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TELEPHONE MEN.

LXIV.—GERALD HOOPER.

GERALD HOOPER, son of the rector of Gateshead Fell, was born at Hexham in 1870. He was educated at a public school at Newcastle, and after leaving was for a short time in an architect's office in the same town. He resigned this position to take up a junior clerkship in Messrs. Hodgkin, Barnett & Company's bank in South Shields, and it was there that he had his first experience of telephones. There was a private wire between the firm's branches at Shields and Jarrow, which Mr. Hooper had to use constantly. The maintenance of the line was not all that could be desired, and the result was that he visited the offices of the Northern District Telephone Company on many occasions to complain about the working of this private line.

Having a mechanical bent of mind, and disliking the confinement of the bank, Mr. Hooper applied for a position with the Telephone Company, and was appointed a learner in May, 1890, by Mr. Clay, the then manager of the Northern District Telephone Company. After some training in South Shields he was transferred to Stockton-on-Tees as an Inspector, and at the end of 1891 was promoted to Middlesborough as Local Manager.

In September, 1893, Mr. Hooper was informed that he had been appointed District Manager at Cardiff. On passing through London to take up his duties, he learnt that other arrangements had been made, and that he was required to proceed to Canterbury and establish a district office there. This he did, but on the completion of the section of the Canterbury-London trunk line between Faversham and Northfleet he proceeded to Cardiff, where he had to take in hand a complete reconstruction scheme.

In January, 1900, Mr. Hooper was transferred to Edinburgh. An agreement with the Corporation for underground work had just been completed, and once more he had the reconstruction of much of the line plant to carry out, and incidentally the centralisation of the numerous small exchanges in the Scottish capital. The Company had undertaken to carry out the work within a short period, and much supervision was necessary. The start was made at the beginning of a hard winter, and Mr. Hooper had the misfortune to be the victim of three consecutive attacks of influenza in as many months, no doubt due to the fact that he never quite recovered from the illness before recommencing work. This resulted in a serious breakdown in health, and, although he was able to see the greater part of the work completed, a rest became necessary, and through the kindness of the late Mr. Gaine he was engaged for several months in outside work in the Engineer-in-Chief's Department which did much to assist him in regaining his strength.

Desiring to escape from the rigorous climate of Edinburgh, it was arranged by Mr. Gaine that a change with the district manager at Birmingham should be effected. Probably a district manager's life is not restful at the best of times, but no sooner had Mr. Hooper taken up his duties in Birmingham than it was decided to carry out an extensive scheme of decentralisation. This entailed the opening of six exchanges in the suburbs, and, as this followed on the heels of the centralisation scheme, it naturally gave rise to very considerable pressure on the staff and to a disruption of the service, which entailed trouble with subscribers.

The state of Mr. Hooper's health was a grave anxiety to his friends during this period of strain, and it was not until he was transferred to the south of England in 1907 that his health and strength were fully restored.

Under his management the utmost has been made of the possibilities which exist in Cornwall, and the development of telephone business in that remote part of the country has been exceptionally satisfactory, amounting to an increase of not less than 116 per cent. during the past four years.

Since Mr. Hooper joined the Tees division of Submarine Miners in 1893, nearly the whole of his spare time has been given to volunteering, and his holidays to military training. In 1906, when an all-wise Government considered submarine mining unnecessary to the defences of the country, there was a break in his military service and he gave up his commission, but on the creation of the Territorial forces he undertook the formation of two companies of electric light engineers for the defences of Plymouth, and has in this direction met with much success. As recently recorded in the JOURNAL, Captain Hooper had the honour of commanding a detachment of electric light engineers at the Coronation ceremonies in London.

THE 48TH ORDINARY GENERAL MEETING OF THE NATIONAL TELEPHONE COMPANY, LIMITED.

AT this meeting, held on July 27, the PRESIDENT (Mr. G. Franklin) said, in moving the first resolution, which was that the report and accounts be received and adopted, and that dividends be paid for the six months ending June 30, 1911, at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per cent. per annum on the preferred stock, and 6 per cent. per annum on the deferred stock, less income tax in all cases, shareholders would notice that although the Company's license was drawing to a close the expansion of the business still continued.

During the past half-year there had been added to the Company's system 15,675 stations, as compared with 14,324 in the previous half-year, and 16,286 in the corresponding half of last year. When the shortly approaching termination of the license was remembered, and the fact that there were as usual a number of cessations, it was gratifying that they were still able to attach to their system a large number of stations, and the total on June 30 last was 549,928 stations.

He wanted to remind them that the accounts for the June half-year were actual results so far as regards the five months ending May 31, but the month of June was a month of estimates, which were included in the accounts in order that they might have their meeting in July before the holiday season, which was generally more convenient to the shareholders.

From the abstract of accounts, which afforded a clear perspective of the whole result of the Company's working during the past half-year, it would be seen in the first column that income accrued in respect of the business of the half-year was £1,807,872, as compared with £1,678,312; an increase in the gross income for the half-year of £129 560.

Taking the next column, Post Office royalties, there was £173,424, as compared with £161,881, showing an increase of £11,543; and that made a grand total paid to the Government under that head of £3,645,820.

After deducting the Post Office royalties, the next column showed the net income. There was a figure of £1,634,447, as compared with £1,516,430, an increase of £118,017.

They then proceeded to deduct the working expenses, which were shown to be £1,058,169, as compared with £971,914, an increase of £86,255, leaving the net result for the half-year £576,277, as compared with £544,516, showing an increased sum for disposal of £31,761. That sum had been disposed of by an additional transfer of £25,000 to the reserve, making £200,000 for the half-year; and the remainder had been absorbed in the item of debenture and other interest.

In the next column, which was one to which they used to attach considerable importance, the percentage of working expenses to net income, they would see that that was shown to be 64·74 as compared with 64·09. That appeared to show an increase of working expenses, but it was not so in fact, as that increase was more than due to a sum of £50,000 which had been charged against the profits of the half-year under the title "Inventory and arbitration suspense account." That was a subject to which he proposed to refer in a few moments. He would only now wish to remark that, but for this special item, the percentage of working expenses would have been considerably lower than it had been for some years past.

In order to get a clear view of the working expenses, he would ask shareholders to turn to revenue account No. 2, and to the debit items—the expenses. They there saw, rents of premises, taxes and insurances £137,630, and that was an increase of £13,386, of which over £9,000 was due to increased assessments in the form of local rates and taxes which they had found themselves unable to resist.

Administration and management was £413,253, as compared with £398,187, an increase of £15,066, upwards of £9,000 of which was due to the additions to operators' wages, the causes of which he had referred to on previous occasions, and perhaps he need not trouble them with them to-day.

The next item was maintenance and renewal of lines and instruments, £366,497, and that also showed an increase on the corresponding sum in the last year's accounts.

There did not appear to be in the revenue accounts, either No. 2 or No. 3, anything further to which he need refer specially, but in capital account No. 1, they would see an item which had been challenged by one or two proprietors who had written to him on the subject—that was the amount of £211,121 which had been expended during the six months on construction. He had been asked why the Company continued to expend so large a sum upon construction, seeing that the Company's end was so near? The answer was, first, that in the telephone business the capital account never closed, and he thought the shareholders might be reassured if he reminded them that the whole policy of the Board was now, and had been for some few years, that of so directing the capital expenditure as to make it reproductive in income within the period of the license. But even that would not be sufficient unless it could be shown that, when the winding up came and the property was transferred to the Postmaster-General, their purchase money would be larger by reason of that expenditure, which they were now making in order to carry on the business; and the view of the Board was that no capital was now being spent except such as would produce an added sum at the time when the arbitration came and their system was taken over.

On the credit side of the capital account was a very large sum of £5,227,438, which represented the difference between the share and debenture capital issued and the amount expended by the Company. That amount was brought down into the balance sheet as the first item in the assets, and he would deal with that presently.

There was one question which arose on the capital account; that was in connection with the 3½ per cent. debenture stock. During the past half-year the Directors had deemed it wise to ask for offers of the 3½ per cent. debenture stock up to a sum of £500,000, and in view of the opinion of counsel as to the amount at which such stock might ultimately be repayable, a limit of par value was placed upon it. In this the Board had in various quarters been subjected to adverse criticism, on the ground that in certain events this stock was redeemable at 103. The Company had been advised by eminent counsel that the events referred to in the certificate and instrument of creation of the stock had not, and never could, arise, and that any payment of the premium mentioned —that is at 103—would only result in depriving the holders of the Company's junior securities of moneys which were properly theirs. Then, again, as in March last when the Board made this offer, the price of the debenture stock in the market was about 99 per cent., the Board felt that in fixing the limit of par for those who desired to offer their stock, a fair and reasonable attitude was adopted, having regard to the opinion of counsel, which the Board could not afford to disregard. Now, as to the policy of such repayment, he thought it would be obvious to all the shareholders, that there could be no better investment for the Company's spare funds than in paying off some of its debenture obligations.

Now, turning to the balance sheet, and commencing first with the capital sum of £5,227,438 overspent, the next item was stock

of materials, £215,243, as compared with £273,796, a very handsome diminution of £58,553.

He did not think there was anything in the other items calling for comment; but that there was one which had been in the balance sheet for a number of years, "special replacement account," which had now disappeared. It would be remembered that was for special expenses incurred in putting down underground systems in large towns, the revenue portions of which the Board felt would be too much to debit to any particular half-year, and having been spread over a period of half-years were now wiped out.

He would call their attention to the fact that securities and cash amounted to £993,296, which he thought justified the Directors in the policy they had adopted of beginning to reduce their debenture obligations.

The balance of revenue was £436,886, and in the appropriation account No. 5 the dividends absorbed £218,750; the reserve fund account £200,000, and the balance carried forward was £18,136. With the transfer of £200,000 now proposed to be made, the reserve fund account totalled up to £4,259,123. Shareholders were constantly asking "Where is this sum of four and a quarter millions? We should like to see it." Well, the answer was that to the extent of £1,839,800 it was represented by solid cash and investments, and by freehold and leasehold properties. Then as to the balance between that and the total sum he thought they could say with some confidence that it would be found in the assets of the Company when they came to be distributed.

In other words, the difference had been used by the Company in the carrying on of its business. Instead of having to ask the shareholders to give more capital in order to meet the public demands, they thought it was best to use that capital which belonged to them collectively rather than appeal to them individually for it.

This amount had now reached a very large sum, and it should, he thought, be ample to protect the shareholders' capital from any possible diminution in value.

At the meeting in February last, he drew the attention of the shareholders to the fact that, in the absence of any agreement with the Postmaster-General as to the value of the Company's assets, such value would have to be determined by arbitration, and that in such circumstances it appeared to the Board necessary to enter upon what had already proved to be a gigantic task—namely, the preparation in detail of an inventory of the Company's plant and apparatus, upon which its claims for money compensation must be founded.

The work of the enumeration and checking of this inventory commenced in the month of October last. It was occupying the constant time and attention of a staff of about 500 persons, and was, of course, a source of great expense, alike to the Postmaster-General and the Company. But the Directors believed that no other course was open to the Company than to face this task, which was, no doubt, a great burden upon the officers engaged upon it. But the pleasant feature was that the work had so far been carried on with perfect smoothness, reflecting the greatest credit upon all concerned.

The cost of that was being charged to the inventory and arbitration suspense account, to which he referred a few moments ago. Last half-year a sum of £25,000 was placed to this account; this half-year a further £50,000 had been added. These were large sums which were being spent, but the answer was that the strength of the Company's case, if and when it was presented to the arbitration tribunal, would largely depend upon the care and accuracy of the detail with which the statement has been prepared.

At the end of the current year the Board anticipated that the inventory of the Company's plant would be completed and that it would be possible to proceed if necessary to obtain the decision of the arbitrators as to the purchase price of the various assets of the Company to be transferred to the Postmaster-General.

Under the provisions of the purchase agreement the Company had received from the Postmaster-General notices of objection to purchase a quantity of the Company's plant, land and buildings, in what are known as competitive exchange areas, as well as a general notice relating to plant not constructed in accordance with the specification comprised in the purchase agreement, the grounds of objection of such notices being that the plant would be unsuitable for the actual requirements of the Postmaster-General's telephonic service on Dec. 31, 1911.

These notices of objection, speaking generally, covered plant of two classes; first, some of the local battery exchanges in competitive areas—London being the most important—and he thought shareholders who had attended those meetings would remember the distinction between these or magneto exchanges and the central battery exchanges. There were also general notices of objection to the character of the plant, which notices were so widely drawn as to include possibly almost the whole of the Company's plant, according to the interpretation which might be put upon them.

As the Board entirely dissented from the Postmaster-General's view with regard to such objections, they deemed it necessary to commence proceedings before the Railway and Canal Commission, to whom any dispute on this subject was, by the purchase agreement, referred.

During the course of such proceedings, certain questions of law arose upon the construction of the agreement, as well as upon the notices of objection. These were decided by the Railway and Canal Commission, generally speaking, in the Company's favour, but this decision was unfortunately reversed by the Court of Appeal on June 28 last, and from the Court of Appeal's decision there was no other appeal. Thereupon the proceedings were resumed before the Railway and Canal Commission, and on July 11 an arrangement was effected between the Postmaster-General and the Company, by which practically the whole of the plant objected to was to be taken over and purchased by the Postmaster-General, certain deductions from the ultimate purchase price of portions of the plant objected to having been agreed to be made by the Company.

He did not want to enlarge too much about that settlement, so perhaps he had better content himself with saying that it was one which the Directors had cordially approved.

With regard to the notices of objection as to the character of the plant, the importance of these had been greatly diminished as the result of explanations made to the Court by the law officers of the Crown. These explanations were such as to justify the Company in regarding those notices of objection as unimportant.

But he could not pass from that bare recital of what had been happening with regard to that recent litigation without expressing the deepest obligations of the Company to its counsel, its solicitor, its engineers, and the whole of its staff, from, he was going to say, top to bottom, who had thrown themselves into the case, with a zeal and energy which, he thought, were beyond all praise; and it had, in fact, been a position of enormous difficulty owing to the technicalities which had had to be overcome, and these recent actions really constituted a very heavy task upon the Company's officers. That work was done at a time when a large portion of the staff of the Company was engaged upon the inventory, which had not been delayed for a moment by reason of these proceedings; and, therefore, the burden upon the officers of the Company had been all the greater.

He was sure they would wish him to express to the officers—as he should like to do also on behalf of the Board—their warm appreciation of the way in which they had plunged into this work, and which had, he thought, secured to the Company fair treatment, at all events, in dealing with these notices of objection. (Hear, hear.)

Now, it might be interesting to the shareholders also to know that there had recently been introduced into the House of Commons a measure entitled the "Telephone Transfer Bill," the object of which is to facilitate the arrangements necessary to be made by the Postmaster-General in relation to such transfer.

On the introduction of the Bill, the Company found it necessary to raise objections to certain clauses, which in its view varied the purchase agreement; and it was but right to say that, in response to representations made to the Postmaster-General by the Company, certain alterations had been approved, which, whilst preserving to the Postmaster-General the necessary powers required, would at the same time remove the Company's objections to the Bill as first presented. The difficulties were perhaps serious, but one felt that the Postmaster-General on his attention having been directed to the question, had met it in a full, frank and fair manner, and, so far as that matter was concerned, the Company had now no cause for complaint.

The Bill also made provision for the Company's staff, and it was also due to the Postmaster-General that he should express satisfaction at the fair and reasonable provision he offered to make; and he hoped the application of the same spirit to the case of the principal officers and others whose claims were now under discussion might remove all difficulties, and secure for the Postmaster-General a continuance of the same loyal and devoted service which it had been the good fortune of the Company to enjoy.

Now, he had endeavoured to indicate, so far as prudence allowed the position of the Company in relation to its current business, as well as to the outlook for the future, and he could only say that no Board could do more than their Directors had done to prepare for the solution of perplexing problems of great magnitude as and when they arose; and as a result of that preparation he thought they might look forward with some confidence to a satisfactory termination. He moved the resolution. (Cheers.)

The VICE-PRESIDENT (Mr. Samuel Herrick Sands) having seconded the resolution, it was, after some observations by shareholders present, carried with acclamation.

AN INTERESTING POINT IN CONTRACT WORK.

BY J. R. BROWN, *Contract Manager, Glasgow.*

AMONG many points on Contract Department working raised from time to time in the columns of the JOURNAL, I do not remember any reference having been made to the best hours of the day for securing orders.

The question was raised with me in Glasgow some time ago, and what might be called a "time study" was made for two months. The *modus operandi* was simple. Each contract officer was instructed to note on the proposal form the hour the document was signed. These times were carefully tabulated, and the result supports the truth of the old saying, "The early bird catches the worm," as the following figures will show:—

Statement showing the hours agreements were signed, for two months, 1911.

