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"The Field Telegraph," its use in war and its Employment in the Late expeditions in the Soudan and South Africa

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Friday, April 9, 1886.

MAJOR-GENERAL SIR REDVERS H. RULLER, D.C., K.C.B.,
K.C.M.G., in the Chair.

"THE FIELD TELEGRAPH," ITS USE IN WAR AND ITS
EMPLOYMENT IN THE LATE EXPEDITIONS IN THE
SOUDAN AND SOUTH AFRICA.

By Major C. F. C. BERESFORD, R.E.

FROM the very earliest ages attempts have been made to invent rapid and secret methods of communication for the purposes of war. The greatest development in this direction has, however, taken place within the last quarter of a century. The electric telegraph has been surely and rapidly spinning its web round the globe.

Space and time have been practically eliminated from calculations for keeping human enterprises in motion, and as war keeps pace with every other enterprise, each new scientific appliance finds an opening in military organizations.

Mr. Plum, the historian of the telegraphs in the American War, remarks: "Like a few great actors who play all parts well, the telegraph upon the stage of life is successful in every rôle, but like them it has its specialities."

It will be my endeavour to show how many different rôles are open to the military telegraph, and to point out what its specialities are; but before it can have full justice done to its capabilities, the interest and sympathy of every branch of the Service must be enlisted.

In almost all armies the telegraph, in its earliest stages, has been snubbed and neglected, not to say opposed; as a well-known authority on the subject, Herr von Fischer Treuenfeld, observes: "The opposition shown to it by many commanders, as being prejudicial to their independent action, is frequently due to an improper ambition, and to a false conception of strategic principles. The most

important principle of modern warfare, *i.e.*, the union of extended action under a single will, being too frequently overlooked." In the Franco-German War, the German telegraph, though one of the chief elements of their success, was at the outset impeded in every kind of way. No proper transport was provided, the detachments were pushed off the roads to make room for other corps, little or no assistance was given in maintaining the line; the poles themselves were frequently used to feed the bivouac fires.

In the Russo-Turkish War of 1877, during the march from the Caucasus to Asia Minor, the field telegraphs were frequently destroyed by wagons and by soldiers, and the poles used as firewood. On complaint being made to the Army Commander, the only consolation received was, "That it was inadmissible in a woodless region to ask the poor sick soldiers to spare the telegraph poles;" and yet the action of the Army depended on an unbroken line of communication some 750 miles long.

In our Army for some years the Field Telegraph Troop at Aldershot was regarded by many as a harmless amusement provided for Engineer Officers at the expense of the taxpayer, and it was much admired as it marched past in the Long Valley. For all that it was quietly doing good work in training Officers and men, and the result of that training has been fully recognized by Generals who commanded in late expeditions.

The greatest triumph achieved by the telegraphs over prejudice has been in China. The difficulties with the French forced upon the Chinese Government the necessity for, among other things, connecting Canton by telegraph with the borders of Tonquin. The characteristic opposition of the Chinese populace to foreign innovation showed itself at once, and all kinds of means had to be taken by the Government and the Danish Engineers, who were in charge, to circumvent the superstition of the people.

It is told how the following explanation was given to awe the inhabitants.

The telegraph poles were said to be inhabited by devils, and were placed close enough together for the devil in one post to be heard by the devil in the next. The wire was merely for the purpose of keeping the posts upright, as a slanting position made the devil inside feel very uncomfortable. These devils spoke a language only known to foreign devils, one of whom was at each end of the line.

Sketch of the History of the Use of Telegraphs in War.

The honour of introducing the telegraph into war is due to the British Army in the Crimea, when short lines were used for connecting the camp before Sebastopol with the harbour, and the several headquarters with one another.

In 1857 it was again used during the mutiny in India, and Lord Clyde's advanced posts were enabled by its means to communicate with Calcutta. The dryness of the soil permitted long lines of bare wire to be laid on the ground without any insulation, though heavy

dews must have seriously interfered with the working. The telegraph, however, is reported to have done excellent work.

The same year the French had a field telegraph in Algiers, and in 1859 they made considerable use of it during their Italian campaign.

Up to this time telegraphs in war had been merely used to connect headquarters with the base, but in 1859 the Spaniards, under General O'Donnel, took a light equipment with them to Morocco, and made successful use of it for outpost work during their campaign in North Africa. A cable had been laid from Tarifa to Ceuta to keep up communication with Spain.

Since that time the Spaniards have developed their equipment with a view to adapting it to outpost and mountain warfare, and its leading characteristics now are, that it is carried by pack transport and is extremely light and portable.

In 1860-61 the Italians were the first to regulate, by means of the telegraph, the advance of two separate columns marching on the same strategic point, but separated by natural obstacles.

Ancona was held by a body of Irish and Belgians, under the French General Lamoricière, when Victor Emanuel determined to invade the Papal States. Two columns of 10,000 men each, one on either side of the Apennines, were directed against this place. Their combined action was completely successful, and entirely due to a judicious use of the telegraph.

In 1864 the Germans made use of the telegraph in their war with Denmark, and at the assault of Düppel there was a field station established close to the position taken up by Prince Frederick Charles, by means of which he received on the field of battle a congratulatory despatch from the King of Prussia.

The Civil War in America.

Up to 1861 telegraphs had been looked upon by commanders as indeed a useful auxiliary, but also as a luxury of war which time might possibly develop, when suddenly there burst upon the world the civil war in America. Before the beginning of that struggle the Federal States possessed neither a State telegraph system nor a field telegraph corps, only a signal corps used chiefly for surveying purposes on the Indian frontier.

The telegraphs of the country were in the hands of three private companies.

Grasping to the full the possibilities within reach, the Federals unhesitatingly seized all the telegraph appliances and personnel, and made such a thorough and rapid use of them, that in a few months the war may be said to have been entirely conducted by means of the telegraph.

It was used for every conceivable purpose, whether for maintaining communication with the base, or between different bodies of troops on the march, in camp or on the battlefield; for reconnaissances, sieges, and outposts.

At the battle of Fredericksburg, 13th October, 1862, it was extended from the headquarters to either wing, and another line fol-

lowed the first advance when made. The operators were exposed to severe fire, but held their ground. Constant and reliable use was made of the telegraph during the battle.

Throughout Sherman's march his headquarters were daily in communication with the base two hours after halting.

Mr. Plum, who took an active share in the operations, states that frequently he had been in telegraphic communication with Officers while they were fighting to maintain a position, and at one time with an operator inside a stockade which was being attacked, the wire, for some unaccountable reason, not having been cut. He also says: "Battle orders by telegraph became the usual means of moving troops, and that was the main object of the service."

At the battle of Petersburg, 2nd April, 1865, a telegraph station was established 500 feet behind a battery engaged, and remained working throughout. Corps Commanders frequently conducted entire expeditions from the telegraph tent without getting on horse-back.

At the close of the war not only the headquarters of four armies, representing 250,000 men, many miles apart, but the outposts themselves were connected by wire with General Grant's tent in Culpeper. Over 8,000 miles of wire were in use, and more than 1,000 operators had been employed.

There is one point I wish to draw particular attention to, and that is, that at the beginning of the war the Telegraph and Signal Corps were organized as separate services. This system was found unworkable and inconvenient, and after a few months was abandoned, and both were placed under the command of General Stager.

War of 1866.

In 1866 we see how the telegraph can minimize the disadvantages of combined armies operating from divergent bases. The three armies of Prussia advancing on Bohemia were in unbroken communication with each other through Berlin, where General von Moltke held the ribbons in his own hand. The concentration on a single point was timed to a day. The hazardous operation of two armies crossing a mountain barrier at 60 or 70 miles apart to meet a concentrated enemy was stripped of its danger, and Königgrätz was a triumph for the telegraph.

The War in Paraguay.

During the war between Brazil and Paraguay, which lasted from 1864 to 1869, the telegraph was largely used by both sides for tactical purposes. The flank movement by which the Brazilians and their allies forced the Paraguayans from the lines of Angostura and Loma was only rendered possible by the use of the telegraph.

General Lopez endeavoured to direct everything during that campaign by telegraph from his own tent, which I believe was, as a rule, kept well out of fire, while the forward stations during a battle were in the thick of it. His Director of Telegraphs was Herr von Fischer

Treuenfeld, who is now well known, not alone in this country but also in Europe, as the greatest authority on military telegraphs.

The Abyssinian War.

In 1867 England sent out a telegraph detachment to Abyssinia, where about 250 miles of line was run up country, for the purpose of facilitating communication with the base.

Use in Spain.

In 1868, at the suggestion of Marshal Prim, an outpost telegraph system was established in Spain, for the purpose of keeping up communication between the advanced guard of a cavalry division and the main body. It did good service in 1868 at the battle of Alcata, but at a later period was given up, owing to the number of cavalry soldiers required to work it.

Franco-German War.

The Franco-German War of 1870-71 proves that Germany had been well aware of the valuable aid to be sought for from the telegraphs, and had a system carefully elaborated and ready, without which, as her Officers have acknowledged, she would not have dared to invade France as she did.

There were three organizations :—

- The Field Telegraphs.
- The Etappen Telegraphs.
- The State Telegraphs.

The duties carried out by each are clearly explained in a work recently published, "The Organization of the Electric Telegraph in Germany for War Purposes," by Major-General von Chauvin, Director-General of Telegraphs.

Extracts from this work, translated by Captain Hare, R.E., will be found in Nos. CXXVI and CXXVII of the Journal of this Institution.

