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The Different Systems of Signalling in the Field

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Friday, February 10, 1893.

LIEUTENANT-GENERAL SIR R. HUME, K.C.B., in the Chair.

THE DIFFERENT SYSTEMS OF SIGNALLING IN THE FIELD.

By Colonel F. G. KEYSER, C.B., Inspector of Signalling.

WHEN your Council did me the honour of asking me to deliver a lecture here on signalling, I was at first very reluctant to comply. I had already exhausted the subject in a paper I read before the Aldershot Society, and I feared that so early a repetition would be of little interest. I was told, however, that among my new audience there would be few who had attended before. If, therefore, on the present occasion I repeat myself, I claim their indulgence, as "signalling" is not an art which can be enlarged upon indefinitely.

There are many ways, as you doubtless know, of "signalling in the field." These are all based upon three necessary conditions—speed, accuracy, and simplicity.

In these express days, "time" is everything, and a campaign which in former times took years, must now be brought to a triumphant conclusion by one side or the other in as many weeks. To accomplish this, it is absolutely necessary that a General should have complete control of his chess board, so to speak, and be in constant and hourly communication with every piece upon it. Prior information and the more speedy transmission of orders may decide the fate of battles. Perfect control, free communication, trustworthy intelligence, and maintenance of carriage and supplies must be received from sources absolutely reliable.

The means now in use for conveying intelligence and orders in the field are:—

1. The electric telegraph.
2. Visual signalling.
3. Mounted orderlies.

Of these the electric telegraph is the most reliable, accurate, speedy, and complete. The operators employed are all trained to such a pitch of perfection that the messages received are accepted unquestioned and mistakes very seldom occur.

Its sister, the telephone, can be used on the same wire, and the two communicants can, by its means, come into actual speaking contact, but so far there is considerable prejudice against its use by officers in responsible places; much in the same way as you decline to accept an agreement unless you can "have it in writing," so are they loath to take for gospel what is shouted by one irresponsible clerk at one end of a wire to another some 80 or 90 miles off at the other.

But there are many difficulties in the path of successful telegraphy in the field. Its transport is bulky, it requires carriages, horses, and drivers with their necessary supplies, it requires time to lay down and more time to take up, moreover it is liable to constant interruption and in a hostile country requires guarding more or less along its whole length, as one cut can entirely destroy communication. In Afghanistan these cuts were very frequent, and made by the enemy not so much for interrupting communication as for twisting bits of wire into slugs for use in their matchlocks.

A telegraph line is liable to be not only cut but tapped by an enemy, and important messages may be read by a hostile force or false messages transmitted.

Then, again, it requires a specially trained corps for its use, men who do no other kind of duty; and the numbers so employed are comparatively so small, that an army in the field which depended on the telegraph, and the telegraph only, for its intelligence and communication would be very imperfectly supplied.

Now to pass to No. 3, Mounted Orderlies. This method is the most reliable of the three. A mounted orderly carries a written message of any length, or many such, each signed by the sender, and returns with a receipt signed by the receiver; moreover, it is the oldest and most old-fashioned method, which is greatly in its favour with some people. But, and there are more buts here than to either of the others, a mounted orderly may be killed, or lose his way, or be taken prisoner, and his despatches read by the enemy, and the sender can never be sure that his message has reached until the return of such messenger with receipt or answer. Moreover, if this were the only means of transmission, I fear that the strength of two full cavalry regiments would hardly supply mounted orderlies sufficient for a single day.

Now I go back to No. 2, Visual Signalling. This system is my particular study, and forms the real subject of this lecture. I do not for a moment desire to see it supersede, or to advance the opinion that it is more useful than or superior to, either of the other two; on the contrary, all three have their advantages for the particular times or places in which they are used, and each should assist and supplement the other.

Its advantages are: It requires very little transport, can be used in difficult countries where there are no roads, indeed the more hilly, broken, and inaccessible the country, the better; it has much greater mobility than the telegraph, and presents very few points of attack; it can be used over the heads, so to speak, of an enemy. Changes of station or position can be made at will by the signaller simply walking

or riding a few miles or yards, and with well-trained men it is as accurate and reliable as any signalling system can be. On the other hand, as compared with the electric telegraph, it is slower—as far as I have tried in actual contest, both systems being worked by the best men, about two-thirds slower; that is to say, when we signallers work together at Aldershot it takes three lines of flag or heliograph men, as hard at work as they can go, to clog a military telegraph terminal; we often practise together at Aldershot, and the rivalry between the signallers and the telegraphists is both healthy and amusing. It is more laborious flashing with flags than working the key of a sounder, and reading by eye is much more difficult and fatiguing, and a greater strain on the faculties, than reading by ear. The telegraph once laid can be worked at all times and in all weathers, but a fog or misty weather destroys all chance of receiving a message by visual signal, and unless elevated and suitable spots can be chosen, visual signalling is sadly handicapped, since to send any distance in a flat or enclosed country involves so many transmitting stations that constant work, unless such stations are permanent, becomes almost an impossibility.

There is another system of conveying intelligence in the field which I have not included as one of the three above; I allude to the conventional signs for use in the fighting line as laid down in the drill book. These are very useful in their place, but are possible at such short distances only, and so easily learnt and used by all, that they can hardly be classed as a system by themselves, but rather as an addition to visual signalling.

PRINCIPLES OF VISUAL SIGNALLING. INSTRUMENTS AND METHODS OF USING THEM.

As these are doubtless well known to most of you, I will only now briefly enumerate the various items.

When visual signalling was first taught at the Chatham School, a code book was employed, and all messages sent by groups of numbers—the samo system, in fact, as that employed by ships at sea; but this coding at one end and uncoding at the other, with the complicated and numerous auxiliary signs, which referred you to different tables in the code book, wasted much time, and the fact that a slight error of a single figure would often alter the whole context of a message, decided the then Inspector that to spell out each word letter by letter with the Morse alphabet, indeed to imitate the telegraph exactly, was simpler, quicker, and more efficient, and the code book was discarded.

The Morse alphabet has two simple elements, the dot and the dash. These are combined in groups to form the letters of the alphabet, those letters which more frequently occur being the simplest combinations. Take the dot as the unit. The dash is three times the length of the dot. The pause between each sign or letter equals a dash or three units, and between words is double or six units.

Good signalling depends entirely upon these correct lengths or pauses being accurately maintained. Whatever the actual rate of signalling may be, these relative-lengths must be kept.

There are various ways of learning and teaching this alphabet. An ordinary novice can easily pick it up in three days. The alphabet once learned, a series of groups of letters are sent with flag, lamp, helio and sounder, at slow rates, until the element of time upon which everything depends is thoroughly grasped. It is absolutely necessary for correct and rapid signalling that letters should be read as a whole, and not by parts. I mean as a note of music is read. To more accurately impress upon the learner the relative lengths of letters we use this sounder; the ear is more sensitive than the eye and less liable to error. These groups are merely the alphabet repeated three times, each representing twenty average words; the letters are written down anyhow, and the object of their use is to prevent all guessing. The various instruments around me are those now in use in our army for signalling. I will not take up your time by lengthy description, but if any of you would like a more detailed explanation of their use and working, I shall be happy to give it after the lecture.

The maximum rate we allow with the small flag or helio is twenty words a minute; but this is excessive and could not be kept up, the physical labour being too great. The ordinary rate is about twelve words a minute with a well-trained signaller. A telegraph clerk averages over thirty words a minute, but it would be a physical impossibility for us to send as fast as that, for, though the ear can keep pace with the sound, the eye could not distinguish the flashes at that rate.

