THE
National Telephone Journal

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TELEPHONE MEN.

LXIII.—WILLIAM HOWE.

WILLIAM HOWE was born at Cardiff in December, 1865, of English parents resident in the Principality, and was educated at Simpson's Academy and various private schools. As a very young boy he made acquaintance with the depths of some of the busiest and deepest Welsh coal mines, and from earliest childhood was intensely attracted by engines and machinery, especially locomotives and railways—under circumstances of choice no doubt his field of study and labour would have lain in that direction.

Providence, however, shaped his end to a newer development in means of communication. Two years after the invention of the telephone his family were at Bristol and it was here he attracted the attention of the local superintendent of the United Telephone Company, and on Jan. 28, 1881, started his telephone career as a switch operator at the exchange in Mary-le-port Street. One frame of the old Bell slipper board and two operating tables existed, and some idea of the development of that day may be conveyed to those who know the city as the chief provincial centre of the Great Western Railway, by the fact that, on the day Mr. Howe started, the first Great Western Railway line was joined up as No. 90. The line staff were almost exclusively composed of retired seamen. There was only one tariff—a £20 per annum flat rate.

With the growth of business in Bristol Mr. Howe was transferred to be first—and only—assistant to the Bristol electrician. He was now fairly in his element. Each man had to shift for himself in those days, and he proceeded by day work and night study to acquire knowledge and experience and shoulder responsibility in a way that soon gained the absolute confidence of his chief.

In 1883 during the license negotiations the Company were not only prohibited from working their Plymouth Exchange, but, encouraged by this check to the patent holders, numerous firms endeavoured more or less ingeniously to avoid or defy the patents, with the result that the Company had to itself provide an extensive system of private lines to fill in some measure the want of exchange service, and at the same time maintain a service of vigilant "preventive officers" to keep down the infringements. Mr. Howe was despatched to Plymouth and engaged there for some nine months on this work, during the year in which he had the mortification of seeing a constructed exchange stand idle. He was subsequently sent to Portsmouth for a few months on similar work and on returning to Bristol was shortly afterwards placed in charge of the whole of the indoor electrical work. In the meantime the license having been settled a great development began. The Western Counties and South Wales Telephone Company was floated under license from the United, with headquarters at Bristol, and Mr. Howe, as their electrician, soon found his responsibility stretching to the supervision of numerous exchange developments in various parts of the Company's wide territory. Investors were, however, shy of an enterprise that had been held in check so long, and the rush of development outran the supply of capital. Multiple boards were an expensive luxury, and non-multiple boards had to be built locally. In 1888 the Bristol switchboard had to be replaced, and for lack of accommodation the old equipment had to be cleared to make room for a new switchboard, which not only had to be joined up, but actually constructed on the spot. The exchange was closed for a week at Christmas, and a few hours after closing down the switchroom was stripped of everything and there was no exchange in Bristol. Mr. Howe, who was in sole charge, ran the work continuously with day and night shifts, but worked on himself the whole week day and night, and personally made the last connection as the clock struck the re-opening hour on the "appointed day." The new exchange resumed work, and its constructor went to sleep.

On the amalgamation of the companies the Western Counties and South Wales territory was broken up into National provinces

and districts, Mr. Howe being appointed Local Manager at Portsmouth in January, 1893, and during his two years' service in that capacity he had to deal with three snowstorm breakdowns. Early in 1895, on the recommendation of Mr. C. B. Clay, who was in charge of the province, he was appointed District Manager of the Hants and Dorset district, which up to 1901 included Portsmouth and the Isle of Wight. At that time development was practically limited to the larger towns. There was no exchange in the city of Salisbury nor in the Isle of Wight, and trunk communication was limited to a service from the district headquarters at Southampton to Portsmouth, Bournemouth and Winchester.

The introduction of a rectified (electric light) system at Portsmouth in 1896 rendered the Company's earth circuit system practically inoperative after dark, and this started the general reconstruction of the district plant from each circuit overhead to metallic circuit underground. During his charge of the district, Mr. Howe has—whilst developing and constructing the service in the Isle of Wight and the district generally—converted all the earth circuit exchanges to metallic circuit, and put in the underground systems of Portsmouth, Southampton, Bournemouth, Weymouth, Salisbury, Winchester and Poole. Although development and the exigencies of competition necessitated the separation of Portsmouth and the Isle of Wight as a separate district, the Hants and Dorset district as it stands to-day has grown to 44 exchanges and 7,982 stations.

That rapidly developing district has proved a fruitful training ground of telephone men, and the many district and local managerships held to-day by old Hants and Dorset men constitute a roll of honour of which Mr. Howe is justly proud. He attributes his success to a stern sense of duty and self-reliance developed by hard experience and stimulated by the example of such men as the late Mr. Gaine and his successive superintendents, Messrs. C. B. Clay, G. F. Preston and C. J. Phillips. His loyal and hard-working staff have accepted the standard set by their head and the mercenary consideration is one of the least of the ties that has bound his band of workers loyal and true to "The Company and the Telephone."

Close on 31 years of happy toil in the service leaves our subject undisturbed by any unpleasant memories of failure or serious mistake and only chafed by thoughts of "what might have been" had the Company and its staff been unfettered in their business. His aim had been efficiency with economy; is severe on waste and haphazard methods, but loves a conscientious worker who can think and act without an unnecessary word.

In private life he is a lover of nature and sees "books in the running brooks, sermons in stones and good in everything." In his younger days Mr. Howe was keen on all sports, and like his old friend, Mr. Prout, was one of the original Bristol Rugby F.C. team. He holds several medals and prizes for long distance road cycling, is more at home in the sea than on it, is a lover of music, and within his limited opportunities enjoys reading, art, geography, astronomy, horology. In fact, he enjoys everything, but is a slave to nothing except his business.

SOME RECENT ADVANCES IN TRANSMISSION EFFICIENCY OF LONG DISTANCE CIRCUITS.*

BY B. GHERARDI, *Engineer of Plant, American Telephone and Telegraph Co.*

(*Concluded from page 77.*)

IN addition to the changes at transposition points and at bridling points referred to above, it was thought desirable on the first of these loaded No. 8 circuits to use a line insulator that would be more efficient than our standard glass insulator. After a careful study of insulator design and insulator materials, it was decided to try on these circuits a double petticoated porcelain insulator. Tests on these insulators extending over a period of several years have shown that the new insulator is several times as good in wet weather as the standard insulator. Part of this improvement is due to the design of the insulator. Some is attributed to the use of porcelain. An objection to these insulators is that they are not so easy to manufacture uniformly, and that each insulator must be inspected, whereas with glass insulators they may be inspected by sample. These porcelain insulators also cost considerably more than glass insulators.

As a result of applying the improvements described above to our No. 8 circuits, it has been found by measurements and tests extending over a long period that the line insulation was at all times sufficiently good to warrant the loading of No. 8 circuits.

PHANTOMING NO. 8 CIRCUITS.

The problem of the phantoming of No. 8 circuits is one in phantom repeating coil design. To meet the special conditions existing in connection with the phantoming of loaded No. 8 circuits as used in our plant, it was desirable that apparatus should be developed of the highest possible transmission efficiency. In order to do this the ringing efficiency of the phantom coil was sacrificed and special means for ringing through these coils had to be adopted. In this way and by specially designing a coil to meet the circumstances of these circuits, coils that were suitable were developed. The manner in which these coils are used in phantoming a circuit is shown in Diagram 5.

THE LOADING OF PHANTOM CIRCUITS AND THE PHANTOMING OF LOADED CIRCUITS.

Up to very recently, while we knew how to phantom ordinary circuits, it was impracticable to phantom loaded circuits because the loading coils so unbalanced the phantom and so increased its effective resistance that a phantom circuit created out of loaded circuits could neither be made quiet nor made efficient from a transmission standpoint. This problem is one of loading coil design. The reasons why ordinary loading coils were unsatisfactory when used on circuits which were to form parts of a phantom will first be stated.

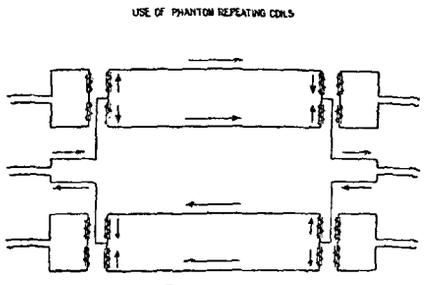


DIAGRAM 5

Diagram 6 shows the arrangement of the windings on an ordinary loading coil. The arrows show the direction in which the current flows in the windings at a given instant and the direction of the corresponding magnetising forces in the loading coil core. If the windings are distributed uniformly over the core, such an arrangement as this produces no external magnetic field. The second part of this diagram shows the same loading coil and the conditions which would exist in it with reference to the telephone current flowing in the phantom circuit. This current, of course, passes in parallel along the two sides of the physical circuit. It will, therefore, magnetise the two halves of the loading coil core in opposite directions. This will produce magnetic poles at the two sides of the core and a great amount of magnetic leakage at these points. The results of this magnetic leakage, which would be different in different cases, would be to make it impossible to get the two side circuits sufficiently alike so as to balance the phantom; would introduce substantial crosstalk due to the stray magnetic field affecting other loading coils, and would bring in serious losses because this stray magnetic field would pass through the solid iron of the loading coil case, bringing in hysteresis and eddy current losses.

In order to overcome this difficulty, it was necessary to devise special arrangements of the windings on the loading coil so that while the coil would still be effective in respect to the current flowing in the physical circuit, the effect of the current flowing in the phantom circuit would be such as not to magnetise the loading coil core. These windings had not only to be balanced magnetically, but also to be so arranged that the electrostatic capacities between the various windings of the coil would not unbalance it. Such

* Reprinted from the *Telephone Review*, New York.

coils were devised and are now in successful use on the New York-Denver circuit.

The phantom produced in this manner is, however, not loaded. It is, of course, desirable to load the phantom in order to obtain the benefits of improved transmission on this circuit also. To do this another coil was devised, the windings of which were so arranged that they would introduce inductance in the phantom circuit without affecting the side circuits.

An important piece of work which it was necessary to carry on in parallel with the work dealing with the wire plant, was the development of a satisfactory cord circuit to be used with these very efficient loaded lines. Very successful results have been obtained in this direction, and a cord circuit has been devised on which the transmission losses are almost negligible. With the new cord circuits the loss brought in on the New York-Denver circuit by the two terminal cords at the toll switchboards at New York and Denver and the two intermediate cords at Morrell Park and Omaha is only 0·3 mile of cable. With the old type of cord circuit these losses were substantially greater. The losses with the old cord circuits were equivalent to making the line from New York to Denver 300 miles longer than with the present arrangement.

While the foregoing touches upon the engineering work necessary to successfully construct a circuit which would operate from New York to Denver, another series of problem arose from the fact that we have not now and could not for many years expect to have traffic sufficient to justify three or even one through circuit from New York to Denver. Plans were worked out by which at certain points one or both of the physical circuits could be cut and made available for way connections without interfering with the use of the phantom on a through connection. Such arrangements are used at several points along the circuit. At other points the physical circuits, and also the phantom, are terminated and are available for connection to any other circuits in the usual manner.

Each of the various functions which we have caused these four wires to perform by the arrangements described above have been obtained in such a manner that no one of them substantially

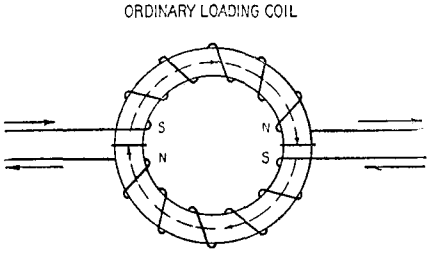


FIGURE 1
Current Flowing in Physical Circuit

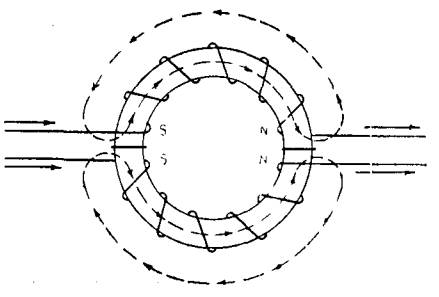


FIGURE 2
Current Flowing in Phantom Circuit
DIAGRAM 6

interferes with the others. The maintenance, however, of the circuits—particularly of the phantom—is not an easy proposition, and requires considerable skill on the part of those responsible for it.

I have said nothing in the foregoing with reference to the special construction of underground cable which is required in connection with aerial lines involving loaded phantoms where it is necessary to bring such lines into large cities. I have omitted this in discussing the New York-Denver line because the cable required for such lines is similar in construction to the Boston-Washington cable which I am now going to describe.

THE BOSTON-WASHINGTON CABLE.

The project of having a complete underground conduit connection from Boston to Washington, and having therein a cable which would insure the service between these points against failure from

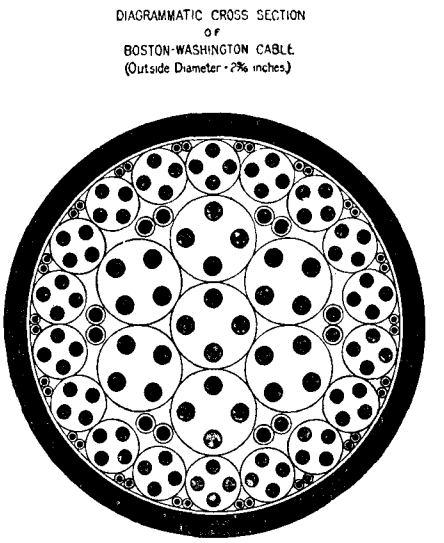


DIAGRAM 7

storm damage, is another of Mr. Vail's great ideas which is about to become a reality.

The underground conduit between New York and Washington is now completed, except for a few miles, and these will be built before the summer. The underground conduit between New York and Boston is to be completed this season. This will make a continuous underground cable route about 475 miles long.

It is proposed to place therein an underground cable, some of the circuits of which will be so efficient from a transmission standpoint that it will be possible to give telephone service between Washington and Boston over these underground conductors. This will be by all odds the longest telephone cable in the world.

This cable itself and the conduits to provide for it will represent a very large expenditure of money, and it is an indication of the broad policy which Mr. Vail is applying to the direction of the telephone business of this country that he is prepared to take such steps to insure the telephone service between Boston, New York, Philadelphia, Baltimore, Washington and the other points on the route of this cable against failure from storm damage.

The interesting feature of this cable, from an engineering standpoint, is that it is so constructed that practically all of the circuits in it may be phantomed and so that these phantom circuits, as well as the side circuits of which they are made up, can be loaded.

The loading problem on these cable circuits does not differ substantially from the problem of loading aerial phantom circuits which has already been described. The difficult work in connection with the design and construction of the cable was to have the circuits sufficiently well balanced so that they could be loaded and phantomed without bringing in objectionable crosstalk.

The make-up of this cable is shown by Diagram 7. In the middle of the cable there are 14 pairs of No. 10 B and S gauge conductors. Outside of these there are 36 pairs of No. 13 gauge conductors. In the spaces between the No. 13 gauge conductors and the No. 10 gauge conductors 6 pairs of No. 13 gauge conductors have been put in because there was space for them. At the outside of the cable 18 pairs of No. 16 gauge conductors have been placed because there was room for them. All of the No. 10 gauge pairs and the No. 13 gauge pairs, except the six put in between the 10's, are arranged so that they can be phantomed. That is to say, they

are arranged in what we call a "quad formation." Each of these quads is built up by taking two twisted pairs and twisting them together, giving due attention to the length of twist employed on the pairs and in twisting the pairs together. By this construction an arrangement is obtained which can be phantomed, providing certain necessary balances of capacity exist. For example, it is important that the capacity of each wire to the other side of the quad—that is, the other pair—should be the same as the capacity of its mate. To attain this result care must be exercised in manufacturing to see that the two wires going to make up the pair are twisted together symmetrically; that is, that there is no tendency for one wire of the pair to be straight or nearly straight and for the other wire to spiral around it. In the same way care must be exercised in twisting up the quad that the two pairs twist about each other evenly.

In connection with splicing up this cable care must be exercised, not only to see that the wires are correctly jointed together, but at certain points tests are made to determine the capacity unbalance of the circuits in two directions, and at these splices to so associate the wires and pairs as to have these unbalances in opposite directions—that is, so that they will tend to neutralise each other.