The network of telegraphs in the Rhine provinces having been organized with a view of converging all the main lines of communication on Berlin, a system for utilizing the French trunk lines running from the frontier towards Paris was then taken in hand; this was the duty of the State telegraph detachments.

Several of the great main parallel lines were selected, those destroyed were repaired, cross lines erected, and centres of telegraph direction arranged as the armies advanced. On the country being occupied, civil government centres were established and telegraphic communication adapted to them. At the close of the war a vast network of State telegraphs in complete working order covered the country.

The State telegraphs not being able to keep pace with the advance of the various headquarters, these were connected with each other in the first place by the field telegraph detachments, whose lines were after-

wards relieved by etappen lines; the field telegraph being thus free for work at the front.

The field telegraph detachments kept up communication with all portions of the armies on the march, using the lines of the country where available, and where not so available, building light temporary lines to be replaced later on by the etappen detachments. General von Chauvin says: "The line was laid quickest when the telegraph detachments accompanied the advanced guards, very often these even preceded the most advanced troops, accompanied by special covering parties. In such cases it happened more than once that the telegraph stations were actually exposed to fire, and sometimes had to retire before the advancing foe."

At sieges the invested places were immediately surrounded by a network of lines; thus at Paris a complete system connected the besiegers' posts, having its telegraphic centre at Versailles.

The telegraph was used for the defence of positions, as at Iisaine by the XIVth Army Corps, where the most important points of the position were connected to headquarters, and the orders and reports transmitted by wire contributed in no small degree to the victory of the defenders.

According to Von Chaurin, it had been clearly recognized in Germany, before the war, that the telegraph could be used on the battlefield itself; but there were no telegraph troops who had been trained in peace-time for the purpose, and it was only the want of such prevented the tactical use of telegraphs on many occasions when they would have been of value.

Even now Germany has no telegraph corps in peace-time, though the want is recognized, and I believe steps will shortly be taken to meet the deficiency.

On this point Von Chauvin says: "The experiences of the Franco-German War have distinctly shown the necessity of a telegraph corps, but the question of expense limits its size to what is only necessary, that is to say, it must only be sufficiently large to enable to be trained in peace the Officers and men required for the field and etappen telegraph detachments in war."

England has got over this difficulty of expense by utilizing a military telegraph division in maintaining a portion of the State telegraphs during peace, thus throwing no expense whatever on the State, and at the same time training a large body of Officers and men.

Ashantee Expedition.

The next occasion we see telegraphs in the field was in Ashantee. A detachment of Royal Engineers from the companies employed in maintaining State telegraphs was sent out under Lieutenant Jekyll. They put up a line 110 miles in length, to a point 20 miles beyond the Prai.

French Regulations.

In 1876 the French took up the question of field and outpost telegraphs, and regulations for field and outpost telegraph sections were

introduced into their Army. A detachment, consisting of 18 mounted telegraphists, 12 of whom were to be Officers, was also arranged for each cavalry division.

Sounders were to be the instruments used.

The duties as laid down were—

1. To connect the Army headquarters with the staff and divisional headquarters, and to extend this connection to the working units.
2. To connect the various headquarters of Army Corps with those of bodies of troops told off for special services, as reconnaissances, outposts, &c.
3. To remove or destroy existing telegraph lines.

Russo-Turkish War, 1877.

Russia followed the example of France, and also organized cavalry telegraph detachments for outpost work.

In the Russo-Turkish War of 1877 the Turks had no military telegraph or signalling corps. Certain existing lines were worked, and extended under civilian employés; but no tactical use was made of them.

On the other hand the Russians, with a purely military organization, employed them freely, and the success of one of their most brilliant operations was secured by an intelligent use of the telegraph.

In October, 1877, the Russians, advancing from the Caucasus under the Grand Duke Michael, decided to cut off the Turks from Kars and Erzeroum. This was to be accomplished by a turning movement, to cut the lines of communication of Muktar Pasha (who commanded the Turks), while he was to be attacked in front by the rest of the Russian Army.

All depended on co-operation at the right moment.

General Lazareff was detached with 27 battalions, 40 guns, and 6 regiments of cavalry, to execute the flank march of 40 miles. On the 13th he had thrown himself across Muktar Pasha's communications, but was threatened by a superior force despatched under Reshid Pasha against him. Lazareff had, however, been accompanied by a field telegraph, and wired the state of affairs to the Grand Duke. The despatch was received by the latter at 3 a.m. on the 14th. On the 17th the Turks were simultaneously attacked on both sides and crushed.

The telegraph was used during the march for reconnaissances, and also during the battle itself. It was guarded by Cossacks, and was only broken down for two hours during the entire operation.

The fate of the campaign in Armenia had hung on a single wire.

Zulu War.

The Zulu campaign in 1879 was the first expedition in which the mounted telegraph troop of our Army took part. After Isandhlwana Lord Chelmsford asked for a field telegraph; up to that he had none. C Troop went out under the command of Major Hamilton, R.E.,

but with only 30 miles of wire and cable. A branch line from the existing colonial lines was run from Ladysmith to Dundee and Landsman's Drift; but the material was then run out, and further operations were carried out by the C troop and other regimental signallers with complete success. Another detachment landed at Port Durnford soon after the battle of Ulundi, with 100 more miles of wire. A line was run from that point to within 10 miles of Ulundi.

Later on, when some troops were stationed in the Transvaal, a line was run to connect Wakkerstroom and Utrecht.

Transvaal War.

In 1881 a combined section (under the new organization) from the Postal Telegraph R.E. Companies, and from C Troop, was made up and despatched to Natal under Lieutenant Bagnold. They arrived at Newcastle towards the end of May, and soon afterwards laid a line to Pretoria, which proved of great value during the negotiations which preceded the Convention with the Boers.

Egyptian Campaign of 1882.

In 1882 the field telegraph section did not arrive at Ismaïlia until a week after the whole of the troops were in Egypt and engagements had been fought. Before their arrival Lieutenant-Colonel Salmond, R.E., had to make the best he could of what he found in the country in the way of lines and operators. On the arrival of Sir Arthur Mackworth, R.E., with the sections, their first task was to repair the existing lines as quickly as possible, and then to push on to the front.

One Officer and a small party of mounted telegraphers were attached to the cavalry division to accompany any raids or reconnaissances.

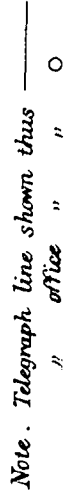
On the 8th September Sir A. Mackworth with a detachment accompanied Sir Gerald Graham's reconnaissance, paying out $3\frac{1}{2}$ miles of cable. Previous to retiring before the enemy, who appeared in considerable force, two messages were sent through to Kassassin. The cable was left on the ground, but most of it recovered afterwards. The instruments used were Theilers, or vibrating sounders with telephones.

On the 9th the enemy attacked from Tel-el-Kebir, and the camp of the telegraph was for some minutes exposed to a hot shell fire. During this a party of telegraphers were steadily working in a tent round which the shells were bursting, and which was hit more than once by the fragments. Several messages were sent with coolness and precision, among others one which brought up the Brigade of Guards and the Headquarters Staff.

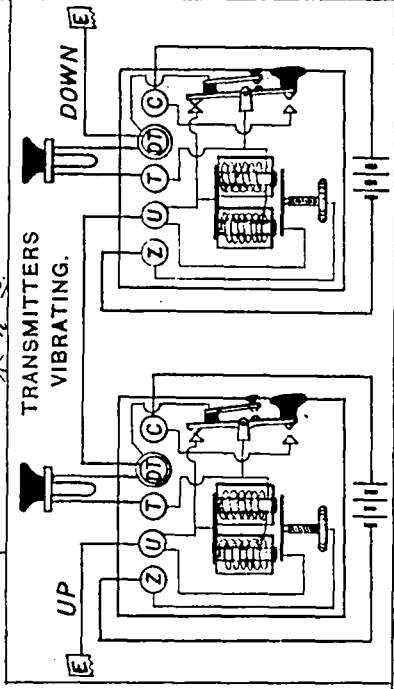
At 7 P.M. on the 12th a cable line was commenced to accompany the advance on Tel-el-Kebir, arrangements were made to follow it up by an overhead wire if necessary, and also for repairing the railway lines towards Tel-el-Kebir.

On arriving at a point a mile in front of the outposts, a halt was made to await the infantry.

SUAKIN.



W



Note. Telegraph line shown thus —
 " office " " O

Just at midnight Lord Wolseley came up, and sent a message through to Sir H. McPherson. At 2 A.M. another move forward was made.

During the action which ensued, the telegraph was present throughout, and came under fire.

Immediately afterwards it was ordered to join up to the railway station 3 miles off. This was accomplished, and communication established with Kassassin by 8 A.M., the 3 miles of cable being laid in half an hour.

At 8.30 A.M. Lord Wolseley's messages to the Queen and War Minister were despatched. At 9.15 Her Majesty's reply was received.

The instrument used was the vibrating sounder and telephone.

A telegraph detachment now proceeded to Cairo with the foremost troops, and without delay put the whole telegraph system of the country in working order.

The field telegraph was used to a large extent in the three expeditions which took place during 1884-85. The lines, however, were all etappen lines, except in one instance, when a wire for a tactical purpose was run in the Eastern Soudan.

Nile Expedition, 1884-85.

