absolue." Under the term Culex, I think he means to include also gnats of the genus Stegomyia.

I have received confirmatory evidence from a gentleman in Egypt, who says that he was recently able to sleep at Ismailia without mosquito nets.

The campaign against Culex at Ismailia originally promised to be a difficult one, owing to the large number of sewage-cisterns under the houses, and the result shows how easily a simple and obvious idea like that of diminishing mosquitoes by dealing with their breeding places can be acted upon by an intelligent and effective executive which sets to work at once, instead of wasting time on useless discussions—as, for the most part, we have been doing in British possessions during the last four years.

It is to be hoped that, following the work of Gorgas at Havana, and Logan Taylor at Freetown, the result at Ismailia will be accepted as clinching the proof of the fact that Culex, at least, may be materially diminished in tropical towns. RONALD ROSS.

Liverpool, July 11.

TRANSLATION of letter, dated July 2, from M. le Secrétaire général de la Compagnie universelle du Canal maritime de Suez, Paris, to Major Ronald Ross, Liverpool School of Tropical Medicine:—

"Sir,—I have the honour to inform you that, following your mission of last September, numerous works of drainage and filling up of ditches have been effected, and that a permanent department has been created for the purpose of oiling cisterns and pits and suppressing marshes and pools of water amongst the habitations of Ismailia. Moreover, measures of prophylaxis, consisting of the gratuitous distribution of quinine and arsenic, commenced in the month of April, 1902, are continued without interruption.

"Since last December, the number of cases of fever has very sensibly diminished by comparison with previous months and with the corresponding period of last year, and this decrease is maintained until to-day.

"Owing to the time at which the sanitary works were undertaken, the complete disappearance of the Anopheles is not yet realised, but it can be stated that recently captured insects have not been infected—which can perhaps be attributed to the fact that the number of cases of fever have been considerably reduced.

"On the other hand, it is interesting to note that, thanks to methodical *petrolage*, and to the incessant surveillance of the breeding-places of mosquito larvæ, the mosquitoes called Culex have been suppressed in a manner almost absolute, and that, in the hottest period of the year, it has been possible to abandon the use of mosquito nets.

"Regarding the consequence of these measures, a definite statement cannot be made until after August to November next, the principal malaria season. We have every ground for hoping that the efforts with which you have been so usefully associated will end in the complete extinction of malaria in the town of Ismailia, and we will communicate with you when we receive definite information on this interesting subject."

### Another White Spot on Saturn.

ON July 9, at 14h. 4m., I observed another large white spot in the northern hemisphere of Saturn, and on the central meridian of the planet. The spot was quite bright in contrast with the dark belt adjoining it, and a tolerably easy object. I saw the spot again on July 12, when it shone with a bright pearl-like aspect, and was estimated on the central meridian at 12h. 50m. The marking is much distended in longitude, and this makes it rather difficult to note its central passages accurately, but the motion of the object seems decidedly swifter than the rate usually adopted for the rotation period of Saturn.

The following end of a bright extension on the eastern side of the spot was on C.M. at 13h. 35s. on July 12, and a dusky patch between the N equatorial belt and the polar shading followed at 14h. 1m.

The markings above alluded to are quite different from the bright spot seen by Barnard on June 23, and by myself on July 1. The present disturbance on Saturn seems to have affected a very large area, and I have never observed anything of the same conspicuous character on the planet in past years. W. F. DENNING.

Bishopston, Bristol.

### The Thunderstorm of May 31.

MR. C. H. HAWKINS, of Croydon, has sent me a copy of a photograph of a lightning flash taken by him at "Addiscombe," Croydon, on Whitsunday morning, May 31, at 2.30 a.m.

The upper part of the main flash and the side flash both show reduplication, and the photograph exhibits so many

Lightning discharge photographed at Addiscombe, Croydon, on May 31, at 2.30 a.m. Direction N.N.W

characteristic features that its reproduction may be of service for comparison with other photographs.

I therefore enclose a copy with Mr. Hawkins's permission.