9 to 10 a.m.	5·3 per cent.
10 ,, 11 ,, ...	27·1 ,,
11 ,, 12 ,, ...	19·4 ,,
12 ,, 1 p.m.	13·4 ,,
1 ,, 2 ,, ...	3·8 ,,
2 ,, 3 ,, ...	7·9 ,,
3 ,, 4 ,, ...	9·8 ,,
4 ,, 5 ,, ...	10·5 ,,
5 ,, 5·30 ,, ...	2·3 ,,

It will be seen that 46·5 per cent. of the orders secured were got in the forenoon, between ten and twelve o'clock, and the worst hours for getting orders were in the middle of the day, between one and three o'clock, the orders within these hours dropping to 11·7 per cent. From three to five businesses improved, rising to 20·2 per cent. of the total.

The old idea that the best time to get a man in good mood is after dinner does not hold good in contract work, if the mood has anything to do with getting orders signed for telephone service. The forenoon in most business places is the busy time, and yet it is the time most productive of orders. It may be that that is the time when the person called on finds himself most in need of the service, and realises what a convenience it would be and signs on the spot. If that be so, our notion not to bother a man when he is busy is all wrong, as it may be because he is busy and business is booming that he is in the mood for signing. It was the practice at one time in Glasgow to have the "unsuccessful interview" cards kept by the contract officers themselves, and the cards were written up in the morning before the officers went out. About two years ago a lady clerk was deputed for that work, so as to let the officers out early in the morning, and the figures already quoted show the wisdom of the change.

It is evident that men are in a better mood for signing in the forenoon, and the importance of making an energetic canvass in the early hours of the day will be apparent to all contract men. Not only is it wise to be extra energetic in the forenoon, but time taken up in unnecessary travelling should be avoided and the whole time given to interviewing. When appointments require to be made at a distance they should, as far as possible, be fixed so as to avoid the two hours in the forenoon. Perhaps this "time study" may be of service to other Contract Departments.

SOME OBSERVATIONS ON TELEPHONE TRANSMISSION.*

BY J. L. MCQUARRIE.

SINCE the beginning of the industry, telephone engineers and inventors have been confronted by two problems with respect to transmission: first, to increase the possible range of communication, that is, the distance over which it is possible to provide a satisfactory grade of telephone conversation; and second, to cheapen the methods or means of furnishing this transmission.

The reason for development along each of these lines is at once obvious. The range of telephone transmission can be extended either by increasing the efficiency of the instruments employed, or by increasing the efficiency of the line. The cost of providing telephone facilities can be reduced either by improving the instruments or by cheapening the line while maintaining a given standard of efficiency, since for a given grade of transmission with improved telephone instruments, a cheaper type of line is possible. This, by the way, illustrates one difference between the telephone engineer's and the power engineer's problem. As a general rule, an increase in efficiency of the generating or receiving station apparatus would not justify the power engineer in decreasing his line efficiency, at least to any marked extent.

The success which has attended the efforts of telephone engineers is attested by the fact that while at the outset it was possible to communicate only between rooms within a building, commercial service is now being given between New York and Denver, and the limit of such service has not yet been reached.

AS TO RECEIVERS AND TRANSMITTERS.

The receiver in its early form proved to be a remarkably sensitive instrument and it was, therefore, not susceptible to the same degree of improvement as the transmitter. Many varieties of receivers were constructed at the outset, the variation consisting principally of different arrangements of the magnets, but the form of the old hand telephone persisted so that the present standard instrument closely resembles the early type. It is about 15 per cent., or perhaps two miles of standard cable, more efficient, however, because of the employment of an improved magnetic circuit.

Very loud speaking transmitters and receivers have been exploited by inventors from time to time, and powerful transmitters have been constructed, arranged to carry a large current, which substantially extended the range of transmission. Loud speaking receivers have also been produced which are capable of being used satisfactorily without being placed to the ear. Such instruments have not been found to be useful for regular commercial service, although they have been employed in some special cases. An equipment of loud speaking receivers is now being tested by one of the large railroads for tower service in connection with a train dispatching circuit.

One of the most interesting problems concerning telephone transmission is that of the repeater. The demand for an instrument which would relay the voice currents was very early appreciated, and much thought and labour have been devoted to this subject. The problem of the repeater consists really of two problems: first, a device for amplifying weak telephone currents without distorting them; secondly, an arrangement of circuits which will permit repeating both ways without switching. A repeater which accomplishes both of these objects has been employed on the long lines of the American Telephone & Telegraph Company for about six years. This repeater is capable of improving the transmission by 100 per cent., which means, in terms of 210-lb. copper circuit, an increase in talking distance of about 250 miles.

* Abstract of a paper presented at the Boston Convention of the Association of Railway Telegraph Superintendents.

TELEPHONE LINES AND IMPROVEMENTS MADE IN THEM.

The instruments which are employed for telephonic transmission must of necessity be of a somewhat delicate nature because the energy with which they deal is of small magnitude. This, coupled with the fact that they are subjected to severe treatment in service makes it essential that they be of substantial design, and that they be manufactured with great care. Uniformity in the product is also a very important factor.

The foregoing deals with the instruments. The lines which form a very important part of the telephone equipment will next be considered.

It was to be expected that the first telephone lines should be similar to the then existing telegraph lines. Iron wire and grounded circuits constituted the early practice, and many years elapsed before proper attention was devoted to the lines to adapt them to the peculiar requirements of telephone service.

The first important improvement in the line plant consisted of the introduction of metallic circuits. This change was a measure of necessity to prevent disturbances caused by other electric circuits, as well as to avoid objectionable cross-talk between adjacent telephone lines.

The next improvement of importance in the line plant affecting transmission was the employment of hard drawn copper wire in place of iron. The limitations of iron wire were appreciated as soon as efforts were made to extend the range of transmission, and, while copper had previously been used for electric circuits, it was not suitable for aerial lines because it was too soft. T. B. Doolittle developed a process for manufacturing hard drawn copper wire, and this was the first important step toward the realisation of long distance telephony.

As the business grew, and the demands for service increased, the congestion of overhead wires in cities led to the employment of cables.

DEVELOPMENT OF CABLE TO REPLACE OPEN WIRE.

Following the development of the hard drawn copper wire, and of the dry core paper cable, some years later an invention was perfected which provided a means for not only extending the limit of telephone transmission but also for effecting economies in the construction of the lines. Especially in the case of cables the economies are so great as to permit the use of underground cables between points which, without this means, it would be practically impossible to connect by cables. This is of great practical advantage since overhead lines are notably subject to trouble from storms, while cables are free from such troubles. The invention to which I refer is the use of loading coils in the lines. This invention, more than any of the preceding improvements, marked the application of scientific principles to the problems of telephone transmission.

In the early records of tests on telephone transmission through cables are to be found statements to the effect that the transmission over cable circuits is equally as good as that over open wire circuits. As the length of cable was increased, however, it was soon found that this was not the case and that telephone transmission was reduced very much more by passage through cables than over a corresponding length of open wire line employing the same gauge of copper conductor. It was quite early recognised that, since the cable had very much larger mutual capacity than the open wire line, telephone transmission must be poorer than the cable. This conclusion developed from the scientific work performed by the late Lord Kelvin in connection with submarine telegraph circuits. What was not realised, however, for many years, was the fact that in the case of open wire lines there was present, to a considerable degree, what may be termed, from the point of view of the telephone engineer rather than from a purely physical standpoint, a "corrective element"—namely, the self-inductance of the line. In the case of cables, due to the fact that the two wires are very close together corresponding to the non-inductive winding of a resistance coil which is familiar to you all, the self-inductance of the circuit is a minimum. In the case of the open wire line, the wires being 12 inches or more apart, the self-inductance has a comparatively large magnitude and is of great importance in telephone transmission. For instance, in the case of a No. 8 B. W. G. copper circuit, which has a conductor weighing about 435 lbs. per mile, the range of commercial transmission between stations equipped with standard instruments is about 1,000 miles. If we could conceive of the wires being left 12 inches apart so that the capacity would be the same as at present but in some mysterious manner the self-inductance of the circuit would be obliterated, the commercial range of transmission over this circuit would be reduced to perhaps 350 miles.

I present this as an illustration of the importance of self-inductance in telephone circuits. Of course, if we could by some means avoid the capacity in a telephone circuit, we would prefer not to have the self-inductance present. If, however, the capacity is to be present, to obtain an efficient telephone circuit, a comparatively large amount of self-inductance should also be present.

WHY THE PUPIN COIL CAME INTO BEING.

It was pointed out that to improve the transmission over open wire lines, the self-inductance that was present should be substantially increased and that over cables where the amount of self-inductance was almost negligible, it should be still further augmented in order to obtain the best results, and it was suggested that one method of increasing the inductance of the circuit would be to insert at intervals self-inductance coils, one winding in each of the two wires of a metallic circuit, or else a separate coil in each wire. No one, however, seemingly was able to show the telephone engineer how to introduce these coils into the lines.

Professor Pupin, by mathematical investigation, checked by experiments, about ten years ago furnished the telephone engineer with a practical plan for the employment of self-inductance coils which came to be known as "loading coils," this designation being derived from the analogy of the telephone circuit, with a string loaded with weights at intervals. For the benefit of those who may be interested I will digress for a moment to amplify on this analogy. If a long string is fastened to a support at one end and the other is moved quickly at right angles to its length, waves will pass along the string. If the string is sufficiently long, these waves will die out almost completely before reaching the fixed end. The distance which the waves will travel before being reduced to a given fraction of their original height or amplitude, will depend upon four factors —namely, upon the frequency or number of times per second the free end of the string is moved from one extreme position to the other and back; upon the frictional losses due to the stiffness of the string and to friction between the string and the air; upon the mass of the string per foot length; and upon the tension under which the string is held. It can be shown mathematically and also by simple experiments that if, instead of a uniform string of a given mass per foot, a very light string with such weights at uniform intervals as to give the same average mass per foot is employed, the waves along the string will start out with the same amplitude for a given movement of the free end of the string, and will die away at the same rate, provided the number of weights per wave length along the line is sufficiently great. Without pointing out the complete analogy between a motion of waves along a string and the telephone circuit, it may here be said that the telephone current is transmitted in the form of waves, and as these current waves progress along the conductor, they become altered in form as a result of counter influences inductively created by the current wave itself, and inasmuch as the loudness and clearness of transmission is determined by the accuracy of reproduction of the wave form, and by its amplitude or height, the effect of the action of these inductive influences is to impair the transmission efficiency of the circuit. In seeking a remedy in the case, the object to be obtained is to preserve the original form and amplitude of the wave as far as possible. In the case of the string, it is found that for a given frequency, tension and amount of frictional losses, the larger the mass per unit length the greater the distance a wave of a given amplitude will be transmitted before being reduced in height by a given amount.

The mass of the string corresponds to the self-inductance of the telephone circuit and just as the mass of the string can be increased by adding weights, a certain number per wave length, so the self-inductance of the line can be increased by adding masses of self-inductance; that is, inductance of loading coils, a certain number per wave length.

In practice, therefore, small coils of copper wire, wound on

iron cores, are connected in the telephone circuit at proper intervals and the effect of this on the current wave corresponds to the effect of the weights attached to the string, with the result that the form of the current wave at the receiving end of the line is comparatively unaltered, and its original height or amplitude is less reduced.

Loading has been very successfully employed on open wire lines and on underground and submarine cable circuits. An idea of the improvement in the transmission which results from the use of loading coils may be gained from the statement that where conditions favour loading, the 175-lb. copper open wire circuit by loading is made equivalent in transmission efficiency to a 435-lb. copper open wire unloaded circuit. In the case of cable, still greater relative gains in efficiency are possible: for example, a No. 19 B. & S. gauge cable suitably loaded has a higher telephonic efficiency than a No. 10 B & S. gauge cable non-loaded. The No. 19 cable conductor weighs but one-eighth of the No. 10.

USE OF PHANTOM CIRCUITS BECOMING MORE GENERAL.

Phantoming has been employed in the past to produce economy in the telephone plant, because the phantom circuit provides a means for obtaining an additional line from two existing lines. It is but recently, however, that advantage has been taken of the increased efficiency of the phantom circuit to extend the range of transmission. The New York-Denver line lately placed in service, and the Boston-Washington underground cable now being laid, are examples of the latest advances in this branch of the art. The New York-Denver line is composed of a phantom of two pairs of 435-lb. copper between New York and Chicago, a single pair of similar conductors between Chicago and Omaha, and another phantom of two pairs between Omaha and Denver. The really remarkable feature of this circuit is that the phantom itself is loaded. The transmission over this circuit is equivalent to that of 30 miles of standard No. 19 gauge cable. The Boston-Washington cable is composed of fourteen pairs of No. 10 B. & S. gauge conductors laid up into seven quads for phantom working and 36 pairs of No. 13 B. & S. gauge conductors laid up into eighteen quads for phantom working, with six pairs of No. 13 B & S. gauge and eighteen pairs of No. 16 B. & S. gauge conductors not laid up into quads. By the use of the phantom principle it has, in this instance, been possible to increase the number of telephone circuits through the cable by 25. In addition to this, the phantom circuits have a higher efficiency than the circuits in pairs of the same gauge. By means of this cable it will be possible to talk very satisfactorily from Boston to Washington over the No. 10 gauge phantom circuits. The smaller gauge circuits will be used for connecting the towns less remotely situated.

(To be concluded.)

NEW TELEPHONE EXCHANGE, COLOGNE.

THE new telephone exchange at Cologne, we learn from the *Kölnische Volkszeitung*, commenced working on May 14 with 12,111 lines without counting auxiliary stations. These are distributed upon two switchboards, A with 6,107, B with 6,004. The latter is devoted to the subscribers making the heaviest use of their lines. The number of telephone stations in Cologne has increased from 6,775 in the year 1900, to 19,062 at the end of 1910.

As regards to total length of wires this has increased to 81,800 km. underground and 8,400 overhead from 5,800 and 7,600 respectively at the end of 1900. Sixty-five cables are led into the exchange, the largest of which have each 500 metallic circuits. Conversations exchanged in Cologne now amount to roundly 120,000; conversations with the suburbs of Mülheim and Kalk 12,000, and with other places 11,000.

The division of calls into the various hours is interesting. From half-past nine at night to half-past six in the morning the traffic is practically *nil*. After half-past seven it rises so rapidly that in the three hours to half-past ten it has reached its highest load. By midday it has decreased one-half and rises again by half-past five to nearly its highest point. This perhaps, says our contemporary, will give a hint to that part of the public which is not obliged to use the telephone at the busiest hours of the day and can be more punctually served at other times.

The number of male officials at the exchange is 115, and of female staff 580. The exchange is on the central battery system, and upright boards and visual signalling replace the old flat board. The trunk section accommodates 265 long distance wires which have increased to this number from 68 in 1900.

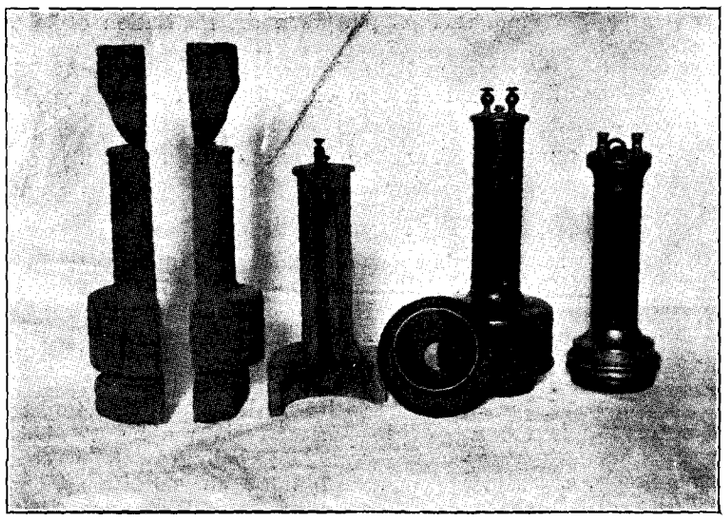
The distribution of the subscribers' lines follows the practice of this country. They are so arranged as to give an even load to each operator.

The changes were carried out without disturbance to the service and as soon as the public and the officials are accustomed to the new working, a great simplification and acceleration of the service is anticipated.—W. H. G.

AN EARLY TELEPHONE.

IN the market town of St. Columb, North Cornwall, the Company has a small exchange situated in the shop of Mr. A. E. Julian, by whom it is worked; and it may be of some little interest to readers of the JOURNAL to know that shortly after the telephone was brought over to this country, Mr. Julian, seeing the description of it in the *English Mechanic*, or *Work*, was fired with the ambition to make a pair.

The method he adopted in making the case is shown in the photograph. Two pieces of mahogany were screwed together, placed in a lathe and turned up in the shape of a receiver. He then hollowed out the inside to receive the magnets and diaphragm, and the cap was screwed on with three round-headed brass screws.