On the Nile the great difficulties to contend against were the unparalleled length of the line of communication, and the restricted amount of transport. We must all regret that it was not practicable to send a line across the Bayuda Desert with Sir Herbert Stewart's column, such an exploit would have been unequalled in the annals of the field telegraph.

One most valuable point as regards the feature of outpost telegraphy was brought out by the satisfactory working of bare wire laid on the ground and joined up with vibrating sounders. I hope that some of the Officers who were on the Nile will give us some further account of what was done.

Bechuanaland Expedition.

In Bechuanaland a line of some 350 miles in length was run to keep the headquarters in communication with the Colonial telegraph system and with the various intermediate stations. The working of this line was admirable. At one time, for a period of nineteen days there was not a single fault or breakdown of any description.

Expedition to Suakin.

In February, 1885, a field telegraph section of two Officers and sixty non-commissioned officers and men was organized to accompany Sir Gerald Graham's force to Suakin. It landed at this place on the 7th March.

Light lines were immediately erected from the headquarter camp to Suakin and Quarantine Island, also other short lines to connect the various departmental depôts in Quarantine Island.

On the 21st March a light overhead line was run out into the

desert from H Redoubt as far as it was safe to do so. This was to facilitate the operations arranged for the following day during the advance of Sir John McNeill towards Tamai.

On the 22nd a telegraph detachment under Lieutenant Lindsay, R.E., accompanied Sir John McNeill's force, and, marching with one of the squares, laid out cable from the end of the line erected the previous day.

5½ miles had been paid out when the halt was ordered, and the General wired back his reasons for not going on to the place previously arranged upon for a zareba. This was about 11 A.M. to 12 noon. One or two messages passed between him and the Chief of the Staff.

Zarebas were now commenced; at 1 P.M. the telegraph instrument was moved from the open into one of them, and stood on some empty ammunition boxes.

At 1.40 P.M. Major Turner, Director of Telegraphs, wired to the C.R.E.: "We have kept up communication so far with perfect success."

At about 2.45 the enemy attacked: the telegraph instrument got knocked over by the rush of men into the zareba; but, when the worst of the storm had blown over, a new instrument was at once joined up. Meanwhile, the telegraph detachment had been assisting to defend the zareba into which, at one time, some Arabs had actually penetrated.

At 3.25 P.M. the General sent his despatch to the Chief of the Staff by wire. This message allayed the great anxiety felt in camp, and stopped reinforcements coming out.

Two press messages, one for the "Times," and the other for the "Daily News," were immediately handed in by the special correspondents. While sending these, the clerk in charge had several times to leave his instrument to assist in the defence, as it appeared from time to time that the enemy would renew the assault.

During the afternoon between twenty and thirty messages were sent and received, several passing between General McNeill and the headquarters.

At 7 P.M. the line was cut, and signallers took up the running with lamps to the Right Water Fort.

After this the duty of the telegraph section was to keep up and extend the communication between headquarters and advanced brigades, and also orders were given to work the railway traffic.

Another section landed on the 21st April.

The telegraph was now only pushed to the front so as to keep pace with the railway, and the furthest point reached was Otao, about 20 miles from Suakin. The great difficulties we had to contend against in the maintenance were the climate, the Hadendoabs, and the camels. The first affected the men to a serious extent, especially as the work at the outset, and indeed throughout, was laborious and carried on without intermission during the day under a tropical sun. Loss of physical energy, when energy is everything as in maintaining telegraphs, is a matter the serious nature of which can only be appre-

ciated by those who have had to force work out of men in a bad climate when the excitement is over and reaction has set in.

The Hadendoahs were most active in destroying the line by night, and caused endless work and annoyance. But they hardly did more damage than the camels. At Suakin, the force being concentrated, a huge number of animals were constantly crossing and re-crossing the line of the telegraph line, and treating the latter with the greatest disrespect.

When the telegraph was broken down the signallers took up the running, but, for reasons which I will touch upon later on, signalling, though a valuable assistance, did not adequately fill the gap.

The affair at To Frik was the first occasion on record (as far as I know) of the telegraph having been in the centre of a fight when it had come to the cold steel period, and enemy were lying where they fell within 2 or 3 yards of the instrument.

The presence of the telegraph on this occasion, I believe, was due to the representations of Colonel Edwards, C.R.E.

Had the expedition been persevered in, this telegraph would have borne a very important part, and the personnel would have required very large reinforcements. How this would have been done is not very clear, as the three simultaneous expeditions had drained the home resources as regards men, and not only that, but a certain strain was felt by the State telegraphs, which had despatched so many Royal Engineers to the seats of war.

It is to be regretted that the absence of proper cable at first prevented light lines from having been run to the extreme points reached by our troops. The cable used at To Frik was outpost cable, totally unfit for the purpose of such a length of line, as being far too delicate and easily broken. The marvel is, it stood as long as it did.

It is the departments of an army who use the wires to the greatest extent; on one day, at Quarantine Island, 800 messages, the majority to or from the departmental offices, passed through two instruments. This beats most records on key speed circuits in the busiest offices in England, and requires the very best clerks to deal with it.

Indian Telegraphs.

In India the telegraph is on a different footing. There is a small nucleus of sappers and miners who form a military telegraph detachment. But on all expeditions they are largely supplemented by the civilian State telegraph employés.

Field telegraphs in the shape of etappen lines have been used in all the expeditions which have taken place of late years in that country. But we have no record of their tactical employment.

Uses of the Telegraph in the Field.

It is scarcely necessary for me, in these advanced days of military science, to dwell upon the uses of the telegraph for war. As I have stated before, it minimizes to the utmost the factors of time and space in dealing with questions of communication; and how far it is

desirable to do this, rests with those responsible for the conduct of an expedition.

All we of the telegraph can do is to provide the messenger that exclaims—

“ I fly with the lightning of Heaven,
I travel unseen and unread;
A word, and the impulse is given,
A touch, and the message is sped.”

Rapidity is the soul of war. “That which is done quickly is done twice,” is a proposition never so certain of demonstration as in the active operations of war.

It has now been clearly established in every army that no extended operations can be carried on without the telegraph, and before long it will be equally recognized that its presence is as necessary to every part of an army as nerves are to a living body.

Some of the ways in which this messenger can be usefully employed may be enumerated as follows:—

- Keeping up communication with the base.
- Regulating the supplies to troops in the field.
- Arranging for reinforcements.
- Arranging for disposal of sick.
- Arranging for disposal of prisoners.
- Keeping up communication between headquarters of armies, Army Corps, Divisions, brigades, &c.
- Controlling the march of columns for strategic purposes.
- Rendering concerted action more certain.
- Regulating railway traffic.
- Obtaining intelligence from the front.
- Concentrating troops for attack or defence.
- Giving orders and necessary reports on the field of battle.
- Investing fortresses.
- Concentrating to repel sorties or make assaults.
- Regulating combined artillery action,
- Defence of fortresses, positions, &c.
- Defence of coasts.

And in many other ways which will easily suggest themselves.

I would direct your notice to a very valuable paper read by Major (now Major-General) Webber, R.E., before this Institution on the 31st March, 1879, and entitled “Orders in the Field, and the Means of Communicating them.”¹ The portion of the paper relating to telegraphs would be read with advantage by all those interested in the subject.

One great feature in the use of the telegraph as a channel for orders is, that it enables a commander to qualify, rescind, or enlarge an original order at once, and without risk of misconception. Those who have much to do with giving orders for the execution of important work know the folly of giving verbal orders; the man you give

¹ See Journal, vol. xxiii, page 631, *et seq.*

it to, in nine cases out of ten, is only partially listening to what you are saying, and, even if he does listen, frequently does not grasp the full meaning. No practical man gives verbal orders.

But with a written order it very frequently arises that a change in the order appears desirable after the messenger has gone. The telegraph gets over all these difficulties.

That it has a great tactical future before it cannot be doubted. Von Chauvin says: "There seems to be no doubt, both from our own experience, as well as from the experience of others in war, that the main point is to improve and increase what may be called the use of the telegraph for tactical purposes."

Outpost Telegraphs.

The necessity for having an outpost organization is recognized in England inasmuch as the equipment has been prepared; but here it stops, no steps have as yet been taken to accustom Officers and men of infantry and cavalry regiments to work with it.

It would be impossible to lay down hard and fast lines for its use, just as it is impossible to lay down hard and fast rules for outposts themselves. All that could be done would be to put a valuable aid to communication into the hands of regiments, and the Officers commanding would soon find out how to use them to best effect.

The proposition I put forward is to give all regiments, cavalry and infantry, a small telegraph equipment which would be at the disposal of the Commanding Officer for such operations as he thought fit, and the combined regimental telegraph would be at the disposal of the Officer commanding the brigade or Division. To work these regimental telegraphs, men of the same high proficiency as are required for army telegraphs would not be necessary, but it would be desirable that they should be trained in the same school.

Signalling is not always applicable for outpost work. Its success depends on weather and the physical features of the country, and its action is readily detected by an enemy.

It is sometimes asked, "Can the telegraph be used in the line of outposts?" The answer I would give is—"Anything that is worth doing can be done."

The opposing armies in Paraguay frequently used it; but it is true that the slowness of their movements facilitated its operation.

That it can be used to advantage in the fighting line has been frequently illustrated. In the American War, on the 27th June, 1862, a telegraphist named Burnell established a station 300 feet behind the fighting line of General Porter at Gaino's Mill, and worked without interruption to the reserves and to General McClellan. Burnell was for hours exposed to the enemy's bullets, only protected by a tree. He took the messages on a sounnder.