Meteorological Office, S.W., July 7. W. N. SHAW.

## THE LODGE-MUIRHEAD SYSTEM OF WIRELESS TELEGRAPHY.

THE system of wireless telegraphy which Sir Oliver Lodge and Dr. A. Muirhead have been developing for some years has, within the past few months, been brought to a degree of perfection which justifies the inventors in the belief that it is now of practical commercial value. Thanks to the courtesy of Messrs. Muirhead and Co., we have had an opportunity of seeing the system at work at a small experimental installation which has been put up in a field adjoining Messrs. Muirhead's works at Elmers End, Kent. At this station signals were being transmitted to and received from a similar installation at Downe. The distance between the two stations is only six or seven miles, but the chalky nature of the Kentish soil and the fact that the station at Elmers End lies in a hollow make this distance equivalent to eight or nine times as much over water. Experiments which have been made under the conditions which would obtain in the practical application of the system for maritime work and also over the Admiralty sixty-mile range have shown that, with the same power and the same adjustments as are required between Elmers End and Downe, thoroughly satisfactory communication can be maintained across sixty miles of ocean. Considerations of distance are, however, of secondary importance in estimating the merits of wireless telegraphy systems, for the recent work of Mr. Marconi and others has made it clear enough that, given sufficient power, almost any range can be attained. Trustworthiness, clearness, the design of circuits and apparatus, and the possibility of successful syntonisation are factors of greater importance. Looked at from this point of view, the Lodge-Muirhead system presents several novel and interesting features which show that, though it may be one of the latest to come into the field of practical wireless telegraphy, it is likely to prove one

of the most efficient. Most noteworthy feature of all is the remarkably delicate coherer which has been finally evolved from numerous experiments, a coherer which not only promises to be accurate and trustworthy in practical work, but also possesses several advantages from an experimental point of view, a characteristic of no small importance in a piece of apparatus which has to be employed in an art in which there is so much to be learnt.

In general outline the Lodge-Muirhead system does not differ materially from other wireless telegraph systems, a fact which is not remarkable when it is recalled how much other systems owe to the pioneering work which Sir Oliver Lodge has carried on ever since the earliest days of Hertzian waves. In fact, if we retrace the development of Hertzian telegraphy from Maxwell's theory of light, the name of Sir Oliver Lodge is singularly prominent, and must be associated with all the more important advances. The connection begins in 1888, when he read a paper on the velocity of electromagnetic waves along wires at the meeting of the British Association, at which Prof. Fitzgerald directed attention to the work that Hertz had accomplished; a little later he discovered, in its simplest form, coherer action, and it is interesting to note that after long trial of the filings coherers derived from the discoveries of Branly, there seems to be a tendency on all sides to return to simpler designs much more closely resembling Lodge's original single contact coherer. To Lodge also belongs the credit of having been the first to insist upon the importance of tuning, and of having pointed out how this might be possibly attained by the proper use of self-induction and capacity. Moreover, it was, we believe, he who suggested using a transformer in the aërial circuit at both transmitting and sending stations instead of connecting the spark gap or coherer direct to the aërial; this device is now in general use for tuned systems. It will readily be realised, therefore, that a system which has been designed by Sir Oliver Lodge is likely to be one of the most promising of wireless telegraph systems, and that this is all the more likely to be the case in the present instance, as Sir Oliver has had the cooperation of Dr. Muirhead.

We do not propose to give a general description of the system, for, as we have said, other systems are similar in general outline, and with these most people are by now familiar. In the installation working between Elmers End and Downe there is no earth connection. The precise utility of an earth connection has been often in dispute, most people maintaining that it merely serves to introduce the earth as the second plate in a large condenser, the first plate being represented by the aërial wire and any capacity connected to it. In the system under consideration, a second capacity is provided which lies upon but is insulated from the earth; in the Elmers End station the capacity was beneath the floor of the instrument shed, and was connected to one terminal of the spark gap (or transformer), the other terminal being connected to the aërial, which has an open wire cage serving as a suitable capacity at its upper end. We need not enter here into the various ways in which the circuits can be connected up; the relative positions of coherer, spark gap, capacity and self-induction, the employment or not of the transformer, &c., offer a number of solutions to the problem of designing a complete station each of which has its special merits for particular purposes. In principle, all result in the same thing—a very large Hertz radiator transmitting into space a succession of untuned or carefully tuned electromagnetic waves. The two questions of primal importance are how to produce those waves, and how to detect them at the receiving end.

