

THE Telegraph and Telephone Journal.

VOL. VII.

JUNE, 1921.

No. 75.

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MODERN WIRELESS TELEGRAPHY AND TELEPHONY

BY F. ADDEY, B.Sc., M.I.E.E., FELLOW I.R.E.

(Continued from page 118).

Continuous Waves.

The earliest systems of electric wave wireless telegraphy used spark transmission, and consequently detached trains of damped waves were radiated. More recently, systems have been developed by which an unbroken train of waves, all of uniform amplitude, is radiated for the whole time during which the transmitting station is sending a dot or a dash. This is known as "continuous wave" transmission, or shortly, as "C.W.," and possesses marked advantages over the older spark transmission.

Interrupted Continuous Waves.

The apparatus used for the reception of spark transmission is, in general, not suitable for the reception of continuous wave signals. It is convenient, however, for a station using continuous waves to be able to communicate, when necessary, with a station arranged for the reception of spark signals. This can be done by breaking up the continuous train of waves into detached portions, so as to resemble the radiation from a spark station. Such a process is known as "interrupted continuous wave," (contracted to "I.C.W.")

Reception of Damped Waves.

The receiving station is provided with an aerial, which is generally similar to that at the transmitting station. The passage of the waves is usually indicated by a sound being produced in one, or more frequently, a pair of telephone receivers. It is, however, not possible to actuate the telephones by passing through their coils the alternating current set up in the aerial, because the frequency with which the current reverses is too great. For signals

made with a wave-length of 600 metres—the normal wave-length used for commercial ship communication—the frequency is half-a-million complete oscillations per second. Even if the electrical and mechanical difficulties involved could be overcome, and the telephone diaphragms set into vibration at a frequency of this order, nothing would be heard, because the frequency of the sound waves produced would be far above the upper limit of audibility. Some other method has therefore to be employed.

The type of detector used depends on whether spark signals or continuous waves have to be received. In the case of the reception of spark signals, some device is generally used by which the currents in the aerial in one direction only are allowed to act on the telephones, the effect of the currents in the opposite direction being suppressed. Such a device is called a "rectifier." The very short uni-directional current pulses so obtained from each wave-train are caused to blend together to produce a single pulse of current through the telephones, lasting as long as the train of waves is passing. As is well known, a pulse of current flowing through a telephone receiver produces a click. The passage of each train of waves will therefore be indicated by a click in the telephones, and a succession of such trains of waves by a series of clicks. Since a train of waves is sent out for each spark which occurs at the transmitting station, the clicks heard at the receiving station will correspond exactly to the sparks at the transmitting station. If these sparks occur irregularly the succession of clicks will also be irregular, and a rough sound will be produced, but if the sparks follow one another at equal time intervals the clicks will do the same, and will blend together to produce a musical note. The pitch of this note will depend on the number of clicks per second, and therefore on the spark frequency.

The various steps in the process are shown diagrammatically in Fig. 6.

The difference between (b) and (c) in Fig. 6 should be noticed. In (b) we have a picture of a section across the trains of waves, showing how, at a certain instant, the waves are spaced out along their line of propagation. In (c) we have a diagram showing how the currents in the aerial vary as the waves shown in (b) sweep across the aerial. In (b) the waves are to be imagined as moving

from right to left, while (c) has to be read from left to right, the direction in which time, the horizontal scale, is supposed to increase. (a), (d) and (e) are similar to (c) in this respect.

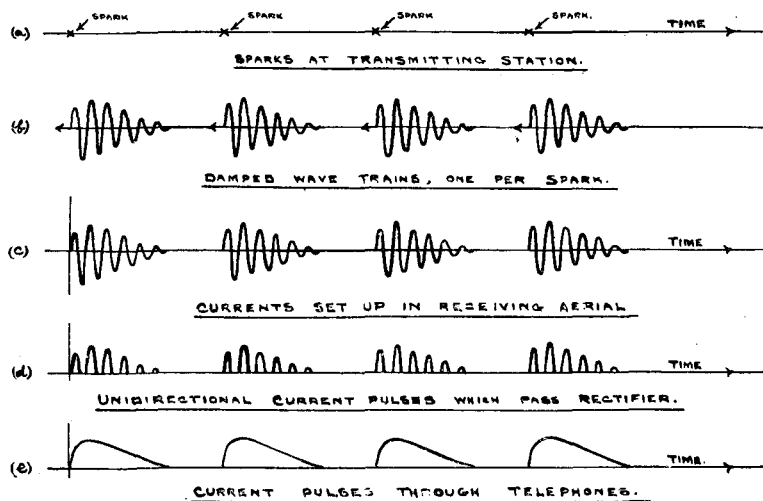


FIG. 6.

DIAGRAM ILLUSTRATING STEPS IN THE RECEPTION OF SPARK SIGNALS.

Reception of Continuous Waves.

If the rectifying arrangement just described were to be used for the reception of continuous wave signals, it is evident, since the waves are perfectly uniform, that a steady current would flow through the telephones during the whole of a dot or a dash. Now, a current produces no sound at all in a telephone while it is flowing steadily, its only audible effect being the production of a click when it commences to flow and of another click when it stops. Thus, if continuous wave signals were to be sent to a station fitted with a rectifier for spark reception, the only effect produced would be a series of meaningless clicks. For the reception of continuous waves, therefore, some other arrangement is necessary.

The method generally used is based on the well-known phenomenon of the "beats" produced by the inter-action of two oscillations which differ slightly in frequency. If two organ pipes which differ slightly in pitch be sounded together, the two trains of sound waves given off, which consist of alternate compressions and rarefactions of the air, will alternately assist and oppose one another in their effect on the drum of the ear, and so the intensity of the sound will rise and fall, thus producing the beats. That this will be the case can be seen from the section of the two trains of waves shown diagrammatically in Fig. 7. In this diagram (a) and (b) represent the two separate wave trains. (c) represents the effect produced when the two trains of waves (a) and (b) are produced simultaneously. The lines AA have been drawn across the diagram at the points where the two wave trains come into exact step. The line B has been drawn at the point where the waves are exactly out of step. It can be proved that the number of beats heard per second is equal to the difference between the frequencies of the two trains of waves.

In the same manner, if we are using continuous waves having a wave-length of, say 3,000 metres, which corresponds to a frequency of 100,000 oscillations per second, a steady alternating current of this frequency will be set up in the receiving aerial. If now, by some means, we generate at the receiving station a continuous alternating current of a frequency of 100,500 oscillations per second, or of 99,500 oscillations per second, and superimpose this current on the current of 100,000 frequency set up by the incoming signal, we shall get a beating effect produced as the two currents alternately come into exact step with one another and then get exactly out of step with one another. The frequency of the beats will be equal to the difference between the frequencies of the two currents and will thus be 500 per second. By suitable means these current beats can be caused to affect the telephones, and a musical note

will be heard of a pitch corresponding to their frequency. For a frequency of 500 per second the note heard will be about the treble C.

Wireless Telephony.

It has been mentioned above that, in order to enable a continuous wave transmitting station to communicate with a station arranged for spark reception, the steady emission of the continuous waves has to be broken up into short portions so as to resemble the series of short detached wave trains emitted by a spark transmitting station. By an extension of this principle of moulding the emission from a continuous wave station it is possible to transmit actual speech.

The broad principle of telephony, wireless or otherwise, is as follows. In ordinary speech, the words are conveyed directly from speaker to hearer by sound waves of complicated form set up by the vocal organs. In telephony, the diaphragm of the transmitter is set into vibration by the speech waves. By the action of the transmitter these vibrations are caused to set up current pulses of similar form, and these current pulses, by the intermediary of either a telephone line or of free ether waves, cause the diaphragm of the telephone receiver at the other end to vibrate similarly to the diaphragm of the transmitter, and so to mould the air in front of it into sound waves, similar to those of the speech which originally started the train of operations. The sound waves produced by the telephone receiver affect the ear of the listener just as if they had come straight from the speaker, and had not undergone all the various transformations mentioned.

In wireless telephony a telephone transmitter is associated with the continuous wave generating apparatus, and when spoken into causes the amplitude of the electric waves given off to be moulded or "modulated" so that the line joining the tops of the waves, when these are represented in the usual diagrammatic manner by means of a wavy line, takes the shape of the curve representing the sound waves of the speech, as shown in Fig. 8 (a), (b), and (c). In practice the frequency of the wireless waves would be much greater relatively to that of the sound waves than is shown in the

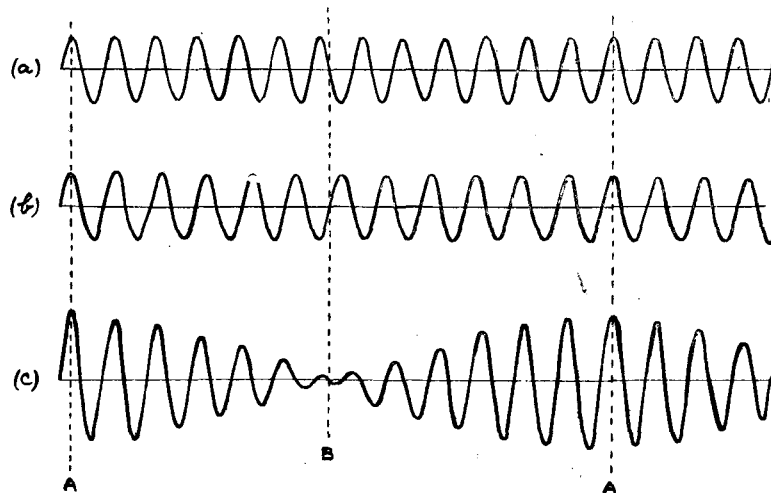


FIG. 7.

BEATS CAUSED BY THE SUPERPOSITION OF TWO WAVE TRAINS OF DIFFERENT FREQUENCY.

diagram, so that the very small ripples in the speech waves are impressed on the wireless waves. These moulded C.W. waves, as they pass the receiving station, set up oscillating currents in the aerial at that station, the amplitude of which varies in exactly the same manner as the amplitude of the waves. Fig. 8 (c), may therefore also be taken as a diagrammatic representation of the currents in the receiving aerial, the horizontal line being now taken as a scale of time, and the diagram read from left to right, as already explained in connexion with Fig. 6 (b) and (c). These oscillatory currents are detected at the receiving station by a rectifying detector, which, as already explained, allows the current pulses in one direction

only to pass. In Fig. 8 (d), the current pulses corresponding to the portions of the curve below the zero line in (c) are supposed to be suppressed. The current pulses which pass the rectifier are caused to blend together and produce a comparatively slowly varying current which varies in exactly the same way as the amplitude of the C.W. waves, and therefore reproduces the form of the speech waves, Fig. 8 (e). This current is sent through the receiving

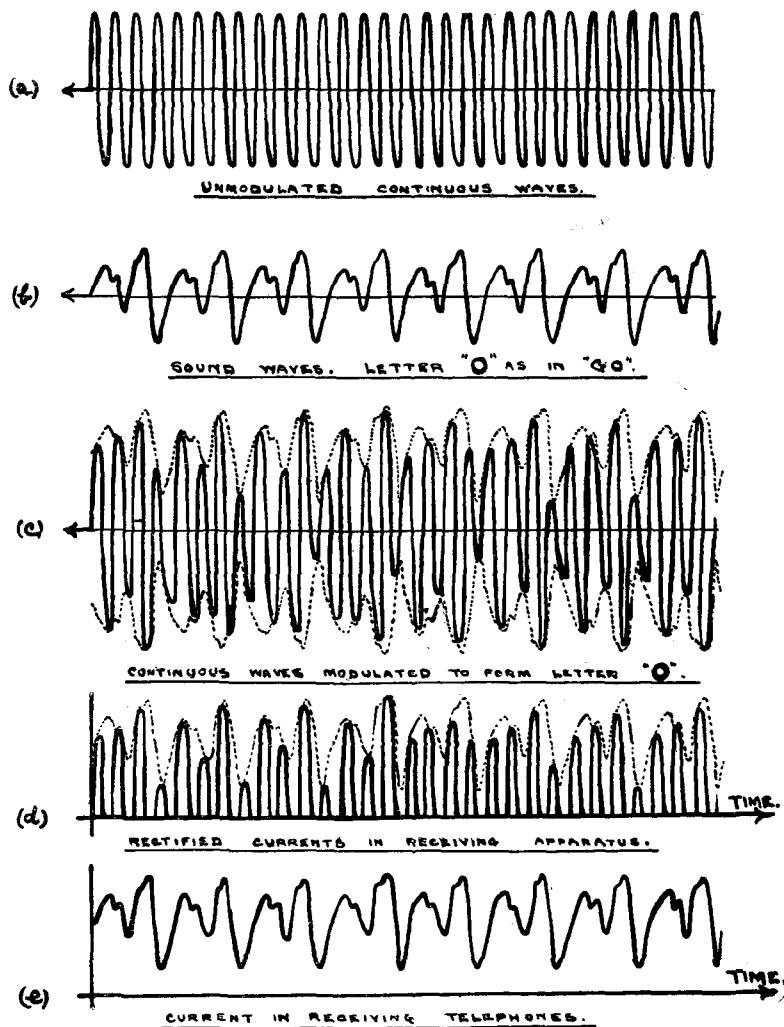


FIG. 8.