In a reconnaissance of the town of Farnington a troop of cavalry under a Captain Smith set up, under a telegraphist called Parsons, about 4 miles of wire. The troop was attacked and partially captured, Parsons telegraphed under fire, while slowly retreating with

the remnant of the troop, by connecting up his instrument from time to time.

Signalling.

As it now exists the signalling is a distinct organization from the army telegraphs in the British Army. The signalling service has two principal rôles to play. The first comprises all communication in the field for minor purposes. The second in connection with army telegraphs, which it has to supplement, and under certain circumstances to replace.

Before the telegraph is laid signalling does the work; if the wires are broken down it bridges the fault till repaired; it forms branches and prolongations when it is not considered necessary to run lines for the purpose; and in many other ways it is an auxiliary.

Signalling accordingly might be split up into two distinct branches:

1. Regimental signallers trained as at present.
2. Signallers to be part and parcel of the telegraph battalion.

The present signallers, that is, the non-commissioned officers and men, though they are as well trained and as expert with their flags and mirrors as could be desired, are nevertheless not possessed of sufficient education to enable them to work the traffic on a busy telegraph circuit, or in conjunction with a telegraph office.

To deal with the heavy traffic of a telegraph office requires a man who is not only a good manipulator, but who has had a fair education, and a long training in a post office. No one else can do it satisfactorily.

This is especially necessary for war, because the telegraphic traffic is greater in some respects than in civil life, and in the midst of disturbing elements a man is required who, being perfectly at home at his work, is not liable to lose his head.

Signalling from its nature can never keep pace with the telegraphs, but also, as it now exists, it cannot, in the event of telegraph lines breaking down or being in need of extension, take up the running as it should do. The lines become clogged with messages, the signaller from want of practice in telegraphic traffic and from want of higher education is unable to deal with it.

The telegraph clerks now used in the field are among the best that the Post Office can produce, and are men of very considerable education.

There is now a system by which Post Office Volunteers can join the colours for service in the field, and very valuable service they can render as telegraphists; this I can personally vouch for. The same system, I believe, is to be extended for the signalling service, but the men should be telegraph clerks.

A telegraph clerk can pick up signalling very rapidly.

Seeing the disadvantages of two services which have to work together being under distinct organization and commands, my proposal would be that the signalling service of the Army should be attached to the telegraph battalion, and the non-commissioned officers and men

should be trained telegraphists; that the Officers, artillery, cavalry, and infantry, should be trained in telegraphy as well as in signalling.

The Americans found in their civil war that they were obliged to amalgamate the Signal and Telegraph Corps, and I think we would find the same in any prolonged operations.

Telegraphs for Artillery.

I would bring to the notice of artillery Officers a proposition for using the field telegraph for artillery tactics.

The question of concentrating artillery fire on particular points during an action has often been discussed. It may be desirable to concentrate the fire of a very large number of guns on some one object. The position may be such that these guns, occupying a very extended front, render unity of action difficult. Would not the telegraph sometimes be of service on such an occasion to concentrate and control the fire without concentrating the guns?

It might also be used for range-finding, as is done in Germany.

Organization.

In some foreign armies telegraphs are classed as—

Field telegraphs.

Etappen „

State „

The field telegraph comprises all advanced and temporary lines, whether for tactical purposes or for connecting various headquarters.

Etappen lines are for connecting the headquarters with the base, and the various points for concentration, or advanced bases on the lines of communication.

State telegraphs are heavy permanent lines for carrying, not only the war traffic, but also all the ordinary traffic of a country.

Then the etappen are the connecting links between the field and the State telegraphs.

In our expeditions we have never, except in Egypt, as yet had to deal with State telegraphs, and in fact what we have done comes under the heading of field telegraphy, as above.

To the three classes mentioned I propose for consideration a fourth, *i.e.*, regimental telegraphs. These would no doubt be a branch of field telegraphs, but would be on a different footing. All regiments, cavalry and infantry, might be provided with a small telegraph equipment, to be used for outpost purposes and for connecting themselves with headquarters in camp. Whether the instruments should be telephones or not is a matter of detail or of experiment.

As regards intercommunication in camp, it would be a simple matter to organize a telephone exchange at the headquarters in many large camps an hour after it was pitched, each regiment to lay and maintain its own line of cable. The number of orderlies saved would far more than compensate for any expense.

Regimental telegraphers, though they should be trained by the

telegraph battalion, would not be under the Director of Telegraphs in the field, whose province is only with the lines for army communication.

Present Organization in the British Army.

As most of you are aware, there is now in our Army a telegraph battalion of two divisions. All the telegraph service in the field is performed by them.

In peace-time, one division with wagons and horses is stationed at Aldershot, and trains Officers and men for field telegraph.

The other division maintains, under the Engineer-in-Chief to the General Post Office, all the State telegraphs in the south of England and Channel Islands.

For war purposes, sections of about fifty men are formed, a certain proportion from each division.

The system has shown itself an admirable one, and the most economical a State could maintain. But in matters of this kind, we must look forward to what is likely to be demanded in the future, and not measure our requirements by the past alone.

The uses made of the telegraph for war increase at a startling rate, and will increase as its powers become more recognized. In years to come, it will be considered as great an anomaly to send a body of troops on any detached duty in the field without its connecting telegraph line, as it would be to send a man who was dumb as a Member to the House of Commons.

What we have to consider, then, is how to extend the training which is necessary for signallers and telegraphers in every branch of the Service.

It is evident that no extra strain should ever be put on the State telegraphs in England by withdrawing too great a proportion of men employed on them for foreign service; but with the present strength of the battalion this is inevitable. The only way to meet the difficulty is to increase to a very considerable extent the Officers and men under training.

Training.

Though the duties in the field may look simple, it nevertheless requires a long and careful technical training to give a man the requisite qualities.

A telegraph lineman in war or peace has far more responsibilities, and has to exercise his judgment and forethought to a far greater degree than falls to the lot of many an Officer in Her Majesty's Service. To train a man to the required point can only be done by a combination of instruction in State and in Field Telegraphy; and to train non-commissioned officers for the positions of great responsibility which may fall to them, can only be done in schools such as the State telegraphs, where responsibility and emergency are their daily portions. Results justify this opinion.

And I may here remark that none but non-commissioned officers of superior education should be chosen.

The maintenance of telegraphs admits of no hesitation, no mistakes, and no fear of responsibility.

As regards the training of Officers, a deep scientific knowledge of electricity is not necessary, but it is necessary that they should know enough to be able to follow and utilize for war purposes the improvements that are daily being brought out in the art of telegraphy, and every Officer should be able to teach his men in all their duties, and in addition to this, should be accustomed to deal with large questions of organization.

In the field, a good organization for working what is a very complex piece of machinery is a *sine quâ non*.

Though the telegraphs have had such great success in our Army, and the organization (thanks to our predecessors in the work) is undoubtedly the best in any European army, and is recognized as such, I would point out the danger of resting on our oars, satisfied with past successes. What we have hitherto done in war has only been the simplest kind of field telegraph work. We have only run single etappen lines from the base to the front; these have been only single lines of communication, and no complicated problems for the telegraph. It will be different if at any time we take part in an expedition into a European country, where the advance may be by several main roads, and cross communications and numerous branches necessary; when the telegraphs of the country will have to be taken over, and worked, not for military purposes alone, but also for the civil government of the country. Instruments of a far more complicated nature than those for field use would become necessary, and such an organization indispensable, that could only be worked by Officers and men who had undergone a long training in peace. Our present organization has been equal to what has as yet been required of it; but to provide a trained personnel for a more extended field of action, such as I have sketched, would be beyond what it could do without unduly straining the State telegraphs at home.

In conclusion, I would say, that whatever organizations may exist, our duty as telegraph engineers is to be ready at all points to show that the motto for the telegraph is, "Ubique."

Herr von FISCHER TREUFELD: Major Beresford has mentioned my name in such flattering terms that I am hardly in a position to know how to thank him for such distinction. There is one thing I can say with certainty, viz., that every telegraph Officer, not only English, but of any army, must feel very much indebted to the lecturer for having brought before this meeting the subject of strategical and tactical telegraphy. We all know very well that not many years ago, say ten or twelve at the utmost, very little was known about military telegraphy. The general knowledge as to the formation, the organization, the personnel, and the matériel of military telegraphs was indeed very limited. Thanks to the literature of late years and to the valuable papers read by various Officers, and especially English, this early condition of semi-ignorance has passed away, and we are now very well acquainted with the formation, the organization, the personnel, and the matériel used by other armies in Europe and elsewhere. But I would ask, have we an equally good knowledge relating to the sphere of action which a military telegraph ought to have in the army? I mean as regards participating in the operations of war. As to these matters there is an immense difference of opinion, and I