The photograph shows a completed receiver, one that was never quite finished, and one of the cases just taken out of the lathe. On the right-hand side of the photograph is shown one of the Company's old pattern double-pole receivers.

Some old telegraph wire and shackles were obtained and a line about 150 yards long connected to the receivers, and fair talking obtained.

Mr. Julian engaged with the Newquay and Wadebridge Telegraph Company in 1866 as messenger, and was taken over by the Post Office at the transfer of the telegraphs. He got the Queen's gratuity of one guinea for proficiency in telegraphy, sending and receiving, but eventually left the Post Office in 1872 to engage in business of photographer and stationer.

He has a small gas plant, and is the only supplier of gas to a few of the principal residents and tradespeople.

NATIONAL TELEPHONE STAFF BENEVOLENT SOCIETY, LONDON.

GRANTS were made during the month of July to the amount of £33 11s.

Total number of grants made since formation of society, 364; value £1,159 14s. 10d.

Amount of subscriptions received during July, £10 19s. 5d.

Donations received, £8 11s. 6d.

Membership—new, 22; ceased, 51.

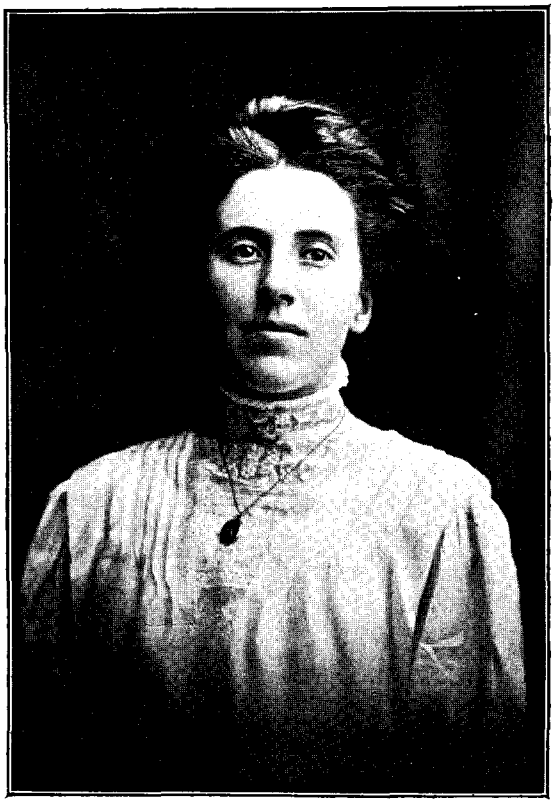
Number of members at July 31—2,879.

TELEPHONE WOMEN.

CI.—MARGARET S. FYFE.

MISS FYFE entered the Company's service at the Royal Exchange, Glasgow, in November, 1898. A year later she was transferred to the Govan Exchange which was then opened, and six months afterwards to the Ibrox Exchange. Two years later she returned to the Royal Exchange.

In 1901 Miss Fyfe was offered an appointment by the Glasgow Corporation Telephone Department, but elected to remain in the Company's service. At that time she operated the party line board in the Royal Exchange, which was a standard floor pattern switchboard fitted apart from the main switchboard. This separate arrangement was discarded later, the party lines being transferred to special positions on the main switchboard. Shortly after this Miss Fyfe was transferred to "B" operating. Subsequently she performed monitorial duties for two years and, since June, 1908,



MARGARET S. FYFE.

supervised on early and late duty and in the absence of a supervisor. In the September of last year she was promoted to be a Supervisor in the Argyle Exchange, Glasgow.

About a year ago a special effort was made amongst the operating staff to create a greater interest in the JOURNAL, and with this object Miss Fyfe was appointed special agent for the traffic staff. Her efforts in the direction indicated have been very successful.

Miss Fyfe is a popular member of the traffic staff, both inside and outside of the exchange in which she is located. She has taken much interest in the doings of the operators' society and club since its inauguration, and has acted in two sessions as a member of committee.

CII.—ELSIE HEAPS.

MISS ELSIE HEAPS, Travelling Supervisor, Exeter district, was born at Aldershot and educated at Alderney. She entered the Company's service at Exeter in April, 1903, as Operator, when the staff consisted of only four operators, and the overhead system with single circuits was in use. Since then considerable improvements have been made both in the outside and exchange plant.

Miss Heaps finds her duties as Travelling Supervisor very interesting, and is very popular with the operators. She combines gentleness with tact, and in every way endeavours to further the interests both of the Company and of the staff.

ELSIE HEAPS.

The district over which she exercises supervision is a pleasant one for a post which involves travelling, comprising as it does some lovely and romantic Devon scenery.

Miss Heaps' chief recreations are boating and reading, and there is plenty of scope for the former in the before-mentioned county.

THE COMPILATION OF A DISTRICT TELEPHONE DIRECTORY.*

BY GEO. D. BATEMAN, *Cardiff.*

To the uninitiated it would perhaps seem a comparatively simple matter to compile a telephone directory. Such, however, is not the case, and I shall endeavour to outline in the following remarks the work that is essential to its successful production.

The Company comes into contact with its subscribers in a variety of ways, but whether it does so by means of the service, the individual members of the staff, or in the very tangible form of an official directory, there is no doubt that it is judged by the subscriber accordingly. He also fully appreciates the advertising value of his directory entry, and the clerk responsible should therefore utilise all the means which the Company's organisation places at his disposal in order to gather together the necessary details and to ensure their accuracy. He should of course supplement this by the generous exercise of his tact and discretion, for which he will invariably find ample scope.

Like most other branches of the Company's business, the directory has for its chief source the works order, for although the actual particulars of new lines, removals, etc., are taken directly

* Prize paper read before the Cardiff Telephone Society, Session 1910-11.

from the forms signed by the subscribers, the works order has to be completed before these can be included in the directory. In the case of new lines and changes of names the method at present obtaining in the district is as follows:—The directory form, duly signed by the subscriber, is detached from the agreement immediately after the works order is issued. The works order number is then written at the foot of the form, and the latter is afterwards placed in a clip in the order of its works order number. At the end of each month all the completed works orders are scanned, and those for new lines are compared with their respective directory forms. If they coincide the forms are then copied into the special interleaved directory in use in the district office. In the case of removals particulars are entered direct from the works orders, as directory forms are seldom used in this connection. Cessations are always dealt with in a similar manner.

In addition to these typical cases numerous alterations have to be made from time to time in the titles and trade descriptions of subscribers, and sometimes in the positions of the entries. The latter are often due to subscribers' requiring their names showing immediately after the entry of the company or firm which bears their name. This, of course, is contrary to the alphabetical arrangement, but it is generally found that the difficulty can be surmounted by adding "(private residence)" after the individual's name.

Other items not coming directly within the scope of the works order are the additional and special type entries ordered through Messrs. Sell, the advertising contractors. These, of course, have to pass through the district office for checking purposes, and have to be carefully watched, for it often happens that by using a little discretion one is able to prevent a good deal of annoyance to the subscriber and trouble to the Company. For instance, we received several advices from Messrs. Sell recently instructing us to delete certain additional entries of subscribers from whom they could not obtain replies to their repeated applications for renewal. To satisfy myself I rang up the subscribers and ascertained that the applications had in some way or other gone astray, and that the entries were still required. The cheques were eventually forwarded and the insertions duly made. Letters and verbal communications are often received from subscribers asking us to insert their names in additional positions. On being informed, however, that it is necessary to forward a guinea to Messrs. Sell, negotiations in the majority of cases come to an abrupt conclusion.

Contract officers can greatly assist the district office by taking care to see that the regulation three words of description are not exceeded when the subscriber makes out the directory form. Another way in which they can co-operate with the district office is in persuading subscribers who are licensees of hotels and public businesses, etc., to have the name of the place of business inserted instead of their own. The reason for this is that these establishments are better known by the name of the house or place of business than by the names of their owners. Furthermore, they are constantly changing hands and if they are inserted in the directory under the name of the owner the entry has to be deleted and a new one put in its place. Besides this, names of owners are always more difficult to remember than the names of hotels.

The contract officer can also save a good many entries in the book kept for recording missing directory forms if he sees that the subscriber always signs the form immediately after the agreement. In this way the possibility of non-insertion can be reduced to a minimum, which is a point that should not be lost sight of.

During the last five years or so about two-thirds of the numbers in this district have undergone a change of some description, and when it is remembered that there are something like 6,700 subscribers, it will be readily seen that a good deal of careful checking was necessary. The cypher prefix to message rate numbers was first dropped, and where this would have occasioned clashing with a flat rate number the latter had also to be changed. A change of rate meant a change of number in those days. Then came the wholesale changes at Cardiff caused by the decentralisation of the Cardiff subscribers and the subsequent changes consequent upon the centralisation at the new exchange last year. The latter, however, were not very considerable, as the Traffic Manager so arranged it that only the Canton Exchange numbers had to be altered. Subscribers having more than one direct line were next tackled, two consecutive numbers being allotted in place of the existing ones, the directory having to be altered so that only one of the new numbers appeared.

The special interleaved directory is in great demand by the district office staff who often have need of the information it contains.

Nearly three months before the issue of a directory, when the signs of the previous one are scarcely out of sight, a reminder is received from the General Superintendent to the effect that the "copy" for the printers is required at Head Office by May 1 or Nov. 1 as the case may be. As the Company's contract with the printers would be broken if this date were not rigidly adhered to, time must be found during the few weeks remaining after the reminder is received to transfer to a new special interleaved directory all the additions and alterations which have been made in the one in use at the district office since the previous issue. Attached to the reminder is a list of 22 different instructions which have to be carried out in dealing with the copy and proof. The gentleman at Head Office who issues these is evidently of a humorous turn of mind, for he adds after the 22nd instruction the following note:—"The above instructions are not intended to be a comprehensive list of everything that requires watching, but an assistance to the work of dealing with the copy and proof."

Having written up the "copy" and despatched it to Head Office, the question might now be asked: "How do we keep a record of additions and alterations that take place during the period intervening between the despatch of the 'copy' and the receipt of the proof?" It would not do to enter them in the *ordinary* way in the district office interleaved directory, as it would be impossible to distinguish them from those already printed on the proof. I would mention that the method employed some years ago was to enter them in a foolscap book in the order in which they occurred, the proof being brought up to date from this. I noticed, however, that considerable inconvenience was being caused the district office staff by having to search through this for a new subscriber's name if they failed to find it in the interleaved directory. I therefore overcame the difficulty by starting a method which has worked satisfactorily ever since—namely, to continue using the district office interleaved directory, but taking care to make the entries in violet ink. This method had the two-fold advantage of making the new additions and alterations easily recognisable from the others while at the same time providing a complete alphabetical list of subscribers. The same idea was extended to meet a similar difficulty which arose after the issue of the directory and pending the receipt of the special interleaved directory, green ink being used in this case.

In this connection I would point out that a great saving of time to the districts would be effected if Head Office were able to forward the special interleaved directory at the same time as the ordinary ones, instead of a few weeks later. Not nearly so many entries would then have to be transferred from the old to the new interleaved directory.

As soon as the proof sheets arrive from the printers, the additions and alterations which have taken place since the despatch of the "copy" are then written on the proof, the coloured ink method enabling them to be easily recognised from the others in the interleaved directory.

The work of checking has now to be commenced with all possible speed, as the proof must be certified correct and returned to Head Office within about a week from the date of its arrival. All the matter on it must be carefully examined and special attention is always given to exchange numbers and the initial names of the various groups of subscribers whose surnames are alike. If a wrong number were allowed to pass undetected, serious inconvenience would be caused the subscriber and considerable trouble would also be experienced at the exchange affected.

Again, if an initial name appeared incorrectly, all the others in the same group would also be incorrect, because of the "dittoes."

Trade descriptions are also very important and need careful watching. In some centres (Pontypridd, for instance) many subscribers carry on widely divergent kinds of business, such as "grocer and draper," "butcher, grocer and outfitter," "fruiterer and cab

proprietor," and there are numerous instances of "builder and undertaker," while one subscriber combines shop fitting with the two latter lines of business. When I saw those in the first directory that I dealt with I thought I had a chance of clearing up some glaring errors, but I was very soon disillusioned. However, on a printer's proof the year before last I noticed a description which read "grocer and baker, builder and undertaker"! This was a trifle startling, even for the versatile Pontypridd tradesmen, so I looked further into the matter, and found that two subscribers' descriptions had been joined together and appeared as that of the first one, whilst the second had none at all. Since then I have been particularly careful to watch, on each new proof, the entries of two Pontypridd subscribers of the same name. The first one is an undertaker and the second an explosives merchant!

When a subscriber discovers the slightest error in his entry he quickly ventilates his views about it. It would not do, therefore, to allow many serious errors to pass undetected, or compiling a telephone directory would have to be added to the list of dangerous occupations!

In addition to the original proof a *spare* one is supplied, and this is divided up and despatched to the various centres, where the local knowledge of the subscribers which is available is turned to good account when checking. The additions and alterations made at the local offices are then compared with those on the original proof at the district office, and any discrepancies are enquired into. In this way valuable information is obtained, and annoyance to the subscriber, with the inevitable letter expressing it, is avoided.

Before finally despatching the proof to Head Office it is customary in the district to ascertain from the local managers what works orders for new lines are *not* likely to be completed by the date of issue of the directory. Having obtained this information the directory forms pertaining to the works orders which will be completed are then gathered together and the particulars inserted on the proof. This is not strictly in accordance with the literal reading of the service instruction which says that only subscribers whose lines have actually been joined up are to be included. Presumably the intention is to obviate the danger of traffic difficulties arising by people ringing up subscribers whose lines have not yet been connected but whose names would appear in the directory. I would, however, mention that the old practice of entering subscribers' names in the interleaved directory at the time the works order was issued did not produce difficulties of this nature in Cardiff district. How much less then are the chances of them being caused while the present comparatively safe method obtains. As previously pointed out we are not taking the service instruction literally as this would mean excluding a large number of subscribers who, although not connected, would in all probability be by the date of issue. We are, however, acting up to the spirit of the instruction, which perhaps is better still. In conclusion, I may say that the existing practice of issuing complete directories every half-year is far more satisfactory than the old one when the January issue and a supplemental list of additions and alterations published in July had to suffice for the year.

CAPITAL AND REVENUE.*

BY J. M. ANDERSON, *Glasgow.*

To start with, let us try to define those two terms. Briefly, capital is the wealth employed in the establishment of a business, and revenue is the earnings of the business, once established. Capital and revenue accounts, like all accounts, have their two sides—income and expenditure. Capital account deals on the one hand with the contributions to the business made by partners or shareholders, and on the other with the disbursement of that money in building the enterprise. Revenue account deals on the one hand with the customers' payments and on the other with the disbursement of that money in running and maintaining the enterprise. Any balance of revenue left, after this expenditure has been fully met, is profit and becomes the property of the partners in return for the use of their capital.

As this paper will deal chiefly with the expenditure sides of these accounts we shall now consider more fully the attributes of these two classes of expenditure.

Capital Expenditure.—Capital may be legitimately spent only in building or establishing the business. Capital expenditure is merely the conversion of one form of wealth into another. For every penny of capital spent some tangible asset must be produced —something which could again be sold and the money restored. Capital account must be prepared to take this oath, "I established the business, the whole business, and nothing but the business."

Capital is most usually spent in the purchase of land, buildings, fittings, stock and goodwill; in the purchase and erection of machinery and plant, and in the conversion of raw material into products.

Having equipped the business and given it a proper start, capital account hands it over to revenue account—washes its hands of it—and will consider no appeals for further help, unless it be towards *extension* of the original business.

Revenue Expenditure.—This is also known as "working expenses," and that title effectively describes its nature. It is the cost of "working the business." All expenditure which will not answer to the tests imposed upon capital comes under this head. Thus, you may purchase the premises on which your business is housed from capital, but if you rent it, revenue pays. Even if you do own a building rates and repairs must come from revenue, as must also a periodical allowance for depreciation, *i.e.*, tear and wear. Capital pays for your stock, or your raw material. It also pays for the processes of converting the raw material into the finished product, because you thus increase its value, but cost incurred in selling your stock or produce must come from revenue.

Let us now come nearer home and consider the application of these generalities to our telephone business (Fig. 1).

Here we have the Company's capital account as at

* Prize paper read before Glasgow Telephone Society, 1909-10.

FIG. 1.