DIAGRAM ILLUSTRATING THE STEPS IN THE WIRELESS TRANSMISSION OF SPEECH.

telephones, and their diaphragms are therefore set into vibration and produce sound waves of exactly the same form as the speech waves at the transmitting station.

High Speed Transmission.

In most wireless stations the signals are transmitted by hand at speeds of about 20 or 25 words per minute. For an amount of traffic greater than can be handled at this speed, however, automatic transmission and reception are necessary. It is at present possible to carry on a more or less successful commercial service at speeds up to about 150 words per minute, and considerably higher speeds have been obtained experimentally.

Directional Working.

It has been explained above that at a wireless station fitted with an aerial which is symmetrical with regard to the earth, and where the nature of the surface of the earth round the station is uniform, signals will be sent out equally in all directions. Under the same conditions the strength of the signals received from other stations will be equal, no matter in what direction from the receiving station these stations may lie, so long as the distances at which they are situated from the receiving station and the strength of the signals which they send out are the same. The

aerial at the first station is then said to be "non-directional." If, however, an aerial which is not symmetrical with regard to the surface of the earth be used, then signals will be received better from stations in certain directions than from stations in other directions. Such an aerial is described as "directional." By suitable means, the direction from which signals are best received can be changed. In this way, by causing the line of best reception to swing round till the strength of the signals received from some other station is a maximum, the direction of that station can be ascertained. This process of "direction-finding" is extremely useful to ships for finding their position during foggy weather, when the ordinary navigation marks are obscured.

Duplex Working.

Another advantage of a directional aerial is that by its use a station can be arranged to receive signals from a distant station, while the signals from a transmitting station near at hand can be cut out. By the provision of a transmitting station and a separate receiving station arranged in this manner at each end of a line of wireless communication, it is possible to carry out "duplex" working, that is, to send messages in both directions simultaneously. The transmitting apparatus is worked from the receiving station by means of a telegraph wire between the two stations.

Automatic Calling Devices.

One of the most useful functions of wireless telegraphy is that by its aid a ship in distress can summon assistance from other vessels in her vicinity or from the shore. In order that full advantage can be taken of this power of summoning assistance, however, it is necessary that a continuous watch should be kept at every wireless station, both on board ship and on shore. At land wireless stations a continuous watch is maintained, but on a small tramp steamer, for example, on which only one operator is carried, the keeping of a continuous watch is not possible. By the provision of "watchers," men able to recognise the S.O.S. distress signal, this difficulty is partially removed, as on receipt of a distress call, the watcher can bring the trained operator to the instruments. Several automatic call devices have recently been designed, with the object of dispensing with the services of a watcher. It is possible for an automatic apparatus to be installed which will not only ring a bell when the S.O.S. or some other equivalent signal is received, but will also ring a bell when the distinguishing call letters of the ship are received, and will differentiate between the distress signal and the ship's call.

Some of these devices, however, have the drawback that they may be actuated by ordinary wireless signalling, and so give false distress calls, and also that they are of delicate construction and liable to become deranged. There is no doubt, though, that before long a thoroughly satisfactory automatic calling device will be produced.

Time Signals.

In order to find his position when at sea, the captain of a ship requires to know the correct time at the spot where he happens to be, the so-called "local time," and also the time at the same instant at Greenwich. By astronomical observations the local time can be found, and then if by some means the corresponding Greenwich time is known, the difference between the two gives the longitude of the ship. Further astronomical observations give the latitude, and thus the position of the ship is fixed.

Greenwich time is obtained by means of one or more chronometers which are carried in the ship, and which are checked whenever possible. Before the development of wireless telegraphy the checking of the chronometers could only be carried out at ports where time guns or other signals were installed, or by means of difficult astronomical observations. Nowadays, however, wireless time signals are sent out once or oftener daily from many of the large stations in different parts of the world, so that it is possible to obtain a daily check of the chronometers. The transmitting apparatus by means of which these signals are sent is controlled from the standard clock at a neighbouring astronomical observatory.

(To be continued.)

HISTORY OF THE ANGLO-CONTINENTAL TELEPHONE SERVICE.

ALTHOUGH the first telephone exchange in England was opened in 1879, and telegraphic communication with France had been enjoyed since 1851, the provision of telephone service to France did not receive practical consideration until 1889. Nevertheless, it must be remembered that the development of long-distance telephony was not much advanced in this country at that time. Trunk lines had existed between Leeds, Manchester and Liverpool since 1886, and Edinburgh and Glasgow since 1887. London had indeed been joined up with Brighton and Birmingham and the North was not completed until 1890, and communication between London and Scotland was not afforded until some years later.

In March, 1889, M. Coulon, the French Director of Posts and Telegraphs, when in London in connexion with negotiations for the purchase of the Submarine Company's telegraph cables, urged the introduction of telephonic communication between France and England, and Mr. Preece, the Chief Electrician of the Post Office reported that there was no electrical difficulty in giving effect to the proposal. On May 16 of the same year the French Administration suggested that telephonic experiments should be made on the Anglo-French telegraph cables. About this time an offer was made by a Belgian Syndicate (Van Rysselberghe's system) to provide the necessary Anglo-French circuits and to sell them to the respective Governments if they proved successful. The offer was refused, the Administrations being of the opinion that they were themselves competent to provide a satisfactory service between England and France. The enterprise was not undertaken without misgivings, however. According to a newspaper report, General Boulanger's visit to London in 1889 was said to be hampered by lack of telephonic communication. "This," said Mr. W. H. Preece in a report "shows that the wire would be used for other than legitimate commercial traffic, and raises a political question." And in a later report Mr. (afterwards Sir J. C.) Lamb, Assistant Secretary, said: "The operations of an agitator like Boulanger would be much facilitated by the possession of means of communication between the two capitals." The idea of limiting the Anglo-French lines to commercial traffic strikes oddly on those who have seen them limited to non-commercial traffic in times when government calls only were accounted strictly "legitimate" traffic! Proposals were nevertheless placed before the Treasury to provide a telegraphic cable and land lines to France of such a character as to be suitable for telephonic working if the establishment of an Anglo-French service were decided on. Treasury sanction to the scheme was given in January, 1890, and the necessary credit having been voted by France in the August of the same year, tenders for the cable were sought. Messrs. Siemens obtained the contract, and manufactured the cable at Woolwich; it was a four-core cable 20.965 knots, in length, weighing 160 lbs. copper and 300 lbs. gutta percha per nautical mile. The laying of the cable between St. Margaret's and Sangatte was carried on in a blizzard in the following year, and completed with great risk and difficulty on March 14, the service being opened to the public on April 1. The cable contained 2 London-Paris telephone circuits and was completed (together with the land lines) at a cost of £23,704, of which France paid £6,356 as their half-share of the cost of the cable.

The following graphic account of the laying of the cable by the *Monarch* is taken from *The Times* of March 18, 1891:—

The telephone cable was stored in the main tank. The steam capstan had been removed and a horizontal spiderwheel or sheave mounted on its axle. The end of the cable, which was coated with whitewash to keep the coils from sticking together, was brought from the tank in Siemens' factory and carried over the intervening water by two pulleys elevated on barges anchored in the Thames. It went round the spider wheel, took three turns about the picking-up drum on the port side, then passed to the main tank, where a dozen hands in white overalls took hold of it and, with the help of iron levers, coiled it neatly, flake upon flake, at the rate of $1\frac{1}{2}$ to $1\frac{1}{4}$ knots an hour. It is a good cable—"one of the best ever made" was the verdict of

Mr. Lumsden (the Engineer-in-chief of the *Monarch*.) Thicker than an ordinary ocean cable, with a single core, the line was beautifully pliant and fell into its coils with the easy motion of a snake.

On Tuesday evening, March 3, the *Monarch* left her moorings near the *Warspite* and put to sea. Next morning she arrived off St. Margaret's Bay, a pretty cove in the chalky cliffs of the South Foreland, with a gravelly beach well fitted for landing a cable. A favourable wind, a smooth sea, and, above all, a clear day, so that the opposite coast can be described as a mark for the ship, were the requirements in the way of weather for the laying of the cable. Mr. Lumsden had sufficient cable to cross, but not much to waste by wandering from his course. For several days there was a nasty swell on the sea and a disagreeable haze. It was impossible to communicate with the shore, and the *Monarch* lies rocking idly at her anchor. She had a distinguished visitor in M. Amyot, the Inspector-General of the French telegraph administration, accompanied by his assistants, MM. Messin and Thomas, who were present on behalf of the French Government during the laying, and who afterwards proceeded to London to make experiments on the line, while officials of the Post Office were present in Paris. Mr. W. R. Culley, assistant-superintendent of the submarine department of the Post Office, was also on board to see the laying and mark the position of the cable.

After waiting nearly a week in hopes of better weather, the morning of Monday, March 9, broke fine and clear. There was a stiff north-easterly breeze at Sangatte, registered as 4 deg. on the nautical scale, and nothing more. The glass was steady, the sea smooth, all the way across, and the white cliffs at St. Margaret's were plainly visible to the naked eye. The long-expected opportunity seemed to have come, and preparations were made for landing the shore end of the cable into the hut at Sangatte. The two lifeboats were lowered, and a strong platform placed across them to form a raft, on which a length of cable sufficient to reach the shore was quickly coiled by the cable hands. The steam launch took the boat raft with the black coil of the cable in tow, the men paying it by hand as she went along to ground. She cast off and gave place to the men, who, in their white overalls and sea-boots, dragged the cable up the sand, along the trench, and into the cable hut. It was half-past 9 when the lifeboats were launched and 12 minutes to 11 when the end was landed. No time was lost in returning to the ship, which immediately started paying out towards St. Margaret's Bay. The cable ran smoothly out of the tank, through the iron "crinoline," which keeps it from lashing about with the rolling of the ship, it glided along the guides, took three turns round the huge revolving iron drum, with its friction-brake which controls the speed of egress, and passed over the starboard sheave or pulley projecting from the bows, then dived into the sea, just grazing the hull about the water line. Mile after mile was traversed in this way, and all was going on well. As yet there were no signs of an approaching storm. A drizzling rain began to fall, and the breeze freshened, but it was not until towards 3 o'clock, when 10 miles of cable had been paid out, and the *Monarch* was half seas over, that the gale came on, and the water became rough. The glass fell rapidly, and soon a blinding snowstorm swept over the vessel. It was still possible to see for a considerable distance all round, and there was no danger of a collision, but the weather grew worse every moment. Mr. Lumsden had no intention of cutting the cable and buoying it. The captain knew how far he had gone on the course the *Monarch* was pursuing, and that he would soon fetch up off St. Margaret's Bay. The sea was lashed into fury by the violence of the gale which increased to 9 deg., but the decks of the *Monarch* rode high, and there was little or no spray. The whirling flakes of snow were the enemy, and they drove on thicker and thicker, keener and keener, till the cheeks tingled and smarted as if they were being cut with crystals of ice. The lookout could only see a short distance ahead, and although the *Monarch* was nearing the land the white cliffs were invisible. At length it was decided to anchor until a lull in the storm should reveal the land, if only for a little while. The cable was fastened and the anchor rattled out soon after 4 o'clock. The whistle was sounded to give notice of her whereabouts, but the signal was unheard above the storm. A gun far out at sea, announcing a ship in distress, was heard and mistaken by the folk on shore for a signal from the *Monarch*, but she never fired a gun. The snow cleared about 5 o'clock, and it was then discovered that she was lying off St. Margaret's Bay, about a mile from the shore, and eastward of the cable hut.