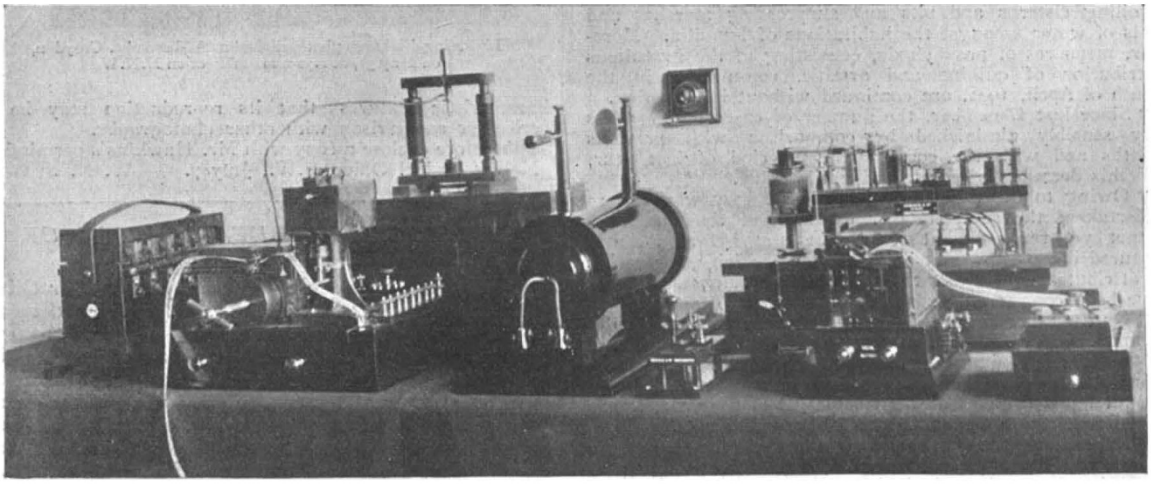

FIG. 1.—Complete Lodge-Muirhead Apparatus.
From left to right as follows :—Battery, receiver, spark gap, induction coil, signalling key, buzzer (at the back), automatic transmitter, and perforator.

The production of the Hertzian waves presents several difficulties. Even for moderate ranges of transmission fairly powerful sparks have to be used; these are obtained from a special induction coil and spark gap (Fig. 1). Here again one notices in the simple spark gap between two rods a return to less complicated apparatus; in the early days of wireless telegraphy a spark gap between polished balls in oil or vaseline used to be regarded almost as essential. In using this apparatus for syntonic work a very great deal depends upon the spark. It is necessary, in the first place, to obtain a regular succession of sparks for every depression of the signalling key The ordinary forms of make-and-break used with induction coils have not been found satisfactory, and a special form of interrupter or "buzzer," as it is called, has been designed. This is seen at the back on the right of Fig. 1. It consists of an ordinary mercury break operated by two cross-connected telegraphic sounders. The first of these sounders works in the same manner as an ordinary electric bell, the arm vibrating to and fro when the signalling key is de-

