The Telephotos: A New Means of Electrical Signalling, by Night and Day, for the Naval, Military, Merchant Marine, Light-House, and Life-Saving Services. With Practical Demonstrations of its Application

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Friday, December 15, 1893.

The RIGHT HON. LORD GEORGE HAMILTON, M.P., in the
Chair.

**THE TELEPHOTOS: A NEW MEANS OF ELECTRICAL
SIGNALLING, BY NIGHT AND DAY, FOR THE
NAVAL, MILITARY, MERCHANT MARINE, LIGHT-
HOUSE, AND LIFE-SAVING SERVICES. WITH PRAC-
TICAL DEMONSTRATIONS OF ITS APPLICATION.**

By Colonel G. E. GOURAUD, (late) United States Army.

The CHAIRMAN: I must, in the first place, thank the Council for having offered me the honour of presiding here to-day. My connection with the United Service Institution in the past has been purely of an administrative character, and therefore I am very thankful to those gentlemen who are upon the Council that they have enabled me, now that I have retired into private life, once more to renew my acquaintance with an Institution which when I was an official I took great interest in. We have met to hear a lecture from a distinguished soldier, Colonel Gouraud, who is well known in the United States, not only as an eminent scientist, but also as an officer of great gallantry, and who has, amongst other recognitions of his merit, received the Medal of Honour for conspicuous service. He is good enough to undertake to explain a new system of electrical signalling, which I am sure will be a matter of great interest to both military and naval officers, but especially to the latter. We must recollect that in these days the tendency is every year to increase the mobility of naval armaments and ships, and, consequently, it is of the very utmost importance, if that increased power of movement is to be utilized, that there should be the simplest and most effective system of signalling amongst the ships thus moving, and one which is specially available at night. I cannot express any opinion upon the merits of this system, because it is a matter which is beyond me, but I feel sure that all here present will give the most respectful attention and hearing to the distinguished lecturer, and that they will welcome him with that cordiality with which the soldiers and sailors of our Service always welcome an officer belonging to another Service, especially if he belongs to a race which is the same as our own, and speaks our own language. With these few preliminary observations, I beg to introduce to you Colonel Gouraud.

In presuming to address an audience comprising so many distinguished members of Her Majesty's Services as compose the Royal

United Service Institution of Great Britain, who have honoured me by their presence here to-day, I feel that some apology is due; all the more so from the fact that I understand there are present many eminent, indeed representative experts of the various signal services, to which the subject of my lecture more directly appeals.

A long and somewhat conspicuous identification with kindred subjects from a scientific point of view, together with the fact that my participation in the military service of another country during a memorable war of several years' duration, which gave me many opportunities for both witnessing, as well as experiencing to my very direct personal advantage, the incalculable value of an efficient signal service, may perhaps in some degree excuse an otherwise unwarrantable presumption.

Having several times before had the honour of being invited to lecture in this Institution, but, unfortunately, always prevented by either absence abroad or illness, I have availed myself of this the first opportunity afforded; and am fortunate in having for my subject one not only in every way peculiarly appropriate to this place and company, but involving as it does an absolutely new invention which is now exhibited and described for the first time in any country. That it was not first shown in the United States is perhaps remarkable, considering that it is the invention of an American, a circumstance, I am informed, which is due to the fact of the keen interest taken in the invention by a well known British naval officer of great experience, who chanced to see the apparatus at the moment of its completion, and who so strongly advised its inventor to lose no time in bringing it to the notice of the British authorities, that he resolved to do so at once. It is alike to that same British officer that I am myself indebted for the pleasure and advantage of having made the acquaintance, only since his arrival in England, of a fellow-countryman whom I have found to possess, besides many high qualities of character, the gift of inventive genius of a remarkable order.

With these prefatory remarks, I have only to crave your kind indulgence, which I do with a confidence begotten of a long and happy residence in a land we are proud to think of as our mother country.

The Telephotos.

(The invention of Mr. Claudius Victor Boughton, of Buffalo, N.Y.)