Captain Thompson had made a good hit in spite of the blizzard. Having found his bearings, an attempt was made to lift the anchor and pay out all the cable, but the strong tide, aided by the furious wind, had driven the cable foul of the anchor, and after a fruitless attempt to clear, the anchor was slipped with 14 fathoms of chain. It was now a quarter past 8 at night, and very dark, but the *Monarch* paid out the rest of the cable to avoid cutting it, and buoyed the end well off the shore to the east of St. Margaret's Bay, about 20 minutes past 9, then ran for the Downs, where she anchored soon after 10 o'clock. Next morning the dirty white cliffs of the headlands and the bleak hollows of the Downs were patched with drifted snow, and the scene was wintry in the extreme. A tawny sea, lashed into foam by a strong easterly gale, with squalls of mist and rain, prevented further operations. Wednesday was not much better, for, although it brightened up, the glass was still unsettled. The *Monarch* was now lying at Dover, where she went to land a visitor and take in stores. Thursday was fine, and after picking up the cable from the buoy she proceeded to clear it from the lost anchor. The line was coiled four times round the anchor, and could only be released by cutting out the damaged part. This was done, the anchor and chain being recovered, and the end of the cable buoyed. She returned to Dover. On Friday nothing could be done owing to the high wind and sea; but Saturday morning was as quiet as a lamb, the blue sky smiling through fleecy clouds. The *Monarch*

was early astir, and although the sea was a little hazy, and a strong easterly breeze blowing, the glass was very steady. The ship had spliced the cable by 20 minutes past 11, and then picked up some five miles of cable from the buoy, towards Sangatte, relaying it so as to clear a bight in the Calais-Dover line, arriving off St. Margaret's Bay about 20 minutes past 3 in the afternoon, where she anchored 1,000 yards away from the landing-place. A raft was speedily formed with the lifeboats, and the shore end landed in the same way as at Sangatte. It was now getting dusk, but groups of spectators had collected on the beach to watch the operations, and a local photographer, deputed by a London illustrated paper, took a picture of the scene. The end was hauled ashore by the sailors at 10 minutes past 6, and 12 minutes later brought into the cable hut. Lieutenant O'Meara called up St. Martin's-le-Grand and announced the good news. Three cheers were given at the Post Office and in the hut through the land line, and those from London sounded so lustily that the lieutenant declared they had split the drum of his telephone. The end of the cable was then stripped and the sheathing filed off, the rasping of the file being plainly heard in London. The cores were then pared, and the cable connected to a Morse apparatus, by which the hut was put in communication with Sangatte. The French electricians there telegraphed a "hurrah for the telephone," and the work was done.

An agreement providing for the establishment of the service was signed on May 17 and June 16, 1891, after approval by the Foreign Office.

The charge for 3 minutes' conversation was fixed at 10 francs. The two Administrations had some difficulty in arriving at a basis for this charge. No estimate could be formed of the revenue likely to be derived from the telephone service, the conditions being altogether novel and the requirements of the public a matter of pure guess work. The traffic on the Paris-Brussels trunk line afforded no guide; there was no difference of language to contend with in this case, and the line was in constant use. This question of difference of language was for some reason regarded as a considerable stumbling block in those days; it was apprehended that the use of the London-Paris service would be confined to comparatively few people, and it was thought necessary to charge a substantial sum. The French Administration, the British Chamber of Commerce in Paris, and Mr. Lamb were all in favour of a charge of 10 francs, and 10 francs was adopted—as a tentative measure, to which the Postmaster-General (Mr. Raikes) agreed with reluctance, and on the understanding that the charge should be reduced when the traffic increased.

Not only did the Post Office at that time expect the use of service to be confined chiefly to stockbrokers and financial houses, but access to the service was denied to the National Company's subscribers, as this course could not be recommended whilst their London service was worked on the single wire system. The service was, therefore, limited to call office traffic and to such subscribers as were subsequently connected directly with the trunk switch.

Call offices in connexion with the Paris circuit were opened at the Central Telegraph Office at Threadneedle Street, and at West Strand. A switch was provided at the Central Telegraph Office to which any wire rented by subscribers might be led, and the Anglo-French traffic was dealt with there until the Anglo-Continental telephone circuits were transferred to the London Trunk Exchange in February, 1904. The use of the service by National subscribers was first permitted under the Purchase agreement in 1905.

According to contemporary press reports, the opening ceremony on March 17 was highly successful. Greetings were interchanged between Mr. Raikes, the Postmaster-General and M. Jules Roches, the French Minister of Commerce, and after Mr. Raikes had transmitted a message from the Prince of Wales to M. Carnot, the President, the British Press conversed with their confrères in Paris. The official speeches were subsequently telegraphed in full, although the speaking is reported to have been very distinct, *The Times* remarking that the peculiarities of accent were easily distinguishable. The *Daily Telegraph* said, *more suo*; "electricity annihilates distance, so far as this pigmy earth is concerned, for there is no appreciable interval between the wave vibrations produced on the transmitters in St. Martins le Grand and their reproduction on

the receivers in the Rue Grenelle. The imagination of poets and romancists never achieved any wilder flight of fancy."

The traffic on the first day amounted to 22 calls, with all of which the speakers expressed their entire satisfaction. By the following year (1892) the traffic had risen to 3,018 calls a month, and it steadily increased until it had reached an average of 4,764 a month in 1895. The delay in the busy hours amounted at this time to an hour or an hour-and-a-half, and it became necessary to provide additional circuits. Each Administration agreed to become responsible for the provision of an additional cable, and in 1897 two new cables were laid, one between St. Margaret's Bay and Sangatte by the British Post Office, and another between Abbot's Cliff and Gris-Nez by the French Administration. After prolonged correspondence between the two countries, in which the claims of the telegraphic and telephonic service were carefully weighed and contested, it was agreed to allot 6 wires to telephones (forming 2 London-Paris and 1 London-Lille circuit) and 2 to telegraphs.



CARTOON FROM *Punch* INSPIRED BY THE OPENING OF THE ANGLO-FRENCH TELEPHONE.

On the completion of these 3 circuits, the French Government submitted a draft agreement suggesting the division of the country into zones for charging purposes, and the introduction of reduced charges at night. These proposals were finally embodied in an agreement, which was signed on July 29, 1902, and by 1904 service was in operation not only between London and Paris, but between Birmingham, Cardiff, Bristol and the Lancashire and Yorkshire towns on the one side and Amiens, Armentieres, Bethune, Bordeaux, Boulogne, Caen, Calais, Cambrai, Chartres, Denain, Dieppe, Dijon, Douai, Dunkirk, Elbeuf, Havre, Lens, Lille, Lyon, Marseilles, Nancy, Orleans, Roubaix, Rouen, St. Etienne, St. Quentin, Tourcoing, Tours, and Valenciennes on the other.

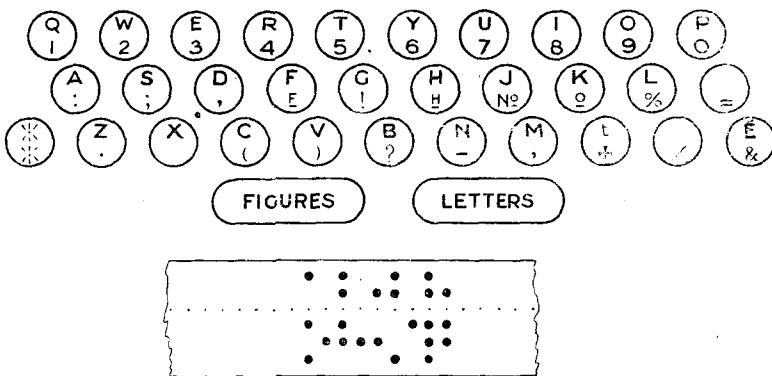
(To be continued.)

The Royal Insurance Co., of 1, North John Street, Liverpool, have forwarded to us a very handy pocket book of the rules of the Royal and Ancient Golf Club of St. Andrews. They offer to supply readers with a copy, so far as their stock will permit, on application to Liverpool, or to Lombard Street, London.

BOOTH-WILLMOT TELEGRAPH KEYBOARD PERFORATOR.

THIS perforator is of the typewriter pattern, having the keys arranged in the standard order, and with two characters to each key. The letters or primary characters are arranged to actuate the punches in accordance with any particular code, while the secondary characters, including the figures, may be arranged in any desired order. With the standard arrangement the figures are placed in numerical order as secondaries to the back row of keys, and this plan is followed in the Booth-Willmot arrangement, although the signals for the figures may be partly or totally different from the signals representing the letters on the same keys. For instance, with the original Baudot code the secondary of letter "Q" is the oblique stroke, while figure "1" is secondary to letter "A," but with the Booth-Willmot device figure "1" of the Baudot code is secondary to letter "Q" of the Baudot code, similarly with the other figures and symbols. Hence a standard arrangement of the keys can be used for a Baudot keyboard perforator. A plan of the keys with their symbols is given in Fig. 1. As Baudot operators will note the specimen of slip punched represents the word "telegraph" as it would be signalled from an ordinary keyboard, and is thus very easily read by any Baudot telegraphist.

The device also permits of an exactly similar arrangement being used for the Morse or Wheatstone keyboard perforators, the key for the Morse letter "Q" producing Morse figure "1" as secondary. It also provides space for additional Morse characters and avoids the use of 3 keys for several Morse symbols, which is a necessity on the Gell and Kleinschmidt perforators.



It will permit of the use of a similar arrangement of the keys, so far as the operator is concerned, on all the various arrangements of the 5-unit alphabet, of which the chief are as follows:—

- (1) Original Baudot code "5-unit A."
- (2) Murray duplex multiplex "5-unit B."
- (3) Western Electric duplex multiplex ... "5-unit B."
- (4) Morkrum system "5-unit B."
- (5) Siemens' automatic "5-unit C."

The 5-unit A, B and C codes differ radically both in their primaries as well as in their secondaries, but perhaps in the course of time the different administrations will decide to bring all these codes into line, at least so far as the letters, figures and control signals are concerned, leaving a few secondaries to be allocated for special characters peculiar to each administration.

The Booth-Willmot device, besides providing a perforated slip, at once readable by all Baudot operators, permits of the use

of the usual 5-key Baudot keyboard as an alternative on the same channel for speaking purposes, without disturbing the perforated slip in the automatic transmitter, or requiring any alteration in the Baudot receiver.

It is believed that the Postmaster-General has granted permission for patent rights to be obtained.

An experimental keyboard has only recently been placed on one of the Anglo-Continental circuits, so that it would be premature to make further comment except that the prospect of its success is promising.

It is understood that the official designation of this form of keyboard is to be known as Post Office 1921 design for foreign Baudot circuits.

J. J. T.

THE BAUDOT.—XXI.

By J. J. T.

ERRATA: p. 119, second column, last issue, read:—*It is also during the next half revolution of the type-wheel axle that a cam K⁴ (Fig. XLVI) fixed to the main axle X of the receiver is so positioned on this same axle as to close the circuit of a local battery by means of two spring contacts shown diagrammatically (Fig. LVII A, B).*

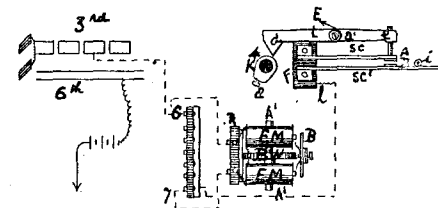


Fig. LVIII.

