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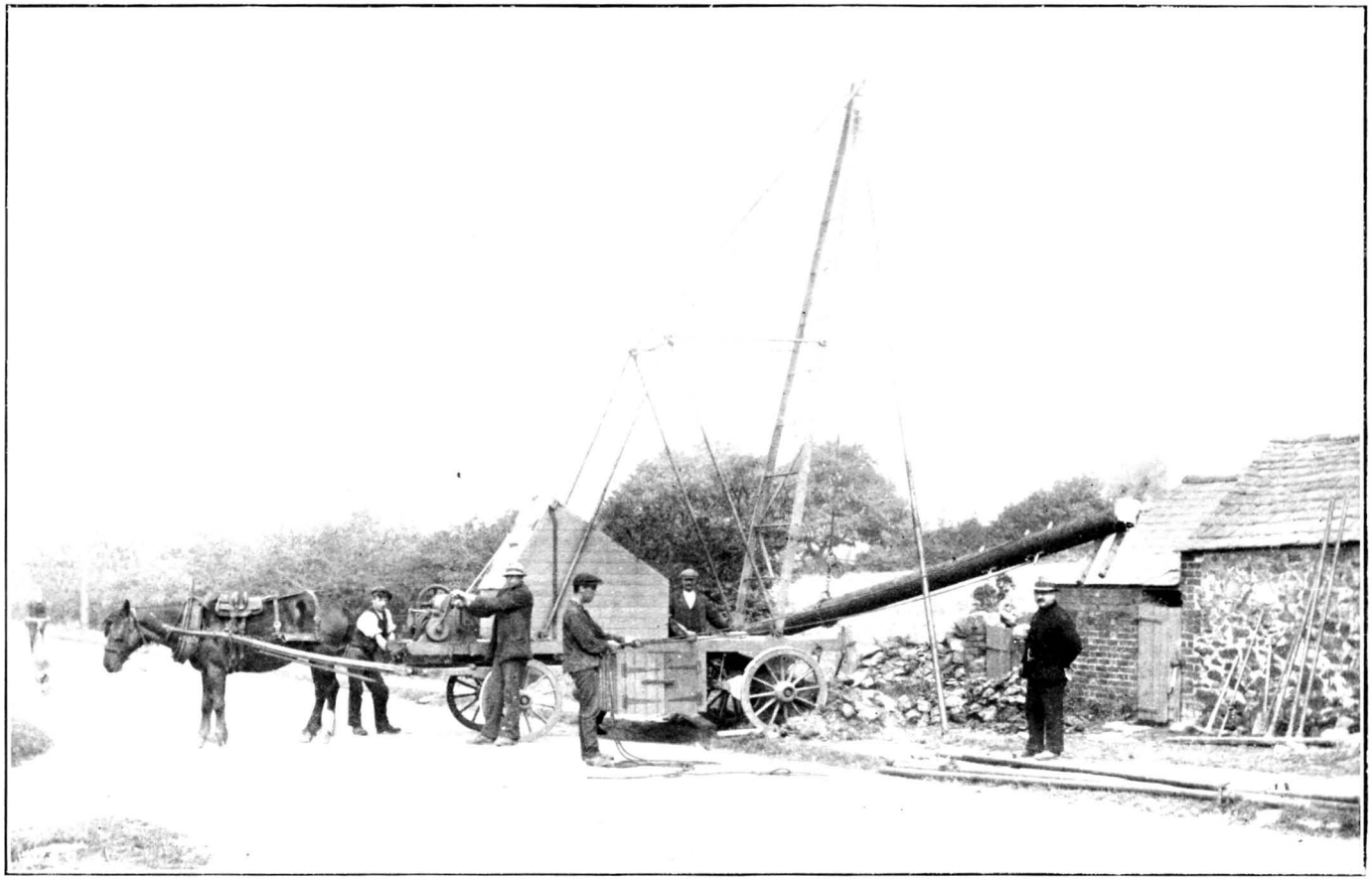
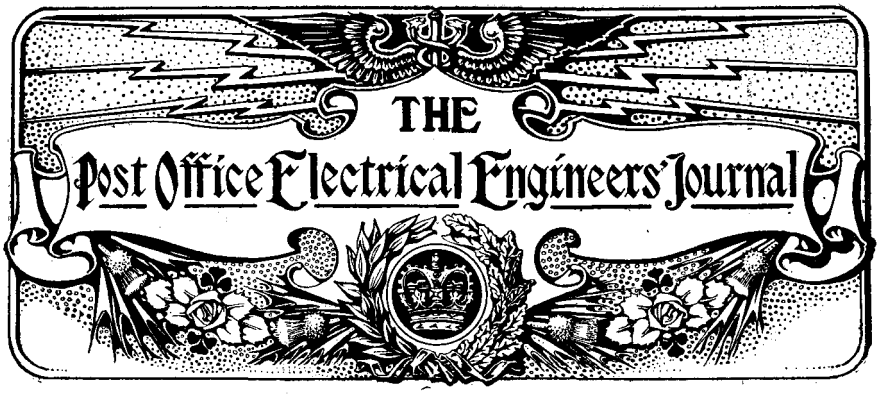


Pole Derrick Wagon at Work on New Main Route, Leicester to Derby.




# THE TELEPHONE ARBITRATION.

By J. W. W.

MOST of those now in the service have personal knowledge or have heard about the important events which concluded with the telephone arbitration of 1912. First, the Edison judgment which declared that a telephone was a telegraph within the meaning of the telegraph acts and, therefore, within the Postmaster-General's telegraphic monopoly, and which defined that monopoly as covering any system of signalling by wire, whether worked by the agency of electricity or not, and any system of electric signalling, whether utilising a wire or not. Secondly, the restricted licences of 1881, which only allowed licensed companies to work within a defined radius of certain towns. Thirdly, the unrestricted licenses of 1884 which practically allowed licensed companies to provide telephonic facilities without restriction as regards territory. Fourthly, the purchase of the trunk wires by the Post Office in 1896, and the limitation of the powers of the National Telephone Company, that had by this time absorbed the other licensed companies, to certain areas which were apparently defined in somewhat haphazard way. Fifthly, the Telegraph Act, 1899, which provided for competition between the Post Office and the National Telephone Company in London and allowed municipalities to compete in the provinces. Sixthly, the London agreement of November 18th, 1901, which arranged for co-operative working between the National Telephone Company and the Post Office in London, and for the purchase on tramway terms of the Company's plant and assets in London on December 31st, 1911. Seventhly, the purchase agreement of February 2nd, 1905,

which provided for the purchase of the remainder of the Company's plant and assets on similar terms, except that goodwill was payable in the case of private wires and certain competitive systems. Eighthly, the preliminary proceedings of last year, when the Post Office notices of objection to purchase certain parts of the Company's system were dealt with, and the Court of Appeal declared that the term "unsuitable for the purposes of the Postmaster-General's telephonic service" referred to both quantity and quality. Ninthly, the transfer of the National Telephone Company's system to the State on December 31st, 1911. And tenthly, the arbitration proceedings of 1912.

On Monday, June 10th, the telephone arbitration commenced in real earnest, although before that date there had been what our athletic readers would call two qualifying rounds, during which both parties expressed their eagerness to name the day, and each with equal cleverness endeavoured to postpone it and to throw the onus of postponement on the other.

The Court of the Railway and Canal Commission, which tribunal adjudicated on the value of the National Telephone Company's plant and assets, was composed of Mr. Justice A. T. Lawrence, The Hon. A. E. Gathorne-Hardy, and Sir James Woodhouse.

Sir Alfred Cripps, K.C., Mr. Danckwerts, K.C., Mr. Forbes Lankester, K.C., Mr. Morton, K.C., Mr. Gaine and Mr. Aubrey Lawrence represented the National Telephone Company; and the Attorney-General (The Right Hon. Sir Rufus Isaacs, K.C.), the Solicitor-General (Sir John Simon, K.C.), Mr. Buckmaster, K.C., Mr. Rowlatt, and Mr. Branson represented the Postmaster-General. Mr. Schwabe took Mr. Rowlatt's place when the latter was appointed a Judge of the King's Bench.

The National Telephone Company claimed from the Postmaster-General the sum of £20,924,700 as the amount of the purchase money payable to them for their plant, property, and assets under the Purchase Agreement of 1905. The particulars of the claim were filed as follows:

| | |
|---|---|
| I. Inventoried plant not specially mentioned below (£17,047,269), less plant recovered since completion of inventory (£311,443) . | £16,735,826 |
| Ia. Cost of obtaining subscribers' agreements . | 643,370 |
| II. Plant included in the notices of objection of last year and subject to an agreed deduction for special depreciation . . | 120,953 |
| III. Plant provided under Joint Purse Schemes (Company's share) . . . . . | 89,140 |
| IV. Plant as to which there was a difference whether or no it was proper to heading II | 42,317 |

| | |
|---|---|
| V. Plant provided since completion of inventory | 658,599 |
| VI. Printing plant at Telephone House, and machinery, etc., at Nottingham and Dalston | 7,592 |
| VII. Books, forms and records; stationery, maps, and books of reference; correspondence and investigations; service instructions; directory | 181,108 |
| VIII. Land and buildings, including wayleaves and structural alterations and additions in the case of rented premises | 1,499,786 |
| IX. Goodwill at Portsmouth, Brighton, and Hull | 211,372 |
| X. Goodwill on private wire business | 212,350 |
| XI. Stores and tools | 434,747 |
| XII. Furniture, fittings and fixtures | 87,540 |
| Total | £20,924,700 |

The Postmaster-General, generally speaking, agreed to the quantities as regards plant but denied the values which were assigned to them. He also agreed to the price as regards the printing plant and machinery (heading VI); but he denied any liability in respect of headings Nos. I*a* and VII and of goodwill for the system at Hull.

In opening the case for the National Telephone Company, Sir Alfred Cripps confined his attention chiefly to the first seven headings and practically the evidence up to the adjournment was devoted to headings Nos. I and I*a*. He called as witnesses:

Mr. Gill, Engineer-in-Chief; Mr. Cook, Assistant Engineer-in-Chief; Mr. Goddard, General Superintendent; Mr. Anns, Secretary; and Mr. Weston, General Superintendent's office, of the National Telephone Company. Sir Alexander Kennedy. Mr. Swinburne. Sir William Plender, President of the Institute of Chartered Accountants. Mr. Butterworth, General Manager, North-Eastern Railway. Sir W. G. Granet, General Manager, Midland Railway.

The main features of the Company's case as developed in evidence were as follows:

(*a*) A peculiar interpretation of tramway terms.

(*b*) The method in which the unit costs were arrived at.

(*c*) The method of depreciation.

(*d*) The lengthy lives ascribed to the various items of plant.

(a) *Tramway terms.*—Sir Alfred Cripps argued that the value on tramway terms was the cost of replacement, less depreciation, and that the cost of replacement should be the cost to which the Company

had been put in providing the plant. In other words, he based his costs on the value of the system *to the seller*. He urged that the special clause in the purchase agreement which referred to the value having regard to its suitability for the purposes of the Postmaster-General's telephonic service had in view, not a depreciation, but an appreciation of the value of the Company's plant and assets. Inasmuch as no item for appreciation appears in the Company's claim, this suggestion was probably not even made seriously.

(b) *Unit costs.*—The Company's unit costs were prepared on the assumption that the whole system would take twelve years to construct, one sixth of it being constructed in two years and the construction gangs being then transferred to another section. The method of calculating the unit costs may be fairly realised from a study of the sample sheet, dealing with the unit cost of one mile of 3-inch cast iron pipe (including wood plugs, draw wire and split pipes) (see Table 1). Similar statements were presented showing the unit cost of a mile of cement duct, underground cable, aërial cable, bare wire, etc.

In order to arrive at the total cost of material, the cost of the material at the suppliers was averaged on the cost to the Company over a period of eleven years, and to the amount so arrived at were added (1) the cost of haulage from the suppliers to the distributing centre and from the distributing centre to the place concerned, (2) the cost of cartage to the work, and (3) the cost of wastage. In item numbered 5 the actual cost of burial was taken, and then various percentages for every conceivable contingency were added separately, either to the cost of labour only, or to the total cost of labour and material to the point at which the percentage was applied. Most of the other items are self-explanatory, but it should, perhaps, be pointed out that, as the resultant unit cost was to be applied to the gross total of inventoried plant wherever situated, an addition was made to item 5 so as to raise the unit cost to a figure which would cover, by application to the whole, the extra cost of work in London.

(c) *Sinking fund method of depreciation.*—Sir Alfred Cripps introduced a new method of calculating the depreciated value of plant, in order, as he said, to make the purchase price equally fair to the buyer and the seller. For this purpose he introduced a set of tables showing, in parallel columns, for a period of twenty years:

(1) The interest on an assumed capital at 5 per cent;

(2) The sinking fund payment which would be necessary to recover the amount at the end of the given life with 5 per cent. interest;

(3) The sum of Nos. 1 and 2;

(4) The accumulated total of the sinking fund year by year; and

(5) The amount still to be redeemed year by year.

He argued that so long as No. 3 remained constant the burden on the undertaking was equally spread over the whole period of years, and that the purchase price at any particular time was the amount shown in column No. 5 as the amount of capital still to be redeemed at that time. For example, in the case of plant, with no residual value and a life of twenty years, costing £100, the seller at the end of ten years would receive from the buyer £62. Sir Alfred Cripps urged that, although the buyer at that price would have to pay more to the sinking fund in order to recover £62 in ten years, he would pay a correspondingly less amount as interest on the smaller capital which he had invested in the business. The Company's witnesses supported the argument, but on cross-examination they admitted that the sinking fund calculations had never previously been used in this way in "tramway valuations," and they could quote no instance of their application to everyday sales.

(d) *Life.*—Sir Alfred Cripps and his witnesses claimed that the life which ought to be taken for the purposes of valuation was not what was at various times referred to as "practical life," "actual life," or "working life," but was "the physical life." Physical life was defined by Mr. Gill in evidence as "practical life" under constant conditions, disregarding any changes other than those due to physical decay. On this basis the Company claimed the undermentioned lives for the main items of plant specified below, viz.:

| | | | |
|---|---|---|---|
| Iron pipes . . | 80 years | Creosoted poles . | 45 years |
| Cement blocks . . | 80 ,, | Bronze wire (40 lb.) . | 22 ,, |
| Cable (L.C.P.C.) . | 70 ,, | Copper wire (100 lb.) | 42 ,, |
| Cable (V.I.R.), aërial | 20 ,, | Subscribers' apparatus | 25 ,, |

Exchange equipment from 2·5 years for cords to 30 years for bulk of equipment.

Mr. Gill was the principal witness on behalf of the National Telephone Company; and he piloted the Court through the Company's numerous statements of unit costs with great skill and patience. The actual detail as regards the statements in respect of subscribers' apparatus and exchange equipments was dealt with by Mr. Cook. It soon became evident during the examination in chief of Mr. Gill that the figures, and percentages especially, in the Company's statement would need close and careful analysis on behalf of the Post Office. These figures were, with one or two exceptions, based on figures taken from the Company's books for a period of a month, a twelvemonth, or the whole period of eleven years; and access to the Company's books was granted to the Post Office for the purpose of checking the calculations. The exceptions were based upon experience and general practice, and were as follows: Head Office engineering 5 per cent., contingencies 2 per cent.,

contractors' profits 10 per cent., and, where no book record was available, some of the component parts of the various percentages.

In the course of the cross-examination by the Solicitor-General and Mr. Buckmaster, the method of calculation of certain of the items was criticised, and an endeavour was made to prove that the figures were inaccurate. The Company's counsel accepted the view that the freight charges required adjustment, and that the percentages (such as those for ordering and storing material), which were based upon certain figures produced from the Company's books, were not correct. It is of interest to note that the error in some of these cases arose through the not unnatural method of entering nett credits in the books instead of making separate entries for the cost of labour in recovering the stores and the value of the stores recovered.

When the Solicitor-General opened the case for the Post Office he made a brilliant speech, which was clear, closely argued, and an intellectual treat from beginning to end. Naturally, a large part of it was devoted to a destructive criticism of the Company's methods and tables; but, before proceeding to that part of his speech, he claimed that the proper interpretation of "tramway terms" in this case was, not the cost of the system to the *seller*, but the cost which the *buyer* would incur in replacing it, less depreciation by the recognised methods. He repudiated altogether the Company's "sinking fund" method of depreciation on the grounds, *inter alia*, (1) that sinking fund calculations were part of a financial arrangement for spreading costs equally over a period of years, irrespective of the engineering conditions; (2) that on the Company's method, the value of the plant at any particular time depended on the rate of interest at which the money could be raised and invested; and (3) that, while the vendor had the certainty of a past life for the plant during his time of ownership, the seller took the uncertainty of a future life with its attendant risks. He urged that the "straight line" method of depreciation had always been adopted in cases of valuations on tramway terms. He also declared that the practical and not the physical life of the plant ought to be taken into account, and that such items as the cost of raising capital were proper to revenue and not construction.

The Solicitor-General then attacked the Company's claim in general and in detail, and drew attention to the following points which he regarded as the weaknesses of their method, viz.:

(1) That the method of percentages necessarily gave two opportunities for error, because a percentage was of the nature of a vulgar fraction, and, if either the numerator or the denominator of the fraction was wrong, the resulting percentage was inaccurate. He claimed that he had proved in evidence wherever a check had been made that the numerators used by the Company were too large and the denomi-

nators were too small, and that the consequence in the case of both errors was to make the percentage larger than it ought to be.