To keep up the supply of trained signallers is one of the perplexities of the much-harassed Commanding Officer of the present day. Bandsmen, servants, orderlies, cooks, regimental transport, mounted infantrymen, sketchers, stretcher bearers, clerks, irritate and annoy him, but the signaller puzzles him more than all. A man made into a good signaller is a sort of Admirable Crichton among soldiers. He must be well educated, well conducted, self-reliant, cool, quick, zealous and not afraid of hard work; not only does he do much extra work by day, but he is taken out night after night for lamp work, when his comrades are out down town. Certainly he may gain a first prize of 2l. for his work, but the chances are he won't, for if one man of the team breaks down during the yearly examination, he will be lucky if he gets his 15s. Naturally these are the Colonel's best men, and those he would rather have as his non-commissioned officers, but signalling does not lead to promotion. Moreover, his difficulties are much increased when you come to consider that out of a batch of twenty men struck off to form a signalling class, the average number who are likely to prove of any use as efficient signallers is seldom more than three.

The method of yearly examination for prizes is carried out in this way.

The signallers work in pairs. Two messages or groups are sent with large flag by each pair alternately reading and sending. The

Assistant Instructor then sends two groups with small flag, each pair alternately reading and writing down. A complete service message is sent with small flag through a transmitting station. The work with the small flag is repeated in exactly the same manner with the lamp at night. When I tell you that two years in succession the first place has been taken by a regiment whose six signallers have accomplished the whole of this without any one man making a single mistake, and that last year the next ten on the list averaged less than two mistakes, I think you will agree that His Royal Highness the Commander-in-Chief had good grounds for saying that the results were very satisfactory.

I think I can safely say that the first forty-four battalions of infantry examined last year, and more than half of the cavalry and artillery, are as efficient as signallers as men can be. But this is not sufficient; we have trained our signallers, the next thing to do is to train those who use them. Last year all the senior officers went to Hythe for a week's instruction in the use of the new rifle, and it would not be a bad plan to proceed in a similar way by inviting a few of them to stay with me for a week at Aldershot. How would you fare if, having paid your 6d. at a Post Office for a telegram, you were to go round the counter and hurry up the operator, or to ply him with questions while at his work, such as, "Has it gone yet? Havn't you finished? How slow you are. Well, what's the answer? Not done yet? Oh, give it me back, I'll send a boy messenger." And yet that is what is constantly done in the field; and, when a man's whole attention is required to be concentrated on the distant wave of a flag or on a flash, to be thus interrupted renders accurate work an impossibility. Again, how can a signaller, perhaps somewhat stout and scant of breath, follow a galloping Staff Officer on foot, and obey an order to send a message with flag to some distant point? Many refuse to hand in written messages, and then complain that what they intended was not properly sent, or mutilated *en route*. No signaller should be allowed to send any message which has not been legibly written and duly signed. Messages should be clear, distinct, and expressed in as few words as possible. It would not be time wasted if the condensing of long-winded orders into short, crisp, intelligible telegrams formed part of a Staff Officer's training.

Signalling should never be used in the fighting line. What can be more ridiculous than to see a fighting line lying down, utilizing every inch of cover, under a supposed deadly fire at 400 yards, all but the gallant and undaunted signaller, who, standing on the highest bit of ground he can find, with his back to the foe, furiously signals, as ordered, for ammunition, bearers, reinforcements, or what not, regardless of the supposed storm of bullets? A General Officer once said to me, when on my yearly tour of inspection, "I've tried your signalling, Sir, and it's all nonsense; it never answers in the field, and I think it's useless." Timidly I enquired how and why; when he explained, not timidly, that, at a recent route marching, he had worked with two battalions marching on parallel lines, and tried lateral communication as he went along. Now, a battalion marches

at the rate, say, of 4 miles an hour, or, say, 110 yards a minute; an ordinary message of forty words would take about ten minutes to code and send, and the halting and calling up of the opposite party and getting to work about ten minutes more; by that time the column would be about 2,200 yards ahead, and by the time the panting foot messenger reached the impatient General at the head of his little column with the answer, I can quite understand that all reason for his message had departed, and also his belief in signalling. But signalling, however useful, where used intelligently, cannot perform impossibilities, and to use it between two battalions on the march in an enclosed country less than a mile apart, when a mounted orderly could do the work in half the time, was not intelligent employment. I could multiply, almost indefinitely, cases where signalling has been supposed to have broken down, but not one where the reason could not be satisfactorily accounted for.

So much for our supposed failures; now let me give you a few instances of what signallers can do, and have done, whilst employed in some of our recent wars.

During the investment of Sherpur, the greater part of the telegraph line between Cabul and Gundamuck was entirely destroyed, but here the heliograph did good service, enabling the Sherpur garrison to hold communication with the solitary post of Luttabund—the connecting link with their supports along the Khyber route—by which means General Roberts was able to assure the army in India, and the Government at home, of his security, and to issue important orders regarding reinforcements.

Among the many merits of the heliograph, the ease and certainty of attracting attention must not be overlooked. Every inch of country visible can be gradually searched by its means, and the positions of parties, unknown before, ascertained.

On the 12th January, 1880, Captain Straton, while at the signal station at Ali Boghan, found out that the Momunds had crossed the Cabul river; this intelligence he at once flashed off to Jellalabad, and that night a brigade started off to intercept the enemy. During the following day communication was successfully maintained between General Bright's headquarters at Jellalabad, the brigade sent out, and a detachment of it succeeded in crowning the heights. At 1.15 p.m. (13th) Captain Straton saw about 1,500 men trying to cross the river at such a point that, had they succeeded, the brigade would have been cut off from Jellalabad, and the detachment severed from its main body. But intimation was at once signalled to all concerned, and at 3 p.m. a couple of guns sent from Jellalabad were shelling the enemy with such good effect that they beat a hasty retreat.

General Chapman told me of a signalling incident specially worthy of mention. After the battle of Akmed Khel he was particularly anxious that the news should be sent to Cabul and so home. Lieutenant Dickie, the Signalling Officer, was sent to the top of the Sheradhan Pass, north of Ghazin, with a squadron of cavalry, to try and find General Ross's brigade, which had been sent out from Cabul to meet Sir Donald Stewart. His supposed line of march was

ascertained from the map and within four minutes after the first flash they found him, and a full report, 207 words in length, was sent 48 miles and so passed on to Cabul, Simla, and London; the two forces did not actually meet for 4 or 5 days after.

A few days later, when encamped in the Arjandeh, collecting supplies, &c., General Chapman sat in his tent sending his orders and receiving supplies from three different valleys entirely by signal.

Mr. Hensman in his book on the Afghan War says (page 36): "Not the least important arrangement of the day was that of signalling. Captain Straton had parties of men with General Baker and Major White, and a third batch of signallers was sent to a high hill to watch the Chardeh Valley and the movements of large bodies of tribesmen who lived the crest of the range overlooking the camp from the west. Heliograms were exchanged between these points and the head-quarters camp, and General Roberts was kept fully informed of all that was happening in these directions. This focussing of all information upon a common centre enabled the General to make his dispositions with accuracy and effect; without the signallers, dangerous delays might have occurred. The heliographing was so thoroughly well done that Sir F. Roberts complimented Captain Straton personally on the success of his arrangements."

Again on page 267 he says: "The signalling branch of the service has come, deservedly, to be looked upon as playing a most important part in every operation undertaken."

In 1880 the besieged garrison of Kandahar opened communication with the advanced guard of the relieving force under Sir F. Roberts at Robat, a distance of 48 miles, and communication was kept up for several hours over the heads of the enemy, who did all they could to stop us, but were powerless to interfere.

The first glimpse of the relieving army was an exciting moment, and when out of the thick hot haze a star-like glimmer suddenly appeared and disappeared, I could hardly adjust our heliograph to answer. They on their side were equally anxious, and Mr. Hensman in his book on the Afghan war graphically describes from their side how we got our first news for nearly a month from the outside world. He says (page 500): "Kandahar was said to lie, in our line of vision, directly beneath this hill. Captain Straton had brought with him some of his mounted signallers, and at half-past eleven a light was directed towards Kandahar. We could not see the city even with our telescopes, as a thick haze hung over the country about it, and for a quarter-of-an-hour no answer was given. The first signal station was on a low hillock to the left of the road, but Captain Straton took another instrument to the slope of a rocky ridge on the right, whence also he could communicate with the main body of our troops halted for the day at Khel-i-Akhund. He had scarcely left the road than (*sic*) Serjeant Anderson, with the first heliograph, saw a faint flash at Kandahar. It was so weak a glimmer that nothing could be made out, but in a few minutes we read a message—'Who are you?' The answer given was—'General Gough and two regiments of

Cavalry,' and then Captain Straton's light was evidently seen by the signallers in Kandahar, who, puzzled by two flashes, asked—'Where are you.'"

