to break down the insulation of the air and to allow the spark to pass, it is obvious that a very considerable electrical pressure is required. Dr. Fleming states that to produce a spark of only 1 c.m. in length requires 30,000 volts.

It will be seen therefore that the essentials to produce these electric waves are :—

(1). A circuit of low resistance made up of capacity and inductance in series with a spark gap.

(2). A means of applying the necessarily high electrical pressure.



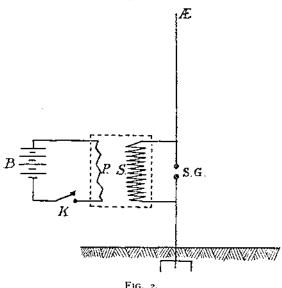
The fact that oscillations do occur in such a circuit has been proved beyond question, the oscillatory spark having frequently been photographed. These oscillations do not last for ever, but die away, like those of a displaced spring, whose oscillations gradually decrease in amplitude till the spring comes to rest. The term "damped" is applied to those oscillations which die away more rapidly, and "undamped" to those that are more prolonged. If we consider a swinging pendulum, we know that left to itself it will cease to swing. As the energy of a swinging pendulum is dissipated by friction, by overcoming the resistance of the air, etc., so the oscillations of the electric discharge gradually die away, the energy in this case being dissipated in the following ways :—

- 1. By heating the dielectric of the condenser.
- By generation of heat owing to the resistance of the oscillation circuit itself.
- 3. By inducing currents in neighbouring conductors.
- 4. By the generation of electric waves travelling out into space in all directions.

For purposes of distance signalling, it is obvious that No. 4 is the most useful outlet for the energy of the discharge.

It is also evident that where the discharge circuit is arranged to have great radiation, the energy is rapidly dissipated, and the oscillations therefore are heavily damped, and the wave train is of very short duration.

The simplest practical arrangement for the production and radiation of these waves is as shown in Fig. 2 :-



B is an accumulator battery or other source of power.

K is a key.

PS the primary and secondary of an induction coil used to obtain the necessary voltage.

SG the spark gap.

Æ the aerial wire which contains in itself an inductance, and has a capacity in relation to the earth.

An arrangement such as this has good radiating power, but its oscillations are heavily damped. This was the original Marconi arrangement. A circuit such as illustrated is termed an open circuit with plain aerial, and the discharge therefrom is often termed a whipcrack discharge.

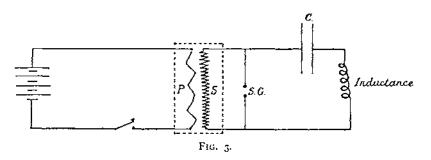
Before following this subject any further a few words are necessary on "electrical tuning," first developed by Sir Oliver Lodge. Every oscillation circuit has what is termed an oscillation constant, dependent upon the values of its resistance, inductance, and capacity, and the length of the wave radiated is dependent on this oscillation constant. Now a sending circuit can be adjusted, by alteration of its capacity and inductance, to radiate waves of any length within limits;

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and this alteration of capacity and inductance, or either of them, can easily be effected with suitable instruments. A suitably equipped station can therefore radiate waves of a known and predetermined length. The following is a good analogy to electrical tuning. The human car is sensitive to, and able to receive, a wide range of sound waves, the reason being that its natural vibrations are heavily damped, i.e., it is not a persistent vibrator. On the other hand, a tuning fork, which is a persistent vibrator, will respond only to a note in tune with it, *i.e.*, to some sound-producing body with the same oscillation constant. If a persistent vibrator is exposed to the waves emitted from another persistently vibrating body of a different oscillation constant, one wave arriving will counteract, or at any rate oppose, some other of the train, and the effect will be to render the receiver incapable of steady vibration. That is to say, a persistent vibrator will readily respond to another only when in tune; it will however respond over a much wider range to a heavily-damped vibrator, though the wave received to set the oscillation in motion must in this case be much more powerful.

The effect of two tuned persistent oscillators can best be compared with the effect that a series of pushes or impulses, properly timed, will have on a swing. If the swing receives a single impulse of great - power, it may reach the same amplitude. This is the case of a heavily damped radiator. If however a series of pushes are given, not properly tuned, it is obvious that the swing will attain no great amplitude, and will merely receive a series of jerks, one acting against another. This is the case of a persistent oscillator exposed to the radiations of another out of tune with it.

In the case of the timed impulses, the longer the impulses continue the greater becomes, up to a limit, the amplitude of the swing, and this is the key to the sensitivity of syntonic or tuned telegraphy, where it is the cumulative effect of incoming impulses which finally operates the receiving arrangement. It must of course be understood that the time taken in this accumulation is infinitesimal.



In Fig. 3 the circuit has all the necessary conditions for oscillation, but very little radiating power; hence the oscillations are only slightly damped. If now it has inductively coupled with it another with the same oscillation constant and considerable radiating power, an efficient sender for wireless telegraphy has been provided.

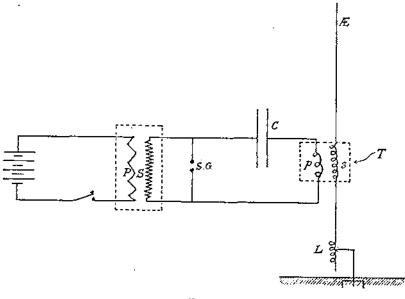


FIG. 4.

In Fig. 4, the portion marked T is an oscillation transformer, whose action is purely inductive; p and s are the primary and secondary coils respectively of this transformer. The object to be attained is good radiation, with persistent or slightly damped oscillations. The condenser C generally consists of a battery of Leyden jars. Referring to this arrangement, Dr. J. A. Fleming says: "The circuits are more or less closely coupled by varying the distance between the primary and secondary (of the oscillation transformer). By the adjustment of the variable inductance L between the earth plate and the secondary circuit of the oscillation transformer, and by variation of the capacity of the condenser in the primary circuit, the two circuits are brought into resonance (or tune) with each other. When oscillations are set up in the closed circuit by the discharge of the condenser, the energy stored up by the Leyden jars is gradually drawn off and radiated by the open circuit. The closed circuit then forms a reservoir of energy, and is in itself a slightly damped circuit or persistent oscillator. The open circuit is a good radiator and is kept supplied with energy from the reservoir. Hence we have a much more persistent train of oscillations set up in the aerial at each discharge than would be the case if the only storage of energy were that due to the small capacity of the aerial."

From the above it will be seen that the means exist of radiating persistent trains of waves, and these can make themselves felt on suitably tuned receivers. It remains to consider how these waves are detected.

There are various classes of detectors, the earliest to be used practically being of the filings type.

When metallic filings are in loose contact, they offer an enormous resistance to the passage of an electric current. It has been found however that the effect of Hertzian waves falling on them is to greatly reduce their resistance and thereby to enable a current to flow through them. Here therefore is a detector. Sir Oliver Lodge gave this phenomenon the name of coherence, and the glass tube in which the filings are generally arranged is now known as a coherer. Once having been affected by a wave, the filings remain in their state of coherence, or lowered resistance, until they receive a mechanical jar or tapping back, termed decoherence. This need for decoherence is a practical drawback to the use of this type of detector, for, in order to receive a series of signals, some tapping-back device must be arranged, thus introducing a complication in the receiver.

Almost any loose contact is improved as a conductor by the reception of Hertzian waves, and perhaps one of the most sensitive of all detectors is the Lodge's single-point coherer (Fig. 5).

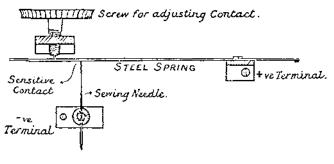


FIG. 5 .- Plan of Single Point Coherer.

This coherer will work without any decoherence, but is uncertain in action, for the contact has to be extremely light and accurately adjusted for good results, and an extra strong impulse will sometimes put it out of action.

Wireless telegraphy is also indebted to Lodge, Muirhead, and Robinson for their wheel coherer (Fig. 6), which is certain in action and very reliable and sensitive. The disadvantage is, however, that it requires clockwork to drive it, at once introducing a further complication.

This coherer consists of a steel wheel with a very fine, almost razorlike, edge. This wheel is made to revolve with its edge just making

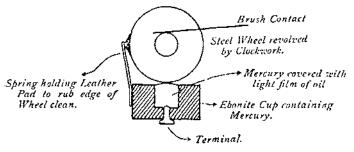


FIG. 6.—Sketch to show Wheel Coherer.

contact with mercury covered with a light film of oil, and held in an ebonite cup. The oil prevents good contact between the disc and the mercury, but when a wave falls on the coherer, the oil is perforated and a current from a shunted cell (see later diagrams) can pass momentarily. The wheel revolving draws in the oil again and the contact is broken. A slight milling on the edge of the wheel is said to be an improvement to this coherer.

Marconi devised in 1902 two forms of magnetic detector. These detectors depend, for their action, on the power of Hertzian waves to magnetize iron. A magnetic detector of Marconi's latest pattern is an extremely sensitive form, and is used for long distance telegraphy.

Another recently developed form is the crystal detector. A mass of carborundum crystals, held between spring clips of metal, is found to act as a detector. There are two ways in which this detector can operate :---

- (a). The crystal is possessed of a unilateral conductivity, *i.e.*, it will allow a current to pass through in one direction and not in another; hence it will rectify the oscillations received and allow them to pass through as a direct current.
- (b). The crystal has a curved characteristic and does not obey ohms law, as the following diagram shows (see Fig. 7), *i.e.*, the conductivity is a function of the voltage.

This crystal (with certain others) can be used without a local cell to convert oscillations into direct current to affect a telephone or galvanometer. Also, since the conductivity is more increased by the addition of voltage than decreased by the subtraction, oscillations are plainly heard in a telephone in series with a local cell and the crystals (see later diagrams).

This crystal forms a most useful detector, and has been much used by the writer; once adjusted to the correct pressure between the clips with the correct voltage, it requires no attention, and remains ready for use for an unlimited time. I am unable to give any definite figures as to its sensitivity, but should this be satisfactory it appears

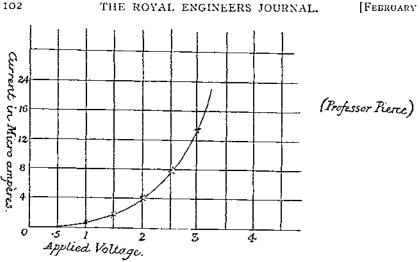
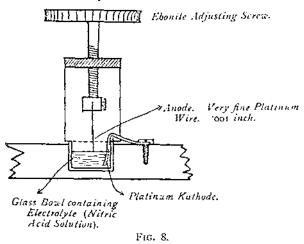


FIG. 7.

an ideal detector for military requirements. Other detectors are those dependent on thermal effects, but the writer has had no experience of these, and does not propose to describe them.

Another, and perhaps the most generally useful type of detectors, are those known as electrolytics. They depend for their action on the power of oscillations to depolarize any very small metallic or carbon surface immersed in an electrolyte. These detectors are made in many forms. An ordinary form is as follows :---

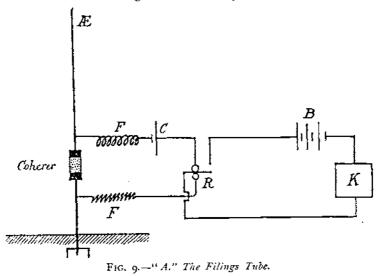


On passing a current through this detector from a shunted cell the electrodes become polarized, and the current ceases, or nearly ceases, to flow. The reception of a wave depolarizes the anode, thereby reducing the resistance of the detector and momentarily allowing a current to pass, which again sensitives the detector by repolarizing the anode.

There are other forms of detectors in great numbers, but the types

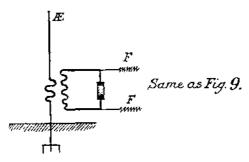
given are those commonly met with. It is interesting to notice how the three main effects of an ordinary direct electric current have been utilized for the detection of these electric waves. In order to be affected and to render manifest signals, these detectors must be inserted in a suitable circuit.

The following diagrams show circuits suitable for the various classes, the oscillation circuit being shown in heavy lines.



FF are choking coils to confine the oscillations to the oscillation circuit only, and to prevent their energy from being wasted in the other parts of the receiving arrangement. C is the cell which passes a current through the coherer when it is rendered conductive by the reception of a wave. R is the relay worked by the current from C, and this relay in its turn closes the circuit of B (henceforward termed the manifestor circuit) and operates K, which may be a Morse printer, a siphon recorder, or any device to record the reception of the wave train. No tapping or decohering device is shown in the diagram.

There are many modifications of this circuit, and Marconi improved it by inserting a jigger, or specially designed oscillation transformer, therein, the object of which was to step up the impulses and minimize slight atmospheric effects.



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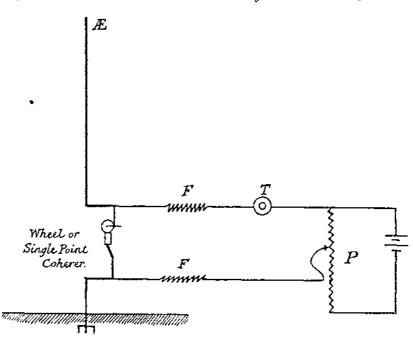
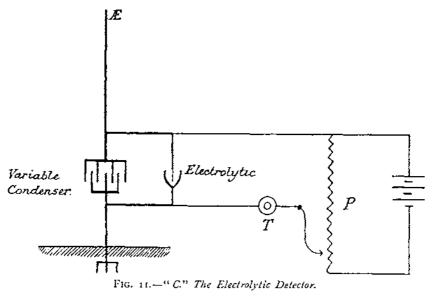


FIG. 10.-" B." Single Point Coherer. Lodge Muirhead Wheel.

In this arrangement a telephone, T, is the manifestor, and no relay is necessary. The carborundum crystal detector can also be used on this circuit, but would usually have a jigger to step up the impulses.

P is a potentionmeter for regulating the voltage applied.



Here again a telephone is the manifestor, and no relay is required. In this circuit, the less of the anode there is in the electrolyte, the more sensitive the device becomes. The voltage must be adjusted to be just sufficient to pass a current through the detector, which current can be heard as a slight roar in the telephone. This roar must be reduced to a minimum when the detector is adjusted for reception.

Any of these circuits will respond readily to a heavily damped radiator, that is to a whiperack discharge, if the distance is not too great; and at short ranges they will respond to radiators having a wide range of oscillation constants, *i.e.*, they are sensitive to various wave lengths.

It has been found however that they will respond at much longer ranges to radiators in tune with themselves, *i.e.*, with those having the same oscillation constants or wave length.

Further, it has been shown that if the radiator sends out persistent wave trains or lightly damped oscillations, then the distance at which a syntonized receiver will respond is yet further increased.

In order for a receiving station to be able to respond to waves of various lengths, its oscillation circuit must be equipped with arrangements for regulating the capacity and inductance, *i.e.*, with variable condensers and coils with sliding contacts to vary the inductance.

- (a). For a given power a tuned station can receive messages from two to three times as far (or more) as an untuned one can.
- (b). Other untuned stations cannot receive the messages, even though considerably nearer the sender.
- (c). Messages from an untuned station do not interfere with and render unreadable the signals from the distant tuned station, even though the latter is much further off.

The extent to which these advantages hold, depends upon the "sharpness of tuning" of which the system is capable. Circuits have been devised which will respond to their own wave length, but utterly fail to accept a signal with a difference of even r per cent. in the wave length; that is, they will respond to a 600-metre wave and be in no way affected by one of 593 metres.

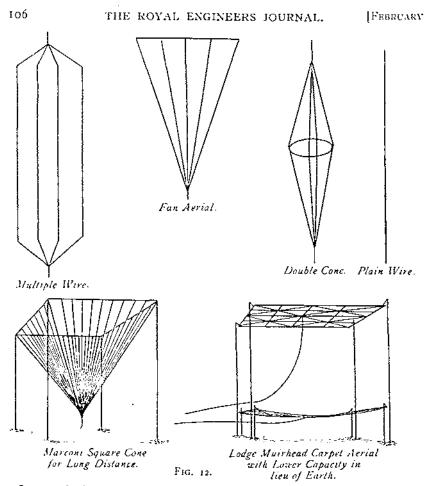
The methods employed for power generation are either :--

Direct current from accumulators or { With induction coil and some form of interrupter.

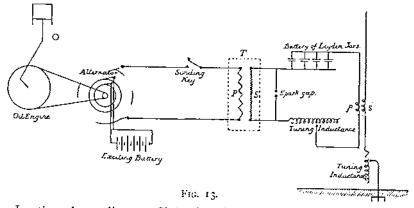
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An alternator, driven by oil engine, { With an alternate current turbine, or other source of power. } transformer.

Many types of aerials also are employed, and in all cases the same aerial, or portions of it, are used for receiving and sending. The commonest forms of aerial are as shown in Fig. 12:-



In conclusion, the following diagram shows a complete practical arrangement for transmission :---



In the above diagram T is the alternate current step up transformer, and *ps* primary and secondary of oscillation transformer.

It is also worth noting that a small exciting dynamo driven from O would be a better arrangement than the exciting battery.

THE FYERS FAMILY. (Continued).

By Col. Robt. H. Vetch, c.B., LATE R.E.

CHILDREN OF MAJOR-GENERAL PETER FYERS, C.B., COLONEL COMMANDANT, R.A.

By his marriage with Frances (born 1791, died 1867), fourth daughter of John Bolland, M.P., of Mark Lane and Clapham, and of Elizabeth, his wife, daughter of Mr. Gipps, of Hythe, Kent, M.P. for Ripon, which took place at Clapham on the 7th November, 1812, Major-General Peter Fyers had four children, viz.:—

1. Henry Thomas Fyers, Captain, R.A., and Lieut.-Colonel Commanding Royal Lancashire Artillery Militia (see below).

2. William Augustus Fyers, Lieut.-General, K.C.B., Colonel of the Durham Light Infantry (see below).

3. Charles Peter, born at Woolwich, 29th August, 1816, and died in childhood (1820).

4. Elizabeth Catherine, born at Edinburgh on the 21st May, 1827, died at Yateley, Hants, unmarried, on 3rd October, 1907.

LIEUT.-COLONEL HENRY THOMAS FYERS, ROYAL ARTHLERY.