Dr. NO. 1.—CAPITAL ACCOUNT, 30TH JUNE, 1909. *Cr.*

Expenditure—	£	s.	d.	Issued Capital—	£	s.	d.	£	s.	d.
Amounts expended on Construction of Exchange and Private Stations, and Purchase of various Undertakings as per last Account	14,404,038	12	1	15,000 Six per cent. First Preference Shares of £10 each, fully paid	150,000	0	0			
Amounts expended during the six months ending 30th June, 1909, on Construction of Exchange and Private Stations	313,393	15	6	15,000 Six per cent. Second Preference Shares of £10 each, fully paid	150,000	0	0			
	14,717,432	7	7	250,000 Five per cent. Third Preference Shares of £5 each, fully paid	1,250,000	0	0			
Land and Buildings	808,747	5	2	Preferred Stock (Six per cent.)	2,225,000	0	0			
				Deferred Stock	3,725,000	0	0			
								7,500,000	0	0
				Three and a Half per cent. Debenture Stock	2,000,000	0	0			
				Four per cent. Debenture Stock	1,983,593	0	0			
								3,983,593	0	0
				Balance— Carried to Balance Sheet				4,042,586	12	9
	£15,526,179	12	9					£15,526,179	12	9

June 30, 1909. On the credit, or right side, are shown details of the shareholders' subscriptions, amounting to about eleven and a half millions. On the debit, or left side, appears the expenditure on lines, instruments, exchanges, etc., and on land and buildings totalling to fifteen and a half millions. This shows the Company's business to be value for four millions more than its subscribed capital, due chiefly to its reserve fund having been used to supplement the capital.

It is a peculiarity of the telephone business that its capital expenditure must be always going on. In trading and manufacturing concerns, the original capital expended may never be largely increased as their transactions are of two kinds which neutralise each other—the conversion by purchase or manufacture of capital into stock or products—and the re-conversion by sale of stock or products into capital. With telephone concerns—which are selling telephone service and not plant—there is no means of redeeming the capital spent, every new customer means more capital expenditure. As it is essential to the success of the business that new subscribers be constantly coming on, a telephone concern must constantly be adding to its capital expenditure. The result is that a concern of any extent and which has been running for a considerable period must have a huge capital.

Hidden away in the total expenditure of £300,000 is included the wages paid to Foreman Brown and his gang for the half-day which they occupied in running a spur for a new subscriber at, say, Rutherglen; and as well as the wages, there is included the cost of the wire and all other material which they used, also their locomotion expenses. In like manner, Fitter Jones has contributed to this huge total, the modest sum paid him for fitting that same subscriber's instrument and, of course, the cost of the instrument itself is included too (Fig. 2).

Here, on the credit side, appear the rentals and fees paid in respect of the services rendered to subscribers during the half-year. After deducting our contribution to the State, by way of royalty, of practically £150,000, they amount to about £1,400,000. The running of the business accounts for some £900,000, and there remains half a million of profits to be used for shareholders' dividends, reserve fund and other purposes.

To the £900,000 spent, Brown's gang has again contributed. After completing the new subscriber's spur, the other half of the day was spent in renewing stays on a route from Rutherglen to Shettleston. The wages, material, etc., so expended are included here. So also Jones, having fitted one instrument had to recover another. His pay for the time so occupied comes from this source.

Other sections of the staff—operators, clerks, inspectors, etc.—are not subdivided in this fashion, their work, since it consists entirely in helping to run the established business, is paid for entirely from revenue account.

A very important figure given in each of the Company's half-yearly statements is called "percentage of working expenses." It represents the ratio of expenditure to revenue. This gives a ready means of judging the economy of management. For the half-year in question the figure given is 63·93 per cent., which means that £63 18*s.* 6*d.* has been spent in order to earn each £100.

The figure is arrived at by adding the working expenses and other revenue charges; multiplying the sum by 100, and dividing the product by the sum of the rentals, etc. (nett) and of the income from certain other sources,

$$\frac{£863{,}561 + £30{,}206 \times 100}{£1{,}375{,}623 + £22{,}263} = 63{\cdot}93 \text{ per cent.}$$

Before we leave these half-year's Company's accounts, let us consider the finances of the average telephone station.

FIG. 3.

FINANCES OF THE AVERAGE TELEPHONE STATION.

		£ s. d.
Capital expenditure in erection	£14,717,432	
	489,747	30 1 0
	2 (£1,375,623)	
Annual receipts	489,747	5 12 5
	2 (863,561)	
Working expenses	489,747	3 10 7
Gross profit		£2 1 10
Percentage of profit on capital		6·95

FIG. 2.

No. 2—REVENUE ACCOUNT FOR HALF-YEAR ENDING 30TH JUNE, 1909.

	£ s. d.	£ s. d.
Expenses—		
Rents of Premises, Taxes, and Insurances	114,024 6 9	
Administration and Management, Office Salaries and Charges, Operators' Wages, etc.	387,704 7 9	
Maintenance and Renewal of Lines and Instruments and Depreciation Allowances	319,152 16 4	
		820,881 10 10 *
Rent and Maintenance of Post Office Wires		42,679 15 9 *
Balance—		
Being Profit carried to Nett Revenue Account		512,062 7 5
		£1,375,623 14 0

	£ s. d.
Subscriptions and Rentals—	
Brought forward from last Account	1,245,350 16 8
Received and Outstanding	1,645,507 12 7
	2,890,858 9 3
Less—Proportion of Subscriptions and Rentals in respect of periods extending beyond the 30th June, 1909 ..	1,366,283 9 0
Accrued for the six months	1,524,575 0 3
Deduct—	
Post Office Royalties	148,951 6 3
	‡ £1,375,623 14 0

No. 3.—NET REVENUE ACCOUNT FOR HALF-YEAR ENDING 30TH JUNE, 1909.

	£ s. d.	£ s. d.
Parliamentary Expenses and Legal Charges	392 0 0	
Pension Fund	4,110 14 8 †	
Income Tax	10,703 9 2 †	
Compensation Fund	15,000 0 0 †	
Interest on Reserve Fund Account	60,321 4 0	
Interest on Debenture Stock	74,286 2 10	
Balance—		
Carried to Balance Sheet	379,850 5 8	
	£544,663 16 4	

	£ s. d.
Balance from last Account	10,338 14 1
Balance brought from Revenue Account	512,062 7 5
Land Revenue Account	15,595 6 2
Profit on Instruments sold, &c.	3,511 9 8 §
Interest Account	2,944 3 0 §
Transfer Fees	211 16 0
	£544,663 16 4

Percentage of Working Expenses $\left\{ \frac{(* £863{,}561 + † £30{,}206) \times 100}{‡ £1{,}375{,}623 + § £22{,}263} \right. = \mathbf{63{\cdot}93}$

These figures are extracted from the accounts for the last completed half-year. The total capital expended in the provision of lines, stations, exchanges, etc. (£14,717,432), being divided by the total working stations (489,747) yields an average capital cost of £30 1*s.* per station.

The half-year's receipts minus royalty (£1,375,623) divided by the same figure and multiplied by 2 gives the average revenue received in respect of each station as £5 12*s.* 5*d.* per annum.

The half-year's working expenses again (£863,561), divided by the same total, places the working expenses for each station at £3 10*s.* 7*d.* per annum.

That figure, deducted from the receipts, leaves as gross profit £2 1*s.* 10*d.* per station per annum, which is equivalent to 6·95 per cent. on the capital expenditure. This profit is, as stated, "gross." Other heavy expenses have to be met, as we have seen, before the actual "nett" profits are arrived at. There are also some other sources of income however, so for our present purpose these figures may be taken as reasonably correct.

Having considered generally the distinctions between capital and revenue expenditure and seen how sharply they have to be distinguished in the Company's financial statements, let us consider how this separation is accomplished. From the passing illustration of the gang and the fitter working under both divisions on the same day the difficulty of this separation will be apparent. Here is a quotation on the same point from an accounting text book:—

> "Some of the most difficult and most important items with which an accountant has to cope when dealing with the financial matters of a business or undertaking are those of capital and revenue expenditure. They call for careful examination so that no items of expenditure which properly belong to revenue be included amongst those of capital. In times of depression of trade, or losses arising from other sources, there is often a tendency when it is desired to keep down losses, or to pay a dividend not less in amount than those declared in previous years, to write up assets by charging to capital expenses which in all strictness should belong to the revenue of the current period, or in other words to consider payments made for the *upholding* of property, fixed plant, etc., as representing an increase in the value of the sunken capital.
>
> "Items of outlay which are actual additions to, or extensions of property, and which increase thereby the permanent value or influence the powers of production, should, without doubt, come under the head of capital expenditure; while those which represent repairs, replacement, or general upholding of property, should be regarded as revenue expenditure.
>
> "It is a fact that at times it requires great discrimination as well as experience to determine whether certain payments belong to the one or the other; yet, where there is uncertainty, capital should indisputably have the benefit of the doubt."

Our capital expenditure is divided into several sections, that we are chiefly concerned with being "ordinary construction," which covers the cost of new lines and instruments.

Our revenue expenditure has many subdivisions. The entire expenditure of the Clerical, Contract and Traffic Departments is allocated to three accounts known as "office," "commission" and "operating" accounts respectively. The entire line plant maintenance is carried out on "line repairs" account, and the instrument and exchange plant is maintained entirely on "instrument repairs" account.

Our difficulty in separating the expenditure belonging to the two classes lies chiefly in the work of the Engineering and Electrical Departments. Our chief aid in coping with it is the issue of a separate works order for each job which these departments carry through. At the time of its issue the works order is allocated, *i.e.*, it is decided to which account it is to be charged, and it is also given a number. On the time sheets, the stores requisition slips, and the expenses sheets, opposite each item of expenditure for a particular works order, the number is quoted by the workman. The clerical staff is thus enabled to collect together the various items of expenditure on a given job and to charge them to the correct account.

A brief examination of a few types of works order will reveal their place in the scheme of accounting.

FIG. 4.

Date issued to Local Manager. *30/9/* 190 *9.* A/c. *O. C.* *N.* W.O. *13,856*

To Line Foreman Centre

Man-hours estimated spent

Please run *M. R.* line

from (*1,500 Calls .. .. £5 10 0*) *Hill.*

to (*Installation Rental, £3 0 0*) *1912.*

for *A. Boyd Scott,*

4, Prince's Gardens, Dowanhill.

Commenced *Oct. 25,* 190 *9.* *A. B. R., p.* District Manager

Completed *Oct. 26,* 190 *9.* Local Manager

Date 190

Posted to Works Order Book by *Jas. Walker,* Line Foreman

Approved *A. K.,* Local Manager

Date 190

This is an order for the making of a new connection. All the work done here is of the nature of provision of new plant. A tangible asset, viz., a new spur and instrument, is left for all the money spent. It is therefore a proper charge against capital and the order is allocated to "ordinary construction."

In carrying out such an order, it is frequently found convenient to "pick up a spare." That is to say, that over part of the route to be followed in making the necessary line connection, a wire exists which has fallen into disuse, and this is joined up to form portion of the new connection. Some time and material may have to be expended to refit this spare for use. Such expenditure does not increase the value of the plant but merely restores its full original value. It is therefore chargeable against revenue and instead of being put against the new works order it is charged to the current month's "line repairs."

FIG. 5.

Date issued to Local Manager. *26/8/* 190 *9.* A/c. L. R. W.O. *11,962*

To Line Foreman Centre

Man-hours estimated spent

Line Repairs. line

from

to *Month ending 30/9/09.*

for

No.

(B 36.) DEBITS. W.O. No. *11,962.* A/C. *L. R.* CREDITS.

Date.	Slip No.	Wages.	Material.	Sundries.	Date.	Slip No.	Wages.	Material.	Sundries.
Total		*110 13 0*	*41 2 2*		*Total*			*15 14 10*	
			15 14 10						
			25 7 4						

A works order of this kind is issued each month, and on it practically all the line maintenance for the district is carried out. Once a pole, cable, wire, etc., has been erected on capital, it must be kept up to its original good condition on revenue, and this is the medium through which most of this work is done. These are a few of the usual classes of work done under this head:—

Clearing line faults.

Regulating wires.

Renewing insulators.

Shifting wires owing to wayleave difficulties and building operations.

Renewing suspenders.

(*To be concluded.*)

The National Telephone Journal.

"BY THE STAFF FOR THE STAFF."

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ANSWERING THE TELEPHONE.

THE excellent article which we reprint from the *Financial Times* covers some ground which we have traversed before. It gives counsel which we in this JOURNAL have often given before, but which, it would seem, cannot be too plainly or too insistently reiterated. The necessity of unwavering courtesy in answering the telephone should be patent to the principal of a firm if not to his employees. But even this is not always so. We are, of course, well aware that recent years have seen an enormous change in the attitude of the public towards the telephone. As regards the large firms the chief factor in this change has undoubtedly been the private branch exchange with its skilled operator, who places the caller in direct communication with the department he wants. Moreover, the telephone habit has developed, the use of the service is confined to no special class, and one even hears working men talking familiarly of "ringing up." Any lingering disposition to regard the telephone as a nuisance is found alone amongst those old-fashioned folk whose prejudices are more lively than their reasoning powers. At the same time there undeniably remains a tendency with certain people to exhibit irritation at the sound of the telephone bell. What, we may well ask, is there peculiar in its note to arouse aggressiveness? Is it a more exasperating sound than the sharp alarm bell which many shopkeepers have attached to their doors; and yet who ever saw a shopkeeper bounce out of his parlour on the ringing of such a bell and ask his prospective customer in petulant tones, "Well! Well! What is it? What do you want?"—as though assuming that the customer only wanted to ask the time or to be obliged with a stamp?

One sentence in the *Financial Times* article merits the consideration of all those telephone users and their servants who are apt to adopt a sharp tone in answering the telephone. "A telephone bell rings in just the same manner whether the caller be an office boy or a man with a big order to place." This well put truism seems so obvious that it is extraordinary that it should be necessary for so many people to lay it to heart.

As regards the quite inexcusable nuisance of passing the enquirer from department to department, and bringing to the telephone a weary succession of juniors of ascending grades until at length one obtains a gentleman possessing the requisite minimum of seniority to deal with the matter in hand, these points we have dealt with on previous occasions. The bad habit, however, is still sufficiently widespread.

ON PROPHECY.

"SOME of the best telephone engineers," says the *Manchester Guardian*, in an article "Can We Do Without the Operator?" "were of the opinion in 1905 that no radical change in apparatus was to be expected. How has time dealt with their prophecies?" Frankly, we think it is premature to attempt to answer at all conclusively. The *Guardian*, however, continues: "The answer is that coincident with the transfer of the telephones to the State the most revolutionary changes are about to be made in equipment." As the automatic principle was certainly well known to the "best telephone engineers" in 1905—and we know of no radical change which has been evolved since then—the above remarks would appear to imply that the installation by the Post Office of experimental automatic exchanges at Epsom and Caterham in some way demonstrates the said engineers to be false prophets. If it is intended to suggest that they were not far-seeing enough to discern in the automatic the telephone exchange of the future, and that the time has now arrived when they are proved to be wrong, the deduction is certainly extremely questionable. Many of the best telephone engineers indeed, whilst antagonistic to the adoption of full automatic working, regard the principle as likely to be useful as an adjunct to manual working; but the ultimate triumph of the new system is still far from assured, for semi-automatic exchanges which continue to employ large numbers of operators certainly fall short of the much-advertised ideal of a "girl-less telephone."

Prophecy and automatic telephones seemed to have some subtle affinity, and we ourselves in 1909 adventured a modest prediction which, so far, we have had no reason to modify. It must be remembered that STROWGER invented the automatic exchange as far back as 1890. Experimental exchanges were opened at La Porte, Indiana, in 1892, and a larger one of 1,000 lines at Augusta, Georgia, in 1894. Other exchanges of varying sizes followed in America, and subsequently in Europe experimental automatic switchboards were tried by the Austrian and German Governments in small exchanges—without exciting much interest except to telephone men and to operators whose doom was now and again sounded in odd corners of the newspapers. Suddenly the mention

of the Hildesheim Exchange in a consular report caused an outbreak in 1909 of newspaper prophecies of the disappearance of the operator. "The operator," we said in the JOURNAL of October, 1909, "will go on being doomed periodically until she has left the service, married and possibly brought up daughters, who, if they become telephonists, will no doubt be doomed in their turn when some newspaper discovers that there is an automatic system in full swing at Timbuctoo or Tehuantepec."

We have since had gratifying fulfilments of our prophecy practically every time the story of the opening of a new automatic exchange found its way into the Press.

The proposed installation of STROWGER and LORIMER switchboards by the Post Office in two quite unimportant places, upon which we made some criticism last month, moves the *Manchester Guardian* to remark gravely: "Little wonder that every European country is watching England with intense interest. A great deal depends on two large experiments which are about to be made with the apparatus." This notwithstanding that similar and more extensive experiments have been made by the German, Austrian and Bavarian Post Offices during the last two and three years!

HOLIDAYS.