(2) That a further risk of error arose where there was not a constant and logical ratio between the numerator and denominator of the fraction, and he exemplified this by reference to a figure which had been used by the Company as the expenditure for a composite year of 1909–1910, and which was less than their average yearly expenditure for the last six years.

(3) That for some purposes the Company had made calculations with a view to the separation of construction expenses and maintenance expenses, and for others had made no attempt at such division.

(4) That, although the claim was put forward as though it was based on the Company's books, they did not appear to make use of such figures as they had in their books. He illustrated this by pointing out that for ordinary commercial purposes the Company separated in their books the expenses on construction from the expenses on maintenance, and yet they made a fresh division for the purpose of the valuation.

(5) That adjustments had been found necessary in the figures for the composite year, but no attempt had been made to correct exactly similar errors in other parts of the tables.

(6) That sometimes the costs were based on ascertained fact and in others on estimates, and some confusion arose between the two points of view. For instance, he mentioned that a charge for contingencies could not be justified if the cost represented the actual cost of the work to the Company.

(7) That a percentage of 5·5 on the total expenditure for construction and maintenance was obtained by calculation from the books, and after many transmutations appeared in the tables as two separate percentages of 5 and 5·838 for Head Office supervision.

(8) That no consistent line was drawn between the place where the contractors' work ended and the place where the employers' work began.

(9) That the Company's costs, being based on their piecemeal construction during many years, affected original prices and the percentages adversely to the Post Office.

(10) That the Company, instead of making a deduction for piecemeal construction, claimed to make additions on the ground that the cost of construction would have been more if it had not been for the existence side by side of an organisation for maintenance purposes.

(11) That the whole system of percentages is so artificial and so difficult to check as to be no safe guide to the Court. He pointed out certain instances of want of internal cohesion between the various tables.

(12) That the percentages were cumulative, and that any error in

the earlier parts of a table increased, like a snowball, before it reached the total.

In these circumstances the Solicitor-General said that he had no hesitation in presenting to the Court an alternative scheme of valuation which had been prepared by the Post Office. This scheme was, he said, based upon the assumption that the whole work of replacement would be carried out by contract, and that the usual consulting engineer's charges of 5 per cent. only would be charged for planning and supervision; and he hoped to show to the Court that his prices covered everything from beginning to end, or, as Mr. Gathorne-Hardy expressed it, "from the cradle to the grave." He produced a large printed book which contained the summary of each of the various calculations in respect of the various types of equipment, and separate detailed books for conduits, cables, bare wire, aërial cable, etc. These tables had been prepared in such a way as to facilitate reference from the summary to the relative detailed calculations; a sample page of the summary is enclosed. It will be seen that each item of cost had two columns, the first column showing the section and page where the detailed calculations would be found and the second the amount in money. Mr. Snell, a partner in the firm of Messrs. Preece, Cardew & Snell, was the first witness on behalf of the Post Office, and he undertook the task of expounding the Post Office tables to the Court. I propose to follow the item of one three-inch cast-iron pipe through the tables in order to show the detail which was included in the various subsidiary tables, and to quote in each case the index number of the section concerned. (See Table II.)

*C.M. 2: Material.*—The price was taken at £121 per mile, and a contract placed by the Post Office on December 21st, 1911, was quoted as corroborative evidence. No reduction of price was made on the ground of the heavier weight of Post Office pipes. Delivery, free on rail.

*C.S.* 1: *Splits and bends.*—Cost based on specified contract and various additions made to cover freight, and contractors' charges to completion, including permanent reinstatement.

*C.F.* 2: *Freight.*—Rates to each of the agreed sixty-eight centres were obtained from the railway companies for conveyance from the most likely sources of supply and an equated average cost per ton was calculated.

As the result of an inquiry by Sir Alfred Cripps, the freight rates were re-calculated for three selected centres on the basis of the actual places where the pipes were laid. It was found that this re-calculation resulted in an increase of 4·7 per cent. on the freight charges for these three centres, but a much greater decrease from the amount claimed by the Company.

Freight from the railway station to the work is covered by the Post Office contracts mentioned in the next heading.

*C.E.* 8 : *Excavation ; and D, reinstatement.*—The whole of the Post Office contracts for 1911 were examined and an average price for each type of surface was calculated. In this particular case the permanent reinstatement charges were included. In the case of the Post Office contracts, prices were tendered by contractors for each type of work, whether the actual work involved that type or not. In cross-examination, Sir Alfred Cripps pointed out that a contractor was likely to tender at a false price for work that he was not required to do, and he endeavoured to show that the great differences in the Post Office prices for the same kind of work was due to that possibility. It was found, however, that in the case of the one cast-iron pipe, if the contracts which did not cover the laying of one pipe were excluded, the average prices for laying would have been less than those adopted by the Post Office.

*C.P.* 1 : *Extras.*—These items included abandoned pilot holes, abandoned trench, tunnelling, diversion of other parties' plant, brick and concrete piers, repairs to cellars, etc., timber for shoring, concrete for protection, wrought iron boiler plate, etc. These figures were based upon an analysis of all the Post Office contracts during a period of ten years covering work in the outer London area.

*C.P.* 2 : *Petty materials.*—One per cent. was added to cover these various items, as a matter of judgment.

Five per cent. was added to the total cost obtained from the various summaries to cover the charges of a consulting engineer for designing, supervision of the contracts, etc.

On the question of life, Mr. Snell gave the following evidence, viz. :

| Article. | Physical life. | Practical life. |
|---|---|---|
| Cast-iron pipes . . . | 60 years . | 40 years. |
| Cement blocks . . . | 80 ,, . | 20 ,, |
| Cables underground . . | 50 ,, . | 20 ,, |
| Aërial cable (V.I.R.) . . | — ,, . | 12·5 ,, |
| Creosoted poles . . . | 27·25 ,, . | 20·5 ,, |
| Bare wire (equated life) . | — . | 8·5 ,, |
| Subscribers' apparatus . . | — . | 9·5 ,, |
| Exchange equipment (equated life) . . . | — . | 12·4 ,, |

And he claimed that, so far as regards the practical life of the bare wire and subscribers' apparatus was concerned, the figures were obtained from the statistics supplied by the Company in support of their claim as regards the age of the existing plant.

At the close of his evidence in chief Mr. Snell handed in the

following statement, which shows how the Company's claim compared with the alternative valuation of the Post Office.

*Heading I of Company's claim.*

| | Cost of construction. | | Valuation. | |
|---|---|---|---|---|
| | Company. | G.P.O. | Company. | G.P.O. |
| | £ | £ | £ | £ |
| Conduits | 2,839,742 | 1,441,093 | 2,790,821 | 1,064,731 |
| Cables | 3,337,353 | 1,962,659 | 3,186,582 | 1,446,391 |
| Poles and standards | 2,614,781 | 1,662,982 | 2,166,489 | 812,006 |
| Bare wire | 3,343,370 | 2,139,702 | 2,994,861 | 1,232,977 |
| Aërial cables | 1,017,261 | 497,987 | 692,355 | 213,569 |
| Exchange equipment | 2,641,640 | 1,505,131 | 2,297,598 | 692,360 |
| Glasgow exchange | | 37,882 | | |
| Subscribers' apparatus | 3,756,168 | 2,369,730 | 2,918,563 | 1,545,817 |
| £ | 19,550,315 | 11,617,166 | 17,047,269 | 7,005,851 |

In the course of the cross-examination of Mr. Snell, Sir Alfred Cripps called attention to one or two other points in the Post Office tables concerning which further information was required. Discussion as regards them was left over until the re-assembling of the Court on October 15th. An order was made by the consent of the parties on July 16th for the payment of a further sum of £4,000,000 on account. This sum, with the £3,000,000 paid at the date of the transfer and the balance of prepaid subscriptions, etc., remaining in the hands of the Telephone Company, made a very large payment on account.

When the Court resumed its labours after the Long Vacation, the leading Counsel announced, to the manifest delight of the Court, that during the Vacation an agreement had been arrived at between the parties in respect of the fundamental cost of construction under Heading I, *i.e.* the cost of material, freight, labour (up to the gang foremen) and casualty insurance, and that consequently the issues to be decided by the Court were confined to the additions which ought to be made to the fundamental cost in order to arrive at the cost of construction, the ages and lives of the plant, and the method of depreciation. The result of this arrangement was that the Court were enabled to jettison much of the literature of both parties, which had been handed to them during the earlier stages of the case, and could confine their attention to smaller summaries which were based upon the agreed figures. The Company's summary was not materially different from the specimen shown in Table I.

The Post Office statements were in the following form, viz.:

*Heading I.*

(1) (*a*) Conduits.

| | £ | £ |
|---|---|---|
| Agreed cost of: | | |
| (*a*) Material at suppliers, manufacturers' profits, and wastage | 466,142 | |
| (*b*) Freight (including cartage from suppliers to site) | 40,746 | |
| (*c*) Wages and expenses up to and including gang foremen, tools and sundries | 716,888 | |
| (*d*) Casualty insurance | 10,753 | |
| | | 1,234,529 |
| Add: | | |
| Cost of contractors' supervision and administration, 21 per cent. on item (*c*) | | 150,546 |
| | | 1,385,075 |
| *Contractors' profits, 10 per cent. on £1,385,075 | | 138,507 |
| | | 1,523,582 |
| Consulting engineer's fee, 5 per cent. | | 76,179 |
| Total | | £1,599,761 |

After the presentation of the revised documents, the cross-examination of Mr. Snell was resumed. The Solicitor-General then called the following witnesses in the order mentioned in support of the Post Office case, viz.:

Mr. G. H. Nisbett, Engineer and Manager of the British Insulated and Helsby Cables, Ltd.; Mr. W. Slingo, Engineer-in-Chief of the Post Office; Mr. J. O. Callender, of Messrs. Callender's Cable and Construction Company, Ltd.; Prof. D. C. Jackson, of Boston, U.S.A.; Mr. A. Siemens, of Messrs. Siemens Bros. and Co., Ltd.; Mr. G. W. Hook, formerly Superintending Engineer of the South Midland District; Mr. W. Aitken, of the Automatic Telephone Manufacturing Co., Ltd.; Mr. S. G. Leech, of Messrs. Saunders and Co. Ltd., constructional engineers; Mr. Andrew Young, Valuer to the London County Council; Mr. A. M. J. Ogilvie, Third Secretary to the Post Office; Sir William Peat, chartered accountant; Mr. P. W. Leake, chartered accountant; Sir Hugh Bell, of Bell Bros., ironmasters and colliery owners of Middlesborough, Dorman, Long and Co., North-Eastern Steel Co., North-Eastern Railway Co.; Sir George Gibb, formerly Solicitor and General Manager of the North-

* In the case of cable and internal equipment, where the work of laying or erecting can be carried out by the same contractor who supplies the material, the contractors' profits were calculated on items *b*, *c* (+ 21 per cent.) and *d*, on the ground that a manufacturer would not ask for two profits and the manufacturers' profit was included in item *a*.

Eastern Railway Co., and now Chairman of the Highways Board Mr. E. Williams, of the Engineer-in-Chief's office; Mr. H. Sparkes, of the Stores Department; Sir John Gavey, C.B., formerly Engineer-in-Chief of the Post Office.

Mr. Nisbett, Mr. Callender, Professor Jackson, Mr. Siemens, Mr. Aitken, Mr. S. G. Leech and Sir George Gibb gave evidence to the effect that, given the agreed fundamental cost, 21 per cent. on the cost of labour was a proper and sufficient allowance for contractors' supervision, that 10 per cent. was the maximum amount ever added for contractor's profit, and that such addition was not made in the case of material which was manufactured by the contractor by whom the installation was carried out. Mr. Slingo gave general evidence in support of Mr. Snell, and had to bear the weight of severe cross-examination concerning negotiations and contracts with the National Telephone Company which had been entered into before his transfer to London, and to explain and defend certain North Wales statistics which were put forward by the Post Office as corroborative evidence in support of the percentage added for contractors' supervision. He had also to bear the brunt of an attack by Sir Alfred Cripps on the Post Office system of valuation, which Sir Alfred urged repeatedly was based upon fiction, *i.e.* on costs of a hypothetical contractor, whereas the Post Office had it in its power to produce facts in the shape of actual Post Office experience of the cost of constructing its own telegraph and telephone systems. It was pointed out by Mr. Slingo and by Sir John Gavey that the Post Office methods of construction differed so materially from those of the National Telephone Company that in many respects the cost to the Post Office of its system was most unreliable as a gauge of the value of the National Telephone Company's system.

Mr. G. W. Hook gave evidence solely as regards the faulty condition of the cement ducts. Mr. Andrew Young, who has certainly had unique experience of valuations on tramway terms, gave general support to the method of valuation adopted by the Post Office, to the straight-line method of depreciation, and to the sufficiency of an addition of 5 per cent. to meet all the employers' burthens in connection with construction. Mr. Ogilvie gave evidence as regards the negotiations between the National Telephone Company and the Post Office for the provision of underground wires by the Post Office on rental terms, and at the request of the Court produced a copy of the whole correspondence, including a copy of a report—dated January 17th, 1906—from Mr. Gill to the then General Manager of the National Telephone Company. In this latter report it was made clear that Mr. Gill considered at that time that the capital value of underground work was works order

cost plus 15 per cent. for supervision. This report seemed to create considerable impression on the Court. Mr. Ogilvie also dealt in evidence with the Company's claims for the cost of raising capital, cost of obtaining subscribers' agreements and Head Office expenditure, and he produced and proved certain figures showing the cost per station of the Post Office system.

Sir William Peat, Mr. Leake and Sir Hugh Bell upheld the views that the depreciation of plant could not in a case of this kind be dealt with by a sinking-fund method, and that depreciation must be spread evenly over the life of the plant, although, for accounting purposes and as a matter of finance only, a sinking arrangement was a suitable means of providing the funds to meet depreciation.

Mr. E. Williams gave evidence as regards the analysis of the Company's books for the purpose of arriving at the various percentages based on the expenditure and allocation of expenditure for a composite year.

Mr. H. Sparkes explained the Post Office arrangements for ordering and storing material.

The Attorney-General and Sir Alfred Cripps had, during the recess and while the case was being conducted, been in negotiation with a view to shorten the proceedings before the Court as much as possible; and on December 9th, the seventieth day of the proceedings, they announced that an agreement had been arrived at as regards headings V to XII of the claim, and that the result of such agreement was to reduce the total represented in the claim as £3,293,094 to £2,055,468.

The Solicitor-General, in his closing speech, which lasted twelve days, pointed out that the settlement of fundamental cost disposed of many questions which had in an earlier part of the proceedings been treated as matters of great importance. For instance, he pointed out that the actual instant at which the valuation should in theory be made and the economic period of construction were now of academical interest only. He expressed his willingness to accept the Company's claim, that "interest during construction" should properly be added to the costs of construction; and he then proceeded in much detail and with frequent references to the evidence to attack the Company's claim on the general lines indicated in his opening speech. He pointed out amongst other things (1) that the fractions on which the charges for Local Administration and Engineering were based were even now obviously inaccurate, because the numerator, when divided into the total claim under that heading, showed that the constructional work of the whole of the Company's system, if carried out at the same rate, would take twenty years to complete, while the denominator, being only one seventeenth of the alleged cost of construction, showed that the period of con-

struction ought to be seventeen years; and (2) that since the agreement as regards fundamental cost the Company had added to their claim an item for sub-contractors charges in justification of which no satisfying evidence had been given. He summed the evidence on behalf of the Post-Office case and then put forward what he termed a series of checks, which, although not each in itself conclusive, were, when taken together, in his opinion conclusive proof that the Post Office valuation was more to be relied upon than that of the Company. The first of these checks was the cost per station of the systems purchased from the Glasgow and Brighton Corporations and of the Post Office system after allowances were made for the material differences between the Post Office method of construction and that adopted by the Company. Then he called attention to the report of the Company's Engineer-in-Chief, which was laid before the Court by Mr. Ogilvie; and finally he pointed out that the Company's total expenditure on capital account fell far short of the amount which they claimed. He argued the question of physical *versus* practical life, and suggested that the life of plant must mean the time which in ordinary course it would remain *in situ*, that the time it remained *in situ* depended on economic conditions as well as on physical decay, and urged that in fixing the life the Court ought to make proper allowances, for obsolescence, decay, overloading, alterations of route, etc., so as to give effect to the condition of the purchase agreement, which provides that the value of the Company's plant and assets must be arrived at having regard to their suitability for the Postmaster General's telephonic business.

In discussing the cost of obtaining subscribers' agreements, he claimed that no addition ought to be made to the cost of construction for such work because it was necessarily undertaken for revenue purposes, that, inasmuch as the Company obtained many wayleaves from their subscribers without payment, the amount claimed was excessive, that no allowance had been made for cessations, age, etc., that the rates of subscription affected cost of canvassing, that the Company in their "Commercial Handbook" gave the object of canvassing as the obtaining of revenue, and that the Post Office would be entitled to appeal against any award under this heading as a point of law. At the invitation of the Court, who apparently thought at first that the cost of raising capital was a revenue and not a capital charge and subsequently changed their minds, the Solicitor-General argued that the cost of raising capital did not increase the value of property, because otherwise the value of similar plant would be more to the man of little financial standing than to the rich man, and less to the man who paid a high rate of interest than to the one who paid a small rate of interest. He also claimed that any award on this question would be open to appeal.