HENRY THOMAS FYERS, the eldest son of Major-General Peter Fyers, was born at Woolwich on the 25th January, 1814. He joined the Royal Military Academy at Woolwich as a Cadet on the 14th April, 1825, and was commissioned as a 2nd Lieutenant in the Royal Artillery on the 26th July, 1831. A year later he was promoted to be 1st Lieutenant. From July, 1840, he was Secretary of the Royal Artillery Institution at Woolwich for a year. He was promoted to be 2nd Captain on 13th April, 1842, and 1st Captain on the 13th April, 1847. He retired on half-pay two years later. He then, as a Captain, joined the Royal Lancashire Artillery Militia, of which he eventually became Lieut.-Colonel Commanding. He died, unmarried, at Kensington on the 21st July, 1886, and was buried at Kingswood, Surrey.

LIEUT.-GENERAL SIR WILLIAM AUGUSTUS FYERS, K.C.B., COLONEL OF THE DURHAM LIGHT INFANTRY.

William Augustus Fyers, second son of Major-General Peter Fyers, was born at Woolwich on the 2nd July, 1815, shortly after his father had been appointed to the command of the Rocket Brigade. He was educated at the Edinburgh Academy, where he acquired a taste for mathematics, science, and drawing, and an aversion to classical literature. Here he learned to fence, and he became a very expert swordsman, and as he grew to a height of 6' 4", he was not very easy to approach. On October 17th, 1834, he was commissioned as Eusign

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in the 40th Foot, and in June of the following year he sailed with the regiment for India. He was promoted to be Lieutenant in May, 1836.

Fyers had been quartered with his regiment for some two years at the sleepy little station of Disa, in the north-west of Gujerat, when they heard with joy of what they hoped would be a prospect of active service. On the 1st October, 1838, Lord Auckland, the Governor-General of India, had issued his famous "Declaration" on the subject of Afghanistan. Intrigues had been set on foot by Russia at the Courts of Teheran and Kabul, which threatened the interests of British India; Dhost Muhammad, at Kabul, and his brothers, who held sway at Kandahar, were in agreement with Persia in the line of policy to be pursued; while the British envoy, Sir Alexander Burnes, had returned from a commercial mission to Kabul, which had proved a complete failure. Moreover, Persia had attacked the Khan of Herat and was besieging the city of Herat, assisted openly by Russian officers and Kabul and Kandahar Afghans.

The "Declaration," or "Manifesto of Simla," as it was sometimes called, set forth how seriously the policy of the Afghan chiefs was opposed to British rights and interests, and declared the intention of the Government to replace Shah Shuja on the throne of Afghanistan, from which he had been driven in 1809.

Since that date, as a matter of fact, Shah Shuja had made repeated and unsuccessful endeavours to recover the throne, the country since his expulsion being parcelled out amongst the Muhammadzai Sardars.

In pursuance of the policy of the "Declaration," measures had been already taken by the Government of India to send a large force to Afghanistan. Two divisions of the Bengal Army were assembled at Firozpur by the end of November, 1838, and a Bombay division was sent at the same time to the mouth of the Indus, whence it marched to Haidarabad. In December the 40th Regiment was ordered to hold itself in readiness to proceed to Lower Sind. Great excitement prevailed, as it was hoped and expected that the regiment was to form part of the Bombay Division. All the heavier was the disappointment which ensued when it was found that the 40th was to form part of a reserve force to be assembled under Brigadier Valiant, K.H., who had been commanding the regiment, and was to be stationed in Lower Sind, with headquarters at Karachi, then held by Baluchis.

On leaving Disa, on 4th January, 1839, the regiment, mustering 650 bayonets, marched to Mandavi, on the coast of Kach, some 240 miles distant. There they arrived on the 27th January, to find awaiting them H.M.S. *Wellesley* (74), bearing the flag of Rear-Admiral Sir Frederick Maitland, one of the Company's steamers with the 2nd Bombay N.I. on board, the transport ship *Hannah*, and a fleet of country boats for the conveyance of stores, annunition, etc. A company of Bombay Artillery was also there. Fyers embarked with his regiment, under Lieut-Colonel Powell, who had just arrived to take command, on board H.M.S. Wellesley, and the artillery on the *Hannah*. The next day the Admiral set sail for the Hajamro, mouth of the Indus, and, anchoring there, was joined by H.M.S. Algerine and two of the Company's cruisers.

On the evening of the 31st January orders came that the force was "to proceed to Karachi and take it," and the following evening the flotilla anchored off Manora Fort at the entrance to Karachi Harbour. Next morning H.M.S. Wellesley cleared for action, and the fort was summoned by a flag of truce sent ashore. The commandant of the fort replied, "I am a Baluchi, and will die first." The artillery and a wing of the 40th were then disembarked on the western side of the fort, under cover of H.M.S. Algerine and of the Company's ship Constance, which stood in for the purpose. A second flag of truce was then sent, but the sturdy commandant, although he knew that the fort must fall to such a strong force, replied in the same strain as before : "The fort may be stormed, but will never be surrendered," and without further parley he opened fire. The remainder of the 40th was then landed. The Wellesley opened a broadside fire, and in an hour's time had dismantled the breastwork of the fort, and the 40th were ordered to attack. But the enemy fired not another shot; the British flag was soon flying on the fort, and many of the garrison were captured endeavouring to escape. Next day the city of Karachi agreed to terms, and on the 4th February was occupied by the 40th Regiment. Thus Fyers saw his first action in an almost bloodless victory.

At Karachi the Brigadier remained, and it became the headquarters of the reserve. For over 18 months Fyers was at Karachi. In the meantime the army invading Afghanistan had entered Kandahar in April, 1839, stormed Ghazni in July, and placed Shah Shuja on the throne at Kabul in August. In the autumn the country seemed quiet, and Sir John Keane, the Commander-in-Chief in India, returned to India, handing over the command in Afghanistan to Sir Willoughby Major-General Willshire also returned to India with the Cotton. Bombay column, having stepped aside on his way to capture Kalat, in Baluchistan. The troops in Afghanistan were then dispersed about the country, those in Eastern Afghanistan under Brigadier Sale, and those in Western Afghanistan under Major-General W. Nott. The Commander-in-Chief, Sir Willoughby Cotton, and the headquarters staff were at Kabul with the British Envoy, Sir William MacNaghten, but Cotton was succeeded at the end of 1840 by General Elphinstone. During these events in Afghanistan the 40th Foot were eating their hearts out at Karachi, their life being varied by a bad outbreak of cholera in March, 1839, which carried off their colonel, Lieut-Colonel Powell, and another officer, and nearly a year later by the presentation of new colours to them by Lord Keane, after his return from Afghanistan.

At last however Fyers was to see some active service in Afghanistan. In the autumn of 1840 the 40th were ordered to Sakkar, and marched

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very leisurely there, experiencing much sickness on the way. Again, on the 2nd January, 1841, they formed part of a large force which marched from Sakkar to Quetta by Dadur and the Bolan Pass, arriving at Quetta in April. Here dysentery and fever played havoc with the troops, and Fyers suffered a good deal from the latter; but they remained there until October, when they were ordered to join General Nott at Kandahar. They marched through the Khojak in company with a battery of artillery, and arrived at Kandahar on 21st October, while Nott was away from Kandahar on the Derawat Expedition.

The country at this time was in a state of ferment from one end of it to the other. A growing bitterness with the prolonged stay of the hated foreigner was brought to a climax by the unwise decision of the Indian Government to reduce the stipends paid to the fierce tribes who held the defiles between Kabul and Peshawar; there was an insurrection in the Kohistan; then Sir Alexander Burnes, his brother, Lieut. C. Burnes, of the Bombay Army, and Lieut. William Broadbent, Bengal Engineers, were murdered on the 2nd November at Kabul, where fighting went on during the month that followed ; after that came the murder of the British Envoy, Sir William MacNaghten, at Kabul, on the 23rd December; and finally, in January, 1842, the annihilation of the whole of the Kabul Brigade, on their way back to India, in the defiles of the Kurd Kabal and the Pari Dara, Dr. Bryden alone escaping to report the disaster to General Sale at Jalalabad. In the Kandahar command Nott took prompt measures. Some irregular cavalry mutinied on their way to Ghirisk and murdered their officer, and were immediately pursued and punished. Early in January, 1842, a large force of Afghans, under Suftar Jang, son of Shah Shuja, and Atta Muhammad, a Ghilzai chief, assembled near Kandahar, and Nott marched out to meet them with a force which included the 40th Regiment. This regiment, with the 2nd and 16th Regiments, formed the right column, under Colonel MacLaren, who was directed to advance to the Arghand-ab River, through the Baba Wali Pass; here a junction was effected with the left column. Before the columns crossed the river the enemy kept up a continuous fire. After crossing and wading through a swamp, up to their knees in mud, the line charged and defeated the enemy, who were greafly superior in numbers.

This was the first big action in which Fyers had taken part. General Nott now decided to camp his force outside Kandahar. Not until the 21st February, 1842, did Elphinstone's orders to evacuate Kandahar reach Nott, and then he refused to act upon them, as General Sale had done at Jalalabad. On the 7th March Nott again took the field, and drove the enemy across the Tarnak and over the Argand-ab, the 40th Regiment taking part in the fight. Successful sorties were made from Kandahar, in which Fyers took part, on the 25th and 26th, after which the garrison was left unmolested for some time. Reinforcements arrived in May, under Major-General England, who met with considerable resistance in coming up, and was assisted by a force sent out to see him through the Khojak.

Among a number of letters written by Lieut. Fyers to his family from India and Afghanistan the most interesting would have been those that dealt with the march from Kandahar to Kabul; but they were lost in transit, and I am only able to give extracts from a few letters written by him from Kandahar, and after leaving Kabul for India. The following refer to the earlier operations from Kandahar in 1842:—

Extracts from a letter from Lient. W. A. Fyers, 40th Fool, to his parents, dated at " Candahar, 23rd April, 1842."

"In the last letter I wrote to you, which I believe never got over the Cojuk Pass, I had described to you how things were here and up at Cabool, and how I was getting on; but all that is material for you to know is that we passed through a very pleasant though cold winter with much satisfaction, and with improvement in health, having got into a comfortable range of barracks, where we all burnt good, cheerful fires, and we had plenty of exercise, but were constantly hearing reports of reverses to our people in the north, which have mostly all turned out to be too true.

"Few things that I recollect in the annals of English history can come up to the late tragic scenes near Cabool. The conduct and measures of the Envoy must have been in the last degree weak, and I must add foolish. The man himself may have been what you call a talented man, and a capital linguist, and otherwise accomplished, but he was most certainly too deficient in understanding to deal successfully with such a people as he was placed to have his eye on. But he is not the only specimen of that sort placed in positions of the greatest responsibility through the same error.

"In my last I told you of a trip we were about to take after the enemy, who were harassing the whole country round and stopping our supplies, which you may believe we did not admire. General Nott therefore took out a large force of about 5,000 men. The first day we came suddenly on a body of the enemy's cavalry, who immediately made the dust fly in clouds from their horses' feet and disappeared, some of our cavalry and light guns after them; but they got off. The next day we came on them in large bodies about some strong villages. We formed into line and advanced on them, skirmishing with cavalry and light companies, before the fire of which they slowly retired; in this way we advanced, driving them before us for 3½ hours, some of the 12-lb. shot and shrapnel now and then knocking over horses and riders. They made their way over a deep channel of a river called the Turnau, when we dropped our pursuit and encamped. No tents except Mess tents, in which the officers slept together.

"Next day, as we were passing under a steep and rugged hill, a fellow took a shot at the General, riding at the head of the column. We then saw a number of them, among the rocks, and proceeded to turn them out. . . We had several marches of this kind and skirmishes, but

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the main body would not stand; so having been out a week, we returned to Candahar.

"There we found that the enemy had made a forced march on the city, and had, two nights before our arrival, attempted to take it. They brought up to one of the gates after hours a number of ass-loads of firewood. The men with these were told that the gates were shut and could not be opened. They then asked for permission to let their loads of wood remain there until the morning, which was foolishly granted them. Some time afterwards the gate was found to be on fire and nearly demolished. The enemy, setting up a yell, then came on to the attack. They were however met with a deadly fire from the walls. Some of the enemy, well inflamed with opium, got in to the gate, but were either shot, bayoneted, or cut down. They continued to press on, but could make nothing of it, and our people, firing into their dense mass, killed and wounded great numbers of them. In about three hours they made the best of their way back again, having this time made rather a determined effort; two false attacks were made on other gates.

"Previously to our starting (on the week's scouring expedition) all those whose cast or character made them obnoxious were turned out of the city, and the arms of all within were seized and secured as far as was practicable. If this had not been done, we might have found ourselves in the wrong box.

"You will be fortunate if this letter ever reaches you. What is taking place at Quetta nobody here knows, except that the enemy, failing here, have taken possession of the Cojuk Pass, and have, we hear, been fighting with Colonel England, of the 41st, who, as far as we can ascertain, attacked their entrenched position and had a hard fight. Two officers were, we hear, killed on this occasion, both of whom I know. . . . This packet will be taken by a brigade, which is to start from this in two days for the Cojuk Pass, by way of a demonstration on Quetta, and to assist Colonel England in uniting the force he has with our own.

"The army from Bengal has by this time, I should think, arrived at Cabool. The fate of Ghuznee is still very uncertain, whether it still holds out or not. There is only one regiment there and a small body of horse. I have my fears for its safety, though the arrival of General Pollock's Army at Cabool may be the saving of it.

"Temporizing with a people such as these Affghans has been the cause of all this reverse and difficulty.

"If the British Government intend still holding this country, they must do so with a gauntlet of mail and with the axe hanging over the head of any man likely to influence the rest. In short, we must treat them as our fathers would have treated such a set, and not in the milk-and-water style that has up to this time been the fashion.

"Young Gardner, who, you mentioned to me in your last, was on his way here to join the 38th (N.L.), has been, I find, some time waiting at Quetta for the marching of the force which is to join us. . . ."

On the 17th May, 1842, he again writes to his parents from Kandahar, and the following is an extract referring to the proposed relief of Kalat-i-Ghilzai :---

"I am writing this to you in all the bustle of a move, as we start for Kelat-i-Gilzie to-morrow morning. This strong fort is garrisoned by a regiment of Native infantry and some artillery, and is now invested by an army of Affghans, stated at 4, 5, and 6 thousand strong. We march about 6,000; it is said the enemy (Ghilzais) are resolved to give us fight, but this we always hear; they are, though, the most warlike of the tribes here, and there is some chance of their giving us an opportunity of wreaking our wrath. It is supposed that we only go a few marches beyond Kelat-i-Gilzhie, and then return again. We may, though, have to go to Ghuznee, which is now in possession of the enemy, and rattle them out of it, if they wait for us. I am very anxious to hear what the determination of the British Government is regarding this country. I am strongly for maintaining our possession of Candahar and keeping the road open by military posts; we should hold, I think, some place in Central Asia to maintain our interests, and merely as an advanced post. . . . It should be made a military colony, being for miles around capable of sustaining a large population. . .

"It was with great pleasure I met young Herbert Gardner." . . . He seems to like his regiment; they belong to the same brigade as ourselves, and are going with us. We (the 40th) will go nearly 600 into the field, all healthy and in capital blow. Kelat-i-Gilzhie is very elevated, so that we expect to have a cool march. . . The enemy's force are chiefly cavalry, and as we have a very small number of that arm, they of course can move round us, and go five times the distance we can in one day. We want one regiment of Light Dragoons; they would astonish them. . . ."

Lord Ellenborough, who had succeeded Lord Auckland as Governor-General of India, was bent on a policy of withdrawal, but General Nott was eager to advance on Kabul and join hands with General Pollock, who was pressing to be allowed to advance to the relief of Sale at Jalalabad. In the meantime Nott sent Colonel Wymer with a brigade, including the 40th Regiment, on 19th May to relieve Kalat-i-Ghilzai, of which the small garrison had so nobly held their ground during the winter. They arrived before Kalat-i-Ghilzai and successfully accomplished their task, and destroyed the fort, returning to Kandahar on the 10th June.

Extracts from a letter to his parents from Litut. Fyers, dated "10th June, 1842, Candahar Cantonments."

"You will see by the place I write this from that we have returned from the trip I mentioned in my last. We were then going immediately to Kelat-i-Ghilzie, and we supposed on to Ghuznee. Altogether it turned out pleasing enough, as it was by no means so very hot, and the marches were generally short and early over. The valley of the Turnau, through which the road passes, was then one unbroken field of wheat, from where we came on it to Kelat, about 70 miles, and is the same I fancy in its whole extent. Our force consisted of about 3,500 men of all arms, and we were as often as not pitched among the growing wheat—camels, men,

^o His cousin (see ante, under Gardner).

horses, etc., making, as you may suppose, pretty havoc among it. We did not see a single inhabitant the whole way up, so there was no doubt of their feelings towards us; they did not oppose our progress though by a single shot (strong as the country was).

"On our arrival at Kelat-i-Ghilzie we found that the body of the enemy who had been investing it for months, hearing of the departure of the force from Candahar, had had the boldness to make a very determined attack on the fort, but had been beaten back with great slaughter; two pits had been filled with the dead the enemy were unable to carry off.

"The garrison were in the finest health, though they had for some time been reduced in their rations; some Bengal artillerymen too, who had not had a drop of grog for months, were looking as hearty as possible.

"The fort is on a hill about § mile in circumference, of no great height. On its summit there is a mound which rises some height above the rest, and from which issue a number of springs, which, uniting, form a beautiful little stream of water, much more than sufficient to supply all the wants of a garrison. Very nice barracks had been built for officers and men, and it seemed altogether to be a place that, if supplied with necessary munitions of all kinds, might have set Affghanistan at defiance for a long time. I believe the enemy acknowledge themselves to having 500 killed and wounded, which may be reckoned at 400 killed, for very few recover who are in any way badly hit; they have a prejudice that a wound received from us must prove mortal.

"We remained at Kelat some days in great uncertainty as to whether we were to go on, or to retrace our steps. We believed the latter was our destination as no sooner had we arrived than the garrison was ordered out, and working parties from every regiment were in orders for the purpose of destroying the fortifications, etc. This took up several days, and no one knew for certain which way we should continue our march until we found ourselves in column looking to the west; then, thought I, the die is cast, they are resolved to make the most of a bad business by not squandering any more money on the country, and are going to quit. . . ."