Also lines 15-17 read:—*the numbered lines 1 to 5 representing the five connexions from Ring 1 corresponding to the electro-magnets 1 to 5 (a to e), connexion 6 representing &c., &c.*

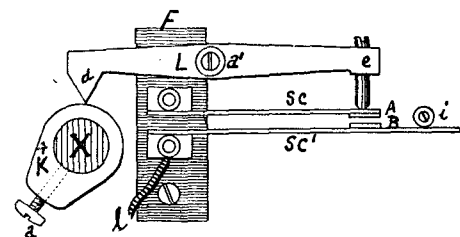
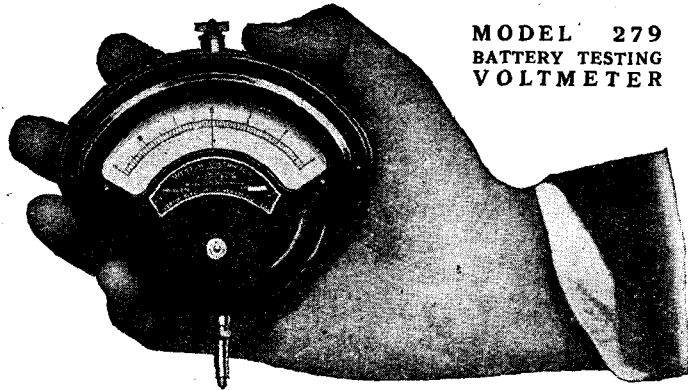


Fig. LIX.

Fig. LVIII shows the general scheme of the automatic braking of the speed of a Baudot receiver referred to in the concluding paragraph of Article XX and should be kept in view as the details of the system are enlarged upon in this and the succeeding articles.

Each Baudot receiver of an installation of whatever type and whether used for actual reception or for the local record of outgoing



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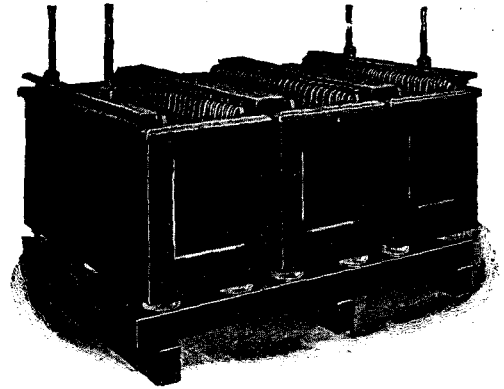
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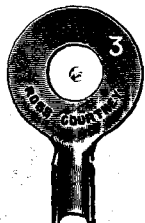


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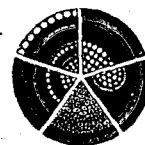


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signals is maintained in phase with its own particular sector of the distributor to which it is allocated. The running speed of such receiver is fixed at a figure slightly higher than that of the distributor which from Rings 3 and 6 automatically transmits a checking or braking current from a local battery of 40 volts by means of the rotating brushes. The latter, as already mentioned, from the same pair of rings and by means of certain other of the segments

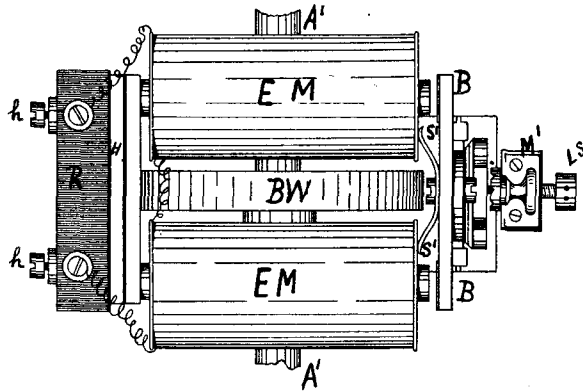


FIG. LX.

of Ring 3 serves the keyboard of each arm with its cadence for transmitting purposes. The brake current passing from Ring 3 is led to terminal 6 of the receiver connexions (Figs. LVII and LVIII) thence passing through the electro-magnet brake coils EM (see also Figs. LX and LXI), to terminal 7 (Figs. LVII, LVIII), thence to the lower of two long steel contact springs SC¹ at l (Figs. LVIII and LIX). The contact springs SC and SC¹ are fixed to an ebonite strip F, which insulates them from the back

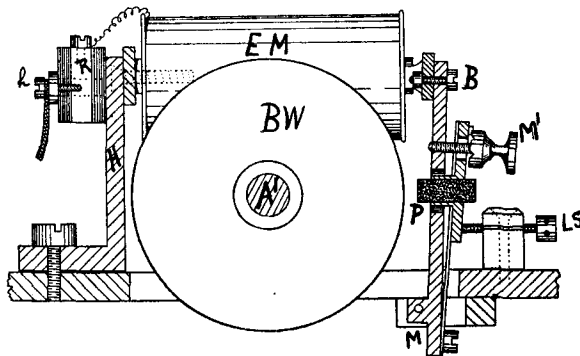


FIG. LXI.

casing of the receiver, to the inside of which the strip F and the balance lever L are fitted. K⁴ is a cam fitted on the type-wheel axle X just below the nose d of the balance lever L. This lever oscillates on an axle pin a¹ and when by the rotation of the axle X the eccentric portion of K⁴ reaches d the lever L is lifted against the gentle pressure of SC and depresses the opposite end e bringing SC into electrical contact with SC¹ and thus extending the path of the current which completes its circuit through the axle-pin a¹ and the receiver casing to earth. The contact springs SC and SC¹ carry platinum contact tips A. B. An insulated limitign stud i keeps SC¹ in position when the latter is at rest.

Upon the base-plate of the receiver is fixed a horizontal pair of electro-magnet brake coils EM (Fig. LVIII) and of which more details are given in Figs. LX, LXI. An axle A¹ with bearings at the front and rear edges of the base plate (Figs. LVIII, LX, LXI) is extended rearwards and thereon carries a speed governor known

as the *moderator* upon it. On the centre of this axle also rotates a brass fly-wheel or brake wheel BW (Figs. LVIII, LX, LXI) the electro-magnet coils EM being fixed, one each side of BW being held in position by screws fixing the coils end-on to an upright metal support H and an ebonite block R.

(To be continued).

REVIEWS.

“*Management: A Study of Industrial Organisation.*” By John Lee, M.A. 125 pp. 5s. net. Sir Isaac Pitman & Sons.—This book, as the preface records, took its origin in lectures to audiences of men and women interested in problems of organisation, amongst them the members of the London Telephone and Telegraph Society. Some of its chapters will therefore be familiar to our readers, although they have been thoroughly revised, especially that on the subject of the Psychology of Supervision which aroused such keen interest when it appeared in our columns. Our readers know what to expect from Mr. Lee’s pen, and will not be disappointed with his treatment of the subject of the volume under review. Mr. Lee reviews with breadth of outlook and sympathy the progress of industrial control from the early stages of absolute ownership to the later forms of Whitleyism and divided control, dealing on the way with such questions as functional management, directive management, scientific management, promotion and discipline, theories of wages, welfare methods and Whitley councils. In conclusion, he says:—“We need some correlation of experience, some interchange of thought between those who have struggled through in the way which I have described and have achieved something in the way of result. In time to come I hope the Universities will supply such correlation. It will not reach the height of dogma. We shall always be ready to learn from new experiences of others, especially from the experiences of those in other countries where industrial conditions are different. . . . Management to be worthy of the name will be unsatisfied until it is so sensitive that the hard articulation of the thread of conflict will not be needed.”

“*The Practical Electricians’ Pocket Book and Diary, 1921.*” S. Rentell & Co., Ltd. 522 and lxxv pp. 3s. net.—It is difficult to find anything new to say about this well known and useful little annual, now in its twenty-third year. It has been revised and is as usual thoroughly up-to-date. We note that it has been recommended by the City and Guilds’ Examiners for Electrical Installation work.

“*Arithmetic of Telegraphy and Telephony.*” By Herbert and De Wardt. Pitman & Sons. 5s. net.—A very useful book by Messrs. Herbert and De Wardt of the Post Office Engineering Department, the former of whom is the writer of the well-known book on Telegraphy. The student in technical subjects often times finds himself at a disadvantage when only at the threshold of his labours through his knowledge of arithmetic having lapsed to some degree by disuse. This work is well designed as a refresher to such persons, and as an aid to entrants for the course of Telegraphy and Telephony.

The opening chapters are devoted to a description of the simpler rules of arithmetic, followed by examples and exercises at each stage, the answers to the 250 problems being placed at the end of the book. The volume consists of upwards of 150 pages of clearly printed matter, the fifteen chapters include such necessary branches in the Elementary Course of Telegraphy and Telephony as Ohm’s Law, Measurement of Cells, Conductors, Current, Resistance and Condensers, with skeleton diagrams for illustrative purposes in some instances, Messrs. Herbert and De Wardt may well be congratulated on their work, which should be in the possession of all Elementary Telegraphy and Telephony Students.

The
Telegraph and Telephone Journal.

PUBLISHED MONTHLY IN THE INTERESTS OF THE TELEGRAPH AND TELEPHONE SERVICE, UNDER THE PATRONAGE OF THE POSTMASTER-GENERAL.

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		J. W. WISSENDEN.
Managing Editor - -		W. H. GUNSTON.

NOTICES.

As the object of the JOURNAL is the interchange of information on all subjects affecting the Telegraph and Telephone Service, the Managing Editor will be glad to consider contributions, and all communications together with photographs, diagrams, or other illustrations, should be addressed to him at G.P.O. North, London, E.C.1. The Managing Editor will not be responsible for any manuscripts which he finds himself unable to use, but he will take the utmost care to return such manuscripts as promptly as possible. Photographs illustrating accepted articles will be returned if desired.

VOL. VII.

JUNE, 1921.

No. 75

"THE FOUNDATIONS OF BELIEF."

"It is not easy to trust implicitly," says a paragraph which has appeared in several well-known provincial newspapers, "the calculation of the Post Office authorities that out of 9,000 subscribers to the telephone service who have given notice to terminate their agreements which ended last March only 3,000 have done so as the result of the increased charges." It is, in fact, preferable to trust vague statements, dark prophecies, vain assumptions, fixed impressions, colorable conjectures, flying rumours, and specious fables than a computation carefully arrived at from actual documents. We are glad of the implied admission; but it is really superfluous. It is much more dramatic, much better copy, to say that "nearly all" the subscribers in X are giving up their telephones because of those abominable and extortionate new rates than to record the unexciting fact that only two per cent. have done so. It is said that we believe most readily what we wish to believe. It is certainly not in human nature to accept without protest facts or statistics which go to prove that a deep-seated impression is all wrong. Perhaps this is why statistics are commonly in such bad odour, and why the statistician's profession is accounted venal, for figures, it is often said, can be made to prove anything.

It must be remembered that the columns of the Press have contained numerous statements during the past month or two to the effect that large numbers of subscribers in this or that town have refused to sign agreements for service at the new rates. In some cases the number is put at half, in others at "nearly all." Numerous letters also have appeared from subscribers vehemently announcing their intention of discontinuing. Quite naturally one would assume that these withdrawals would affect the returns of the whole country in some striking manner. We can understand

the astonishment and disappointment of the journalist looking for dramatic developments, and his pardonable doubt on being told that while 3,000 subscribers had terminated their agreements on account of the increased charges, 6,000 had done so for ordinary causes.

It is not perhaps understood by the Press and the public that in normal times some two to three thousand out of the great body of subscribers to the Post Office telephone system give up the telephone every month, owing to death, retirement, failure, or other valid reasons. Since the inception of the new rates 16,500 new agreements have been signed, and the number of telephones in use in this country is now nearly a million.

HIC ET UBIQUE.