maintain that we are very far from having clear ideas on these points, and therefore think that it has been very timely and opportune of Major Beresford to bring this subject before the meeting. If we take a glance over the various organizations of military telegraphy, we shall find that some countries have an organization which only allows telegraphic connection from the base of operations with the headquarters of armies, not even including the headquarters of army corps. There are others which have such an organization that they extend their telegraphic communication beyond the divisions and brigades to the very outposts, or even, as for instance, the French and the Russians, behind the outposts in the form of cavalry telegraphs for reconnoitring purposes. Major Beresford states that in the year 1876 the French took up the question of field and outpost telegraphs, and regulations for field and outpost telegraph sections were introduced into their Army. The duties as laid down were—"First: to connect the army headquarters with the staff and divisional headquarters, and to extend this connection to the working units. Secondly: to connect the various headquarters of army corps with those of bodies of troops told off for special services as reconnaissance, outposts, &c." This is an organization which goes very far in tactical telegraphy, but if we compare another European Army, equally anxious to arrive at perfection, namely, the German, we find that quite different opinions are held. There the official *règlement* prescribes the task of field telegraphy, to maintain an uninterrupted telegraphic communication from the base of operation, to the great headquarters, and thence to the headquarters of the armies in the field, the telegraph not extending to the army corps, but to such corps which are operating independently. The connection between an army headquarters and an army corps is only admitted under exceptional and favourable circumstances. But here stops the programme of German field telegraphy! I should like to impress still more upon you this difference of opinion with regard to strategical and tactical use of the telegraph by a few figures. First, allow me to draw your attention to the difference of formation with respect to the number of telegraphic sections for each army corps. Of course the section might be of different strengths, say fifty, eighty, or more men, but let us take the section as the unit in this present general comparison. There are some armies in Europe which have no telegraphic sections at all—Turkey, Portugal, and Greece. I believe Portugal is going to have an organization, because they have had a Director of Military Telegraphs for several years. Then, and this is a striking thing, comes Germany, which shows that in Germany the opinion in favour of the extensive use of telegraphs is very limited, that is to say, the telegraph is concentrated within the sphere of the principal headquarters and not beyond them. In the Franco-German War the Germans had twelve telegraph sections for fifteen army corps, equal to four sections to five army corps. After the war this low proportion, through an increase of army corps without a corresponding increase of telegraphic sections, became still smaller, and the German Army has now only four telegraph sections to six army corps. We have then Belgium, Holland, Sweden, and Spain having each one telegraph section for one army corps. Then comes France, which in accordance with the new organization of 1884, possesses field sections, telegraph parks, etappen sections, and railway telegraph sections, and taking all these together they have two telegraph sections for one army corps, or nearly so. Then comes Switzerland, with two telegraph sections for one army corps; then Italy with nine telegraph sections each of one hundred and nine men, and which are so divided that there are two sections for one army corps; then Russia has three telegraph sections for one army corps; Austria has fifty-two telegraph sections in the proportion of three sections for one army corps; and last, or rather foremost, comes the English Telegraph Battalion, which has eight sections for two army corps, or in the proportion of four sections to one army corps. These numbers show that there is certainly a great variety of opinion with regard to organization and with respect to strategical and tactical co-operation of the field telegraph. There is another point upon which, with your kind permission, I would bring a few figures before you, in order to show the very vast difference in the opinion of army telegraph authorities, namely, the proportion between insulated cable and naked wire that is prescribed by the army equipment and carried by

each field telegraph section. We may say that the naked wire erected on poles represents the strategical element, because that is a line which can only be slowly erected, and it requires more transport, and therefore is kept more at the rear than the light cable which requires less transport, and can be more readily led out towards the front. I should, therefore, say that on the other hand the field cable represents the tactical element of an army telegraph system. A comparison of the proportions carried by each army of these two would give an idea of the views of the different armies with regard to the strategical or tactical sphere of action for their military telegraphs. Commencing again from the lowest proportion, we find that Sweden uses very little cable, only about one-sixth cable to one of naked wire. Then Denmark has about the same proportion—one-fifth of insulated cable to one of naked wire. I would say that these armies do not use cable because they dislike to use any articles of war which they cannot manufacture in their own country, so that strictly speaking they are not opposed to the use of cable except for that reason. Then there is Russia, whose use of cable in respect to naked wire is as one-fourth to one; of course Russia will always have to rely more upon naked wire than upon cables, owing to the enormous distances they have to cover. Then comes Germany, in which the use of field cable is also limited. The proportion between cable and naked wire in Germany is with regard to the field sections 0·7 to 1, but of course in the *etappe* telegraph sections the proportion is very low, namely, 0·1 to 1. In Italy the proportion is 0·7 to 1. In England the proportion is 0·8 of cable to 1 of aerial line. In Holland it is 1·3 of cable to 1 of aerial line; in Austria 2·1 of cable to 1 of aerial line. Then we come to France, which after the Franco-German War has given the preference to cable. Thus after the organization of 1874 the French Army possessed 19 field telegraph and 14 *etappe* sections. All these sections had five times as much cable as aerial wire, so that the proportion was 5 to 1. According to the new organization of the 16th March, 1891, the proportion between cable and aerial wire is for the field sections 3·6 to 1, for the telegraph parks 4·6 to 1, and for the reserve parks 8·3 of cable to 1 of aerial wire. So you see that France has a far greater abundance of cable than Germany and England. Then comes Spain, which has no aerial wire at all; the Spanish telegraphs being entirely based on cable communication. All cable and other materials being packed and carried on mule-back, the Spanish Army possesses the most movable field telegraph, well adapted for tactical operations. The above figures show that a vast difference of opinion exists with regard to the question under discussion, and compared with former years those figures prove the importance which cable-lines have attained, and that their rôle is becoming more and more extended. As the field cable represents the tactical element of the army telegraph, and supposing it is wanted to increase the sphere of action of an army telegraph towards the front, the principal thing to be done for attaining such an end is, to improve the field cable; that is to say, to make such cable stronger and lighter. It is the question of transport, and that alone, which puts a limit to its being brought to the front in a great war, as for instance with the English field cable, which the late Director of Austrian Field Telegraphs, Ritter von Klar, and I devised in 1875, for the Austrian Army, and which has now been adopted by nearly all European Armies, it would require at least ten cable-wagons and sixty to seventy horses to connect one single advancing army headquarters with three army corps, not including any connections to any division. The weight of the field cable being the principal hindrance in advancing telegraphic communication towards the front, I recommended fourteen months ago to improve the present field cable, and Messrs. Siemens Bros. and Co., of London, have constructed since then a number of such cables, some of which were submitted to the Royal Engineers many months ago. I have now the pleasure of laying before you a small length of such cable, which I believe will give very great advantages to field telegraphy, because the conditions of that cable are much more favourable to transport and strength than those of any cable hitherto used. The cable now in use in the English Army, which is called No. D. 5, has a diameter of 6 millimetres, whereas the new cable has a diameter of less than 4 millimetres; the weight of the old cable is 170 lbs. per statute mile, as against 105 lbs. for the new cable of the same length. The breaking strain of the old cable, the D. 5, is 250 lbs., and of the new cable 500 lbs., so that the old cable is 62 per

cent. heavier than the new one, and, besides, the latter has double the breaking strain. The result being that 8 miles of the new cable is only equal in weight to 5 miles of D. 5, and that each cable-wagon would thus carry 8 instead of 5 miles of field cable. That is such an improvement that by the use of the new cable it will, I think, be possible to push forward the operations of telegraph work still further than has been done at present. But there is one principal thing which must not be forgotten in considering questions relating to strategical and tactical telegraphy, that is, whether we are dealing with advancing warfare, or with warfare in position. Now with regard to warfare in position, every telegraph Officer agrees to-day that telegraphic communication must be extended beyond the headquarters of army corps, divisions, and brigades, to the very outposts and advanced detachments of observation. There no longer exists, therefore, any difference of opinion as to the use of the telegraph, electrical as well as visual, in warfare of position, but it becomes quite another consideration with a rapidly advancing army, that is, when we treat the case of "advancing warfare." The vast difference of opinion to which I have alluded refers principally to this latter form of warfare; hence the discussion of a paper on "The Use of the Field Telegraph in War" must necessarily direct itself to the question, how far telegraphic communication during the operations of advancing warfare can advantageously be carried out, and, therefore, ought to be adopted? In my opinion a well-planned field telegraph organization ought to provide all the elements, "personnel and matériel," to maintain not only daily uninterrupted communication between the base of operations and the advancing headquarters of the armies and army corps, but also in special cases of necessity and on favourable occasions, to extend their communications towards important points near or at the front, especially at those moments when decisive battles are expected. But a well-planned field telegraph must also possess all the necessary elements to enable it to be changed at once from its strategical work, consisting in the connection of headquarters of an advancing army, to its tactical work, spreading out the telegraphic communications to the smaller bodies of the army, and even to the outposts and battle-fields, should the form of warfare suddenly change from that of advancing into that of position. That the field telegraph can be brought to the front and be used there with advantage during the outset, was proved over again in 1892, by the splendid action of Sir Arthur Mackworth before, during, and after the battle of Tel-el-Kebir, and I regret, with Major Beresford, that during the Nile expedition of 1884-85, when the decisive battles were fought north of Khartoum, the most advanced field telegraphic station at Hamdab was over a couple of hundred miles at the rear of General Sir Herbert Stewart's column advancing on Metammeh. In spite of this unfavourable fact, which tends somewhat against the doctrines of advancing telegraphic communication, and participating in tactical operations, I nevertheless maintain the opinion, also favoured by such experienced telegraph Officers as Colonels Hamilton, Armstrong, Jelf, and others, who in this very hall, on the 15th of February, 1884, opined that "the telegraph should be able to follow advancing columns and keep uninterrupted communication with them." Such achievements will be greatly assisted by the method of paying out bare wire, to be supported later on by field posts, and using Captain Cardew's vibrating sounder, or by adopting any such field cable as I have the pleasure to lay before you, by which not only the strength of the line is doubled, but the proportion of cable carried by each wagon is increased from 5 to 8 miles. The adoption of such technical improvements is required in order to extend the sphere of action of the field telegraph during "advancing warfare."