On the question of the sinking fund method of depreciation, he pointed out that not even the Company's own witnesses could quote any case where that method had been adopted as between a buyer and a seller.

Sir Alfred Cripps followed the Solicitor-General and also spoke twelve days. As counsel for the claimants he had the final word, and this fact gave him considerable advantage, more especially in the last few days, when, tired with his prolonged effort, he objected in the strongest possible way to any interruption by Mr. Schwabe or Mr. Branson, who had been left to look after the interests of the Post Office. But his effort was in every way a masterful one: and, although to Post Office ears he seemed at times to put an entirely wrong construction on both facts and figures, his arguments were generally to the point, and in some respects the Post Office case was left in rags after his destructive criticism. In the first instance he somewhat changed his attitude as regards "tramway terms." He now claimed that valuation on tramway terms was artificial in character, that the company offered as evidence of what it would cost to reconstruct their system proofs of what it had cost them, and that the Post Office merely offered estimates based upon the probable doings of a supposititious contractor, and supported by the evidence of contractors who hoped for future benefits from the Post Office. He claimed repeatedly that the Post Office evidence was merely an attempt to whittle away the honest claims of the Company by innuendo, and towards the end, it seemed as though the Court and everyone present had mental visions of the "Mikado" whenever mention was made of the punishment of "whittling away by innuendo." Sir Alfred attacked the Solicitor-General's checks most vigorously and they certainly suffered severely. He also criticised the North Wales figures put forward by the Post Office, and contrasted the total amount of expenditure in North Wales (£30,000) with the figures for the composite year put forward by the Company as a basis of calculation (£1,000,000). He said that the Post Office ought to have put forward figures based on the cost of the Post Office works, and glozing over the differences in construction, type, situation and general conditions, asserted with some heat that they had been afraid to do so. In summing up the various details of the Company's claim, he agreed that the item of discounts in the calculation as to the cost of raising capital should be omitted, but he maintained that every halfpenny of the remainder of the Company's claim ought to be met. He defended the item of sub-contractors' charges on the ground that they had been taken out of the Company's figures when an agreement was arrived at as regards fundamental cost and must be replaced somewhere; and he claimed that life meant the time for which the plant would remain useful if the working conditions remained unaltered, and consequently, as no allow-

ance was made for future profits, no consideration ought to be given to the requirements of expanding business, etc., or to improved methods of working. He asked the Court to allow the cost of raising capital on the ground that no system could be constructed without the expense of financing it, and the cost of obtaining subscribers' agreements on the grounds that the system could not be constructed without detailed information as regards the situation of the subscribers' apparatus, and that such cost was analogous with the cost of obtaining statutory powers which had always been allowed in previous tramway arbitrations. Sir Alfred was at his best when singing the praises of the sinking-fund method of depreciation, but he did not seem to remove the bad impression created by the admissions of his own witnesses that they had never known it used in the case of a sale.

At the conclusion of Sir Alfred's speech, both parties handed in revised summaries dealing with the headings Nos. I, II, III, IV and V, and the Solicitor-General, who had no right to address the Court again, very cleverly directed the attention of the Court to the fact that the percentages in the Company's summary had been altered in order not to alter the totals.

The statement on p. 241 shows the comparative figures for these headings, and in the last columns the award of the Court for each of the various items. The award was given on January 13th, 1913.

The total amount of £13,059,827 was reduced to £10,062,607 on account of depreciation, and to this amount was added the agreed amount as regards the other headings, viz. £2,055,468, and the sums awarded by the Court as the cost of raising capital £247,189, and the cost of obtaining subscribers' agreements £150,000, making a total of £12,515,264. Sir James Woodhouse considered that the cost of raising capital ought not to be allowed, and disagreed with the majority of the Court in this respect. Costs were awarded against the Post Office.

The Post Office appealed against the award as regards the cost of raising capital and the cost of obtaining subscribers' agreements; and the Company on a counter-appeal raised various points which, in effect, were tantamount to asking the Court of Appeal to re-open the whole case. The appeal came before the Court of Appeal, composed of the Master of the Rolls (Sir H. H. Cozens-Hardy), Lord Justice Buckley and Lord Justice Kennedy, on April 15th, when Mr. Danckwerts raised an ingenious point of jurisdiction whether in this case, which was an arbitration under a special Act of Parliament, there was any right of appeal from the Judgment of the Railway and Canal Commission. The Appeal Court decided that a right of appeal did exist; and the House of Lords, to whom the Company appealed on this point, upheld that view.

When the case was again brought before the Court of Appeal,

HEADINGS I, II, III, AND IV.

| Item. | Description. | National Telephone Company. | | G.P.O. | | Railway and Canal Commission. | |
|---|---|---|---|---|---|---|---|
| | | Amount. | Percentage on item E. | Amount. | Percentage on item E. | Amount. | Percentage on item E. |
| | | £ | | £ | | £ | |
| A. | Material at suppliers, manufacturers' profits, and wastage | 6,963,353 | — | 6,963,353 | — | 6,963,353 | — |
| B. | Freight, etc. | 375,375 | — | 375,375 | — | 375,375 | — |
| C. | Wages and expenses up to and including gang foreman, tools and sundries (including the item (F) in P.M.G. 10) | 2,857,752 | — | 2,857,752 | — | 2,857,752 | — |
| D. | Casualty insurance | 42,865 | — | 42,865 | — | 42,865 | — |
| E. | AGREED FUNDAMENTAL COSTS | 10,239,345 | 100 | 10,239,345 | 100 | 10,239,345 | 100 |
| F. | Sub-contractor's supervision | 162,279 | 1·58 | Included in item J | — | — | — |
| G. | Sub-contractor's profit | 57,136 | 0·56 | Included in item K | — | — | — |
| H. | Ordering and storing material | 468,298 | 4·57 | Included in items C, J, O | — | 267,759 | 2·61 |
| I. | Contingencies | 296,034 | 2·89 | Included in items A, C, D | — | — | — |
| J. | Contractor's (or local) supervision and administration | 1,992,144 | 19·46 | 600,128 | 5·86 | 660,732<br>267,759 | 6·41<br>2·61 |
| K. | Contractor's profit | 1,377,•27 | 13·45 | 600,650* | 5·87 | 300,000 | 2·92 |
| L. | TOTAL CONTRACTOR'S CHARGES | 14,592,263 | 142·51 | 11,440,133 | 111·73 | 11,735,595 | 114·61 |
| M. | Obtaining wayleaves | 168,179 | 1·64 | 42,635 | 0·42 | 100,000 | ·97 |
| N. | Wayleave payments, rent of premises, maintenance and insurance of plant until revenue-earning | 264,821 | 2·59 | *Nil* | — | 200,000 | 1·95 |
| O. | Consulting engineer's fees (or head office supervision and administration) | 1,449,522 | 14·16 | 574,138 | 5·61 | 560,806 | 5·47 |
| P. | Interest during construction | 769,985 | 7·52 | Included in "Total Contractor's Charges" so far as relates to contractor's working capital | — | 463,426 | 4·52 |
| ●. | Cost of raising capital | 765,657 | 7·48 | *Nil* | — | See nett addition | — |
| R. | TOTAL COST OF CONSTRUCTION | £18,010,427 | 175·90 | £12,056,906 | 117·76 | £13,059,827 | 127·54 |

* Manufacturer's profit on material is contained in item A, and amounts to £439,352. If this is added to item K, the total contractor's profit allowed by the Post Office is £1,040,012, or 10·16 per cent. on the agreed fundamental costs.

## THE NATIONAL TELEPHONE COMPANY, LIMITED.—VALUATION OF PLANT.—TABLE I.

PARTICULARS OF CLAIM.—*Heading No.* 1 (1) (*a*). UNDERGROUND PLANT.—*Conduits*.
*Unit Cost.—One Mile 3-inch Cast Iron Pipe (including Wood Plugs, Draw Wire, and Split Pipes).*
*Item No.* 24, *Page* (3), *Conduits* (*F.G.* 2).

| A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|
| Item No. | Material. | Quantity. | Rate. | Cost. | Weight. Tons. | Freight. From Suppliers. | Freight. Local. | Cartage. | Wastage. | Total. |
| | | | £ s. d. | £ s. d. | | £ | £ | £ | £ | £ |
| 1 | Pipes, 9-ft. length | 567·69 | 0 4 7·23 | 130 12 9·52 | 26·5415 | 17·3581 | ·9069 | 1·0550 | 4·2669 | |
| | Pipes bell-mouths, | 48·8 | 0 3 3·71 | 8 1 5·85 | | | | | | |
| | Wood plugs | 7·726 | 0 0 3·14 | 0 2 0·26 | ·0254 | ·0511 | ·0015 | ·0023 | ·0187 | |
| | Draw wire | Tons ·0697 | 9 6 3·05 | 0 12 11·78 | ·1744 | ·1987 | ·0106 | ·0158 | ·0188 | |
| | Split pipes indicator | 1·94 | 0 2 10·99 | 0 5 7·88 | ·0138 | ·0166 | ·0008 | ·0007 | ·0003 | |
| | | | | 139 14 11·29 | 26·7551 | 17·6245 | ·9198 | 1·0738 | 4·3047 | 163·6698 |
| | | | | £139·7470 | | | | | | |

| | | | | |
|---|---|---|---|---|
| 5 | WAGES, EXPENSES, TOOLS, SURFACE RE-INSTATEMENT— | | | |
| | Laying ducts | | £162·7713 | |
| | Pilot holes | | 3·2375 | |
| | Other extras | | 21·4414 | |
| | Tramway and railway crossings | | 4·8202 | |
| | Company's supervision | | 5·7681 | |
| | Cost of reinstating | | 166·3629 | |
| | Extra for work in London | 1·2264 per cent. of £528·0712 | 6·4763 | |
| | Casualty insurance | ·96 ,, ,, 534·5475 | 5·1317 | —376·0094 |
| 6 | Ordering and storing material | 5·265 ,, ,, 534·5475 | | 28·1439 |
| 7 | Maintenance and insurance of plant until it becomes revenue earning | ·007 ,, ,, 534·5475 | | ·0374 |
| | SUPERVISION, ENGINEERING AND ADMINISTRATION— | | | |
| 8 | Local engineering supervision | 11·311 ,, ,, 534·5475 | 60·4627 | |
| | Local administrative ,, | 9·643 ,, ,, 534·5475 | 51·5464 | —112·0091 |
| | | | | 679·8696 |
| 9 | Head office engineering, 5 per cent.. | | 33·9935 | |
| | Head office administration, 5·838 per cent. | | 39·6908 | —73·6843 |
| | | | | 753·5539 |
| 10 | CONTINGENCIES, 2 per cent. | | | 15·0711 |
| | | | | 768·6250 |
| 11 | INTEREST DURING CONSTRUCTION— | | | |
| | (*a*) On cost of plant, 5 per cent for 1 year on | 768·6250 | 38·4313 | |
| | (*b*) On working capital, 5 per cent. for 2 years on 1 per cent. of | 768·6250 | ·7686 | —39·1999 |
| 12 | CONTRACTORS' PROFITS, 8·75 per cent. of | 768·6250 | | 67·2547 |
| | | | | 875·0796 |
| 13 | COST OF RAISING CAPITAL, 4·44 per cent. | | | 38·8535 |
| | | | | 913·9331 |
| 14 | Add for cost of split pipes, 17·35 pipes at £1·3700 (each as per unit cost) | | | 23·7695 |
| 15 | | | | £937·7026 |
| 16 | Unit cost used in Claim, £937·6991. | | | |

on June 23rd, it was announced that the parties had come to an arrangement, and that the appeal and counter-appeal should be dismissed. The Court offered their congratulations to the parties on the final settlement of the matter, and, on July 1st, made the necessary order. Under the arrangement between counsel, the appeal and cross-appeal were withdrawn on condition that the purchase price of the plant and other property should be reduced by £45,000 and the Company should waive the payment of their costs, for which a claim of £122,000 had been made. The total sum payable to the Company was therefore reduced to £12,470,264, which is properly comparable with the original claim of the Company of £20,924,700 for plant, etc., and £122,000 for costs.

The tax-payers of this country are to be congratulated on the result of the arbitration, which was carried to such a successful conclusion by means of the almost superhuman efforts of the Law Officers, their assistants, and the Post Office Staff. The Post Office obtains the telephone system without making any payment in respect of goodwill or of the reserve fund which was invested in the business; and on the other hand, the Company obtains a sufficient price to enable the Liquidator to pay out the Shareholders at par, the Shareholders having received dividends of 5 per cent. or 6 per cent. for many years.

The only parties who really suffered by the terms of the award are those misguided individuals who, tempted by the generally accepted notion that in a business deal a Government department always comes out second best, speculated on the probabilities of the amount of the award being considerably in excess of the subscribed capital, and bought shares in recent months at as much as 50 per cent. above their face value. We need not waste our sympathy on them.

The following statistics may be of interest:

*Plant purchased.*—1,500,000 miles of wire: 1565 exchanges: 561,738 subscribers' and private wire stations.

*Number of days' proceedings.*—In Railway and Canal Court (Preliminary), 9; in Appeal Court (preliminary), 6; in Railway and Canal Court (1912–13), 74; in Appeal Court (1913), 4; House of Lords, 2; total, 95.

Sir John Simon's opening and closing speeches occupied sixteen days and covered 883 pages of the *verbatim* report of the proceedings. Sir Alfred Cripps spoke for fifteen days and his speeches covered 732 pages of the report. Mr. Gill was in the witness-box on thirteen days and Mr. Snell on fourteen days. The *verbatim* report and the papers handed in to the Court, when placed one on another, measure nearly 4 ft. in height.

Everybody who was present in the Courts during the hearing

# TABLE OF

## I. (1) UNDERGROUND

| I. | II. | | III. | | IV. | | V. | VI. | |
|---|---|---|---|---|---|---|---|---|---|
| Class of conduit. | Material based on prices as on December 31st, 1911. | | **Splits and bends** on agreed basis, including re-excavation, filling-in, and extra width of reinstatement, and contractor's profit. | | **Freight.** | | **Contractor's profit** on material and freight (10 per cent. on Cols. II. and IV.). | Contract rates for unloading and carting out stores. **Excavation** to agreed average excess depth, trenching in rock, laying and filling-in, and contractor's profit | |
| | Index **C.M.** No. | Cost per mile. | Index **C.S.** No. | Cost per mile. | Index **C.F.** No. | Cost per mile. | Cost per mile. | Index **C.E.** No. | Cost per mile. |
| **CAST IRON PIPES.** | | £ | | £ | | £ | £ | | £ |
| 1 2-in. C.I. | 1 | 77·000 | — | — | 2 | 6·757 | 8·376 | 8 | 250·337 |
| 1 3-in. C.I. | 2 | 121·000 | 1 | 13·539 | 2 | 10·476 | 13·148 | 8 | 250·337 |
| 1 4-in. C.I. | 3 | 220·000 | — | — | 2 | 15·505 | 23·550 | 8 | 250·337 |
| 1 6-in. C.I. | 4 | 306·533 | — | — | 2 | 27·867 | 33·440 | 9 | 196·849 |
| 2 3-in. C.I. | 2 | 242·000 | 1 | 21·725 | 2 | 20·952 | 26·295 | 10 | 407·508 |
| 2 4-in. C.I. | 3 | 440·000 | — | — | 2 | 31·010 | 47·101 | 11 | 407·508 |
| 3 3-in. C.I. | 2 | 363·000 | — | — | 2 | 31·428 | 39·443 | 12 | 502·125 |
| 4 3-in. C.I. | 2 | 484·000 | — | — | 2 | 41·904 | 52·590 | 13 | 568·744 |
| 5 3-in. C.I. | 2 | 605·000 | — | — | 2 | 52·380 | 65·738 | 14 | 485·467 |
| 6 3-in. C.I. | 2 | 726·000 | — | — | 2 | 62·856 | 78·886 | 14 | 523·967 |
| 7 3-in. C.I. | 2 | 847·000 | — | — | 2 | 73·332 | 92·033 | 15 | 605·051 |
| 8 3-in. C.I. | 2 | 968·000 | — | — | 2 | 83·808 | 105·181 | 15 | 643·551 |
| 9 3-in. C.I. | 2 | 1089·000 | — | — | 2 | 94·284 | 118·328 | 15 | 682·051 |
| 9 4-in. C.I. | 3 | 1980·000 | — | — | 2 | 139·545 | 211·954 | 16 | 840·877 |
| 10 3-in. C.I. | 2 | 1210·000 | — | — | 2 | 104·760 | 131·476 | 17 | 776·417 |
| 11 3-in. C.I. | 2 | 1331·000 | — | — | 2 | 115·236 | 144·624 | 17 | 814·917 |
| 12 3-in. C.I. | 2 | 1452·000 | — | — | 2 | 125·712 | 157·771 | 17 | 853·417 |
| 13 3-in. C.I. | 2 | 1573·000 | — | — | 2 | 136·188 | 170·919 | 18 | 973·300 |
| 14 3-in. C.I. | 2 | 1694·000 | — | — | 2 | 146·664 | 184·066 | 18 | 1011·890 |
| 15 3-in. C.I. | 2 | 1815·000 | — | — | 2 | 157·140 | 197·214 | 18 | 1050·390 |
| 16 3-in. C.I. | 2 | 1936·000 | — | — | 2 | 167·616 | 210·362 | 18 | 1088·890 |
| 17 3-in. C.I. | 2 | 2057·000 | — | — | 2 | 178·092 | 223·509 | 19 | 1268·329 |
| 18 3-in. C.I. | 2 | 2178·000 | — | — | 2 | 188·568 | 236·657 | 19 | 1306·829 |
| 19 3-in. C.I. | 2 | 2299·000 | — | — | 2 | 199·044 | 249·804 | 19 | 1345·329 |
| 20 3-in. C.I. | 2 | 2420·000 | — | — | 2 | 209·520 | 262·952 | 19 | 1383·829 |
| 21 3-in. C.I. | 2 | 2541·000 | — | — | 2 | 219·996 | 276·100 | 20 | 1483·673 |
| 22 3-in. C.I. | 2 | 2662·000 | — | — | 2 | 230·472 | 289·247 | 20 | 1522·173 |
| 32 3-in. C.I. | 2 | 3872·000 | — | — | 2 | 335·232 | 420·723 | 21 | 2233·213 |
| 33 3-in. C.I. | 2 | 3993·000 | — | — | 2 | 345·708 | 433·871 | 21 | 2271·713 |