These precautions are necessary because the transmission efficiency of the cable is so great that crosstalk taking place at a considerable distance from either of the stations at the ends of the cable would be much more audible than in circuits of lower transmission efficiency.

I have already mentioned that the loading coils themselves are of the same general type as those used for loading aerial phantoms and the side circuits of phantoms. Those for use on the No. 10 circuits are almost as big as the coils used for loading open wire circuits. It is necessary to make them of this size in order to reduce the losses in the coils to a sufficiently small amount. The coils are spaced at intervals of about 1·4 miles, the side circuit coils and phantom coils being placed at the same point. This spacing is determined by the capacity of the conductors, the side circuits having a mutual capacity of about ·070 mf. per mile and the phantom having a mutual capacity of about ·1 mf. per mile.

The transmission efficiency of these circuits is interesting, and in this connection I may say that while a sufficient amount of this cable has not as yet been manufactured to permit of actual transmissions tests on it, so great is our confidence in formulæ for computing these efficiencies which have been developed as a result of our studies and experiments that we are satisfied that the results predicted will be obtained, and the manufacture of about 150 miles of this cable at a cost, including loading, of about $1,000,000 has been recommended with complete confidence in regard to the results.

The distance from New York to Washington is 235 miles. The most efficient circuits in this cable will be the No. 10 phantoms. These will have a transmission efficiency equivalent to only thirteen miles of standard cable—that is, they are nearly twenty times as good as standard cable, and decidedly better than unloaded aerial No. 12's. The physical No. 10 circuits will have a transmission efficiency between New York and Washington of sixteen miles of standard cable. The phantomed 13's—21½ miles of standard cable and the physical 13's—28½ miles of standard cable. These last circuits would not give good service from all subscribers in Manhattan to all subscribers in Washington. They will, however, be very useful from New York to Philadelphia, Wilmington, and even Baltimore, and for other combinations, such as Philadelphia and Washington. Between Boston and Washington, the only circuits that can be counted on for commercial service, will be the phantomed No. 10's. These will give a transmission efficiency between testboards of 26 miles. This will be sufficient to insure the service in case the open wire lines are down, although it is not expected that they will have to be used in this way, because it is not likely that there will be so many breaks in the lines that the cable would have to be used at any time all the way from Boston to Washington. All open wire lines are not likely to be down at the same time both north and south of New York City. The cable intersects the open wire lines at numerous points between these two places so that patches can be made at short intervals.

Most of you probably remember the very bad storm which we had the day that President Taft was inaugurated. This storm was particularly severe between New York and Washington, and produced very serious breaks in the overhead line construction in that territory. These breaks seriously interfered with telephone and telegraph service between New York and Washington at a very important time. When the cable is completed this cannot happen again.

NEW TELEPHONE PATENT APPLICATIONS.

THIS list is specially compiled for THE NATIONAL TELEPHONE JOURNAL by Messrs. Rayner & Co., registered patent agents, of 37, Chancery Lane, London, from whom all information relating to patents, designs, trade marks, etc., can be obtained gratuitously.

13,948 Charles Skiff Bann. Telephone-receiver holders. June 12.
14,144 Siemens Bros. & Co., Ltd. Calling circuit arrangements for automatic and semi-automatic telephone exchanges. June 14.
14,590 Louis Skinberger. Telephone mouthpieces. June 20.
14,591 Louis Skinberger. Telephone mouthpieces. June 20.
14,613 Bronislaw Gwozdz. Telephones. June 20.
14,683 Siemens Bros. & Co., Ltd., and Christian Rasmus Riber. Telephone transmitters. June 21.
14,802 Ernest Frank Farmer and George Ramsey. Antiseptic telephone caps. June 26.
14,887 Frank Schulz. Telephone system. June 26.
14,950 Alfred Ernest Bradshaw. Attachments in telephone mouthpieces. June 27.
15,126 Association des Ouvriers en Instruments de Précision. Recording counter for telephonic conversations and similar purposes. June 28.
15,133 Walter Howley Derriman. Telephone systems. June 28.
15,157 Clara Sandy. Telephone lock. June 28.
15,318 Bronislaw Gwozdz. Telephones. June 30.
15,502 British Insulated and Helsby Cables, Ltd., and Joseph Beighton Redfern. Circuits for telephone instruments. July 4.
15,503 William Aitken and British Insulated and Helsby Cables, Ltd. Telephone exchange systems. July 4.
15,544 Bronislaw Gwozdz. Method of manufacturing metallic filaments or bands to be used particularly in connection with thermic telephones. July 4.
15,569 Telephon Apparat Fabrik E. Zwietusch & Co., G.M.B.H. Subscribers' sender mechanism for automatic telephone systems. July 4.
15,725 Charles Frederick Killar. Telephones. July 6.
15,859 Alfred Ernest Bradshaw. Attachments in telephone mouthpieces. July 8.

NATIONAL TELEPHONE STAFF BENEVOLENT SOCIETY (LONDON).

Special Notice.—With reference to the circular of Jan. 6 last the committee have decided that the society shall be continued after Dec. 31 next. Collectors are therefore asked to advise all their members to this effect and to give as much publicity as possible to this intimation.

The grants made during the month of May, 1911, amounted to £24 0s. 6d. Total number of grants made since formation of society, 349 — value £1,110 15s. 10d.

Amount of subscriptions received during May £6 10s. 7d.

Donations received—	£	s.	d.
London Wall Exchange dance and social	10	3	0
East and district operators' annual social	3	10	0
National Telephone Company	11	3	8
Do. lost property found at call offices	1	12	
London Wall entertainments' committee whist drives	3	6	4
	£29	15	6

EDINBURGH TELEPHONE THRIFT CLUB.

AT a recent meeting of the above, the following interesting figures for the period December to June were given, which showed the club's flourishing condition :—

	£	s.	d.
Balance in bank, as at November, 1911	130	10	9
Cash deposited (December to June)	319	4	3
	449	15	0
Cash withdrawn by depositors	323	15	0
Balance in Savings Bank as at June 10, 1911	£126	0	0

The club still continues to meet the admirable purpose for which it was formed, and to its promotors it is particularly gratifying to observe the good use made of it by the junior members of the staff.

During the month of April, the sum to the credit of the club in the Edinburgh Savings Bank reached the highest on record—namely, £153.

It may also be recorded that the largest amount withdrawn in any one week—namely, £40 11s. 0d., occurred in May. This doubtless was due to the fact that the Whit Sunday rent term took place in that month.

THE ROYAL AGRICULTURAL SOCIETY'S EXHIBITION, NORWICH.

By O. W. Stevens.

The Royal Agricultural Society of England, holding its annual exhibitions in different towns, must be familiar to the general public, and therefore requires no special description, but the show recently held at Norwich presented some special features that may be of interest.

The show ground at Crown Point, Norwich, was larger than that occupied in any previous year, measuring roughly three-quarters of a mile in length and half a mile in breadth. There was a record entry of exhibitors, the shedding had a total length of seven miles, and the attendance for any single day has only once been exceeded.

At Liverpool last year 44,327 people paid at the gate on the first shilling day. On the corresponding day at Norwich, the

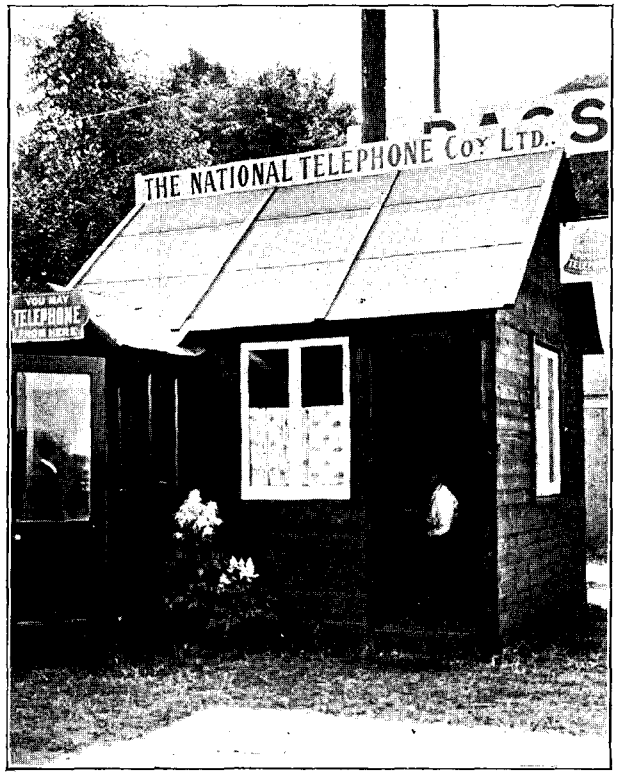


Fig. 1.

attendance was 75,259, which figure does not include the season ticket holders or those who bought tickets in advance.

Up to 1909 the telephonic requirements of the show had been met by an installation of call offices, but at Liverpool last year an exchange was opened on the ground for the first time, and at Norwich, the Company went a step further by installing a C.B. switchboard, fitted with eyeball signals.

The switchboard of 50 lines, C.B. floor pattern was installed in a building erected by the society for the Company, a general view of which is shown in Fig. 1, the position given being the nearest approach to the telephonic centre possible.

Power wires not being available it was necessary to have a local battery at the exchange, and two 24-volt batteries consisting of No. 1 Sac cells with circular zincs were equipped, together with a change-over switch, the practice being to run each battery for half a day only. The voltage dropped to 22 in a day or so, but maintained this pressure to the closing of the exchange, a period of fourteen days, during ten of which the traffic was exceptionally heavy. The working hours at the exchange were from 8 a.m. to 8 p.m. including the Sunday previous to the opening of the show.

In addition to the local exchange, the Company equipped a private exchange for the society, connecting various officials and parts of the show ground, and provided the operating, the wires being mostly run on the Company's system of poles. In all 34 exchange and private stations were fitted.

Fig. 2.

The Company also provided and maintained eight telegraph circuits for the Post Office from the entrance to the telegraph office, which is shown in Fig. 3.

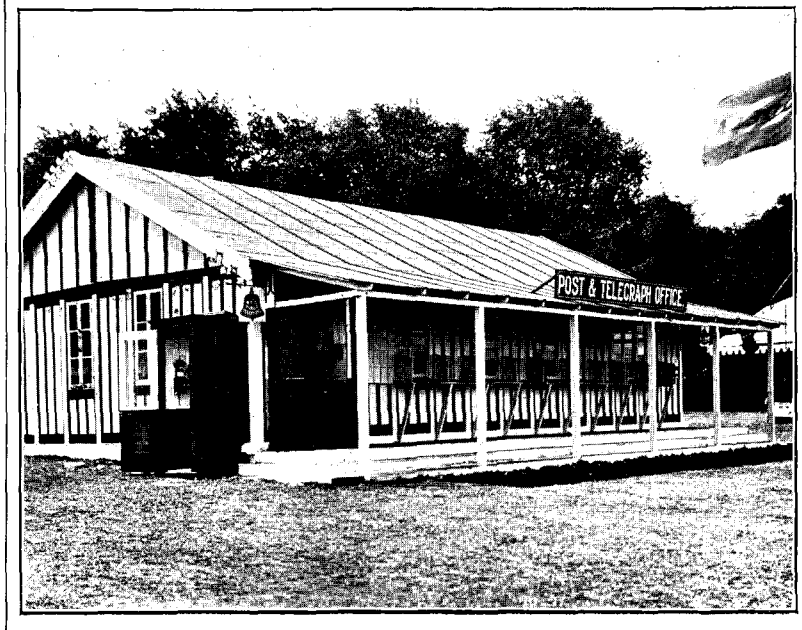


Fig. 3.

The call offices were placed in convenient spots, the three at the exchange being open for trunk service, and directing signs fitted were about the grounds for guidance. A continuous night and day service was given from two of the call offices by plugging

them direct through to the Norwich Exchange, when the Royal Show Exchange was closed, and it may be here mentioned that a call office service was given for some time prior to the opening of the exchange, and also after it was closed, for the benefit of contractors and others.

FIG. 4.

The King visited the show on the Wednesday following the Coronation, lunching in the Royal Pavilion (Fig. 4) and subsequently driving round the grounds with Sir Ailwyn Fellowes, the acting president of the society, whom he had previously knighted. The illustration shows the King and Sir Ailwyn Fellowes on the tour of inspection.

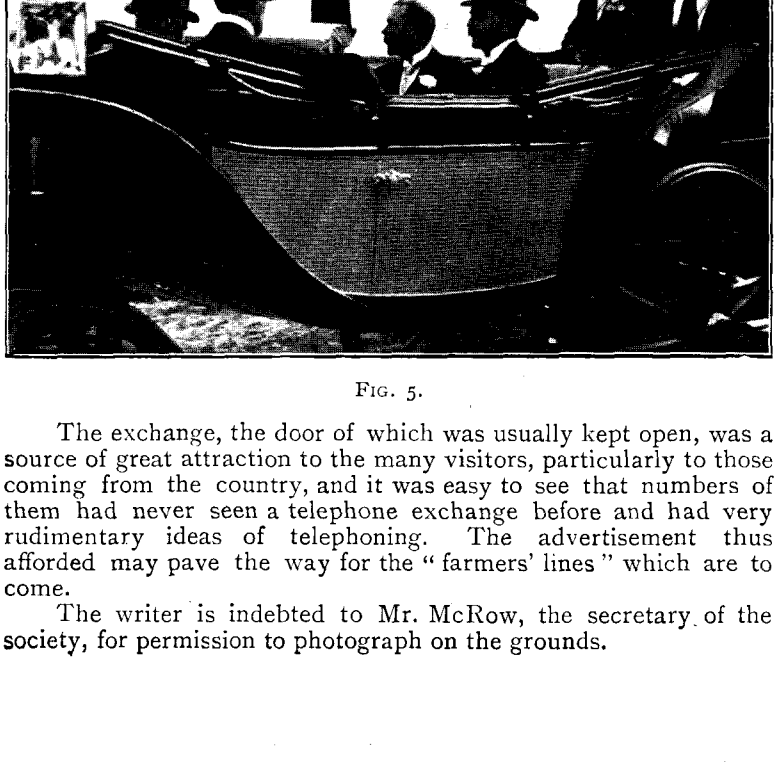


FIG. 5.

The exchange, the door of which was usually kept open, was a source of great attraction to the many visitors, particularly to those coming from the country, and it was easy to see that numbers of them had never seen a telephone exchange before and had very rudimentary ideas of telephoning. The advertisement thus afforded may pave the way for the "farmers' lines" which are to come.

The writer is indebted to Mr. McRow, the secretary of the society, for permission to photograph on the grounds.

THE TELEPHONE EXCHANGES OF LONDON.

BY G. H. BRYANT.

(*Concluded from page 71.*)

Faults and their Tendency.—The seeming complexity of modern equipments as compared with those of a few years ago, directs one's attention to a consideration of the extent of the troubles now experienced and whither we are tending.

The sum total of the exchange, line and instrument faults cleared and fault O.K. per annum for the Company's Metropolitan exchanges for the years 1906, 1907, 1908 and 1909 is shown in Fig. 12.

Although the exchange lines and instruments have multiplied during that period you notice that there is a marked decrease in the complaints per annum. The fault O.K.'s, besides figuring in the total complaints, are shown separately, and their declining is of interest. In order to obtain a valuation of these figures, I have divided by the total exchange lines and also by the total instruments. The result is seen in Fig. 13. In 1906 you notice there were on an average 86 complaints per exchange line, which decreased to 5·3 for 1909, and on the basis of faults per instrument 4·0 in 1906, which fell to 2·5 for 1909.

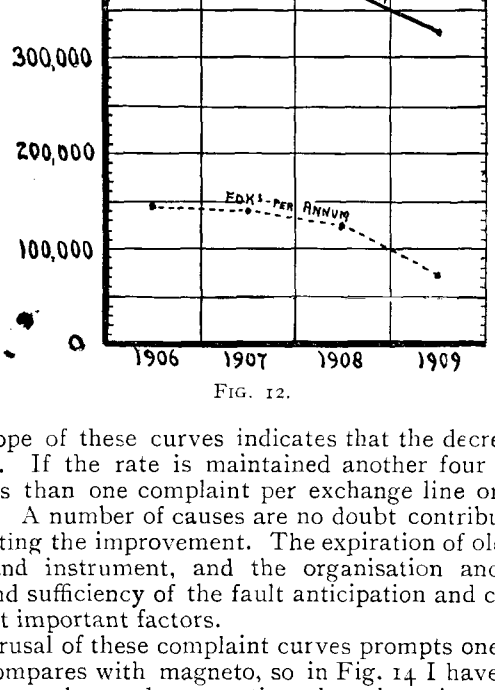


FIG. 12.