A new means of electrical signalling by night and day, for naval, military, merchant marine, lighthouse, and life-saving services. Its theory and construction, with demonstrations of its application. For the better appreciation of the advance in the science of signalling which is claimed for this invention, it may be convenient, more especially for those of my hearers who are not experts in this special branch of the Services, if I touch briefly upon the three most rapid and reliable systems now in use, namely, the flags and heliograph for

day, and the Colomb signals by night, conceding at once both their rapidity and accuracy, and then indicate the particulars in which they fall short of what is required, leaving you to determine in the end whether I am right in the opinion I have formed that Mr. Boughton's invention fills an important gap.

Signalling by flags has not made any remarkable progress since the day of the historic signal "Engage the enemy more closely;" "England expects every man will do his duty," which was displayed with 33 flags in 13 hoists from Nelson's flagship, the "Victory," at Trafalgar, while if the same signal had to be made to-day, it would

take 25 flags and 9 hoists. I use the illustration merely to point the very small advance which has been made in the flag system since 1805. Certain atmospheric conditions will defeat all signalling by sight, some systems being more affected than others, but I presume it is not too much to say that colours of flags are not distinguishable over a mile in ordinary haze, and certainly not at that distance in a moderately thick fog; and that in a calm the flags have a tendency to hang up and down for minutes together, less so perhaps in these days of fast steaming than in the days of the wooden sailing ship, when hours instead of minutes often ruled, yet the probability remains that, with a large fleet at anchor, ships 2 miles from the flagship have difficulty in reading the Admiral's signals in a calm.

I learn that the night signals of Admiral Colomb have done, and are still doing, most efficient service in some ships which are not provided with electricity, and that ships having command of a current and provided with mast-head electric lights effect a saving of time in displaying Admiral Colomb's time flash, with the obvious result that the increased brilliancy of the light carries with it the power of communicating to a greater distance; nevertheless, the system of the long and short flash for night signalling is still the one in common use. I do not refer to the occasional use of the search light for the purpose. I quote from a pamphlet published in 1866, and entitled "Commander Colomb's Patent Night Signals":—

"This system of night signals, &c.

"1. It requires less skill and less knowledge than the ordinary flag signals in the daytime, and is not liable to error.

"2. This system possesses also the greatest range, and is the most rapid system known for daylight and fog signals."

The first quotation is endorsed by the fact that the original Colomb lamp is still in use in many ships, and that the time flash by electric light is the only improvement which has been made upon it. The second quotation I am not in a position to offer any comment upon, and I only introduce it to emphasize the advance on Colomb's system claimed for this new invention, which I shall presently reach.

I will now touch upon the heliograph, which, with the sun at command, is, of course, the most powerful day signaller known, far exceeding in distance every other system; but obviously useless when the sun's uncertain rays are not at command.

Reflect for one moment on the Fort Ekowe episode of the Zulu War, with its piece of common looking-glass for day signalling and no available means, beyond a common lamp, of communicating by night, and consider the similar incidents other wars have furnished in the past and will doubtless furnish in the future.

I could point, of my own experience, to several instances of like failure during the American War of the Rebellion.

The theory of the telephotos is the production by electricity upon a shaft of incandescent lamps of any candle power, of the symbols of the Morse alphabet and numerals, in dashes of 5 ft. length, made with 10 lighted lamps, and dots of 3 in., made with one lighted lamp, and with unlighted intervals of 5 ft. between each, which will bring under

the eye the complete symbol at once, and is intended for use at any points within vision between which the laying of telegraph wires is impossible or impracticable.

Its Construction.—The Telephotos is a combination of electrical connections contained in a case mounted on a pedestal which is fastened to the floor, having a key-board of the alphabet and numerals, the same as that of a type-writing machine, and the keys have raised on their under side all the Morse characters in brass, with platinum points; the cross bars, 106 in number, are flexible and embedded in hard rubber. A groove under the keys contains a number of fine steel bicycle balls, with $\frac{1}{16}$ in. of lost motion, which is the thickness of a key, so that, when that space is occupied by pressing one key down between the balls, all other keys are locked. The key, when pressed down, contacts with and conveys the current to the cross-bar by means of the raised symbol on the under-side of the key, from which cross-bar wires lead to the lamps on the light frame, which, when lighted, make the Morse character corresponding to that on the key pressed down. The switch-board is 11 in. by 14 in., and has a capacity of controlling perfectly 106 incandescent lamps, and I think I am safe in saying that so many lamps have never before been controlled in so small a space. The lamp is one of an entirely new design, representing in shape a round door-knob, with a filament of 10 coils placed cross-wise, in order to secure the greatest light surface of the lamp; each lamp fits into a parabolic metal reflector, and the front of each is covered with a paralleling lens, designed at the Cornell University for this invention.