Key to Index references: C.M. = Conduits, materials. C.S. = Conduits, splits and bends. C.P. = Conduits, extras

## COST.—TABLE II.

### PLANT. (*a*) CONDUITS.

| VII. | | | VIII. | | IX. | X. | XI. | XII. | XIII. | XIV. |
|---|---|---|---|---|---|---|---|---|---|---|
| Contract rates for **reinstatement** of roadways and footways, including contractor's profit. | | | **Extras on contract** rate to cover abandoned pilot holes, concrete, timber in trench, extra widths, shoring pipes, etc., and contractor's profit. Index **C.P. 1.** | | **Petty materials** and sundries (1 per cent. on Col. II). Index **C.P. 2.** | **Total cost per mile.** | Total mileage of conduits as in agreed inventory of 68 centres. | **Total cost of construction as on 31st December, 1911.** | Equivalent miles of single duct. | Remarks. |
| Group. | Index **C.R.** No. | Cost per mile. | Percentage on Cols. VI. + VII. | Cost per mile. | Cost per mile. | | | | | |
| | | £ | | £ | £ | £ | | £ | | |
| D | Included in cost under Col. VI | | 2 | 5·007 | 0·770 | 348·247 | 0·428 | 149·050 | 0·428 | |
| D | | | 2 | 5·007 | 1·210 | 414·717 | 1062·218 | 440519·862 | 1062·218 | |
| D | | | 2 | 5·007 | 2·200 | 516·599 | 0·145 | 74·907 | 0·145 | |
| D | 4*a* | 191·044 | 2 | 7·758 | 3·065 | 766·556 | 0·359 | 275·194 | 0·359 | |
| E | Included in cost under Col. VI | | 3½ | 14·263 | 2·420 | 735·163 | 92·240 | 67811·435 | 184·480 | |
| E | | | 3½ | 14·263 | 4·400 | 944·282 | 0·001 | 0·944 | 0·002 | |
| E | | | 6 | 30·128 | 3·630 | 969·754 | 27·976 | 27129·838 | 83·928 | |
| E | | | 6 | 34·125 | 4·840 | 1186·203 | 8·304 | 9850·230 | 33·216 | |
| F | 6 | 486·069 | 15 | 145·730 | 6·050 | 1846·434 | 1·395 | 2575·775 | 6·975 | |
| F | 6 | 486·069 | 15 | 151·505 | 7·260 | 2036·543 | 3·935 | 8013·796 | 23·610 | |
| F | 6 | 486·069 | 15 | 163·668 | 8·470 | 2275·623 | 1·042 | 2371·199 | 7·294 | |
| F | 6 | 486·069 | 15 | 169·443 | 9·680 | 2465·732 | 1·338 | 3299·149 | 10·704 | |
| F | 6 | 486·069 | 15 | 175·218 | 10·890 | 2655·840 | 0·871 | 2313·237 | 7·839 | |
| F | 6 | 486·069 | 15 | 199·042 | 19·800 | 3877·287 | 0·001 | 3·877 | 0·009 | |
| F | 6*a* | 545·964 | 15 | 198·357 | 12·100 | 2979·074 | 0·285 | 849·036 | 2·850 | |
| F | 6*a* | 545·964 | 15 | 204·132 | 13·310 | 3169·183 | 0·208 | 659·190 | 2·288 | |
| F | 6*a* | 545·964 | 15 | 209·907 | 14·520 | 3359·291 | 0·332 | 1115·285 | 3·984 | |
| F | 6*a* | 545·964 | 15 | 227·903 | 15·730 | 3643·094 | 0·418 | 1522·813 | 5·434 | |
| F | 6*a* | 545·964 | 15 | 233·678 | 16·940 | 3833·202 | 0·031 | 118·829 | 0·434 | |
| F | 6*a* | 545·964 | 15 | 239·453 | 18·150 | 4023·311 | 0·045 | 181·049 | 0·675 | |
| F | 6*a* | 545·964 | 15 | 245·228 | 19·360 | 4213·420 | 0·015 | 63·201 | 0·240 | |
| G | 7 | 582·647 | 15 | 277·646 | 20·570 | 4607·793 | 0·072 | 331·761 | 1·224 | |
| G | 7 | 582·647 | 15 | 283·421 | 21·780 | 4797·902 | 0·059 | 283·076 | 1·062 | |
| G | 7 | 582·647 | 15 | 289·196 | 22·990 | 4988·010 | 0·034 | 169·592 | 0·646 | |
| G | 7 | 582·647 | 15 | 294·971 | 24·200 | 5178·119 | 0·163 | 844·033 | 3·260 | |
| G | 7 | 582·647 | 15 | 309·948 | 25·410 | 5438·774 | 0·189 | 1027·928 | 3·969 | |
| G | 7 | 582·647 | 15 | 315·723 | 26·620 | 5628·882 | 0·151 | 849·961 | 3·322 | |
| G | 7 | 582·647 | 15 | 422·379 | 38·720 | 7904·914 | 0·032 | 252·957 | 1·024 | |
| G | 7 | 582·647 | 15 | 428·154 | 39·930 | 8095·023 | 0·055 | 445·226 | 1·815 | |
| | | | | | Totals . . | | 1202·342 | 573102·430 | 1453·434 | |

C.F = Conduits, freight. C.E. — Conduits, excavation. C.R. — Conduits, reinstatement. and petty materials.

must have been impressed with the careful thought and strict attention to the minutiæ of details which both parties have given in the preparation of their cases. The labours of our friends the enemy, especially of Mr. Gill and Mr. Cook, must have been enormous; and there was no mistaking the obvious enthusiasm of Mr. Slingo and all his assistants, especially Mr. De Lattre and Mr. Martin, in their efforts to obtain for the State the telephone system at its "fair market value." And last but not least, Sir Robert Hunter, who conducted the Post Office case, added further lustre to his long and brilliant career in the service of the State.

In the overwhelming bulk of figures, weighted and equated averages, unit costs, splits and bends, and other weird and wonderful things, the lighter side of the human character was not often uppermost during the conduct of the case; but there were one or two sparks of humour among the dry-as-dust material. For instance, Mr. Danckwerts, never at a loss for an example, mentioned the youthful Solicitor-General as an instance of the increase of revenue-earning capacity with age. The Post Office engineers, who early found that the seats in the jury-box had cushions and stayed there, received offerings in the shape of halfpence from the ladies' gallery. Mr. Swinburne, when saying that if he were a moneylender he would prefer compound interest, was informed by the Bench that they did not contemplate coming to him for a loan. Sir Alfred Cripps referred to Mr. Danckwerts as a jockey, and one wondered whether it would not need an "iron horse" to complete the analogy. The Solicitor-General, at the instance of Mr. Danckwerts, inquired of Mr. Snell whether stray currents were found in the sheaths of other than lead-covered cable; and, later on, he expressed the hope that Mr. Snell (and presumably his evidence) would not suffer too much from electrolytic action during the process of cross-examination. Mr. Slingo supported the teetotal movement by declaring that water, with nothing in it, would not cause electrolysis. But we had no "bull" to compare with the description of a multiple, which was given during the preliminary proceedings, as the things that stick out on the front of the switchboard.

## TESTING INSULATION RESISTANCE WITH THE DETECTOR NO. 2.

The scope of the detector No. 2 is not exhausted when used for the purposes already indicated in past issues of this JOURNAL. It can be used to ascertain the insulation resistance of lines in the same manner as the voltmeter test set equipped at all large exchanges.

Naturally the detector has not such a large range nor the sensitiveness of the proper voltmeter set, but it serves very well in ascertaining roughly the state of lines, and is very useful for this purpose at small exchanges where there is no standard testing equipment.

The detector has a scale of fifty divisions, and the needle gives full deflection when fifty volts are applied to the instrument with no external resistance in circuit. Since the resistance of the instrument is 5000 ohms. the current is 10 m.a., and each division represents $\frac{1}{5}$ m.a. From this the formula used—

$$\text{Insulation res.} = \frac{50 - \text{deflection}}{\text{deflection}} \times 5000,$$

is easily shown to be true.

With 5000 ω resistance in the external circuit the potential drop across the voltmeter terminals is obviously halved. The current is—

$$\frac{50{,}000}{10{,}000} \text{ mv.} = 5 \text{ m.a.}$$

$$= 25 \text{ divisions, and,}$$

$$5000 \text{ is equal to } \frac{50 - 25}{25} \times 5000$$

With 245,000ω external resistance the current is $\frac{50{,}000}{250{,}000} = \frac{1}{5}$ ma.

$$= 1 \text{ divn.}$$

$$\text{And } 245{,}000 \text{ is equal to } \frac{50 - 1}{1} \times 5000.$$

This is the highest insulation resistance that can be ascertained with the detector, but although this would be of no use in the larger towns where the plant is all underground, it is quite sufficient for small provincial towns where the lines are mostly open.

The following table gives the approximate external resistances corresponding with the deflections obtained on the detector, when a 50-volt battery is used with the 5000ω coils of the instrument:

| Deflection. | Resistance. | Deflection. | Resistance. |
|---|---|---|---|
| 1 | 245,000 | 13 | 14,200 |
| 2 | 120,000 | 14 | 12,800 |
| 3 | 78,500 | 15 | 11,700 |
| 4 | 57,500 | 16 | 10,600 |
| 5 | 45,000 | 17 | 9,750 |
| 6 | 36,700 | 18 | 8,870 |
| 7 | 30,700 | 19 | 8,150 |
| 8 | 26,300 | 20 | 7,500 |
| 9 | 22,900 | 21 | 6,920 |
| 10 | 20,000 | 22 | 6,280 |
| 11 | 17,700 | 23 | 5,860 |
| 12 | 15,800 | 24 | 5,420 |

| Deflection. | Resistance. | Deflection. | Resistance. |
|---|---|---|---|
| 25 | 5,000 | 38 | 1,580 |
| 26 | 4,620 | 39 | 1,410 |
| 27 | 4,250 | 40 | 1,250 |
| 28 | 3,930 | 41 | 1,095 |
| 29 | 3,630 | 42 | 955 |
| 30 | 3,330 | 43 | 815 |
| 31 | 3,060 | 44 | 672 |
| 32 | 2,820 | 45 | 556 |
| 33 | 2,580 | 46 | 435 |
| 34 | 2,350 | 47 | 320 |
| 35 | 2,140 | 48 | 208 |
| 36 | 1,940 | 49 | 102 |
| 37 | 1,750 | 50 | — |

Of course if a resistance of 5000$^{\omega}$ is inserted in series with the detector and a 100-volt battery is used, the external resistance measured will be double that given in the above table.

W. A.

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## London District: Progress of New Equipments.

New Victoria: 8100 lines. Expected to utilise part of equipment early in October.

Museum: 10,000 lines. Commenced August 6th. Work proceeding rapidly.

Charterhouse: 10,000 lines. Office of Works engaged on building plans.

Kensington: Extension to 8400 lines. Approaching completion.

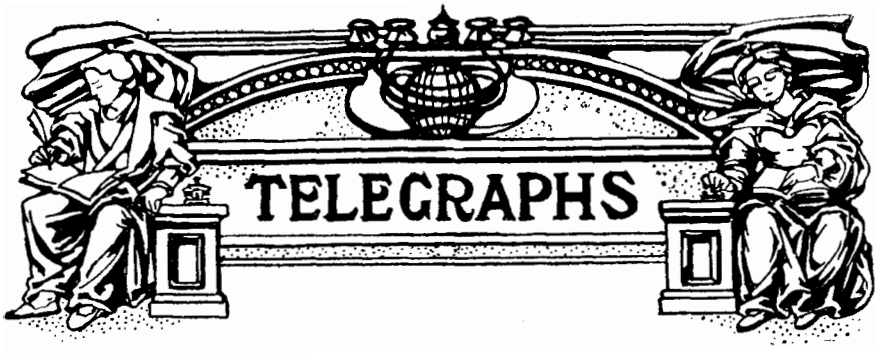
Hop Extension: "A" positions increased by 31; "B" positions converted to Keyless working. Practically completed.

Regent: Extension to 8080 lines. Practically completed. 4000 lines and 6500 stations connected in less than a year.

North: Extension by 1000 lines. Building being modified.

Trunk Exchange: Fifty Toll Sections to be installed by local staff. Fire Alarm system being introduced throughout the building.

Transfers.—The work of re-arranging the line plant has, during the last two years, absorbed a large amount of the time and energy of the District Staff. Another considerable instalment was completed on July 1st, when 3983 exchange lines were transferred to their appropriate exchanges. No hitch occurred, although the preliminary work had been of a complicated character, and next day Mr. Moir communicated to all concerned his appreciation of the satisfactory manner in which the work had been carried out. Subsequently a note commending the good work of the District was received from Headquarters, and, naturally, was much appreciated.




# THE CREED TELEGRAPH SYSTEM.

By E. Lack, A.M.I.E.E.

The General Post Office has had in use for some time, notably on the London-Edinburgh underground circuit, the Creed system for receiving and the subsequent printing in Roman characters of the ordinary Morse signals which have been sent by the Wheatstone transmitter.

In the usual method of Wheatstone working the operations which cause the greatest loss of time are, first, the preparation of the punched slips at the transmitting offices; secondly, the translation of the received signals at the intermediate stations; thirdly, the re-perforating for re-transmission; and lastly, at the terminal office, the writing up or printing of the received signals.

The first part of the problem, the simplification of the preparation of the punched slips, may be solved readily enough by means of a keyboard perforator such as the Gell, Pollak, or Kotyra.

The remaining causes of time loss are very greatly reduced by means of the Creed receiving perforator and the Creed printer.

## The Receiving Perforator.

The receiving perforator is designed to facilitate re-transmission and to save manual labour in the reception of telegrams.

For instance, a station "B" may have to transmit telegrams received from a station "A" to stations beyond.

Ordinarily in Wheatstone working the messages from "A," which are to be forwarded by "B," are received by the latter in the usual Morse signals. In order that they may be forwarded an operator at "B" has to prepare a new Wheatstone slip similar to that which was prepared at "A" in the first instance.

The object of the Creed receiving perforator at "B" is to avoid

the necessity of preparing a fresh Wheatstone slip by hand, and to perform the same operation automatically by means of the signals received on the line relay.

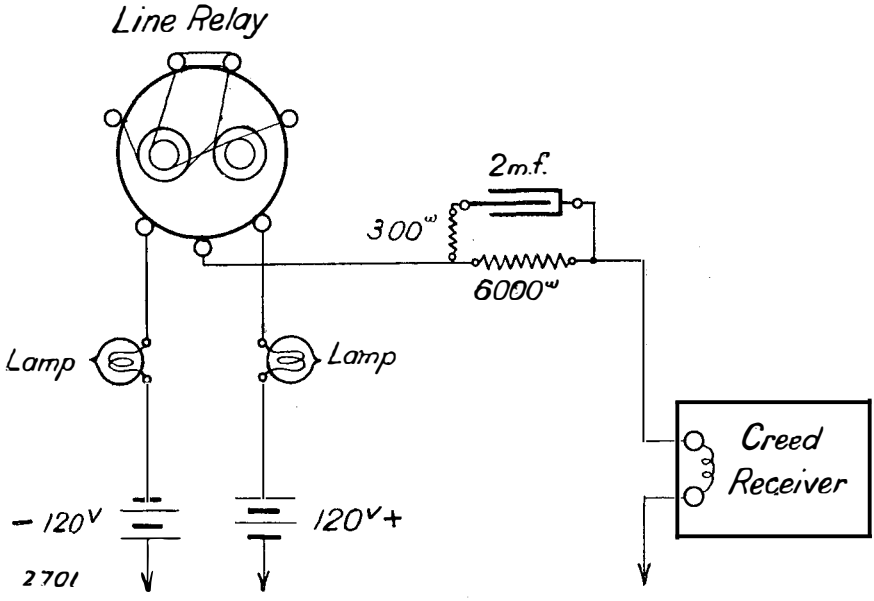
The mechanism for accomplishing this consists of—

(1) A relay.

(2) A perforator; this latter in its turn comprises three principal parts:

(*a*) Punches and a system for actuating them.