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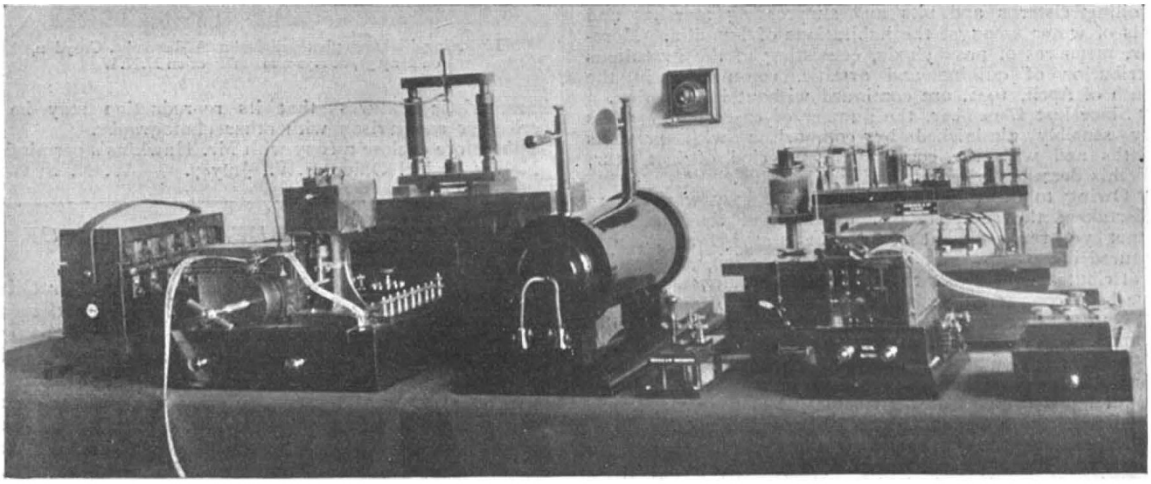

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pressed and the circuit closed; the vibrating arm opens and closes the circuit of the second sounder, to which is attached the dipping rod of the mercury break. It is said that this arrangement gives a more regular succession of sparks than is obtained with one sounder only. An automatic transmitting apparatus has also been worked out by Messrs. Lodge and Muirhead. This is shown at the right of Fig. 1, in front of the buzzer, and consists of two pieces of apparatus, a perforator and a transmitter, which are used in conjunction with the buzzer, &c., in place of the ordinary signalling key.

A regular succession of sparks having been thus obtained, still only part, and that the simpler part, of the difficulty has been overcome, for it is not the period of the sparks but the period of the oscillations in the spark which has to be syntonised. When one considers how short is the train of waves from each individual spark and how long comparatively the interval between two successive sparks, it is easy to see the importance of getting the best results possible

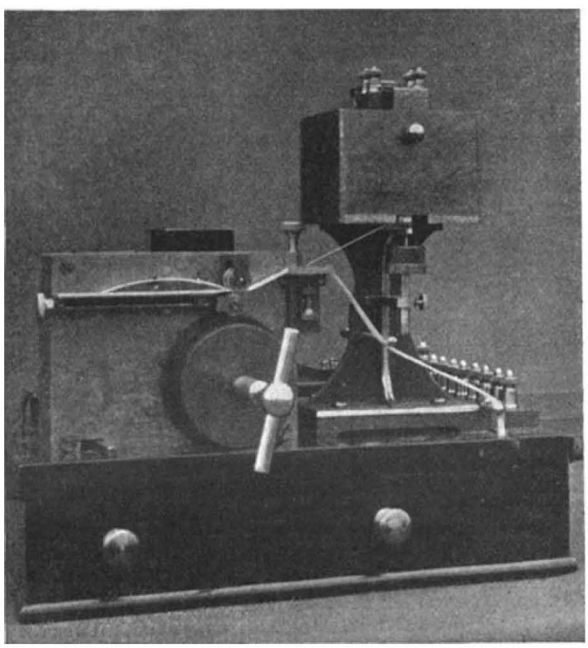

FIG. 2.—Receiving Apparatus.

from each spark. Herein, indeed, seems to lie one of the chief unsolved problems of wireless telegraphy—the problem of obtaining a really continuous series of undamped oscillations. It seems doubtful whether, even with the best possible design and arrangement of apparatus, a satisfactory solution will ever be found by means of disruptive sparks. Perhaps we must look to some quite different method of setting up the oscillations. The method that gives most promise of ultimate success is some application of the principle of Mr. Duddell's musical arc, as suggested by Mr. Duddell at the Royal Institution last year (see also the *Electrician*, May 1, vol. li. p. 84). It certainly seems that from this discovery may be developed a means of producing a continuous series of undamped oscillations of high frequency, and if this should prove to be possible a change amounting almost to a revolution would be effected in the practice of syntonic wireless telegraphy.