THE *Wall Street Journal* of New York recently published a criticism on "British Government Ownership," chiefly in reference to the new rates. We are fairly well hardened to unscrupulous attacks, but the article in question surpasses the usual limits of controversial mendacity. "There is a system of recording calls," we are told, "and charging for them, which would not be tolerated here for a week. The renter of the telephone calls a number and is electrically recorded thereupon (*sic*) as making a call. After ten patient minutes, he calls 'Central' again, having failed to get his number. For this 'service' a second call is charged to his account."

So far from not being tolerated for a week, the British method of charging for calls is precisely that in force in New York; that is to say, the call is not recorded by the telephonist until the two subscribers have been placed in communication. This method was investigated and approved both by the London Chamber of Commerce and by the Merchants' Association of New York.

THERE is, we learn from *Telephony*, a strike of 700 telephone subscribers in Bloomfield, Nebraska. Although the State Railway Commission duly authorised an increase of about 22 per cent. on the old rates, the subscribers have voluntarily cut themselves off from the service. A committee of bankers and business men requested the Commission to order a reduction of rates, but the Commission will not allow the Company to reduce its rates, even if it should seek that way out of the difficulty, because the law having been invoked must govern. "Meanwhile," we are told, "the strikers are reported to be looking for some way to let go of the bear and at the same time save their faces."

"NOTHING," says the *New York Times*, "can make increased cost of necessities popular, but Americans will accommodate themselves to whatever they believed to be just, even if they register a protest, which is both lawful and economic, by going without whatever they dislike the price of. The Public Service Commission, having heretofore reduced telephone rates and increased wages by eleven million dollars, finds that the telephone company is unable to earn its operating expenses. Accordingly the Commission allows the company to increase charges enough to yield eleven million dollars more annually." *Telephony*, in quoting the foregoing, commends the sane attitude of *The Times*. "Politicians and yellow newspapers," it says, "oppose adequate rates for utilities and seek to befog the issue so that the public will flock to their banner heedless of the inevitable fact that resulting losses must eventually be made up in increased taxes." No comment from this side of the Atlantic seems necessary.

A CORRESPONDENT of the *Weekly Despatch* basking, if we may so put it, in Northern lights, and describing how their magnetic effects disorganised temporarily several telegraph and telephone lines in Sweden, explains that a milliampere is a measure of electrical brilliance. Journalistic brilliance admits no obstacles, and would seem to have as devastating an effect on things electrical as the brilliance of the Aurora.

THE *Near East* gives information of a projected General Telephone Company of Persia. A circular asking for subscriptions issued in Teheran in English exhorts the reader not to miss this chance to benefit himself and the public, but to "take part in this great fortune which is indeed the key to prosperity of the individual as well as of the public and the country." Apparently we must go to the East to hear such nice things about the telephone. In no other way, we are told, is it possible for two friends or commercial correspondents, who are separated, whether near or far, to inform each other of their family matters or trade secrets.

TELEPHONE AND TELEGRAPH MONOPOLY.

"*La Legislation Télégraphique d'après les documents officiels.*" (Bureau Internationale de l'Union Télégraphique, Berne, 1921, 1,064 pp.)

This useful compilation, which contains a digest, and in many cases the text, of the telegraphic and telephonic laws of forty countries, we do not propose to review in the ordinary way, but rather we shall attempt to extract from it some facts and data for the instruction, and, if possible, edification of our readers. It covers the whole field of telegraphic legislation, dealing with monopolies, sub-licences, royalties, wayleave rights, protection of lines, etc., and would prove an invaluable basis for a comparative treatise of the practice of state telegraph administrations. Over 160 pages are occupied by the enactments of the United Kingdom, ranging from the Telegraph Act of 1853 to the Acts of 1899, 1904 and 1907.

"The study of British legislation in telegraphic matters," says the compiler, "is of particular interest by reason of the special conditions to which the telegraphs of the United Kingdom have been successively submitted in their origin, in their development, and in their transfer. In Continental countries this new mode of communication having been instituted by the State from the beginning, legislation was obliged to regulate the principal conditions of its establishment and working in a more or less complete manner. In England, on the contrary, where the establishment of the telephone was long left to private industry, the legislative authority did not have to intervene until the service had attained to a considerable development when in the general interest the State judged it useful to assign it to the Post Office." Then, accompanied by explanatory paragraphs, follow excerpts from the various acts bearing on the purchase of the telegraphs, the establishment of the monopoly, the protection of lines, and the purchase of the telephones.

The compiler records the Attorney General's judgment of 1880 that "the telephone is a telegraph in the sense of the laws of 1863 and 1869." It is interesting to note that this opinion was not confined to British lawgivers. Immediately after the invention of the telephone, the German Government announced their opinion, maintained ever since, that this means of communication was a subgenus of telegraphy and within the competence of the Empire. This was confirmed by the law of 1892 in which it was expressly stated that the expressions "telegraphic establishments" comprised also telephones. In France it was held that the laws which conferred a telegraphic monopoly on the State referred not only to electric telegraphy, but to all distant transmission by signals by any means whatsoever. Concessions were granted to companies in 1879 to

establish telephone systems in Paris, Lyons, Bordeaux, and Marseilles, but a law was passed in 1889 authorising the purchase of these systems, since which date the telephone has been a state monopoly. The Belgian Government also claimed that the telephone service came under the telegraph law of 1876. On the invention of the telephone they authorised the construction of telephone lines at the demanders' risk and peril under payment of a tax, and in 1883 their monopoly was fixed by law. Certain exchanges were constructed by licensees and repurchased 1893-96, and others were exploited by the State itself. In Austria, also, where telegraphic monopoly was conferred by a law of 1847 the telephone service was first established by licensees and acquired by the State 1893-95. In Switzerland the law of 1889 decreed that the exploitation of telephones formed part of the telegraphic service (monopoly conferred in 1851). In Russia the law of 1881 lays down that telephonic communication forms part of the telegraphic monopoly (conferred by the law of 1855). In Sweden there is neither a telegraphic nor a telephonic monopoly, but a law of 1906 provides that no company or person may establish telegraphic or telephonic communication on crown lands, public roads or railways without royal sanction. The telegraph and telephone service is, however, chiefly in the hands of the State. As regards Denmark, an Act of 1897 permits the Minister of the Interior to grant telephonic and telegraphic concessions of a maximum duration of 20 years.

State telegraphic monopolies are of long-standing in Europe. That of Austria dates from 1847, Belgium from 1850, France from 1851, Switzerland 1851, Sardinia 1853, Russia 1855, and Great Britain 1869. Telegraphic communication was regulated by the State in Holland as early as 1852 and in Prussia and the North German States before 1851. By the year 1853, therefore, the lines of all the States of continental Europe which possessed a telegraphic system of any importance (i.e., France, Belgium, Holland, North and South Germany, Austria, Northern Italy and Switzerland) were under State control.

As we have shown, this monopoly was generally held to include the telephone, when that means of communication was introduced to the public. In some countries the telephonic monopoly was specifically confirmed by subsequent legislation, in others not.

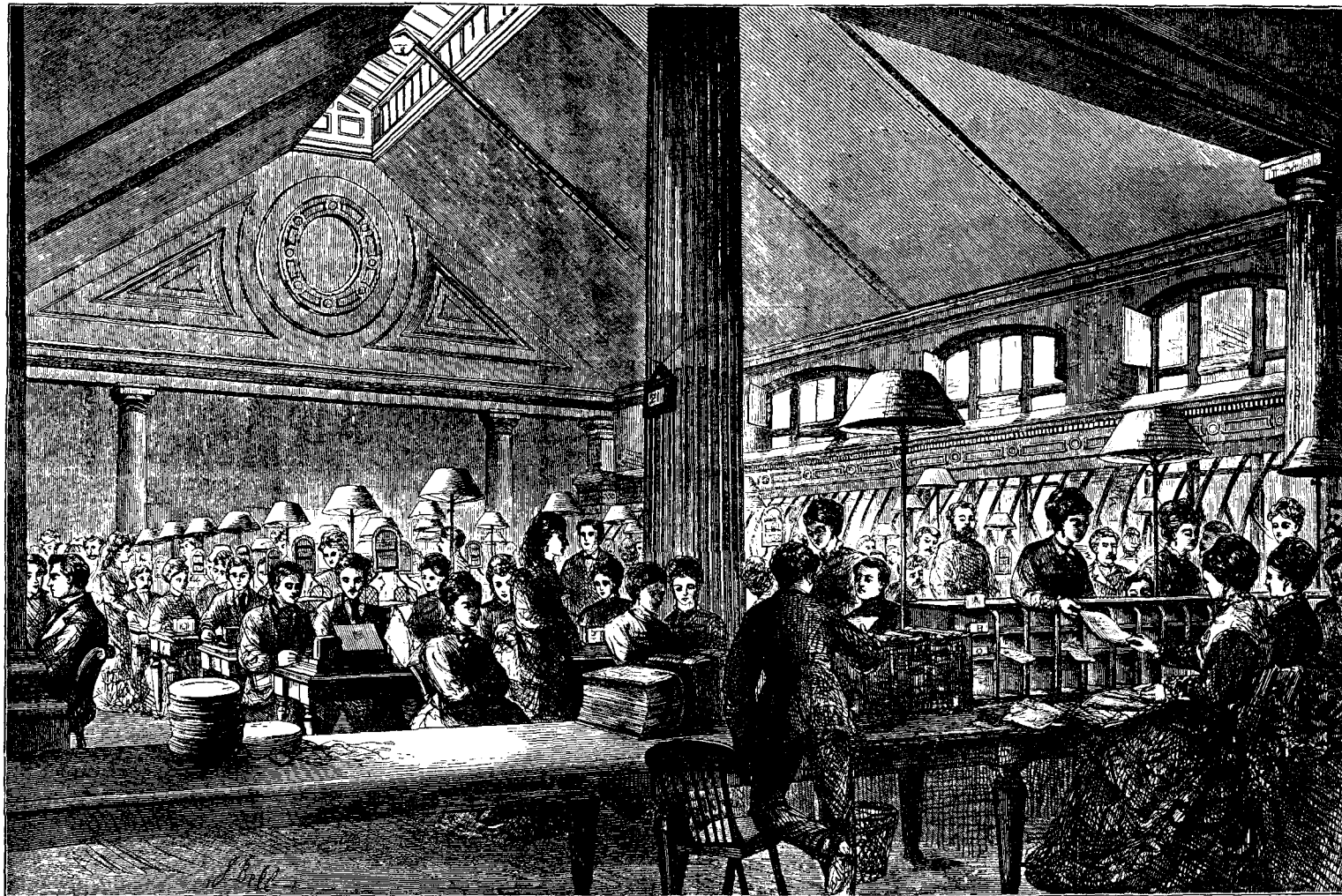
We detect one small error in the book. Municipal boroughs are defined in a footnote as boroughs having the right to return members to Parliament. Many municipal boroughs do not, and never did, even before the days of the Reform Bill, return members to Parliament; some parliamentary boroughs are not "incorporated," and the boundaries of several towns which are both corporate and parliamentary boroughs are not coterminous.

W. H. G.

POST OFFICE WORKMAN CAPTURES HOUSEBREAKERS.

Prompt action on the part of a gang foreman recently led to the capture of two housebreakers in a South-West suburb. The foreman, hearing cries for help emanating from an adjacent garden, hastened to the spot to find an old gentleman bleeding from an injury to the head and to learn that the injury had been caused by a brutal attack from two housebreakers who were still at their nefarious work in the premises. The foreman notified the police from a nearby telephone, and commandeering the assistance of a passer-by, returned to the house just in time to grapple with one of the housebreakers who was escaping by the back entrance. They trussed him up with a clothes rope conveniently at hand, and, with zeal whetted by this preliminary success, waited for the second housebreaker, who now had jumped from an upstairs window on to the kitchen roof. On seeing the plight of his "pal," however, this second man retreated to the house, but observing at this moment the arrival of fresh reinforcements in the shape of the police he was wise enough to surrender.

The irony of the whole thing, so far as the foreman is concerned, lies in the newspaper report of the subsequent Police Court proceedings. In this report the constable effecting the arrest is stated to have said "I arrived at the house in time to capture Jones as he ran out of the door. He struggled and I tied him up with rope. I then saw Williams rush out of the door and with assistance arrested him." Unfortunately, the gentleman who knew the real facts was unable to appear owing to the extent of his injuries.