The slope of these curves indicates that the decrease is likely to continue. If the rate is maintained another four or five years will see less than one complaint per exchange line or instrument per annum. A number of causes are no doubt contributing to and jointly effecting the improvement. The expiration of old apparatus, exchange and instrument, and the organisation and increasing efficiency and sufficiency of the fault anticipation and clearing staff are no doubt important factors.

The perusal of these complaint curves prompts one to consider how C.B. compares with magneto, so in Fig. 14 I have plotted the systems separately, and you notice that there is not a deal of difference between them, magneto is improving as well as C.B.

Fault O.K.'s are on the decrease as you saw from the curves of total faults, and when expressed as a percentage of the total faults their decline can be fully appreciated, see Fig. 15.

Some Possibilities of the Future.—Having traced the development of exchange lines and equipments, and how the magneto system has given place to the manual C.B. system, one is led to consider whether the latter will meet the demands of the future, and whether it will not some day be superseded.

I have so far only a superficial knowledge of automatic systems, but it is sufficient to convince me that the economic superiority and efficiency of the automatic will be proved, and when the present-day plants have run their course the time for the general innovation of automatic equipments will be here.

The present-day manual systems are but a phase of the

evolution of telephony, and not the ultimate. It needed but a casual inspection of the automatic system on show at the Earl's Court Exhibition two years ago to realise its possibilities, and that some master minds are at work on the problem. That the manufacturers of manual systems realise this and are striving to make headway in the new field is proved, I consider, by the patents that are being taken out by them. If you glance through the specification files at the Patent Office you will tumble across patents relative to automatic systems which tell their own tale.

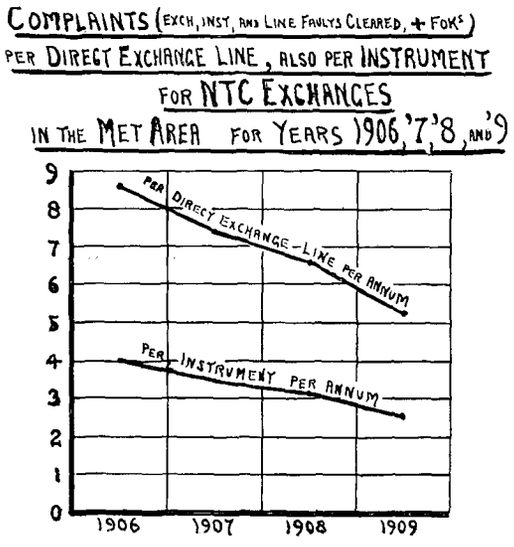


FIG. 13.

I am of the opinion that we shall graduate to an automatic system. Every auto-device that is added to manual boards is a step in that direction, and by such means the worth of automatic plant will be gauged and the preliminaries for a pure automatic system be tested.

For some months past I have been pondering over the possible advances that will be made on our present-day manual switchboards, and I have, as a result, figured out what might be called a transition stage.

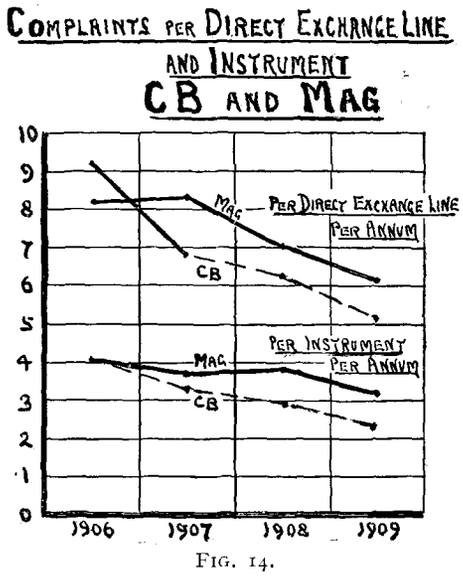


FIG. 14.

I conceive a manually operated switchboard similar in outline to the board of the present day, but minus the answering cords, local jacks and lamps; an automatic device would evenly distribute the calls, as they were made, among the operators required for the load, and be so arranged that the working portion of the board could be expanded or contracted according to the load. Such an arrangement would enable an even quality of service to be given day and night; and combined with a simplification of the operator's work the extent of the switchboard would be reduced owing to the loading up that would be possible.

The subscribers and out-junction multiples would be retained. Each cord would have two supervisory and one calling lamp (of a different colour) also a listening key.

When a subscriber lifted his receiver off the hook he would be automatically connected to a cord circuit on a position, and cause the calling lamp to glow.

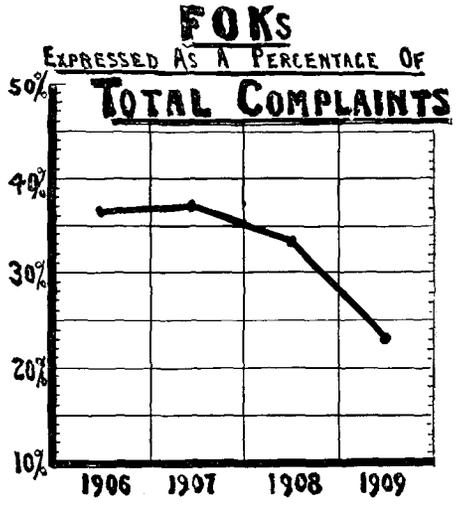
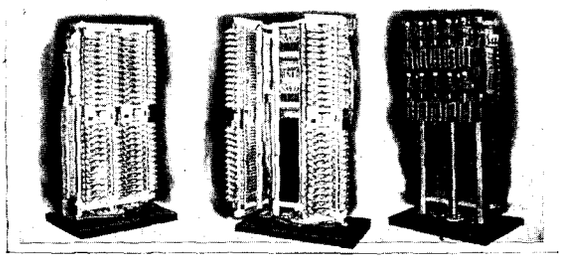


FIG. 15.

The operator would throw the listening key, ascertain the subscriber's requirements, and connect accordingly; for local as well as junction connections the ringing would be automatic. An indication of the calling subscriber's tariff would be given to the



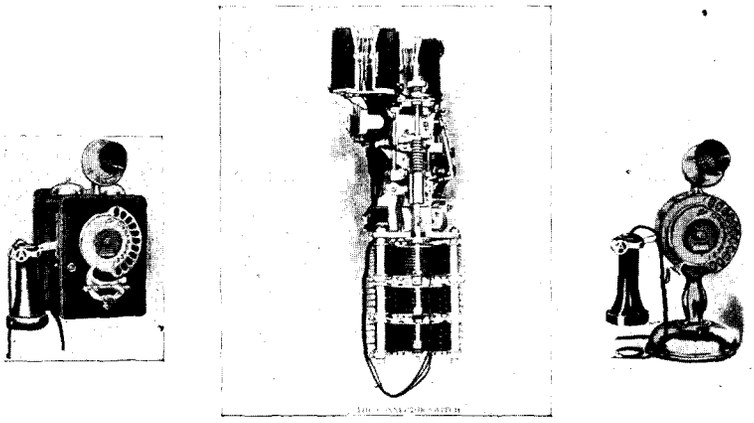


FIG. 16.

operator on one of a series of tariff pilots arranged so that when the listening key of a cord circuit was thrown the pilot corresponding to the calling subscriber's rate would glow.

The foregoing covers the "A" board only. It is conceivable that the "B" board will be replaced by automatic apparatus controlled by the distant "A" operators, who would take up a disengaged junction and select the required number by means of a device on the keyshelf. Such a selecting device would have to take a minimum of the "A" operator's time in selecting a

number, and would not be designed on the lines of the impulse sender as used on a subscriber's instrument on an automatic system.

It will doubtless occur to you that a semi-automatic board such as I have just outlined is not many stages off the auto-manual system which has been advertised in *Telephony* for a year or so past, and of which some interesting details were published in that journal a few months since. But on consideration you will, I think, agree that whereas the auto-manual system is dependent largely on automatic apparatus, the arrangement I propound is our present-day system supplemented by automatic devices, and therefore there is a deal of difference between them.

I did not grasp the significance and limitations of a system such as the auto-manual until I had arrived at what I termed the transition stage.

And I say that such systems will only serve as stepping stones and prove the capableness of automatic apparatus and pave the way for the general introduction of automatic exchanges.

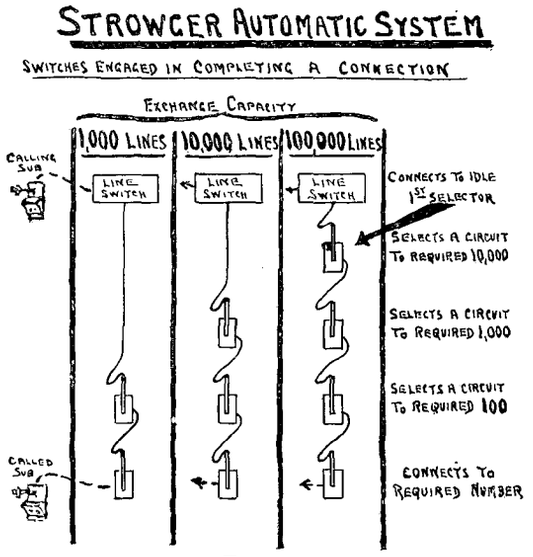


FIG. 17.

"*Strowger*" *Automatic System.*—To conclude, I have two illustrations which relate to the automatic system that is making most headway commercially. In Fig. 16 a wall instrument is shown on the left-hand side and a pedestal on the right; these are, however, not the latest type.

The dials are pivoted centrally and have eleven divisions, marked one to nine, nought, and long distance, *i.e.*, trunks. To make a call a finger is inserted in the numbered holes and the dial rotated downwards to the stop at the bottom and then released; this is done for each digit in the number required.

Movements of the dial send impulses over the line and link up a series of switches, similar to that shown in the centre, and thereby effect a connection between two subscribers; the ringing is automatic.

Each switch accommodates 100 circuits, leading either to other switches or subscribers; the arm which you notice in the centre has a vertical and also a rotary movement, and by means of the electro magnets, seen at the top, motion is imparted to the arm *via* the notches and any of the 100 circuits is almost instantaneously selected.

The Keith line switch shown at the top is a device for connecting a calling subscriber to an idle selector switch immediately the receiver is taken off the hook.

At one time I was at a loss to understand how such devices as these could pick out any one subscriber from 10 or 100,000 subscribers when each switch only accommodates 100 circuits. On mastering that point the cloak of mystery disappeared, and the extent to which such a system could be extended was apparent; and Fig. 17 will, I hope, assist those who have not yet bridged a similar difficulty.

I have shown three exchanges with capacities for 1,000, 10,000 and 100,000 lines.

The subscribers' circuits terminate on what are called line switches, whose function is to connect a calling subscriber to an idle selector when the receiver is taken off the hook.

In a 1,000 line exchange two switches are required to make a connection apart from the line switch; in a 10,000 line, three; and in a 100,000, four; in each case the last switch of the series is known as the connector, and the others as selectors.

Consider that we are dealing with a 10,000 line exchange: when a subscriber lifts his receiver from the hook his line is extended by the line switch to an idle first selector. The caller then proceeds to rotate the dial on his instrument, and if it is 4,654 that he is requiring, the arm of the first selector will select a circuit leading to the 4,000 group and terminating on a second switch, which will respond to the impulses from the caller's instrument, take up a circuit leading to a connector switch in the 600 group, and the arm of this last switch will then pick out the 54th circuit and, providing the line is disengaged, establish the connection to 4,654. When the subscribers hang up their receivers the switches return to normal.

TELEPHONES IN THE KING'S BENCH.

(*Reprinted from the* "DAILY NEWS.")

THE newspapers are too full. One of the difficulties of our time is that there are too many things to occupy our minds. How is a plain man to master the different amendments to the Parliament Bill, or the details of the discussion of the Insurance Bill, or the development of aviation, or the vagaries of the thermometer? Little wonder that the most important law case for many years is passing almost without attention on the part of the public.

It is taking place in Court Nine, King's Bench Division. Great legal luminaries are employed—the Attorney-General, the Solicitor-General, Sir Alfred Cripps, Mr. Danckwerts and others. Great experts are giving evidence. Huge maps hang on the walls. "Model towns," in cardboard, surround the bench. Electrical apparatus and blue prints lie here and there. Of course, into the close atmosphere of Court Nine no one would go save he who must. Yet a stranger, dropping in by accident, could see in process a mighty struggle, a significant struggle. The bench consists of Mr. Justice Lawrence, cool and deliberate of utterance, Mr. Gathorne-Hardy and Sir Joseph Wodehouse. They are the Railway and Canal Commission.

And what is all the row about? Well, you and I, Mr. Man-in-the-Street, are parties to this action. We are about to buy up the National Telephone Company. *Caveat emptor!* So we employ this phalanx of brains, the most highly cultivated which we can find, to settle the little bargain. It will not cost so much as a Dreadnought, but it is a far more complicated business than buying a Dreadnought. We have (by our representatives) to discover what is and what is not suitable apparatus. Taxpayers must not buy what is obsolete, and so the question of obsolescence of telephone apparatus must be threshed out. Sir Rufus Isaacs speaks of central batteries and magneto generators as if he had been trained as a telephone engineer. Behold Sir John Simon with traffic curves on his lips, just as readily as Free Trade statistics. Sir Alfred Cripps handles junction lines and area boundaries with the same intensity of purpose as if they were revisions of the Prayer Book, and Mr. Danckwerts fondles bits of telephone apparatus with a tender intimacy born of mechanical (as well as legal) genius. Once for a few days even greater luminaries were called in, and the Master of the Rolls and Lord Justice Kennedy and Lord Justice Farwell showed to the world that they were telephone operators born to the purple—or scarlet.

It is a mighty big case. Week in, week out, it proceeds. Shafts of good humour occasionally lighten the heated gloom, and the legal luminaries twist up the expert. To-day they play on the word "obsolete." An expert protests that a certain type of exchange has something in its favour. True it has been swept away from New York. True it has been discarded nearer home. Still, he says, it is by no means so old-fashioned as we (in the gallery) might suppose. For the Post Office is too modern; it carries certain ideas—reckless, daring institution as it is—much too far. Then Sir Rufus Isaacs thumbs a text book. It might be a book on arithmetic or a guide to the Inns of Court. He turns to page 206. "This book says that the type of exchange is obsolete—and the book was published in 1906—and it is written by one of

the expert's colleagues." The witness is quite ready. "The language is much too strong, much too picturesque." Whereat the Court laughs merrily. There was some joke here which we, poor souls in the gallery, altogether failed to comprehend. "Will 'obsolescent' do?" asks Sir Rufus. The witness nods, and we are all happily agreed.

They had a struggle on the question of overhead lines. Apparently there is something to be said for overhead lines, after all. Innocents in the gallery thought that overhead lines belong to the past, that they were dangerous, that they offended the eye and darkened the sky. The expert witness put in a gentle demurrer. Then Sir John Simon looked him in the eye. "I offer you a present of a route of overhead lines, and of another route, with precisely the same number of wires, of underground lines. Which would you prefer?" "Depends on the cost," said the expert. "But, I said, I offer you a present." "The underground lines, of course." The innocents in the gallery breathed more freely. In that atmosphere of volts and resistances it sounded like a breath of common sense which the humblest of us could appreciate.

Carefully and deliberately they proceeded. There is no passion and no rhetoric. It is the preliminary laying of the foundadations of a great nationalising effort. It is stamped by the scrupulous intent of being fair. The State is claiming no privileges; it is asking for the strictly just value to be appraised. The taxpayer must be protected, and there are other interests just as sacred. It makes one proud of England to observe how minutely each detail is considered. And it makes one a little envious of the legal type of intellect which is able to pick up technical details so quickly and apparently so accurately. But what is most surprising of all is that this long investigation should proceed with apparently so little interest on the part of the public. Surely, one would suppose, the question of spending many millions in purchasing a vast corporation is of some importance to those whose money is to be spent.