Lieutenant-Colonel JELF, R.E.: As there seems to be a disinclination on the part of people who have more right to speak than myself to give their views, I may perhaps be allowed to justify the old adage "that fools rush in where angels fear to tread." In doing so it may perhaps be found of interest if I give some little account of the line that we laid, in connection with Sir Charles Warren's late expedition, from Barkly up to Mafeking and as far as Molopolole, in South Africa. This telegraph was laid in a country which absolutely had no telegraphs at all; we found a perfectly clear space before us, but we had to take every single article of equipment from England, 7,000 miles by sea, and another 1,000 miles by land, before we arrived at our point of departure. Sir Charles Warren's great idea was to have the

telegraph with him, at all events as soon as he moved, and if possible (in places where it was safe, and as long as it was safe) actually in advance of him, that is to say, with the most advanced party, a sphere of operation which I think has been mentioned to-day as one of the possible rôles of the telegraph in future. One of the great difficulties that we had to contend with, looking at the magnitude of our plant, was the very small number of men we had to deal with it. We only had one Officer and forty-five men of the Royal Engineers for the purpose of constructing and working this telegraph, a distance of 220 miles from Barkly to Mafeking, the latter being the point to which Sir Charles Warren was bound to penetrate with all possible despatch. We were met at once by difficulties, political as well as strategical. We knew that very many people in Griqualand West (which properly speaking is part of the Cape Colony) were as disaffected as those in any portion of the South African Republic, though it was generally supposed that the South African Republic was to be the enemy that we were to meet. It therefore became necessary at the very earliest start from Barkly to treat the expedition as being in an enemy's country. The earlier part of our marches were all carried on under the escort of cavalry, or mounted infantry, and the telegraph was laid and protected in exactly the same way as if expecting an attack at any moment. We always langedered at night, and proceeded with these precautions as far as Taung. The distance covered each day by the advance was about 6 miles—6 miles a working day—and that was the rate of progress we carried on throughout the whole 350 miles of wire that were constructed. No doubt the number of miles a day that can be done in telegraph construction depends absolutely upon the number of men. We had not sufficient men to find more than two wagon detachments a-day, and frequently could only find one detachment. If we had had more men we should of course have done more, and on occasions we actually did as many as 9 and 10 or 11 miles, but that was on special occasions when it was of importance to complete a section of the line. Looked at strategically, the line selected strikes one as being somewhat hazardous; that is to say, it is carried on the whole distance within from 5 to 30 miles of the borders of the very people who were supposed to be our enemies. Of course that was entirely beyond the control of the telegraph staff; we merely had to do what Sir Charles Warren required for his own march. As far as Mafeking the telegraph was, as I have said, constructed at the rate of 6 miles a working day, for that distance of 220 miles. The distance from Mafeking up to Molopolole made the total length of the wire 350 miles, but that addition was merely made subsequently for the purpose of the occupation. That also carried on at the same pace, though without the same precautions that were taken at those earlier portions of the proceedings when we did not know how far we were likely to be opposed, or how far we were to be let go without attack. Our main difficulty was to get sufficient matériel. The whole of it as I have said had to come from England. When we first went out we only had 100 miles, of which only 20 miles was actually with us, but the remaining 80 miles reached us before we got to Griqualand West, and, therefore, in time for us to use for our first distance. In the whole of South Africa, to show how very dependent we were on what we got from England, we had the greatest difficulty in scraping together 30 miles of wire, and it took several weeks to get this. It must be remembered that we had to drop at every one of the eleven stations at least one clerk and one lineman. That being so, you will readily see that we were exceedingly pinched for men, but there is no doubt that the men we had got had derived great advantage from the fact that they had been practised together in peacetime. There is no doubt that certain campaigns out that we had had in the summer, by which we had been enabled to teach the men exactly what would have to be done on active service and in open country, helped greatly towards the rapid execution of the line that we laid. The strict discipline of peacetime also prepared the men for the positions of great responsibility and independence which must necessarily fall to the lot of clerks and linemen on active service. Small parties had to be left along the long line of communications with all sorts of temptations in the shape of stores, public-houses, &c., in their way, affording them every inducement to go wrong, but I am happy to say that I was particularly complimented by Sir Charles Warren upon the extraordinarily good behaviour of the men. That being the case, I am glad to make public recognition of it, and of the way in which they did justice,

when they came actually to be tried, to the pains which had been taken with their discipline in peace-time. Of the Bechuanaland Expedition there is nothing more particularly to be said, except that the line not only worked very well during the expedition, but I am happy to say that the 220 miles to Mafeking is working as well at the present time as when it was erected fourteen months ago. Now turning for one moment to the general question of the training of the men, and the suggestions that are being made with reference to improving our organizations for the future, the thing that mostly strikes me, as being rather an old hand at telegraph work (for I was with the troop when it was raised fifteen years ago), is the fact that notwithstanding the great advantage of pay and position that are offered in the Engineer service, it is with the very greatest difficulty in the world that we can get sufficient men to fill the ranks. Both at Aldershot, in London, and at Chatham we find the greatest difficulty in the world in getting men to enter, even with the attractions of good pay and allowances, so as to fill our ranks with the proper class of men. I cannot myself see how we are likely to improve that by going out into the highways and byways. It seems to me that our great object should be either by some new system of enlistment and training, or by encouraging the enlistment of boys, and teaching them as boys, to try and get the very best men possible for the organization *as it exists*, getting them taught to be good telegraphists when young, and then gradually passing them into the reserve. What happens now is that almost as soon as we have trained a man we pass him to the reserve (and the very best thing too, because when we come to a large campaign we shall want such men badly enough). Still we must have something to carry on with, and certainly as far as my experience goes, whether we try army men or civilians, it is with the very greatest difficulty that we can get men suitable to fill these posts. No doubt so far as it went, the experiment of enlisting Post Office Volunteers into the ranks, and passing them into the reserve, has succeeded admirably. I know that as clerks they served us remarkably well, though I fancy that in the matter of discipline and soldierly qualities perhaps they had not got all that might be expected from those who had had a longer training. But when we come to trying to get assistance from the line, my experience has been most unfortunate. Throughout the whole of the Bechuanaland campaign, with one cavalry and four infantry regiments in South Africa, notwithstanding all my efforts to get some assistance from them, we could only get two men. One had only been a soldier a very short time, but we were able to make him fairly useful. The other was sent for 1,400 miles from the Welsh Regiment in Natal, with great paraphernalia and flourish of trumpets, and sent to Barksby. We found him absolutely useless, and for the whole of the rest of the campaign that man had to act as cook to the detachment. The same sort of thing has met me at other places. At Aldershot, where you would think that if there were any men to be got, we certainly should be able to hear of them, I can only say that it is not possible to get men from the line to work even the camp offices. I had the same experience at Gibraltar, where a few line and artillery men were employed in the military telegraph offices, but I always found it the case that if one fell sick or committed himself recourse always had to be had to the Engineers. I therefore cannot think that there is very much recruiting ground for us in the line, particularly at the present time, when, in consequence of the number of things that have to be taught, it is almost impossible to get men for any purpose whatever. Directly a man is found to be a good telegraphist he is probably also a good clerk, and as such is absorbed in the orderly room, whence I defy anybody to fish him out. I wish to add on behalf of myself and my brother Officers (as I happen to be the senior Officer in the Telegraph Battalion at the present time) that we fully recognize the fact that we must not stand still, and that we are only too anxious to do our utmost to meet the requirements of the times. Still I hope and believe that we may point with a certain amount of satisfaction to the fact that with all our faults, we have been able to carry out in the last eighteen months on a peace establishment three simultaneous campaigns, I hope without discredit to ourselves and with a certain amount of satisfaction to those under whom we have had to serve.

Major-General WEBBER, C.B., R.E.: I think I may safely say that never before in this theatre has such an interesting account been given of telegraphs as that which we have heard from Major Beresford to-day. My experience is that when a lecturer