(*b*) A mechanism for carrying the slip forward at a speed uniform with that of the transmitter at the sending station.




1.—Creed Receiver. Electrical Connections.

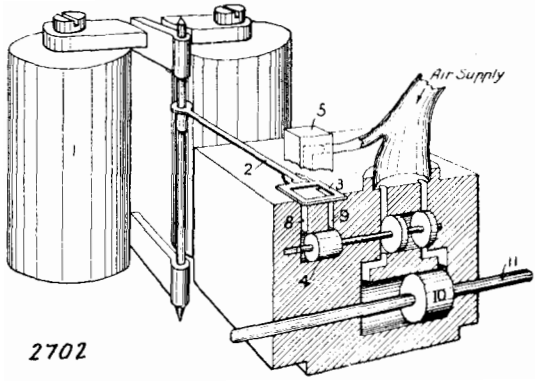
(*c*) A method of holding the slip firm whilst it is being perforated, and then releasing it as soon as the perforation has been accomplished.

The two operations (*a*) and (*c*) are performed by pneumatic agencies, whilst the operation (*b*) is fulfilled by a friction arrangement which will be more fully explained later.

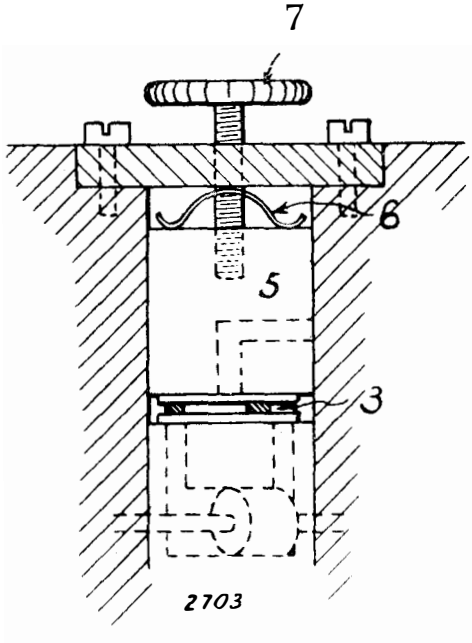
The line relay is actuated by currents in the usual way. The local connections are shown in 1.

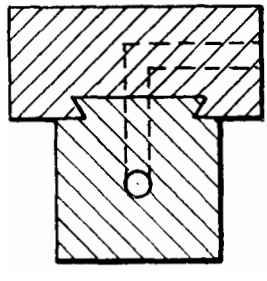
Within the receiver is another relay similar in construction to the Post Office standard relay 1 (2), with the exception that *in lieu* of the usual tongue the spindle of the armature carries a light arm *2* (2), at the end of which is an arrangement for opening and closing a small air valve *3* (2), which controls the supply of air *viâ* the block

*5* (**2**) and the channels *8* or *9* to a small piston *4* (**2**). The pressure of the block *5* is regulated by means of the spring *6* (**3**) and the adjustable screw *7* (**3**). The small piston thus responds to the move-




**2.**—Sketch of Relay.



**3.**—Details of Air Valve.

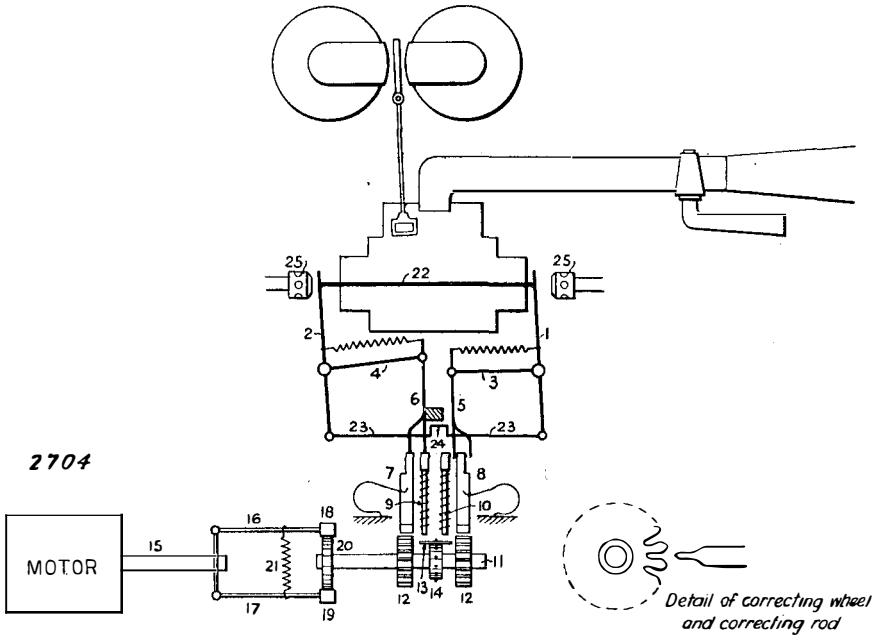
ments of the relay in accordance with the currents received from the line.

On an extension of the small piston-rod is an arrangement for controlling the air supply to a larger piston, which, by means of a rod passing through it acts in turn on the adjacent arms of the

system of bell-crank levers *1* and *2* (4). The movement of the piston-rod and the levers *1* and *2* is regulated by means of the adjustable buffers *25* (4). Attached to the arms *3* and *4* (4) are two bifurcated hard-steel strikers *5* and *6* (4), the free ends of which force forward the correcting rods *7* and *8* and the punches *9* and *10* (4).

The correcting rods and punches are mounted and guided in a separate block with the die-plates of the perforator and the feed-wheel spindle *11* (4). (7) and (8) show the old and the new form of punch blocks.

The correcting rods *7* and *8* (4) have flattened extremities at one




4.—Creed Receiver. Sketch of Mechanical Arrangement.

end, *1* (5 and 6), which when thrust forward enter the slots of the correcting wheels *12* (4). Retracting springs are provided to restore the rods to their normal positions against stops in the punch blocks. (5) and (6) show the earlier and later methods of doing this. The punches are equipped with springs in like manner.

The Wheatstone paper slip *13* (4) is centre-holed in order that it may be fed forward.

It is placed in the paper guide, and by means of the centre holes engages with the star-wheel *14* (4), and is led upwards between the die plates and past the punches. The star wheel and the correcting wheels are fixed to the spindle *11* (4).

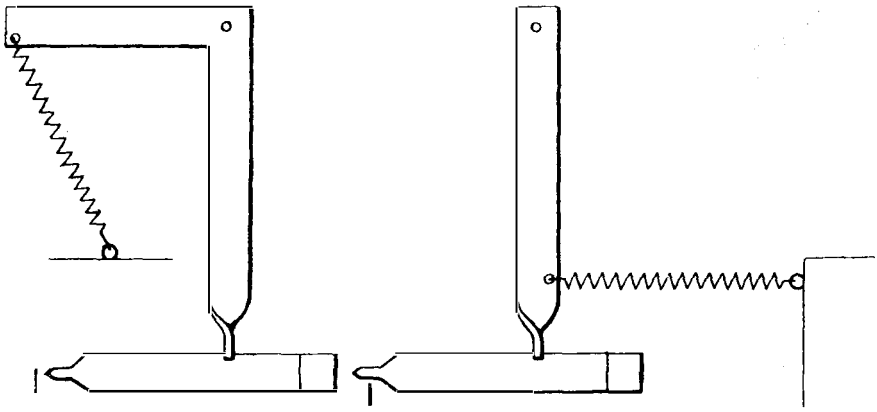
When the point of either correcting rod *7* or *8* (4) is thrust

forward by the striker *5* or *6* (4), it enters the space between the teeth of the correcting wheel, and thus adjusts the position of the wheel and holds it and the paper firmly in such a manner that the corresponding punch *9* or *10* (4) will perforate the paper exactly opposite the centre or feed holes.

The spindle *11* (4) is rotated by an electric motor whose spindle *15* (4) is connected to it by means of jointed arms *16* and *17* (4), which have friction blocks *18* and *19* (4) pressing on the disc *20* (4). The friction is regulated by means of spring *21* (4), which can be moved to the right or left along the rods *16* and *17* (4).

The action of the apparatus is as follows:

When a current is received in the relay *1* (2) its armature *2* (2) moves to the right or left, dependent on the direction of the current through the relay coils.




5 AND 6.—CORRECTING RODS, OLD AND NEW FORM.

If a "marking" current be received the light arm *2* (2) moves to the left. This opens the air-channel *8* (2), and the pressure of the air forces the piston *4* (2) to the right; this (as shown diagrammatically in 2) is connected with the main valve, which is opened in like manner, and the main piston *10* (2) is driven to the right also.

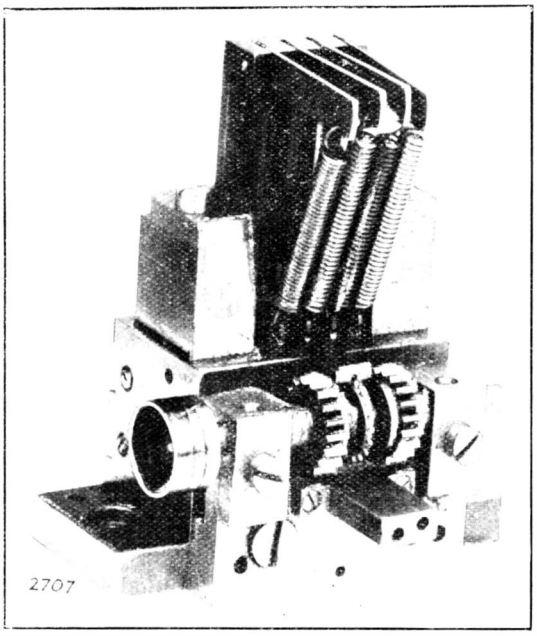
The actual connection between the small piston and main valve is by means of a cranked lever, which is clearly shown in the photograph (9).

The further action will now be seen by reference to 2 and 4.

The motion of the main piston *11* (2) and *22* (4) is transmitted by means of the bell-crank *1* (4) and the link *23* (4) to the bell-crank *2* (4), which in turn causes the left-hand striker *6* (4) to force the sharp point of the correcting rod *7* (4) between the teeth of the correcting wheel *12* (4), thus adjusting the feed-wheel *14* (4) if

necessary, and pressing the punch *9* (4) through the paper slip *13* (4). The tappet piece *21* (4) on the link *23* (4) now comes in contact with the striker *6* (4), and pushing it aside from the correcting rod and punch allows them to withdraw from the correcting wheel and paper respectively through the action of the retracting springs and assume the normal position.

When the line-current is reversed the armature *2* (2) of the relay *1* (2) is moved in the opposite direction, the piston rods are reversed in their action, and another operation similar to that just described causes the correcting rod *8* and punch *10* (4) to be actuated.




7.—Creed Receiver. Punch Block, Old Form.

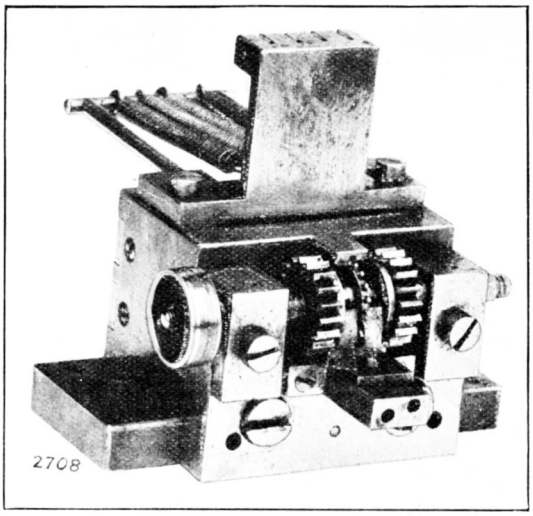
As the operation of forcing the correcting rods and punches forward occupies only about $\frac{1}{300}$th of a second, the time during which the movement of the feed-wheel is arrested is practically negligible, and the difference between the dots and dashes on the slip depends therefore on the time-interval between the successive spacing and marking contacts, during which time the tape is allowed to travel forward. In order to allow for the interval of time occupied by the reversal of the currents required for signalling a "dot," during which period the slip has travelled forward a little, the right-hand punch and correcting wheel are given a lead, so that, although the spacing punch comes into action a short time

after the marking punch, the spacing perforation is made immediately opposite the same centre hole as the marking perforation.

9 shows a plan of the receiving perforator, and 10 gives a front view of it, while 11 gives a closer view of the paper-driving mechanism.

The air supply is obtained by means of a small pump placed in the engine room, and is delivered at a pressure of 30 to 35 lbs. per square inch. A container is placed near the apparatus so as to avoid fluctuations of pressure when a variation in the number of instruments at work takes place.

The maximum speed of working which has been obtained




8.—Creed Receiver. Punch Block, New Form.

experimentally by the Department is 215 words per minute, but a speed of 150 words per minute is generally regarded as the maximum for reliable working.

## The Creed Printer.

The printer translates the signals on the received perforated slip and prints them in Roman characters on a paper tape. The tape is afterwards gummed on to an ordinary telegram form.

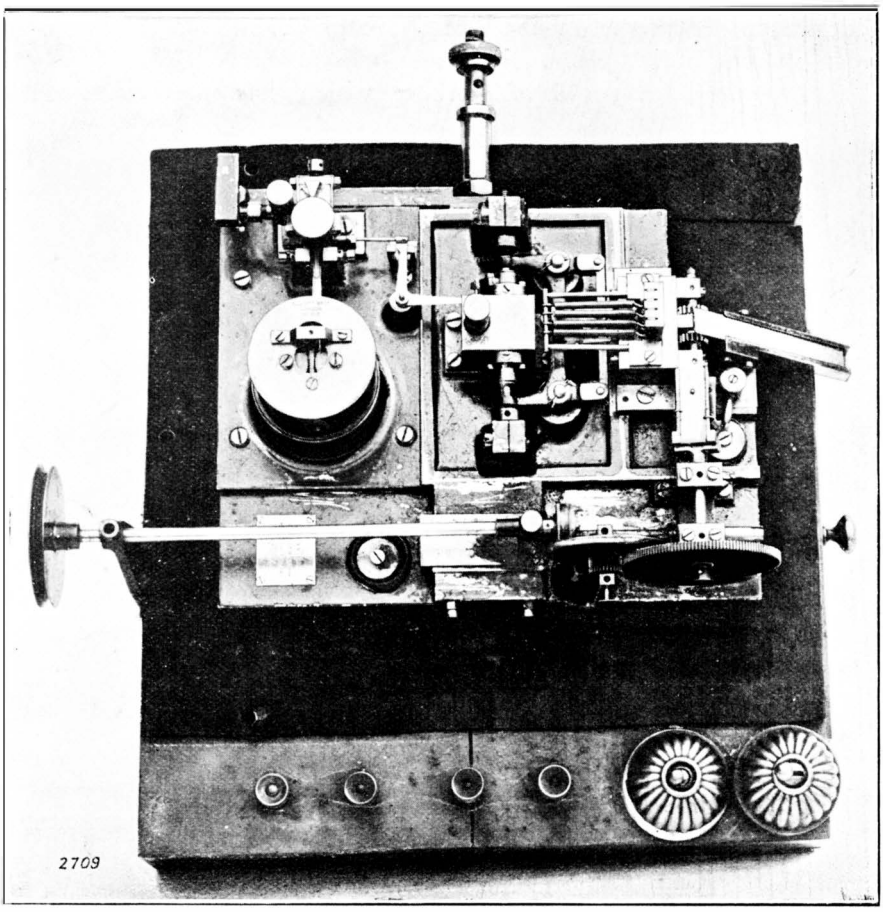
The action of the printer will be understood by means of the skeleton diagram shown in 12.

The perforated slip, which is identical with ordinary Wheatstone slip, is shown passing through the printer on the right hand of the figure.

The roll of Morse paper which receives the printing is placed on

a wheel similar to that used in the Wheatstone receiver, and, guided by a roller, is then drawn forward between the connecting rods of the type bars by means of two rollers (between which it passes) which are driven by the mechanism. On its journey the slip passes over a printing platen and under a typewriter ribbon.

The perforated paper is fed upwards by means of a star wheel




9.—Creed Receiver. Plan.

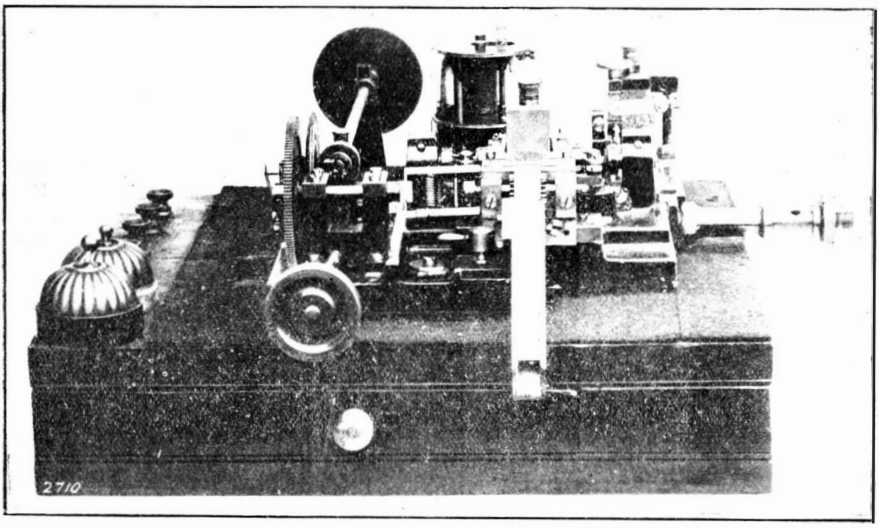
fitted on a spindle carrying a toothed wheel, which is rotated as desired by the paper-lifting rack. The rack's movement is obtained by means of a cam on the main shaft of the printer, which is belt-driven from an electric motor.