Visual signal stations were afterwards established from the signal tower in Kandahar to nine different points at distances varying from 4 miles to 58, and kept open day and night for several months, and during that time only one serious complaint as to an error in any message was made to me.

At the commencement of the Afghan war we crossed the frontier with 20 signallers and 6 instruments for 1st Division; at the end of the war each European regiment had 20 or more trained signallers besides many natives, and between Peshawur and Cabul over 200 men were employed as signallers daily, using 100 heliographs.

Here is one heliogram I have selected which speaks for itself:—

"From General Watson, Shalozan, to Captain Connolly, Piewar Kotal—'Use telegraph as little as you can. The heliograph brings them more correctly. Your telegraph messages go to Kurrum, and have to be repeated on here, hence mistakes.'"

Signalling in Egypt was carried out under difficulties; the country was so flat and unsuitable, the mirage played tricks with the heliograph, and messages had often to be read up in the clouds. During our first occupation of Alexandria two drunken signallers in a distant fort roused Sir E. Hamley and his whole garrison by sending round a bogus message for a lark, a signalling feat which cost them dear.

A curious circumstance deserves a passing reference here; for although it is not actually a signalling story, it is still closely connected with signalling. Some of you may remember that I complimented Sir Garnet, now Lord Wolseley, upon his recent victory, by heliograph from the top of the Pyramids, and assured him that, like Napoleon, forty centuries saluted him. This happened to get into the papers, but somehow they mixed up Alexandria with Cairo and reported that I had heliographed from the Pyramids to the former place, from the nature of the ground a physical impossibility. However, I shortly received a letter from a gentleman signing himself "John Hampden," thanking me for my valuable experiment, which, he added, incontestably proved the truth of his theory that the world was flat and not round, a fact he had been trying to impress upon the Royal Geographical Society for twenty-five years. I was sorry to have to undeceive him, and so, once more, cast doubts upon his pet hobby. The poor gentleman is since dead, leaving that obstinate Society still unconvinced.

Signalling by moonlight with the heliograph has been successfully practised; but the heliograph should be aligned by day. At the time communication was established between the Cabul and Kuram Valleys advantage was taken of a full moon, and a heliograph was set on Kuram from the Agam Pass. The light was seen with the naked eye 12 miles off. I have used it successfully 9 miles.

Heliographs can also be used with artificial lights. During the investment of Sherpur they were worked by night with the reflected

light from lamps between the different faces of the works, and to the pickets on the adjacent heights. The ease and silence of this method, and the correctness of the alignment, are of great advantage. To limited distances the flash from a heliograph is capable of penetrating any ordinary haze, smoke, translucent clouds, or dust. An impromptu heliograph can be made by aligning two sighting points on a distant station, and directing the flash from an ordinary shaving glass on them. Signalling can be carried on by exposing and obscuring the flashes with a book or anything else at hand.

Communicating by signal from Etchowe to Ginghilovo was successfully practised on March 15, 1879, with a sixpenny shaving glass and two sticks to take the alignment, the flash being shut off by means of a board.

Signalling with the Burmah Expedition, 1885-87.

The troops were conveyed from Theyetmyoo to Mandalay, and, later on, from Mandalay to Bhamo, in river steamers, and communication was kept up entirely by visual signalling. The signallers were placed on the roofs of the steamers.

Large flags were mostly used, as the smoke from the steamers and the constant changing of the background, owing to the winding course of the river, rendered the reading of the small flag very difficult.

The steamers halted at sunset for the night, and signalling was carried on between the steamers.

Had it not been for visual signalling the expedition would have been considerably delayed, as there was no other means of communication except by small boats.

For some time after landing, communication was kept up between Ava, Mandalay, and other stations, entirely by signallers, as the telegraph line was continually cut by the enemy.

All service messages were sent by night after the columns had reached their destination, or the General had returned to headquarters.

Many messages of from 50 to 400 words had frequently to be sent after sunset, at long distances, by lamp flashing, there being no other means of communication.

Suakin, 1885.

Extract from report on Signalling, Suakin field force, 1885 :—

“During the campaign signalling has been associated with the telegraph, but, owing to frequent disconnection of the wire, signalling communication has always been kept up along the whole line.

“There were twelve stations connecting the different regimental camps and headquarter camp with each other and with the base on Quarantine Island. Between the 5th and 23rd March a daily average of 64·23 strictly official messages passed through the station on New House, Suakin, and almost as many unofficial.

"19th March. During the cavalry reconnaissance to Hasheen, Lieutenant Morris, 20th Hussars, had cavalry signallers with all the advanced parties, and in direct communication with the General Officer commanding cavalry brigade. The first sight of the enemy was promptly signalled back by flag.

"On the wire being cut, all official messages were sent by signal, and lengthy returns of casualties were successfully sent after dark to headquarters.

"24th March. The telegraph line had been repaired, and cut again by the enemy. On this date the following telegram was sent from the director of telegraphs:—'The General will not have the line kept up as the heliograph is working so well.'

"3rd April. Over 1,200 messages were sent by heliograph including messages to the Queen and War Secretary.

"28th April. Between the 19th and 29th of April there passed through the Handoub signal station a daily average of 118·3 messages; average length 25·46 words.

"In consequence of the frequent interruption in the working of the telegraph owing to damage caused by the enemy, and also by camels and other animals fouling the wire, it was necessary to maintain the chain of visual signalling along the whole line."

South Africa, 1883-85.

Major Davidson says:—"The quickest time in which a message, under ordinary conditions, was received, was one of fifty-two words delivered at Molopolole, thirty-five minutes after it was handed in at Mafeking, a distance of 110 miles.

"The total distance covered by the heliograph since leaving Orange river is 429 miles, which has been performed in six sections, the longest of which has been 110 miles (Mafeking to Molopolole), and the shortest 49 miles (Sitlagoli to Mafeking). The total number of signal stations formed has been 29. The longest distance signalled by heliograph, 42 miles (Molopolole to Kanya, and Mashow to Matuqui), and the longest distance signalled by limelight, 42 miles (Molopolole to Kanya).

"The greatest number of words received and sent in one day was 3,043."

I think these extracts are interesting as showing what we have done; now, in conclusion, let me say a few words as to what I think we can do.

A very distinguished General Officer said to me the other day, "I do believe in your signalling, but only to a limited extent. I mean it should be confined to the line of communications." Now with due respect to so high and experienced an authority, my humble opinion and small experience lead me to an exactly opposite conclusion. I consider that for the line of communication visual signalling should be used only as an alternative or auxiliary to the telegraph, as when the telegraph line for some temporary cause breaks down, or to relieve press of work. An instance of the former case occurred at Suakin in

1885, and of the latter, when the whole of the fresh water canal transport work was controlled by signallers in 1882, of whose efficient work the Naval Officer in charge gave me handsome acknowledgment. But the real work of visual signalling comes in when the telegraph line ends. It is impossible and unfair to gauge its usefulness from examples taken from Aldershot or other peace manœuvres, because these are necessarily hurried. The work of days is often compressed into the hurry scurry of a few hours, and signallers barely have time to take up their necessary positions before the "cease fire" sounds. Brigade Signalling Officers are not sufficiently instructed beforehand or taken into the General's confidence as to the "Plan of Campaign," and much time is wasted trying to find out how to keep touch with the various brigades, so as to be ready for orders. The most difficult duties of signalling are those connected with keeping up communications with units on the move. Let me give you a few instances of how we signallers think we should, and how we shall, be used.