(From the "Illustrated London News," Dec. 12, 1874.)

THE CENTRAL TELEGRAPH OFFICE: INSTRUMENT GALLERY.

THE CENTRAL TELEGRAPH OFFICE IN 1874.

WE reprint some interesting pictures of the Central Telegraph Office as it was in 1874, which appeared in the *Illustrated London News* of Nov. 28 of that year. The following excerpts from the accompanying text throws some light on the number of staff and volume of traffic in those days:—

The Central Electric Telegraph Establishment at the General Post Office is one of the most admirable results of administrative organisations for business, and of science applied by an apparatus of exquisite precision to the needs of social life. We have great pleasure in setting before our readers a few illustrations of the machinery and the methods here employed for the most rapid transmission of intelligence between all parts of the United Kingdom, and for its communication, also, to the submarine and foreign lines. Before attempting to explain the subjects which our artist has drawn, we would thank the official gentlemen of this department—especially Mr. H. C. Fischer, the controller—for the opportunity lately granted us of making a personal examination. It would be superfluous to comment or to congratulate any of them upon the beautiful order and wonderful efficiency with which everything there is arranged and conducted.

The large and handsome new building in St. Martin's-le-grand, at the corner of Newgate Street, facing the old building of the General Post Office, was shown in an illustration we gave some time ago. Its upper portion is occupied by the collective staff and instruments of the Central Telegraph Station, removed in January last, but with great additions, from their old quarters in a lane off Moorgate Street, near the Bank of England. There are 1,240 instrument clerks, of whom 740 are females, and there are about 270 messengers. This does not include the engineering staff, or that of the Controller. Between five and six hundred instruments are here kept at work, and the wires therewith connected within and beneath the building have an aggregate length of nearly three hundred miles. Besides this electric apparatus there are twenty-six lines of pneumatic tube, with air-pumps worked by three powerful steam-engines, for conveying messages bodily,

by means of atmospheric power, between the principal City offices and the West Strand office, opposite Charing Cross Station, and the Central Telegraph Office. . . .

To this gallery, on the third floor, we now ascend by the wide staircase, enjoying by the way, the ample provision for clear light and fresh air, and the cheerful aspect of the whole interior. The instruments, of various kinds and uses, occupy a great central hall with four wings, one at each corner. These it will be convenient to mention as the north-east and south-east, the north-west and south-west galleries. The north-west gallery is for messages to and from Scotland, the north of England, and Ireland. The south-west is partly devoted to newspaper despatches and reports, and to the special "racing circuits;" the extra force of spare instruments, on Wheatstone's automatic system, is placed here, for use on particular occasions. The two eastern galleries are mainly occupied by the metropolitan telegraphs. They contain 263 instruments, of which 21 are duplex, 101 Morse printers, and 100 single needles. The central hall contains the instruments which are connected with the different provincial circuits of England. The provincial telegraph business employs 205 instruments at the Central Office; and of these 57 are Wheatstone's autmatic, 20 are duplex, 7 are Hughes's type-printers, and 97 are Morse printers. But on the south side of the central hall are the pneumatic dispatch-tubes for sending telegrams bodily, through an underground tube, to or from the more important London offices. On the west side is a tall and wide frame called the test box, exhibiting in its front a great number of metal knobs and wires; these afford means of establishing an electric communication with any station throughout the kingdom. They derive their power from 4,000 cells in the Battery Room. The battery test box, above referred to, and the sympathetic clock, with the chronifer, or regulator of clocks, are situated also here, between the two western galleries. The total floor space is 20,000 square feet; the mahogany desk space extends in length three-quarters of a mile. Mr. H. Eaton, as superintending engineer, is in charge of all the instruments on this floor. We are indebted to one of his staff, Mr. T. Hill, for much assistance in preparing this account.

It is a cheerful scene of orderly industry, and it is, of course, not the less pleasing because the majority of the persons sitting here are young women, looking brisk and happy, not to say pretty, and certainly quite at home. Each has her own instrument on the desk before her. She is either just now



Single Needle.

Automatic.

Old Double Needle
or 'Cottage'

Higley's Type Printing.

Pneumatic Puncher.

B.C.

Galle's Water.

American Sounder.

J. Bell.

actually busy in working off or in reading some message, or else, for the moment, she awaits the signal, from a distant station, to announce a message for her reception. Boys move here and there about the galleries, with the forms of telegrams which have been received in one part of the instrument room, and which have to be signalled from another, but which have first to be conveyed, for record, to the nearest of the check tables and sorting-tables in the centre. Short pneumatic tubes facilitate the distribution and collection of papers in this building. The total number of messages daily received or sent at this Central Office is from 26,000 to 30,000. But of these a very large part, 17,000 or 18,000, are transmitted through the central office from other offices, and have to be repeated and forwarded; so that, in each case, there is the work both of receiving and despatching, though each is counted but as a single message. In addition to the number above stated, newspaper telegrams and reports, often lengthy, are sent through this office, more especially during the night. The female instrument-clerks do not remain for the night work, and their labour does not exceed eight hours a day, with half-an-hour allowed for dinner, which is comfortably provided for them in their own dining-hall. Five or six thousand of the day's messages are transmitted to or from the Anglo-American, the Eastern, the Northern, the Indo-European, the Submarine, and other foreign lines. Three thousand a day, on the average, are messages within the London district. The markets, the Stock Exchange, the races that may be going on, and other business of the day, communicated at once to all the chief towns in the United Kingdom, give some hours' employment to many instruments in the morning and afternoon, besides all sorts of private messages. In the night work of newspaper reporting, which begins at eight o'clock in the evening and continues two or three hours after midnight for the morning papers, 200,000 or 300,000 words are not unfrequently telegraphed to the provincial press. The heaviest task of newspaper-reporting telegraphy yet done was on a Budget night in Parliament, to the amount of 427,000 words.

SELECT COMMITTEE ON TELEPHONE SERVICE, 1921.

RESUMÉ OF EVIDENCE.

April 6.—Sir EVELYN MURRAY, the Secretary of the Post Office, was the first witness called. After giving a short historical survey of the Telephone Service, he explained how the engineering programme had been delayed by the war and the delay in completing exchanges and connecting subscribers. He quoted figures showing that the London service was practically restored to its pre-war efficiency. He explained the method of registering calls in force, which had satisfied the London Chamber of Commerce and the Merchants' Association of New York. Sir Evelyn then gave figures of the increase of wages since the war and turning to the new telephone rates, he stated the objections to flat and measured rates. He furnished a list of countries where the flat rate has been abolished and condemned, and gave a sketch of the organisation of the telephone service.

On April 11, Sir E. MURRAY resumed his explanation of the organisation of the Post Office Administration, and gave further information as to war bonus and pension liability. Sir HENRY BUNBURY (Comptroller and Accountant-General) accompanied by Mr. F. J. PEARSON, then gave evidence on telephone expenditure, depreciation fund, life of plant, and wages, explaining to the Committee the maximum wage paid to telephonists. He said that the scales of pay for labour in the Post Office was "not widely out of relation to what the Ministry of Labour report about industry in general."

On April 13, Sir HENRY resumed his explanations of overhead charges, renewals, depreciation and wages.

April 18.—Mr. H. C. ROBBINS, of the Press Association, was examined. He stated the case for the large user and gave figures showing the increase which a subscriber making 5,000, 6,000, and 10,000 calls would have to pay under the new rates—in the case of London 94, 123, and 242 per cent. respectively. He complained of the abolition of the flat rate, and the diminution of the London area, and the increase of the trunk rates. He also gave his views on the carrying capacity of a line, and quoted an opinion that the National Telephone Co. was more business-like than the Post Office. He had, however, never joined in denunciation of the Post Office service, which he thought was as good as that of the National Co. He suggested an all-round percentage addition to the present rates. He thought the trend of the Administration was to restrict use, and that one supervisor to eight telephonists was too many.

On April 20 Mr. C. R. S. KIRKPATRICK gave evidence on behalf of the Port of London Authority, opposed the abolition of the flat rate, and complained of the enormously increased cost of the service to the Port Authority. He claimed that Tilbury, which was part of the Port of London, should not be excluded from the London area, even if the loss involved had to be borne by other subscribers.

April 27.—Sir WM. NOBLE, Engineer-in-Chief of the Post Office, accompanied by Major PURVES, was examined. They described to the Committee the division of work in the Engineer-in-Chief's office, the scope of the Research section and the encouragement given to inventions. After showing how that office kept in touch with progress in foreign countries, they explained the costs in which the new rates are based, and why the cost per call was practically the same in the case of large and small users. The recent development of thermionic valves was mentioned, but it was pointed out that they could

not be used with advantage on light temporary lines erected for Admiralty purposes during the War. The relation of cost to development was explained, and information given on the cost of switchboards.

On April 28, further information was supplied on Organisation and Research Work. The question of a fall in prices and wages was considered, and the Committee were assured that the rates would fall when costs came down. The Chairman commented on the ratio of the wages paid to skilled workmen and to telephonists. The system of dealing with correspondence was explained, and information was given to the Committee regarding automatic exchanges, the loss on the trunk lines, the debiting of Post Office accounts with war plant, and the possibilities of rural development. It was stated that American farmers run and maintain their own lines, which could thus be done more cheaply than by sending men from distant towns to do the work. Major Purves doubted whether it was practical politics to allow farmers to run and maintain their own lines here and whether farmers would rise to the occasion.

On May 2, the Engineer-in-Chief's evidence was continued. Major PURVES dealt with cases of alleged waste of time by Post Office men, who, according to communications which had been received, were employed in large numbers to carry out small jobs. Satisfactory explanations were given in all cases, the fact being that besides the Post Office men present there were employees of Gas and Electric Light Companies, of private contractors, or of the London County Council engaged at the points about which complaints were made. Sir WM. NOBLE gave figures of the cost of automatic and manual exchanges, and explained how cost of work executed by the Post Office was checked by the cost of outside tenders. He gave further evidence of the ratio of costs to development and on the subject of depreciation.

On May 4, Mr. T. S. BROWN and Mr. W. B. SMITH were heard on behalf of the Glasgow Corporation. They suggested the return of the Glasgow system to the Corporation, and gave their opinion that they could afford service at a £5 rate rental plus 1½d. a call. They confessed that they had taken no expert opinion but thought that, despite the enormous rise in prices, it should be possible to give service at that rate. The Chairman in summarising their evidence said that it was based on opinion rather than on substantial facts, and that their experience was born of different conditions from those at present existing.

On May 9, Mr. A. J. HOBSON and Sir A. SHIRLEY BENN gave evidence on behalf of the Association of Chambers of Commerce. They suggested transferring the Post Office system to the care of a Telephone Authority, but had not any detailed scheme to offer the Committee. They thought the large user should be charged at a more favourable rate than the small user, because "the proportion the latter makes of the user of the capital is less." It was explained that the traffic of great and small subscribers was so distributed on the board that each operator dealt with the same amount and therefore that the cost of operating all calls was the same. Mr. HOBSON, however, claimed that the cost of handling calls was not confined to switch-board work. Sir SHIRLEY BENN suggested that ample funds ought to be provided for the research department.

TELEGRAPHIC MEMORABILIA.

THE following extract from the "Current Topics" of our contemporary *Electricity*, should prove interesting to every reader of these pages. The warning note in the lines which I have taken the liberty of italicising is much needed at the present time when each and every boasted stunt is hailed as a practical success applicable to every-day working and conditions. One has no desire to belittle the results of effective organisation added to those of months and even years of study and research. It is well, however, that the really scientific press should at least raise a warning finger against that type of advertisement which leads the general public to expect the results of the latest developments of the laboratory and those of carefully nursed experiments to be available for common every-day use a week or two after their announcement. "Elektron" the writer of the paragraphs, says:—

"The recently reported 5,500 miles telephone conversation, although a typical American "stunt," is, nevertheless, of historical interest as demonstrating what the future may hold in the way of transcontinental and international telephony. Given the necessary organisation, apparatus, and suitable cable connexions there is now practically no limit to the possibilities of telephoning half round the world. Wireless can bridge the gaps left in air and cable routes, whilst the thermionic valve repeater provides the necessary additional energy at intermediate points to boost up the initially feeble telephonic currents. It must not, however, be inferred that these facilities for long-distance telephony will soon be available to all telephone users who care to pay the special trunk fees, which would have to be very heavy indeed to cover the enormous cost of such an organised scheme as that above referred to.