The slip is drawn forward, letter by letter, in front of ten pairs of selecting needles. One pair only is shown in the figure, which, by means of small springs, are pressed against the paper and made

to enter the perforations that may happen to be immediately in front of them.

One of each pair of needles is connected to the hinged extension of a thin perforated plate or stopper sliding in the path of the air valves. Each of the ten slide plates can take two positions, and they thus provide a number of different combinations, every one of which opens one complete and particular passage through them. Air under pressure is admitted through the main valves below these plates, and through the passages thus opened to small cylinders placed immediately above them.

The type levers terminate in pistons which fit into the small




**10.**—Creed Receiver. Front Elevation.

cylinders, and as the plates are displaced the air acts on one or other of these pistons, and causes the corresponding type lever to print the letter or sign on the paper.

The movement of the slide valves or plates is determined by the paper-lifting rack. For this purpose the rack is given, independently of its up-and-down movement, a side motion, by means of which it pushes the slide valves which have been brought into its zone of action by the movement of the selecting needles.

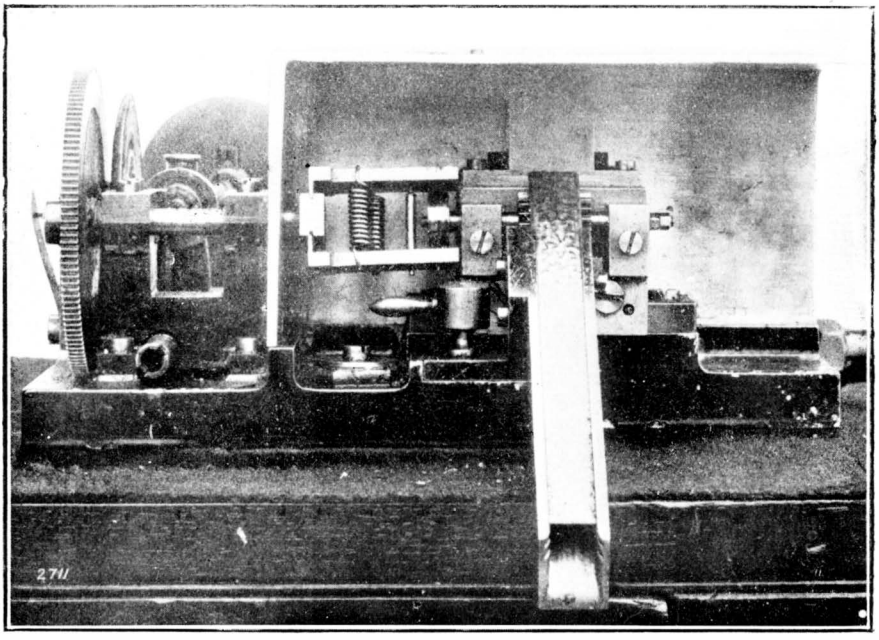
The vertical motion of the paper-lifting rack is determined by the position of the first blank space in the slip; that is to say, it corresponds to the length of the letter which has been selected.

To provide for the variable vertical movement of the rack there is a group of ten space levers which are normally in its path, but

when the selecting needles pass through the holes in the slip they press these levers aside and thus allow it to descend.

The rack can therefore move downwards as far as the space signal between the letters, which it cannot pass, because the position of the corresponding space lever has not been altered.

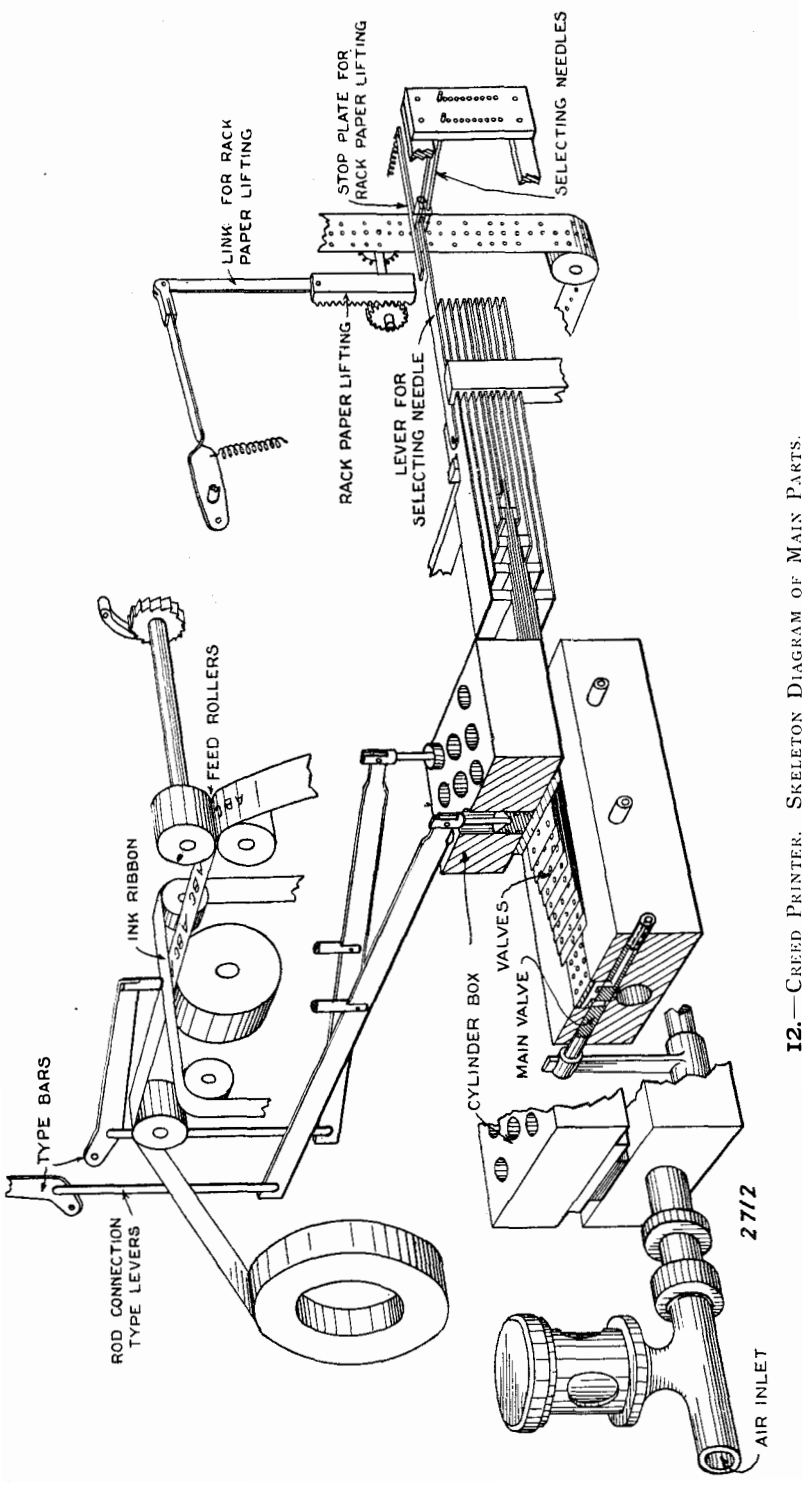
In its downward movement the rack does not engage with the toothed wheel which governs the movement of the paper, but at the end of its vertical motion it is moved laterally by means of a cam on the main spindle, and thus presses against the selected slide valves, and then engages with the toothed wheel of the paper-moving



II.—Creed Receiver. Punch Block and Friction Drive.

mechanism. The rack then rises and the slip is drawn upward, and as the amplitude of the rack's rising motion is equal to that of its descent the paper is lifted exactly the length of the letter which has just been printed. The slip is now in position ready for the selection of the next letter. The stop plates are formed of thin plates of steel; they are each provided with a hinged extension, which can follow the movements of the selecting needles, and at the same time it and the plate are free to move in a direction at right angles to them; in addition the extension is provided with a shoulder against which the paper-lifting rack presses in its lateral movement.

The admission of the air into the distributor is controlled by four main valves, which are actuated by a cam on the main shaft only

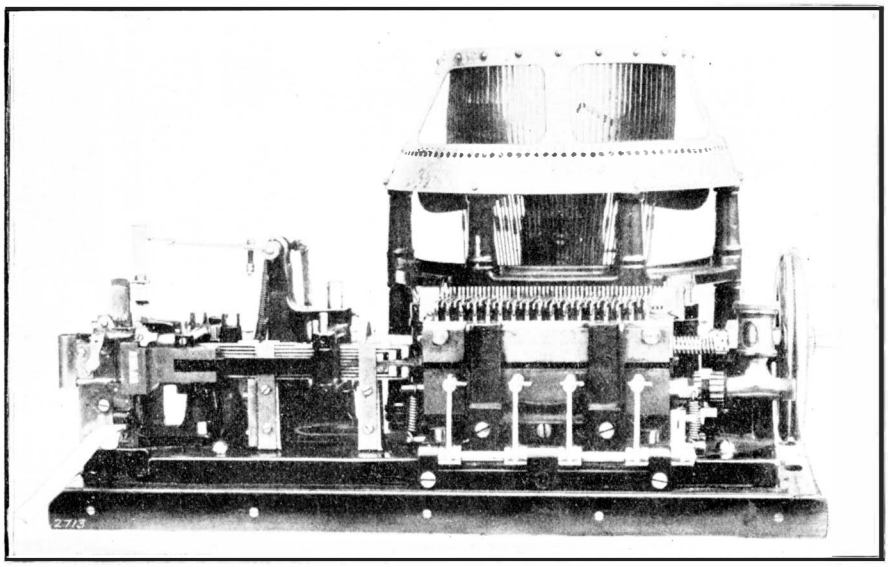



**12.**—Creed Printer. Skeleton Diagram of Main Parts.

after the paper-lifting rack has pushed the selected stop plates into the working position. After the letter has been printed the four valves move into a second position, the air then escapes, and at the same time the stop plates are brought back to their normal position by means of a cam on the main shaft.

It may be remarked that the selecting needles may enter the holes of the following letter or letters in the slip, but they do not affect the printing of the proper signal, because the stopping plates are not actuated by the paper-lifting rack as it does not descend beyond the first space after the letter which is being printed.

As previously stated, there are twenty selecting needles (10 pairs),



**13.**—CREED PRINTER. BACK ELEVATION, SHOWING CYLINDER BOX, MAIN VALVES, STOPPING PLATES, ETC.

but only the ten acting on the lower row of holes in the Wheatstone slip are attached to the valves; the other ten are not required for selecting purposes, but are used for shifting the space levers for the first portion of the dash signals.

The typewriter ribbon is fed forward by mechanism, which is actuated by the same cam that actuates the paper slip.

In addition to its forward movement it is given an oscillatory motion, which brings all parts of the ribbon under the letter types in turn, and thus adds materially to its life.

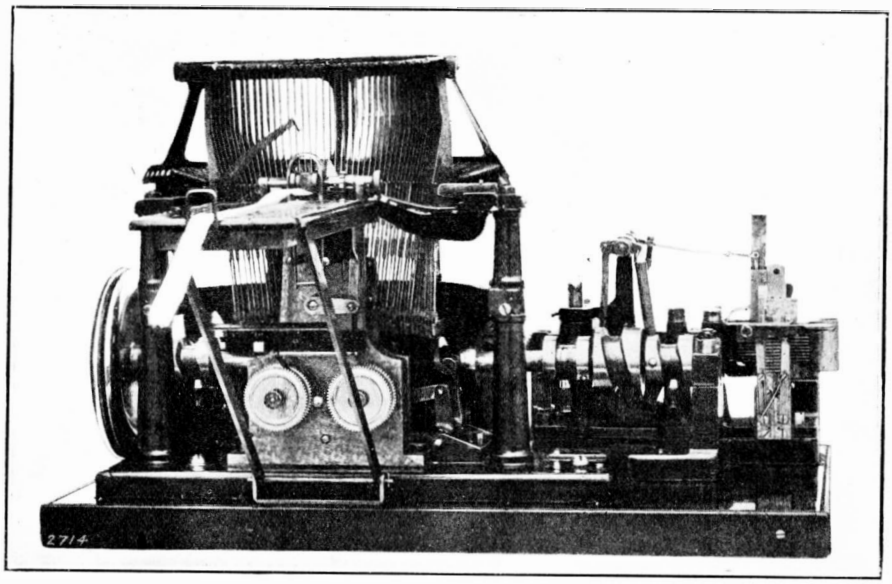
**13** shows the four main valves, the block containing the cylinders in which the type bar pistons are actuated, the slide valves and the paper-lifting rack mechanism, whilst **14** shows the main shaft

with its various cams, the selecting needles, the type levers and the typewriter ribbon feed wheels. The instrument is shown in the act of printing a letter on the Morse slip.

The printer has been experimentally worked at a speed of 128 words per minute, but 100 words per minute is generally regarded as the most suitable speed for reliable working.

The staff required to operate the Creed apparatus is as follows: No. 1, printer and receiver clerk. No. 2, to gum the printed slip on to the message forms. No. 3, checker. No. 4, checker.

These four operators are able to deal with a regular flow of traffic of about 150 to 180 messages per hour without delay.




14.—Creed Printer. Front Elevation, showing Selecting Needles, Cam Shaft, Paper Feed, Ink Ribbon Feed, etc.

On the London-Edinburgh circuits there are two Creed receiving perforators and two printers.

The two receiving perforators are connected to two separate circuits with a switch for transposing them as required.

Between the hours of 10 a.m. and 2 p.m., when the received traffic exceeds 200 and sometimes reaches nearly 300 messages per hour, two additional operators (one printer clerk and one gummer clerk) are engaged. Should the flow of traffic necessitate the second circuit being brought into use for a short period, this additional staff is in a position to deal with the overflow as well as relieve the pressure on No. 1 circuit.

The following table shows a day's working during a period of pressure:

| Hour. | 9 a.m. to 10 a.m. | 10 a.m. to 11 a.m. | 11 a.m. to 12 noon. | 12 noon to 1 p.m. | 1 p.m. to 2 p.m. | 2 p.m. to 3 p.m. | 3 p.m. to 4 p.m. | 4 p.m. to 5 p.m. | Total. |
|---|---|---|---|---|---|---|---|---|---|
| First circuit . . | 86 | 150 | 210 | 217 | 210 | 132 | 197 | 189 | 1391 |
| Second circuit . . | — | 25 | 123 | 120 | 89 | — | 80 | — | 437 |
| Total messages received | 86 | 175 | 333 | 337 | 299 | 132 | 277 | 189 | 1828 |
| Number of operators | 4 | 6 | 6 | 6 | 6 | 4 | 4 | 4 | 40 |
| Number of messages per hour per operator | 21·5 | 29·16 | 55·5 | 56·16 | 49·86 | 33 | 69·25 | 47·25 | Average for day 45·70 |

It will be seen the operator output per hour has reached the figure of 69·25, so that with skilled operators it would be possible to maintain an operator average of 50 messages per hour.

# THE "KNIGHT" FIRE-ALARM SYSTEM.

By J. J. MARKWICK.

ON a visit to Leicester the writer had the pleasure of inspecting the "Knight" fire-alarm system installed by the corporation in that town, and as the system is comparatively new it was thought that a short description might be of interest to readers of the JOURNAL.

At Leicester "open" circuit working has been adopted, but the patentees claim that a "closed" circuit can be provided if required.

The fire-alarm boxes transmit a code signal to the fire station, which allows several to be placed on one circuit, and a telephone accessible to the public is provided.

The external wiring is on the "radial series" system, two wires being used for each circuit. Two wires are not essential, but they enable a loop test to be made from the fire station and provide alternative means of passing a fire call. Telephoning is also over the two wires in parallel.

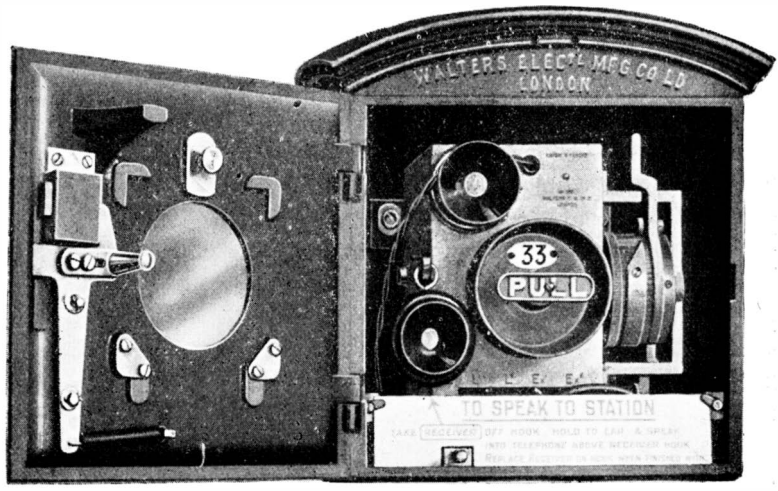
## THE FIRE-ALARM TRANSMITTER.