Mounted signallers should be the eyes of the army. All scouting parties should be accompanied by signallers, and reliable information sent back from time to time would be most useful during an advance into an enemy's country. Within an hour headquarters would receive messages from any reasonable distance, say 100 miles, and an army could advance in perfect security. In a small way we practise this in our tactical instruction at Aldershot. A central party of three or four stations is placed in some commanding position A, and a chain of mounted officers sent out in ones and twos several miles ahead. These appear in unexpected places at intervals, call up A, send a message for headquarters, and sitting in my office I receive these messages in quick succession, often from a distance of 12 or 15 miles.

For artillery operations on either flank, connection by signal is invaluable, and at some recent German manœuvres the concentrated fire upon a concerted point by massed batteries 10 miles apart, governed by orders conveyed by signal, was, I am told, the turning point and feature of the day.

For outpost and piquet work, signalling is, in my opinion, absolutely indispensable, and it is almost criminal to neglect its use, especially at night. Look at this plan. Here all the piquets are connected with the supports, and they with the reserves, and back to headquarters. What greater sense of security could be given to a General and the army than the knowledge that half-hourly news is flashed back of everything going on at these watchful points in the extreme front, instead of having to trust to reports gathered by tired Field Officers wearily going their long rounds in the dark, often over almost inaccessible or unknown ground. This is not a fanciful picture of my own; I have purposely taken this illustration from a French signalling book, where it is given as an example of the means which should be employed to receive frequent night reports from piquets. In the many examples I have quoted from recent campaigns, you see how signalling has been usefully employed in the ordinary way, and it would be

presumption in me to suggest more, when its useful limit is only governed by the common sense of those who have to employ us.

There remains one other system, which we sometimes employ. I allude to that borrowed from our friends the Royal Navy, "The Semaphore." This is the alphabet. It is very easily learnt, and far speedier than the ordinary "flag wagging," but can be used for short distances only. It might be used when signalling is absolutely necessary in the fighting line, or to keep touch between battalions, but its real use would be between ships and shore, especially for forts or landing parties. I find the signallers pick it up very easily, and that it in no way interferes or is confused with our regular system.

Most foreign armies have their signallers, but not having had the same opportunities for practice on service, their training is not so fully developed as our own, the Americans perhaps excepted. Since lecturing at Aldershot last year, I have received a letter from Brigadier-General Greely, their Inspector of Signalling (they know how to promote signalling and its chief officer out there), confirming every word I had said, and for which I was taken to task by Colonel Hutton, as to the great importance their army attached to signalling. I think his kind letter to me so interesting and instructive that, with your permission, I will read it.

That, I think, effectually sets the seal upon all I have said as to the merits of visual signalling.

Lieutenant-Colonel W. T. DOONER: I do not know that I have anything very important to say with regard to the interesting lecture to which we have just listened from Colonel Keyser, but there are one or two points I would like to refer to. He has given us many capital examples of when signalling not only can be used, but has been used, on service; but there was one instance which occurred to me in the peace manoeuvres during last summer that I would like to refer to, as it is a case which Colonel Keyser has not mentioned. It was in the Isle of Wight, during the mobilization of the troops which took place there. It happened that I was placed in command of some five or six miles of coast line, which I had to defend with my own battalion, some artillery, and also a battalion of militia artillery. I found that by means of the signalling everything worked in the most perfect and thorough manner. I myself was in telegraphic communication with headquarters at Parkhurst; and this example I might mention as showing that perhaps the distinguished General officer to whom Colonel Keyser has referred is wrong. Apparently the authorities do not think that this visual signalling is to be generally used along lines of communication. As they certainly placed me in communication with headquarters by means of the telegraph, I found everything worked excellently; I was enabled to sit in the fort where my headquarters were, and, when I had once settled on the different fighting stations, to move the troops with perfect ease and rapidity by means of the signallers. I had only three stations, my own; one at Sandown Fort, and one at Bembridge, and I found I was able to send the necessary orders to move the troops without the slightest difficulty. The signalling was most useful, and I think that is a case—in defending a coast line—where it must always come in and work well. With regard to the whole question of visual signalling, there is no doubt that General officers used to be a little unreasonable about it. They would sometimes dictate very long messages, and almost before the message could be committed to paper they would be asking the unfortunate signaller had he yet got any answer? And the example given by Colonel Keyser of the General officer who was moving in parallel columns seems to bear out that. That General apparently went to work thoroughly prejudiced against signalling, for he did not

even wait to try and get any reply to his messages; he must have moved on with his column at once, without waiting to get any answer to know if the parallel columns were on the same front with him. Colonel Keyser has referred to the many little perplexities and annoyances that a Commanding Officer has now to put up with. Of course the amount of classes and work, and everything going on in the present day, are a little trying sometimes, but I think you ought to urge on the authorities that they should give some small extra pay to the signallers. Commanding Officers do all they can; they try to treat them in many regiments we know like the band. They permit them, where possible, to have a room by themselves and keep to themselves, which soldiers seem to fancy, for some queer reason—but they do like it; and then for discipline some try to have them under the signalling officer and sergeant. There is no doubt the prizes are a great deal too small, and something ought to be done. It is quite unreasonable in the present day for the State to be expecting General officers—who act in the most liberal manner in their districts—to be giving larger prizes to the signallers. It is quite on a par with the Government a little time ago asking, or trying to induce, the different districts to equip the Volunteers. In my opinion officers are unwise in acting in this manner, and in their liberality are doing what really should be done by the State. Colonel Keyser mentions the promotion question as a difficulty. I do not think that enters very much into it, because if a signaller wants a lance stripe, it is exceedingly easy to give it to him. He can have the first step, and then in most regiments—I know it was so in the regiment I had the honour to command—it generally takes from eight to ten months before a lance-corporal can get any pay. It acts unfairly on the men, lance-corporals not at once getting pay, but such is the system; and therefore this long interval of eight or ten months gives plenty of time to replace the man, so that when he comes first for pay you can then let him go to his duty. I hope Colonel Keyser will impress on the authorities that the signallers should certainly get more encouragement. They work hard; theirs is work that keeps them out of a great deal of amusement. I have gone out in the evening to look at them. There they would be working hard at the lamp signals when there would be scarcely any other men off duty in barracks. This work takes them two or three nights a week to try and keep efficient. I consider that if they give up their evenings they ought to get paid for it, and if the regiment to which they belong comes up to a certain standard, which I will leave the lecturer to settle, I think the men should get some extra pay.

Colonel E. T. H. HUTTON, A.D.C.: I am very glad that Colonel Keyser has given me the opportunity of correcting the wrong impression which appears to have been conveyed in America by the report in the "Broad Arrow," of the remarks made by me at the discussion which took place on the occasion of Colonel Keyser's delivering this very lecture at Aldershot, in November, 1891. Brigadier-General Greely is well known in this country for the distinguished position he now holds as Inspector of Signalling in the United States, and for the conspicuous part he played in the War of Secession. I wish, for my part, to say that I am not responsible for the report in the "Broad Arrow," nor for the account the "Broad Arrow" has given of the lecture and of the remarks that I am credited with having made at its conclusion. In common with other students of the Great War in America, I am well aware of the use that was made of visual signalling and of the importance which it was proved to possess. I will read, with your permission, the extract of the discussion referred to, published by the Aldershot Military Society, which correctly gives my remarks: "From the numerous histories we know that, in the War of Secession in America, the telegraph was universally used, and to an extent which perhaps has not been equalled since. Signalling was used, but to a very limited extent (i.e., compared with the telegraph, and considering the vast number of troops engaged), &c." My intention was to show that there were certain objections to any system of visual signalling, due to climatic influences and physical conformation of ground. It was this point which we discussed at Aldershot, with reference especially to a previous lecture on the subject of Field Telegraphs. It is quite obvious to all students of war and to all Generals or Staff Officers responsible for strategical combinations, that the means of communication must be such as *under all circumstances* can be relied on for the con-