Extract from a letter from Lieut. W. A. Fyers to his brother, Lieut. H. Fyers, R.A., dated "August 2nd, 1842, Candahar."

". . I want to let you all know that we are going on towards Ghuznee with a large proportion of the force now here. What we are really going to be about is still a secret, but it is thought not improbable that we will have the retaking of Ghuznee at least, and that eventually we are to go by a road, which leads through the Soliman Range, down to a place on the Indus called Dara-Ismael-Khan; there it is supposed we are to be an army of observation on the conduct of our uncertain allies, the Seiks. . . ."

The persistence of Generals Nott and Pollock at length induced the Governor-General to give way, and Nott was permitted to adopt "the line of retirement by Ghazni and Kabul." On the 30th July Nott received his orders; part of the force, including the sick, was to leave the country by Quetta and the Bolan, and the main body, composed of the *best troops*, was to *retire* to India by way of Ghazni and Kabul. Among the best troops was the gallant 40th Regiment. On the 9th August General England moved south and General Nott north. The latter met with no opposition until he reached Kula Azim, a march beyond Mukur, where on the 28th August a cavalry affair occurred, and on the 30th, near Ghoain, he encountered Shamsh-ud-din Khan, the Afghan commander, with a force of 12,000 men, who came holdly on to the attack, but was defeated with loss of guns, ammunition, and tents. The light company of the 40th brought in the captured guns. Shamsh-ud-din then fell back on Ghazni.

Ghazni was reached on the 5th September. Siege works were begun the same night. On the following morning it was found that the garrison had fled. The walls of the citadel were destroyed and the gateways demolished. The famous sandal-wood gates of Samnath were removed from the tomb of Sultan Mahmud, and carried off under escort of a company of the 40th, in accordance with the orders of the Governor-General. Resuming the march to Kabul, resistance was again encountered at Beni-badam on the 14th, when the 40th took possession of the heights, and at Maidan on the 15th, when the forts were destroyed. On the 17th September Nott encamped his troops near Kabul, where he found Generals Pollock and Sale had already arrived.

After resting for nearly a month at Kabul, the 40th Regiment set out on their return to India through the Khurd Kabul and Khaibar Passes. At Tezin on the 15th October the rear guard was attacked and was hard pressed; a wing of the 40th Regiment was sent to their assistance, and rushed the position of the enemy and drove them off.

On the 19th a subaltern of the regiment was wounded in a rearguard action and a number of men killed. At Ali Masjid the 40th was on rear-guard duty, and was much molested by the Khaibaris on the 4th November. At Fathgar the enemy made a final attack, and again the 40th were prominent in driving them off.

Extracts from a letter from Lieut. W. A. Fyers to his parents, dated from "Camp near Peshawur, 8th November, 1842."

"I am certain of the pleasure it will give you when you see by the place this is dated from that the fatigues and troubles of our Affghan War are over. I have written to you from both Ghuznee and Cabool, but I fear you never can get those letters.

"As to our campaign, I have never spent a pleasanter time, and from the day we started from Candahar have been as happy as you could wish me to be. Nott, by his decisive move from thence, obliged everybody to be on the alert, and the consequence has been unbroken success.

"The destruction of Ghuznee was most complete; that of Cabool very partial, and badly brought about through the want of energy of the other commander. If our General had got there first he would have given the people a few days' warning, and destroyed both town and defences in a way that would have given a lesson to such faithless wretches, and their children after them.⁴ I do not advocate cruelty, but ought not the crimes of an individual nation to be punished and have a mark put on it as much as when only individuals of a nation are concerned?

"I had no idea that the passes between this and Cabool were such places as they are. . . They are tremendous, and the getting through them by force of arms is certainly what could hardly be expected if the inhabitants were worth their salt. . . A day or two ago we (the 40th) were on baggage guard, or rather rear guard, from 6 in the morning until 6 the next—24 hours, but as to our defending the baggage, it was impossible, for there was a string of camels the whole way into the next camp—15 miles; the consequence was a good deal was lost, as you may suppose. We have had a number of scrimmages since entering the passes, in which we have not escaped scot free. These you will see by the papers. For my part, thanks to the Almighty, I have not had as much as a scratch . . . and have enjoyed very good health.

"It is thought we shall be at Ferozepoor about the 25th December. We shall, I daresay, be very gay."

On the 22nd December Nott's force reached Firozpur, and next day was received with great honour by the Governor-General, the Commander-in-Chief and their Staffs, and a brilliant assembly. Already Nott had received at Gandamak, on his way down from Kabul, a copy of the General Order of the 21st September, acknowledging the splendid services of the force he had commanded.

The part that Fyers's regiment had taken in the bold, successful march of Nott's force from Kandahar to Kabul, and thence by the Khaibar route to Peshawar, might well be deemed sufficient to initiate the young subaltern into the art of war, and as he was a keen soldier, his experiences in Afghanistan, as will be seen by his later achievements, were not lost on him. For his services in the campaign byers received the Afghan Medal, with clasps for Kandahar, Ghazni, and Kabul.

In the spring of 1843 Fyers returned to England, and from 1845 to 1847 was employed on recruiting service at Tonbridge, Kent. While there he had the misfortune to lose his father, the veteran Major-General Peter Fyers, who died in May, 1846, aged 77 years. Fyers was promoted to a company, after $12\frac{1}{2}$ years' service, on 7th May, 1847. Three years later he exchanged into the 4th Foot, and on 8th July, 1851, he again exchanged into the 1st Battalion of the Rifle Brigade, then stationed at Dover. When the service companies of this battalion were sent to South Africa to take part in the Kaffir War, Capt. Fyers's company was moved to Walmer. There, on the morning of the 14th September, 1852, the great Duke of Wellington died at Walmer Castle. Among the Duke's many distinctions he numbered the Colonelcy-in-Chief of the Rifle Brigade, and used frequently, when at Walmer, to visit the Depót Barrack Square of the Rifle

* Stocqueler, the biographer of Nott, says that Nott would have destroyed the Bala Hissar, but would have spared the city.

Brigade with his grandchildren. Capt. Fyers had the honour of commanding the Guard of Honour at the Castle while the Duke's body remained there until the 10th of November, and also of taking part in the State funeral procession from Chelsea Hospital, where it had lain in state, to St. Paul's Cathedral in London on the 18th November.

On the outbreak of the Crimean War, Capt. Fyers embarked at Portsmouth at the beginning of March, 1854, with a portion of the 2nd Battalion of the Rifle Brigade, in the transport Vulcan for Malta. On disembarking there on the 11th March, he stayed at the Palace, Valetta, with his cousin and uncle by marriage, His Excellency Colonel Sir William Reid, who was at the time Governor of Malta. Several of the chiefs of the allied armies were arriving at Malta during his stay there, and among others he had the opportunity of making friends with General Canrobert. Fyers sailed again at the end of the month in the transport Golden Fleece, with Major-General Sir George Brown, commanding the Light Division, for Gallipoli. During this voyage he must have made the acquaintance of a young fellow passenger in the Royal Engineers, who afterwards became famous, the late Lieut.-General Sir Gerald Graham, V.C., G.C.B., who sailed from Malta as a subaltern with two companies of Sappers and Miners in the same ship, while another fellow passenger, then unknown, but destined to distinguish himself in quite another line, was the Times correspondent, the late Sir William Howard Russell.

On arrival at Gallipoli, the 2nd Battalion of the Rifle Brigade was employed in throwing up the entrenchments across the isthmus between the Gulf of Saros and the Sea of Marmora, called the Lines of Boulair. Before moving to Constantinople, the opportunity was taken of showing off the British troops at a review before the French generals. In describing this review in a letter to a relative Fyers mentions that, the weather being very hot, large numbers of men fell out, until the ground had the appearance of the scene of a recent engagement. He throws the blame partly on the heavy loads which the men had to carry and partly on the high collar and stock " that our martinets are so fond of." Hereby hangs a tale. An extract from this letter was sent indiscreetly by his correspondent to the Times newspaper, and it is needless to say that when a copy of the paper in due course reached Sir George Brown in the Crimea, the fat was in the fire. Sir George was one of the old school who delighted in pipe clay, and could express himself in strong language when he was irritated, so that Capt. Fyers had a very unpleasant interview with the old General in his tent one morning after the arrival of the mail.

After a short rest at Scutari, the 2nd Battalion of the Rifle Brigade moved to Varna, and then to Aladyn and Devna. There cholera broke out among the troops, and it was moved to Monastir. At last, in the early days of September, came the welcome news that the army was to go to the Crimea. Fyers embarked with his battalion at Varna in eight transports, his own company going in the Mary Anne, and landed on the shore of Eupatoria Bay on the 14th September.

Some idea of the share taken by Fyers and his men in the Battle of the Alma may be gathered from Kinglake's elaborate account of the battle and from W. H. Russell's letters to the *Times* newspaper, but the following extracts from a letter written by himself to his family at home give a more particular insight :—

> "CAMP ON THE HEIGHTS OF ALMA, September 22nd, 1854.

"You will see by the despatches how greatly our division has suffered; to me that great and, in many instances, personal loss is the more painful that it was evident to me, as to most others, that it resulted very much from a deficiency in the leading of some of those commanding regiments, who allowed their corps to close too much upon one another, until at last they became quite clubbed, and the grape and round shot then told with fearful effect.

"My company was on the extreme left in skirmishing order. The enemy's rifle balls and shot were coming fast as we approached the river and the gardens on both sides of it. I gave the word, and down we went on it, secured a wall, and fired away. I then got possession of a road through the vineyards, led my men through it, seized different strong points in turn, and came on the river. Here I found a good ford, and at once crossed. Vineyards and ruined houses were before me. I took a careful survey and decided on making a dash on these. They were taken. I had a high bank then in front, with a wall running along halfway up. This was good cover, and I made for it, to wait for further orders and for support.

"Errol's company had been my support, and now came up and lined the bank. Shortly after Major Norcott came up and took command of the two (companies) and led us further on. We then crowned the bank, and kept up a hot fire on guns and skirmishing riflemen. Here the grape, canister, and rifle bullets flew about us thick as hail. I lay at full length behind a stone about 16" high, now and then taking a shot with my little rifle at the artillery, but it was too far for it. An entrenchment with guns was about 500 yards in advance. We made for this in two rushes. It was a dreadful trial to my strength and wind, and midway I fell down quite spent with exertion. Here I got a little shelter by the mere inequality of the ground, rifle balls falling fast around. I took a minute or two breathing time, and then pelted on my heavy limbs as well as I could to the entrenchment.

"My company was by this time much broken, and their strength had been much tasked, for we had been kept too long unsupported by infantry. Those who were there did good service, but at last we got mixed with the 23rd, 19th, and some others who were there in no order at all, completely clubbed. A cry was raised by some officers that we were firing on the French, and the bugle sounded the 'Cease Firing.' This the men did not understand, for the batteries were raking them with grape; so with one consent they turned round and in a guiet walk

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retreated towards the cover they had left. It was here and then that the frightful losses occurred, but half-way we were met by the 1st Division coming on in line. They let us pass on through, and they then took their turn well and successfully, and very soon the enemy retreated.

"The action commenced on the right by the French, but we had the brunt of it. The Russians had a hundred guns in the field; some of them, which the Light Division took, 32-lb. brass guns, beautiful pieces; these were the guns that dealt such volleys of shot on us. The Russians had all the distances staked. Their rifle is a beautiful arm, superior, I think, to ours, and made at Liège, in Belgium. The sight is far superior to ours, and marked for 1,200 yards; however, the Minie must have done good service, for great numbers of the Russians were shot in the head.

"I think I may take some credit that my loss in the late engagement was so small, for I worked like a horse to make the men get into every shelter that offered. My loss was one sergeant and one private killed, three privates and one bugler wounded. I will not say that all came to the scratch as they ought to have done, but very many are very young officers and soldiers, and it was a severe trial for the first time. They will pay more attention to me another time.

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Sir William Cope, in his *History of the Rifle Brigade*, gives the following account :---

"Descending the slopes of the right bank of the Alma, Norcott's riflemen entered the vineyards, and at once were exposed to the fire of the Russian artillery, and became engaged with their light troops. Fyers's company was extended on the extreme left, with Lord Errol's company in support. The riflemen, inclining to the left to avoid the burning village of Búrliúk, which, as we have seen, had been fired by the Russians, forded the river and, ascending the other bank and passing through the vineyards, halted at a wall—a low wall which separated the cultivated ground from the slope beyond. Here Norcott moved up and extended Errol's company on the right of Fyers, and then, or soon after, he advanced, and inclining to the right, on observing that Codrington's Brigade has disarranged or lost its formation, and was threatened by a Russian column, he poured such a searching fire from his line of skirmishers that the enemy were checked, and hindered from taking full advantage of the want of regular formation of Codrington's Brigade."

Major (afterwards General Sir) William Norcott wrote that the conduct of Capt. Fyers at the Alma was conspicuous for coolness and gallantry; "the first man in the infested vineyard, across the river, and swarming the opposite bank under a fire that called for leading."

Lord Raglan, in his despatch, says that the capture of the Great Redoubt was materially aided by the advance of four companies of the Rifle Brigade, under Major Norcott.

Cope writes as follows of the part taken by the 2nd Battalion in the flank march to Balaklava, under Lord Cardigan :----

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"On this day (September 26th) the 2nd Battalion led the advance on Balaklava. The approach was by a narrow gorge, with high, bare hills on each side. Colonel Lawrence detached his majors, Norcott to the right, Bradford (Major-General W. H. Bradford) to the left, while he himself, with two companies, kept the centre. Thus they approached Balaklava, throwing out skirmishers. No opposition was offered till they had advanced some distance, when some musketry fire was opened; but this was only from a few men on the heights, who were soon driven in; and the advance continued. A staff officer then reported to Lord Raglan that the road was clear, and he rode forward, and was just entering the gorge, when Lawrence observed to him that he still saw some of the enemy on the hills, and asked permission to send a company in advance. This was granted, and Fyers's company was taken by Norcott towards the town.

"On their approaching it, and the battalion appearing on the heights, a few harmless shots were fired from the old Genoese fort, and soon after, on their advancing nearer, a white flag was hoisted. Fyers, who mistrusted the sincerity of the Governor, directed his subaltern to halt with one subdivision, whilst he, with the other, advanced by a narrow road engineered between the high ground and the sea. On Fyers' men entering the fort, the Governor left it by another side and, meeting Egerton and Ross, surrendered, handing his sword to the former. Then Fyers taking his company into the town, a baker, evidently in great terror, came out of his house and, notwithstanding the early hour of the morning, produced a roast turkey, which he offered him, and a great number of loaves. These Fyers desired him to break in two and to give half to each man. So that all the men of his company had a good meal.

"The battalion subsequently occupied Balaklava, posting sentries for the protection of the inhabitants, and at night bivouacked among beautiful vineyards outside the town."

Capt. Fyers, writing on the 29th September about this same flank march, savs :---

"I came on an upset wagon (Russian), with a horse on the ground kicking; further on a great many wagons laden, but horseless. In short, it turned out that those in advance had come up with the baggage guard of a considerable Russian force which was leaving Sebastopol; it was, I understood, purely accidental however; the Horse Artillery had fired a few rounds and the cavalry had charged, and the result was the most utter confusion, everything left higgledy-piggledy on the road. A number of valuable things were secured by the men, and some cavalry officers in front had apparently secured some good things, fur cloaks, military orders, plate, money, etc. Our men got a few things, and I purchased a curious ring from one of them."

During the month of October, Capt. Fyers, with his company, was employed in the trenches before Sebastopol, afterwards so memorable, to cover the working parties. "On the 14th October," says Cope, "Fyers was with his company in the 5-gun battery when he observed a column of Russian infantry advancing. Taking a rifle from one of the men, he put the sight at what he considered their distance and fired, carefully watching the effect of the shot. When he perceived that it struck the ground a little in front of the column, he ordered his men to fix their sights for 750 yards and 'give it them.' They had not been long firing when he found that he was under fire from the rear.

"Some of the Russians had moved up the ravine towards a house which was occupied by a picquet of another regiment under a sergeant, which had retreated on their approach, and the Russians, having taken possession of the house, were firing on Fyers's party. He therefore sallied with his company out of the battery and drove the Russians back, not before they had eaten the dinners of the former occupants of the picquet-house and carried off their coats and blankets. Most of these they dropped on their way back, as they probably impeded their retreat, pressed as they were by Fyers and his party. . . In this affair two riflemen were wounded. Fyers took a sergeant and some men prisoners, of whom three were wounded; several others were carried off by their companions, and many were killed.

"On the alarm, Sir de Lacy Evans had moved up two regiments and some of the 1st Division, and the rest of the 2nd Battalion (of the Rifle Brigade) were brought up and halted in rear of Gordon's battery, and some guns were ordered up; but before these troops came into action Fyers had repulsed and effectually disposed of the Russian attack."

Admiral Sir Edmund Lyons, having expressed a wish that his Marines, who were holding a position on the heights above Balaklava, might have a share in the work in the trenches, the important position on the heights was taken by four companies of the 2nd Battalion of the Rifle Brigade. On November 4th the companies commanded by Capts. the Earl of Errol, Hammond, Fyers, and Colville, under Major Bradford, Major Norcott being sick, proceeded to their new post.

On the 14th of this month Fyers-found himself a helpless spectator of the havoc caused to the shipping in Balaklava Harbour by the terrible gale of that day. He writes :--

"It was with the greatest difficulty I got along, every now and then obliged to throw myself flat on the ground, and sometimes hurled with violence down the hill, which is very steep. At last, after a great struggle, I got among the ruins of the old castle and gained a rock overhanging the sea at this point. I lay flat on my face with a firm hold of the rock, and from this point I saw five transports go down; first by being driven on the rocks, and then filling and sinking. The *Prince*, just arrived from England with all the warm clothing, etc., was one of them."

However the staves of broken casks thrown up among the wreckage proved very useful to him for roofing the hut which he had constructed to shelter him on the wind-swept hill.

When the spring came, after that terrible winter of hardship and privation, Fyers was again in the trenches, where he continued to do

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duty until the fall of Sebastopol. At the unsuccessful attack on the Great Redan on the 18th June, 1855, Fyers acted as second in command to Colonel Macdonnell.