THE NATIONAL TELEPHONE COMPANY *v.* THE POSTMASTER-GENERAL.—CONCLUSION.

A FURTHER stage in the proceedings leading up to the ascertainment of the price to be paid by the Postmaster-General to the National Telephone Company for the purpose of its plant, property and assets was commenced before the Railway and Canal Commission (Mr. Justice A. T. Lawrence, the Hon. A. E. Gathorne-Hardy and Sir James Woodhouse) on July 3.

We reported in our last issue the decision of the Court of Appeal, after several days' argument, upon certain preliminary questions of law which had been referred to it in connection with the Company's application to set aside the notices of objection given by the Postmaster-General in which he objected to buy certain plant, land and buildings of the Company as being in his opinion unsuitable for the actual requirements of his telephone service on Dec. 31, 1911.

In their judgment the Court of Appeal laid down two important principles—viz., (1) that the Postmaster-General was entitled to object to buy plant, land and buildings of the Company in competitive exchange areas if he possessed other plant, land or buildings adequate and suitable to the actual requirements of his telephonic service on that date, and (2) that all the notices given by the Postmaster-General (a number of which the Company had alleged were invalid because they were indefinite or too wide) were, in fact, valid in form.

The Court considered that a notice was not bad because it might include items which could not be objected to.

In consequence of this decision it became necessary to test the validity of the Postmaster-General's notices on their merits, and this was the purpose of the proceedings commenced before the Railway and Canal Commission on July 3.

The case for the Company was opened very briefly and lucidly by Sir Alfred Cripps, the leading counsel for the Company, who dealt with the judgment of the Court of Appeal, and then proceeded to call Mr. Frank Gill, the Engineer-in-Chief of the Company.

At the outset of his evidence, Mr. Gill gave it his opinion that no two competent engineers acting separately would arrive at the same conclusion as to what plant was covered by the notices, and he proceeded to give evidence to justify this.

In particular Mr. Gill drew attention to the use in the notice of the expression "telegraphic line" which was defined to mean the same as in the Telegraph Acts. On reference to these Acts it is found that "telegraphic line" includes not only a wire from a subscriber's office to an exchange, but it includes all the supports, such as poles and stays, and all the covering apparatus, such as cables and ducts as well as the equipment both at the exchange and at the subscriber's office. The use of this definition as applied to wires and cables connected to an exchange objected to by the Postmaster-General was to exclude from the purchase large quantities of plant to which there could be no objection whatever.

Mr. Gill further explained to the Court how telephonic wires, for economical reasons, are run in such a way that the Postmaster-General's objection, if taken literally, would also exclude large quantities of plant which, though not connected directly to a rejected exchange, was inseparably intermixed with wires connected to such exchange. Many illustrations, both by models and plans, were given of this difficulty.

The Postmaster-General's notices did not extend to private wire plant, yet private wire plant was included in the same cables and was inseparable from plant alleged to be objected to as unsuitable.

As an illustration of the effect of the notice, Mr. Gill produced a diagram showing a pole at Eltham Station, which carries two circuits, which connect the Bank Exchange (one of the exchanges objected to) with Sidcup. These circuits, even assuming that the Bank Exchange were properly objected to, are several miles away from that exchange, and in no sense affected by any unsuitability of that exchange, yet under the notices they would be objected to, although if they were removed other similar circuits would have to be provided.

In the course of his evidence Mr. Gill controverted a statement which had been made on behalf of the Postmaster-General that the proper place for testing private wires is at the manhole. In his opinion the proper thing is to take the lines by the most economical route, and that is generally through the exchange. Testing really divides itself under two heads—*i.e.*, testing done as an exceptional measure, which, of course, can be done from almost any place where men and instruments are sent down whenever wanted; and testing done in a regular manner, which is more conveniently done in a test room properly equipped for the purpose.

At a very early stage in the proceedings, the Court invited the Post Office to disclose their scheme, and show how what they proposed to reject would not come within their working needs when the Company's system was taken over. This suggestion was not adopted, and Mr. Gill proceeded with his evidence, and gave a series of interesting statistics to show the nature of the service being given by the London exchanges of the Company which are objected to. These figures show, for example, that in the case of the Avenue Exchange the average time from commencement of call until the operator answered was 5·4 seconds. The average for the seventeen London central battery exchanges was 5 seconds. The percentage of calls answered by the operator in 5 seconds or less was 69·5 for the Avenue, and for the seventeen exchanges 74·7. The average time until called subscriber answered was 32·3 seconds for Avenue and 36 for the seventeen exchanges. The average time taken to disconnect for all outward and inward calls for Avenue was 14·3 and 11·9 for the seventeen exchanges. The cost per 1,000 effective originating calls for the 21 exchanges in London objected to was 156*d.*, the lowest being Avenue at 122*d.* The same figures for five of the Company's central battery exchanges gave the average cost of 127*d.* Compared with this the Company had in 1908 certain negotiations with the Post Office, in which it was taken that the Company's cost per 1,000 effective originating calls was 118·64*d.*, and the figure given by the Post Office for their own exchanges was 216·68*d.*

Mr. Gill was cross-examined at very great length by the Solicitor-General. A point was attempted to be made that the Company had made a proposal in 1903 which involved the conversion into central battery exchanges of a number of then existing local battery exchanges. Mr. Gill explained that this scheme was put forward for the purpose of a preliminary discussion. As a fact the scheme never eventuated and the Company on its own account carried out a great deal of the work then suggested.

Mr. Gill pointed out that in his opinion the proper course was

for the Post Office to take over the whole of the Company's exchanges, and from time to time, as occasion served, to substitute central battery exchanges for the local battery.

It became evident in the course of cross-examination as to Avenue Exchange, which Counsel for the Post Office took generally as typical of the Company's local battery exchanges, that the Judge took the view that it was not competent for the Post Office specially to construct plant for the purpose of rendering the Company's plant unsuitable because unnecessary. All that he considered the Court of Appeal had talked about was the natural excess of plant which one competitor will have over to equip his own business.

In addition to cross-examination being directed to the relative advantages and disadvantages of central battery and local battery equipment, a great deal was made of the relative inferiority of the overhead system as compared with an underground system.

At one point the Solicitor-General referred to an article by Mr. A. B. Gilbert which appeared in this JOURNAL in May, 1908. In that article it was pointed out that in two exchanges then recently exchanged from magneto to central battery working very considerable economy had been effected, and it was sought by the Solicitor-General in this way to invoke the authority of this JOURNAL in support of the proposition that local battery plant is inevitably and greatly inferior to common battery. Mr. Gill, however, effectively retorted that the purpose of the article was misconceived. Its title is "The Value and Application of the Scientific Spirit." The purpose of the writer was not to compare the respective merits of the two systems of working, but to show in fact that good service might be given on equipment of not the very latest type if the organisation was good and based on what the writer called the scientific spirit. Mr. Gill was in the witness box for three days, and gave evidence very effectively.

The next witness was Mr. W. W. Cook, the Assistant Engineer-in-Chief of the Company, whose evidence was mainly directed to the question of the Company's plant in, over and along railways, and objections to plant on account of its character.

Mr. Cook expressed the opinion that the Post Office carried distribution by underground work to excess. He was strongly of opinion that a change-over of 21 exchanges in London on one particular day was most unwise, unless in the case of absolute emergency, which does not exist in connection with the present transfer. Existing exchanges are not worn out. The proper way would be to combine them, and having combined them to make any replacements necessary, and spread the work over a proper period of time. He pointed out how important it is before a change-over takes place that thetraffic conditions should be thoroughly understood. If, for instance, the Avenue Exchange were closed and the subscribers divided, as had been suggested by the Post Office, between the Central Exchange and the new Creechurch Lane Exchange, the individual requirements of each subscriber would need to be considered in order that the facilities of service might be divided between the two exchanges in the proper proportion.

Mr. Cook's evidence, which occupied the greater part of two days, entirely supported that of Mr. Gill. He was followed by Mr. H. F. Parshall, Chairman of the Central London Railway, whose evidence was directed to show that telephone cables in railway tunnels worked by electricity are not liable to danger when constructed under present-day conditions.

Mr. S. Z. de Ferranti, President of the Institution of Electrical Engineers, confirmed Mr. Parshall's views, and showed that, from an engineering point of view, there are many and important reasons why the change-over contemplated by the Post Office should not take place at one time.

Sir Alexander Kennedy, who had given general evidence at an earlier stage of the proceedings as to the nature and working of a telephone system, also supported the Company's case. He instanced cases in his own experience where he had made changes in electric distribution, much simpler than those which would have to be made in the case of telephonic service, where considerable periods of time had to be allowed for the purpose. He also generally confirmed the evidence given by Mr. Gill and Mr. Cook.

Mr. Hammond V. Hayes, of Boston, U.S.A., was the next witness for the Company. Mr. Hayes is well-known in telephone circles on both sides of the Atlantic. After a distinguished career at Harvard University he entered the service of the American Bell Telephone Company, now the American Telephone and Telegraph Company, and was for some years chief engineer of that company. He relinquished that position in 1907, and since that time has been in private practice with a retainer from the American Telephone and Telegraph Company as their telephone expert.

Mr. Hayes has had a great deal of experience in practical working of the telephone system and in the scientific investigation as to improvements, many improvements now in common use, as for instance the central battery system, having been originated in his department and developed under his direction.

It is an open secret that Mr. Hayes was approached two or three years ago by the Post Office and invited to give them expert assistance in the present proceedings, but having already been retained by the Company, he was unable to act for the Post Office, and his natural inclination was to assist the case of a company which, so far as comparison is possible, is most nearly like the important corporation with which he has been so long connected.

Mr. Hayes explained the methods of the use of overhead and underground wires and of distribution in the United States. The introduction there of the common battery system does not involve the scrapping of local battery plant in the exchange that has been superseded. The practice is to take the local battery apparatus from the superseded exchange and use it elsewhere, and it is a fact that in the last five years there has been more local battery apparatus manufactured and put into service than ever before, even in the days when it was the only system, because the business has developed in the outlying small towns to such an extent that all the apparatus set free in the larger towns is needed to supply as far as possible the small outlying towns with apparatus.

Mr. James Swinburne, electrical engineer, also supported the Company's case on the question of the unwisdom of making the change-over of so many exchanges on one day, but, for reasons stated below, his evidence was not concluded.

On July 11 the Court did not sit at the usual time. It was evident that negotiations were on foot, and it was not until 1.30 p.m. that the Attorney-General and Sir Alfred Cripps appeared in court and informed the Commission that, as the result of certain negotiations, terms of arrangement had been agreed, which settled all questions arising on the notices of objection and litigation subsequent thereto.

Shortly stated, this arrangement is that the whole of the notices of objection relating to character and situation, as, for instance, all wires not forming a metallic circuit, or wires which do not correspond to the test of audibility laid down by the purchase agreement, are to be allowed to stand, but are to be subject to the modifications and explanations given by the counsel for the Post Office, the effect of which is to render them of very little importance. All the remainder of the notices, with the exception of those relating to Abergavenny, where the Company has only fifteen subscribers, are to be withdrawn. The Post Office are to be met by an agreed rate of reduction from the price to be paid for plant, land and buildings in and upon the exchanges objected to and local battery instruments used in connection therewith and outdoor plant within an agreed radius of the exchanges objected to.

While the wisdom of entering into this arrangement was not doubted, there was no little disappointment on the part of the Company's technical staff in court that the evidence of the Post Office on the interesting questions in dispute was no longer required.

The case, as may be expected, was fought seriously on both sides, and but little amusement was to be extracted from the hearing. Some little amusement, however, was caused during Mr. Cook's cross-examination by the Attorney-General, from the fact that quotations were put to him by the Attorney-General from Mr. Poole's standard book on the Telephone, particularly a passage which stated that "since the year 1898 another great development, amounting almost to a revolution, had been taking place in telephone work by the introduction of common battery system." Mr. Cook smilingly agreed generally with this and other statements in Mr. Poole's book, but thought to some extent that the language was picturesque.

As a piece of information, which may be of interest to the engineering staff, it may be stated that at one stage a member of the Court asked for an explanation as to what a "multiple" was. The answer (given by counsel—not by an engineer) was "as I understand it, it is the part that is behind the frame."

TELEPHONE WOMEN.—XCVI-C.

THE SWANSEA SUPERVISOR STAFF.

ELIZABETH ANN THOMPSON.

ROSE MILLER SMALE.

AMY ELLERY.

CLARA JANE COOK.

MILDRED GWENLLIAN OWENS.

XCVI.—AMY ELLERY.

MISS ELLERY, Clerk-in-Charge, Swansea, entered the Company's service as an Operator in June, 1900. At that time there was one exchange in Swansea to which about 300 lines were connected. The switchboard was of the early magneto type with multiple jacks, and the staff consisted of six operators. The telephone business has developed considerably, and there are now two exchanges (Central and Docks) in operation, on which are working 1,670 and 541 lines respectively, the Docks Exchange being the principal exchange of the Swansea Corporation system which was absorbed by the National Telephone Company in 1907.

Miss Ellery was appointed Supervisor in January, 1908, and promoted to be Clerk-in-Charge in March, 1909. She has seen many changes in the *personnel* of the staff, having served under three district managers, two local managers, two exchange managers and two clerks-in-charge.

To Miss Ellery her work is a pleasure, and during the years of competition with the Municipal system she always displayed keenness and interest in her duties.

One of her hobbies is the secretarial work in connection with the Swansea Operators' Telephone Society, which society claims the honour of being the pioneer operators' society in the country.

XCVII.—CLARA JANE COOK.

MISS COOK, Senior Supervisor, Swansea, entered the service of the Company in September, 1899, and was appointed to the position of Supervisor in September, 1908. Like Miss Ellery, she has seen much progress in the telephone business in Swansea, and many changes in the staff.

XCVIII.—ROSE MILLER SMALE.

MISS SMALE, Monitor, Swansea, joined the Company's service in January, 1901, was made Supervisor in March, 1909, and in the July of last year was appointed Monitor.

XCIX.—ELIZABETH ANN THOMPSON.

MISS THOMPSON, Supervisor, Swansea, entered the service as an Operator at Neath in September, 1904, and the ability and energy she showed in her work led to her appointment as Supervisor in the July of last year.

C.—MILDRED GWENLLIAN OWENS.

MISS OWENS, Travelling Supervisor, Swansea district, entered the Company's service at Swansea in September, 1900, as an Operator, but resigned in the November of the same year. She subsequently rejoined the service in January, 1903, and was appointed Observation Clerk in April, 1909. In June, 1909, she was appointed to the position of Travelling Supervisor for the Swansea district. Her task of supervision and training the operating staff at the outlying exchanges is no light one, but the results achieved prove that in appointing her Travelling Supervisor a happy selection was made.

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"BY THE STAFF FOR THE STAFF."

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HIGH-GRADE MEN.

AN interesting article on "Telephones in England and U.S.A.," by Mr. T. F. PURVES, in the *Post Office Electrical Engineers' Journal*, concludes with the following paragraph:—

> "The apparent harmony with which all classes work together in the American service is striking. Two or three times I commented on this, and the reply in each case was to the same effect—"Employ high-grade men and there will be no friction," with which excellent sentiment I will wind up."

From this we learn three things. Firstly, that the working harmoniously together of all classes is considered "striking" by a Post Office official. Secondly, that this harmony is attributed by American telephone men to the employment of "high-grade men." Thirdly, by inference, since the said harmony is found to be striking and worthy of comment, Mr. PURVES appears to suggest that the grade of Post Office staff does not attain sufficient height to be harmonious. Surely this could hardly be his meaning. But, we may ask, why precisely should the lower notes of the scale fail to strike harmonious chords? Such failure, surely, is contrary to all musical theory.

Seriously, however, we agree entirely with the above quoted American rule, and with Mr. PURVES' opinion that it is an excellent sentiment. But the expression "high-grade men" conveys no very precise meaning. It may refer to birth, to breeding, to education or to ability, although from a business point of view it must manifestly refer to the two last. A standard of education may be set, and we know that a high standard *is* set in the Civil Service examinations, but whether the attainment of that standard fills all the requirements of administrative and commercial fitness it would be unbecoming in us to inquire.