AT the time these words are written (the middle of August) the vast majority of the staff may be fairly divided into two groups. Those in enjoyment of their annual holiday and those in immediate anticipation of it—an eminently desirable estate for either group. If we were inclined to philosophise we might entertain ourselves with weighing the more prolonged pleasure of "looking forward" with the transitory one of actual enjoyment, and the latter again with the sad-sweet pleasure of silent reverie and reflection upon past delights. Those whose holidays are short are certainly entitled to get what comfort they can out of the reflection that the pleasures of anticipation must be less to those whose vacations and week-end holidays are of frequent occurrence; and it is no sophism but a sober truth that the fore and after tastes of enjoyment to which reference is made above are very real things to the normally good imagination. We need not remind readers that "man does not live by bread alone" to convince them that the pleasures that light up and fill the imagination are as actual—we had almost said tangible—as the material ones they presage. We must, however, proceed in this direction with caution. When the POSTMASTER-GENERAL appeared as "the apparition, the dumb sign, the beckoning finger" at the annual dinner, assuring us of "ampler day, divinelier lit" when we went over to the Post Office world, he suggested that one of its most powerful attractions would be an extra week's leave at full pay. We have, of course, no desire to suggest that the imaginations of telephone men are so glowing and the pleasures they derive from anticipation so superior to enjoyment that the extra week's leave will be superfluous.

The medical press, with its fondness for periodically alarming the public, has attacked the general unquestioning faith in sea air. We do not think they will deter many holiday makers from visiting their favourite resorts. Happily not everyone is haunted with the ghost of indifferent health, and holds a common-sense opinion that, within reason, what he enjoys most agrees with him best in the way of holiday recreation. That our readers, whether they cycle, motor, sail boats, rusticate, play cricket, bathe mixedly, or climb mountains, may have their due enjoyment of this magnificent summer is our principal hope and wish.

THE STAFF AND ESTABLISHMENT.

THE promises of a broad basis of establishment granted by the POSTMASTER-GENERAL in connection with the passing of the Telephone Transfer Bill through Parliament, together with the many concessions contained in the Bill itself, must be very gratifying to the staff, more especially having in mind that a broad establishment must of necessity increase the chances of establishment for those who are not already established at the transfer.

To have secured the establishment not only of practically the whole of the Company's pensionable officers but also many of the construction staff not pensionable under the Company, is, apart from the many other concessions obtained, sufficient cause in itself for sincere congratulations to the Joint Board of the two Associations. We think they are also to be warmly congratulated on the manner in which they have handled the very delicate negotiations, and especially on having secured the valuable support and advice of many influential members of Parliament.

HIC ET UBIQUE.

THERE was a hiatus in last month's "London Notes" which requires some explanation. In consequence of the insertion immediately before going to press of Mr. Corner's article on "Telephone Traffic and the Coronation" a paragraph in "London Notes" (covering much the same ground and remarking on the great credit with which the operators had come through the ordeal) was excised. The succeeding paragraph, stating that all necessary provision was made for the convenience and comfort of operators on duty, which of course should also have been cut out, read therefore somewhat inconsequently.

THE Belgian Minister of Railways, says the *Zeitschrift für Schwachstromtechnik*, has brought in a Bill for the alteration of telephone tariffs. Subscribers are to be divided into four groups in accordance with the number of calls they make. An annual charge per annum will be made of 110 to 130 francs (£4 8*s.* to £5 4*s.*) according to the population of the area, and in addition a special charge will be levied based on the number of calls to be made. The lowest tariff includes the making of 1,200 calls, for which 40 francs will be charged. The highest (10,000 calls) involves a payment of 180 francs (£7 4*s.*). More than 10,000 calls are not permitted for one subscription, but at that limit a second annual payment must be made. The charge per call at public call offices, which was formerly $2\frac{1}{2}d$, will be fixed at 1*d.*

THE telephone statistics of the Old World for Dec. 31, 1909, have just been published in the official *Journal Télégraphique*, dated July 25. We append the total subscribers' stations for the countries given in the statistics. They show some slight divergencies from the figures (mostly from official sources) for the same date published in the NATIONAL TELEPHONE JOURNAL last November. This is due to various causes. For instance, the financial year (to which the figures apply) does not end in all countries on Dec. 31, in some it ends on March 31. Again, it is

not always clear whether the call office stations should be added to the subscribers' stations or whether they are already included:

EUROPE.

	Subscribers' stations.
Germany	926,644
Great Britain	610,096
Sweden	169,840
Russia	129,826
Austria	94,569
Denmark	85,688
Switzerland	72,515
Italy	57,941
Netherlands	52,635
Hungary	47,924
Belgium	41,621
Spain	20,855
Roumania	11,170
Luxemburg	2,862
Bulgaria	2,015
Servia	1,522
Greece	1,499
Iceland	671
Bosnia-Herzegovina	565

Figures for France, which should come third on the list, are wanting. The number of stations was 211,728. Norway—also lacking—had about 58,000 stations.

ASIA.

	Subscribers' stations.
Japan (including Formosa, Chosen and Sakhalin)	115,602
India	9,595
Dutch Indies	7,844
French Indo-China	517
Siam	393

AFRICA.

Cape Colony	4,413
Tunis	1,308
Natal (State)	1,222
Orange River Colony...	621
Madagascar	232

AUSTRALASIA.

New Zealand	29,681

A SHORT time ago, says *The Times*, the Post Office laid a new and improved telephone cable in the Straits of Dover, and this has recently been connected to land lines from London and Paris, thereby providing increased and improved telephone facilities between the two capitals. By the extension of these circuits to provincial towns speech is rendered possible between places in England and France which could not previously communicate with each other, and, in order to determine the extent of the increased range, experiments have recently been carried out by English and French officials from a number of provincial towns on this side of the Channel. Before the new cable was provided no town north of a line connecting the Humber and Mersey could communicate with Paris, but in the recent trials it was found possible to converse with the French capital from Newcastle-on-Tyne, Glasgow and Edinburgh. Finally, trials were made from Aberdeen involving a circuit length of over 900 miles, and in the best conditions of line and apparatus commercial speech could be conducted from that place with Paris. These tests will enable the Post Office engineers to determine what other English towns can communicate with France, and it is hoped that a list of such towns will be published shortly. The increase in the range of telephonic speech has been brought about by means of the new telephone cable recently laid between England and France. This cable is fitted with loading coils which neutralise the disturbing effects on speech transmission introduced by the insulating material which must necessarily be employed when conductors are laid in water.

OFFICE EQUIPMENT AND ORGANISATION.

TELEPHONE OBITER DICTA.

(Reprinted from the "FINANCIAL TIMES.")

IT is, of course, a mere platitude to say that the telephone is an invaluable aid in the conduct of modern business. No one can be blind to the necessity of the telephone—no one, that is to say, who has or who hopes to have a certain amount of daily business to transact. Nevertheless, there has grown out of the universal use of the instrument a number of evils which do much to counteract its utility. It is my impression that business men in general are unaware of these defects in their telephone service; therefore my remarks on the subject may be opportune and useful.

In the first place, I am afraid that many business concerns imagine that the telephone is a sufficient excuse, not to say explanation, of the brevity that is a near companion of rudeness. A few days ago I had occasion to ring up a certain firm with which I wished to place an order. My ring was answered by a junior, a very junior junior, whose voice was better adapted for the peddling of coke than the conduct of a telephone conversation. After demanding "'Oo er you?" "What name did yer say?" and a few other questions, this young man promised to put me through to a more responsible official. I clutched the receiver for some few minutes until, eventually, another voice took up the conversation. Again a demand was made for my name and business in tones which implied that the speaker was considerably ruffled by my impertinence in taking up his time. I answered his questions, and was informed curtly that someone else would be called to attend to the business. It is, perhaps, hardly necessary to say that I declined a third catechism—and my order went elsewhere.

I am convinced that a good deal of business is lost and bad feeling engendered by telephonic misconduct. Talking over the telephone must always lack the amenities of an ordinary conversation, but for that very reason any concern with customers to lose should see that members of its staff who are called upon to answer the telephone should take special pains to make their end good. A man who complains of a belated delivery of goods, an overcharge, or what not, over the wire should be handled with tact; more frequently he is further incensed by the unmannerly bellowings of a hobbledehoy deputed to answer him.

A man rings up a concern and is answered by a junior. He states his business, but is interrupted in the middle of a sentence and curtly told to "Wait a minute." Meanwhile, the junior saunters off to fetch the right person or proceeds leisurely to put the inquirer through to the individual wanted. It is surely easy enough to train these juniors in the elementary essentials of telephonic usages. They can be taught to pitch their voices to the right key and disabused of the notion that it is necessary to yell into the transmitter to be heard. They can also be taught to use the correct formula in putting inquirers through to responsible officials. A junior who is told to say, pleasantly and clearly, "Will you hold the line for a moment, sir, while I put you through to Mr. So-and-So?" will soon get the habit and the house will profit. A boy or girl who is slow to pick up telephone lore should never be permitted to use the instrument. He or she will assuredly do more harm than good.

Senior officials are, however, in a large number of cases, little better than the juniors. I have sat by the desk of a responsible official and seen him jerk the receiver off the rest with a loud yell of "Yes, yes. We're Jones & Co. Who are you? Can't hear you. No, I can't hear you. What name? How do you spell it?" etc. A telephone bell rings in just the same manner whether the caller be an office boy or a man with a big order to place. In any case, it is best to treat the inquirer with ordinary civility.

As one who answers and makes many telephone calls in the course of a business day, I can speak feelingly as to the vast difference existing between the methods of various concerns in this respect. There are some firms I detest calling up on the telephone. I can always be sure of vexatious delays and needless difficulties. Others appreciate the potentialities of the instrument in cementing friendly relations with the outside world, and the staff is equipped and instructed according to these ideas. Other things being equal, there is no doubt that such firms will get a bigger share of business, and they deserve it.—J. W. H.

FROM THALES TO NEWTON.*

BY P. T. WOOD, *London.*

SOMEONE—I think it was Lord Kelvin—once said that the function of a teacher was to save the student time by properly directing his efforts, and not to save him trouble by doing the work for him. But the teacher has another duty not so generally realised, though no less important than that already mentioned, and it is the awakening of the student's interest in the subject taught.

To those of us who are still students the keenness with which our studies are undertaken is largely dependent on the intrinsic interest of the subject. "No profit grows, where is no pleasure ta'en" is still true now, as it was in the days of Shakespeare, and, since one cannot always choose the study one likes, it is necessary to like the study one chooses.

Of all studies I suppose there is not one that can be made so overpoweringly dull and difficult as mathematics, and few take up the subject purely for love of it. It is related of Euclid that when a lad who had just commenced the study of geometry asked, "What do I gain by learning all this stuff?" Euclid replied that knowledge was worth acquiring for its own sake, but made his slave give the boy some coppers, "since," he said "he must make a profit out of what he learns."

Scholars have not much changed since that day, and of mathematics more than any other subject in his curriculum is the bored student tempted to say, "What benefit shall I gain from this study?" In answering this question I propose to ignore the skeleton as found in the ordinary text book and say something of the birth and growth of the original body. This seems to me best done, firstly, by introducing the historical element, and so giving a human interest to the narrative; and secondly, by pointing out a few cases where the application of mathematics to natural problems has enabled solutions not otherwise obtainable to be found. It is only by constantly applying the formulæ and equations of mathematics to everyday problems and ascertaining their physical meaning and practical application that life enters into the otherwise "dry bones" of the subject, and to-day the relation between physics and mathematics is so intimate that any advance in our knowledge of the one is largely dependent on our acquaintance with the other.

Let me give an instance. Some months ago a paper was read at the Institute of Electrical Engineers by Mr. S. G. Brown on a new type of telephone relay which he had invented. This relay had been developed along quite new lines, and owed its efficiency to its delicate mechanism and design, whereby minute changes in the air gap between two metal electrodes varied the resistance in a receiver circuit. The relay was to a great extent capable of self-adjustment and would operate successfully in any position. In the subsequent discussion Professor Perry, after making a few congratulatory remarks, said he hoped to be able to express mathematically the reasons for this accurate self-adjustment, in which case he would submit his formula to the institution. This was accordingly done, and mathematical proof given to show how largely the adjustment may vary without affecting the total current in the local circuit of the relay under consideration. The point that particularly struck me was the close connection between physical phenomena and mathematical formulæ. On first thoughts it seemed to me a strange thing that a material fact like the operation of a relay should be so readily amenable to a mathematical solution, but little consideration was sufficient to show that the connection was not one dependent on the chance identity of two distinct subjects, but was owing to the fact that the human mind has been able to invent a symbolic language to express the relation between natural phenomena. One is almost led to the conclusion that natural phenomena are based on a definite mathematical plan, so that one has but to learn the details of any physical action to discover the mathematical or mechanical principle underlying that action. But to return to our subject.

One of the earliest acts of rational man must have been that of counting, and one of his earliest needs would have been some method of indicating quantity. At first by means of gestures, and then by repeating numbers on the fingers of the hands he would obtain a system of notation, but it can be seen from primitive people to-day how very limited such a system is. When ten was reached, so also was the limit of this method of notation, and any higher numbers were either called a "heap" or expressed by multiples of ten. Had man been furnished with six fingers to each hand it is practically certain that the duodecimal system would now be in general use, and ·6, ·4, ·3 and ·2 would all be represented by whole numbers, and the fractions one-fifth and half in the decimal system would give place to the $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{6}$, of the duo-decimal. It is, of course, possible to make use of any scale of notation, and most books on algebra will explain how to operate with scales of any radix.

When we come to historic times, considerable progress had been made among the more civilised nations, but not even the advent of writing assisted much in the advance of arithmetic, and of course algebra was unknown. Also the advantage of figures as distinct from words was little appreciated, and it will only be necessary to call to mind the Roman system of notation, which was of comparatively late development, to give an idea of what difficulties lay in the way of carrying out even the most simple arithmetic operation. As an example, until the sixteenth century multiplication as we now know it was unknown, and its results obtained by repeated additions, generally by means of the abacus, an instrument now relegated to the nursery and kindergarten.

It was not until the introduction of the Arabic notation that the decimal system became possible by grouping numbers into tens and giving names to the groups. In this system was first introduced the first symbol for zero, and the important step taken of assigning different values to the same figure according to its position; for it is not correct to suppose that ten consists primarily of a combination of the two symbols 1 and 0; it has one sign and that is "one" written in the ten's place. The zero refers to the units, of which there are none.

Chiefly owing to this lack of a suitable system of notation, few operations could be performed by means of arithmetic, and those but clumsily, so that little advance was made in counting or measurement until very few centuries ago.

In geometry, however, a science which dealt with magnitudes only, extraordinary proficiency was obtained, and many problems were solved by its means that to-day are considered to belong to the province of algebra alone.

One of the earliest known applications of geometry to practical purposes was made by the early Egyptians to obtain the direction of due east and west. A rope, A, B, C, D, was divided by knots at B and C, so that the lengths A B, B C, C D were in the ratios 3, 4, 5. This rope was pegged down to the ground at B and C so that the length lay north and south. The two free ends were then brought together and the rope made taut. A right-angled triangle was thus obtained whose vertical lay due east and west. This method is made use of in land surveying at the present time.

But it was with the Greeks that geometry first became a science and was considered a subject suitable for school teaching. Until their time there is no evidence that the knowledge possessed was other than that founded on observation or experiment, but in the Greek schools proofs were obtained deductively from previously ascertained premises, and many valuable properties of plane figures obtained by their method of geometrical reasoning. The value of this system is very limited, as every particular problem attacked requires some special procedure, and no universal rule can be given that would assist in the solution of new problems.

For the first time, however, rigorous proof was demanded in support of any theorem advanced, and a standard of accuracy attained that served as a model for all further enquiries. To the student of to-day the facts for which the Greeks sought so arduously are either taken for granted or readily accepted when explained; but it must not be forgotten that we owe to the life-work

* This paper was received by the Editor contemporaneously with Mr. Payne's, and, like his, is designed to increase the interest of those who find mathematics dull.

of these Greeks discoveries that enable us to obtain with little trouble the proofs upon which to build the more advanced problems of modern mathematics. It is difficult to imagine the delight of the ancient who first discovered the proof of such a problem as the area of any circle or the properties of a right-angled triangle. Such discoveries were celebrated on more than one occasion by sacrifices to the immortal gods by the happy geometer.

The founder of the earliest Greek School of Mathematics was Thales, one of the seven sages of Greece. He is probably responsible for the proposition that the sides of equiangular triangles are proportional. This was probably the outcome of a desire to find the height of a pyramid, and a dialogue is given by Plutarch, who, addressing Thales, says: "Placing your stick at the end of the shadow of the pyramid, you made, by the sun's rays, two triangles, and so proved that the height of the pyramid was to the length of the stick as the shadow of the pyramid to the shadow of the stick." According to another source, the height of the pyramids was obtained by finding the length of their shadows at the moment when the shadow of a staff was equal to its own length. Thales is also credited with the fifth proposition of Euclid, book 1, the *pons asinorum* of one's school days.

From the time of Thales to that of Euclid, 300 years later, a number of schools flourished in Greece, all of which contributed more or less to the collection of geometrical problems and theorems, afterwards revised and added to by Euclid.