Here I must premise that, to make the entire Morse alphabet and numerals with separate lamps, 535 would be required, and would necessitate a shaft 270 ft. long; but the inventor, by an ingenious arrangement of his electrical connections, effects his object with 53 lamps in a shaft 27 ft. long by $3\frac{1}{2}$ in. by 3 in., and in so using the 53 lamps to perform the work of 535, you will observe that, as the current is cut off from a symbol, the greater portion of the lamps which formed it are instantly relighted to form the next symbol, and so, practically, the objection which might be suggested, that the expiring incandescence of the filament of the lamp takes time to disappear, must be considerably modified in regard to the Telephotos; as a matter of fact, which you will presently see, the symbols are clearly defined and instantly cut off, the expiring incandescence of the lamps not instantly relighted being rendered invisible by the paralleling lens placed before each lamp. The ordinary telegraph key requires 129 motions to complete alphabet and numerals, as against 38 motions on the Telephotos.

You have before you, in the raised Morse symbol upon the keys, and the arrangement which insures that only one key at a time can switch the current which lights in the lamp frame the necessary lamps for exhibiting complete the symbol of the key touched, the essence of Mr. Boughton's invention, and you will observe that not any lights in the frame, other than those forming the symbol displayed, can possibly be lighted.

I ask your attention for a moment to the ingenious device contained within the cylinder which surmounts the key-board. It consists of the type arms used in the ordinary type-writing machine, and 36 double magnets for throwing the Roman type of the symbol simultaneously with its display on the light frame, on to a paper ribbon in order to preserve an unmistakable record of all communications made by the Telephotos, which record, being under seal, the duly authorized alone can have access to, and a device is being fitted to an instrument now in course of manufacture which will record the date and time of day any communication is made. The casual observer may possibly consider that he is looking upon a maze of wires with complicated connections and consequent liability to derangement.

Although consisting of many parts, there are but very few that are movable, and their movement is of such a nature that failure is impossible, and wear and tear practically *nil*.

While the inventor has certainly aimed to accomplish his object within the smallest possible space, and has admirably succeeded, he has made no sacrifice of certainty in the operation of any part of his system. Indeed, as is the case with many marvels of science and invention with which we are familiar, so do I feel justified in describing the Telephotos in its entirety as simplicity itself.

The Application of the Invention.

The shaft is portable, and may be either one-faced, or four-faced, as desired, to be hoisted to any point, or, laid horizontally in any convenient position, or, along the signal yard; it can be permanently fitted on any line of available space on a ship's hull or starboard and port sides, and across the bow and stern parts, on a pole topmast swivelling around it, or, the topmast could be fitted with a four-faced shaft showing ahead, astern, or abeam. A single or four-faced shaft, arranged to elevate to the perpendicular or lower as expedient, can be fitted on a bridge, and can also be placed on the semaphore mast, lighthouses, and lightships, and, as these latter are brought into postal and telegraphic connection with the shore, the Telephotos will complete the circuit between coast protecting navies as well as incoming and outgoing freight and passenger ships and the telegraphic centres on land. Lightships which it may be found difficult to connect with the land by submarine cable will have the very best substitute in this invention.

A light horse wagon is designed, for military use and life-saving service with stranded ships, to carry a shaft of lights, dynamo, and engine - the shaft lies horizontally on the vehicle, and can be raised and signalled from in a few seconds; the total weight, when complete, not exceeding 1,000 lbs.

Without in the least decrying the importance of either the telegraph or telephone in field service, permit me to suggest that the Telephotos will accomplish what neither of these systems can, to wit, free communication along the coast between land and sea forces acting together. It can move side by side with an army in its strategic

changes of position, and within vision limits by day or night be doing good work long before wires can be laid to operate either telegraph or telephone.