We think, however, we know the sense in which it is referred to by the American maxim quoted by Mr. PURVES. A high-grade man, from a service point of view, is one to whom in his work the end is primary and the means secondary. He desires all efforts, all forces concentrated on achievement, and can tolerate no friction, no jealousies. The low-grade man is either indifferent as to his work, or if zealous, his energy is stultified by a sense of the importance of himself or his department. But how are you to obtain your high-grade man? Not entirely by educational tests, for it is at least certain that education does not create high ability and single-minded enthusiasm, however satisfactorily it may cultivate abilities already possessed. You can obtain high-grade chiefs by a process of natural selection, but to secure supermen (those, we mean, adept in the high and complicated harmonies referred to) in bulk for the rank and file is a problem of which, we imagine, even the Americans possess no infallible solution. If they have their secret should be worth knowing.

FUTURE RATES.

SOME strange arguments are brought forward in an article in the *Yorkshire Post* which, in commenting on the transfer of the Company's business to the State, refers to the question of future rates. But when were the arguments of thorough-paced upholders of the flat rate other than strange and disingenuous? It is said that it has been plainly shown "that the cost of telephoning is increased disproportionately by a large increase in the number of small users; that in this trade, as in many others, it is cheaper to supply large users by wholesale than small users who come occasionally." This would be wholly true if all you had to do was to join up the larger subscriber to a switchboard and let him revel in as many calls as he liked by means of operating of his own providing and maintenance of line at his own expense. But when it is remembered that every one of his numerous calls has to go through the same process at the operator's hands as every one of the few calls of the small user, that a percentage of his calls are junction calls and consequently necessitate the provision of a larger proportion of this class of circuit than is needed for the small user, and that, in addition, his busy line is the direct cause of many unproductive engaged calls, entailing in the long run additional clerical and supervising expense, the case is entirely altered.

"To make the large user pay for the small user," says the *Post*, boldly endeavouring to destroy the enemy with its own guns, ". . . is not reasonable or fair." But when has such a suggestion ever been made? The aim of the measured rate is to make the large user pay for what he has; for, it is, of course, common knowledge to students of the rate question that the insoluble problem in the framing of a flat rate is to fix a rate with a sufficient margin to cover the vagaries of the large user, which necessaily has the effect of making it to be unfair to the small user. In fact, the small user pays in the most direct way for the large users' liberal use of the telephone.

We gather from the *Yorkshire Post*, that since an increase in the number of subscribers necessitates a disproportionately large increase in the apparatus and in its complexity, the addition of small users to an exchange ought not to be encouraged, especially if such addition is to cost the large user more. It is to be assumed, we suppose, that the large users only desire to commune amongst themselves, that an extension of the field of their telephone service three and four-fold is of no advantage to them, and that it is a matter of indifference to them whether they can call up only a few

large firms or everybody of any business importance at all. In the halcyon days when message rates were unknown the number of telephone subscribers was not a third of what it is at present. Is it nothing that the scope of the telephone service has been enormously widened in every direction, or will advocates of the flat rate maintain that the large subscriber has no desire to speak to the small user and no interest in seeing the list of subscribers grow?

It will perhaps be wondered whether the *Post* desires the small user to wait until he is important enough to be a big user before he subscribes for a telephone. By no means. A suggestion of effulgent genius is lightly sketched out by which, if we apprehend it rightly, the sheep and the goats are suitably divided. The former would be joined up to one exchange and would converse *ad libitum* with their peers at a moderate unlimited rate; the latter would be connected to another exchange, but whether at flat or message rate is not indicated. The two would then be connected by what we take to be junction lines, and communication would thus be obtained between the two groups, presumably on payment of a fee, otherwise the scheme seems to have no *raison d'etre*. There may, of course, be certain firms whose communication is limited as to *clientèle* if not as to quantity and who would never require to pass out of the charmed circle; but doubtless the majority of large firms would find that their business took them very frequently into the outer darkness of the small users' exchange, and if these firms had to pay a fee per message for every outside call, plus a fair flat rate, it would certainly suit the book of any company or administration very nicely. We do not, however, see how it would make for cheapness. Precisely at what point the large user would be differentiated from the small user; where the one would be compelled to enter the ranks of the other; and how the subscriber whose business made him a large user in one season and a small user in another would be treated, these are difficulties over which a veil of discrete silence may be mercifully thrown.

As regards the rates of the future, the Company can have no personal interest in their structure. But it is at least a matter of interest to the staff, and to all telephone enthusiasts, that rates are designed to extend the telephone to the largest number, and that they are on the fair principle that each man pays according to the use he makes of his service.

STATISTICAL ILLUSIONS.

WE apologise to our readers for bringing to their notice the trite saying that "figures can be made to prove anything," but we are moved to do so by a long anonymous letter over the initials "H. H." which appears in the *Financial Times*, and which concludes as follows:—

> "There is one point which I would add. The National Telephone Company after 30 years' work in the London telephone area possesses 123,000 subscribers; the Post Office after nine years' work possesses 71,000. Whether this fact comes under the heading of reason or logic I know not, but it speaks for itself."

What we think speaks for itself is that during these nine years the Company added 73,500 exchange stations to its system, while its powerful rival with all its advantages of an entirely underground system, a clean slate, that is to say the advantage of being in every case able to instal up-to-date plant without having to scrap old plant, and of intercommunication with the Company's large *clientèle*, added 71,000. What does a reasoner or logician of the type of the *Financial Times*' correspondent expect. He seems to us to suggest that as the Post Office, starting from some small beginning of 40 or 50 in 1901 have increased their stations to 71,000 (an increase of about 150,000 per cent., the Company which had 29,000 stations ought logically, if it were aught other than an effete and moribund concern to have now at least 58,000,000 telephones, which it will be seen would give not only one for every happy Londoner, but no cupboard or coalcellar would be without its telephone. Such is the incalculable majesty of statistics in unskilful or too skilful hands.

THE AUTOMATIC EXPERIMENT OF THE POST OFFICE.

THE notices which have appeared in many papers heralding an "improvement in telephony," due to the fact that the Post Office are about to construct at least two automatic exchanges to be used by the public, deserve attention. The proposal as outlined in the notices is (in addition to an experimental installation at the Post Office) to equip a Strowger automatic exchange at Epsom and a Lorimer automatic exchange at Caterham. It is further stated that this is to be done after full study of the system by the Post Office engineers in the United States, but just what these experimental equipments (for they are frankly described as experimental) are to prove has not been disclosed. Epsom is in the London area, and probably about 75 per cent. of the calls are outgoing junction calls; apparently, therefore, every time a subscriber originates such a call he must call an operator, so that the amount of real automatic connexions is bound to be very small. From this may easily flow two results—both due to an unfortunate selection of place for an experiment: (*a*) The subscriber, who will have to manipulate a dial to call an operator (which he can do now by taking the telephone off the hook), may easily be led to express a preference for the manual system; and (*b*) the subscriber may contrast the length of time he takes to get through to a *local* subscriber with the time taken to get through to a subscriber on another exchange, and so express a preference for the automatic. Of course both these would be preferences constructed upon wrong premises, but it is not clear how this construction is to be prevented in the minds of the subscribers. It seems clear that the experiment is intended to prove something *vis-a-vis* to the subscribers, else the Department would hardly have arranged to try the experiment on the public before trying its own exchange—the "trial on the dog" referred to by Mr. PURVES in the current issue of the *Post Office Electrical Engineers' Journal*.

Viewing the matter without knowledge of the special conditions of the Department, it would seem that the correct procedure for such an investigation is something as follows:—First, detailed study of working results, including costs in one or more established exchanges. This can be done in the United States, and, presumably, has already been done. If this is demonstrated to be successful, both as regards security of service and cost, but not otherwise, an examination as to whether the proposed equipment will give all the various kinds of service which are requisite; if that is satisfactory, the next step is to study the cost of doing this, and care is necessary here because the matter must be studied from

a long-sighted point of view—not for a short time or for a small piece of territory. If that also is satisfactory the next step is to familiarise staff with the working of the apparatus, and here the construction of an exchange for domestic use by the Government would be correct. Not until all these are accomplished should any telephone authority, as we conceive it, try a new equipment of such a radical departure, from that already in use in the country, on the public.

Such caution is especially necessary seeing that, although large automatic equipments have been working for ten years in the United States, the best opinion in that country has definitely decided against the adoption of full automatic working.

Some very weighty arguments for this decision were put forward by Mr. CARTY at the second International Conference of Telephone Engineers at Paris in September last, and these, as far as we know, remain unchallenged.

HIC ET UBIQUE.

THE experiments in long distance telephony from Aberdeen to Paris, says the *Electrical Engineer*, which were carried out last week, have proved highly successful. They were undertaken by the Post Office with the object of testing the new loaded cable, the efficiency of which, it is claimed, is about three and a quarter times that of the ordinary cable. It is announced that with little difficulty connection was established over the circuit from Aberdeen to Glasgow and London, thence to Dover, and then to Paris *via* Calais, and the conversation between Aberdeen and newspaper offices in Paris was easily conducted, and items of current news were exchanged between the two offices. Those in charge of the experiment were highly satisfied with the result, and it is understood that in those cases in which the test has proved satisfactory the centres will be put in authorised communication with Paris. It is also stated that, the new type of cable having proved so successful in communication between England and the Continent, cables of similar type will be laid in the future, and will result in a generally extended range of communication.

THE *Pall Mall Gazette* says, in relating the good fortune of a St. Louis telephone operator whose sweet voice, heard over the wire, captivated a Mr. McCalpin of boundless wealth, and resulted in a wedding, that the moral is too obvious to be drawn. It however proceeds to exhort sharp-voiced operators to mend their ways and bear the St. Louis idyll in mind. The Company can certainly supply any number of musical-voiced operators. Will the *Pall Mall Gazette* arrange for the supply of American millionaires at the other end of the wire?

Fearson's Weekly has a prophetic paragraph about the future of wireless telephony, adapted to the taste of the general public. We observe with pain that in referring to Tesla, they style him "the Wizard of Electricity." What has Mr. Edison done that he is so ruthlessly deprived of his sovereignty.

The following extract from the *Bristol Times and Mirror* of June 23 will be of interest to members of the staff:—

"Some consternation was caused yesterday in York Road, New Cut, by the running away of a horse attached to a cart containing loose boards. At some risk to himself a man named Baker, a telephone linesman, jumped at the animal's head, and amid the falling boards brought the horse to a standstill. It was a plucky deed and probably averted a disaster, as the horse was making towards Bedminster Bridge, where the traffic at the time was heavy."

"THE CIRCUIT OF EUROPE"—AVIATION AND TELEPHONY.

BY P. C. LANGRIDGE, *Chief Inspector, Dover.*

CURIOUSLY enough, when telephonic communication is required it often seems to be quite as an afterthought that the Telephone Company is consulted, and that at the eleventh hour. At such a time the telephone man has to show that it is not only aviators who "fly," so that although the telephone was installed on the French torpedo boat within five minutes of its entering into Dover Harbour, it was just eight hours prior to the start of the Calais-Dover stage of the "circuit of Europe" that it was decided that an exchange connection to the aerodrome was indispensable. Then we had to "don sparking plugs" and "whizz." An official car, placed at our disposal by the authorities, quickly landed us at the ground—picking up stores and a man on the way—where we had just time in the gathering darkness to view the situation. Partial provision had been made in the shape of a temporary earth circuit private wire, but the use of this entailed re-transmission, and in many cases double translation, both of which difficulties were overcome by the use of the type of translator with which telephonists are familiar. A pair of spare wires being, fortunately, available a good part of the way, we proceeded to run covered wire to the end of the route, with the aid of one of the motor lamps, then—being still at liberty, in spite of the questionings and strong suspicions of two "plain clothes" men—cutting and diverting the private wire through trees and along hedges to meet the route, the connection was completed. Then back to the tent to prove all "O.K." almost on the strike of midnight, home for a short nap and to the aviation ground once more by 3 a.m. Now patience and long sight came into play, but our reward was complete when the last of eleven flying machines of various types landed safely on the ground. Within two minutes of each man leaving Calais the news was at the air station at Dover, and signalled across the aerodrome by army signallers to the officials and timekeepers. Immediately upon the arrival of each airman information was telephoned to the torpedo boat and thence transmitted by "wireless" to Calais, so that the aviators' friends should known of their safe arrival.

The utility and importance of the telephone connection was demonstrated on the morning of the return to Calais, when, the aeroplanes being all lined up and one aviator having actually started his engine, word came through just in the nick of time that a fog had developed on the French coast, and that it was unsafe to start. The actual departure took place half an hour later, by which time the Channel was reported "clear." The messages from Calais were all received in French, so that one *human* "translator" was indispensable and he, being stationed in the telephone tent, did yeoman service.

SWIFTLY the time is coming
When we of the N.T.C.
Must come beneath the ægis
Of the mighty P.M.G.

Some of us joined but lately,
Some from the first have served;
None of us watching the passing
But feels a bit unnerved.

"The past has been very pleasant.."
"What will the future bring?"
"Will it improve our standing?
"Or any—or every thing?"

"What of our new companions?
"Where will they put us, pray?"
"What of the men who will lead us?
"At that fast nearing day?"

"What ——?" but the list is endless,
And the Editor cuts it short;
We shall know the answers, doubtless
When the ship gets into port.—E. M. B.

THE NATIONAL TELEPHONE STAFF BENEVOLENT SOCIETY, LONDON.

COMMITTEE
(READING FROM LEFT TO RIGHT).

Front Row.—Miss E. Ralph, D. Stuart (Chairman of Committee), C. B. Clay (President), A. C. Greening (Vice-Chairman of Committee), Miss J. McMillan.
Middle Row.—J. B. Ryall, H. G. Corner, G. Buckeridge, W. Cullum, P. V. Dowson (Auditor), A. H. Hudson (Secretary), A. Warner, Miss A. Reckie, G. W. Livermore.
Back Row.—D. Davies, J. R. Angier, J. Leslie (Treasurer), J. A. Bartlett, P. Swan, E. How, A. E. Wild (Assistant Secretary), J. Moon.

£1,000 OF BENEVOLENCE.

BY A. H. HUDSON, *Secretary of the National Telephone Staff Benevolent Society, London.*

WHEN Mr. Clay, the Metropolitan Superintendent, at the Metropolitan Staff Dinner in 1906, suggested the formation of a benevolent fund in London, I do not think he could really have expected the results which ensued, for the London Society, which was formed soon afterwards, was the pioneer of many such societies throughout the service. The idea seemed to strike many favourably, and, in consequence, a considerable number of distressed persons have had good cause to thank Mr. Clay for his kindly thought.

The London Society having now been in existence for five years, it might perhaps be of interest to the readers of this JOURNAL if I gave as briefly as possible an outline of the formation, and the method of dealing with the work, of the society which now numbers nearly 3,000 members with an annual income, including donations, of over £300, and which, since its formation, has distributed over £1,000 in grants.

At the outset the idea met with the approval of the Directors and chief officials of the Company. The Board started the fund with a cheque for £50, and most of the chief officers came along with donations small and large, in addition to becoming, in many cases, ordinary members and paying the humble shilling per annum. Moreover on Nov. 17, 1907, the Board passed the following minute:—

> "The question of a grant to the Metropolitan Staff Benevolent Fund was considered, and it was recommended that on the basis of the members of this and similar funds in other districts contributing one penny per month, the

Company should make an equivalent contribution to the said funds monthly."

Since then under this minute they have paid us a large sum, and in many other ways have given material help. The interest thus shown and the assistance given has been of the greatest help to the committee in carrying out the objects of the society.

The suggestion to form such a society was most enthusiastically taken up, at any rate by the promoters. A meeting was held and officials appointed. These officials, with the exceptions of the vice-presidents and trustees, were chosen from outside the executive officers of the Company, so that it could truly be said the society was formed and run by the staff for the benefit of the staff. Of course the help of the executive was not refused, and in a quiet way Mr. Clay and his chiefs of staff have assisted to make smooth the pathways it was necessary or desirable to tread.

On April 26, 1909, the society was eventually definitely formed, Mr. Roger Payne being the first president, the late Mr. Arthur Waller secretary, and Mr. Dudley Stuart chairman of the committee, which was chosen from all ranks of the staff. With the Company's £50 to go on with the society was then prepared to commence business.