Another name that should be mentioned in this period is that of Pythagoras, who did much to advance the scope of geometry, and was responsible for its inclusion among the subjects that made up a liberal education in those days. The idea of proportion first introduced by Thales was more fully investigated by Pythagoras, and utilised by him as a basis for a kind of ethical religion. Pythagoras appears to have been much impressed by certain numerical relations occurring in nature, and was the first to treat music as a branch of applied mathematics. As it was some such connection between our knowledge of nature and our ability to express natural phenomena in mechanical or mathematical terms that suggested this article, I may be permitted to describe more fully the numerical ratios underlying the production of music. The story goes that Pythagoras, hearing three blacksmiths with different sized hammers at work on a bar of iron, was struck by the musical harmony of their blows, and sought for the cause. He was thus led to investigate the production of musical tones from a vibrating string, and is credited with the discovery that the pitch of these tones depended on the length of the string according to a definite law. He found that the lengths which gave a note, its fifth, and its octave were in the proportions of 4, 3, 2. The similarity in the sounds of a note and its octave had been noticed from the earliest times, as also the musical concord between a note and its fifth, so that the ratios 1 : 2, 2 : 3 may be supposed to represent the notes that are in the strongest concord. It was but a step from calculating the ratios between similar strings of different length to the calculation of ratios between the actual vibration numbers themselves and thus applying tests to any musical instrument.

Further investigations into the harmony of strings whose vibrations bear a simple ratio to each other, disclose the interesting fact that all notes in the major scale may be obtained from a suitable combination of the ratios represented by the whole numbers 1, 2, 3, 4, 5. For instance, 1 : 2 gives the octave; 2 : 3 gives the fifth, 2 : 4 is the octave again; 3 : 4 gives the fourth and 3 : 5 the major sixth, both good concords; 4 : 5 gives the major third, also a pleasing concord. Assuming 1 to represent the note C, G F A E C' are all thus seen to be closely related to the tonic of the natural scale. But with the growth of musical knowledge a need was felt for a more complete scale, and certain other notes were introduced based upon the intervals of the major scale. For instance, if we desire to associate with, say, G, its third, we get a note whose ratio to the fundamental is $\frac{15}{8}$, and this gives us a new note—B. Its fifth gives us a note whose ratio to the octave of the fundamental is $\frac{9}{8}$. This falls between C' and E' and gives us D'.

Helmholtz was the first to give a scientific explanation of musical harmony. He showed by experiments with the siren that two musical tones depend for their harmoniousness or consonance on the possession of a greater or less number of identical harmonics or upper partial tones, and pointed out that our keen feeling of the relationship between tones of different pitch is due to the presence of a whole series of these harmonics. This series is the same for all musical tones, and is such that its vibration numbers, compared with the fundamental as 1, are as 2, 3, 4, 5, etc. For instance, the first upper partial tone is the octave of the fundamental, or prime, the vibrations being as 2 to 1; the second upper partial tone is the fifth of the octave, the vibrations being as 3 to 1 of the fundamental: the third upper partial tone is the second higher octave, the vibrations being as 4 to 1, and so on, becoming continually fainter until the limit of audibility is reached.

From many sources, such as chemistry, astronomy or mechanics, one obtains curious series of numbers that rouse a wonder as to nature's system of notation.

Once more to return to our subject.

In the time of Pythagoras and for 200 years later the circle was the only curve considered in geometry. At a later date Menaechmus, the Athenian, introduced the curves which can be formed on the surface of a cone when cut by a plane in different directions, and gave mechanical constructions for the ellipse, hyperbola and parabola.

The measurement of circular areas was one of the most famous problems of antiquity, and was for long attempted without success. The ancient Greeks, however, stated the problem in a way that proved insoluble by plane geometry. It was the determination of a square whose area would be equal to that of a given circle—commonly called the squaring of the circle. Archimedes, a contemporary of Euclid, was the first to give a rule for finding such an area, though not in terms of the side of a square. With the radius of the given circle as base, a right-angled triangle is drawn whose perpendicular is equal to the length of the circumference. The area of this triangle is equal to the area of the given circle. For if the circle be divided up into an infinite number of triangles the sum of these is equal to one large triangle whose sides are respectively the radius and the sum of all the separate infinitely small portions of the circumference. To-day the student is instructed to find the area of a circle by multiplying the square of the radius by π, because as we have seen the area of circle equals

$$\tfrac{1}{2}\, r \text{ (length of circumference)}$$

which is $\tfrac{1}{2}\, r\, (\pi\, d)$ or $\tfrac{1}{2}\, r\, (2\, \pi\, r)$ or $\pi\, r^2$

The determination of π is another subject, closely allied to that just referred to. From the earliest times the relation between the circumference of a circle and its diameter has been a problem of great practical importance, and the attempts to solve it have been many and interesting. It could not have been unnoticed that the circumference was always about three times the length of the diameter, but it was not until the study of geometry was well advanced that the value of π was obtained with any degree of accuracy. An approximation was obtained by Archimedes, who inscribed a regular polygon inside a circle, and another with same number of sides outside of it. The circumference of the circle was thus greater than one and less than the other. By continually increasing the number of sides the difference could be made less than any assignable quantity. Archimedes constructed approximate circles made up of 96-sided polygons, and by this means proved the ratio to be less than $3\frac{1}{7}$ and greater than $3\frac{10}{71}$. The ratio has since been ascertained to 707 places of decimals, and the diameter and circumference are known to be incommensurable.

It is not to be wondered at that the early mathematicians avoided the solution of problems by arithmetic, when two of the most important figures dealt with—namely, the square and the circle—should involve incommensurable ratios.

With the invention of trigonometry a century later, the mathematics of the ancients reached its limit, but sufficient progress had been made to assist very materially in the sciences of the day—astronomy, land surveying, mechanics, hydrostatics, etc.

The next general progress in mathematics was due to the Arabs, who brought from India the decimal system of notation and algebra under the name of "algorism." This knowledge reached

Western Europe through the Moors of Spain, and came into general use about the fifteenth century. There is little likeness, however, in the forms of this early algebra and that of the text books to-day. At first it was entirely rhetorical, and the whole process of reasoning was expressed in words, and without the use of symbols. At a later date abbreviations were adopted, the principle underlying the process remaining the same. For instance, in Queen Elizabeth's reign x was denoted by R (res) and its square by Z or C (zensus or census), p for plus, and so on. An expression such as $x^3 + 2x^2 - 10x + 8$ would be written:

1 K p 2 Z m 10 R p 8

A further improvement was introduced by Stifel, an Augustine monk, who used different letters to signify different "things," but the same letter for similar "things," whatever the power. The relation between a number, its square, cube, etc., could thus be seen at a glance. Thus A raised to the third power became AAA. It was not till the time of Descartes (1596 to 1650) that algebra reached its modern form, and became entirely symbolic, its notation having no obvious connection with the things represented, and its symbols in many cases—unlike arithmetic—admitting of unthinkable quantities and operations. It was during this transition period that signs were introduced for the commoner operations of arithmetic. Record, who wrote an algebra in the year 1557 takes to himself the credit for the adoption of several signs, *e.g.*, "And to avoide the tediouse repetition of these wordes 'is equalle to' I will sette, as I doe often in woorke use, a paire of paralleles or Gemowe lines of one lengthe = bicause noe 2 thynges can be moare equalle."

Advance was now rapid in all branches of mathematics, but extremely cumbrous methods were still in use for multiplication and division, and it was only expert mathematicians who could undertake calculations entailing such processes. The most simple trigonometrical problems required long and laborious arithmetical operations, and so great were the chances of error that an elaborate system of checks was usually carried out to verify conclusions.

Division, even at this period, was really an appalling business, and considered a very severe test of mathematical ability. 'The training master of the gladiators says to his pupils, "A firm foot and a keen eye." Let the arithmetician say to the scholar, "A sharp intellect, a strong memory, a hand skilled in the daily practice of division." And let no one esteem himself a really studious pupil if he does not work out every day as long a division sum as he can.'

The invention of logarithms by Napier was a great aid to practical calculations, and its universal application followed rapidly on its publication. It is general nowadays to regard logarithms as a natural sequence to the use of indices, but their discovery was made quite independently of the other, and actually antedated it. Considering the extent of mathematical knowledge at the time, the invention of logarithms was an extraordinary achievement, and the more so as it was the result of no mere accident, Napier having deliberately set himself to find some method of shortening the long processes of multiplication and division so as to aid the study of astronomy, then as now invaluable to the English sailor for navigation purposes. By the help of arithmetic and geometry alone Napier succeeded in calculating a table giving the logarithms of the signs for every minute of a right angle to seven figures. A table giving the logarithms of all numbers from 1 to 20,000 was subsequently published by Briggs, a contemporary and friend of Napier, and is the one in general use to-day. Napierian logs, strictly so-called, have entirely passed out of use, but it will be of interest to indicate the fundamental principles discovered by these men, and made the basis of their systems. Napier realised that everything effected by means of multiplication and division in geometrical progression is effected in arithmetical progression by means of addition and subtraction, and was the first to see that all numbers may be either terms or as near as we please to terms in a geometrical series.

In G. P. the terms increase or decrease by a common factor, whereas in A. P. the terms increase or decrease by a common difference. For example, taking any series—1, a, a^2, a^3, a^4, etc.—with a constant factor a, we should obtain values in geometrical proportion. By plotting beneath these values their respective indices we should obtain an arithmetical series.

1.	2.	4.	8.	16.	32.	64.	128.	256.	512.
0	1	2	3	4	5	6	7	8	9

is such a case where $a = 2$.

To multiply together any two items in the top row it is only necessary to add together the two corresponding items on the lower row corresponding to the answer on the upper row. It is on this principle, of course, that the slide rule is based, its scales corresponding to the figures in arithmetical progression on the lower row which are the logarithms (lit. numbers of the ratios) answering to the series of numbers in geometrical progression in the upper row.

Such a series would be useless, however, for general purposes, as many more numbers would be omitted than included. But if we make a exceed unity by a very small amount powers will increase but slowly, and every whole number may be made a power of a, or as near as we please to a power of a

It is on this principle that all tables of logs. are based. To make it quite clear, let us suppose that our system is to be such that 0 is the log. of 1 and 100,000 the log. of 10. Then the 100,000th root of 10 would be 1 + a minute fraction, or $(1 + t)^{100000} = 10$.

It would be noticed that 2 is very nearly the 30,103rd power, or $(1 + t)^{30103}$, that is, in passing from 1 to 2 we should come nearest to 2 in 30,103 steps, these steps being the number of the ratios or logarithms.

(To be concluded.)

IMPRESSIONS OF THE INVENTORY-TAKING AT MANCHESTER, 1911.

From the Typist's Point of View.

WE were engaged as temporary typists to assist at the National Telephone Company's offices during the great pressure of work involved by taking the Inventory of plant (not the common or garden kind, mind you) which was in progress. I am not sufficiently conversant with an inventory to describe it in detail, but it is as well to note that it has *not*, as the name may suggest to some, anything to do with enlisting. To put it in brief, it is something like this—

A whizzing up and down large poles,
And diving deep into manholes;
The former to find out the height,
The latter for the depth of pipe.
And mighty brains, in congress come,
From totals work an average sum.

At first we worked in the typists' office, a large airy room which bears many signs of feminine occupants, and over which Miss "X" hold an ever-smiling sway. It is governed on two sides by large windows which admits the "fresh, clear, Manchester air," whilst the windows are invariably adorned with sweetly perfumed flowers. But this was not to last, and one day the bomb fell! With but little notice and scant ceremony my colleague and I were consigned to the Inventory Department, or, in other words, the lower regions, and thereafter regarded ourselves as "underground typists." It did not take us long to discover that our new abode favoured not a little the theory that the actual lower regions are rather warm, but a piece sawn off the top and bottom of the wooden partitions, which gave it such a barrack-room appearance, reduced the heat considerably, whilst the subsequent opening and shutting of our mouths acted in a similar manner to an electric fan; thus the atmosphere became quite normal.

A good many of the men for whom we work appeared to be Scotch, and I am inclined to think that they had not a very high opinion of the English. One of them was "A," who had a great and proper pride in his native heath; a human desire to have all his own way; and a remarkable inclination to assume an authority far beyond his years. It was also characteristic of him that he could not dictate a letter comfortably unless his feet were deep down in the wastepaper basket. Then there was reference "B," who was habitually serious, in our presence at least, and always appeared to have one definite end in view which must be accomplished at all costs. I have sometimes been curious enough to wonder what he was thinking about, and have even tried to imagine what effect it

would have upon him if a dozen or so of the braw laddies rushed in, clad in their national attire and rent the air with the plaintive notes of their beloved bagpipes, awakening glorious visions of purple hills and grand sunsets. Perhaps it is presumption on my part to write about him, for I do not think he likes me. I made an awful hash of his letters once—a long time ago, and if I cannot forget, how then shall he? Both my colleague and I liked C 5 and D 5 *well*, and it is interesting to note that the former had an obvious appreciation of the humours of life, and was often heard to burst into a laugh which made the very walls tremble, whilst the latter took a kindly interest in our welfare, and appeared to be a general favourite all round. Reference "E" was *nice*, but had one peculiarity, *i.e.*, he always stood, or sat, as far away from us as possible when dictating a letter, almost as though typists were things that bit. It would take too long to mention each in detail, but it is worthy of note that reference "F" was the quickest dictator of all, but a nice plain speaker, and that reference "G" was a nice dictator but had weird letters, to say the least. H 4 and J Z were both engaged upon the same class of work, and were possessed of an unnatural habit of following each other in and out of our office with horrid agreement things, *re* age analysis, etc., which seems to me to be a routing round for birth certificates—those things which I once heard someone remark go to prove that you are born. We christened "N" the little "steam engine," on account of the hasty way in which he rattled off his letters, often departing hence long before we had got even a suggestion of the tail end of the missive. He afterwards developed a bad habit of scribbling his letters out in a weird style of handwriting, which greatly perplexed us, and sometimes led to comical errors in translation. Last, but not least, as the saying goes, comes reference W., who almost invariably inquired kindly after our creature comforts—as to whether we had had our cups of tea, etc. I don't quite know how many he thought we indulged in, but my colleague and I evidently looked a thirsty pair. Being allowed to have tea every afternoon is one of the special privileges of the National Telephone employees, and Miss "Z" (the cook) makes ripping scones every Friday; but in speaking of the inner man I am rather wandering away from the point. There were many more whom we did not know sufficiently well to write about, but we cannot complete this without some mention of the two boys—Jones and Smith respectively. Jones was a nice boy, with a good slice of his sister's love of a good joke, whilst Smith had a dreadful weakness for playing with the inkpots. His hands were generally in a state of inky darkness, and the condition of his collar bespoke a deep affection on the part of his associates. He was known between we two as the "infant," and we very often experienced an overwhelming desire to wash him with the sponge which we used for moistening the enclosure slips. To do so, however, would undoubtedly have caused a disturbance, as he was just at that interesting age when boys have no great love of soap and water. He is interesting though, and I am told that he has a very good voice—not like mine, which is good but spoils when it comes out. I discovered that he was fond of tracing, and spent his spare moments practising. I hope he makes something of himself some day, he might—one never knows.

I think I have said about all I can say in memory of the Inventory, and trust that if anyone whom it may concern reads these lines will do so without prejudice.

PRIVATE BRANCH EXCHANGE WORK.

BY CONSTANCE DREAPER, *Operator, Liverpool.*

THERE is no doubt that this branch of work has proved beneficial to the telephone service, both to the subscribers and the operators. The private branch exchange operators, being familiar with the conditions of working in the exchange, can work in harmony with the operators there; for instance, by repeating and passing numbers, according to the Telephone Company's method; by giving only short rings, knowing that it is not necessary to ring long to signal the exchange; and by not ringing after a connection has been made, knowing that it will give the exchange the clearing signal. In making any inquiries the private branch exchange operator will deal directly with the monitor, instead of discussing matters with the exchange operators, thus delaying them from their duties, as many of the subscribers do.

The fact of answering with the name of the firm saves the time of the calling subscriber, and he can proceed with his conversation without delay. On a private branch exchange all calls can be answered immediately, for the operators, having been trained in the exchange, get accustomed to answering every call promptly. Although the work is not so heavy as exchange work, the responsibility is greater.

For instance, we private branch exchange operators are expected to know the whereabouts of all members of the firm, when they are not in their own departments. When any of the principals wish to speak to other offices or works we are expected to get the person they want to the telephone, and then call up our subscriber.

Trunk calls are an important item in this branch of work, and the operators have all the responsibility of booking the calls, seeing them through, noting the time they speak, and making inquiries about delayed calls, noisy lines, imperfect connections, etc.

One of the chief difficulties the private branch exchange operator has to cope with is having the junction lines taken when they are already engaged. This difficulty seems to be experienced in all private branch exchanges, and as far as I can see the only remedy is to have separate junctions for incoming and outgoing calls. If this were done we could at least prevent our outgoing calls from being disconnected.