I know that signalling has obtained a high point of efficiency in the military Service, and I have every reason to believe the same of the naval Service; still maritime incidents have not been wanting of late which emphasise the pressing need in marine signalling for the means of rapid interchange of orders, news, and opinions: one, an Atlantic liner, filled with passengers, lies disabled in mid-ocean, and passing ships only bring to port news of the fact without the faintest clue to its cause, and the public mind is racked with anxiety for days; another, a catastrophe, the memory of which will always abide with us, and which, though seemingly led to by more than one contributory cause, nevertheless points clearly enough to the fact that in marine signalling there is great room for means whereby free, rapid, and unambiguous expression can be given to vital doubts.

The application of the invention from the inventor's point of view has now to be demonstrated, and I would here observe that any practical illustration of its value for actual service would be an impossibility in its present situation. Any discussion, therefore, which may follow the reading of this paper must of a necessity be somewhat one-sided, for you are familiar with every signalling system in use, and with the merits and demerits of each respectively, but this invention has yet to be brought to practical test, and its result brought to light before any comparison can be instituted, and its full value can be appreciated.

Farther back I said I would presently refer to the quotation I made from the 1866 pamphlet of Admiral Colomb, in order to emphasize the apparent advance the Telephotos is upon the Admiral's system, which is acknowledged to be the very best for night service ever used, observing that what the pamphlet affirms as true of the system it sets forth must also be true of the Telephotos, and the advance the latter is upon the system of Admiral Colomb is that it exhibits by one pressure of the finger a complete symbol, and simultaneously makes a perfect record of it in Roman characters.

To dilate upon the superiority of the Telephotos as a night signaller over Admiral Colomb's system is not the object in view, but I hold the opinion, based upon a careful examination of the invention, that when it is given a trial it will speak for itself with an eloquence more persuasive than any within my command.

The lights at night will show as far as any other lights of equal power, but the use of the Cornell lens gives an increase of one-third in the distance; and Mr. Boughton informs me that at $2\frac{1}{2}$ miles in bright sunshine and clear blue sky the Telephotos has been read with the aid of an ordinary glass, while at night in ordinary conditions of atmosphere the same signals were distinctly read without a glass 6 miles. This experiment represents the greatest distance there has as yet been an opportunity to try it; but, from the experiments made, Mr. Boughton assures me that he is confident that under similar conditions with the aid of field glasses such as are

ordinarily used, the signals can be distinctly and reliably communicated a distance obviously sufficient for all practical naval requirements.

The only knowledge required is that of the Morse alphabet and numerals. Telegraph operators read the symbols in lights more rapidly than they do those of the ordinary telegraph, because the light symbol is presented to the eye complete, and the letters of the alphabet and numerals upon the keys sufficiently indicate their use.

Given an expert telegraph operator to read the symbols, and an equally quick typewriting clerk at the key-board, letters made and read per minute by the Telephotos must greatly exceed the number the telegraph could transmit in the same time. This will be readily understood by those familiar with telegraphy.

The wires connecting the "keys" and "lights" being practically unlimited as to length, the "lights" can be assigned to any point, and the "key-board" located at any distance from it; the intervening wires between them, wrapped with water-proofing, form a cable $\frac{1}{2}$ in. in diameter. A simple arrangement on the "key-board" by the turn of a thumbscrew, gives two changes for private signalling, and a third change for any cipher combination of which alphabet and numerals are capable is provided for.

This key-board can be adapted to any light symbol. The Morse is used by the inventor merely to exhibit the principle of the Telephotos, namely, that of showing a symbol in its entirety. I make bold to suggest that, had the Telephotos been on the bridge of the "Camperdown," it might have been the means of saving a million sterling, and of preserving the lives which went out with the "Victoria."

The invention as a whole, as presented for your consideration, I feel every justification in pronouncing to be one of exceptional merit both in its conception and execution. As I have already stated, the apparatus before you is now shown in public for the first time; it, therefore, goes without saying that it has not yet had the advantage of having been subjected to the crucial test of practical service at sea, and while there is in the mind of the inventor no reason to doubt that it will realize all his expectations, he, with characteristic modesty, anticipates that the criticisms and suggestions which will naturally emanate from the distinguished officers of Her Majesty's Service into whose hands it will naturally pass for trial may, perhaps, lead to some modifications of more or less importance. He desires me to add that he will thankfully receive all such suggestions in the confident belief that he can satisfactorily meet them.