Now the staff of so large a Company as ours is naturally suspicious of anything good being offered at a cheap rate, and the Metropolitan staff has confirmed this in every way in connection with the benevolent society. Not that the higher staff have not entered into the idea; quite the contrary. Unfortunately it is amongst the lower paid branches of the staff, the section from which we would naturally have expected most support, that the smallest percentage of members has been obtained, with the result that cases where help was urgently required could not be assisted owing to the applicants not being members. It might be said by some that this is not fair to the men, as such men could not be expected to pay the subscription out of their comparatively small wages, but Mr. Clay's idea was that a combination of the whole of the staff at a very small subscription would yield a substantial sum quite sufficient to meet all reasonable demands. The Company's staff in London was then about 4,000, and at one shilling per annum, or less than a farthing a week, this would have brought in about £200 yearly. Every man or boy in the service could have joined on these terms without doubt, but notwithstanding the great benefits which might be obtained at so small a sacrifice, a large number, nearly 40 per cent. of the labour, fitting and inspecting staffs, still hold aloof. It is only fair, therefore, that any man not joining should be exempt from any benefit, as if he is not generous enough to wish to help others with his pence he cannot expect help himself. And yet, I do not think it is meanness that prompts them. We have found by experience that any suggestion amongst the labour staff to help a colleague who is in trouble is invariably accorded a generous reception, and in the course of a year the men easily pay in their own way more than one shilling for such purposes. One can only think, therefore, that the real reason is a misconception of the objects of the society, and the difficulty of disseminating the news amongst so large a staff so that each member thoroughly understands the arrangements. Of course it is possible that some of them belong to other friendly societies and see no reason for belonging to more than one.

During the first year (or rather portion of year) of the society's existence up to Dec. 31, 1906, 1,540 members joined, paying nearly £40 in subscriptions, and four grants were made to the value of £5 13*s*. Before 1906 closed the advisability of registering the society with the Registrar of Friendly Societies became apparent, and as this costs nothing and carries with it a legal status, the necessary formalities were gone through and on Nov. 28, 1906, we became (under No. 1089 London Ben.) one of the great army of officially recognised societies formed for the purpose of assisting their members when in distress.

Applications for assistance came in more quickly in 1907, during which 38 grants were made to the value of £130 9*s*. 6*d*.; 1,376 members joined and the income all told was £148 17*s*. 11*d*.

In 1908 we had the additional help from the Company under the minute mentioned to the extent of £137 15*s*. 3*d*. and up to the end of April, 1911, we had received, including the original £50, nearly £500 from this source. I should like to mention here that although these donations from the Company are comparatively speaking large sums, the formalities to be gone through in claiming them are very little. The Secretary of the Company in carrying out the minute of the Board has not required any formidable returns and a certificate each month giving certain details is all that has been asked for in order to obtain the coveted cheques. With this extra assistance the committee were naturally able to deal liberally with the applications.

The following table shows the actual progress of the society from the date of formation up to the end of April, 1911, a period of five years :—

Year.	Grants.	Value of grants. £ s. d.	Income. £ s. d.	Membership at close of year.
1906 ...	4	5 13 0	116 4 0	1,503
1907 ...	38	130 9 6	148 17 11	2,756
1908 ...	88	258 3 5	351 0 8	2,644
1609 ...	95	278 13 11	276 6 11	2,700
1910 ...	87	301 1 0	317 7 4	2,906
1911 to April 30 ...	31	102 14 6	136 9 3	2,913
	343	£1,076 15 4		

Bookkeeping.—In dealing with so large a membership it is, of course, very necessary for a sound system of bookkeeping to be adopted, and carried out in such a manner as to allow of easy and thorough audit.

The system introduced at first worked well for a time, but, as the membership increased, was found to be somewhat awkward to keep going, especially for the collectors. It was also very difficult to audit.

In 1908 and 1909 a new system was gradually formulated, and at the present time is found to be working very smoothly indeed.

For each member a card of membership is issued, giving on one side the details of the member and on the other a list of the permanent officials of the society. At the same time a membership record card is also made out, and this constitutes the register of members. A number, which must be quoted in all communications, is allotted to each member, and the record cards are kept in a cabinet with pilot cards in alphabetical order, A*a*, A*e*, A*i*, etc. In each vowel section the cards are kept numerically, it having been found better to keep it in this manner than in actual alphabetical order throughout, as it is easier to put a card in its correct place numerically than alphabetically, and we thus have a combination of both systems. We also keep a numerical register of members separately, but this is no trouble to keep, as from it the numbers are allotted to members, and in doing so the name of the member and department are entered in the book. No number is used twice, so that the book does not need re-writing owing to alterations.

For the purpose of collecting the subscriptions, a card similar to that used for the Saturday Hospital Fund is supplied to the collectors, of whom we have 80. A copy of each card is kept in book form by the secretary for the purpose of keeping a check upon the collectors, and following up outstanding subscriptions.

The card is sufficiently simple and self-explanatory, and I will only mention that the collector should enter any amounts collected in the month when the collection takes place, and forward them to the secretary during that month, and in cases where the amount collected from any member includes the entrance fee of threepence which is charged, such amount should be shown inside a circle, thus six would mean that threepence entrance fee and threepence subscription had been paid. A remarks column is utilised for advising the secretary of any changes in membership, and no other intimation is required, thus saving correspondence. In some departments the subscriptions are collected annually, in some quarterly, and in some month by month. The cards have been ruled so as to allow of any of these systems. When the amount collected has been forwarded to the secretary, a formal receipt is issued for the same, and the secretary also initials the collector's card as having received the amount mentioned. Any member can thus assure himself by inspecting the collection card that all amounts paid by him have been duly forwarded to headquarters. The secretary once a month hands over the total received to the treasurer who initials the counterfoils of the receipts, signifying that

he has become responsible for the amounts, and these are then paid into the society's banking account. When, in the opinion of the committee, too large a sum is standing to the credit of the drawing account, a portion is transferred to the reserve account in the Post Office Savings Bank, and thus earns interest. At May 1, 1911, we had £77 18s. on the reserve account, and up to date have earned £8 10s. Cheques are drawn for all amounts paid out, and only on the direct authority of the committee, as will be explained later. The cheques, which are unstamped (friendly societies are exempt from stamp duty), are signed by the chairman or vice-chairman of the committee, the treasurer and the secretary, each of whom assures himself that the amount to be paid has been authorised by the committee. Each month a circular giving the statistics of the previous month is issued to the collectors for posting on the notice boards, and in this way the members are kept advised of what has been done.

Applications for Assistance.—A member desiring to apply for assistance writes direct to the secretary, and all applications are treated in the strictest confidence. In reply a printed form of application is sent in which the applicant sets out his request, and gives the details which the committee have found by experience are necessary. On receiving this form correctly filled in, and having confirmed that the applicant is entitled to apply by extracting from the cabinet the membership record card, the secretary forwards the case to a member of the committee to enquire into and report upon. The report having been received is placed before the next meeting of the committee (a special meeting is called if necessary) and considered. All proposals for grants are written out on paper and signed by the proposer and seconder, and, if the suggestion is approved by the committee, initialled by the chairman. The proposal form when approved and certified forms the authority for payment of the sum agreed and is attached to the application form. Each application is numbered, and in the five years we have dealt with 360 cases. Any accounts to be paid other than grants are presented to the committee to be authorised for payment, the chairman initialling the account when approved. The transactions at each committee meeting are entered in due form in a minute book and confirmed at the next meeting. This book is used by the auditors when checking the accounts at the end of the year, as every amount paid must be shown therein as having been sanctioned by the committee. An index to the cases is kept in card index form, a card being made out for each case and filed alphabetically. As the case papers are filed in numerical order, we have both alphabetical and numerical systems in use. When the case is settled a note of the transaction is entered on the back of the membership record card before being replaced in the cabinet.

Committee.—We have fifteen ordinary members of committee in accordance with the rules, which, however, provide for co-option of further members if found desirable. We of course endeavour to arrange for each department to be represented. Five of these members retire each year but are eligible for re-election. The co-opted members retire annually.

A meeting of the committee must be held at least once a month, but it is very rarely that we do not have at least two meetings each month and sometimes we have more. The average attendance at these meetings is twelve. It will be understood, therefore, that the members of the committee give up a very large amount of time to the society. The portion of their work of reporting on cases is certainly not always pleasant, often involving a visit to very undesirable parts of London. As far as possible the cases are distributed to suit the convenience of the committee members and to give an equal share to all. Sometimes, however, I have been obliged by necessity to trespass on the good nature of a committee man, and send him a case which may take up the whole of a Saturday afternoon. It says a good deal when I mention that, notwithstanding the large number of cases dealt with and the time taken in dealing with them, they have always been willingly undertaken by the various members of the committee. As many of our committee are also connected with other societies, and one at least is a town councillor, it will be appreciated that they must needs be very benevolently minded to give up so large a portion of their leisure to our little society, without any recompense beyond the feeling that comes when a good action has been performed or time well spent. They have followed out Mr. Clay's suggestion in a manner which, I think, must have met with his entire approbation, otherwise he would not have allowed himself to be at last persuaded to accept the presidency when Mr. Payne retired on account of ill-health.

Audit.—The work of auditing the books and accounts is undertaken by two members who are elected each year at the annual general meeting. In the first three years, the work of auditing was most omplicated and took up a great amount of time. Subsequently with improved methods of keeping the books the task has become much easier, although still involving the sacrifice of some of their leisure hours by the two gentlemen who carry out the work.

Trustees.—The appointment of these gentlemen is a necessity following the registration of the society, as the trustees are the legal representatives of the society, who would take on behalf of the members any legal action which might be necessary. Fortunately they have not been called upon to carry out any unpleasant duties, and have only been asked so far to be responsible for the society's reserve bank account which stands in their names.

Arbitrators.—These gentlemen have not yet been called upon to perform any of the duties of their office, the decisions of the committee having never been objected to.

The work of the society is most interesting and instructive, and has certainly shown how large a number of our fellow workers are at times in trouble, of which perhaps we should never have known had it not been for the benevolent society. We have found out how much the poor help the poor, to an extent we would probably never have believed had the fact not been proved by experience. It is possible that the committee in considering the cases put before them have been "taken in" in some instances. I do not think this is so to any appreciable extent, but that the money distributed has been money well spent.

The committee have decided, so far as they can do so, that the society shall be continued after Dec. 31 next, and there is every hope that under the new authorities the work may still go on as successfully as in the past.

MATHEMATICS AS AN AMUSEMENT.

By E. T. PAYNE, *Chief Clerk, Newcastle-on-Tyne.*

(*Continued from page* 87.)

(This paper, which has been considerably abridged, was written by Mr. Payne for the Newcastle Telephone Society with the view of interesting members of the non-technical staff in the subject. It has been necessary to omit many interesting problems and their solutions.)

Infinity and Zero.—These are not exactly branches of mathematics. All calculations in reference thereto, however, come under that head, although (except in the "Calculus," which for various reasons does not form a portion of this paper) they have no really distinctive classification.

As such calculations possess a special interest of their own, I decided to at any rate refer to them.

To help in illustrating the subject, the following definitions and symbols will be of use.

Arithmetical zero = "absolute absence of quantity" = O

Mathematical zero = "something smaller than any conceivable quantity" = Θ

Infinity = "something larger than any conceivable quantity" = ∞

It will possibly at once strike you from the definitions that the mathematical zero is quite a different thing from the arithmetical zero or cypher. In arithmetic the cypher standing by itself represents an absolute absence of any quantity whatever, whereas the mathematical sign does represent something, only the something is so very very small that our ordinary figures cannot express it. It must therefore be regarded as a symbol in the same way as the sign for infinity. I may mention that there is no standard symbol to represent the mathematical zero, as there is with infinity. This is perhaps a slight flaw in mathematics. The sign Θ is purely imaginary, and I have given it to avoid the use of words in full.

I will endeavour to show by means of actual examples that

very small things are quite as important mathematically, or scientifically as the very large things, and that both are as a rule much more interesting than the mediums between them that we deal with daily.

In scientific investigations the importance of anything *does not* necessarily depend on its size, any more than in everyday life we should consider a sovereign less important than a penny owing to the fact that it is smaller.

In our ordinary business life, we do not deal with such figures as those in the various examples which follow, but in mathematical calculations and scientific investigations they are in constant use. Members of the electrical staff will know that "infinity" *is* used to a certain extent in practical electrical work (as applied to resistance), and if they attempt to express its meaning at all frequently in ordinary figures they will at once realise the practical necessity for a separate sign.

There has always been some difficulty in realising what things "infinitely small" and "infinitely large" really are, and one scientist endeavoured to partly explain by the following little poem:—

"All our fleas have little fleas
Upon their backs to bite'm.
The little fleas have lesser fleas,
And this *ad infinitum*.

The greater fleas themselves in turn
Have greater fleas to go on;
While these as well have greater still,
And this *ad lib.* and so on."

The intention being to show that however small a thing is to our limited knowledge, there may be something smaller still, and also that however large a thing is there may be something larger.

The microscope and telescope give us a partial idea of the infinitely small and infinitely large. With the assistance of the former, for instance, scientists have been able to distinguish separately from each other things that are only about an hundred-thousandth part of an inch in diameter, and it has also been proved without actually seeing them that other things exist infinitely smaller still.

On the other hand, with the aid of a telescope, we can see over enormous distances, covering millions and millions of miles, and yet also know by science that there are stars, etc., millions of miles farther still that we cannot see at all.

The difficulty in realising the meanings of "infinitely large" and "infinitely small" is partly caused by our natural tendency to take things common to ourselves as a standard. The earth is to us for instance, of enormous size. Compared to the space it floats in, however, it is extremely small.

As regards mathematical calculations relating to the infinitely large and small the following electrical example may not be out of place:—

You doubtless know that the battery voltage available on an external part of an electrical circuit equals—

(1) Current in amperes × resistance of such part in ohms, or

(2) Electro-motive force in volts − (current in amperes × internal resistance of battery in ohms).

If we now take as an actual example a cell or cells with an electro-motive force of 2 volts on an "open" or disconnected circuit, and an internal resistance of 2 ohms so long as the circuit remains disconnected we should have current as *nil* and external resistance as ∞, and,

(*a*) If V = voltage available on external circuit
C = current flowing in amperes
E = electro-motive force in volts
x = external resistance
r = internal resistance
$V = {}^{(1)}\ C\,x \quad \text{or} \quad {}^{(2)}\ E - C\,r$

(*b*)
$$V = C\,x$$
$$2 = O \times \infty$$
$$2 = O$$

(*c*)
$$V = C\,x$$
$$2 = \Theta \times \infty$$
$$= \cdot0000000001 \times 2000000000$$
$$2 = 2$$

If, however, we try to fit these facts in with the first formula we find (*b*) that things are not as they should be, or, in figures, that $2 = O$. As the formulæ are accurate the figures must be wrong, and on looking into these we find that so long as the arithmetical O is used we cannot get them right, but if the mathematical Θ, or its value as nearly as we like to make it, is used instead the correct result is obtained, *e.g.*, $2 = 2$.

This result is shown below preceding example, see (*c*) and our electrical staff will recognise that electrically the figures given for Θ and ∞ are accurate.

In the formula $V = E - C\,r$ we can use O or Θ for current, getting a correct result in either case.

$$V = E - C\,r$$
$$2 = 2 - O \times 2$$
$$= 2$$
$$V = E - C\,r$$
$$2 = 2 - \cdot0000000001 \times 2$$
$$= 2 - \cdot0000000002$$
$$= 1\cdot9999999998$$
$$= 2$$

This does not, however, illustrate difference between O and Θ so well.

Another thing a little difficult to understand is that mathematically nothing ÷ nothing may equal 2, 4, 6, or anything else. A few figures are given to show this

$$O \div O = \text{say, } 2$$

$$2 = \frac{\cdot2}{\cdot1} = \frac{\cdot002}{\cdot001} = \frac{\cdot00002}{\cdot00001} = \frac{\cdot00000002}{\cdot00000001}$$

$$= \frac{\cdot000000000002}{\cdot000000000001} = \frac{\Theta}{\Theta}$$

$$\therefore \frac{\Theta}{\Theta} = 2$$

If we mentally carry on the figures to an infinite extent the mathematical Θ and arithmetical O become of same value. The fact therefore applies to both.