Another source of annoyance is the unnecessary long rings we receive from the exchange. Very few exchange operators seem to realise that they have only to drop a signal when calling a private branch exchange, and they waste both their own, their subscriber's and our time as well by incessant ringing.

The private branch exchange operator must have patience and tact and a vivid imagination. People often ring up who haven't the least idea what department they want, and will proceed to describe their business to the operator, who often finds it difficult to guess who they want.

One advantage we have over the exchange operators is we are in closer touch with our subscribers and get to understand thoroughly their wants. We also have a better chance to study the different dispositions of the people we have to deal with, and are thus enabled to deal tactfully with each individual. The subscribers also get used to their operators, and put full confidence in them, which encourages the operators to do their best to deserve the trust reposed in them.

INVENTORY NOTES.

FROM time to time the columns of the JOURNAL have borne testimony to the enthusiasm of telephone men as such, but it is interesting to note that similar enthusiasm is displayed by them in whatever branch of sport they make their own. Frequently, too, occasions arise calling for a combination of these interests, when the prowess of the sportsman serves to further the ends of the engineer or electrician, and such opportunities, owing to the peculiar nature of the work and the absence of cut-and-dry method of reaching a desired result, have been more than usually frequent since the beginning of the Inventory.

THE enumerator who does his ten miles of route per day, for instance, is no sedentary ascetic and unaccustomed to the outdoor life, while the conditions in the Thames Valley in the Spring made progress impossible, unless among his many other accomplishments the enumerator possessed the ability to punt his craft through the rising flood to the D.P. which formed his temporary haven. Surely, too, he must have been a cross-country champion who, arriving at the bank of the river and seeing his route straight before him and the bridge 500 yards distant, boldly took the water, thus setting an example to his assistant, who, willy-nilly, had to follow. That he possessed prudence as well as pluck was clearly shown at the next similar though more perilous crossing when he commandeered a horse, on which he and his party made a safe and rapid transit.

Sport for sport's sake, however, is not ignored and the members of the "G" division spent a very happy afternoon one Saturday in June when they accepted the challenge of the Durham district staff to a cricket match. This took place on the staff's recreation ground at Middlesbro' and resulted in a win for the visitors, who scored 65 runs against 46 runs for the home team. It was a most interesting and enjoyable game. Non-cricketers were catered for in a corner of the field where many enjoyable games at quoits were carried on, while the wants of all were amply provided for by the ladies who dispensed tea in an attractive and obviously appetising manner. Our thanks in this respect are due to Mrs. Hann and Mrs. Nicholson who superintended and to the ladies who assisted. At the same time we would express our appreciation of the arrangements made and of the admirable manner in which they were carried out.

SERVICE DIFFICULTIES IN A LONDON EXCHANGE.

By G. BUCKERIDGE, *Exchange Manager, Paddington.*

FOLLOWING on a full season, with extra traffic induced by the Coronation festivities, we have been subjected during July and August, usually slack months, to the effects produced by abnormal heat, heavy storm and labour disputes, which have all caused the telephone to be largely used as a means of communication. During the heat the telephone has undoubtedly been a great saver of physical energy from the public point of view, but it has been very trying for the operating staff, who, depleted by the holidays and debilitated by the heat themselves, have been called upon again and again for special effort, when, as a rule, they are enabled to take things more easily.

As if the heat were not enough, July 28 was the occasion of the most disastrous rain and thunderstorm we have experienced, from a telephonic point of view, for several years in London. As a result of the storm there were over 200 lines affected on Paddington, 175 actually being out of order. These lines were, of course, put "O.K." in a few days, but the faults had a marked effect on the quality of the service, and, in addition, necessitated the provision of one additional testing operator, 200 plugging-up circuits and ten extra transfer circuits to the testing position, so that enquiries for lines out of order could be dealt with.

While the storm was in progress it was found that the lantern light window sashes had shrunk owing to the long drought previously and allowed the rain (tropical in its volume and intensity) to rush in to such an extent that the staff was flooded out in a few seconds. As a consequence for a quarter of an hour the major portion of the "A" operators had to leave their positions, and it was not until sheets were obtained and the switchboard and operators protected that work could be resumed. It was found then that the water had percolated through the key shelves into the aprons in many cases, though fortunately not in sufficient quantity to do more than soak a few of the cords.

The interruptions, taking into consideration the number of circuits affected, were not serious here, but for a few days complaints were general both of intermittent faults and of difficulty in getting numbers owing to their being out of order.

Hardly had the effect of the storm interruption been overcome than the traffic was affected by the labour disputes. This was marked by the number of complaints it excited through difficulty in obtaining communication with the railways and large carriers. Personally I dealt with several cases where the callers had waited some hours for Carter, Paterson and the G.E. and G.W. Goods Departments. In each case it was impossible to help in any way, the unfortunate callers eventually having to take their chance of a connection. They appeared reconciled to the situation, though whether this frame of mind will continue in event of further strike developments remains to be seen.

Already it has been necessary here in two cases to reserve lines for outgoing calls from railways where they have groups of lines, as they complained that incoming connections were put on so quickly as to make it impossible for them to get messages out at all. In addition, extra operators have had to be provided where the Company operates private branch exchanges so that the extra traffic can be hauled. This was necessary during the whole of the strike period.

CORRESPONDENCE.

"FARMERS' LINES."

TO THE EDITOR OF THE NATIONAL TELEPHONE JOURNAL.

THE proposal of the Postmaster-General to supply farmers' lines on the party line principle with unlimited service at £3 per annum, commented upon in your editorial in the June issue, would, I had hoped, induce some members of the staff who are brought into close touch with farmers to have expressed their views in last month's issue.

The East Coast district covers one of the largest agricultural districts in the country, and the proposal is of more than passing interest.

The term "farmer" is a fairly comprehensive one. There is the "landed proprietor" who calls himself a "gentleman farmer," the "tenant farmer" and the small "general farmer." The horse breeder, cattle dealer, fruit grower, flower grower and potato grower, each calling themselves "farmers." Where is the line to be drawn as to who shall be entitled to a £3 party wire?

I am convinced that "farmers' party lines" will never be the success that is claimed for them, for several reasons.

By far the most important reason is the disadvantage of each subscriber being able to overhear the other subscriber's conversation. The farmer, although on the best of terms with his neighbour, would not for one moment countenance being beaten in a deal over the line. Further there is the important question of trunk and junction service. The probability is that each subscriber on the circuit would require the use of the line about the same time daily, for getting into touch with different buyers in distant markets.

One can imagine five bucolic farmers, each with their receivers off, endeavouring to attract the attention of the rural operator. For result see No. 11, Company's *Rules and Regulations*.

The farmer's vocabulary is not extensive, but is none the less effective. Again, owing to the isolated nature of the farmhouses, the cost of one party line circuit would be nearly that of direct wires.

I believe a great deal of the success attending farmers' lines in America is due to the fact that farming is there carried out on the co-operative principle.

The Postmaster-General named several advantages derivable from such a service. The convenience of the farmers being able to keep in close touch with the Meteorological Office. I will back the farmer to know more about the weather in his particular locality for the next 24 hours than the weather expert in London could tell him. "Make hay while the sun shines" is his motto. "Social intercourse" is another advantage. The farmer socially is a good fellow, but I am perfectly sure the most persuasive and bland contract officer could not induce him to have a party wire to ring up his neighbour or neighbours, if he felt lonely. He firmly believes in jovial company and would cure his loneliness in a more substantial and satisfactory form. I happen to know the farmer's little weakness.

It is interesting to note that we are now connecting up to a small exchange in the Fen country, seven farmers on direct lines paying minimum measured rate tariff, including extra mileage, at rentals ranging from £11 to £15.

The average farmer is well able to afford the cost of a direct line at measured rate, and there seems no logical reason in offering him unlimited service at such a low rental, viewing the matter in the light of a commercial proposition. There is no one keener at making a bargain than the farmer, but it is bad policy to offer him a service that is cheap and inefficient.

I have carefully thought out an alternative proposition to the party line proposal, which I shall be happy to submit, when the opportune moment arrives. No one is more anxious than I am to see some businesslike scheme put forward, as practically the bulk of our development on the East Coast lies in the rural districts.

HENRY J. ALLEN,
Norwich. Contract Manager, East Coast District.

THE ROYAL AGRICULTURAL SOCIETY'S EXHIBITION.

TO THE EDITOR OF THE NATIONAL TELEPHONE JOURNAL.

IN connection with Mr. Stevens' interesting and descriptive article in your August issue, I should be glad if you would allow me to correct one minor detail. Mr. Stevens says that at Liverpool last year an exchange was opened on the ground for the first time. He is evidently not aware that an exchange was opened on the ground when the Society's Exhibition was held in Gloucester in 1909, and even this I do not think was the first of its kind.

Gloucester, Aug. 9. C. ELLIOTT.

TO THE EDITOR OF THE NATIONAL TELEPHONE JOURNAL.

I HAVE read with much interest Mr. Hudson's very lucid article on the Benevolent Fund and its workings, and am glad to see it is hoped to "carry over" the good work.

It has often struck me as peculiar this grand fund was not open to the *whole* of the staff. I am sure many of us would be glad to subscribe to it, if it would help our poorer colleagues in trouble, out of what little we are able to set apart for "good turns," if we were organised all over the country as London is. Is there any good reason why this cannot be done? Liverpool had a local and very strong society; why not all other places? There are, of course, difficulties, but we all work under one set of rules flexible enough to meet all classes of circumstances, and it should not be impossible to draw up a set of rules for mutual benefit that would fit all the staff by a little local alteration to suit the centre.

As Mr. Hudson says, the staff as a whole are never wanting in generosity when any individual member is in need, and I feel sure in most centres everyone gives a great deal more every year than 1s. to local whips for a sick comrade. I must confess it has been my experience that the man who is first to lay down his 6d. or 1s. in a special case will "grouse" the hardest at subscribing 1d. a week to a fund *which he cannot see at work and which someone else has control of*. Mr. Hudson's article should do a lot to remove this spirit of suspicion and to increase the membership of the society amongst those who will benefit most from it. Perhaps you will be good enough to invite opinions from other members of the staff as to the possibility of a universal society for "old Nationals."

I would like before closing to congratulate Mr. Hudson on a splendid result from what must have been solid hard work. He can now—like the Scouts—"tuck his tie in," having done his good turn. "SCOUT."

INVENTORY STAFF.

The following additions have been made to previous lists:—

HEADQUARTERS.

Marshall, A. E.	.. ..	Clerk	Metropolitan

TRAVELLING STAFF.

Eckstein, F. W.	.. ..	Ex. Inspector	Liverpool
Sansome, P. V.	.. ..	Inst. Inspector	Leicester

Deletions.

Elsom, J.	.. .. ..	Foreman	Metropolitan
Findlay, R.	.. .. ..	Foreman	Metropolitan

HEADQUARTERS INVENTORY STAFF, LONDON, JULY, 1911.

Back Row—E. V. Whitworth, J. A. Lade, G. Johnson, H. G. Smith, H. Constantine, J. Ewing, D. Edwards, A. M. Sinclair, R. McHardy, E. L. Hague, T. Richardson, A. M. Watt, O. Allen, C. H. Phillips, T. Elliot, J. H. Storrie.

Third Row—F. Barr, C. D. Ogilvie, J. Fairhead, R. A. Skinner, A. M. Lynn, F. C. French, R. B. Rae, Miss L. Werrell, F. Robson, S. Moody, J. McClintock, J. K. Murray, L. Price, E. S. Byng.

Second Row—J. B. Mairs, H. Goodman, J. H. Watkins, G. M. Maddock, W. J. Gray, R. Aitken, A. Watts, R. Bryson, C. F. Street, F. Blake Brown, C. E. Morgan, G. H. Bryant.

Front Row—E. Hanchett, H. V. Main, R. Williamson, F. J. McGinness, J. Jameson, S. J. Husband, P. R. Cockrem, T. J. Early, A. W. Spooner.

GLASGOW NOTES.

THE Bell Golf Club August Medal Competition was held at Carntyne on Saturday, Aug. 5, with the following results:—

Mr. James Paton (winner)	.. .. ..	97 – 23 =	74
Mr. H Thomson	.. ..	90 – 9 =	81
Mr. J. F. Murray	.. ..	98 – 12 =	86

WE are now right in the heart of Inventory work, three gangs having been sent to Glasgow. Very commodious premises were obtained at 341, Argyle Street, and the Inventory staff are comfortably housed.

WHAT may, perhaps, be looked upon as one of the last cruises of the Company's staff took place on Friday evening, Aug. 25, when members of the staff and their friends to the number of some 250 journeyed by special train to Gourock, thence by boat to Loch Striven. Glasgow is exceptionally fortunate in having within easy distance such magnificent scenery, which is invariably admired by our Southern friends.

MR. JAMES Y. HUTCHISON, Exchange Inspector, has been appointed to the position of Exchange Manager-in-Training.

THE Inventory work necessitates a complete change of method in connection with current work. In this connection, so that the foremen and inspectors should be fully conversant with the methods to be followed, conferences were held and matters were fully explained.

AT this time of industrial strife Glasgow has not escaped, the tramway men having essayed to "strike work" for better working conditions. At the time of writing some 1,700 men are out, and a restricted service is being run. The Company's employees staying out of town are indirectly affected and it is quite possible that delays in getting to and from subscribers' premises will take place It is interesting to note that the Corporation Tramway Department benefit to the extent of about £1,000 per annum by the Company using their cars.

THE C.B. equipment which has been installed in the new premises built for the Douglas Exchange in Renfrew Street has now been completed and the subscribers' lines were satisfactorily changed from the old exchange, which has now been closed, on Aug. 19, and the further transfer of subscribers' lines from the Company's Royal and the Post Office Central Exchanges was made on the 26th, so that there are now approximately 3,000 lines working in the new exchange. This exchange supplies a considerably larger area than the old one, taking up as indicated part of the old Royal and Post Office Central areas. The exchange is at present fitted for 4,000 lines on the multiple and 3,820 lines on the answering equipment, the ultimate capacity being 7,000 lines.

The closure of the exchange at 140, Douglas Street is an historic event in Glasgow's telephone history. The first exchange in Glasgow, it was originally opened more than 30 years ago by Messrs. D. and G. Graham. The then existing exchange was acquired by the Company about Whitsunday, 1881, and since that time with frequent extensions to meet the ever-increasing demand of the telephone public, the exchange has been accommodated at Douglas Street.

LONDON NOTES.

THE garden party held at "The Firs," Clapham, by the staff in South-West London a few weeks ago was very successful. About 150 attended, and derived much enjoyment from the music, etc., which had been arranged by the committee. The gentlemen's hobble-skirt race in particular provided a good deal of amusement. In the evening a programme of dances concluded a delightful day. The S.W. staff have already started preparations for the social events of the winter, and arrangements have been made for a whist drive at Stanley's Restaurant, Lavender Hill, on Oct. 7.

A COMMITTEE meeting of the London Telephone Society was held on Friday, Aug. 11. Notwithstanding the holiday season the attendance was good, and from the keenness displayed by the committee men it is clear that they intend the coming session to be a successful one. Provisional dates for the meetings were settled, the first of the series being Oct. 9. The papers committee have not quite settled the programme, but have strong hopes of being able to present an attractive one. The suggestion that the hour before the meetings should be filled in by some popular demonstrations has met with general approval and the details of the scheme are practically settled Considerable attention is being given to the appointment of suitable agents to the society, and it is proposed to call a meeting of these in the near future, so that their duties can be explained to them The sub-committee elected to consider the suggestion that the session should open with a *conversazione* report that the proposal has met with considerable favour and the matter will therefore be pursued.

Mr. H. B. TAYLOR, who was transferred from the stores office to the rentals office a few months ago, has just "committed" matrimony. His friends on the staff united in presenting him with a black marble clock. The presentation was made in a very happy speech by Mr. Wild, a colleague of Mr. Taylor in the old Southern district.

IN connection with the Telephone Transfer Bill recently before Parliament, many members of the Metropolitan and Head Office staff have unselfishly given up their evening hours to interviewing their members of Parliament with a view to interesting them in the staff's claim for establishment. What this meant during the scorching weather of early August only those who were then in London can adequately appreciate.

DURING August the traffic in London drops with almost startling rapidity. This year the fall was partially arrested by the very large use made of the telephone service in connection with the strikes. In the City and East districts the increase was particularly noticeable, the exchanges most affected being those whose subscribers had business connection with the docks. The early morning traffic on East and Tilbury Exchanges was so heavy that the day operating staff had to be brought on duty at 7 a.m. The fact of the pressure occurring when the heat wave was most oppressive made the conditions more than usually trying for the staff, and also made the manner in which they dealt with the work all the more creditable.

STAFF GATHERINGS AND SPORTS.