Cope relates an incident that occurred on the 3rd July :-

"Capt. Fyers was coming off picquet in the advanced works with about 400 men. They were retiring by a zigzag which by some oversight of the Engineers was directly enfiladed by a Russian gun. As soon as the men were well in the boyau a round shot was fired, which, bounding along, knocked down 13 men, of whom eight were killed, or died of their wounds. The wounded were removed by Fyers, Colour-Sergt. Kemp, and some soldiers of another regiment, who came to their assistance. The rest of the men turned into another zigzag not exposed to this fire. The ball, after this destructive course, ran along the boyau and stopped against the bank of the parallel a dead ball."

It was in this month that Colonel Williams, the gallant defender of Kars and Chief British Commissioner with the Turkish Army in Asia Minor (afterwards General Sir William Fenwick Williams, Bart., of Kars, G.C.B., Royal Artillery), wrote to Fyers the following letter :---

"MY DEAR SIR,

"Kars, "*July* 14th, 1855.

"I must be candid with you. I did receive your first letter, but I am up day and night, being closely invested by a large Russian army under General Moravioff, and in hourly expectation of being assailed by him. I have begged Lord Clarendon, as a personal favour, to send you to serve with me. The letter goes off to-day. Send these lines to Sir W. Reid, for whom and Lady Reid I have and shall always retain the highest regard and esteem; that link, added to my having known your parents from my earliest days, is quite sufficient to bind us together in this work of war.

" Believe me,

"Very truly yours, "W. F. WILLIAMS."

It would seem that Capt. Fyers must have written to Colonel Williams to ask him to apply for his services on his Staff, and getting no reply had written again, and had probably asked his uncle, Sir William Reid, to write also on his behalf. Nothing came of it.

When the Siege of Sebastopol was about to finish came Fyers's great opportunity. Writing to his mother on September 7th, he says :—"I have just time to tell you that I am placed in command of the covering party, that is, those who go first, in an attack on the Redan. . . . I have not volunteered this duty. General Codrington called me out from parade and told me he had selected me for it." He certainly never expected to come out of it alive.

Cope says :—"On September 8th, when the assault was to take place, one half of the 1st Battalion being in the trenches under Colonel Norcott, the remainder, consisting of about 280 men, under Lieut.-Colonel Somerset, moved out of camp at 11 a.m. and took up a position in reserve on the Woronzow road. The 2nd Battalion furnished a covering party for the assault of the Redan, consisting of 100 men,* under the command of Capt. Fyers, who were to cover the advance of the ladder party and to keep down the fire from the parapet; a party also of 100 men, under Capt. Balfour, occupied some broken ground and a Russian rifle pit in front of and to the right of our most advanced works, who were also directed to keep down the fire from the parapet. With the same object, two parties of 50 men each, under Lieuts. Baillie and Playne, were stationed one in the fifth parallel and one in the Woronzow road. The remainder of the battalion, about 230 men, under the command of Lieut.-Colonel Macdonnell, took part in the general attack.

"These men had to advance 150 yards, exposed to a most terrible fire in front and flank. This attack, most gallantly carried out, was not entirely successful, though, as is well known, the operations of the day led to the abandonment of the works by the Russians and the fall of the place."

Fyers described his share in the assault as follows :---

"Sept. 11th. The grand event has come off, and long ere you get this you will know I have been again most mercifully spared. . . . As to those I had the command of, they behaved very well indeed and carried out their orders as well as they possibly could. I had 100 men, with sergeants, and 2 subaltern officers, Lieuts. Moore and Ryder of our own regiment, and 100 men, with their officers, of the 3rd (The Buffs). This was the covering party, to go before and protect the advance of the ladder party. After the French had made their rush at the Malikoff and got into it so well, the signal was made from thence for our advance, and repeated from one of our batteries, on which we jumped over the parapet in open order and advanced with all the rapidity we could, followed immediately by the ladders and storming party. I had detailed off two parties, each under an officer, to fire on the embrasures which flanked the angle of the Redan, in order to keep down their fire. On we went till we came within a few yards of the ditch, and then got what cover could be found, commencing a fire at once on the parapets and embrasures, while the ladders were brought up very well and got down into the ditch. The 97th and 95th, leading the stormers, pushed very well up to the works of the Redan, crossed the ditch, but when so far, whether it was from fear of mines inside, or whatever it may have been, they would not go further, and all that the officers could do was unavailing to get them further,

"This was the deuce for those lying outside, who expected that the gunners (Russian) would be soon shot down or bayoneted, and consequently the grape shot and other pleasing missiles continued to rattle and hiss, on every side laying men low. This sort of thing went on, those on the earthwork of the Redan refusing to go forward, and others coming on, expecting them to make way for them. The enemy's shot swept our columns as they endeavoured to cross over the 250 yards of

• This covering party numbered 200, half being Rifles and half Buffs, all under Fyers's command.

ground between our trench and the Redan. . . . When there was no longer any doubt of our failure, and we had again sought our own trenches, I found that I had lost very severely, but as yet I do not know the full account. An officer and 4 sergeants killed, and 1 officer contused, and a large proportion of men (riflemen) wounded."

The special correspondent of the Times wrote to his journal :---

"Of the commanders of parties, only Acting Brigadier-General Windham, Capt. Fyers, Capt. Lewes, and Capt. Maude got untouched into the Redan.

"The riflemen advanced admirably, but from their position they could not do much to reduce the fire of the guns on the flanks and below the re-entering angles. The bravery and coolness of that experienced, deserving, and much neglected officer, Capt. Fyers, were never more brilliantly displayed or urgently called for, and here let me ask how is it that an officer like Capt. Fyers, with 21 years' full service, who went through the campaign of Candahar and Afghanistan in 1841 and 1842, and who was present in five actions, who was at Khelat, and was with his regiment throughout Nott's campaign, who was conspicuous for his gallantry at the Alma, and whose conduct in the trenches has been beyond all praise, is exposed to the pain and mortification of seeing young men, who were scarcely born when he was a soldier, raised above his head because they have had the good fortune to look at a battle from a distance or to ride in the rear of some cautious General! I know nothing of Capt. Fyers's past services except through Hart's *Army List.*"

From October 1st till his departure for home on the 5th December, 1855, Fyers was in command of the Guard of Honour to the Commanderin-Chief, consisting of 6 officers and 200 men. By this time he was one of only 11 officers remaining with the Light Division who had originally landed with it in September, 1854. He had entered on this campaign when he was 39 years of age and had 20 years' service, but was still a Captain. Such was the fate in those days of an officer who, although he had seen more service than any other officer in his battalion and had few equals as a leader of light infantry, was lacking in money and in influence in high places. But the Crimean Campaign was the dawning of a new era, and rewards were lavishly distributed, too lavishly it was thought by many who remembered that many a veteran who had served in the junior ranks under the Great Duke in the bloody battles and sieges of the Peninsula War had not even a bit of red riband to show until more than 30 years after it was all over, and then how few were left alive to be grateful for this tardy recognition of their services.

For his services in the Crimean Campaign Fyers was mentioned in despatches, received the war medal, with clasps for Alma and Sebastopol, the 5th Class of the Legion of Honour, the 5th Class of the Medjidie, and the Turkish Medal; he was also promoted to be Brevet Major on the 2nd November, 1855, and Brevet Lieutenant-Colonel on the 26th December, 1856.

TRANSCRIPTS.

THE ENGINEER SCHOOL AT WASHINGTON.

The following General Order, issued by the American War Department at Washington in October last, gives the regulations governing the Engineer School at Washington, and is reprinted, as it is likely to prove of interest to readers of the R.E. Journal.

General Orders, No. 136, War Department, August 16th, 1905, is hereby rescinded, and the following regulations governing the Engineer School at Washington Barracks, District of Columbia, are announced :---

I. The object of the school is to prepare the junior officers of the Corps of Engineers for the active duties of their arm and corps; to make researches in such branches of science as relate to the duties of the Corps of Engineers; to disseminate information so obtained; to make such experiments and recommendations and to give such instruction as may be necessary for the civil engineering work of the Army.

2. The Engineer School at Washington Barracks is under the supervision and control of the Chief of Engineers. It consists of a commandant, a secretary, and such directors, instructors, student officers, and troops as may be assigned to it for duty or instruction by orders from the War Department. The Chief of Engineers may correspond directly with the commandant on questions of a technical character which do not involve matters of command, discipline, or administration, and do not relate to the status or interests of individuals.

THE COMMANDANT OF THE SCHOOL.

3. The general administration of the school is entrusted to the commandant. In case of the absence or disability of the commandant, the senior engineer officer present for duty at Washington Barracks will act in his place in all matters pertaining to the school.

4. The commandant will make application to the Adjutant-General of the Army for such articles as may be required for the school, and will direct the expenditure of such authorized quantities of material as may be necessary.

5. The commandant will submit to the Adjutant-General of the Army, on or before August 31st of each year, a report of the operations of the school for the year ending on the 30th of June preceding, with such suggestions and recommendations as he may deem desirable for the interests of the school. He will also submit to the Adjutant-General, on June 30th of each year, a detailed programme of instruction to be carried out at the school during the ensuing school year. This programme, when approved by the Secretary of War, with such modifications as may be deemed necessary, will be returned to the commandant for the information and guidance of the officers on duty at the school.

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THE SECRETARY.

6. The secretary of the school will be the custodian of the records, books, and property of the school, and the recorder of the school board. He will conduct the correspondence of the school and promulgate the orders of the commandant.

7. The school library will be maintained separate and apart from the post library. In case of loss or damage to any book, periodical, map, or other property belonging to the school, the person responsible for such loss or damage will make the same good by the payment of the actual cost of the article or the cost of repairs. This amount will be assessed by the secretary of the school, whose action, when approved by the commandant, will be final.

DIRECTORS AND INSTRUCTORS.

8. When practicable the directors and instructors will be senior in rank to the student officers, but whether senior or junior the directors and instructors, while in the execution of their duty, will be accorded the respect due to their position.

9. The directors, instructors, and student officers will be exempt from all ordinary staff duties and garrison routine, from attendance at the garrison school for officers, from court-martial duty, from such drills and ceremonies as are not included in the course of instruction, and in general from all duties which would interfere with the performance of their functions in the school; *provided*, that in case of lack of sufficient officers for the proper performance of garrison and post duty the commandant may assign school officers to such duty.

THE SCHOOL BOARD.

10. The school board, consisting of the commandant, the directors, and the instructors, will arrange the programme of instruction as to subjects, textbooks, and allotment of time; prescribe the character and scope of the examinations and re-examinations, and have final determination of all questions of proficiency of students; *provided*, that no action of the board which changes the regulations of the school or the course of instruction shall be final until approved by the Secretary of War. The school board will meet at such times as the commandant may deem advisable.

11. The deliberations of the school board and its decisions until duly published will be confidential.

THE COURSE OF INSTRUCTION.

12. The course at the school will begin September 1st of each year, and will be concluded about September 30th of the following year. Sessions of the school will be held daily, except Saturdays, Sundays, holidays, and the period from December 23rd to January 4th, both inclusive. Practical work and practice will be combined with theoretical work in all subjects in which it can be advantageously done, and will include the use and operation of instruments, apparatus, and machines; field astronomy; photography and map reproduction; geodetic and hydrographic surveying, and garrison and field duties with engineer troops. 13. The course of instruction will be divided into three departments, as follows : --

(a). Military engineering.

(b). Civil engineering.

(c). Electrical and mechanical engineering.

The school board may transfer from one department to another such of the subjects hereinafter mentioned as it may deem desirable for the equalization of duties of directors and instructors.

14. In the different departments instruction will be given in the following subjects :---

DEPARTMENT OF MILITARY ENGINEERING.

Seacoast defences, including land defence. Ordnance, armour, and explosives. War ships and sea power. Photography and map reproduction.

DEPARTMENT OF CIVIL ENGINEERING.

hydro-	Heating and ventilation.
	Water supply.
	Sewage disposal.
	River and harbour improvement.
	Lighthouse construction.
	Construction plant,
	Contracts, specifications, estimates,
	and accounts.
	hydro-

DEPARTMENT OF ELECTRICAL AND MECHANICAL ENGINEERING

Direct current machinery and storage batteries. Alternating current machinery. Electric power transmission. Electric lighting and searchlights. Fire control apparatus. Steam power electric machinery. Hydro-electric power machinery. Internal combustion engines. Electric power plant design.

15. In connection with the prescribed course of instruction in the several departments, visits will be made to points where important engineering works are in progress, when such visits are approved by the Chief of Engineers and authorized by the Secretary of War.

EXAMINATIONS.

16. Subject to the following limitations, examinations will be held under such rules as the school board may prescribe, as soon as practicable after the final review in each subject.

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17. An officer declared deficient in any subject may apply in writing for re-examination in that subject, but such application must be made immediately after the announcement of the result of the original examination. A re-examination will be of such a character as may be determined by the school board, and will be held with as little delay as practicable.

18. Officers who have been unable to complete the entire course will receive certificates of proficiency signed by the commandant in such subjects as shall have been satisfactorily completed.

19. A student officer, who by reason of sickness or other unavoidable cause has been absent from an examination, or has been unable to complete entirely any course with his class, may be permitted, in the discretion of the school board, to complete the said course and be authorized to take the necessary examination before or within a reasonable time after the graduation of his class.

DISCIPLINE.

20. The school will be governed by the rules of discipline prescribed for military posts, and by special regulations formulated by the school board and approved by the Secretary of War.

GRADUATION.

21. A student officer who successfully completes the entire course of instruction will receive a diploma setting forth his proficiency, and his name will thereafter be borne upon the Army Register as a graduate of the Engineer School at Washington Barracks. Diplomas will be signed by all members of the school board. The fact of graduation of each officer will be reported to the Adjutant-General of the Army as soon as practicable thereafter.

22. Graduates of the school will be exempt from professional examination for promotion in all subjects covered by their diplomas for a period of two years after graduation. Officers not graduates, holding certificates of proficiency in any subjects embraced in the course, will be similarly exempt from such examination in the subjects covered by their certificates of proficiency for a period of two years from the date of such certificates.

By order of the Secretary of War,

W. W. WOTHERSPOON, Brigadier-General, Acting Chief of Staff.

Official:

HENRY P. MCCAIN, Adjutant-General.

THE FINAL STRUGGLE FOR 203-METRE HILL AT PORT ARTHUR.

Translation of an article by Staff-Capt. Kostinshko in the March, April, and May numbers of the *Eenzhenernee Zhoornal*.

(Conclusion).

4th December.—During the night of 3rd—4th December Lieut. Kalmin succeeded in getting a 6" gun of 120 puds (4,3334 lbs.) to Pigeon Bay, and in mounting it secretly in front of the quick-firer entrenchments of Staff-Capt. Sirtsov. His intention was to strike the flank and rear of the Japanese during their expected fresh attack on Visokaya Hill, and in the course of the day he fired a few trial rounds. During the whole night the enemy kept up occasional artillery fire on the hill. At dawn the fire increased and attained the same proportions as on the previous day, and at the same time weak infantry parties kept annoying the garrison. Both sides carried on entrenching work with increased activity, and the whole day they kept up firing and bomb-throwing.

Movements of Japanese towards Visokaya Hill were noticed from Pigeon Bay and from other parts. And so, while the enemy rested and collected large reserves, the Russians had to wait prepared for the attack.

General Kondratenko and Colonel Semenov rode up to the 5th Regiment Headquarters and consulted with General Irman concerning Visokaya While arranging for resting the rank and file, Generals Hill. Kondratenko and Irman showed equal consideration for those in command. In Order No. 39 of the Western Front of the Land Defence, two reliefs of commanders for Visokaya Hill were detailed as follows :-In the first the director of the hill was Lieut.-Colonel Organov and the commandant Lieut, Ivashchenko, with Sub-Lieut. Rafalovich as his assistant, all three being of the 26th Regiment. In the second relief the director was Lieut.-Colonel Butusov, of the Frontier Guards, the commandant Capt. Solonikio, 27th Regiment, and his assistant was Ensign Kraushvili. The second relief took up the duties at 11 a.m. on the 4th December. At about 4 p.m. the 2nd, 3rd, and 4th Companies, 5th Regiment, set out for the hill. They had all passed a night in barracks, and all had been made up to strength with hospital men. They were commanded by Ensigns Foshin, Kondratiev, and Moskvin respectively.

As it was intended that these companies should be relieved on the next day, it became necessary to get a fresh draft of the 5th Regiment ready, and for this purpose the 9th, 10th, and 12th Companies were recalled from Flat Hill. They numbered altogether about 100 men, but in the course of the night they were made up with hospital rank and file and dismissed to rest in barracks, with strict orders to sleep out the rest of the night but at the same time to be ready at the first summons to come up to the headquarters, 5th Regiment—surely a rather complicated task 1

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To replace losses among the officers of the 5th Regiment, Stessel sent up Sub-Lieut. Gudkov and Reserve Ensign Semenov. Gudkov arrived on the evening of the 4th December, and took over the 6th Company, 5th Regiment.

During the 4th, Naval Lieut. Lavrov, commanding the Aeronaut Detachment, was mortally wounded. Owing to the great losses which had been suffered on the right peak from artillery fire, part of the Aeronaut Detachment was sent to the spot, and Lavrov went with it. General Irman being on the hill, and not wishing to lose a good officer without special necessity, said to him, "You had better not go; I will find you some other employment." "No," answered Lavrov; "where my 'swallows' go, there I go too," and he went off with his party.

At this time the right peak was under fire from machine guns and occasional shrapnel. The sailors quickly reached the trench which had been allotted to them and began to take their places, Lavrov standing up to his full height to attract their attention. Suddenly a shrapnel burst within four paces of him and he fell. The first of the sailors who ran to his aid was killed by machine gun fire, but others lifted up their beloved commander and bore him to the dressing station.

5th December.—At dawn Lieut. Kalmin opened fire on the enemy, who had during the night crowded into all the trenches, approaches, and shielded places on the western slope of the hill. Several very good hits were observed, especially in the portion of the Ring Trench occupied by the Japanese, as after each a crowd of the enemy was seen to break away and run in the direction of Angle Hill.

When they tried to advance over the open in dense masses, Lieut. Kalmin's shells fell in the midst of their columns and on the very sky-line of the hill, which checked their advance and compelled them to move by small parties in rushes along approaches which they hastily built up with sandbags.

Their artillery also opened an answering fire, but as they did not see the 6" gun, they directed their fire on Sirtsov's quick-firing gun position, so that the latter could be no longer occupied. Kalmin fired in all 98 shell and greatly assisted the defence.