Photographs of the call point apparatus are shown in 1 and 2, and a diagram of the electrical connections in 3. The box can be fitted to a wall, lamp-post, or pedestal.

The fire-alarm transmitter consists of a train of wheels, driven by a powerful spring, which is held in check by a cam engaging with

the "pull handle" mechanism. The spring is wound by pulling down the lever shown on the right in **2.**


1.—Call Point Box.—Front Elevation.




2.—Call Point Box, with Door Open.

Normally the brushes on the code signalling or character wheel *A* (3) rest on an insulated strip, the remainder of the wheel being metallic and connected to earth. The brushes on wheel *B* rest on small metal plates, the rest of its periphery being insulation.

When the handle is "pulled" the trainwork is set in motion, and the wheels *A* and *B* immediately revolve sufficiently to allow the brushes on the former to be put to "earth" and those on the latter to be disconnected. The trainwork cannot revolve further until a current has passed through at least one coil of the electro-magnet, *C*, and by this means confusion of signals at the fire station is prevented, if two or more boxes are pulled at or about the same time. This matter will be referred to again later.

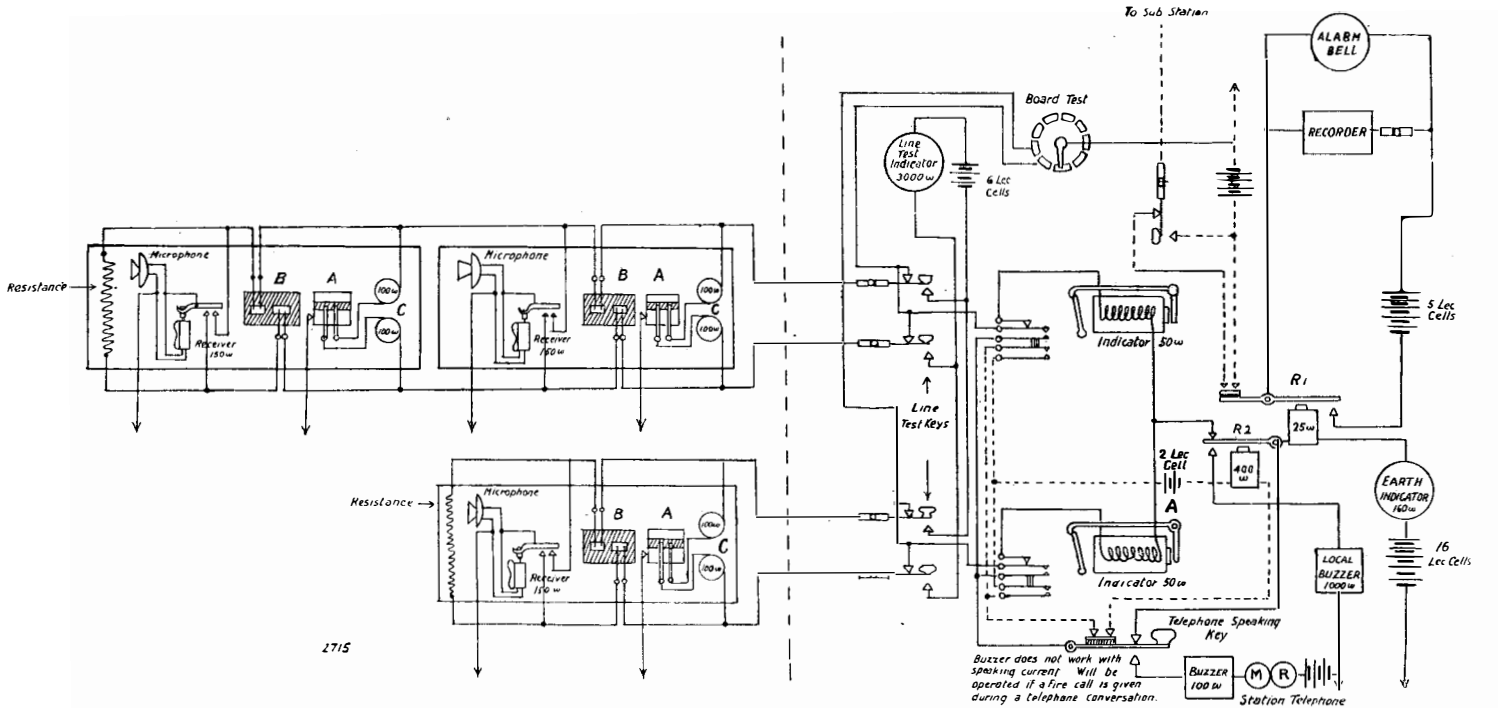
Assuming that no other box on the system is signalling and a current passes through *C*, then *A* will revolve twice and *B* once for each pull of the handle. The function of *B* is to cut off all boxes on the "down" side of the circuit and also the telephone in the box actuated, until the code signal has been transmitted twice to the fire station. The door of the containing box is then opened automatically by the cam on the winding mechanism withdrawing the latch.

The pull handle is of the non-interference type; that is, it does not matter if the person giving an alarm hangs on to it or gives a number of separate pulls; the trainwork, having started, is unaffected until it has twice sent the code call to the station.

In addition to driving the chain of wheels and opening the door of the containing box, the spring also rings a loud-sounding mechanical bell. This local alarm is intended to draw the attention of passers-by, or the police, to anyone giving a malicious call.

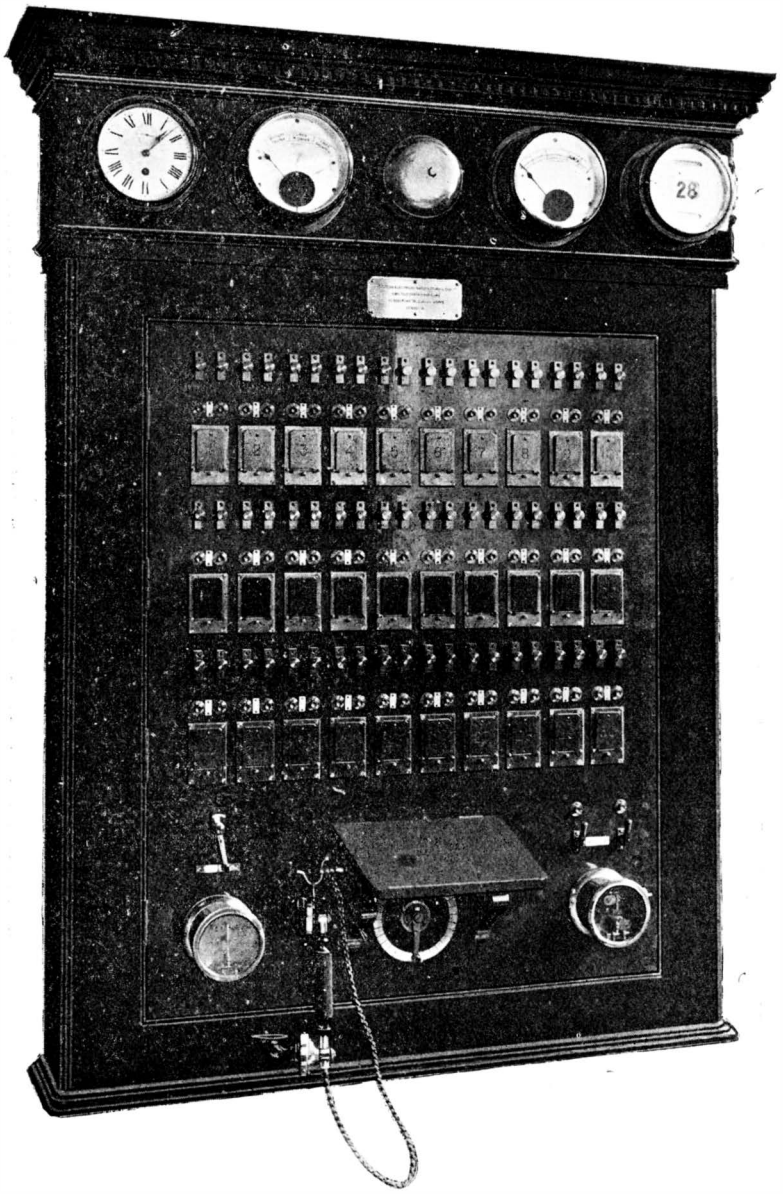
If, when the handle is pulled, another box on the same circuit, but nearer to the fire station, is signalling, the second call will be held up by the armature of the electro-magnet, *C*. When the box nearer the fire station has completed its call, its earth connection is automatically taken off and the lines are put through to the boxes beyond. A current can now pass through *C* of the second box pulled, and its call will be transmitted to the fire station. A second call from a box nearer to the fire station cuts out the one already signalling and sends in its own call. The first call, however, is not lost. If the character wheel *A* has completed one revolution before the second box is pulled, the code signal has been transmitted to the fire station and the mechanism returns to the normal. If one revolution of *A* has not been completed the armature of the electro-magnet *C* will hold up the trainwork until a current again passes through its coils; *A* will then be released and one complete set of signals transmitted.

The handle, when pulled, remains extended, and cannot be restored to normal, except by winding the spring, which should be done by the fireman when renewing the glass front of the box. If this is omitted the projection on the inside of the door, just below the lock, will foul the drum of the driving spring and prevent the




**3.**—KNIGHT FIRE-ALARM SYSTEM. ELECTRICAL CONNECTIONS. CALL POINT CIRCUITS SHOWN ON LEFT, STATION WIRING ON RIGHT OF VERTICAL DOTTED LINE.

door closing. At the same time the glass front is splintered by the pull handle.




4.—Station Indicator Board. Front Elevation.

## Station Apparatus.

Photographs of the indicator board are shown in 4 and 5 and a diagram of the connections in 3.

With the exception of the indicator, special reference to the apparatus fitted is unnecessary, as it is of a type familiar to readers of the JOURNAL.

Two photographs of an indicator are shown in **6**. It is of an ordinary drop pattern, the special feature being the commutator fitted at the back. The dropping of the shutter breaks one and makes two contacts, as shown in **3**.

As previously mentioned, if the handle of a fire-alarm transmitter is "pulled" the two lines are "earthed." This causes the main battery to send out a current through the "earth indicator," the coils of relay *R1*, the armature of relay *R2*, the coils of a drop indicator, according to which circuit the box actuated is on, and the top contacts of the indicator locals, to the lines. Immediately the indicator shutter drops a current from the local battery *A* passes through the coils of relay *R2 viâ* the fourth and fifth contact springs of the indicator, and the telephone speaking key. The armature of relay *R2* is attracted and the main battery now has two paths, one from the coils of relay *R1* to the telephone speaking key, and the second and third contacts of the indicator local to the lines, the other through the local buzzer to earth.

Relay *R1* responds to the makes and breaks of the character wheel in the fire-alarm transmitter, the distinctive signals being announced on a loud-sounding trembler bell, and recorded on a self-starting Morse inker.

The local buzzer is to prevent a shutter being allowed to remain down unnecessarily.

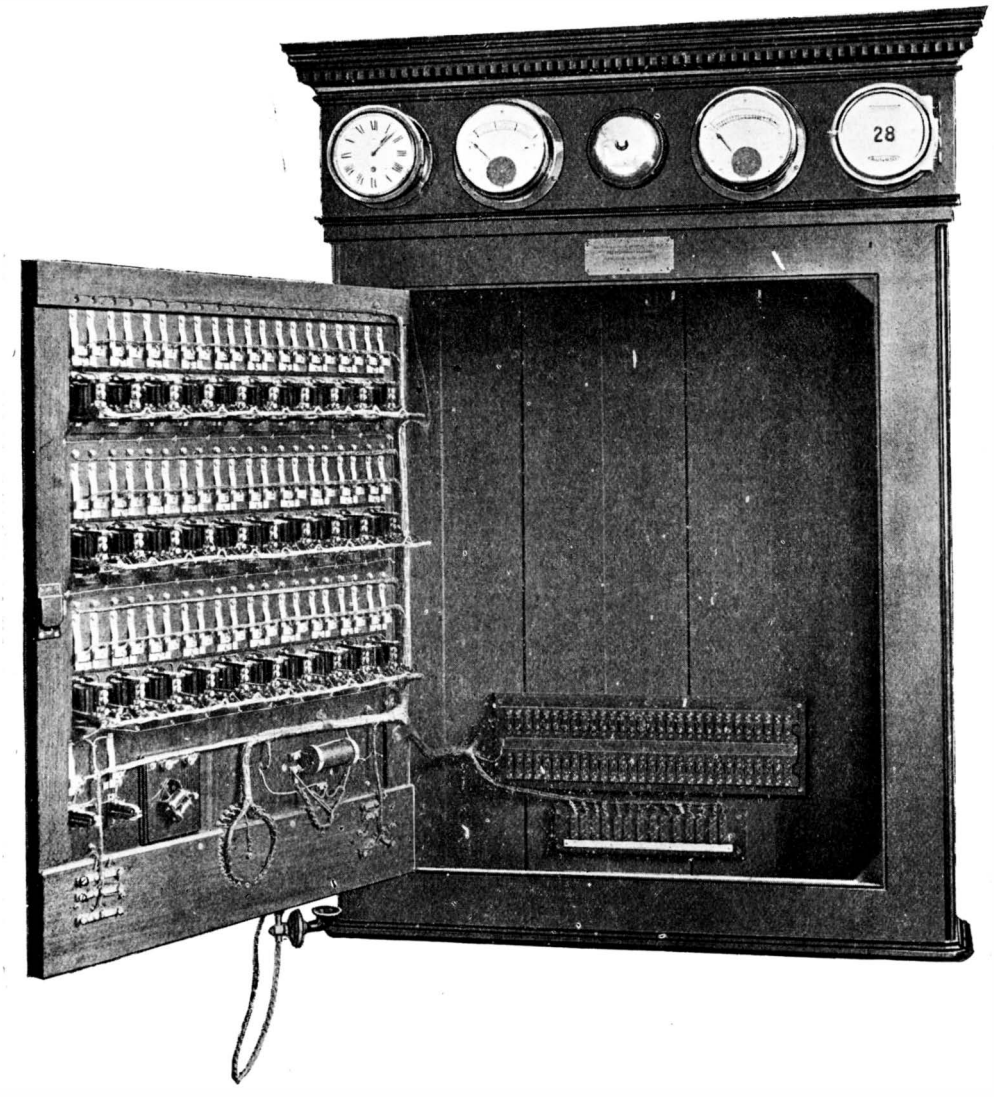
As long as the armature of relay *R2* is held down the main battery is cut off from the indicator circuit and all lines, except the one on which a box is signalling. It will be remembered that the trainwork of the fire-alarm transmitter is held up until a current passes through the electro-magnet *C*, so that if a box on another circuit is now "pulled" it will await the restoration of the indicator first dropped, and interference between circuits is prevented.

To speak on the telephone the "telephone speaking key" has to be held and the indicator allowed to remain down. The speaking key disconnects the local battery from relay *R2*, its armature remains up, and the main battery is available to the other circuits.

Should a fire-call be given on another circuit during a telephone conversation, a second indicator shutter will be dropped, and if this is not observed by the attendant the buzzer in the telephone circuit will be operated, due to the increased current sent out by the telephone battery. The telephone speaking-key should be immediately released and the first indicator restored; the fire call will then be received.

A fire call from a box on the circuit on which a telephone con-

versation is proceeding will also operate the buzzer in the telephone circuit. If the fire call is given at a box nearer to the fire-station, all boxes beyond it will be cut off, and the restoration of the tele-



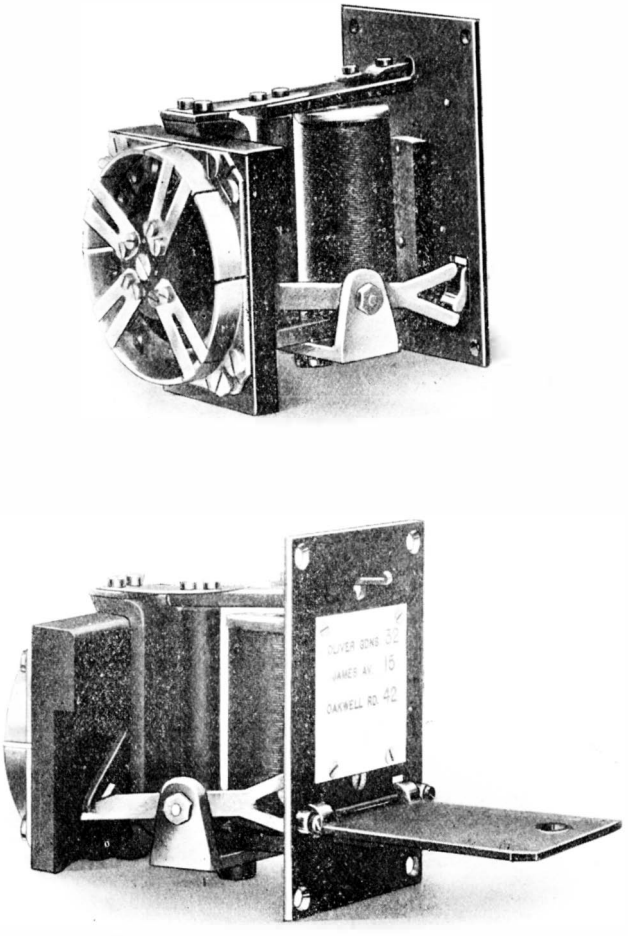

5.—Station Indicator Board with Door Open to show Wiring.

phone speaking-key at the station is all that is necessary. A fire call from a box beyond the one being used for telephone purposes will be transmitted to the fire station immediately the telephone receiver at the intermediate box is placed on the hook.