"It is a comparatively simple, though expensive matter for a powerful organisation like the American Telephone and Telegraph Company to pre-arrange a set of conditions along its various air line and cable routes extending across the Continent so that theoretical possibilities, worked out in the laboratory in detail, can be put to actual test as indicated. Such an experiment involves whole-hearted co-operation between all the responsible officials along the route, and a good deal of preliminary experimental work at the various links to

ensure success on the date fixed for the demonstration. Great credit is due to Colonel Carty, vice-president and chief engineer of the company, and his staff of assistants for their achievement, and when in later years, perhaps, we speak in London to our friends and business confrères at Johannesburg, Bombay, or Hong-Kong, we shall have the A.T. and T. to thank for the inception of the idea."

It is gratifying to discover that in matters electrical and engineering this country is still able to lead the way, at least along certain well-defined directions. The *Manchester Guardian* recently stated that according to Mr. Pearce, chairman of the Manchester Electricity Committee, and City Electrical Engineer, who had paid a visit of careful enquiry into the large electricity generating stations of the U.S.A. on the spot, these large generating sets have not been a complete success, and there is a tendency to proceed more slowly and generate with sets of a lower capacity. Consequent upon this visit the responsible engineers of Cottonopolis have decided to continue with the Barton scheme as already designed, without practically a single change, certainly without alterations of a fundamental character.

It may be accepted perhaps as a sign that the writer is approaching the stage of sere and yellow leaf, but taking all risks of this character, one is fain to admit one's leaning towards the pensioned officers of the telegraphs together with that interest in the manner in which they spend the evening of their days. Two letters are in front of me. Both indicate hobbies not easily equalled. Says one, "I am busy with Latin just now, picking up the threads. . . It has always been my dream to read Horace and Catullus in the original." The other, with his heart still interested in telegraphia and his study of and interest in astronomy still unabated, interrogates:—"Have you or Marconi heard anything of the Martians, or Lunarians or Saturnians yet? Why not try wireless to Orion? It would only take 100,000 years to obtain a reply to your first signal, that is, taking the velocity of electricity to be approximately that of light, about fifty thousand years on the outward journey and the same on the return. There would be quite a comfortable time in between to go out and obtain a little light refreshment!" I have taken the trouble to check these figures and staggering as they may appear they are without doubt well within the most modern estimates. Sir Norman Lockyer says that the time taken for light to travel from the Orion constellation (light and electricity may be considered identical in speed and somewhere in the neighbourhood of 11 to 12 million miles per minute), "cannot be less than sixty thousand years."

It is understood that the re-decoration and restoration of the home of the Institution of Electrical Engineers on the Victoria Embankment are rapidly approaching completion. One looks wistfully towards the possibility of the London Telephone and Telegraph Society resuming their monthly meetings in one of its commodious halls, so well adapted for gatherings of this and kindred character.

From my South African post-bag it is gathered that no less than seven illuminating systems were tried in the Cape Town C.T.O. before a satisfactory one was obtained. Kimberley reported that a satisfactory system had been tried at that office, but had been dismantled owing to its high cost.

The telephone and not the telegraph was responsible for the following on the day of the Football Final: "The King shook his feet in the sand," which, being translated, dear readers, meant, "the King took his seat in the stand!" It must have been the same telephone which directed an adjutant to "Arrest Private Jones, 21421, have some tea, report, &c." "Absentee" being the term by which the three more hospitable words had been supplanted.

Readers will doubtless have noted the new feature of the Calendar of Coming Events which commenced in last month's issue, page 130. Secretaries of Post Office educative, social, philanthropic and recreative organisations would oblige by furnishing a one-line announcement by not later than the 15th of each month prior to the nominal date of publication.

The retirement of Mr. Tinson was referred to in last issue by those specially connected with the telegraph school in which sphere he so ably completed the closing term of his service. It will surely not be amiss, though slightly belated, if on behalf of the many friends and colleagues in the wider sphere of the C.T.O. itself expression is here given to the goodwill and best wishes which follow him into retirement.

La bénédiction nuptiale était donnée en l'anglais de St. Laurent Anvers à 11 heures le 20 Avril 1921 au mariage de Albert (fils de Monsieur et Madame Collignon) avec Mademoiselle Adrienne Anthonis.

Regret is expressed that direct telegraphic communication between London and Rome should be interrupted even temporarily, and it is hoped that this important line linking up the two capital cities will ere long be re-established.

The *Court Journal* for May 13 announces that the following officers lately attached to the C.T.O. have been authorised to receive the Imperial Service Medal, viz. :-

Messrs. Louis V. Desous and William G. Foord, Overseers; also Messrs. Archibald H. Hunter and Albion G. Tomkins, Telegraphists.

The *Electrotechnische Zeitschrift* gives the following interesting items regarding some of the latest practical developments of wireless telegraphy. During recent wireless trials with the high-speed Siemens printing telegraph system between Berlin and Leipzig, which covered a period of five hours, all the available traffic between these two cities was disposed of. The rate of working during this period attained the remarkable figure of 120 telegrams per hour. The length of the telegrams is not stated. The same journal notes that a very powerful wireless station has been erected at Banjica near Belgrade, Yugoslavia, and that the Japanese Government has constructed a high-power station at Haranomachi, Fukushimaken for a projected communication with the U.S.A.

According to the *Journal Télégraphique* of Berne, the Swiss Government is arranging to erect a powerful station at Münchenbuchsee, near Berne, with a range of 2,000 kilometres. The station will be exploited by a private company, the Government assuring the latter a sum sufficient to pay interest at the rate of 6 per cent. on the capital involved. If, however, the profits permit of a higher dividend than this figure the company is under an obligation of sharing the surplus with the administration.

By a curious coincidence, in the same journal it is noticed that the number of periodicals reviewed dealing with telegraph and telephone subjects and written in the English and German languages, is exactly equal. In the case of our own tongue this includes the U.S.A., and in that of Germany includes Austrian issues. France comes next on the list, but includes Belgian publications.

Herr K. W. Wagner, in *Elektrotechnik und Maschinenbau*, gives some interesting particulars of experiments which he carried out for the German Government in 1919 on the 400 kilometre Berlin-Hanover circuit, in which utilising high-frequency currents (i.e., of a frequency of 100,000 and over) successful trials whereby three simultaneous conversations were rendered possible over the same pair of telephone wires. High-frequency multiplex telegraphy is also being developed, Siemens at a speed of 800 to 900 words per minute being used. It is stated that between Berlin and Frankfurt six telegrams were simultaneously dealt with over the ordinary single conductor circuit. It will be recalled that Squier of the U.S.A. has been independently working on this subject for some years with no small measure of success, as also Rühmer in Germany.

A small delegation from the Belgian telegraph administration visited the C.T.O. London during last month and spent a whole week with us, observing investigating and noting the special telegraphic features of that great centre. They were evidently pleased with their visit, and it is hoped that they have taken back with them information which will prove of unmistakable utility to their industrious and enterprising country. J. J. T.



(Photo by W. Paige Stuart, Bedford.)

THE POSTMASTER-GENERAL RETURNING THANKS AFTER HIS ELECTION AT BEDFORD. MRS. KELLAWAY IS ON HIS RIGHT.

CALENDAR OF COMING EVENTS.

- June 1.—Cricket. Secretary's Office v. Office of Works at Crystal Palace.
- " 8.—" Cable Room v. Civil Staff Police, Paddington.
- " 8.—Re-union of Pensioned Colleagues and Friends (C.T.O.) Kew Gardens Main Gate, 2.45 p.m.
- " 9.—Cricket. Centels II v. Cable Room. Dulwich Park.
- " 11.—Civil Service Athletic Sports (54th Annual Meeting) Stamford Bridge, 3 p.m.
- " 14.—Cricket. Cable Room* v. Stock Exchange. Dulwich Park.
- " 16.—" Secretary's Office v. Alexandra Park at Alexandra Park.
- " 19.—Belgrave Social and Athletic Association L.T.S. Char-a-banc trip to Tunbridge Wells.
- " 22.—Cricket. Secretary's Office v. Slough at Slough.
- " 22.—" Cable Room v. South Suburban Co-op. at Dulwich Park.
- " 28.—" Cable Room* v. News Division at Dulwich Park.
- " 29.—" Cable Room v. Central VI at Dulwich Park.
- " 30.—" Secretary's Office v. C.T.O., on C.T.O. ground.
- July 6.—" Cable Room v. Elmers End, at Elmers End.
- " 7.—" Cable Room v. S.E. & C.R. at Catford.
- " 11.—Manchester Post Office Sports at Belle Vue. Competition for "J. D. Williams" Cup and "Hulton" Cup.

* C.T.O. League.

LONDON ENGINEERING DISTRICT NOTES.

Engineering Department Dinner.

THERE are two classes that attend public dinners—those who go for the sake of the dinner itself, and those who go to enjoy the words and music and to greet old friends. Both classes were amply catered for at the Annual Dinner of the Engineering Department held under the Chairmanship of Sir W. Noble at the Connaught Rooms, on April 22. An excellent dinner, excellently served, a musical programme not too long to risk the charge of tediousness, and interesting speeches combined to make a very pleasant evening.

The toast of the Post Office Engineering Department was proposed by the Right Hon. Pike Pease, M.P., in his usual fluent style, and seconded by Sir H. Bunbury, K.C.B., and was replied to by Sir W. Noble. The toast of the visitors was proposed by Mr. A. Moir, O.B.E., who, in a very pleasing speech, skillfully worked in appropriate references to the principal guests present. Mr. L. B. Atkinson (President, Institution of Electrical Engineers) replied on behalf of the visitors. The sterling qualities of Sir W. Noble were gracefully alluded to by Sir E. Murray in proposing the toast of the Chairman. The gathering afforded a welcome opportunity to members of the P.O. Engineering staff to greet old friends from other branches of the Service and profession and from commercial undertakings with which the Post Office have business relations.

A Common Sense Decision.

The chief impression gained in listening to Mr. Crum's paper on "Some Features of the American Telephone Service" on April 18, was that the conditions in the United States of America all favour the use and development of the telephone as a means of communication. We were told that even the charlady loses caste unless she has a line. The chief difference between America and this country appears to be that whereas in the former everyone does his utmost to facilitate the development of the telephone service, in the latter every possible difficulty is put in the way of the business being conducted economically and expanded rapidly. Fanciful objections are raised here to the erection of poles in cases where the cost of underground plant cannot be justified. Apparently in America the presence of poles in the streets is taken as an indication of progressiveness. Incidentally, judging from illustrations in the technical journals, American poles are not always so upright as American citizens.

As an indication of the kind of difficulty met with in this kingdom the following case is quoted:—

A pole had stood for 10 years on a piece of waste land in a London suburb. The freehold of the land changed hands and an application was made immediately by the new owner for increased payment on the score of the depreciation of the value of the sovereign. As the Department would have been put to heavy expense to move the pole, and as the owner of the land was apparently suffering no loss by its presence, the case was taken to arbitration and was heard on April 27. The Judge was in sympathy with the Department's efforts to keep down working costs and ruled that as the freeholder was not suffering any apparent loss through the presence of the pole on his land, the rental would be reduced to a purely nominal sum, and the costs borne by the wayleave grantor. In summing up the judge paid tribute to the very fair and courteous manner in which Department's officials had dealt with the matter. When laying plant the first considerations of the Department are efficiency and economy. Although the maintenance charges are less for underground than for overground plant, other factors come into play which militate against the use of the former in all cases. Whenever the prospective development is such as to justify the high first cost of underground being incurred this type of plant is laid. When it is clear that the financial advantages are in favour of overground plant then the Department looks to the local authority or owner of the soil to co-operate in forwarding the national work of providing an efficient service at the lowest possible outlay by granting the necessary facilities without attempts to impose onerous conditions. If such co-operation is not forthcoming the American standard of one telephone per eight inhabitants will never be reached in this country.