veyance of messages to the different bodies of troops concerned. On the face of it, visual signalling, or signalling as explained by Colonel Keyser, in his lecture, is dependent upon certain conditions of climate, and also upon the configuration of ground and country. The remarks I made at Aldershot with regard to the use of signalling during the American war had in view particularly the very difficult character of the country in which many of the operations were conducted. I referred more especially to the battles in the Wilderness, and the battles towards the close of the war round Richmond, which ultimately terminated in the capitulation of General Lee. The country was more or less flat, undulating, and densely wooded, and in such a country signalling cannot be depended upon. Again, signalling must be affected by climatic influences; in storms of wind and rain, in fog and unfavourable conditions of weather, visual signalling cannot be relied upon; it is and must be often useless for the purpose of transmitting messages. Colonel Keyser has stated that the "useful limit of signalling is only governed by the common sense of those who have to employ it." I think that Colonel Keyser is too severe upon Generals and Staff Officers, and that he should modify the "useful limit" and add something with reference to climatic influences and physical condition of ground. Nearly the whole of the instances he has given in his interesting paper have reference to countries where the conditions of weather, as a rule, are favourable, and in such cases it is quite unnecessary, I am sure, to demonstrate the enormous value, and use, that signalling is to an army. It requires really no illustration, because all who have been engaged in recent campaigns, or in peace manœuvres, have had ample opportunity of judging of its enormous value. Many of us at Aldershot were of opinion that Colonel Keyser did not go far enough. We had hoped that he might have shown us how, in combination with the Field Telegraph, he would initiate some inter-regimental, inter-brigade and inter-division system of signalling which would include the use of the telephone and a light field telegraph. It should not be very difficult for the regimental and brigade signallers to acquire some knowledge of the telephone and the ordinary manipulation of a light field telegraph. It seemed to us also a pity that the signalling of the Army should not be in some way connected with the field telegraphs of which it practically is a part. With reference to the tactical use of signalling in the case of outposts, and where detached bodies of troops are concerned, it is almost impossible to overestimate its value, especially at night, where the difficulties of sending either mounted men or men on foot are particularly great. Those of us who have been in recent campaigns, or even in peace manœuvres, have had ample opportunity of seeing its value in these respects over and over again! Therefore any criticism that I have ventured to urge is not intended in any way detract from the enormous value and importance of signalling generally. We must always bear in mind that the British Army has to serve in all parts of the world, and therefore we must be prepared to make our various military institutions, whatever they may be, suitable to the different conditions under which our varied campaigns will have to be conducted. There is no question whatever, as Colonel Keyser has shown in his paper, and as many of us have had ample opportunities of judging for ourselves, that the importance of signalling is simply incalculable, especially in foreign campaigns, where the climatic advantages are entirely favourable to signalling, and the physical configuration of the ground is also suitable. My remarks are, therefore, intended to imply that our present system of visual signalling might be made more generally applicable to our varied requirements if allied with the telephone and some light portable form of field telegraph.

Lieutenant W. P. C. LETHBRIDGE: Colonel Keyser in his lecture has referred to German signalling. I, for my part, was very anxious to hear whether he intended to make any reference to French signalling. The short time I have studied the French methods in use in their service convinces me that their system claims many advantages over our several apparatus. Roughly described, the apparatus consists of a wooden box 3 ft. by 2 ft., in shape of a photographic camera. There are three sizes in use. The one I refer to is the one generally used in the field. It is actuated by a petroleum lamp. It can come into use by day, as well as by night. It is visible 8 to 10 miles by day, and 20 to 25 by night. In addition, it possesses

a system of auxiliary mirrors which, used in conjunction with the sun, operates in the same way as our heliograph. Thus the instrument combines oil lamp, lime light, and heliograph in one. I refer to this more particularly, as I should like to hear whether there is any intention of doing away with the large flags, which, I think, are the most clumsy way of sending messages that has yet been devised. The labour in using them is excessive compared with the results. I am sure Colonel Keyser will agree with me on that point. He refers in his lecture to a certain signaller being of a very stout nature. I am sure the man referred to had not been in the habit of using a large flag as often as a signaller ought to do. In dull and misty weather flag signalling is most difficult to decipher. In such cases the petroleum lamp has the advantage, and, compared with other lamps, has greater brilliancy for piercing haze or mist. As regards transport, the labour of carrying about our signalling equipment is excessive, and the more we diminish that the better. If we had some apparatus like the French method, to which I have referred, I feel sure it would tend to make signalling more generally used. I shall be very glad to gain some further information on these points from the lecturer.

Captain A. S. BARNAM: I do not know that I can speak with any authority, or indeed that I ought to trouble you to-day, because I have the misfortune in some respects, and, I may say, the honour in others, to belong to the junior branch of the Service known as the Volunteers. I, therefore, do not enjoy the opportunities of testing the various methods of signalling on active service which have been the lot of other officers. I noted that Colonel Keyser made no reference to an electric signalling lamp. I know there has been one tried. It may be, and probably is, useless, but it would seem to me that at headquarters, at forts, and other places where electric lighting may be established, such a lamp would be of great power and of great service. I have also several times been struck with the fact that mineral oil, so far as I know, has never been tried as an illuminating power, although I may be wrong on this point. The ordinary bullseye lamp with its colza oil is a very smoky and unsatisfactory affair. Mineral oil is used, I believe, in a great many lighthouses, and generally where a great power of light is required. It would be more portable than the lime light, not of course so powerful as that, but it would be in every way a great improvement upon the present lamp. Colonel Keyser mentioned that the telegraph line may be tapped by the enemy, but I have not heard any speaker yet who has referred to the fact that so may the signalling line. I know at peace manœuvres that has frequently been done. We have got into a quiet corner, and have read all the messages the enemy has been sending, without their being a bit the wiser. Of course the remedy for this is to send them all in a code, and if you are going to code your messages some simple code system should, in my opinion, be adopted. Colonel Keyser has told us that it has been tried and has been discarded; but the ABC and other codes are of great value for mercantile telegrams, and I cannot help thinking that some concise and simple code, specially drawn up with a view to its use for military signalling, would be inestimable in saving not merely the time of the message, but also the labour of the signaller, which would be a great advantage. I saw in the "Times" a year or two ago, in an account of the naval manœuvres, a statement as to the happy condition of one signaller who happened to be the only signaller on board his ship. He was fed on beef steaks, champagne, and various other good things, in order to keep him going. It seems a curious way of keeping a man in training, but that appears to have been the one adopted on this occasion. I only mention that to show how valuable a signaller is found to be, and one would think that some means could be devised of sending messages more rapidly and easily than by the wagging of a large flag. We have in the Signalling Manual various illustrations of collapsible drums, of flashing shutters, and things of that kind which, apparently, from the illustrations, do not appear to be of very much use; but it would seem that some adaptation could be made of a shutter, easily portable, which could send messages accurately, quickly, and with infinitely less labour than is required with the flag, especially if a strong wind is blowing. No one has referred to the establishment in this country of a signalling corps. Colonel Keyser, in the letter which he read, showed us that there is one in America. We have a corps for engineering, for army service, and for

almost all other special departments, and why should not the signalling be undertaken by a corps? You would then spare your Commanding Officer the harassing duty of having to tell off many of his best men for signalling, and you would be able to encourage the men more. They would work together, they would have signalling officers who would devote their working time, or the greater part of it, to the perfection of their special branch of the Service, and it would be a great advantage in every way.