Huddersfield.—The operators at this centre had their annual picnic on Aug. 5. A party of 24 were conveyed by coach to Sandal, near Wakefield, and a substantial tea was provided at the "Castle" Inn, after which visits were made to the ruins of Sandal Castle and the old church. The drive was through a well-wooded country, and the little rain which was encountered served to enhance the beauty of the country. The outing was thoroughly enjoyed by all who participated.

Swansea.—The annual outing of the Swansea engineering and line staff took place on July 29, when a party numbering 45 spent an enjoyable day amidst the beautiful North Devon scenery in the neighbourhood of Ilfracombe. Glorious weather and an excellent passage across the Bristol Channel put everybody in good spirits, which were in no way diminished by a first rate dinner upon arrival at Ilfracombe. The afternoon's programme comprised a delightful drive to Combe Martin, where, in spite of the high temperature, sports were indulged in. During the return drive a storm gathered but, fortunately, Ilfracombe was reached just as it broke. After tea, at which Mr. W. J. Hodgetts (Engineer) presided, and a ramble along the cliffs the party boarded the steamer for the return journey, which was safely accomplished, in spite of a troubled sea and some disturbed feelings. Mr. W. King (Store-keeper), who was an energetic secretary, is to be congratulated on the highly successful results attending his efforts.

H. O. Inventory.—On Saturday, July 22, some 50 of the Head Office Inventory staff and friends journeyed to High Beech, Epping Forest, and had a most enjoyable outing. After tea Secretary Barr, from Sheffield, took advantage of the beaming countenances, and for the benefit of posterity did some camera work in quite a professional manner. One feature of the party was the great amount of botanising alleged to have been done, but, it was evident by the absence of specimens when the couples returned to the station, that the close season was on. Some of the less seriously inclined indulged in trips on the whirligigs or faced the music at the cokernut shies.

Bristol.—The Bristol electrical staff (accompanied by the Engineer, Mr. Preston, Asst. Engineer, Mr. Rumley, and Wayleave Officer, Mr. Saunders) had an enjoyable outing by brake to Clevedon on Saturday, July 22. Tea was taken at Dyer's Dairy. The trip was organised by Messrs. T. Hagley and J. S. Hazell, and every credit is due to them for the capable manner in which the arrangements were carried out.

Nottingham.—A cricket match took place on Saturday, July 15, on the Victoria Embankment Ground, between teams representing the Nottingham Factory Wall Set Department and Staff Officers. An interesting game was witnessed, the Wall Set Department winning an exciting game by the narrow margin of 5 runs, the total scores reading: Wall Set Department, 86; Staff Officers, 81. The highest score of the match (25) was knocked up for the Staff by W. Hunter, of the Engineer-in-Chief's Test Department, whilst the bowling honours were shared by H. Myers (3 for 7) and E. J. Smith (4 for 22) for the Staff, and H. Spinks (3 for 4) and R. B. Ibbs (4 for 24) for the Wall Set Department.

Portsmouth.—On Aug. 5 the Portsmouth operating staff and friends had their outing to Beaulieu. The steam launch *Victorious* was chartered and took a company numbering 80, but unfortunately the weather was not very genial. It rained for about two hours in the afternoon and the pleasure was somewhat marred. However, the best was made of the occasion, and tea, instead of being served in the open, had to be served aboard the boat, part in the cabin and part on deck under an awning. After tea the weather was fine and some of the staff enjoyed a ramble through the beautiful woods of Lord Montagu's demesne. The party was accompanied by the District Manager, Mr. S. J. Smith, and Mrs. Smith, and amonst the visitors was Mr. S. O. Allen, Traffic Manager, from Southampton.

EXAMINATION RESULTS.

Bradford.—*City and Guilds of London Institute Examinations.*

Telephony (ordinary grade), first class, W. Murgatroyd.
Do. do. second class, A. E. Wills.
Do. do. do. O. Dalgleish.
Telegraphy (ordinary grade), first class, F. Bastow.
Do. do. second class, H. Shaw.

Board of Education Examinations.

Magnetism and electricity (stage 1), first class, F. Bastow.
Do. do. do. H. Shaw.
Do. do. do. A. E. Wills.
Do. do. second class, W. Murgatroyd.
Do. do. do. H. Birkby.

Weston-super-Mare.—*City and Guilds Examinations.*

Telephony (ordinary grade), second class, D. Dobbins, Inst. Inspector.
Do. do. first class, and bronze medal, B. J. Smith, Chief Inspector.
Do. (honours grade), second class, B. J. Smith, Chief Inspector.

Dover.—*City and Guilds Examinations.*

Telegraphy (ordinary grade), first class, E. J. Woods, L. M., Margate.
Do. do. do. P. C. Langridge, Chief Inspector, Dover.
Do. do. second class, F. J. Sandiford, Chief Inspector. Margate.
Do. do. do. G. W. Smith, Inspector, Dover.
Telephony (ordinary grade), first class, E. J. Woods, L. M., Margate.
Do. do. second class, F. J. Sandiford, Chief Inspector, Margate.
Do. do. do. H. Pool, Chief Inspector, Canterbury.
Do. do. do. G. W. Smith, Inspector, Dover.

Cambridge.—*London City and Guilds Examination.*

Telephony (ordinary grade), first class, F. A. B. Doggett, Wayleave Officer, Cambridge.

Sheffield.—*City and Guilds Examinations.*

Telegraphy (honours), first class, J. Hyde.
Do. (ordinary), do. A. Broomhead.
Do. do. second class, A. Clarke.
Do. do. do. C. Marsden.
Telephony (honours), do. G. C. Christie.
Do. (ordinary), first class, A. Broomhead.
Do. do. second class, H. Addy.
Do. do. do. G. C. Christie.

Sheffield University Examinations.

Mathematics (practical), stage 1, second class, H. C. Richardson.
Magnetism and electricity, first year, first class, J. W. Wright.
Do. do. do. do. B. Glenn.
Do. do. do. do. A. Burgess.
Do. do. do. do. H. Addy.
Do. do. do. do. D. Thomson.
Do. do. do. second class, B. Marsden.
Telegraphy (honours), first class, J. Hyde.
Do. (ordinary), first class, A. Broomhead (prize).
Do. do. do. A. Clarke.
Do. do. do. H. G. Rowe.
Do. do. second class, H. Addy.
Do. do. do. A. Burgess.
Do. do. do. D. Thomson.
Do. do. do. S. Young.
Do. do. do. P. R. Grieve.
Do. do. do. E. Chappell.
Telephony (honours), first class, J. W. Wright.
Do. do. do. F. N. Smith.
Do. (ordinary), first class, P. Burcher (prize).
Do. do. do. R. Gillett.
Do. do. do. A. Clarke.
Do. do. do. H. Baker.
Do. do. second class, W. Wilcock.
Do. do. do. S. Young.
Do. do. do. A. Burgess.

Southampton.—*City and Guilds Examinations.*—Thomas Farwell Reeves, Acting Chief Inspector, Southampton, first class, telegraphy and telephony courses (in addition to a first class certificate for magnetism and electricity in the Board of Education examination.

NEWS OF THE STAFF.

Mr. C. S. WESTON, Chief Clerk, Guildford, has been promoted to be Chief Clerk at Portsmouth. He entered the Company's service as a Clerk at Head Office in July, 1896, and after being transferred in turn to posts at Plymouth (1904), Swansea (1905), and Bristol (1907), he was made Chief Clerk at Guildford in December, 1907.

Mr. J. RADFORD, Electrician, Swansea, has been appointed Local Manager, Barry.

Mr. A. L. STANTON, Test Clerk, Swansea, has been promoted to be Electrician, Swansea.

Miss WINIFRED M. BAUGH, Operator, Cardiff, left the Company's service on July 27 in order to take up the nursing profession. Miss Baugh joined the Company's service on Nov. 24, 1905, and on leaving was presented by her colleagues with a leather writing case. They trust she will be successful in her new work and be blessed with good health.

Mr. A. J. HART, District Office Clerk, Nottingham, was presented with a travelling bag by the D.O. and C.D. staffs on being promoted to be Fees Clerk at Coventry on July 14.

Miss EDITH M. MERCHANT, Operator, Llanishen, left the Company's service on July 6 owing to ill-health. Although she has only been at a small sub-exchange in the district she has always taken a great interest in her work and the service given by her has been in every way satisfactory. The operating staff at Cardiff presented her with a china tea service as a mark of respect and with best wishes for her speedy return to health.

Mr. F. E. COLLINS, Chief Clerk, Portsmouth, was transferred on Aug. 14 to a similar capacity at Leeds. Advantage was taken of the occasion by the staff to present him with a silver-plated tea set as a token of their esteem and regard. The presentation was made by Mr. S. J. Smith, District Manager.

Mr. CHARLES LATHAM, Senior Faultsman, Southampton, has been presented with an armchair and oak bookcase by the line, instrument, local and contract staffs on his completing 25 years' service.

Mr. J. TRANTER, Local Manager, Blackpool, has retired after 26 years' service. He originally entered the Engineering Department of the Lancashire and Cheshire Company at Liverpool, under Mr. Thos. Rowe, in 1885. He had charge of the opening of the Llandudno and Colwyn Bay Exchanges, and was afterwards sent to develop the Lake district. He was placed in charge of Blackpool centre in 1903, and under his management the number of stations has been increased by 1,160. He was presented by the staff of the whole Preston district with a sum of gold as a token of their esteem.

METROPOLITAN STAFF CHANGES.

Mr. A. E. MARSHALL, Clerk, Statistical Office, to Inventory Department, Head Office.

Mr. A. LENNARD, Clerk, Statistical Office to District Engineer's Office, West.

Mr. A. CAMPION, Improver, Metropolitan Workshops, to be Inspector, London Wall.

Mr. F. PIERCE, Foreman, Hop, to Inventory staff.

Mr. W. PRICKETT, Inspector, Battersea, to be Test Clerk, Battersea.

Mr. J. H. JOHNSON, Chief Inspector, Dalston, to be Chief Inspector, Gerrard.

Mr. C. LEWIS, Foreman, City, to be Acting Faultfinders' Overseer, West.

Traffic Department.

Miss EDITH MORGAN, Supervisor, Paddington, made Senior Supervisor-in-Charge, Hampstead.

Miss ELLA FULLFORD, Operator, London Wall, to be Supervisor, Bank.

Miss FLORENCE BROOKES, Operator, Holborn, to be Supervisor, London Wall.

Miss EMILY CARTER, Operator, Westminster, to be Supervisor, Gerrard.

Miss ETHEL GLAYZER, Kensington, on being promoted to be Supervisor at Westminster was presented with an ebony dressing set.

MARRIAGES.

Mr. WALTER RICHARDS, Exchange Manager, Manchester, was married on July 6 to Miss Mary Davies. To mark the occasion he was presented with a set of fish carvers, a case of fish knives and forks and a biscuit barrel by members of his own staff at the various exchanges and by friends from other sections of the Company's staff. Mr. Staite, the Traffic Manager, in making the presentation on behalf of the staff, wished Mr. and Mrs. Richards every happiness in the future.

Miss JOSEPHINE HART, Supervisor, Birmingham Central Exchange, who entered the Company's service Sept. 22, 1898, left to be married on June 22. She was presented by the Central operating staff with a case of dessert knives and forks and by the Midland operators with a pair of silver serviette rings. She was also the recipient of many other presents from individual members of the staff.

Miss M. E. CLARK, Operator, Birmingham Central Exchange, who entered the Company's service May 22, 1903, left to be married on July 27. She was presented with a case of fish knives and forks by the staff and with several other presents from her friends in the switchroom.

Miss MARY WOODWARD, Operator, Kings Norton Sub-Exchange, Birmingham district, who entered the Company's service Nov. 29, 1907, left to be married Aug. 10. The sub-exchange operators sent her a pair of silver serviette rings with best wishes for her future happiness.

Miss BLANCHE OLLIS, Operator, Cardiff, left the Company's service on June 22 in view of her approaching marriage. Miss Ollis joined the Company's service on Sept. 29, 1905, and her colleagues in the Cardiff Exchange presented her with an electro-plated dinner cruet as a mark of esteem, and with best wishes for her future health and happiness.

Mr. C. BROWN, Mechanic, Nottingham Factory, on the occasion of his wedding, was recently the recipient of a handsome brass curb complete from the members of the Wall Set Department,

Miss EDITH CLOSE, Night Operator, Sheffield, left the Company's service on July 27 to be married. She was presented by the operating staff with an oxidised flower vase.

Mr. HARRY JAMES, Assistant Exchange Inspector, was married on July 12 to Miss BERTHA BLOOR, Operator, Rotherham, and was presented by the staff with a case of cutlery.

London Traffic Department.

Miss LILIAN TURNBULL, Supervisor, Avenue, was presented with a set of cutlery by the staff on leaving to be married. Miss Turnbull was the recipient of many other gifts, among which were a tea service, breakfast service, rose bowl, *epergné* and teapot.

Miss ALICE LAING, Operator, Avenue, on leaving the service to be married, was presented with a dinner service and cake stand by the staff. Miss Laing, who has been the caterer for some time past, also received numerous gifts from individual members of the staff. Among these gifts were silver photo. frames, teapot, three fruit dishes, table centre, Bretley ware vase, jam jar, sugar sifter and salt cellars, sweet dishes, doylies, etc.

Miss ELIZABETH STEAR, Senior Operator, Avenue, on leaving the service, was presented by the staff with a tea service. Miss Stear, who is journeying to Canada to be married, received many other gifts, including a fruit dish, three afternoon tea cloths and doylies.

Miss MAY PHILBROOK, Kensington on leaving to be married was presented with a silver-plated cruet.

Miss ETHEL MITCHELL, Kensington, on leaving to be married was presented with a silver-plated and glass salad bowl and servers.

Miss ADA BUCKLAND, on leaving Ealing Exchange to go abroad to be married, was presented with a set of cutlery.

Miss HETTIE STOCKMAN, Operator, Hammersmith, on resigning to be married was presented by the staff with a salad bowl and a set of oak trays.

NEW PATENTS.

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.

LATEST PATENT APPLICATIONS.

16,075 Western Electric Co. Ltd. Telephone exchange systems. July 11.
16,352 Frank Bowley Mitchell. Telephone call apparatus and the like. July 15.
16,523 Charles Moreland Montague Dare. Portable field telephoning apparatus. July 18.
16,553 Cuthbert Charles Chapman and Arthur Grimsley. Apparatus for recording telephone calls. July 18.
16,707 Charles Kahn, trading as F. C. Rein & Son. Telephone and other suitable sound-receivers. July 20.
16,867 Frank Robert McBerty. Automatic telephone exchange selector. July 22.
16,868 Western Electric Co. Ltd. Wiring contacts of telephone switches. July 22.
16,869 Frank Robert McBerty. Semi-automatic telephone systems. July 22.
16,894 Edwin Frank Mortimer Branson and Felix Horace Bowden, trading as Branson & Bowden. Memorandum and like appliances for use in connection with telephone and other purposes. July 24.
16,954 Edward Charles Robert Marks. Telephone instruments (receiver). July 24.
17,027 Alexandre Vojen. Telephone receiver of the radiating field type. July 25.
17,211 Frank Robert McBerty. Semi-automatic telephone exchange systems. July 27.
17,278 Bronislaw Gwozdz. Telephones. July 28.
17,363 Bronislaw Gwozdz. Telephones. July 29.
17,429 Bronislaw Gwozdz. Telephones. July 31.
17,441 Otto Sterkel. Telephone cabinets. July 31.
17,530 Bronislaw Gwozdz. Telephones. Aug. 1.
17,587 Bronislaw Gwozdz. Thermic telephones. Aug. 2.
17,595 Bronislaw Gwozdz. Telephones. Aug. 2.
17,635 Thomas Doddrell. Method for timing telephone calls. Aug. 3.
17,820 Bronislaw Gwozdz. Telephones. Aug. 4.
17,874 Western Electric Co., Ltd. Registering device for telephone systems. Aug. 5.
18,080 Bronislaw Gwozdz. Telephones. Aug. 9.
18,115 Harold Frank Tayler. Automatic switch for telephone circuits. Aug. 10.
18,235 Bronislaw Gwozdz. Telephones. Aug. 11.
18,284 Harry Grindell Matthews. Improvements in wireless telephony, applicable also to wireless telegraphy. Aug. 12.

SPECIFICATIONS PUBLISHED THIS MONTH.

24,347 Perotti. Process and device for transmitting and registering verbal communications by means of the telephone.
22,239 White. Intercommunication telephone systems.
27,088 Adams. Manhole covers, surface boxes, gully grate frames, and the like.
12,931 Friedmann. Joint boxes for electric wiring.
12,117 Siemens Bros. & Co. Semi-automatic telephone exchange systems.
27,857 Born. Conversations-counter for telephones without crank handles.
11,339 Bellini. Transmitters and receivers for wireless telegraphic and telephonic apparatus.

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