On this day the observations from Pigeon Bay gave less useful results than hitherto, because the Japanese made use of their approaches and did not advance in the open. Thus to the observers it frequently appeared that no advance was in progress, and yet the terrible artillery fire on the hill, which raised clouds of dust and further impeded observation, left small doubt that something very serious was going on there.

What really happened was that from 6 a.m. the Japanese artillery began sweeping the hill with every nature of shell fire, and their now rested infantry harassed it in the most persistent manner. At this time the posts of director and commandant were held by Butusof and Iyashchenko respectively.

Kondratenko reached the 5th Regiment Headquarters at 7, and Colonel Semenov arrived some time later. Between 8 and 9 a.m. the companies in reserve were expressly summoned to the headquarters, at first the 6th and 12th, later on the 9th, and finally the 10th Company, 5th Regiment. The men had had no rest, as the 10th Company had only got in at about

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3 a.m., and the 9th Company only about an hour earlier, and it had taken a long time to reorganize them and complete them with hospital men before breaking off.

Between to and tt a.m. the Japanese began to attack the hill, at first with small parties, and later on with larger ones. The Russian losses from artillery fire had been considerable, and the enemy had some success on the left flank. Alarming reports began to come in from the hill, and as these arrived, so the reserve companies were sent up; but as the Tea Ravine began to be swept by Japanese rifle fire, the advance of these companies was delayed, the men having to go by ones and twos, and in places by rushes. In consequence of this, they only reached the hill at about midday. Up to then nothing very serious had occurred, except that the enemy had got into the left redoubt.

The 6th Company, 5th Regiment, under Sub-Lieut. Gudkov, which arrived before the rest, was sent by Butusov to make a counter-attack on the left flank of the hill, while Butusov himself with Ivashchenko set to work to reorganize the retiring parties of riflemen. The 6th Company, going up by the communication trench, moved rapidly against the Japanese, led by Gudkov, who set a fine example of courage, and by his dashing conduct compelled the Japanese to fall back. After this heavy firing continued for a long while; the Japanese bombarded the hill with every description of shell, especially shrapnel, they swept it with the fire of rifles and machine guns, threw hand grenades, and occasionally cast mines. The Russian riflemen replied chiefly with grenades, and partly also with rifle fire, but they preferred grenades, as many of their rifles had become blocked by the dust thrown up by the heavy artillery bombardment. Lieut. Gudkov went the round of his men and encouraged them, joining in the fight with his revolver. After a time he was wounded, but remained on duty directing the action of his (6th) company, into the ranks of which many men from other companies had now become mixed. until he received a second wound and was rendered unconscious.

Meanwhile the Japanese waited patiently. Lieut.-Colonel Butusov used every endeavour to hold the hill up to the arrival of Lieut.-Colonel Organov, who was better acquainted with the ground. The latter was due at 11 a.m., but for some reason was delayed. Butusov, ill acquainted with the ground and exhausted by his night's work, sent frequent telephone messages, urging his despatch. These were passed to Irman, Kondratenko, and Colonel Semenov, but at 11.30 a message was received with news that he was dead. He had been mortally wounded, and only survived his wound for a few hours.

Capt. Ivashchenko, now left in sole command and appreciating the precarious state of the hill, collected some odd men and a party of newly arrived riflemen, and led a counter-attack against the left redoubt; but he was wounded in the right leg and carried to the dressing station. After this Lieut. Agafonov was appointed commandant. He had recently taken over the command of Fort No. 5 from Ivashchenko.

Kondratenko was very uneasy while Visokaya remained without a commandant, and he urged Agafonov to get there as quickly as possible. The latter started at once from Fort No. 5, and to please the General

took a short cut, which however led him astray, and a long time passed without his arriving at the hill. Kontratenko, nervous and anxious for its fate, at about 12.30 appointed Capt. Solonikio to be commandant, Lieut.-Colonel Pokrovski to be director, and, as assistant to Lieut.-Colonel Seifulin who was keeping order in rear, Capt. Pobllevski. These appointments were made at the headquarters, 5th Regiment, and a considerable time elapsed before the officers arrived at their posts.

After Ivashchenko was wounded, for some time the sole command on the hill rested in the hands of Acting Ensign Abramov, 5th Regiment, who encouraged the men by the example of his personal courage, and besought them to hold on stoutly until assistance should come up; but owing to the large numerical superiority of the enemy a certain amount of ground was lost.

Meanwhile the companies of the reserve, which had been sent from the headquarters at 10 a.m., came straggling up, and Lieut.-Colonel Seifulin, who was posted to preserve order under the hill, appointed the senior of the new arrivals—Staff-Capt. Sazonov, commanding the 12th Company—as temporary commandant of the hill,

Sazonov forthwith set to work to organize a counter-attack against the Japanese who had taken possession of half of the left redoubt. This attack he superintended and led forward himself. At first all went well; the bravest men in the companies crept forward with grenades in their hands, and fairly soon gained the crest of the left redoubt. Gorielikov, a gallant young N.C.O. of the 12th Company, led the way, and the rest of the rank and file followed, with their company commanders well to the fore. The Japanese began to fall back. The counter-attack, in spite of the terrible fire and preponderating force of the enemy, promised full success, when unfortunately Sazonov fell insensible from a blow on the head from a stone or splinter. Almost at the same moment Lieut, Sirotko, commanding the 9th Company, was wounded in the head. Deprived of their commanders, the men lost confidence. They did not fall back, but distributed themselves in the recaptured works, and carried on a grenade fight with the Japanese, holding on to the hill as best they could, up to between 3.30 and 4 p.m.

At about 1 p.m. Lieut.-Colonel Organov arrived at the headquarters, 5th Regiment, and immediately set out for Visokaya. Kondratenko saw him, and prayed him to use every endeavour to preserve the hill. The telephone at that time was not working, because the connecting leads had been cut by Japanese shells. Reports were being sent by mounted volunteers, and were delayed accordingly.

At about 1.30 to 2 p.m. Irman rode up to the hill, and on his return reported to Kondratenko how things stood, and that everything depended on the sending up of fresh troops. At about this time a party of sailors arrived, and were immediately sent on to Visokaya. The urgent need of a reserve forced Kondratenko to draw four more companies from the Eastern Front and the centre, and also to beg for two companies of sailors from the General Reserve.

Just then things began to go badly on Visokaya; the artillery fire found many victims, and the groups of Russian soldiers grew thinner and

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weaker. At 3.30 in the afternoon the Japanese advanced to the attack in dense masses. From the weakness of their numbers and the want of reserves, the Russians were able to offer little resistance, and the Japanese easily captured the left redoubt and part of the saddle, while in other parts the fight went on stubbornly.

At about 4 p.m., from the headquarters, 5th Regiment, it could be clearly seen with field glasses, and even with the naked eye, that the Japanese had gained the crest of the hill, especially on the saddle, and were fighting the Russians with grenades, constantly advancing towards their left front, *i.e.*, from the left redoubt towards the right.

The telephone was again working, and each report from the hill became more alarming than the last. These reports took the form of conversations, and may be summarized as follows :—" The Japanese are advancing; they are pressing us back; the position is critical; reinforcements are necessary."

The last officially appointed commandant of the hill, Capt. Solonikio, fell about this time, though no details of his fate are forthcoming; and after him the command passed from one to another, until at 4 p.m. the role of commandant, in fact that of practically the whole charge of the defence of the hill, appears to have been held by Naval Engineer Losev, who had several times gallantly distinguished himself in the previous fighting. Thus for example on the 28th October, having collected some 20 volunteers, he advanced to drive the Japanese from one of the trenches which they had occupied. There was about a company of the enemy present. Coming upon their flank Losev threw a grenade, and the Japanese, surprised, rushed to one side, whereupon the volunteers leapt into the trench. Without allowing them time to recover, he advanced in front of his men throwing grenade after grenade, and pressed back the enemy step by step, until he had cleared the whole trench. After easily carrying out this and other comparatively straightforward tasks, this gallant sailor now found himself in a position of extreme difficulty, as he was called upon to assume the sole command of Visokaya Hill at a desperate moment, when with a terribly thinned line of six companies, in all about 300 men, he had to oppose three whole regiments of attacking Japanese. Little skilled in the fortifications, in the duties of commandant and in the complicated defence of the hill, he felt small confidence in himself, and sought for a man who might help him with advice on emergency. But by this time all the officers had fallen, and only by chance he found Sub-Lieut. Gudkov, who, having been wounded at mid-day, had lain for some time in an unconscious condition on the crest of the hill, until he had been picked up by the men and carried into the telephone blindage. After someone had hastily dressed his wounds, he remained lying in the blindage waiting for a stretcher, and getting a little warmer, he began to feel better. At about 4 p.m., when the overwhelming strength of the Japanese was clearly evident, in order not to fall into their hands, he decided to wait no longer for the belated stretcher, and was preparing to crawl to the dressing station when Losev, approaching the blindage for the purpose of holding a conversation with the 5th Regiment Staff, stopped him and appointed him his assistant.

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"Of what use can I be?" asked Gudkov.

"You as senior infantry officer can help me with your advice," answered Losev. "Lie as you are, only do not leave the hill until another commandant arrives to take the place of Solonikio, so that in case of necessity I may have someone to consult with." Gudkov agreed, and remained lying in the telephone blindage.

Meanwhile things were going from bad to worse. The small handful of Russians who remained on the hill was melting away with alarming quickness, and having no power to withstand the dense masses of the Japanese, was falling back step by step.

While reporting the critical state of affairs, the commandant begged for either reinforcements or orders as to what he should do. At this time reserves with all haste were moving from the Eastern Front and centre, and some companies were already arriving at the headquarters, a fact which was communicated to the hill. "Hold on a little, reserves are already arriving," was passed to the commandant; but the Japanesewould not wait, and at about 4.30 to 4.45 he reported that the Japanese, having taken the left redoubt, were sweeping with fire the hill and its slopes, had taken the saddle, and were strengthening their attack on the right redoubt, in the maintenance of which no hope remained. In addition to this they were spreading over the top of the hill; the nearest of them were within 10 to 15 paces of the telephone blindage, and would soon cut it off and break the telephone connection. He begged permission to move down under the hill and take the telephone with him. In reply to this Staff-Capt, Baum, Chief of the Staff of the Western Front of the Land Defence, in the name of General Irman, did not sanction the removal of the telephone, and ordered him to defend the hill to the last.

A few minutes later, from the 5th Regiment Headquarters, they tried to ring up Visokaya Hill, but no further answer was received. And so the last time that Visokaya Hill spoke on the telephone was at about 4.30 to 4.45 in the afternoon of the 5th December.

Taking into consideration the state of things on Visokaya Hill, Generals-Kondratenko and Irman, Colonel Semenov, and their Chiefs of Staffs, at 5 p.m., held a consultation in the headquarters, 5th Regiment, and decided at the approach of dark, *i.e.*, from 6 p.m., to bombard Visokaya simultaneously from all the forts and entrenchments, and then to attack the Japanese with the fresh companies and drive them off. Orders were accordingly sent to all the forts and entrenchments of the Western Front. to open fire with all their guns on Visokaya Hill, exactly at 6 p.m.

The 1st Foot Volunteer Detachment, 5th Regiment, which was now commanded by the newly appointed Acting Ensign Lavrov, was again summoned from Entrenchment No. 4. It had not been made up with hospital men, and numbered about 50 men. The command of the attack was entrusted to Lieut.-Colonel Organov, and for general supervision General Irman also rode up to the hill within a few minutes of 5 p.m. At 5 it began to get dusk, and by 6 almost complete darkness enwrapped the belligerents.

On the 5th December, in the afternoon, the Japanese also carried out an attack against Flat Hill, and again seized part of the Russian trenches, but were then driven out, on this occasion by one of the Hospital Detachments.

After Irman had ridden off from the headquarters, 5th Regiment, to Visokaya, Generals Kondratenko and Nikitin continued to watch the fight through their field-glasses. There was also present General Tserpitsky, Inspector of Hospitals, who had come over to look into arrangements in the section under attack. General Tserpitsky immediately set out for the foot of Visokaya to look after the preservation of order in rear.

As Kondratenko thought that the men would obey a general officer more readily than a newly appointed acting ensign, and that even the presence of a General would make a favourable impression on the troops, he begged Nikitin also to ride up to the hill, and consequently the latter, in company with his aide-de-camp, Lieut. Uspenski, went off soon after General Tserpitsky.

At this time the reserve companies moved up the Tea Ravine, the men going by rushes, either singly or in groups. In order to stop them the Japanese, having seized almost the whole crest of the hill, opened a terrible rifle fire, and now and then shells also came flying over. All movement in the ravine became extremely difficult and dangerous. Many who were wounded while passing through it came back again, but the dead were left lying in this ill-fated ravine, as there was no time to collect them.

Not more than a quarter of an hour after he had left the 5th Regiment Headquarters, Uspenski, aide-de-camp to General Nikitin, was carried back on a stretcher, wounded in the left side below the heart.

Irman had started at 5 p.m. on horseback, accompanied by two orderlies. Bullets whistled overhead and fell alongside him, but he rode on guickly, entirely in the open, presenting an excellent target to the enemy. About half-way his horse was wounded in the neck, and a second time in the mane, but hard ridden he continued his gallop until a third bullet, which raked him full length, breast, kidneys, etc., knocked him over. Irman succeeded in jumping clear, and an orderly flew to the horse, but immediately fell dead.

"Shall I kill it?" asked the other orderly, taking his place.

"No, take it back and have it attended to," answered Irman, and went on on foot to the hill.

After the General, a Sister of Mercy, Mme. Krik, drove up in a pairhorsed ambulance, and had just got down when the horses, frightened by the firing, from which one was wounded, turned and started back again full gallop, taking with them the driver, scared, and wounded in the leg.

A few minutes later a hospital cart came up and stopped under the hill; seated by the driver was General Tserpitsky, who as he began to get down was wounded by a bullet in the leg. A rifleman ran to his assistance, and with the driver lifted the wounded General from the cart, who was at this time again wounded by a bullet in the head. He was carried to the dressing station in an unconscious condition, and Sister of Mercy Krik dressed his wounds.

Carts loaded with cartridges and grenades drove rapidly to the hill, and rarely did one get through without having either driver or horses killed or wounded. Meanwhile, advancing by rushes, the reserve companies drew near to the hill. Capt. Pobilevsky received them. In advance of the rest there came up a company of sailors from the *Baran*, and by 6 p.m. the following :--

A company (probably the 9th), 25th Regiment, under Sub-Lieut. Soloviev. A company, 15th Regiment, without an officer.

Half of the 6th Company, 26th Regiment, under Ensign Golubey.

Ist Foot Volunteer Detachment, 5th Regiment, under Ensign Lavrov, and apparently one more company, of which details are wanting.

The newly arrived companies were very weak (30 to 35 to 50 files), and the 1st Volunteer Detachment numbered only 50 men. In this way the force under Irman, although considerably strengthened, did not exceed from S00 to 1,000 men, and was too weak to retake Visokaya Hill, now occupied by 8 battalions of Japanese.

To take command of companies which had no officers, Lieut. Agafonov, 26th Regiment (who was detailed to the company of the 15th Regiment), Lieut. Sinkevich, Sub-Lieut. Nechay, 27th Regiment, and others also arrived at the hill.

At 5.30 p.m., Kondratenko, having discussed matters with several artillery officers, and having ascertained that the Russian artillery through want of shells could not do much good, but would rather do harm, as it would force the retirement of any of the men who might by chance be holding out upon the hill, and besides that, judging that the extra time would enable the Japanese to entrench more strongly the part which they had occupied, altered his decision to attack the hill, after first bombarding it with artillery from all the forts, and sent word to General Irman by mounted orderly not to wait for the artillery preparation, but to attack Visokaya as soon as the reserve companies should come up. Orders to cancel the firing were sent by telephone to the various forts and batteries, but probably these new orders did not reach them all in good time, because at 6 p.m. some of the forts, entrenchments, and batteries opened fire, all the same, on the very top of the hill; in the absence of definite information they supposed that the Japanese were on every part of it. The fire was not marked by good mutual combination, because only certain of the works were firing, and consequently it did no good; but, on the other hand, a handful of men who were apparently holding on to the right peak, and a group of the 2nd Company, 5th Regiment, under Ensign Fomin, who were still maintaining themselves on the left flank of the Ring Trench, and who had had no orders or information, on seeing that the Russian artillery was shelling Visokaya, concluded that the hill had been finally abandoned, and retired.

In doing this Fomin found that he had to burst through the Japanese outpost line on the southern slope (left flank) of the hill. The Japanese apparently had no suspicion of the presence of any Russians on the hill, because they were all looking keenly, and also firing, in the other direction, *i.e.*, towards the Tea Ravine. As it was already quite dark, Fomin collected together the remnants of his company (10 men), and after he had fired a volley into the enemy and thrown his last grenade into a column which he found in rear of them, which sent them rushing in alarm to one side, he rushed through with his men and happily reached False Hill, and

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eventually Tea Ravine. Here the men were unable to take part in the firing, because of the condition of their rifles; all were choked with dust, the greater number were quite unserviceable, and the rest could be used only very slowly.

The retirement of the party on the right peak was carried out entirely without incident.

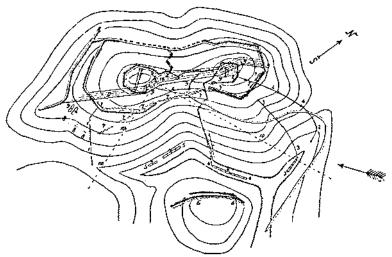


FIG. 9.-Visokaya Hill. Position of the combatants at 6 p.m., 5th December.

(1). Position and line of retirement of 7 to 10 men, 2nd Company, 5th Regiment, under Ensign Fomin,

- (2). Line of retirement of lost group of men from right redoubt.
- (3). 1st Foot Volunteer Detachment, 5th Regiment, and the line of its attack.
- (4). Centre column (advanced along the covered approach).
- Left column.
- (6). 3rd Section, 8th Company. (7). Japanese outpost line.
- (8). A few individuals and small groups of Japanese.
- (9). Line of Japanese reserves.
- (10). Japanese machine gun, showing its are of fire.