Major E. S. COPEMAN: There is one thing that ought to be mentioned in the discussion of a subject like this. The lecturer hardly did justice, in my opinion, to the difficulty of learning the system of signalling now in use. The classes at Wellington Barracks are admirable, they are as well managed as they possibly can be and, with great effort, with every kindness and assistance, they pull a man through in the course of three months. After that, if he happens to be, as I am, a volunteer officer in the country, he goes down to join his regiment, and what chance has he of keeping up to anything like the standard which he attained after three months' hard work at the Wellington Barracks? I think an opinion exists amongst regular signallers that signalling ought not to be attempted by volunteers at all, because they know that without constant practice and experience it cannot be done efficiently; and I believe that, except in some of the crack London regiments, it has not been found possible for volunteer signallers when they have gone to the field to carry out their signalling work as it ought to be done. The fault does not all rest with the officers or with the men, but I think the authorities are partly to blame. In my own brigade we get very little or no assistance whatever from the War Office. The men have not sufficient appliances to carry on their work. No assistance whatever is given, in the way of contribution towards the expenses; we cannot even get the flags that are required for teaching the men their duty, to say nothing of lamps, heliographs, or other appliances. Nevertheless, the War Office has, I believe, signified to the Generals commanding the different volunteer brigades that they are required to provide a body of signallers for their brigades and signalling officers qualified to instruct them. I think if that is required of Brigadiers in the country, it is absolutely essential that such signallers should be thoroughly instructed by a sergeant trained in the Guards or in some line regiment, and who shall have nothing to do but to go round to the different districts and instruct the men so as to keep them up to the mark, in the same way as is done in all the London volunteer regiments where efficient signalling is carried on. If this is not done, signalling in volunteer country brigades will continue to exist only on paper, and when signallers are wanted, I am afraid they will not be found up to their work.

Captain E. HEREFATH: Colonel Keyser has referred in his lecture to the senior officers. He says that last year, senior officers went to Hythe to be instructed in the use of the new rifle, and that it would not be a bad plan to invite a few of them to stop with him for a week at Aldershot. Now, I had the honour of going through a training class under Colonel Keyser two years ago, and I can say that it certainly gave me a great amount of confidence in handling signallers. I have found very good results follow from using it in a small way in summer manoeuvres when you have two or three companies in hand. Last year I had three companies engaged in outpost duty, extending very little short of a mile. I was able to place my signallers with the greatest confidence, whereas I am sure that if I had never been through a class I should not have had the same confidence. Further, it had the advantage of leading me to understand the difficulty under which signallers work, and I am sure that if senior officers would adopt Colonel Keyser's advice and stay with him for a week at Aldershot, they would not afterwards be so inclined to call upon signallers to do what they find almost impossible.¹

¹ I meant to have said the following at the discussion, but it escaped me, as I had not made notes during the lecture: "Although I consider that signallers with outposts are almost indispensable, at the same time they may become a danger if used injudiciously, particularly at night, for an astute enemy sending out reconnoitring parties may find out the general position of the outpost line and view the

A VISITOR: As an old sergeant instructor of a cavalry regiment, I should like to make one or two remarks about instructors in the Indian Service. I was sent up to C—, in the Himalayas, in the monsoon, to take a certificate as Instructor. I arrived there with a large number, most of them knowing very little about signalling. The weather was very misty in the mornings, and by the end of the first month very little had been done except in flag wagging. At the end of three months very little heliographing had been done on account of the weather. When the examination took place, a large number were told that if they would promise to work when they got back to their regiments, certificates would be given to them as instructors. I luckily went up as a trained telegraphist; I knew signalling before I went. We came back, and I had about a dozen signallers who went out with the regiment to do duty, but about half of them knew as much about signalling as that clock. Some of them had their certificates, and were down in the book as trained signallers, but when they came to work nothing could be done. I think that is a most important point that when signallers are sent to obtain certificates they should be well versed in signalling before they go, for two or three months is not nearly sufficient for any man with ordinary ability to thoroughly comprehend what he has undertaken. In the cavalry, a Commanding Officer finds it very difficult to spare men for this duty; with my own men I found them always very willing and only too glad to go out at any time for lamp or other signalling work. They also seemed to evince great interest in the heliograph, but it is utterly impossible for 50 per cent. of the men to learn the heliograph, and to become competent with it, in six months. I always found it was best to teach them from the sounder. After a man has learnt the alphabet, if he has been taught with the sounder, he immediately picks up the heliograph without going through the flags. Though having a fair eyesight, I found it impossible to learn the heliograph until I had been taught telegraphy. In India, a large number of soldiers, especially in the infantry, are employed in the Government Telegraph Offices instead of Eurasians (for which they get extra pay), and would all read the heliograph at the first attempt if required. I found that immediately I was able to read the telegraph, the heliograph came to me as second nature. Directly I saw the flash I could read it, and I think if more attention was paid to the matter of the sounder, you would get more competent signallers.

Major A. GLEN: I am sorry I was not here at the beginning of Colonel Keyser's lecture. I understand he said something in disparagement of Volunteer signallers, or, at all events, suggested that they were not of much use.

Colonel KYSER: I did not say a word about Volunteer signallers; they were not mentioned.

Major GLEN: I beg pardon; I misunderstood a statement which was made to me just now. I have had some experience with such signallers, and have found it has always been possible at peace manoeuvres to do something with them; they have proved of some service, and from time to time, when I have been in charge, I have been told by the officers commanding that useful work has been done by them. This was particularly the case in some Easter manoeuvres under Colonel Strachey and Colonel Gascoigne. They both told me that very useful messages had been carried through in the course of the manoeuvres by the signallers. There is one remark that I should like to make with regard to signallers in the field. Colonel Hutton referred to the field telegraph; this is rather a hobby of my own,

position of the supports and reserves by the outposts flashing signals at night without reason or caution. Every signal station should be under the strictest discipline, and no indiscriminate signalling allowed, which in peace manoeuvres often happens. It is by no means an unusual thing to our signallers at a station, when tired of waiting for messages, to have a little practice with a flag on their own account, and this should be discountenanced by the officer or non-commissioned officer in charge of the station. It is the object of all outposts to conceal from the enemy their positions, and I consider that if the signalling of different stations is not kept under proper control, this object may not be advanced by signallers."—E. H.

and I suggest the use of a light field telegraph for signallers. My idea of a signaller in the field is that he should be a man who is prepared to get a message through somehow. If the sun is shining brightly, and the distant station is a long way off, by all means take the heliograph; if not, take anything that you can get, even if it is only a branch of a tree, to signal with. There is a way in which signallers in the field may be able to some extent to overcome climatic influences, and that is by the use of a light field telegraph. I do not wish to ride my hobby just now, because the field telegraph is not the immediate subject of this lecture, but as it is connected with signallers and visual signalling, I think it ought not to be left out of sight. Your signallers, whether regimental or forming an independent corps, ought to be furnished with all the best apparatus known for getting messages through under various conditions, and I think that one apparatus that a signalling party ought to have would be some kind of light field telegraph, which can be used with the telephone, and read in a similar manner to the sounder. The Royal Engineers use a comparatively light field telegraph, which will stand a good deal of knocking about. There is a telegraph much lighter than that, which, if laid down, probably would not last very long: a cart passing over it would break it. But as it would only be used in short lengths, it could easily be replaced, and the cost of replacing a mile of wire would not be very much. That is one of the methods by which signallers may overcome adverse climatic influences, and I think that something may be made of it.¹

Major-General W. L. YONGE: A great deal that I might have said has been already said by speakers who have gone before me, and I will endeavour not to go over the same ground again. I agree with what Colonel Hutton says, that nobody can possibly question the utility of field signalling; nor can any one doubt the extraordinary efficiency to which it has been brought, especially in heliographing, in the British Service. The instances given by Colonel Keyser in his paper, and examples well known to all of us, make it almost superfluous to refer to the subject. But I do not think Colonel Keyser has said enough on the subject of the means by which he arrived at this efficiency. We know that "Rome was not built in a day," and I want to remind you that a signaller is not made under something like three months. The official Manual of Instruction in Signalling, which I have here, says that in about fifteen to twenty days the alphabet may be learnt, the class making in each day five attendances of an hour. Colonel Keyser, in his lecture, says it may be "picked up," whatever that may mean, in three days. Probably the audience, looking at that table of the Morse alphabet, might learn the groups in three days, and perhaps name the different letters, but that is not signalling. You have not only to learn the groups like the notes of music which have been referred to, but you have to transmit them by means of the flag, and others have to read the message so transmitted. The Morse alphabet was originally started in connection with the electric telegraph, and it consists of only two elements, the dot and dash. But there was a good reason in the case of the electric telegraph why only two elements were adopted as the basis of the Morse system. The telegraph needle was not capable, as far as I know, of anything but two motions; these motions were "right" and "left," and therefore if the advocates of the Morse system intend to carry further the system restricted to two elements which obtains in telegraphic instruction, it is excusable for them to accept any apparatus which can furnish the two necessary elements; thus they find all they require in the heliograph and the flag. The heliograph is only capable of these two units, viz., the observation and reappearance of the flash of light called "the dot and dash," and therefore in connecting these two with the electric telegraph