We may pass now to a consideration of the receiving instruments which are shown in Fig. 1, and in more detail in Figs. 2 and 3. Fig. 2 represents the complete receiving instrument. The instrument looks at first sight much like a Morse recorder; the coherer is mounted behind the box which contains the clockwork for feeding forward the tape and rotating the coherer wheel. Its construction can be seen from Fig. 3, which shows a coherer by itself. It consists of a small steel disc with a fine razor edge which dips into a little pool of mercury in an ebonite cup. The mercury is covered by a thin film of oil, and the disc is adjusted so that under normal conditions the oil serves just to insulate it from the mercury. When oscillations are set up in the coherer circuit, this thin layer of insulation is broken down, and connection established between the disc and the mercury. The disc is slowly rotated by means of the notched wheel seen clearly in the illustration, which gears with a similar wheel at the back of the clockwork box. Connection is thus no sooner established between the disc and mercury than it is broken again by a fresh oily portion of the edge coming round; there is consequently only connection during the time the oscillations are actually arriving and the

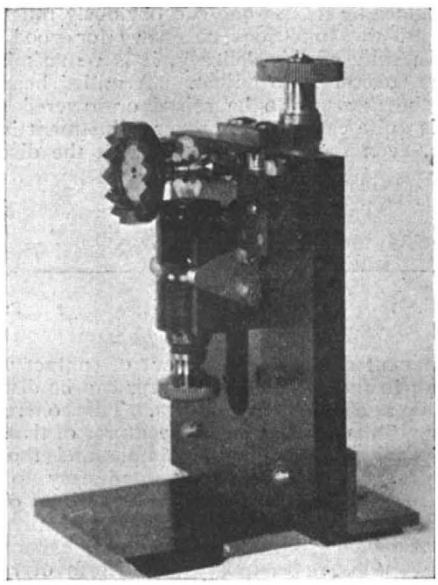

FIG. 3.—The Coherer.

coherer is self-decohering and requires no tapping back. In some respects the device recalls a suggestion made by Rupp five or six years ago, who proposed mounting a filings coherer so that it was rotated slowly by the Morse tape. The Lodge coherer is, however, a far more mechanical contrivance than a filings tube however the latter may be decohered. In order to keep the edge of the disc clean a pad of felt is pressed lightly against it; this can just be seen on the left near the top of the disc; contact is made by a spring pressing against the shaft on which the disc is mounted. The coherer will only work with a very small potential difference—a fraction of a volt—between mercury and disc; it is therefore connected in series with a potentiometer, which reduces the voltage from the cell.

Another feature of the receiving circuit is the absence of any relay; the coherer and potentiometer are directly in series with the recording instrument, which takes the form of a simple syphon recorder. This is seen on the right of the clockwork in Fig. 2; the pen consists of a fine glass syphon tube suspended from the galvanometer coil, one end dipping in a cup of ink

and the other resting on the tape. When no signals are being received the pen draws a fine line on the paper, but when a signal arrives it is deflected. The result can be seen from the specimen of tape in Fig 4. There is an arrangement by which the amplitude of the deflection can be controlled by making the syphon come up against a stop. It is obvious that the tops of the humps in the line representing dots and dashes are not needed for reading the message, since it is easy to see from the length of the break in the base line whether the signal is a dot or a dash. The tops of these humps have, however, a special interest. It will be noticed, on examining them closely, that they are not smooth, but are slightly irregular. These irregularities represent the sparks, and it is possible therefore to see from the form of the humps whether the sparking at the transmitting end is good or bad. A particularly bad spark is seen at the beginning of the third signal (the second dot) in the letter *l*, and a careful examination, of the dashes more especially, shows quite clearly the nature of the sparking at the transmitting station seven miles off. This not only points to the great sensitiveness of the coherer, but shows that it should prove particularly useful in research, since by its use one can obviously much better investigate the conditions necessary for good signalling. In spite of this delicacy, it is remarkable how easy the coherer is to adjust. A milled head screw allows the mercury to be raised or lowered at will, and it is quite easy to get proper adjustment in a few seconds, even though one starts with the disc either