In this way the whole summit of Visokaya fell into the hands of the Japanese, who now dropped their shells on the rear slope and the foot of the hill. These shells fell exactly where the men of the newly arrived companies had been with so much difficulty assembled and got into order and arranged by companies. While carrying out this work Lieut.-Colonel Seifulin was wounded by a bullet in the arm, and was taken to hospital. The troops that were under the hill, and also their commanders, now knew that the Japanese had taken the whole hill, and the riflemen retreating from the right peak, by the news which they brought in, confirmed their doubt in future success, and threw a clearer light on the existing state of affairs.

Just after this Irman received the order for the immediate attack of Visokaya Hill, and with Organov, Pabilevski, and others, began to discuss the final arrangements. A large shell burst near this group, and the force of the explosion threw them from their feet and covered them with stones; but impressed with the gravity of the situation, they continued the consultation. It was decided to divide the force into three parts, and to move one against the right peak, the second against the saddle, and the third against the left redoubt. The right column was to consist of one company, the centre of two companies, and the left of one and a-half.

By this time it had become almost pitch dark, and the newly appointed company commanders, knowing neither their men nor the ground, were in a position of great difficulty. The newly arrived companies, unacquainted either with the ground or with their new commanders, were crowding together without confidence, while the Japanese dropped shell after shell at the foot of the hill and their infantry kept up a continuous rifle fire. All this added considerably to the difficulty of organizing the attack ; but in spite of it the advance took place at about 6.30 p.m.

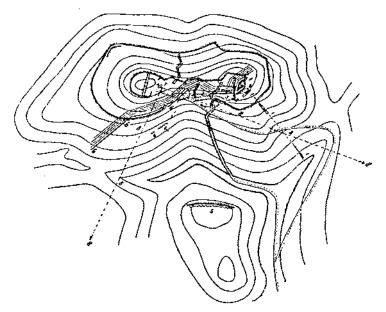


FIG. 10.-Result of attack of General Irman, carried out at 6.30 p.m., 5th December.

(1). Line of advance of the right column (1st Foot Volunteer Detachment, 5th Regiment). The portion of the redoubt occupied by them is shaded.

- (2). Section under Sergt, Kibikin.
- (3). Centre column(4). Left column. Centre column. } Shown in their most advanced positions.
- (5). 3rd Section, 8th Company, 5th Regiment.
 (6). The thick line shows the limit to which the Japanese were driven back.
- (7). Japanese machine gun.
- (8). Arc of fire of machine gun.

The 1st Infantry Volunteer Detachment was detailed for the attack on the right peak, the company of the 15th Regiment, under Agafonov, and half of the 6th Company, 26th Regiment, were told off to the attack of the left peak, while the Baran company of sailors and the company of the 25th Regiment, under Soloviev, attacked the saddle. Each man was ordered to take with him two or three grenades, and they were encouraged to take more, as great reliance was placed in these weapons.

The companies, encouraged by General Irman and the other officers,

and formed in column by the right, moved boldly forward, the centre column passing along the communication trench, which had been recently made by Ensign Ermakov. Between the left and the centre columns there advanced the 10th and the remnants of the 2nd, 3rd, 6th, and 12th Companies, 5th Regiment, and between the centre and right columns the remains of the 0th and 4th Companies and others.

The Japanese met this attack with a terrible fire. Every available weapon was brought into play; a machine gun, which they had succeeded in posting on the saddle near the left redoubt, and which brought a cross fire to bear on the whole slope traversed by the Russians, began to crackle, together with rapid rifle volleys; bombs were thrown, and the Japanese artillery directed all the fire of their artillery on the slope and foot of Visokaya Hill. Death filled the air, and at each step the killed and wounded rolled over in heaps. In spite of this, Irman, with Organov and Pabilevski, continued to clamber up the hill. It was evident that they had decided to conquer or die.

The hillside was covered with killed and wounded, but the living continued to move forward. The Volunteer Detachment on the extreme right flank, in spite of the terrible fire—they were fortunately covered from the machine gun by the northern slope of the hill—and suffering enormous losses, quickly climbed the hill, reached the right peak, and attacked it without delay. Charging with the bayonet, they succeeded in retaking half of the right redoubt.

In this success the Volunteers were greatly assisted by Sergt. Kibikin, who had taken command of the remnants of his oth Company after Lieut. Sirotko had been wounded, and who also quickly climbed to the right peak, and by his supporting fire and successful grenade throwing in rear of the Japanese, who were being attacked by the Volunteers, forced them in spite of enormous numerical superiority to fall back. For this act Kibikin was recommended by General Kondratenko to be promoted to the rank of Ensign and to be decorated with a gold cross; but because he was not so rewarded on the spot, he is still a N.C.O., and wears no cross of the Order of St. George.

The success of this attack was also partly due to the fact that Irman himself assisted in its immediate superintendence, and encouraged the men by his personal example. The *Bayan* company was one of the first to scale the hill, but its commander was unfortunately wounded, and after this the men lay down in the path which led to the telephone blindage.

The gallant company of the 25th Regiment also pushed forward under Sub-Lieut. Soloviev, an officer whose deeds of valour had come especially under the notice of Kondratenko, and who, outstripping his comrades, gallantly climbed upward with his company, and reached the road to the telephone blindage, in fact, very nearly the top of the hill. Then, without waiting, he set to work to drive out those Japanese who were posted there and on the saddle, when he fell severely wounded in both legs by a grenade, and was carried to the dressing station, and subsequently to the headquarters, 5th Regiment. Here General Kondratenko had a long talk with him, asking many questions about the state of things on Visokaya, and promising to reward his gallant actions with the Order of St. George. His company, after it had lost its commander, also lay down approximately along the line of the road and opened fire.

The toth Company, 5th Regiment, was now commanded by Sub-Lieut. Borodich. This officer, who belonged to the 28th Regiment, had been sent to take the place of Staff-Capt. Astafiev, who was killed on the 30th November. He became highly popular with the men, who would do anything for him. In their ascent, climbing over heaps of killed and wounded, they reached the same road, leading up from the telephone blindage. At this point gallant Borodich was killed, to the great grief of his men, who also lay down here and opened fire.

The left column rushed forward up the hill with the utmost gallantry, but coming under very heavy fire, they lost Lieut. Agafonov killed, and Ensign Goluber wounded, and lay down on the slope at a little more than half-way up. After they had lost their commanders, the men lying on the exposed slope also melted away under the cross fire of the Japanese. The corpses lay in heaps, and among them lay the survivors. Groans, the crackling of machine guns, and the explosions of shells and grenades filled the air with all kinds of noises, in which the voice of one man was completely lost. While keeping up their rifle fire, the men saw nothing but the dark silhouette of the hill and the flashes of the fire directed at them, heard nothing but the echoes and whistling of every possible form of deadly danger, and could only try more closely to crouch against the slope, which provided no cover, and which was being so appallingly swept with shells, grenades, and the bullets of rifles and machine guns.

All the efforts of Irman, Organov, and Pabilevski to make these companies get up and move forward were unavailing. After despatching Organov to the headquarters, 5th Regiment, to make a personal report of the state of affairs to General Kondratenko, Irman went down the hill, and finding there a large crowd of stragglers, he set to work to organize them into a single unit, with which he might support the companies lying on the hill and carry them forward. But he found this plan very difficult to carry out; some of the stragglers, through bad food, hard work, nine days' uninterrupted fighting, and other ills, were quite exhausted, others, from wounds received in previous fighting, were maimed and quite unable to mount the hill, and finally a third lot, having survived the horrors of the fight, had become moral cripples, and of all were the least fit for fighting.

Such was the state of affairs on Visokaya Hill at 8.30 p.m., when Irman, desiring an interview with Kondratenko at which he could personally explain the causes of his failure, handed over the command to Capt. Pabilevski and set off for the 5th Regiment Headquarters.

General Kondratenko, rapidly losing hope of recapturing the hill, was suffering severely from the disappointment, when Irman arrived and reported approximately as follows :—" The men are extremely fatigued and cannot climb the steep slope; they crawl a few paces and then stop to take breath, and consequently their attack has no vigour and they suffer enormous losses. The stronger men move forward more quickly than the weaker ones, but almost all of them have fallen under the terrible fire from the hill. Besides this, it is extremely difficult to direct the attack, it is so dark that nothing can be seen. From the explosions of shells and grenades, from the crackling of the Japanese machine guns, from the rifle fire, the shrieks of the wounded, and the cries of the combatants, the noise on all sides is so great that commands are not heard. The men are so keen on firing that nothing will stop them; it is necessary to shout orders to each man in his ear. The greater part of each company has fallen, and the survivors, collected together in groups, lie flat on the slope and fire. Unfortunately hardly anyone knows the ground; there are no officers—all have fallen. But in spite of all difficulties I led the men three times to the attack and obtained some success in places. But for complete capture of the hill the force is utterly insufficient; we require at least eight fresh companies more."

Having no spare companies at his disposal and unable to abandon the hill, Kondratenko was dissatisfied with this report, and after asking Irman several questions, he wound up the interview by saying :-- "Do you wish me myself to lead the companies to the attack? Ride off there and attack again!"

Irman answered, "It shall be done," and turned to leave; but the officers present at the headquarters detained him for a minute. Well knowing the reckless bravery of General Irman, no one doubted that after this order he would go to certain death, and with no possibility of obtaining success, he would do his best to return no more. To each one it appeared certain that he saw Irman for the last time, and each tried to calm him and to persuade him not to sacrifice his life quite uselessly. M. Sliunin, the priest of the 5th Regiment, who was present, took an ikon and, blessing the General, hung it round his neck outside his sheepskin coat.

He then set out for Visokaya Hill in company with Capt. Gobyato, and found the conditions unchanged. The road to the telephone blindage was in several parts brightly illuminated by the woodwork of blindages and other works having been set on fire by the explosions of shells and grenades. The companies, now much thinned, were still holding the slopes in groups and carrying on rifle firing.

Irman and Gobyato collected some of the stragglers and led them up the hill. The Japanese, noticing the movement, re-opened a terrific fire, increased now by the fire of yet another machine gun.

Capt. Gobyato urging on the men started up the steep slope, but had only got about half-way up when he was hit by a bullet in the mouth and lower jaw, and went back to the dressing station. Irman, now unattended by an officer, went in the open up the slope, and gathering together from various parts a few handfuls of men, led them to the attack, throwing himself with drawn sabre in front of them, but found that he could do no good. It is astonishing that he should have remained uninjured. His orderlies were wounded, and his *gens d'arme*, though twice wounded while doing his duty and accompanying him, remained with his General until a third wound finally laid him low.

On his way from the dressing station to hospital, Capt. Gobyato called in at the 5th Regiment Headquarters and explained in writing, for he could not speak, to General Kondratenko, the state of affairs on Visokaya. His opinion was that either everyone in Port Arthur must be sent at once to the hill, or that it should be abandoned while it was yet dark and the [apanese could not see the weakness of the force attacking them.

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At any rate, to attack an enemy eight times stronger, and occupying, and entrenched in, a position of such strength as Visokaya Hill, was a matter of great audacity, to which the Russian troops had gone only on the strength of the brilliant results of their counter-attacks on the preceding days, and because the Japanese had acted without confidence.

The reports which were brought in by mounted Volunteers were short, delayed, and sometimes entirely lost. Consequently it was necessary to apply to the wounded officers who were brought in from the hill, and most of the information received was obtained from this source. This information was very unfavourable and left little hope of success, but Kondratenko was unwilling to believe it. How many times already had they survived alarms on Visokaya? How many times had he lost all hope and sent one or two companies in haste, rather to cover a retirement than to support an advance, when he had received the entirely unexpected news that the hill was re-captured? In his heart he was awaiting yet once more news of success.

But after he had received Gobyato's report, he decided to call a council of war, and summoned first Lieut.-Colonel Organov, and later General Irman also, to explain the existing state of affairs. After hearing from these others reports to all intents similar to that of Capt. Gobyato, he said sadly, "Now begins the death agony of Port Arthur," and then after a short silence he sent round to summon the council.

A table was put into the room, which previous to the fighting had been occupied by Colonel Tretyakov and Lieut.-Colonel Seifulin, and which had previously been a model of neatness and cleanliness, but was now deserted and disordered, with unnecessary rubbish thrown about the floor. On the table was unrolled a large plan of the fortifications of Port Arthur, and around were arranged a stool and a few benches. In the centre sat General Kondratenko, with Colonel Semenov by his side, and the rest sitting and standing round the table in two rows, irrespective of ranks. Irman and Organov had returned to their troops under Visokava.

The state of affairs was briefly as follows:—From all places where men could be withdrawn without actual danger everyone had been taken, and had perished on Visokaya Hill. Of those who remained there were insufficient to re-occupy and hold the hill unaided. Besides this they were extremely exhausted by the 10 days of uninterrupted fighting, and could hardly move.

The Japanese were quite firmly established on Visokaya, and at the same time carried forward their attacks on the centre and right flank of Arthur. No one doubted that their main objective was Visokaya Hill, and that the other attacks were merely demonstrations; but it was quite impossible to make use of the companies in the attacked areas. It was necessary to hold on at least to what was not yet lost.

After informing those present of the existing state of affairs, Kondratenko put a question in this form: - "Can anyone give a suggestion as to how Visokaya Hill can be preserved?" After some silence, various remarks were heard, from which the general opinion was clearly shown that, with a sufficient number of fresh troops and with complete artillery support, it might be possible, but such resources were not at their disposal. To the question "Is it not possible to save Visokaya with available resources?" all present, fearing to grieve their already saddened comrades, merely shrugged their shoulders. The spirit of hope and confidence which had existed up to the 30th November was now changed to despondency and apathy.

At first General Kondratenko wished to adopt the former method of saving the hill, *i.e.*, by bombarding it with the artillery from the forts, and again attacking it with all available forces; but then he hesitated and renounced this plan, for the reason that the artillery, through want of ammunition, gave no hope of success. An example lay before us. At 6 p.m. the artillery had fired, but it had given the infantry no assistance. Added to this, at any rate on the right peak, the Volunteers were somewhere holding on, and it would not do to risk shelling their own men.

"And so, gentlemen, no one can propose a way of preserving Visokaya Hill?" said the General, casting a lingering glance around those present; and when he had recognized that this was indeed the case, he decided to abandon the hill, and put forward the following question :—" What position shall we now occupy, *i.e.*, shall we hold Flat, False, and Division Hills, or retire to the line of the original position, between Forts Nos. IV. and V., including Red and Fougasse Hills and the New and Two-Angled Lunettes?"

Here followed a short but animated interchange of opinions, from which it was decided that the second position was the more suitable, because with the fall of Visokaya the strength of Flat and False Hills had been lost, as the near distance and the great command of the first gave to the Japanese the power of raking their trenches, and of observing each yard of their defences, with a view to attacking at a favourable moment. The whole of the Tea Ravine was clearly seen from Visokaya, and all passage along it of provisions, cartridges, grenades, or reinforcements in the daytime must be finally put a stop to. Further, if the Japanese by a successful attack should occupy these hills by daylight, the garrisons retiring along the ravine under fire from Visokaya must inevitably be destroyed; and it was surely a mistake to risk whole companies where men were so short.

But the main advantage of the second position lay in the fact that it was only half the length of the other and gave the power of saving several companies. Its fault lay in the trenches, blindages, and other works, which were greatly inferior to those erected with so much trouble on Flat and False Hills, and which had not as yet been completely destroyed by the Japanese artillery. But this fault was not a serious one, since the distance of the Japanese trenches from the new position was at least a verst, while from the old position it was only some 50 to 70 paces; and while the Japanese were advancing over this distance the Russians would have considerable time to improve the condition of their works.

And so it was decided to occupy the position from Fort No. IV., through Two-Angled and New Lunettes, and Fougasse and Red Hills, to Fort No. V.

Orders for carrying out this decision were sent at about 11 p.m. to the various companies. Division, Flat, and Fougasse Hills were to be evacuated during the night, and all necessary stores were to be brought to the new position, every precaution being taken that the enemy should not notice what was going on. In order that the Japanese should not advance into the Tea Ravine before dawn, and by doing so upset the plan for occupying the new position, General Kondratenko sent Lieut.-Colonel Zubov to take command of and reorganize the troops under Visokaya, with orders to hold back the Japanese at all costs the whole night and retire at dawn, after demolishing all works which had not yet been wrecked by shells, and which might be serviceable to the enemy.

Irman and Organov started back on their way to the headquarters at about 10 p.m., and Pabilevski remained in chief command under Visokaya. At this time there was a distinct lull in the firing, and the gallant Sub-Lieut. Nechay, 27th Regiment, who was commanding several companies of the 5th Regiment. noticing this weakening of the Japanese, decided personally to satisfy himself as to where they exactly were, and in what numbers.

In vain did Pabilevski tell him not to do this, and with three or four Volunteers he started on his rash reconnaissance. He crept to the top of the hill and stopped before the low parapet of a newly completed Japanese trench. Cautiously raising his head, he began to look around, and the Volunteers did the same. Just then the Japanese began to fire; Nechay's forage cap flew high into the air, and he and two of the Volunteers remained motionless while the rest crawled rapidly down.

Shortly after this Pabilevski was appointed to the command of the newly occupied original position, and he was recalled to headquarters to receive his instructions. Lieut. Sirotko, who was lying wounded in the dressing station in a blindage, took his place, pending the return of Irman and Organov; but he did not hold the command very long, as the others soon returned, and at about 1 a.m. Lieut.-Colonel Zubov also came up to superintend the retirement.

Each of the companies posted on Flat, False, and Division Hills, on receiving instructions for their retirement to the new position, was divided into two parties, one of the uninjured men and the other of the remainder. The able-bodied half-companies were at once loaded with stores, and under the command of N.C.O.'s started for the new ground, while the rest, with the company commanders, remained to guard the trenches.

At about 1 a.m. the able-bodied men reached their new positions, deposited their stores under guards, and at once returned, so that at about 2 a.m. the companies were again at full strength. Then in each company from 12 to 20 Volunteers were chosen to cover the retirement. These men were to remain in the trenches for about an hour after their company had left, and extended in a thin line were to fire and throw grenades at the enemy, so that he should not discover the retirement. At about 3 a.m. the companies left their ruined trenches on Flat, False, and Division Hills, and at about 4.30 the Volunteers also retired.