In conclusion, permit me to submit the question this paper suggests to me—

Is the Telephotos an invention which, on trial, is likely to prove an important addition to the existing systems of signalling?

I have no doubt at least that the subject will receive all due consideration at the hands of the authorities of the various Services it concerns, and which must necessarily include an exhaustive practical test of its many applications.

To this end I understand Mr. Boughton is prepared to freely place both himself and his invention at your disposal.

There only remains to me to express to you, my Lord, in the name of both Mr. Boughton and myself, our very sincere thanks for the great honour you have done us in presiding at this meeting, and as well to you, gentlemen, for both the honour of your presence and the very kind attention you have accorded to my remarks.

I have the further pleasure of introducing Mr. Boughton, who will be both happy and able to supply my many deficiencies of description, together with the important supplement of such practical demonstration as the somewhat limited dimensions of this hall will permit.

Mr. BOUGHTON then gave a demonstration of the practical working of the Telephotos, explaining its details, and answering questions as to its adaptation to military and naval uses.

Admiral CLEVELAND: I speak with some diffidence on this subject, as I have not devoted very much attention to signalling; but it seems to me that this instrument, for exposing and occulting the light, is a similar application to that of my friend Admiral Colomb, when he introduced his flashing system some years ago. The only difference is, that this is an instrument for signalling *in form*, whereas Admiral Colomb's was for signalling *by motion*. All naval men will remember the kind of hurdy-gurdy box which Admiral Colomb introduced with his flashing signals—the application of the Morse system. This box was very soon discarded; it was found to be perfectly unnecessary, and the exposure and occultation of the light was effected entirely by hand. As far as I can understand, we want a light that will show *all round*, with which we can signal to any part of a fleet, and an electric light fixed at the mast-heads, exposed and occulted by an electro-magnet, actuated by a key in the conning tower, is the direction in which we ought to go, and, I believe, are at present looking. I am afraid that this instrument now before us, though beautifully made, is far too complicated for working on board ship. We want something very much more simple. I am very sorry to say anything against it, but I do not think that it is the thing we require for ship work.

Mr. QUAIN: I should like to ask whether it is the fact that the electrical lamp exhibited by Mr. Boughton is worked with the electro-magnet?

Mr. BOUGHTON: It is not. There is no incandescent lamp constructed with electro-magnets, that I know of.

Mr. QUAIN: It was mentioned that these lamps had the quality of electro-magnets?

Mr. BOUGHTON: This is not an electro-magnet lamp at all; this is a simple incandescent light. There is a magnet connected with this apparatus in recording. That is entirely cut off now from these lights, because six of the keys in the instrument are defective, owing to the breakage of the glass. The magnets are not connected. If you will look on the drawing, you will see that it is a simple incandescent light.

Admiral Sir VESSEY HAMILTON: I am afraid that this is such a wonderful change in signalling—it is so different from our preconceived notions—that we are all really rather amazed at present, and unprepared for discussion, and as I hear that these lamps are to be put up on the Thames Embankment, I only regret that it has not been done before the lecture to-day, so that we might have seen something of the results of actual practice before discussing it. Speaking for myself, I came here perfectly ignorant on the matter, hoping to hear what some of our able signalling officers might have to say about it. For instance, my friend Admiral Colomb, I think, might give us some information which will be very interesting.

Admiral COLOMB: My Lords and gentlemen, I do not think it is quite fair to draw me. However, of course I respond. The instrument exhibited for actuating the lights and the way in which the light is displayed are perfect novelties to all