FIG. 4.—Facsimile of Tape.

in permanent contact or right out of contact with the mercury; in fact, the whole coherer can be dismantled and set up again in a few minutes. This coherer seems to us one of the most promising features of the system; it is a device at once quite simple and thoroughly mechanical, easy to reproduce, and easy to adjust, and, judging by the results which have been obtained, is both sensitive and trustworthy in practical work. So far as one can judge without lengthy experiment, it is more promising than any other form of receiving apparatus yet devised.

We may add that the system has been adopted by the Eastern Extension Telegraph Company on its two new cable ships, and is reported to be giving every satisfaction. In conclusion, we should like to express thanks to Messrs. Muirhead and Co. for showing us the system at work, and for lending the photographs from which the illustrations to this article have been made.

MAURICE SOLOMON.

## THE ALLIED COLONIAL UNIVERSITIES CONFERENCE.

A STRONG committee—Sir Gilbert Parker being the moving spirit—addressed the following circular letter to the universities of the United Kingdom on May 30:—

In order to facilitate the proceedings at the Allied Colonial Universities Conference, to be held at Burlington House on July 9, I shall be very much obliged if you can assist me with information upon the following points:—

(*a*) Whether, and if so in what way, the conditions under which degrees are given by the University of —— are modified in the case of persons who have studied in or taken the degrees of colonial universities.

(*b*) Does the University of —— afford any special facilities for post-graduate study (in particular with regard to applied science) to the graduates of colonial universities? Does the university reward special post-graduate students by bestowing upon them degrees, and on what conditions as to residence or tests of fitness are such degrees bestowed?

(*c*) Does the University of —— possess any special endowments for the encouragement of colonial students; or are colonial students habitually aided by any endowments not under the control of the university?

(*d*) What is the average number of colonial students studying in the University of ——?

The colonial universities (with the exception of the universities of India) had meanwhile been asked to appoint delegates to represent them at the conference, with the result that, when the conference opened, almost every university within the Empire was directly represented.

The actual session occupied one day only, but a good deal of hospitality was exhibited during the week, and whatever view may be held as to the value of the business actually transacted, there can be no question as to the quality of the entertainment provided. The informal meetings between the delegates both before and after the session day, constituted probably the most important part of the conference the opportunity for interchange of ideas was absolutely unparalleled in the history of British education, for not only were the delegates drawn from practically every university within the Empire, but they were, on the whole, exceptionally well qualified for their duties. It is not possible to set down in writing a precise estimate of the advantage to be drawn from informal conversations between those who are interested in the same things but have few opportunities of discussing them; the British Association, however, affords a proof, repeated annually, that there is a very important advantage to be gained in this way. Those engaged in carrying on university work in new countries and in communities where the importance of that work is not always properly understood, are apt to wonder now and again whether they are really on the right track, whether their work is, after all, as important as they have been in the habit of thinking it is, and whether their methods are sound and progressive. To such men the stimulus of a conference such as the one just over is invaluable, and the chance of learning at first hand what others are doing is also invaluable.

To come to the conference itself. The chairman, Mr. Bryce, called the meeting to order with commendable punctuality, and explained in a scholarly way—though in the most general terms—how universities might cooperate to their mutual advantage. The Vice-Chancellor of Cambridge then proposed the first resolution:—

"That in the opinion of this conference it is desirable that such relations should be established between the principal teaching universities of the Empire as will secure that special or local advantages for study, and in particular for post-graduate study and research, be made as accessible as possible to students from all parts of the King's dominions."

This was supported with businesslike brevity by various delegates both from the United Kingdom and from Greater Britain, and was finally passed without dissent. From the discussion the following principles finally emerged:—