That the retirement was entirely unnoticed by the Japanese is shown by the fact that, in their official report of the occupation of Flat Hill, it is stated that the Russians posted there could not hold it under the fire from Visokaya and from other points, and were obliged to retire, and that in consequence of this the hill was occupied by them at t p.m. on the 6th December. There is no mention of the occupation of False and Division Hills in the report. This shows that they were taken still later, in fact, it was not till about 2 p.m. on the 7th December that, after a powerful artillery bombardment, they attacked Division Hill and took it without loss. On the 7th December Sub-Lieut. Galileev, 5th Regiment, with Volunteers from his own (11th) and the 8th Companies, carried out a sortie from Red Hill against False Hill, and found that the side of it facing the Russians was unoccupied, while the other side was held only by a picket.

The companies posted under Visokaya Hill waited till dawn on the 6th December, and then retired in good order to the original position, covered by Volunteers and by the units which had suffered less seriously than the rest. The Japanese could not have failed to notice the retirement of these last detachments, but they contented themselves with pursuing them only with rifle fire.

During this day, the 6th December, Naval Engineer Losev and Sub-Lieut. Gudkov, with a wounded rifleman and a telephonist, were taken prisoners in the telephone blindage on Visokava. It will be remembered that at 4.45 p.m. on the previous day Losev had reported by telephone the critical state of affairs, and had begged permission to leave the hill and carry down the telephone, but had received orders to hold on. Meanwhile the Japanese had already reached the blindage and dropped down into the approach leading to it. Fearing that they might get into the blindage and make use of the telephone to listen to orders from the Russian staff, Losev barricaded himself in the blindage, hoping to get out again when the hill should be retaken. But this did not take place. All night long bullets and splinters of shell whistled past, machine guns crackled, and hand grenades burst on it or near it, threatening to set it on fire. By dawn the sounds of the firing receded, and it became evident that the Russians were retiring. They consulted together as to the best way to escape, and decided to wait for the night, hoping that in the darkness they might succeed in slipping past the Japanese, who were moving about near the blindage and over the whole hill. Unintentionally they all went to sleep, and were thus captured.

On this day, also, a wounded rifleman came in, and stated that he had remained after the rest had retired in the dressing station, where he had been found by the Japanese, who treated him kindly and dressed his wounds, and one of their doctors had spoken to him in Russian. He said that the Japanese were all laughing; probably they were delighted at the capture of the hill.

On the 7th December, at dawn, 'two riflemen came in from Visokaya, and said that by a miracle they had escaped injury in a ruined blindage, and subsisting on biscuits, were waiting to be dug out, when they found that the fighting on the hill was finished, and that Japanese voices were heard on all sides. Using their combined efforts to enlarge the opening of a loophole, after about 24 hours' work they made it large enough to climb through. Going cautiously down the hill and taking the direction of False Hill, they nearly ran into a Japanese picket, but thanks to the loud talking of the Japanese soldiers, they discovered it in time, and turned in the direction of Tea Ravine. When they had avoided the last Japanese post, they got up and began to run. A dog ran after them and the Japanese fired a few shots, but did not follow them. They were the last to leave Visokaya Hill.

Results.

When they had taken the hill, the Japanese established an observation post on it, from which they were able to correct the fire of their 11" guns on the fleet, and in the course of three or four days they sank all the battleships which had taken cover under the land defences in the inner roadstead.

The Russians saw with pain and disgust the shameful destruction of their fleet. One after another, large and small, they were struck and foundered in the shallow waters of the inner roadstead, now called sarcastically the "Haven" or "Mouse Trap." Only the gallant commander of the ironclad *Sevastopol*, Capt. Essen, not wishing to expose his ship to such a fate, took her into open waters and moved to the outer roadstead of the White Wolf. Almost daily did the Japanese throw 11" shells at this ship, right over Arthur, and almost nightly they attacked her with torpedoes, in which they sometimes lost torpedo-boats; but it was not till the end of December that they so wounded her that there remained nothing for her heroic crew but to sink her. Then Essen took her out into 150' of water and sank her. A heroic resistance; and even the very fact of sinking her where he could rely upon her total loss encouraged the land garrison and drew great sympathy towards her crew.

The Japanese, observing from Visokaya Hill everything that went on in the New Town, were able practically to stop any movement about the streets by daylight. They also fired by night; but this firing was only at random; while by day they threw shrapnel from guns posted on Visokaya at every passing wagon and cart, every group of men, and even at individual passers-by.

Besides this the hill played an important part as an observation post in the attack on Forts Nos. II. and III., Entrenchment No. 3, and the Great Eagle's Nest.

Tactically, in Visokaya Hill the Russians lost and the Japanese gained the strongest of all the temporary defences of Port Arthur, a commanding height and key to the Western Front, and, in some opinions, to all Arthur. The loss of Visokaya was especially felt by the works of the Western Front, which it took in flank and rear at a short range, as, for instance, Fort No. IV. Besides this a direct road into New Town—the Tea Ravine—had been thrown open to the enemy. Morally, the fall of the hill had a very depressing effect on the garrison, and greatly encouraged the Japanese.

The men now posted in new positions, which were neither naturally nor artificially notable for their strength, instead of engaging in cheerful conversation, kept their eyes sadly directed against the threatening, depressing form of Visokaya Hill, covered with the black craters of 11" shells, like the festering sores of some terrible illness. They did not fail to see the importance of the position and the power of its works. They recognized that every effort had been used in the struggle for its defence, and that each man, sparing neither life nor strength, had loyally done his best, had fought to the last, and yet the enemy had conquered evidently he was stronger than they !

The conversations on such occasions sometimes turned into grumbling

against those in command, who, when Flat, False, and Division Hills were abandoned, had forbidden the men to set fire to the uninjured buildings and stores which were left behind. This was done to conceal the retirement, but it offended the men that blindages built by their hands should preserve their enemies from the cold.

The desperate struggle on Visokaya had so thinned the garrison and weakened its numbers that it had lost the power of making a sufficiently strong defence of the remaining positions. Want of men and the absence of reserves was noticeable everywhere, and this, in the writer's opinion, was the chief cause of the failures which brought about the fall of the fortress.

It is very difficult to fix the exact number of the Russian losses in this fighting, because the troops which took part in it included, besides the whole of the 5th Regiment, many combatant, non-combatant, and composite companies of other Arthur regiments and Reserve Battalions, Hospital Detachments and sailors. In all, more than So companies and detachments took part in the fighting on Visokaya and Flat Hills, some of which had completely disappeared in the fighting, and others, Hospital Detachments and Reserve Battalions, were now drafted into other units, and of their losses it is very difficult to form an estimate. But the total loss in killed and those of the wounded who were taken to hospital certainly exceeded 5,000, and if the wounded who continued to perform duty are included, the total was probably nearer 7,000.

In the 5th East Siberian Rifle Regiment alone, out of 23 officers, 26 ensigns, and 1,805 rank and file, in which number the non-combatant company is included, as it was present throughout the fighting on Flat Hill, the following casualties were sustained :—14 officers, 17 ensigns, and 1,251 rank and file, in which number the proportion of killed was about one in four.

If it is estimated that the Japanese in this fighting lost twice as many men as the Russians, *i.e.*, 10,000, and that their army had previously numbered 100,000 men, which was about five times the strength of the Russian troops employed on the positions at that period, it will be seen then

that after this fighting they remained six times $(i.e., \frac{100-10}{20-5})$ as strong.

And so the desperate struggle on Visokaya Hill and its fall influenced very strongly the fate of the fortress, and were, so to speak, the turning point in the direction of the failures which led to its fall. Well may Kondratenko have said when he saw no means of preserving Visokaya Hill, "This begins the death agony of Port Arthur."

In conclusion, the author describes how at the end of the war he obtained three days' leave from the Prisoners' Camp at Sizooko and paid a visit to Tokyo. He and his companions did a great deal of sight-seeing, and visited among other things the museum, which already contained a large collection of Russian arms and equipment; but their interest was aroused at a fairly late hour on the last day of their visit by hearing that in a certain garden a feast of chrysanthemums was being celebrated by

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means of pictures, made almost entirely of live flowers and foliage. Hastening to the spot, they found that the garden was divided into four parts, in each of which were exhibited two large and two to three small pictures, illustrating popular scenes of Japanese legends and history. The majority of these naturally had reference to their recent war, and the place of honour was given to a large representation of the final struggle for 203-Metre Hill.

A large crowd was gathered round this picture, and, with the help of an interpreter, the writer was able to understand that among the Japanese the fighting on Visokaya was admired beyond any other incident in the war. Nowhere did they meet with such resistance, nowhere were the methods of fighting so ghastly, and nowhere did the Russians show themselves so courageous, resolute, and persevering, as on this occasion.

When the Japanese decided to erect at Port Arthur a monument to the fallen Russian soldiers, in honour of the gallant deeds of the garrison, and sought to place it on the spot which was most glorious to the defence, they decided upon Visokaya Hill. Surely this fact is more eloquent than words.

And yet this is far from being the way in which the Russians look upon the gallant actions of their own troops. In a slough of intrigue, and stirring up all possible dirt, they apply a magnifying glass to the microscopic blots in the grandest struggle of the war, and while unsparingly baiting the seniors of the garrison over small trifles—very often invented and always exaggerated—they leave themselves no time to notice and reward the gallant deeds of those who took an actual part in the defence.

In conclusion, as the name of Tretyakov is so inseparably associated with that of Visokaya Hill, the author adds the following short note on his previous career :---

General Tretyakov, at that time a young Sapper officer, earned considerable distinction during the Siege of Plevna. During the China War, at Hunmir, a small Russian force, consisting of two companies, 5th Regiment, and a company of Sappers, was attacked unexpectedly by large masses of Boxers, but was saved by the courage and resourcefulness of Colonel Tretyakov, who threw himself forward, leading on his men, who were paralyzed from surprise, and finally dispersed the Boxers. Finally at the Battle of Kinchow he and his regiment greatly distinguished themselves, and sustained the attack of three Japanese divisions.

F. E. G. Skey,

Note.—In the portion of this Transcript which appeared in the October and November *Journals*, the dates given have been wrongly transcribed from the "old" to the "new style," and should really be two days earlier than shown. 1910.]

REVIEWS.

LA MANŒUVRE POUR LA BATAILLE.

By COLONEL OF ARTILLERY F. FOCH. - (Berger-Levrault et Cie. 10 frs.).

This book is the sequel to *Principes de la Guerre*, which was reviewed by Capt. Sewell in the *R.E. Journal* of May, 1907. It consists mainly of a critical strategical account of the action of the German armies in 1870, up to August 18th, with particular reference to the 1st and 2nd Armies. The author first briefly considers the object and direction of a campaign and the preparations to be made during peace time. The conclusions arrived at may be summed up as :-Detailed preparations leading up to the first battle; then further movements in accordance with the needs of the fresh situation, but always in conformity with the end in view.

The author next proceeds to discuss in detail Moltke's memoir of 1868-9, and from his remarks about present-day preparations he seems to think that France has more railways than are necessary for concentration on the north-east frontier. This would give her a choice of several lines of action, and enable her to reply to the German idea of carrying out a preconceived plan, seizing the initiative, and forcing the enemy to conform to their movements by the rapidity of their action, by carrying out a plan-prepared indeed beforehand, together with several others—but only chosen at the last moment and thus creating a strategic surprise.

The main themes of criticism thoughout the book are :- The lack of a strategical advanced guard to the German forces, the great distance from the front at which the Royal headquarters remained, and the preference of Moltke and Prince Frederick Charles to base their actions on hypothesis as to what the French ought to be doing, rather than on information as to what they actually were doing. Moltke did indeed twice order masses of cavalry to be pushed forward, but in the second case-the occasion of the passage of the Moselle by the 2nd Army-Frederick Charles had allotted all his cavalry to separate corps, and could only dispose of two brigades. The cavalry divisional commanders, too, by no means fulfilled the very moderate demands made on them by headquarters. But while criticizing, from the strategical point of view, the manner in which the German forces were led, Colonel Foch does full justice to those moral qualities in the leadership which enabled the Germans to gain victories despite their mistakes-the determination to win, and the initiative and loyal co-operation of the subordinate commanders. He contrasts with this the conduct of the French leaders at, and in the neighbourhood of Spicheren on August 6th, the supineness of

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whom Colonel Foch declares to be the chief characteristic on the French side. They obeyed only the letter of their orders; each considered hisown situation, with the conviction that he could not count on his neighbour; he felt himself alone and involuntarily looked to the rear. The causes of this lay in a steady centralization and repression of all initiative. Moreover, the natural qualities of the French were ignored, and the advantages of fire and of the defensive—*i.e.*, of immobility—were impressed upon all.

In his account of the Battle of Vionville the author is full of praise of Prince Frederick Charles' decision, so strongly condemned by Moltke, to order the last German attack. Throughout the day it was only the moral superiority of the German leadership which enabled two German corps to make head against the whole French Army, and this last order to attack was, in Colonel Foch's opinion, the crowning example of this superiority. The men were exhausted, but "the will of the leader must dominate the troops." In the centre the guns were ordered to advance, "not with the hope of securing material effects, but to affirm the will to conquer and the power to advance." The same spirit was shown two days later at St. Privat, when at 7 p.m. orders were sent to the last reserves, the IL, X., and most of III. Corps, to join in the attack.

Though one or two of the author's arguments may not be entirely convincing, yet it is altogether a most interesting book, and gives a good idea of the modern French doctrine of the strategic advanced guard.

C. F. STOEHR.

NOTES ON GERMAN FIELD TELEPHONES, AS LAID DOWN IN "ARTILLERIE UNTERRICHT."

(From a translation by Capt. A. H. Ollivant, R.G.A.).

Each (German) battery of field or horse artillery has three telephone "stations," each consisting of two men; in the horse artillery all the "stations" are mounted, in the field artillery only one.

The equipment of a "station" consists of-

- (a). A portable telephone apparatus, with hand telephone and buzzer call, and an additional headgear receiver.
- (δ) . A telephone receiver, with calling switch and a megaphone attachment.
- (c). Six drums, each containing 500 yards of cable.
- (*d*). Three signalling flags.

In addition there is a reserve for each battery, containing two telephone, sets, 30 rolls of 500 yards of cable, an acetylene signalling lamp, and various spares.

The "hand telephone" is somewhat similar in appearance to telephone hand, C, Mk. II., and is of the "Mix and Genest" pattern, which was tested

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by the R.E. Committee a few years ago, but was not adopted. The portable set is carried in a leather case, which is fitted with a carrying strap, but is carried in the knapsack.

The telephone receiver (δ) is used in double stations or intermediate posts. It is carried in a case on the waistbelt, along with the megaphone attachment,

The cable (M96) consists of 2 tinned steel and 1 copper wire, surrounded with tape, and waterproofed with wax. Breaking strain, 66 lbs. [Our D1 has seven strands and a breaking strain of 140 lbs.].

The apparatus is carried by a mounted "station," as follows :----

By the "telephonist "-

Portable telephone on his back.

Battery, rear of saddle, near side.

Case containing two reels of cable, rear of saddle, offside.

By the "orderly"-

Telephone receiver (b) on belt.

A case containing two reels of cable on each side of saddle.

Signalling flags in a carbine bucket.

The cable is laid on the ground and is afterwards raised on to trees, etc., if possible. It can be laid from horseback at any pace required. Winding up is always performed on foot, the horse being led. All officers, telephonists, scouts, orderlies, and horseholders are to be trained in the use of the apparatus, and also in visual signalling (Morse code).

The telephone apparatus is apparently used both for the brigade connection (O.C. brigade to O.C.'s batteries), and for the battery communication (observing station to battery). Apparently one of the "reserve" sets is used at the battery, so that for a brigade of three batteries there are 12 telephone sets and about 8 miles of cable available, which corresponds very closely with the numbers in the British Army. In the latter however a heavier cable, carried in and laid from a wagon, is used for the longer lines of the brigade connections.

E. G. GODFREY-FAUSSETT

1910.]

NOTICES OF MAGAZINES.

ELECTRICAL REVIEW.

1st October, 1909.

DAMAGE BY LIGHTNING (p. 536).—Damage to buildings from lightning stroke is practically preventible. The only means of ensuring safety is Franklin's system propounded 150 years ago, namely, by placing metal rods above the loftiest pinnacles, and continuing the lines of conduction down to moist ground. On the score of cost contracts are often given to those who put in a poor system. Only about 2 per cent. of buildings fitted with conductors are damaged by lightning; this is a proof of their value even when improperly applied. The author states that a defective conductor is usually better than none, and gives a certain amount of security by causing damage to be done at less vital spots. Inspection and maintenance of systems is absolutely necessary, but frequently neglected. Inspection is required to see that new metal work put into the building is properly dealt with.

15th October, 1909.

ELECTRIC MASTER CLOCKS FOR MAURITIUS OBSERVATORY.—An impulse is given to the pendulum every second by a weighted lever, which trips at every swing of the pendulum, and in falling gives it an impulse. The lever closes the contact of an electro-magnet and is lifted back to its original position. The beat can be temporarily retarded or accelerated electrically.

TROLLEY OMNIBUS (p, 634). —A demonstration of railless electric traction was given in London. The object of the system is to enable electrically propelled vehicles to run on ordinary roads instead of only on special tracks, and at the same time to draw their motive power from overhead lines.

22nd October, 1909.

TECHNICAL GUARANTEES.—Under this heading an article in *Engineer* is referred to, and the point emphasized is that—" Too much reliance must not be placed on guarantees given by contractors before acceptance, especially those of an exceptional nature."

WATER FROM BOREHOLES.—Considerations as to necessary depth and permanence of water supply are dealt with, and it is claimed that such holes are frequently bored too deep.

29th October, 1903.

COMPARISON BETWEEN PARSONS AND CURTIS TURBINES (p. 6S3).—Defects and advantages of each type is given, and as the former is not so efficient at the high pressure end, but very efficient at the low pressure end, a combination of two types is advocated. EVAPORATIVE CONDENSERS.—These condensers consist of stacks of tubes, over which a small amount of cooling water trickles. This evaporates and gives low température.

12th November, 1909.

SEALED CARTONS FOR M.F. LAMPS (p. 777).—These are now being introduced, and the lamps can be examined and tested while in the carton. If found defective, they can be returned to the maker, and so long as the seal is unbroken they will be replaced.

15th November, 1909.