attempts to deliver an account of the history of telegraphs, he must necessarily leave out a great many instances and examples of very great interest, and perhaps it would be better on such occasions if he confined himself to referring to the other accounts which are on record in our proceedings. This has particularly impressed itself upon me because Major Beresford has apparently been unable to obtain—and I believe it is at present difficult—a good account of the extensive and most valuable telegraph operations of the Afghan War. If any Officer here to-day can tell us how well the telegraph and signalling were there combined in the same service, it would be a very valuable record in the debates of this Institution. There is no good account of it, I believe, unless it be in the records of the Government of India, and it is certainly a great loss to the history of military telegraphs. As regards the subject of the uses of telegraphs in time of war, there is one which, I think, our present Chairman will testify to as being most valuable to the commander of an army, and that is the power of holding conversation. No one who has ever carried on a conversation, or who has been in the habit of doing so from time to time by means of a telegraph, can forget how he realizes being brought face to face with either his superior or his junior Officer at a distance of many hundred miles. All he has to do is to sit down beside the instrument, which the telegraph clerk manipulates, and with a piece of paper by his side and a pencil in his hand, record the questions and answers as they follow one another. His correspondent at the other end is doing the same, and it may be safely said that the speed of that conversation is very little less than half that of a conversation in which actual conversation was being carried on. The power of asking questions and of rejoinder, the power of obtaining alternative information, and so forth, is so great, that those who have used it must feel that large operations, where great distances intervene, could not be carried on without such means quite independent of the ordinary service of the telegraph, which, I may say, in such operations as the Nile Expedition, comprises the whole correspondence of the army. With regard to outpost telegraphs, which Major Beresford strongly advocates, I am rather sceptical. Years ago I had the opportunity, knowing the Director-General of Telegraphs of the German Army, of discussing this subject with him—and I must say I could not help agreeing with him in every word—he then said that the attempt to use the telegraph under the ordinary conditions of outpost duty was really out of the question. In this theatre myself, I have more than once said that a telegraph which is not served and maintained in the most perfect way is worse than no telegraph at all. Within the distance of outposts from the headquarters of an army corps or a Division, I believe that all who have ever been in command or have read an account of what precedes actions, either in the night or in the day, must know that there are indications in the air, that there is the sound of outpost firing, the sound of artillery, which tells every General and Officer in the Army almost instinctively what is going on; and I have very little faith in that sort of security which rests or depends on a telegraph instrument and on a wire lying on the ground, as a means of giving information to the Generals or Staff Officers, or telling them what the movements of the enemy are. In the American War, the orders to and the instinct of every General and Staff Officer were to move to where they heard the nearest firing, and I do think that that instinct which teaches us what to do, more or less may be lessened in its keenness if telegraph wires are known to be lying about between the headquarters and the outpost—a feeling which would only be lessened by the perfect knowledge and consciousness of the General as to how unreliable they are. Under this head I do not think that Major Beresford's scheme of regimental telegraphs is a very workable one; I do not say this from any feeling that such an organization, and such a unit in the economy of a regiment, might not be very useful to the men and very instructive to the Officers; but I think I know as much in the past, as Major Jelf has told you, of the difficulty of obtaining men to do this work from the infantry or the cavalry. I remember the day when the first Officers and men were placed under me in the 1873 manoeuvres, who were thought to be trained signallers, and I know how little they were able to do. We all know the high state of efficiency to which that body has attained, and I believe if there is to be any means of communication of a telegraphic nature in the regiment, it is better that they should confine their duties to that which they have proved themselves well able to perform. We, as I said before, do not know so much

as we ought to do of what was done in the Afghan Expedition by regimental Officers and men in signalling. If signalling is to be confined to the regimental unit where it can be well taught, I would do everything I could to improve that knowledge, to encourage it even more than it is now encouraged, and from time to time to bring large bodies of signallers together. This has been attempted in some cases very successfully, but I do think it might go very much further, and that long lines of signalling, which is really one of the most difficult things to establish and work out, should be a part of the summer manœuvres of our Army every year, both at home and abroad. Unfortunately there is one thing which, I think, has been a mistake in our signalling system. About ten years ago a revised edition of the signalling book was brought out with a most extraordinary result; it appeared that whoever made the revision desired that signalling and telegraphy should have an insuperable gulf established between them. The very alphabet and syntax of telegraphy was varied in signalling. With the view to approximate the systems, Colonel Malcolm, R.E., and I spent much time in revising the old edition. It went forward (as the term is), and we only heard from time to time rumours of what was being done. A few months after the new edition came out, diverging more than before. The only thing untouched was the preface which I had written myself. The evil consequences have been many. If the author's shade wanders here below, he may like to know how the evil of his deeds has lived after him. I think on every occasion on which I have seen signalling and telegraphy used in the field, there has been the most unhappy want of union and the most miserable absence of power to work together. Considering that they are both means to the same end, there can be no doubt that this proceeding is most irrational. The telegraphists and signallers of the Army only come together on occasions, and it is only common sense that on those occasions they ought to be able to work on the same system, and if there is any organization they ought to work under the same direction. I think that every signalling Officer who has had experience will cordially agree with me in this. I can't help endorsing every word that has been said on the subject of good training. We have been for sixteen years trying to organize a good telegraph service in this Army. It has grown up step by step; we may be very much to blame that we have not done it in less time, but I think now it has reached a point at which it may be said to be a good organization, which has stood the tests of late campaigns and has not been found wanting. I think those who have to do with these things will be best advised if they will allow the organization to go on on its present lines until it fails; then is the time to change and do away with it, or improve it in some other direction. There is a great craze for change with some people, and when there is a good thing they want to knock it over. Now our signalling is a very good thing, and our telegraphy is a very good thing; I should like to see them both go on on their present lines, only let them have the same language, the same alphabet, the same procedure, and when they take the field let them work cordially together to the same end.

The CHAIRMAN: I am sorry that I am obliged to go away, but before I do so I should like to add my mite to the discussion on this most important and really vast subject. There have been two or three things said that I may, perhaps, throw out a hint about. I have myself no knowledge of telegraphy, but I have had a good deal of experience of army telegraphy, and of the way the Officers and men of our Telegraph Battalion do their work in the field; and I am quite sure it is impossible for anybody who has not seen the men at work under the very difficult circumstances of field service really properly to appreciate the admirable manner in which that work is done. On two occasions I have had the general supervision of work that extended over a great extent of country, and was carried on entirely by telegraph, and on both occasions, the length of each being nearly a year, I never had one single complaint, and I hardly knew of any slip, however slight, on the part of any Officer or non-commissioned officer or man employed on telegraph duties. They were placed, most of them, in most uncomfortable positions, in tents, in stables or houses, with no proper accommodation; the work was incessant day and night, and the way in which it was performed was excellent beyond words. I should not be doing common justice if I did not say so. Something has been said against telegraphers from the line; that is my own branch of the Service, and I must to a certain extent defend it. Colonel Jelf was rather hard on the line

telegrapher. We do not, in England, attempt to teach soldiers of the line anything to do with telegraphs, but I believe a considerable use is made of them in India, and on every occasion on which I have been employed abroad with any regiments brought from India, there has always been a certain number larger than would have been expected of good telegraphers. I think Colonel Webber will bear me out in saying that in the Nile Expedition the telegraphic work in the advanced post was carried out in the early part of the campaign by privates of the Berkshire Regiment; and in 1881, in the Transvaal, a considerable accession of strength to the telegraph section out there was obtained by employing men of the 92nd and 60th, and the other two regiments that were brought on from India for the purposes of the then campaign. I think if we were to train in England a certain number of linesmen we should find they would give as good results as those linesmen do in India. Major Beresford mentioned in his lecture the fact that a bare wire was, during the little expedition, laid along the ground for use as a telegraph wire. It was, no doubt, his modesty which prevented him from adding what I believe is the case, that the buzzer that was used with that wire is due entirely to the invention of an Officer of the Royal Engineers, or at any rate that its present improved state is due to the invention of an Officer of Engineers—I would suggest for consideration by those skilled in the matter whether we have sufficiently tried the telephone in war. I cannot help thinking that in the case of the very conversations that Colonel Webber alluded to the telephone would be more useful than a telegraph instrument. When a senior Officer is holding a conversation with a junior Officer, the junior Officer, even if he wants to ask a question in the middle of a sentence, does not like to stop the operator and ask, but he could do that with the telephone. It occurred to me once, in the course of a conversation with a senior Officer, lasting nearly an hour, that the clerk taking down one word wrong threw out the whole sense of my instructions. I should have asked the question at the time and stopped him because I thought it was wrong, but I did not like to stop the long instructions I was receiving. I asked, afterwards, but my question was not understood, and consequently I misunderstood the instructions. Another point for consideration is that mentioned by Herr von Treuenfeld: "Cannot we decrease the weight of our insulated wire, and have we yet obtained the lightest and best insulated wire we can get?" I do not know enough of that question to go into detail, but it appears to me that the greater the length of insulated wire we can carry with our field telegraph the better it will be for us.

The Chair was then taken by Sir J. STOKES.

Major E. J. BROWELL, R.A.: Major Beresford, in his very interesting lecture, has alluded more than once to the signallers at Suakin. As I had charge of the signalling arrangements in the last campaign there, I should like to make a few remarks on the subject. He stated that when the telegraph was broken down the signallers took up the running, but that although they rendered valuable assistance they did not adequately fill the gap. Of course they did not, and I maintain that no signallers in the world could do so. Of course a telegrapher can send his messages very much quicker than a signaller; he sits in his tent with his instrument by his side, and does his work in comparative quiet and repose. The signaller on the other hand, is perhaps on the top of a rickety crow's nest, and by the very nature of his instrument exposed to the sun and the dust all day long. Of course there is no doubt in the world that the signallers are not as efficient as telegraphers. Major Beresford has said that the operators he had with him were some of the best the Post Office can produce, so that in any case I maintain that if there was a pressure on the telegraph, and its work was transferred to signallers, there would naturally be a block. Colonel Webber said the language of signalling was different to that of telegraphy. It was certainly the case some time ago, but I know the idea now is to assimilate it absolutely to the telegraph, and I believe it is exactly the same. Major Beresford mentions with regard to Sir John McNeill's zambas, that "at 7 P.M., the line was cut, and signallers took up the running with camps to the Right Water Fort." It may be interesting to the meeting to know what the signallers did that day. They went out completely equipped, with Sir John McNeill's force. On arrival they communicated with the Right Water Fort, and maintained communication more or less all day, but of course the General

Officer commanding used the surer and quicker medium of the telegraph wire for his official messages. The fact that when the line broke the signallers took up the running is, I hope, to be considered satisfactory to the signallers generally, especially as very hard work was got through, comprising messages containing the regimental numbers and names of the killed, wounded, and missing, the work extending far into the night. The wire was certainly mended the next day. The day following it again broke, and the General gave orders that the wire need not be repaired any more as the heliograph was working so well. A few days afterwards, during the advance on Tamai, the signallers had a great press of messages to work through. One press message came in 205 words, and so on. From the extreme point reached, messages were written by Sir Gerald Graham right away to the Queen and Lord Wolseley, and heliographed as far as the Right Water Fort, where the field telegraph had an instrument.