¹ The three-wick and four-wick paraffin lamps commonly used for large magic lanterns, and having no glass chimney, but only a glass plate in front for the light to pass through, have been successfully used (in conjunction with the heliograph, in lieu of a shutter) for signalling at night at a distance of several miles by the Inns of Court Volunteer signallers. The tall iron chimneys were found inconvenient, but might, no doubt, be improved if the lamps were specially made for signalling purposes.—A. G.

it was quite right that the same system of instruction should go on between the heliograph workers and the telegraph operators; especially as I believe it used to be a grievance of signalling officers that as soon as they had an efficient signaller he was seized on by the telegraph department and carried off, and they had to begin again. It was an important part of the duty of instructors in visual signalling to supply the telegraph with operators. The course of signalling takes, according to the official book, forty or fifty working days to learn, but the result is that when Colonel Keyser goes round on inspection and examines the signallers, he tells us that out of, perhaps, twenty, three are the utmost that he can call good and efficient signallers.

Colonel KEYSER: That is not the trained signallers of the army; but when you take twenty recruits to start with, as a rule you will only get about three men of those recruits who will ever become efficient signallers. I am not talking about the signallers themselves.

Major-General YONGE: I am not quite clear as to whom you inspect, whether those sent up as signallers from the corps, or the regimental class of twenty on probation.

Colonel KEYSER: I inspect the regimental signallers.

Major-General YONGE: The six men?

Colonel KEYSER: The six trained men.

Major-General YONGE: That rather strengthens my case; to get these six men the Colonel is obliged to provide something like twenty. In the example of Army Form B, 226, as given in the Manual, there are the names of twenty men, and these men have to go through your course of instruction, occupying from forty to fifty *working* days. That means a good deal more than fifty actual days from the beginning to the end of the course, the men being struck off all duties and parade, and their efficiency is to be maintained by further "frequent practice." It is a pity, having secured these three efficient signallers, that the other seventeen, who have gone through the preliminary training, should be entirely lost to the service, but they are not estimated as signallers. A bad signaller is almost worse than none at all, especially in the case of the dots and dashes, where the loss of a dot or of a dash changes the letter signalled. Therefore, I think, when you speak of the "average" of a regiment, it is altogether misleading: a man should be classed either as a good or a bad signaller; either the one or the other. Take the case of the "Admirable Crichton," referred to as a man who might have earned the 21. prize, but who may be considered lucky if he got the 15s. Why does he lose his 21. prize? Not on account of any failing of his own powers of signalling, but simply because somebody else, one man in the team, breaks down, and he forsooth loses the pre-eminence which he might still justly claim, and instead of getting 21. gets 15s., and his battalion is "averaged" out of the 1st, 2nd, and 3rd prizes. The system of averaging regiments, therefore, is altogether fallacious. There should be so many good men and so many indifferent, wherever they are to be found individually. The difficulty is to find a sufficient number to fill up vacancies, and there ought to be some system by which every man could be made a signaller, available under ordinary circumstances. When I first saw this lecture announced on "The Different Systems of Signalling," I thought we should have a description of the various systems, French, German, and others, with all of which Colonel Keyser appears to be familiar;¹ but on seeing him the other day and asking the question, I found it was not so, and that we were to have a lecture pointing out what has been done in our own army. But there are other systems, and, by permission of Colonel Keyser, I will refer to one which is my own invention, and which has been in use upwards of twenty years in the Austrian army: It was described originally in 1871, in the "Proceedings of the Royal Artillery Institution," and copies were in the ordinary way given to the Austrian Staff, at Vienna, who no sooner saw the description of the clock signal vane, than they

¹ I understood Colonel Keyser to say that he had never heard of the so-called Austrian system. "A prophet is not without honour, save in his own country."—W. L. Y.

seized upon it, and, as my informant told me, they said it was a "pearl of price." They set to work at once, and before the week was out made the apparatus themselves, and the system has been in use twenty years. Before that they had the flag system, which they thought so bad comparatively that they threw it over, and still work this system of mine. I have here the Handbook of the Military Forces of Austria-Hungary, which contains a full description of this system. It is not merely a system for the parade ground, but it was the system used during the campaign in Bosnia, in 1878. It has also been spoken very highly of by French and German critics. This system can be learnt in five minutes, and in that space of time I would undertake that this audience should be made perfect masters of it; they could read the signals sent, and could send signals. Having once learnt it, they could never forget it. I know that this is speaking rather strongly, but I have no hesitation in saying that in ten minutes' time the whole of this audience could become perfect signallers. And remember it is not merely a new fad of my own, but it has stood the test of experience. It has been adopted by the Austrians and Swiss, and, I believe, by the Norwegians. After the lecture is over, if any one will care to see the system explained, I have the apparatus here, and, by permission of Colonel Keyser, I will do so. Prince Edward of Saxe-Weimar was good enough to help me on one occasion, at Frensham. He gave me three or four detachments of the Guards, and almost before I had done speaking there was a universal cry, "I see it." I took them out the next day with the division, and they signalled successfully, and those who saw it agreed that "there was something in it at any rate." The apparatus could be made very cheaply, and I really think it is worth attention, as a second string to the bow. I do not seek to abolish the present Morse system, which is essential to the heliograph, but I advocate its adoption as a second string to your bow, by which a whole battalion could be made useful in signalling to moderate distances of six or seven miles with the assistance of the telescope. My "clock vane" can do whatever "flag-wagging" can do.¹

Colonel F. C. KEYSER, O.B.: I think, on the whole, my critics have been very kind to me. All that Colonel Dooner said was most complimentary, except that he accuses me of not looking after the regimental signallers. If he only knew, during the four years I have been in office, the efforts I have made for the improvement of signallers, to try and get them paid, to try and get the sergeant instructors in a better position, I am sure he never would have said that. In fact, I have made myself perfectly objectionable over the way in my endeavours to get them extra money and grants. The answer I always receive is, "We spend too much upon signalling already, and we are not prepared to spend another penny. If anything, we shall do the other thing, we shall cut it down." Colonel Hutton, I am pleased to see, is very sociable, too. The only thing I object to is that he accused me of saying that you could *always* signal. I rather think he has overlooked one paragraph, where I said "a fog or misty weather destroys all chance of receiving a message by visual signalling, and, unless elevated and suitable spots can be chosen, visual signalling is sadly handicapped." I do not think he quite heard what I said there. I quite agree that we ought to make the telegraph and visual signalling more interchangeable. I think nearly all our best signallers, with a very little practice, would be very good on the telegraph. In fact, if you ask Captain Lethbridge, he will tell you that his best signallers are often taken away for use in the telegraph offices; and, I may say,

¹ The Manual says that, "Signalling with flags from the first or attacking line is an absurdity, and should never be attempted." The lecturer has enlarged upon this text, but there is no difficulty in thus signalling in safety with the clock vane, especially if a small code of twelve or twenty-four emergent sentences be prepared for use under such circumstances.—W. L. Y.