Excavations in Ludgate Hill.

Although the lot of the engineer who endeavours to find space for telephone pipes in the congested streets of London may not be a very enviable one, yet there are compensations, especially to one who has a taste for history or archaeology. Some of the "finds" are exceedingly interesting. These finds include Saxon, Roman, and early English relics.

Ludgate Hill has just been opened in order to lay additional pipes, and at a depth of twelve or fourteen feet the surface of the original Ludgate Hill was discovered. It was paved with large stones which bore unmistakable evidence of having been rounded by running water. At the bottom of the hill was revealed a stone arch which evidently formed part of the bridge which crossed the Fleet River at this point. Remains of old houses were also found, and there is reason to think that subsequent to the Great Fire the level of the road was raised by filling in the debris of the destroyed houses.

It is rarely that a street is opened within half a mile of Ludgate Circus without revealing some objects which take the mind back to the days when London was a small town constructed in the midst of a swamp. Pictures are conjured up of Romans striding haughtily past crowds of half-naked and sullen islanders or of dandies with slashed doublets and silken hose picking their way daintily through streets filled with garbage. From time to time human bones are discovered, showing that what is now a busy and prosperous thoroughfare was once the site of a churchyard or cemetery. The thought irresistibly occurs, "Can these dry bones live?" If it were possible to

breathe life into these old bones to rehabilitate them in warm living flesh. to clothe them and then to conduct them to a modern telephone exchange, there would soon be another death from shock, even if our mediaeval friend survived the journey on a vehicle without the need of horses, the only perceptible means of propulsion being noise and smell

Power Supply for Telegraph Offices.

The cost of maintaining primary cells for working busy telegraph sets is a serious item, and in order to reduce this cost a scheme is just being completed for supplying offices within a short distance of the G.P.O. West with power from the C.T.O. For this purpose a six-core rubber-covered and lead-sheathed cable has been laid in the Fleet Street area on the ring main system. The voltage of the supply is 40, 80 and 120 positive and negative. Switches have been inserted at suitable points so that if a fault should develop the section affected can be isolated without interfering with the supply to other sections.

Pneumatic Tubes.

There is a "certain liveliness" in the pneumatic tube schemes just now. A tube has recently been completed between the C.T.O. and Mt. Pleasant. This tube is suspended from the roof of the tunnel which has been constructed for the purpose of carrying mails. A number of other schemes for the extension of the pneumatic tube system are also being dealt with.

Electrophone Service.

In most services there are occasions when abnormal demands are experienced. Sunday, May 8, proved to be such an one at the Electrophone Exchange. The reason was that Madame Melba was singing at the Albert Hall. Thanks to the thermionic valve amplifier no less than 600 subscribers were enabled to listen to the famous singer.

Everyone who knows the Managing Director of the Electrophone Co., Mr. H. J. S. Booth, will learn with regret that he is at present dangerously ill, having some 13 weeks ago had a stroke causing paralysis of the left side. The doctors are hopeful of his recovery. It is the wish of his friends that he will be back at business in completely restored health in the near future.

Wireless Installations.

Reference was made in the March issue of this JOURNAL to the installation of a demonstration set at the District Apparatus School, Denman Street.

An aerial has now been erected on the roof of the Superintendent's Engineer's Office, and the apparatus is now in operation.

Those officers selected to undergo the course of instruction are greatly appreciating the privilege.

Post Office Engineers as Public Speakers.

Sir William Noble's paper was read and discussed before a crowded audience at Manchester recently, and a writer in the *Electrician* in commenting on the discussion states:—

"The fluency of speech of many Post Office Engineers was a feature of the discussion, ascribed privately by one of their number to the practice they have acquired in preparing official minutes, or is the real reason the necessity they have been under recently of explaining the shortcomings of the telephone system."

Post Office Engineers have nothing to apologise for. The reason for this fluency is well-known to the engineers themselves.

An Echo of the Strike.

During the strike one supervising officer received the following laconic message:—

"Sorry cannot attend to-day. Have not arrived home yesterday."

SECRETARY'S OFFICE CRICKET CLUB.

The captain for the present season is Mr. G. O. Wood, the vice-captain Mr. P. P. Cove, and the secretary and treasurer, Mr. F. J. Pearce. The club is at present without a ground, but hopes by the middle of June to be in possession of one at Walthamstow within half-an-hour of the office. The first match was played at Richmond on May 11 against the Ministry of Labour and won by 7 wickets.

<i>Ministry of Labour.</i>		<i>Secretary's Office, G.P.O.</i>	
Ashford, c. Brodie, b. Reed	... 13	P. P. Cove, c. —, b. Fricker	... 5
Philipson, c. Buckland, b. Hambridge	... 0	C. G. Bray, b. Fricker	... 5
Prodger, b. Reed	... 2	J. W. Hambridge, c. —, b. Fricker	... 26
Wigg, b. Reed	... 3	T. G. Reed, b. File	... 10
Fricker, b. Reed	... 0	H. G. G. Welch, b. Fricker	... 0
Birch, b. Cove	... 3	M. Brodie, not out	... 17
Nix, R., c. Hambridge, b. Whiffen	2	D. O. Lumley, lbw., b. File	... 0
File, b. Reed	... 16	J. Whiffen, b. File	... 2
Nix, G. E., b. Reed	... 0	E. Buckland, b. Philipson	... 7
Turtill, not out	... 1	F. W. Allan, did not bat	... —
Hayman, c. Cove, b. Reed	... 3	F. J. Pearce, did not bat	... —
Extras	... 4	Extras	... 30
	47		102

Reed took 7 wickets for 15 runs.

WHERE TO STAY.

The attention of our Readers is directed to the following list of Boarding and Apartment Houses.

BRIGHTON.—Rusthall Boarding Establishment, 11-12, Cannon Place. Central. One minute West Pier. From 2 guineas weekly.

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EASTBOURNE.—“The Polytechnic,” 109-111, Tideswell Road Recommended by Polytechnic, Regent Street. Comfortable holiday home. Seven minutes station. Five minutes pier. Liberal table. Piano. Terms, board residence 5s. deposit and 2 guineas at end of week.

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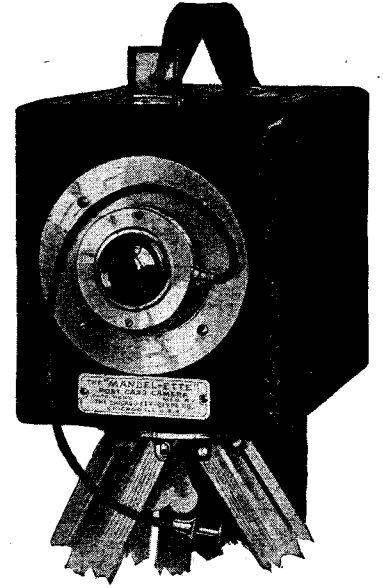
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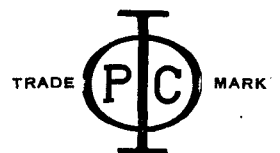
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After tea sweets were distributed and a singing competition was held. Ten little girls and ten little boys selected from at least a hundred applicants competed. A show of hands decided the order of merit, which was suitably rewarded, the boys voting on the girls' efforts and vice versa. The honours generally fell where deserved, but not always. The first prize for boys fell to a nice little boy with ruddy cheeks and a clean blue jumper whose looks were obviously better than his voice.

Amid great excitement the ventriloquist and marionettes arrived, and thenceforward the children were all "eyes and ears." How they laughed and yelled when Robinson Crusoe danced and when the roller skater "came a purler"! How quiet they were when the ventriloquist asked them to nod at him when his dummy endeavoured to pick his pocket!

The giant bonbon, so tastefully prepared by Miss Bigger and her colleagues on the Carter Lane School staff, was next pulled, and the children filed up and dipped for toys in its capacious pockets. An orange and a new penny were handed to the children as a parting gift, and both children and helpers dispersed to their homes feeling that all had had a happy afternoon. The children's cheers and their happy faces were an ample reward for the efforts made on their behalf.

Throughout the afternoon the chief supervisors of the exchanges were present and actively assisted in the entertainment of the children. The funds for the entertainment were subscribed by the exchange staffs in the City District, and the arrangements made reflect great credit upon Miss Ruffy and Miss Cureton, of the Trunk Exchange who, with Capt. Berry, were primarily responsible for the success of the afternoon.

It was intended to give 250 of the older children in the neighbourhood of Canning Town a day in Hainault Forest on May 21, but owing to transport difficulties it has been necessary to cancel the arrangements made.

The funds will probably be devoted to sending the boys and girls to the holiday camps arranged by the Mansfield House Settlement.

INTER-BRANCH GOLF MATCH.

On the kind invitation of Sir Andrew Ogilvie, formerly Second Secretary of the Post Office, 15 officers representing the Telegraph, Telephone, Home Mails, and Foreign and Colonial Branches of the Secretary's Office, joined with him in a golf match on the afternoon of the King's Birthday Holiday. The match took place on the charming Surrey Links at Woking, and resulted in a victory for Sir Andrew's own particular branches—the Telegraph and Telephone—by 3½ points, each match counting as 1 point and a victory on the byes as ¼ point.

The detailed scores were:—

T. and T. Branches. H.M. and F. and C. Branches.

SINGLES.

J. Curran	1½	D. A. Hogg	0
Sir A. Ogilvie	0	H. Darby	1
de G. Gavey	1	D. J. Lidbury	0
R. A. Dalzell	0	Com. E. L. Ashley Foakes	1½
W. E. Weston	1	F. Hardwick	0
T. Mackenzie	1½	W. G. Gates	0
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FOURSOMES.

Ogilvie and Curran ...	0	Hogg and Darby ...	1
Gavey and Dalzell ...	1	Lidbury and Foakes ...	0
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	7½		4½

The outing and Sir Andrew Ogilvie's hospitality were much enjoyed by his former colleagues.

PERSONALIA.

LONDON TELEPHONE STAFF.

Resignations on account of marriage.

- Miss M. A. MANSELL, Assistant Supervisor, Class II, of Putney Exchange.
- Miss E. M. DREW, Assistant Supervisor, Class II, of Avenue Exchange.
- Miss M. E. DAVIES, Telephonist, of Avenue Exchange.
- Miss D. Z. M. CLARKE, Telephonist, of Avenue Exchange.
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- Miss L. R. BEER, Telephonist, of Trunk Exchange.

PROVINCIAL.

Mr. C. A. GATE, Assistant Traffic Superintendent, Class I, Blackburn, was presented by his colleagues with a case of pipes as a mark of esteem on the occasion of his transfer to Norwich as Traffic Superintendent, on April 9, 1921.

Mr. S. A. YOUNG, Contract Manager, Blackburn, was presented with a smoker's outfit on the occasion of his transfer to Belfast as Contract Manager on April 16, 1921.

Mr. W. MORAN, Clerical Officer, District Manager's Office, Telephones, Blackburn, was presented with an attaché case by his colleagues on his appointment to the Customs and Excise at Chester on April 30, 1921.

Miss VASS, who has been for several years in the service of the Elgin Telephone Exchange, was on Thursday, on the occasion of her retirement from night service, made the recipient of a wallet containing £50. Col. C. J. Johnston, of Lesmurdie, who made the presentation, referred in glowing terms to Miss Vass's valuable work.



(Photo by R. C. Whyte, T.N.S.)

THE THREADNEEDLE STREET P.O.

This historic building is about to be demolished and a new office erected. It will be noticed that on the face of the building are the words "Telegraph Station," the names of the four continents, and the name of the Company, "The British & Irish Magnetic Telegraph Company." The encircled globe over the main entrance will be noticed.