Captain CARDEW, R.E. : I have here an instrument, a portable telephone box with vibrating call, which I should like to exhibit, though as it only came up this afternoon, I have not had the opportunity of trying it. Major Beresford, in his paper, alluded to these vibrators (Transmitter, Vibrating, Mark II), and I think, on one occasion, he called them Theiler's sounders, and, on another, vibrating sounders. This instrument is not used by us as a sounder at present. It might be described as a vibrating sounder by itself, and was originally deduced from the instrument known as the vibrating sounder. We use it as a transmitter, that is to say, as a means of converting an ordinary battery current into a vibrating current, which has more effect on the receiving instrument, viz., the telephone, and thus more efficiently utilizing the telephone as a receiving instrument for telegraphic signals. The battery current is converted into a vibrating current of a certain period, which is far more audible in a telephone than the mere make-and-break signals such as the signals in the ordinary Morse key. The chief advantage of the telephone as a receiving instrument is that it never requires any adjustment. Any of the ordinary Morse instruments require delicate adjustments, and if the current strength alters from time to time, as is often the case on field service, and the instrument requires readjustment, it sometimes leads to considerable delay, particularly when communication is wanted to be established after an interval of rest. If the receiver does not get his call signal owing to want of adjustment in his instrument, there is very often considerable delay. The telephone always responds to the call however it is varied. That is the principle of this system. I need not go into the details of the connections, except to say that the vibrator is put across the battery so that the current to it is always the same, and is independent of the condition of the line. It should not, therefore, often require readjustment, and even should this be necessary, it does not entail serious delay, as the instrument is at the sending end of the line. I have here another instrument, a portable telephone box, which is intended for a purpose which should be kept distinct, that is, for telephoning as distinguished from telegraphing. Unfortunately, in order to make the telephone sufficiently audible at any rate to inexperienced ears, it is necessary to use a microphonic transmitter, that is to say, to make use of a battery current modified by the action of speed, and not merely to speak into the telephone itself. Of course everybody knows you can use the telephone to speak into; it is both transmitter and receiver; but it wants a good deal of practice to hear with this arrangement, whereas the use of a microphone gives you a louder result. Colonel Jeff asked whether we could get men at Chatham. I may draw attention to the fact that we do not profess to retain telegraphers there, in fact whenever I get a good telegrapher he burns in my hands till I get rid of him. I regard him as quite wasted at Chatham, and he should be doing service in the Telegraph Battalion. As regards the training of men, I do not think it is feasible. I have a good deal of experience in instructing men in telegraphy, and I do not think it would be feasible to take the ordinary Tommy Atkins, as he enlists, and with his present short service make him an efficient telegrapher before we have done with him, but I do think a great deal can be done by taking boys. The proper way to train telegraphers is to take boys as young as you can, as is done in the Post Office. If you take boys who have had a good schooling, you will train them in about one quarter the time that it takes to train a man, and they become very much more efficient.

Lieutenant-Colonel HAMILTON, R.E.: I only want to say two words in confirmation of what fell from Major Browell, that the system of telegraphy and of signalling are now as nearly identical as possible consistently with the different instruments that are used. I say this because about two years ago I was on a Committee in conjunction with the Inspector of Army Signalling in revising the "Manual of Army Signalling," which was then brought into exact harmony with the telegraphic system.

Major HEREFORD: I am very sorry that time did not allow us to hear Herr von Treuenfeld to the end, and I only hope he will give us the remainder in writing, because I have no doubt everything he gives us on the subject of telegraphy is most valuable. He spoke of insulated wire; I have here a new pattern of insulated wire, sent in by Messrs. Siemens Brothers, which Herr von Treuenfeld expects will cut out everything else, including D. 5. Its core is a combination of steel and copper, and it is said to be not only very much lighter, but very much stronger than our D. 5. There is also a pole exhibited which Messrs. Siemens have sent in as an example of how light an iron telegraph pole can be made. I have also here an insulator, proposed by Herr von Treuenfeld as a field insulator. I cannot agree with Colonel Jelf's remarks about men from the line. There are many men, capable of being trained as telegraphists, to be had from the line regiments—there is not the smallest doubt about it—if you can get hold of them from the commanding Officers. I do not say the very best man, but one of the very best men of my section at Suakin, was a 92nd Highlander from the Reserve. At the present moment he is employed by the General Post Office as a civilian, and has been promoted, or is about to be promoted, in that department. When we left Suakin, the telegraphs were taken over by the Shropshire Regiment, and they have been working them up to the present time. They may not be able to do the work as well as Telegraph Battalion men, but they can perform good service, and with further training they would become more and more efficient. In India, men from all regiments are employed. I had a conversation yesterday with Mr. Reynolds of the Indian Telegraph Department, and he gave me a very interesting account of how the telegraphs are worked in India. He had the preparing of all the material for the Afghan War, though he was not himself present at the field operations. There was a very good piece of telegraph work done in India some years ago in connection with the famine—that telegraph was carried on under the superintendence of an artillery Officer, Major Mallock, who, I think, is now at the top of the tree in the Telegraph Department. General Webber said there was no account of the telegraph operations in Afghanistan. Mr. Reynolds told me that there were two accounts to be found in the "Proceedings of the Society of Telegraph Engineers." I have not, as yet, seen them myself, but General Webber may know of them—one is written by a gentleman of the Indian Telegraph Department who was present himself during the operations. General Webber said he had very little faith in outpost telegraphy, and that it has not been tried. Well, all I can say is you do not know what you can do till you try. Twelve years ago at Aldershot there was very little faith in the Telegraph Troop itself. I remember on one occasion at that particular time when we were supplied with an exceedingly faulty cable and worthless instruments; there was a battle out on the hills to the south of Aldershot. One division of the defending army was on the Hog's Back, and the other on Hungry Hill and at Caesar's Camp. Captain Macgregor, afterwards killed in the Transvaal, and I were working the telegraph; he was on the Hog's Back, and I was on the other flank; the line was working perfectly for a wonder, and early in the day he telegraphed to me as follows: "The enemy are leaving our front, and moving towards your flank, so look out." I brought this telegram to the General, and he laughed at me. He hinted the telegram was a creation of fancy, and he did not believe in the information for a moment. Half an hour after that, the enemy were across our right flank, and rolled us up into Aldershot; such a defeat was never suffered in peace manoeuvres before or since. Sir Redvers Buller mentioned the telephone. I think the telephone in some cases would be most useful, but I do not think when any active operations are going on that it would be reliable. The telephone is not such an accurate instrument as one may think—the words are very likely to be misunderstood—I prefer the sounder as being far more reliable.

Certainly the telephone saves clerks, for it is not necessary that a telegraph clerk should be present to work a telephone. Major Browell spoke on behalf of the signallers. In my remarks about them, I did not mean to say all that could have been done with the existing means was not done; I know it was carried through with credit by the Officers in charge; but what I assert is, that the men that were given were not educated enough for the work in connection with the telegraphs, and that if Major Browell had had telegraphers under him who were signallers also he would have done a great deal more. At McNeill's zureba, the signallers did their work excellently, but that was not on the main line of army communication—not where the press of traffic was going on. I do not think I have any other observations to make except to thank the gentlemen who have been present at this lecture.

Sir J. STOKES: Gentlemen, you will not expect many observations from me as I have taken the Chair at very short notice. I should like, however, to make one or two remarks on what has passed. And first I must say it is extremely gratifying to me as an engineer Officer to have heard Sir Redvers Buller's high encomiums on the work done by the Telegraph Battalion of Engineers in the field on all occasions which had come under his notice, and I am sure it must have been highly gratifying to the Officers of that battalion present to have heard those encomiums. As regards the observations made on the probability of using the men of the line and cavalry with the engineers, I am certain that in individual instances there may be very excellent telegraphers found in those branches of the Service; but it seems that on some occasions when they have been most wanted there have been great difficulties in getting hold of them. I am equally certain that whenever they are found they will always be welcomed and gladly attached to the Telegraph Battalion of the Royal Engineers as most valuable auxiliaries in the work they have to do. I cannot help thinking that those who wish to establish a different order of things to that which now exists do not fully realize the extreme difficulty of finding proper material in men and training them, and getting the boys and training them for the work they have to do; but, as I said before, we shall always be glad to receive assistance from the other branches of the Service if we can get it. As regards the proposition of telephoning, I think Sir Redvers Buller lost sight of one very important difference between sending telegrams and speaking by telephone; there may be an occasional mistake in the telegram, but at all events it is recorded, and whatever is sent stands and remains on paper and can be referred to hereafter as a proof of the wrong order having been given; but in the telephone the order is heard, forgotten, and passes away, and there is nothing to prove what the order has been. I think that would be a very great difficulty in sending military orders by telephone. I cannot sit down without asking you to record a vote of thanks to Major Beresford for the admirable paper he has read to us. And I think we owe very much to the gentlemen who have taken part in the discussion, for they have thrown a great deal of light upon the question, and in saying this I must especially mention the remarks made by Herr von Treuenfeld.