of us. We are introduced to a new set of ideas, we may say, and I think we might quite easily, with our preconceived notions, not see at first the whole plan which is opened to the inventor's mind. First of all, I think his aim must be rapidity. It is perfectly well known that with the flashing system, as it stands, we are eternally working for greater rapidity. The rapidity he has got; about 20 words a minute, 100 letters I think he said, happens to be the highest speed which my military colleague (Colonel Keyser), if I may call him so, who sits behind me, has got with the flashing system, and I hope that he will be "drawn" as soon as I have finished. They do in the army 20 words a minute—I have seen it myself—not slurred over, but done with absolute correctness, with corrections made, so that the message should come with perfect accuracy. 12 words a minute is their ordinary working speed. We have not got as far as that in the navy yet, because the apparatus which can be used with that speed for land service is not suitable for sea service, but it is perfectly certain, with the number of officers who are now engaged in the matter, that we shall ultimately get that greater speed. Then, I think, in this way the aim of the inventor in getting greater speed will be, or I am afraid is likely to be to some extent, frustrated by the greater rapidity which is being got gradually out of the flashing system. The system before us is one of signals by form almost alone. You must recollect that there are only three ways of making visible signals, either by difference of colour, by difference of form, or difference of motion; commonly, two or more of those three things are combined, as in the flag system. In this system there is a little colour used, just enough to make the distinction. The flashing system is wholly motion; it has nothing whatever to do with form or colour, but everything depends on comparison of the times in which the symbols are produced. The observer compares in his mind the difference of the time as they pass, and knows his signals accordingly. This is a new application of form by light signals. It is nearest to the system of which, I think, Sir Alexander Milne was the author. He had a series of lights placed vertically; they were, of course, not electric lights in those days, but they were white lights at different distances apart, making a similar sort of arrangement to that which we have before us now, supposing that line of light was vertical. When you get electricity, you can do an infinite number of things which you could not do before it existed, and the inventor has shown the greatest possible skill in his contrivance, and must have had, I am sure, any number of sleepless nights over it. He may be mistaken, from his want of practical knowledge of signalling, in the way in which he has applied it, but I can hardly help thinking that out of this may come modifications which will be found exceedingly useful. I am sure there is a great deal in these keys, and in the method of employing electricity, which is quite likely to be developed. There is a point we have to think of practically for the service of the fleet. I am bound to say I do not in the least agree with the officers who put it forward—but the officers who do so are possibly much better judges than I am—there is a certain demand in the navy for "standing signals" for the manœuvring of the fleet. I myself have seen a fleet manœuvred for months with the flashing system, and, knowing that all our fleets have been manœuvred for 25 or 30 years entirely with the flashing system, cannot lay much stress upon this demand; but many officers, Admiral Baird, for instance, a most practical officer, lay great stress upon the idea of having standing signals for manœuvring the fleet at night, and for nothing else. He proposed to use a line of vertical lights which might, by their colour and varying distance apart, form a standing signal which could be kept visible—not like the flashing system, a succession of signals, but like a series of flags—a standing signal which might be looked at as long as necessary by the fleet, and might be kept showing as long as it was desired. Now, if you take this system and put aside the idea of using the Morse, or the modified Morse, which the inventor has been using—if you take the instrument itself and think of the possible modifications there may be in the way of producing those standing signals which the navy has been working for, possibly something might be done with it. I know nothing whatever of Mr. Boughton; he was good enough to call upon me, and I am afraid I was excessively rough with him—not unduly rough I hope—because I was not in a position to listen to long explanations, and I had to gather the object of the inventor in a series of very short, sharp questions; but I am bound to say it struck me from his answers

that, barring the fact that he had no practical knowledge of signalling, he had the sort of mind which would be certain to come to right conclusions when he added the practical knowledge of signalling to his knowledge of electricity and to his great mechanical skill. I never saw the instrument before to-day, but I saw a photograph of it, and it struck me that there was great skill displayed in its construction. These are only thoughts that strike me at first. In all these cases I know only one way of going to work, unless the thing is absolutely absurd on the face of it, and that is to try it against existing systems, to see which way the wind blows, which way the land lies. That is the only way that I know of to get at the rights and wrongs of a question of this sort. I hope, my Lord, you will call upon my colleague behind me to carry on the discussion.

Colonel KEYSER, C.B. (Inspector of Signalling, Aldershot) : I rise in obedience to the challenge of Admiral Colomb, though I do not think I have anything to say, but as representing the army signallers I wish to explain to the inventor that what we principally aim at is portability combined with simplicity, and at first sight this enormous mechanism rather takes one's breath away. I daresay when we come to know it better we shall see other points about it, and if we work together we may be able to adapt it in some way to our system : but so far as I can see at present I am afraid it is very much too cumbersome for any use in the field. I think for fixed stations, for forts, standing camps, or anywhere where we may be for four or five months at a time it may be very useful indeed. The great advantage would be that you would not have to focus your signal continually ; everybody could see it without having to take the trouble of finding out the exact whereabouts of the people with whom you are going to signal, but beyond that I am very much afraid it would be of very little use to the army.