One or two illustrations showing how very small things can be split up into smaller things still may be of interest. These will also indicate how measurements, otherwise impossible, can in some cases be carried out.

If for example one grain of indigo is put into a ton of water, it will split itself up and give a distinct colouration to the whole of the latter, that is to a substance over fifteen million times its own size.

Another substance, fluorescein, is more powerful still, as a single grain will cause fluorescence (a peculiar blue effect) to every particle of 100 tons of water, *e.g.*, to the whole of something which is about 1,568 million times its own size.

As an instance of how scientific instruments, and therefore mathematical calculations, can deal with very small as well as very large quantities, a spectroscope can detect the existence of a portion of sodium salt in a substance if only weighing the one hundred and eighty-millionth part of one grain.

As an example of calculations *re* the very small, I give also details of the sizes of molecules, etc., existing in liver cells of our bodies. The actual figures are of course very approximate.

$$\text{Molecule} = \frac{1}{125000000}$$

$$\text{Atom} = \frac{1}{125000000 \times 5000}$$

$$\text{Electron} = \frac{1}{125000000 \times 5000 \times 100000}$$

$$= \frac{1}{625000000000000000}$$

(of 1 inch approx.)

This is one of those cases where figures, ordinarily speaking, quite fail to give an idea of size, that is, the brain, except perhaps with experts, fails to rise to the occasion.

The infinitely large is also beyond our comprehension, although, with the aid of certain proved facts, we can partly realise what it means.

To give an example, 20625 × 92000000 (miles) represents approximately the distance of the *nearest* star from the earth. This is 206265 times the distance of sun from earth. The *farthest* star is at a distance which no one can realise, and space doubtless extends far beyond that limit, as if not we should have to imagine the *last* star as hanging against a solid wall in much the same way as our pictures at home.

If these few examples have helped in any way to a partial realisation of the infinitely large and small they have served their purpose. If they show that mathematical calculations are not always the dry and unpoetical things they are generally supposed to be, so much the better.

Mensuration.—Most of you are doubtless aware that the object of mensuration is the measurement of lengths, areas and volumes. When anything cannot be measured it is called "immeasurable," or, if its measurements cannot be got at exactly, "incommensurable." An isolated example of the former is "infinity," and of the latter the useful symbol π.

The last-named is a Greek letter used to represent the ratio of the circumference of a circle to its diameter, and owing to the fact that its value cannot be exactly obtained, the supposed impossibility of "squaring the circle" arises. If by any new system of calculation we could find the exact value of π all difficulty in squaring the circle would probably disappear. Many famous people have had a try at this from very ancient times without success.

Its general value for practical purposes is taken as either 3·1416 or $\frac{355}{113}$, and in some cases, where a less exact result required, $\frac{22}{7}$.

As regards ancient times, Solomon with all his wisdom was decidedly inaccurate with this point, as in 1 Kings vii, verse 23, we read:

> And he made a molten sea, 10 cubits from the one brim to the other. It was round all about, and its height was 5 cubits, and a line of 30 cubits did compass it round about.

This gives a value of three only. The Egyptians were much nearer the mark with $\frac{256}{81}$, or 3·16.

I may mention for benefit of those interested that the ancient measure of a cubit represented the length of the arm from elbow to middle finger tip or somewhere about $1\frac{1}{2}$ feet.

As an example of what experimenters with a thirst for knowledge will do, a Mr. Shanks, of Durham, calculated the value of π to over 700 places of decimals. If you make an attempt to work out any mensuration problem with this as a multiplier you will find that you have a big order on hand.

There is an interesting game or problem introducing the symbol π which may be new to many. Horizontal lines can be drawn on any level surface at an equal distance from each other; a needle is then cut to any length shorter than distance (d) between these lines (say, for convenience half of d); and the game, or rather experiment, is commenced by dropping this needle haphazard and recording the number of times thrown and the number of times it falls on or touching a line.

$$\text{Formula } \frac{s}{n} = \frac{2l}{\pi d}$$

$$\text{or } \pi = \frac{2ln}{ds}$$

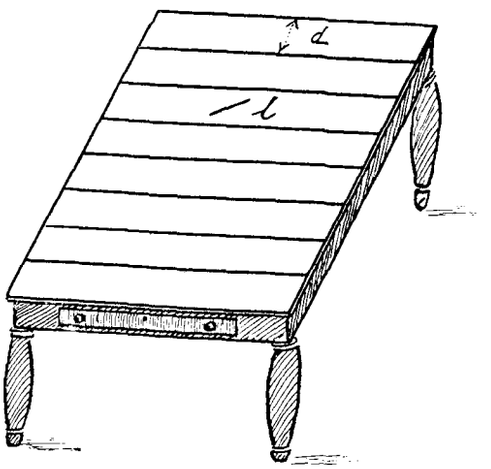
where n = total number of throws
s = " " successful throws
l = length of needle
d = distance apart of lines.

If $l = \frac{1}{2}d$ formula simplifies to

$$\pi = \frac{n}{s}$$

By using the formula given we shall be able by experiment to get a value of π of our own, and the larger the number of throws the more accurate will our value get.

This amusement is essentially mathematical and introduces algebra, chance and probability, geometry and mensuration. It is a very good illustration of the laws of chance as well as providing



for us the obvious problem of the connection which exists between the circumference of a circle and equidistant parallel straight lines; that is, why should the needle generally speaking fall in the ratio of the circumference of a circle to its diameter. Of course in examining this problem it should be dealt with in a mathematical way, that is, it should be given a proper chance by means of a large number of throws, use of several needles, etc. For example, to take an absurd extreme, if we throw the needle a few times only the result will not express value of π or anything else.

As in other branches of mathematics, many problems, scientific or otherwise, are based on mensuration. The following example indicates the nature of some of these:—

A man wraps 200 yards of strong thread around a broomstick 1 inch in diameter and fixes same in a field, allowing for a circle of 200 yards radius, and invites a friend to take exercise by unwinding the thread in walking around the broomstick. The thread to be kept tight during the whole operation.

To carry out this what distance would his friend have to walk? The answer is a little surprising.

ANSWER.

Diameter of 1 inch = ⊙ ce. of 3·1416 inch
= " " ·0873 yards
= shortest journey

Diameter of 400 yards (from radius 200 yards) = " " 3·1416 × 400 yards
= " " 1256·64 yards
= longest journey

Number of turns = 200 ÷ ·0873 = 2291

Average journey = (1256·64 + ·09) ÷ 2 yards
= 628·36 yards

$$\text{Total walk} = \frac{628{\cdot}36 \times 2291}{1760} \text{ miles}$$

= 818 miles. *Ans.*

INVENTORY OF PLANT.

The following additions have been made to previous lists;—

HEADQUARTERS.

Greaves, G. F.	Clerk	Head Office

TRAVELLING STAFF.

Searle, W.	Walking Foreman	Metropolitan
Purce, F.	Foreman	Metropolitan

Deletions.

Taylor, G. J.	Linesman Inspector	Cirencester

TELEPHONE TRAFFIC AND THE CORONATION.

BY H. G. CORNER, *Assistant Traffic Manager, London.*

FROM time to time the traffic staff is called upon to deal with those exceptional and abnormal occurrences which arise in the course of the social and political life of the community and for a period disturb the noiseless tenour of our telephone traffic and upset that scientific adjustment of the load to the operator which is the chief aim and object of the traffic man's vocation. Such occurrences are of two kinds. The most disturbing are those which come with the unexpected suddenness of a bolt from the blue, and, should they catch the traffic staff napping, may well lead to something like a breakdown in the service. For example, we have the well-remembered instance of the sudden postponement of the Coronation of the late King through his unfortunate illness, which event happily found the resourcefulness of the officials and the loyal determination of the operators equal to the occasion. In other cases that some great event is going to happen is known beforehand and due provision can be made for dealing with the traffic arising therefrom, though even here we are faced by the contingency of having to grapple with something of the effects of which upon telephone traffic no previous records exist (within the comparatively brief experience of the traffic expert) to guide us in prevision of the possible requirements. General Elections, which have lately attained the tiresome frequency of a bad habit, we know, and we have become experts in the business, but this elaborate and long-anticipated Coronation—who could foresee its probable effects upon the rapidly growing telephone habit? Certainly one such was celebrated no longer than nine years ago, but that for various reasons was small guide to what might now come to pass, and no other event of a similar nature has left its mark on telephone history.

At any rate, it was determined that nothing should be left to chance, and as, to quote the Irishman, "It is always safest to be on the safe side," it was decided, if error there was to be, it should be in the direction of over preparation. For weeks before the momentous event traffic had been abnormal, and a record London season, from the telephone point of view, was experienced. Loads increased week by week, and were met by the provision of more operators and more junctions. Incidentally, it is to be observed that the former are by no means so easily brought into being as the latter. Moreover, the temperature rose *pari passu* with the calling rate and made our difficulties none the lighter. However, these were all successfully surmounted, and the great day, or rather days, approached. The proclamation of a Bank Holiday, and, so far as London was concerned, of a second, added to the complexities of the situation, for there was no idea of depriving the operating staff of the benefit of these unexpected boons, and so all the staff required was put on the holiday scale. The extraordinary precautions of the London police proved at once a deception and a help, the former because they led to unnecessarily elaborate precautions against early morning rushes, and the latter in that by their apparent success in keeping away the expected crowds they nullified the anticipated difficulties of the operators in reaching their posts of duty. Acting on the advice of the secretary to the Chief Commissioner of Police, each operator was provided with a specially printed card stating her destination and the time at which she was expected there, which card was to be her talisman to guide her safely through and across the streets lined with troops and guarded by police and barriers. Fortunately or unfortunately, according to the way one looks at it, these were not required.

The force which it was thought prudent to provide was about 30 per cent. over the normal Bank Holiday staff and consisted of two exchange managers, twenty supervisors, 400 exchange operators, 30 private branch exchange operators, and eleven of the kitchen staff on Thursday, June 22, and two exchange managers, 30 supervisors, 533 exchange operators, 36 private branch exchange operators, and fourteen kitchen staff on Friday, June 23. But these were supplemented on both days by additional staff between 6 a.m. and 8 a.m., and by arrangements for staff to stay on if necessary from 8 p.m. to 10.30 p.m. Breakfasts were provided for those on duty early, and supper for those stopping late. But besides this and to provide against contingencies an emergency staff of twenty operators, two supervisors and a clerk-in-charge was constituted and stationed at an hotel on the night of June 21-22, instructions being given to the night manager that this operating force could be called upon in case of need before 6 a.m. The need, however, did not arise, and it is not reported that the slumber of these reserves was in any way disturbed. The night staff was of course strengthened, and a large additional maintenance staff was on duty.

Thanks to these precautions the work went on smoothly, no untoward incident seems to have signalised either day, and it may be of interest to add that on 173 service tests made to "B" operators, although continuous listening was not in force except in a very small proportion of order wires, the average answer was eight seconds. Complaints were almost non-existent, and loads which, in the afternoon, assumed considerable proportions were handled promply and expeditiously.

The experience gained on this occasion is carefully recorded, and will be added to the accumulated experience of the Metropolitan Traffic Department to be brought into use on the occasion of the next Coronation which, we may hope, will be in the very distant future.

AN UNUSUAL FAULT IN UNDERGROUND CABLE.

BY A. BASCOMBE, *City Divisional Engineer, London.*

WE have a 204-pair lead-covered dry core cable in a 3-inch cast-iron pipe under the footway in Shoreditch High Street, 153 pairs of which open out on a distribution pole in the neighbourhood.

Immediately following the thunderstorm of the 31st ultimo faults began to develop in this cable, and a joint was broken down in one of the manholes between the exchange and the D.P. The test showed it to be in the length going up the pole; this was opened and it was discovered that the lightning had fused four pairs and broken down the insulation of several other pairs of wires, necessitating a renewal of this section of the cable. On making a second test it was found that faults existed in the section between the broken down joint and the exchange. This was tested and localised and found to be at a spot 6 yards from the before-mentioned broken down joint, and on opening up it was discovered that the pipe which contained this cable was resting on the brickwork of a baker's oven which had been built out under the footway. The heat was so intense as to cause the paper to be very brittle, and on making an examination of the lead it was found there were certain black streaks, pointing to the theory that the lightning had discharged itself at this particular spot through the lead sheathing. The paper insulation was burnt up on each conductor and extended for a distance of about 6 feet, which necessitated cutting in a new length in order to repair cable.

In the route there were altogether three pipes. The other two were then examined and it was discovered that the heat had affected the second cable, although in a very much smaller degree, there being a few wires in outside layer with the paper insulation damaged. The third, however, was found to be in good condition, the reason being that neither the second nor third pipes were actually lying on the oven, but quite close to it.

LONDON NOTES.

NEVER has there been such a long spell of glorious holiday weather as we have been favoured with this summer, and fortunate are those who have and are taking advantage of it. It is hoped that they will obtain much pleasure and enjoyment by their temporary migration to some congenial spot where the simple life beside the silver sea, during these burning summer days, offers charms irresistible, or where those of a more strenuous turn of mind can indulge in mountaineering and other Continental delights!

WHETHER it be due to the intelligent anticipation of events as regards the weather, or to the impending visit of the Inventory battalions, who are expected to be all over us before very long, we are unable to say, but so many more of the staff are away on holidays this month than has been the case in previous years, that in fact, Salisbury House seems "quite empty"!

ALL necessary provision was made for the comfort and convenience of operators on duty, each one was informed as to the most convenient route to adopt in order to get to the exchange each morning, and acting on the suggestion of the private secretary to the Commissioner of Police (Sir Edward Henry) tickets were provided for the operators which, if necessary, could be shown to the police in order to obtain a passage across any street on the line of route.

THE social activities of the staff have been somewhat relaxed, no doubt due to the holiday feeling abroad. We have to record a very successful outing which was undertaken by a party from the Paddington operating, maintenance and engineering staffs on Saturday, July 1. This took the form of a river picnic, the arrangements for which were carried out to the complete satisfaction of all by Miss E. Steele, assisted by a committee. Tea was tastefully served in the *annexe* to Tagg's Island Hotel at 5 p.m. and was thoroughly enjoyed by all. Afterwards the majority were attracted to the river, upon which they disported themselves—of course in boats. Those preferring to remain on *terra firma* visited Hampton Court and the Indian Encampment. The comfort of the whole party, both in the outward and homeward journey by rail, was enhanced by the London and South-Western Railway Company's courtesy in reserving carriagse for their use.

THE third annual outing of call office collectors took place on July 8. Hastings was the favoured resort on this occasion. Unfortunately, owing to the late arrival of the train, a sea trip to Eastbourne, which had been contemplated and arranged for, had to be abandoned, but a drive by motor cars through beautiful Sussex scenery proved an excellent substitute. Lunch was partaken of at the Royal Albany Hotel, and afterwards a four-in-hand conveyed the party to Battle, where much pleasure was derived by the exploration of the Abbey and its historic surroundings. A pleasant return drive back to Hastings gave the members of the party just that keen edge to their appetites to enable them to do full justice to the excellent tea provided. The remaining time was pleasantly spent in songs and music, and all returned home in excellent spirits, having thoroughly enjoyed an outing which was throughout a complete success.

MR. PRESCOTT, the acting Local Engineer, Hop, has joined the noble army of "benedict," and on the occasion was presented by his colleagues and friends as a memento with a handsome hall stand. The presentation was made by Mr. Appleby, the Divisional Engineer, who expressed the best wishes of all for his future happiness.

MISS BRIDGMAN, Typist, Hop, was recently presented by the staff in the Hop divisional office, with a handsome autotype picture on her retirement from the Company's service in view of her approaching marriage The presentation was suitably made by the Chief Clerk on behalf of the staff concerned.

GLASGOW NOTES.

THE preliminary work of inventorying the plant has now commenced. One result of the visit of the Inventory divisions at this time of the year has been the cancelling of all August holidays as far as the Glasgow staff is concerned.

Five Inventory divisions will be stationed in Glasgow.

MR. W. AITKEN, of the British Insulated and Helsby Cables, Limited, has very kindly consented to lecture before the National Telephone Society (Glasgow and West of Scotland districts) in January next. Mr. Aitken's subject will be "Automatic Telephones," and this being one of exceptional interest, should prove attractive. There is additional interest in Mr. Aitken's visit in that he is an old member of the Glasgow staff.