ELECTRIC LOCOMOTIVE.—A description of a steam electric locomotive, manufactured by North British Loco. Co., Glasgow, is given. The boiler is of the ordinary loco, type fitted with a superheater. The engine is a turbine of impulse type, connected to a continuous current generator, whose voltage can be varied between 200 and 600 volts. As there is no oil from the turbine, an ejector condenser is used; condensed steam and condensing water are mixed together, and pass to a common tank, from which the boiler feed water is drawn. The cooler is placed in front with turbine driven fan. There is forced draught for the fire, and there are four series-wound traction motors. Two S-wheel compound bogies carry the engine; each bogie has two driving axles, on which is a motor apiece. The engine is intended for express passenger work, so that it will be possible to make comparative tests between it and ordinary standard engines.

19th November, 1909.

FURTHER CORRESPONDENCE ON Low VOLTAGES FOR COUNTRY HOUSE INSTALLATIONS (p. SO7).—Voltages as low as 4 are mentioned. These low voltages allow low c.p. lamps to be used, as well as a small number of accumulators, but prevent arc lamps from being installed, require very large copper mains where many lamps are used, and are not so suitable for electric heaters and motors.

CONTINUITY GRIPS (p. 809).—The wiring rules of the Institute of Electrical Engineers require all systems of metallic conduits electrically to be continuous. To bring various "slip joint" systems within these rules, "continuity grips" have been introduced, so as to avoid replacing such systems already installed by screw conduit work.

BRIEF RÉSUMÉ OF LECTURES ON ELECTRIC RAILWAY WORKING GIVEN AT INSTITUTION OF CIVIL ÉNGINEERS (p. 813).—Experiences of three systems are given, namely, Heysham, Mersey Railway, and Tynmouth branches of N.E. Railway. The first mentioned is single phase A.C.; the two latter C.C.

LIGHTING SCHEME FOR x SMALL VILLAGE (p. 837).—An article on this subject shows that where water power is available electric light can be supplied commercially at *low rates* even *for small* installations.

26th November, 1909.

ELECTRIC IGNITION FOR INTERNAL COMBUSTION ENGINES (p. S50).—The article gives a description of the various types, viz., accumulator and coil,

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high and low tension magneto, lodge system, and synchronized system. Comparing the magneto and the coil ignition, the author states that the magneto is the more expensive in initial cost, but the mechanism is more simple, compact, and reliable. Greater power is obtained when using magneto, because, as the speed of the armature increases, the spark produced becomes larger and hotter, and combustion commences and progresses more rapidly.

2,000-H.P. MOTOR-DRIVEN LOCOMOTIVES FOR PENNSYLVANIA RAILWAY (p. 878).—A description and pictures are given of these locomotives. The loco, is of the articulated type. Each half weighs 150 tons, and has four 68" driving wheels.

3rd December, 1909.

TELEPHONE SYSTEMS (p. 915).—In a lecture on this subject stress is laid on the necessity for speed in dealing with calls in the exchange. The following advantages are claimed for the central battery system. It dispenses with local batteries and generators; it keeps the lines permanently under test; it concentrates responsibility and supervision on the switchboard; and it gives greater uniformity of speech. A wider use of telephones in offices and workshops is advocated.

10th and 17th December, 1909.

LOADING OF TELEPHONE CABLE CIRCUITS (pp. 953 and 993).—In any telephone circuit there are four factors which exert an influence on transmission. These are (a) resistance; (b), inductance; (c), electrostatic capacity; and (d), reciprocal of the insulation resistance. The investigation of their joint influence on the transmission of speech is a matter of some complexity, and is dealt with at length.

TRANSMISSION OF ELECTRICAL ENERGY (pp.956 and 995).—Water-power schemes and long-distance transmission lines are more common in America than in Europe, largely owing to the cheapness of wayleaves. A 110,000volt transmission is mentioned, but 60,000 volts is the usual limit. Modern practice of hydro-electric plants is discussed. The capital costs appear to be from £20 to £30 per k.w. installed, as against £10 for steam turbine stations.

A. E. DAVIDSON.

LE BULLETIN.

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EMPLOYMENT OF FIELD ARTILLERY.—In the June number of the journal General Langlois contributes an article on the employment of field artillery in conjunction with other arms, which is also continued in the July number.

SAPPER CVCLIST DETACHMENTS.—Under the heading of Foreign Military Intelligence there is a brief description of the sapper cyclist detachments which form part of the French light cavalry divisions. Each of the four divisions has one such detachment allotted to it, its strength being 1 officer, 3 drivers, 31 N.C.O.'s and men. The detachment carries 40 lbs. of mélinite and a certain number of technical tools on their bieycles. Additional technical and bridging stores and explosives are carried in two wagons, which, with a G.S. wagon for regimental stores, form the 2nd line transport of the unit. The bridging stores are chiefly lashings and waterproof bags, each of the latter carrying four men in marching order or five men in fatigue dress. The full load on the bicycle is 40 lbs., excluding the rider. The men are armed with the carbine and short bayonet.

August, 1909.

REORGANIZATION OF THE FRENCH ARTILLERY.—The evidence, taken before the Military Commission, as to the merits of 4-gun as opposed to 6-gun or 8-gun batteries is given at some length. The 4-gun organization for field batteries has been definitely adopted. The reorganization will be complete in two years' time, and will provide 634 field batteries (75 m.m.).

AUSTRO-HUNGARY.—In the Foreign Military Intelligence it is stated that Austro-Hungary is experimenting with an explosive rifle bullet, designed to produce a puff of smoke on percussion, for use in ranging.—The War Office is said to be purchasing two dirigibles of the Parseval and Lebaudy types.

October, 1909.

THE REFORM OF MILITARY LAW IN FRANCE.—An Act for the suppression of courts-martial in time of peace was passed by the Lower House on June 11th, 1909. It provides for additions to the Civil Code, to enable military offences to be dealt with by civil courts, aided by military juries, which will include N.C.O.'s and men.

A list of penalties is given, and these certainly do not err on the side of leniency, e.g.:-

Sleeping on sentry duty		2 to 6	months'	Imprisonment.
Refusing to obey an order	· ···	1 to 2	years'	**
Striking his superior officer	• • • •	5 to 10	years'	.,

General Langlois has proposed an amendment retaining courts-martial and constituting a corps of military legal advisors.

November, 1909.

A short digest is given of the Japanese Field Service Regulations, 1907.

MILITARY INTELLIGENCE. – France.— Telephonic apparatus for infantry regiments. A certain number of infantry regiments who took part in the last grand manceuvres were supplied with portable field telephone apparatus. This was carried in three wallets on the waistbelt, one containing the cell, another the apparatus and spare microphones, and the third a reel of wire 1 kilometre long; the latter could be unrolled either by being held in the hand or by fixing on to the wallet. The apparatus was of the existing pattern, microphone and receiver on the same holder. The wire being extremely cheap, it will be unnecessary to pick it up again in the field, as this was found impracticable to do in the late war. It is laid most simply; an iron rod, with a hook at the end, fits into the end of the rifle, and allows of the wire being hung some distance above the ground, on trees, posts, etc.

'E.R.'

MITTEILUNGEN ÜBER GEGENSTÄNDE DES ARTILLERIE-UND GENIEWESENS.

October, 1909.

A COMPARISON BETWEEN THE EFFICIENCY OF INFANTRY AND ARTHLERY FIRE, BASED ON THE RESULTS OF THE RUSSO-JAPANESE WAR.—There has latterly been a good deal of complaint that artillery fire is far behind rifle fire in efficiency, the reason being that in the last war only 7 per cent. of the losses were due to artillery and 93 per cent. to infantry.

The following is an attempt to eradicate the false impression which has been produced.

From trustworthy documentary evidence, it is known that the percentages of deaths and wounds due to the different weapons were as follows:----

Caused by rifle fire	•••	•••	 	86 pc	er cent.
Caused by artillery fire		•••	 	11	, ,
Caused by cold steel			 	3	"

Thus, as in the Russian Army the proportion of guns to men was three guns to 1,000 men, from the table above, the proportion of the losses due to these two forces is 11:86.

To obtain a fair comparison, we must compare the results obtained by a battery firing for a definite space of time, say one minute, with those of an infantry firing line whose length is the same as that of a battery in fighting formation, also firing for one minute.

The extent of front occupied by three guns is about 50 paces, and the maximum number of men that can be got into a front of that length is 50. It must also be remembered that the efficiency of artillery fire at a range of 3 kilometres is about equal to that of infantry at 1 kilometre, and that at 500 metres they are about equally effective. From the above it follows that if 50 men and 3 guns were allowed to fire at a target of men at a range of 500 metres for one minute, the losses due to each of these two units would be equal. Now the proportion 11:86 is based on the fact that there were 3 guns to 1,000 men; so to make our comparison fair we must find the proportion of losses due to 3 guns and 1,000 men, both firing as hard as they can at 500 metres. This proportion is obviously 1:20, for 3 guns are equal to 50 men - or 4:3:86!

Therefore in the Russo-Japanese War the artillery was 11/4.3, *i.e.*, $2\frac{1}{2}$ times as efficient as it might have theoretically been expected to be! Moreover it must be remembered that the artillery has always to fight the hostile artillery before the battle begins, that is to say, a target which does not offer nearly as many living objects as an infantry target.

From the above it will be seen what an extremely powerful weapon higher commanders have at their disposal in their artillery if only they use it properly; to do so however a clear idea of its fire efficiency is absolutely necessary.

THE PREVENTION OF MALARIA.—It is well known nowadays that certain diseases, malaria amongst others, are transmitted to the human body by means of microbes. Hitherto the means of fighting malaria have been either mechanical (the use of mosquito nets, masks, etc.), or internal remedies (such as quinine), or, finally, by the destruction of the insects by pouring petroleum on the marshes they inhabit.

Mr. Hartmann of Wiesbaden now suggests a new means, viz., to plant a type of fern on the surface of the water, thereby preventing the insects from laying their eggs on the surface of the water, and also preventing those hatched larvæ which are already in the water from coming to the surface.

NEW FIELD SEARCHLIGHTS FOR THE GERMAN ARMY.—The result of several experiments with searchlights mounted on motor cars has been so satisfactory, that the German Government has decided to get some for use in the field. The first one built has a strength of 25,000-C.P. and is driven by a 10-H.P. motor; the reflector is so made as to obtain a very long range.

REORGANIZATION OF THE GERMAN ENGINEERS.—The "General Inspection of the Engineer and Pioneer Corps and for Fortifications" is at Berlin, and has under it :—(a), Four Engineer Inspections, of which two are at Berlin, one at Strasburg, and one at Metz; $\langle b \rangle$, the Engineer Committee, which has four sections, all of which are at Berlin; (c), four Pioneer Inspections, of which one is at Berlin, one at Mainz, one at Magdeburg, and one at Dresden for the Saxon Army; (d), the Fortification School at Charlottenburg; (e), the Constructional School at Strasburg.

The *Pioneers* consist of :—The Pioneer Battalion of the Guard at Berlin, with 4 companies and 1 experimental company; and 24 pioneer battalions at different stations all over the Empire.

The Line of Communication Troops (Verkehrstruppen) consist of: (a), The Line of Communication Troops Inspection, under which is the Railway Brigade of 3 regiments. There are 2 battalions to each regiment and 4 companies to each battalion. Two companies of the 2nd Regiment belong to the Saxon Army. The rest are all at Berlin.

To the Railway Brigade are also attached the depôt of the Railway Battalion at Berlin; the Berlin-Juterborg military line, which is 70 kilometres long, and entirely under military direction; and the Traffic Section at Berlin, with a small detachment in Saxony.

(b). The Field Telegraph Inspection at Berlin, which controls 4 telegraph battalions of 4 companies each, stationed at Berlin, Franckfort on the Oder, Coblentz, and Karlsruhe. Three companies of the 1st Battalion belong to the Saxon Army, and a detachment of another company is garrisoned in Wurtemberg. To the 1st Battalion are also attached a wireless section and the Cavalry Telegraph School in Berlin, and to each telegraph battalion is attached a detachment of "train" (A.S.C.) drivers, with their horses, for horsing the wagons in the field.

(c). The Airship Battalion, of 3 companies, stationed at Berlin.

(d). The Experimental Department, consisting of 1 experimental company and an automobile brigade of 2 automobile companies.

The Inspection of Fortifications and of the Corps of Engineers of the Royal Bavarian Army is at Munich, and has under it, the 1st and 2nd Pioneer Battalions at Ingolstadt and Speyer, each consisting of 4 companies, and the 3rd Pioneer Battalion at Munich, consisting of 3 companies; the Railway Battalion, with an automobile section, at Munich; the Telegraph Detachment, 2 companies and a wireless section; the Cavalry Telegraph School at Munich; the Airship Detachment at Munich.

. New FRENCH MACHINE GUNS.—The 11th Division at Nancy has been recently equipped with the improved model of the Pateaux Mitrailleuse; the other troops on the eastern French frontier still have only Hotchkiss machine guns. The Pateaux Firm have to deliver 4,000 machine guns with 6,000 rounds of ammunition per gun in six months. The full allowance is to be 434,000 rounds per gun. Each infantry regiment will be armed with 4 guns (2 sections of 2 guns), the guns being carried on pack animals. Each rifle battalion will have a mounted machine gun detachment. This detachment will consist of 2 machine guns, 2 wagons to carry their equipment and 49,000 cartridges, 1 officer, 24 men, 1 riding horse, and 9 draught horses.

A NEW SWISS RIFLE FOR NEW AMMUNITION.—At present the Swiss Army is equipped with the M89/92 rifle, which has a calibre of 7'5 millimetres, and fires a projectile weighing 13 grammes. The initial velocity is 600 metres per second, and the rifling consists of only three grooves. This weapon does not come up either to the French one firing the D cartridge, or to the German one using the S. It is therefore intended in Switzerland to construct a new rifle and a new cartridge which will surpass both the above-named sorts of ammunition. It is known that up to a range of 750 metres the trajectory of the German projectile is the flatter of the two, but that after that range the French projectile is the better one to use. The reason of this is that the German bullet is 10 grammes lighter than the French one; its initial velocity is SS0 metres per second as opposed to the French 720 metres per second.

The new Swiss bullet is to have an initial velocity of \$15 metres per second. The following table gives the dangerous space, at three different ranges, for a target 1 metre high :--

	Projectile.		At 500 m.	At 1,000 m.	At 1,500 m. p.c.
German S		• • •	 146 m.	29 m.	10 m.
French D		•••	 132 m.	36 m.	16 m.
New Swiss	••••	•••	 185 m.	53 m.	29 m.

The new Swiss rifle is to weigh only 4.5 kilogrammes, *i.e.*, 300 grammes less than the one now in use; its calibre is to remain as at present, 7.5 millimetres, and the magazine will hold six rounds.

A. H. Scott.

REVUE DU GÉNIE MILITAIRE.

October, 1909.

THE FLIGHT OF BIRDS.—The writer shows, by mathematical calculations, that a bird or aeroplane which flaps its wings will remain in the air longer than one that merely glides. These calculations do not assume the existence of any valves in the wings. In the same way, a floating plank that has not sufficient buoyancy to support the weight of a man will nevertheless support him if he dances upon it instead of standing still.— *To be continued.*

THE ORGANIZATION OF MINES IN A FORTRESS.—This article begins with a description of the Russian countermines at Port Arthur, taken from the *Eenzhenernee Zhoorual*. No work had been done before the commencement of the siege. If any system of countermines had been designed, it was not available, as all the plans of Port Arthur were with Kuropatkin's field army. The Russian engineers were unwilling to commence any countermines, as they believed that the fate of the fortress would be decided before the galleries could be driven to any effective distance. Finally, when a beginning was made, the Japanese had driven their saps and mines too close up to the forts for the countermines to cause them any serious delay.

At Kikwan North Fort the Russians began two countermine galleries. Through some miscalculation one of these came to the surface of the glacis a short distance from the crest. To remedy this, a shaft about 14' deep was sunk a little distance back and another gallery was started. When it was estimated that the Japanese gallery had come within about a yard of the Russian gallery, the countermine was charged with So kilogrammes The Japanese gallery was destroyed, but the of powder and fired. explosion also laid bare the concrete roof of the counterscarp gallery, The Japanese at once established themselves in the crater, breached the counterscarp gallery, and drove the Russians out of it. The other countermine gallery at Kikwan North did not come sufficiently near the Japanese gallery to be used effectively. This countermine was charged and fired four times. On the first occasion it failed to damage the Japanese in any way. The second charge destroyed part of the counterscarp gallery wall, the third did considerable damage to the Japanese saps, but the fourth destroyed the counterscarp wall altogether. A certain amount of countermining was done at Hatchimaki, Ehrlong, and Long-shu shan, but none of these mines were charged or fired .-- To be continued.

J. E. E. CRASTER.

CORRESPONDENCE.

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TENSION BRIDGE,

DEAR SIR,

Owing to Capt. Mozley's article on a proposed tension bridge in R.E. Journal of May, 1909, a bridge of this type was made in Bangalore. I think it presented few advantages over the ordinary type of suspension bridge. The span was 159', and there were 9 transoms. Ties made of telegraph wire; breaking strain, 2,000 lbs.

I will take the advantages claimed by Capt, Mozley for this tension bridge in order.

CAPT, MOZLEY.

I. Elimination of vertical oscillation, etc. 2 liability of bridge to ... collapse suddenly, etc.

3. No large cables involved. This is a matter of importance, as they are rarely available on service.

4. Distinct saving of time, etc.

5. Simplicity and speed of adjustment, etc.

I. Yes, z. Yes.

3. If sufficient wire is available to make a tension bridge, there is also sufficient to make cables for a suspension bridge.

4. The bridge took me longer to construct. Each tic consisted of 3-7 wires; the extra time required to join these up into a cable is not great.

Putting two cables over a frame, making four anchorage fastenings, and 18 fastenings on cables for transoms took less time than putting 1S ties over a frame and making 36 anchorage fastenings.

5. I find it a great deal easier and quicker to windlass up the transom of a suspension bridge than it is to raise the transom of a tension bridge by taking in the ties at the anchorages.

6. The necessity of high piers in a tension bridge is a disadvantage

7. The ties seemed to stretch more than cable. I twice loaded the bridge, and each time had to readjust nearly the whole of the transoms; a lengthy operation.

S. The same company made a bridge of this type in Sikkim. The only advantage found was stiffness.

The Editor, R.E. Journal.

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