Mr. BOUGHTON : In reply to Admiral Colomb and to Colonel Keyser, I wish to say that I do not profess to be an expert in signalling. I am exhibiting a principle that can be modified in every way. I have had the question asked me since I came here, how long I have sailed. My reply was, when I crossed the gang-planks of the "Paris," to come to Europe, was the first time. I never up to that time saw a signal thrown.

Lord GEORGE HAMILTON (Chairman) : Well, ladies and gentlemen, if nobody has any further observations to make or questions to put, I may discharge what I believe is the duty of the Chairman, and a very pleasant duty, on behalf of this meeting, to heartily thank Colonel Gouraud and Mr. Boughton for the lecture which they have been good enough to deliver, and for the very effective manner in which we have been shown by experiment and illustration the advantages of the invention which is brought before our notice. If the distinguished naval officers who are present, and also if those in the room who have a special knowledge of the training of signalling men are unable to express any very definite opinion on this invention, it is pretty clear that a poor layman like myself is hopelessly in the dark. I carried away with me from the navy certain ideas, and, those ideas being few, I am very tenacious of them. The one idea I got from my connection with the Admiralty was, the enormously increased power and the enormously increased mobility of ships of war : that means rapid concentration. Rapid concentration is not of much use unless that concentration enables successful co-operation and combination, and successful co-operation and combination can always be promoted and advanced by a simple and effective and rapid system of signalling. And therefore I think that anybody who is good enough to give his attention to this particular subject and to make various suggestions, no matter in what direction, which will tend to increase and accelerate the existing system and methods, confers a very considerable service not only upon the navy, but also upon the army. I am sure it is in that sense that we have all listened to this lecture. We hope that the criticisms and the observations that have been made will not be in any way considered discouraging, but, on the contrary, that they may have the effect of inducing both the gentlemen who have been here present to look at these objections from a practical point of view, and if they do so let us sincerely hope that they may be able so to overcome them as to make this instrument and this invention ultimately a means of benefit to both Services. I think you will perhaps allow me to convey to Colonel Gouraud and Mr. Boughton our very hearty thanks for

their goodness in being present here to-day and delivering the lecture to which we have all listened with so much pleasure.

General GEORGE ERSKINE: Ladies and gentlemen, we have listened to a very clear and interesting lecture, and we have seen experiments exhibited which have no doubt given a great deal of pleasure to all present, and a vote of thanks has been accorded to the lecturer, which is quite right. But we must not think that we can allow our Chairman to leave his post without being thanked for the very great trouble which he must have taken in coming here and presiding over the meeting on the present occasion. This Institution, I might be allowed to remark, owes a great deal to Lord George Hamilton in the past, and very probably in the future we shall owe him a great deal more. Therefore I think that our vote of thanks this evening should be very cordial indeed.

Admiral Sir VESER HAMILTON: I have very much pleasure indeed in seconding the vote of thanks so ably proposed by the Chairman of this Institution, General Erskine, and I have the more pleasure in doing so from the fact that I was associated with Lord George Hamilton some part of the time when he ruled over the Queen's navy, a period which, I think all naval men will agree with me, may be described as the golden age of the navy.¹ Lord George Hamilton is particularly fitted to preside over this meeting. His knowledge of all the details of the Admiralty, not only the financial details but also of the scientific details such as we have before us, particularly qualifies him to preside over this meeting.

The resolution was carried by acclamation.

Lord GEORGE HAMILTON: I am exceedingly obliged to you. I was glad to be present to-day. I take great interest in this Institution. When I was at the Admiralty I fully recognised its utility and did my best to try and secure for it a rather more fitting habitation than that which it now occupies. I believe the results of those endeavours were successful. You are about to enter into a magnificent house, and I sincerely trust that when you get there you will be in the possession of an income adequate and suitable to maintain it.

¹ In saying this I would observe I had nothing to do with the Naval Defence Act. But its principles and details were completely worked out before I went to the Admiralty.