MR. R. P. CRUM, who has been employed in the capacity of Assistant Traffic Manager for the last eighteen months, has been promoted to the Engineer-in-Chief's Office, London (Traffic Department). He left early last month for the south, and prior to his departure was presented by the traffic staff with a watch suitably inscribed.

MR. C. N. CARTER has been appointed to the position of Assistant Traffic Manager in place of Mr. Crum, transferred to London. Mr. Carter is succeeded by Mr. J. R. Craig.

IT is with deep regret that we record the death, as the result of an accident, of Mr. William Crawford, who was employed by the Company as a Plumber. The deceased was working on a roof in Myrtle Street, Charing Cross, on June 26, and in coming out of the hatch and stepping on to the duckboard, which was wet with rain, he slipped and fell into the back court. The building was two storeys high, and death was instantaneous. The deceased, who joined the service in January, 1904, leaves three children, for whom much sympathy is felt in their sad bereavement.

THE BITER BITTEN.

AN interesting incident illustrating the utility of the telephone in baffling wrongdoers occurred in May last at Castleknock Exchange, near Dublin.

About midday a couple of men drove up to the exchange door, alighted from their car and entered the hall leading to the call office. Without being observed at the moment, they suddenly left the premises, taking with them a small picture, the property of the exchange attendant. A few seconds later the latter observed her unwelcome visitors driving quickly away with the souvenir of their visit. The operator thereupon telephoned to a subscriber at the gate of the Phœnix Park, a couple of miles distant, through which gate the car would in all probability have to pass, asking him to request the police to stop the culprits on their arrival. The policeman on duty, acting on the description given him, identified the runaways and brought them to justice. Needless to say, the exchange attendant recovered her treasure.

CORRESPONDENCE.

TELEPHONES AT THE CRYSTAL PALACE.

TO THE EDITOR OF THE NATIONAL TELEPHONE JOURNAL.

IT has been pointed out to me that, in the plan accompanying my article on the above subject which appeared in the last number of the NATIONAL TELEPHONE JOURNAL, one of the conventions used to indicate private branch exchange service is unfortunately liable to give rise to some misconception and I shall be obliged if you will allow me to point this out in next month's issue.

The symbol used for a direct exchange subscriber's station is a black dot, and the symbol for a private branch exchange is a black dot enclosed in a circle. Some of the buildings in which direct exchange subscribers' stations are situated are of circular construction, and in the plan the circles representing these buildings are approximately the same size as the circle outside the black dot which was chosen to represent a private branch exchange. A number of direct exchange stations appear in the plan, therefore, as private branch exchanges. There are two private branch exchanges only at the Crystal Palace, and these are both situated in the main building.

London, July 10. F. G. C. BALDWIN, Acting Met. Engineer.

NEWS OF THE STAFF.

MR. A. SPEIGHT, Electrician, Hull, has been promoted to a position on the Engineer-in-Chief's staff, Head Office.

MR. G. WHITE, Wireman, Bedford, has been promoted to the position of Linesman Inspector at Huntingdon.

MR. JOHN AKED, Local Manager, Keighley, has been transferred to Blackpool in a similar capacity.

MISS EDITH V. LOSE, Operator, Leeds Central, left the Company's service on July 6 after four years' service, and was presented by the operating staff with a gold bangle and set of silver hat pins.

MISS ELSIE TAYLOR, Operator, Leeds Central, resigned on July 6 after four years' service, and was presented by the operating staff with a silver teapot and Apostle teaspoons.

MR. FRANK RATCLIFFE, Bolton, resigned the Company's service on May 20 to take up professional work. Mr. Ratcliffe had twelve years' service and was for ten years Switchboard Inspector, being promoted to be Exchange Inspector on Feb. 12, 1909. The staff presented him with an inlaid oak timepiece and silver cigarette case.

MR. A. T. E. DYSON, on the occasion of his transfer from Margate to the Inspector's Department, Ramsgate, was presented with a handsome set of hair brushes, subscribed for by the whole of the staff at Margate, where he has been local office Clerk for four years.

MR. W. E. BROMHAM, Chief Exchange Inspector, Central Exchange, Manchester, has resigned from the Company's service to take up an appointment with the Oriental Telephone Company in Bombay. Mr. Bromham, who has been in the service since Jan. 1, 1901, was presented by members of the operating and electrical staffs with a suit-case and a kit-bag as a token of the esteem and regard in which he was held. Mr. G. S Wallace, Chief Electrician, made the presentation, and, on behalf of the staff, wished Mr. Bromham every success in his new sphere

MR. W. H. MYERS, Exchange Inspector, has been promoted to be Chief Exchange Inspector, Central Exchange, Manchester, *vice* Mr. Bromham resigned. Mr. Myers entered the Company's service in December 1905, and has been engaged on exchange maintenance during the whole of his service with the Company, with the exception of the last few months, during which he was on the travelling Inventory staff.

METROPOLITAN STAFF CHANGES.

Traffic Department.

MISS ETHEL GILDING, Supervisor, Westminster, promoted to be Senior Supervisor-in-Charge, Ealing.

MISS AGNES CHESTER, Operator, Paddington, promoted to be Supervisor, Gerrard. On leaving Paddington she was presented with two silver-backed hair brushes and comb in a case by her late colleagues.

MISS FLORENCE CLARKE, Operator, Holborn, promoted to be Supervisor, Gerrard.

MISS ROSE BRADSHAW, late Chief Operator, Trafford Park, Manchester, transferred as Supervisor to Avenue.

MISS ETHEL GLAYZER, Operator, Kensington, promoted to be Supervisor, Westminster.

MISS ELLA SUTTON, Operator, Paddington, who left the service to take up another appointment, was presented with a trinket set and art bowl by some of her friends on the Paddington and Gerrard staffs.

MISS LILIAN PENNEY, Docket Messenger, East, on her promotion to the School for Training as an Operator, was presented by the staff with a hand bag.

MISS ETHEL JACKSON, Operator at the same exchange, who is to take up a position elsewhere, was presented by the staff with a Wedgwood biscuit barrel and cut-glass specimen vases.

MARRIAGES.

MR. A. F. DUNN, Cost Clerk, Edinburgh, on the occasion of his marriage to Miss A. C. FERGUSON, late Travelling Supervisor, Edinburgh, was presented with a handsome case of cutlery. Mr. C. C. Worte, District Manager, made the presentation, and Mr. Dunn suitably replied. Miss Ferguson left the service on June 1 last.

MR. R. CLELAND, Post Office Fees Clerk, Oldham, was presented with a barometer upon the occasion of his marriage. The presentation was made on behalf of the district office staff by Mr. A. Pugh, District Manager.

Miss EMMA WILKINSON, Senior Operator, Bradford, resigned on May 25 to be married. The operating staff presented her with a bronze coal vase, and she was also the recipient of a number of personal gifts from the operators.

Miss FLORENCE KERSHAW, Operator, Bradford, left to be married on June 29. She was presented with a royal Doulton teapot and hot water jug by members of the supervising and operating staffs.

Mr. F. PINDER, Foreman, Table Set Department, Nottingham Factory, was recently presented with a handsome marble clock on the occasion of his approaching marriage.

Mr. GEORGE B. BOWMAN, Warehouse Ledger Clerk, Nottingham Factory, was recently presented with a handsome inlaid rosewood clock on the occasion of his approaching marriage. Mr. Fenton (Factory Manager) made the presentation on behalf of the Factory and Engineer-in-Chief's (Factory) staffs in each of the above cases.

Mr. W. BARRETT, Fault Clerk, Woolwich, on the occasion of his recent marriage, was presented with a fire screen and clock, subscribed for by the traffic, engineering and maintenance staff, South-East district.

Miss FLORENCE JENNINGS, on leaving her position as Supervisor, Gerrard, to be married, was presented by the operators in her division with a fruit dish, and by the exchange staff with a dinner service and a double toilet service, besides several smaller gifts.

Miss CHRISTINA BISHOP, Supervisor, Croydon, on resigning to be married, was presented with a set of carvers and silver sugar tongs by the operating staff in the Croydon district.

Miss MAUD SMALE, Operator, Tottenham, on leaving to be married, was presented by the combined local staffs of the traffic, maintenance and engineering departments with a silver-plated cruet.

Miss SARAH GOUGH, Supervisor, Manchester Central Exchange, left the service on June 29 last and was married on July 12 to Mr. Bernard Standen, late of the Engineer-in-Chief's staff, Manchester, and now Assistant Manager of the Oriental Telephone Co., Rangoon. Miss Gough was the recipient of many handsome presents from her colleagues and friends of the City and Central Exchanges.

OBITUARY.

We regret to record the death, on July 9, of HENRY BOWYER, Wireman, of the Hanley district. He joined the Company's service in 1898 as labourer and has been continuously employed here since then.

STAFF GATHERINGS AND SPORTS.

Tunbridge Wells.—A cricket match was played at Tunbridge Wells on Saturday, June 24, between the Tunbridge Wells staff and the combined staff of Eastbourne and Hastings. The result was a handsome win for the Sussex men, who compiled 117 runs and disposed of their Kentish opponents for 62. After the match the Tunbridge Wells members entertained the visitors to a very substantial tea, and a very pleasant afternoon was brought to a close by a stroll round the town. It is hoped to be able to play a return match at Eastbourne in August.

East Kent.—The district staff held their final picnic under the Company's *régime* on Saturday, July 1, in Waldershare Park (by kind permission of the Earl of Guilford). The staffs of the various centres travelled thereto by brakes, the drive in the country being much enjoyed. The programme commenced with a cricket match between Dover centre and "The Rest," resulting in a win for Dover. Mr. Fletcher, of Ramsgate, won the Margate cup for the highest score, viz., fifteen, the "cup" taking the shape of an insulator S.L.2 suitably mounted and inscribed. Sports were then held, the various items being keenly contested. After an interval for tea, a blindfold boxing match took place (Messrs. Mannock and French displaying their skill in the noble art), causing much amusement to the spectators. Music and dancing were then indulged in, the proceedings closing with hearty cheers for the Company at the call of the District Manager (Mr. C. F. Asbby).

London.—The annual outing of the Woolwich maintenance and engineering staff took place on Saturday, June 24. The party to the number of 65, which included a great number of friends from other centres in the Metropolitan area, journeyed by tug to Southend-on-Sea. A start was made from South Woolwich Pier at 2.30 p.m., the destination being reached at 5.30 p.m. On arrival the party adjourned to "The Grotto," where an excellent meat tea was served. A start for home was made at 8 p.m., and after a somewhat boisterous trip Woolwich was eventually reached at 11 p.m. Music and refreshments were provided on board. Thanks are due to Messrs. Clarke, Bonfield, Bilney and Rogers for the musical portion of the programme, the former proving an efficient pianist.

Luton.—Members of the Luton staff and friends travelled by brakes to Boxmoor on Saturday, July 8, on the occasion of the annual staff outing. They were joined there by members of the staff from St. Albans and Watford, and in splendid weather a very enjoyable time was spent.

Inventory Staff "C" Division.—The office staff of "C" division accepted an invitation of the P. O. checking staff to play cricket on the ground of the Y.M.C.A. at Barrow, kindly lent for the match. The National staff had an easy win. The following is the score:—P. O., 13; N. T. Co., 69 (Biggins 41).

Leeds.—On the completion of the Inventory in the Mid Yorks district, a very enjoyable social function, in the form of a smoking concert took place at the Victoria Hotel, Leeds, on Friday evening, July 14. The District Manager (Mr. W. V. Morten) presided, and was supported by Mr. Gilbert and Mr. C. S. Wolstenholme, Divisional Officers. There was a large attendance of the members of the district and Inventory staff present, and a high-class programme of songs and music was provided by the following artists:—Messrs. H. Sunderland, C. W. Blackburn, J. B. Scott, F. V. Squire, E. Christie, C. H. Crawshaw, H. M. Kenworthy, R. Towers, J. Wilson, T. Pettigrew, G. R. Scott, T. Heggie, G. Nicoll, T. Radford and "The Debonair Troupe," consisting of Messrs. W. Ambrose, G. Houghton, W. Amer and F. Taylor. During the evening, the Chairman in a few and appropriate remarks, referred to the excellent way the Inventory work had been carried out, and on behalf of the Mid Yorks district, thanked them. Mr. Gilbert (Divisional Officer), who responded on behalf of the Inventory staff, gave some interesting particulars in regard to the magnitude of the work done. He also referred to the excellent men provided by the district, and conveyed to the District Manager and his staff all good wishes for the future.

Bradford.—Members of the telephone society paid a visit to Manchester on Saturday, June 24, when the Central and new City Exchanges were visited. Members of the Manchester staff in charge of Mr. G. S. Wallace, Electrician, met the party at the station, and under their guidance a thorough inspection was made of both exchanges. The party had ample evidence of the rapid strides made in telephony as shown in the two exchanges, the Central having a call-key system with a horizontal switchboard and the City being a new central battery exchange in a building specially designed for the requirements of modern telephone practice. Tea was subsequently partaken of at the Cosmo Restaurant, and on the proposition of Mr. T. W. Jowett, seconded by Mr. G. Wicker, a hearty vote of thanks was extended to the Manchester staff for their kind services and the manner in which they had taken charge of the party. Various parts of the city were visited in the evening and the party returned in specially reserved carriages at a respectable hour, after having had a most instructive and enjoyable time.

Coventry.—The annual picnic took place on July 1. The Coventry and Leamington staff went by four-in-hand and cycles to Dunchurch, and were met there by the Northampton staff. A most enjoyable time was spent, various games being heartily entered into; 59 sat down to a good tea, over which the District Manager, Mr. John Mewburn, presided. The arrangements were carried out by the Local Manager, Coventry, Mr. R. S. Grosvenor. The journey home was made in good time, the party arriving about 10 p.m.

PRESENTATION TO MR. CURRALL.

ON Wednesday, July 5, the Dublin staff met in the Superintendent's Office to present Mr. Currall, District Manager, with a token of their appreciation and good wishes on the completion by him of 25 years' service with the Company. Mr. Connor, Electrician, occupied the chair, and in Mr. Cowley's absence, Mr. Dillon, Solicitor, in suitable terms made the presentation, which was in the form of a silver rose bowl, an exact replica of the famous Ardagh bowl designed in the tenth century. Mrs. Currall was presented with a silver tea caddy.

Mr. Currall, in accepting on behalf of himself and Mrs. Currall—who, unfortunately, owing to indifferent health, was unable to be present—thanked the staff for their gifts and good wishes. Speaking of his associations with the Dublin staff he expressed his appreciation of their loyalty and the readiness with which they responded when any special effort had to be made.

In concluding, he mentioned that in connection with this function, the heads of departments had erred in their duties in maintaining such secrecy, since Service Instructions distinctly stated that district managers should be advised of everything which was occurring in the district.

The meeting closed with a vote of thanks to Mr. Dillon.

CITY AND GUILDS OF LONDON EXAMINATIONS.

Durham.

Inspector W. Wilson, Darlington, first-class honours.
Inspector L. H. Shadforth, Bishop Auckland, first-class honours.

Nottingham Factory.

H. R. Honick, telephony, honours, first class; ordinary, first class; telegraphy, ordinary, first class.
G. C. Pearson, telephony, ordinary, first class.
J. Mellor, telephony, ordinary, second class.
F. Pinder, telephony, ordinary, second class.
F. Rider, telephony, ordinary, second class.
E. P. Graham, telegraphy, ordinary, second class.

Hanley.

W. D. Edwards, telegraphy, ordinary, first class; telephony, ordinary, first class.
R. E. Deakin, telegraphy, ordinary, first class; telephony, ordinary, second class.
G. D. Etches, telegraphy, ordinary, second class; telephony, honours, second class; telephony, ordinary, first class.
J. M. Furnival, telephony, ordinary, second class.

Preston.

Inspector W. S. Brickell, ordinary grade, second class.
Inspector C. W. Arthur, ordinary grade, second class.
Inspector S. A. Taylor, honours grade, second class.

POST OFFICE INSTITUTION OF ELECTRICAL ENGINEERS.

THE following paper read before the above institution is now on sale at the price mentioned:—

"Fundamental Principles of Modern Internal Combustion Engines," P. Dunsheath .. .. 9*d*.

Application for copies should be made with remittance to the Engineer-in-Chief, Head Office.