² After the lecture many of the audience availed themselves of General Yonge's offer to explain his system, and appeared to be quite satisfied that it was extremely easy to learn, and some suggested that it might with advantage be taken up by Volunteers and others, who have no time to devote to the learning of the Morse system.—EDITOR.

on several occasions, at Suakin and other places, and in India, in my own experience, our best signallers were often taken away by the engineers for their telegraph line, and we had to begin again and educate others for ourselves. Captain Lethbridge wanted to know why I did not say something more about French signalling, and General Yonge also accuses me of neglecting other systems. If once I had begun to speak of the other systems of various nations, as well as fancy notions, I found, from the pile of books I should have had to go through, that it would have made my lecture so long, that I do not think your kind patience would have stood it. I therefore confined myself to what we had at home. I have here the French official signalling book, with a picture of the *Appareil Optique*, which apparatus is also described. We are told it is very portable: it does not look very portable here. It may be. I never saw one myself, but it is very complicated. Their heliograph, instead of working, as ours does, by hand, with a vertical and tangent screw, goes by clockwork, and if anything had happened to that clockwork in Afghanistan, I wonder where we should have been. Then as to petroleum lamps. In the first place, in India they use nothing but petroleum lamps, but the great difficulty we found in using them was with the glass chimneys. No petroleum lamp will burn without a chimney, and the great difficulty is to get a glass chimney that will not break. If you are signalling you must have a perfectly level piece of ground to put your lamp on; otherwise, put it a little on one side, crack goes your chimney! One drop of rain on the chimney, crack it goes! The signaller in charge carries the flame up a little too high, crack the chimney goes! A gust of wind comes, out it goes, or the chimney cracks again. A petroleum lamp is a very difficult thing to manage, and I found that a whole camel load of chimneys which I got up to Candahar at my own expense was used up in a fortnight. However, we are now trying an "unbreakable" chimney, and the inventor assures me I can throw it in the air, let it fall to the ground, and it will not break. I tried it the other day with great diffidence, and it did *not* break. The great defect or difficulty with a petroleum lamp is that you cannot keep it alight in a gust of wind. Even that colza lamp goes out sometimes. The oil is very difficult to get on service, and it is a nasty black-burning oil. Petroleum would be very much better if we could only get a suitable lamp to burn it. If there is anybody present who can find a suitable lamp there is a fine field open to him. Captain Barham and other Volunteer officers have taken me to task rather about Volunteer signalling. It is not a question to-day of signalling in the various component parts of our Services. I purposely left it out to-day, because the matter is very controversial, and would take too long; so, with their kind permission, I will not say anything about it. We want all to be friends here, and perhaps we should not be if I ventured on detail. However, we will not say anything about that. I consider the Volunteers are improving every year. Last year there were only twelve Volunteer regiments that qualified; this year there are nearly thirty. They have a very good average indeed. Some regiments can qualify, some cannot; those which can do it are quite satisfied with the present state of things, and those who cannot are not. Captain Barham also wanted to know about the electric light. I quite agree with him; what we want is the electric light. It would be a splendid thing. I had an unfortunate inventor who worked at it with me for three years, but we came to the conclusion that to carry two carboys of acid about on a mule's back was a dangerous experiment, and you cannot have primary batteries without acids. If anybody can invent a primary battery that will work by putting a handful of crystals into a jar and pouring a tumbler of water over it, he will make a fortune. Until you can get a *portable* battery, or something of that sort, it is impossible to think of an electric light. I have tried four or five which give a good light, but it is the question of carriage which always spoils them. On service the signaller is only allowed a mule or half a mule, and with that half mule he cannot do much. Then there is the large flag which people have been grumbling about. I quite agree, large flags are a great nuisance; but when you cannot use a small flag you must use a large one. Until you come to the point where we can do away with distance and find something that is better and easier to read than a large flag, we must still go on using it. I am perfectly willing to do away with it as soon as anybody shows me how. Captain Herepath was very kind. I quite agree that some of the senior officers want as much

instruction as some of the junior, and, I think, even more, because to the senior officers it is a new thing. Senior officers very often do not like new things. To many, signalling is comparatively new on the present advanced basis. Before, when we signalled in a small way, it was only done as a sort of freak. Now that we use it constantly as part of our equipment, I think everybody ought to know something about it. One gentleman talked about signalling in India. I can assure him we do things very differently here. I think they carry on the signalling school there on better lines now than they did in his time. No one is allowed to come to my school to begin at all, unless he can send and read at the rate of six words a minute. Major Glen rather took my breath away by accusing me of having said something terrible against the Volunteers. I assure him I never opened my lips about the Volunteers. It was the very last thing I should do to disparage the Volunteers. I have a great deal to do with them. I have attended their meetings very often, and I can only say that it has always been a subject of wonder to me that they could do so much with so little opportunity. All their work is done out of hours, all their work is done at their own expense, all their work is done when the rest of the corps are enjoying themselves; they get nothing but kicks and no ha'pence, and I only wonder that they have any signallers at all. As to a light field telegraph, I think it would be a very useful and good thing between outposts and piquets, and for short distances; but we signallers, when on service, work not by miles but hundreds of miles, and we cover 50 or 60 or 70 miles at a time. No man, and no batch of men, could carry a wire 60 miles long; if they did, it would take too long to lay down, and too long afterwards to take up. A light telegraph such as Major Glen mentions, between piquets and outposts, would be very useful for telephone work and that sort of thing, and could be laid down at the rate of a man running, but for long distance work I do not think it would be very practicable. General Yonge has a baby of his own, and therefore he does not like mine. No mother ever did. But I think, if he would only come down and pay me a visit, we could convince him that, although our alphabet is a little complicated, yet when it is learnt it is thoroughly learnt, and the great advantage we have is that we can work and are in touch with the telegraph. As long as the Morse alphabet is good enough for the telegraph which is used all over the world, I think it is good enough for us. When they change we will change: till then I do not see our way to do it. I will only conclude by thanking you all very much for your kind attention, and also General Sir Robert Hume, for his very great kindness in coming here and presiding as my Chairman.

The CHAIRMAN: Ladies and gentlemen, the lecture and the discussion have been so very exhaustive there is not much left for me to say, except that having had personal experience in connection with Colonel Keyser of the value of signalling at Candahar, where he and I were together in 1891, I will just add one instance to those that he has given us of the value of visual signalling. In January, 1891, we had to send a mixed force out from Candahar to Maiwand, a distance of 36 miles. It is a part of the country whose normal state is disturbed. We had to send a force out, because the people would not send in their tribute of grain of different sorts required for the garrison at Candahar. It was quite possible there might have been disturbance more or less, and it was of great importance that the column should be connected with headquarters. On the day the force arrived out there, they established a heliographic station on the top of a hill close to the camp-ground, and that evening the force at Maiwand was connected with headquarters at Candahar. I think that is pretty good proof of the value of visual signalling. I know it was an immense comfort to me. It is not necessary for me to go through all that has been said already, but I think one of the great points about this lecture is that it has been given to us by an essentially practical man, who is not only an enthusiastic signaller, but who has gone through the ranks of the army, and has commanded a regiment himself, so that he can be in touch with both sides. I am quite certain that in all that he does while working as well as he can for the efficiency of his own branch of the Service, he, as far as possible, respects the feelings and the efficiency of the regiments he has to work with. And, I think, one very great point is that, notwithstanding the many objections that are made to visual signalling, we have been able to have such a

record placed before us to-day, showing what has been accomplished by this means. I do not understand that Colonel Keyser would be at all adverse to having the system improved by electricity or anything else. A fortnight ago we had a most admirable lecture from Mr. Bruce, on signalling by electrical balloons, and I have not the slightest doubt that in a very short time that will bear good fruit. Electricity, of course, is at present in its infancy, but I look forward to seeing it in a very short time applied to our field signalling, and to many other things. With regard to the signalling of the Volunteers, I think certainly in these days the Volunteers and Regulars are so much part and parcel of the same force, that everything that is good for the Regulars is good also for the Volunteers, and what is good for the Volunteers is good for the country. I will not detain you further, but will simply ask you to do what I am perfectly sure you will be glad to do, and that is to join me in a very hearty vote of thanks to Colonel Keyser for his lecture to-day.