Should the person using the telephone fail to restore the receiver,

the second call will be stored until the brigade arrives at the intermediate box in response to the fire call, which must be given before an unauthorised person can gain access to the telephone.

If more than one box is fitted on a circuit a self-starting recorder




6.—Station Circuit Indicator.

is essential, and in all cases its use is desirable as a record of a call is then obtained.

A coil of high resistance is placed at the distant end of each pair of wires, so that tests for continuity and short circuit may be made by depressing the "line test keys" and taking the readings on a milliampère-meter, shown in 3 as a "line test indicator." A disconnection on one wire, or a short circuit, do not affect the working of the system.

An earth will be shown on the milliampère-meter marked "earth indicator" on the diagram.

The switch marked "board test" is for testing the station apparatus.

In conclusion, the writer has to express his indebtedness to the Institution of Electrical Engineers for permission to publish the photographs; to Messrs. Powles and Moore, of the Walters Electrical Manufacturing Co., who kindly supplied the diagrams, blocks, and particulars of the apparatus; and to Mr. Neal, Chief Officer of the Leicester Fire Brigade, for the facilities given at the time of visit.

[*It is only fair to Mr. Markwick to state that the foregoing article was written prior to the publication of Mr. Moore's paper on the subject by the Institution of Electrical Engineers.*—EDS. POST OFFICE ELECTRICAL ENGINEERS' JOURNAL.]

# CORRESPONDENCE.

## SOUNDER SILENCERS.

WE have received the following interesting letter on the subject of sounder silencers from Cape Colony:

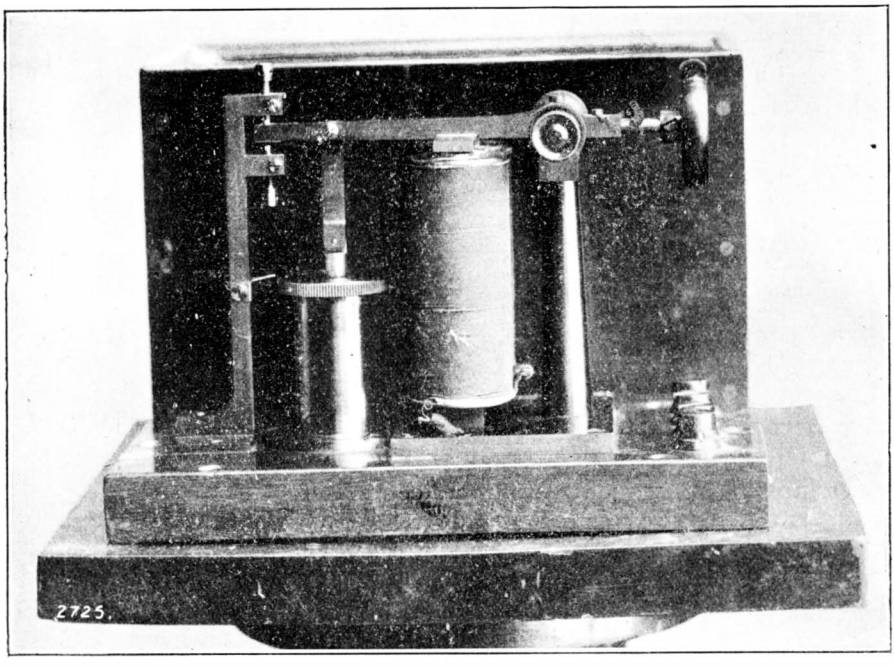
TELEGRAPHS,
BEAUFORT WEST,
CAPE COLONY.
*February 18th*, 1913.

SIR,—As the article on Silencer No. 3 in the JOURNAL for January, 1913, appears to imply that an ideal silencer has not yet been evolved, I venture to forward a note on a silencer which has been tried here.

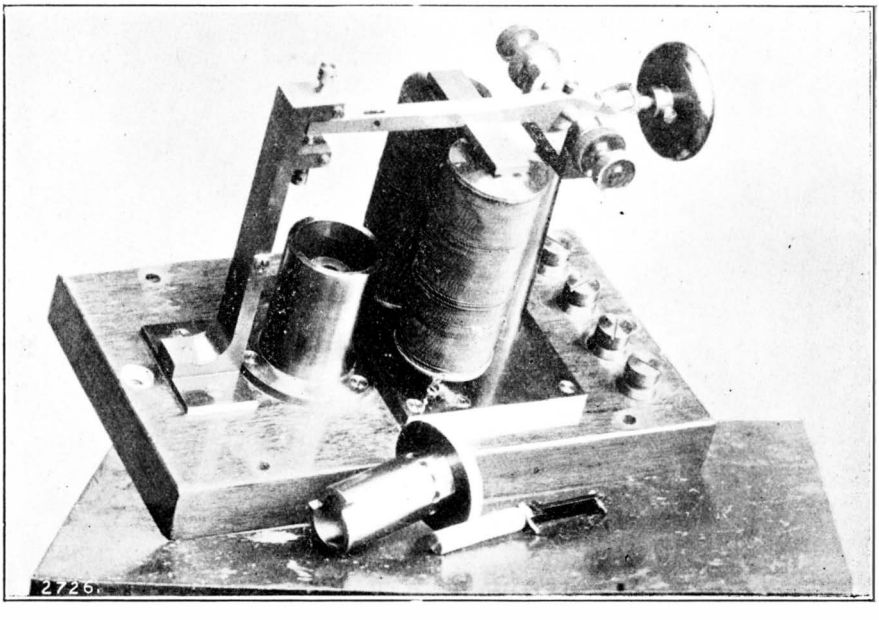
The instrument shown in **1** and **2** is a "call device" made by Elliott Brothers, which was used on the Eastern Telegraph Company's repeater here.

It is practically a sounder of 4000 ohms resistance, the spring replaced by an adjustable weight, and the descent of the armature retarded by a plunger which has to force Rangoon oil from an inner to an outer cylinder through an adjustable channel. The oil can return to the inner cylinder through a ball-valve, so that the upward movement of the armature is not hindered.

The outward flow of the oil is controlled by the cylinder, the milled head being turned round a vertical axis, and an alteration

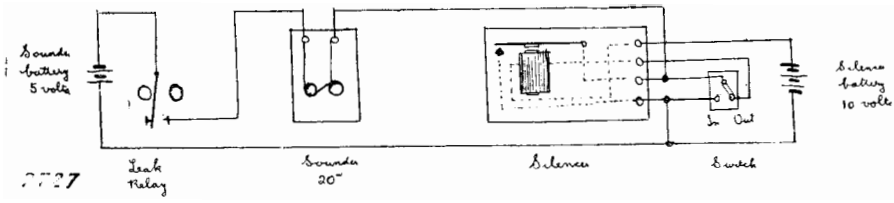



1.—Sounder Silencer. Side Elevation.




2.—Sounder Silencer, with Plunger removed from Oil Cylinder.

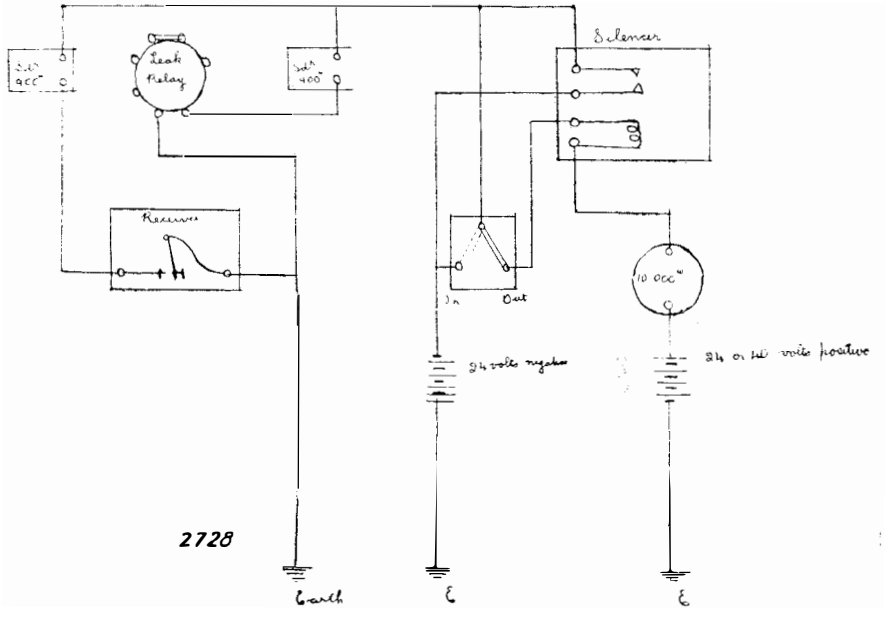
in the time of descent of the armature is thus a simple matter. This instrument formed part of the repeater leak-circuit, and did not respond to the short beats of the cable code, but was adjusted so that when either the dot or the dash key was depressed for about




3.—Connections of Silencer on Repeater Leak Relay.

two seconds the armature descended, closed the bottom contact, and so rang a trembler bell, thus indicating that the repeater clerk's attention was required. The upper contact is insulated.

The repeater is now being converted to an ordinary fast repeater,




4.—Suggested Arrangement for Secondary Cell Installation.

and the suggestion was made that this call device might do duty as a silencer.

This was accomplished by connecting it up as shown in 3. When the sounders are "out" and the leak relay is marking, the sounder and silencer batteries combine to send a current through the sounder and silencer in series. This current is too weak to work the sounder, but if prolonged for the necessary period will cause the

silencer armature to descend and make its contact. This contact closes the silencer circuit through its own battery and coil, so locking the armature in its depressed position and at the same time completing the sounder circuit, and the sounders may now be heard. The silencer works well. It can be adjusted to actuate the sounders in five seconds and yet keep them out to ordinary working, nor does the period to which it has been adjusted vary.

The Rangoon oil keeps good for years. 4 is a suggestion for connecting it to a secondary cell installation.

A two-way switch is provided which, when turned to the "In" position, completes the sounder circuit and disconnects the silencer battery. When a call is received the repeater clerk should turn the switch to the "In" position, though this is not absolutely necessary.

The silencer armature rises and falls very gently when working signals are passing.

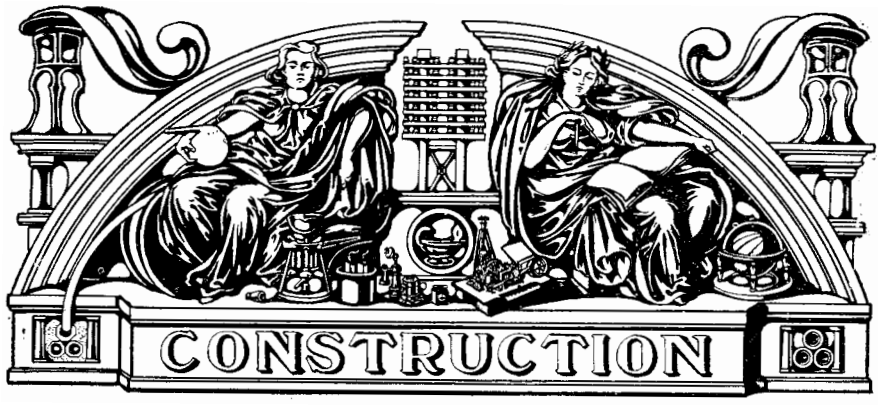
Yours faithfully,
R. WATSON.

## LONDON DISTRICT: PNEUMATIC TUBES IN THE CENTRAL TELEGRAPH OFFICE.

THE work of principal magnitude engaging the attention of the Engineering Staff at the Central Telegraph Office at present is the provision of a new equipment of pneumatic tubes on the continuous "Dudley" system. The estimate provides for the installation of some 27,000 feet of $2\frac{1}{2}$-inch brass tubing, which is being hung from the ceilings of the various galleries in symmetrical runs. The displacement of the old system with its heavy sluice valves and "D" boxes will involve the recovery of some seventy tons of metal. Some of the new tubes have already been brought into use, and they give flattering indications as to the extent to which the communication facilities will be improved and time and labour economised.

POWER WIRING.—The re-wiring of the power leads which was in progress at the time of the lamentable outbreak of fire at the Central Telegraph Office has now been completed and there remains no vestige of the old "V.I.R." cable. The power circuits are in lead-covered cables throughout the building, with special distribution switches on each floor, and, of course, the usual and adequate fusing provision in connection with the various sections.

BUCKINGHAM PALACE CONNECTED TO QUEBEC.—By Royal request a special press button was fitted on June 3rd in the boudoir of Queen Mary at Buckingham Palace and connected to Quebec so that the Queen might open a Hospital there by electrical signal. The Commercial Cable Company's line was used across the Atlantic; the signal was successfully given and acknowledged by a return signal, which was received within fifteen seconds.



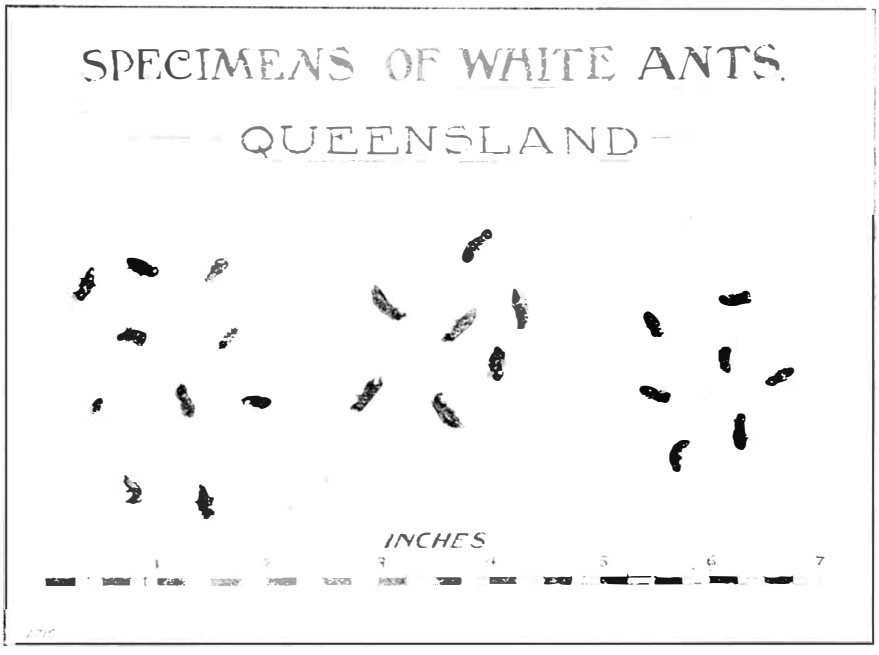

## THE RAVAGES OF THE WHITE ANT.

My interest in the white ant and its doings dates from an early period in my telegraphic experience. It had its origin in the frequent references in technical text-books to the deadly effects of the white ant on telegraph poles, and was greatly stimulated by descriptive accounts sent me by a colleague who accepted a post with the Eastern Telegraph Company and was stationed in a district infested with the white ant. How far it is shared by telegraph engineers at home I cannot say, but from the various inquiries which my correspondence brings I judge that my interest or curiosity in the subject is not uncommon amongst British engineers, whilst to my professional brethren in many countries abroad the white ant is a subject less of curiosity than of anxiety.

In common with most telegraph engineers, I knew that the white ant was an exceedingly destructive insect, working havoc with timber in general and with telegraph poles in particular. As to the exact method of attack and effects produced I was a little uncertain. But until quite recently I shared the common belief that so far as the telegraph engineer was concerned timber was the only object of attack. That lead-covered P.C. cables, lying in earthenware ducts in the heart of a city, should also be subject to serious damage from this formidable pest was never dreamt of in my telegraphic philosophy, and, so far as I am aware, technical literature contains no reference to the subject. Yet, as the facts subsequently stated show, this is exactly what happened, and the case adds a new and subtle terror to this telegraphic pest of the tropics and Southern Hemisphere generally.

Before entering into details of the case a few particulars as to the white ant and his ways may be of interest. I shows a few

specimens of the larger white ant (*Termes Australia*; family, Termitidæ) found in Northern Queensland. Like all other members of the ant family they well deserve the high enconium on their industry passed by that wise observer, King Solomon. They work ceaselessly, and many a telegraph engineer wishes they would observe at least an occasional Sabbath. They appear to have much the same highly developed communal organisation as their black brethren, so fascinatingly described by Lord Avebury, but they are necessarily more restricted in their travels and mode of life. They congregate




I. —Specimens of White Ants.

together and live in nests or hives which in structure are not unlike those of the bee, except that instead of being made of wax they are formed of a brown excretion exuded from their bodies. In appearance it is very like a brown cement. It also possesses some of the same properties as cement, and is often dug up, levelled, moistened and rolled out, and thus converted into excellent cricket-pitches and tennis-courts. In the "out back" regions it is even used for floors.

The nests, honeycombed with cells, each with its busy occupant, may either rest on the ground or be formed with the wood or other substance attacked as a base, or the ants may enter the timber below the ground surface and proceed to reduce it to a dry powdery substance, filling it with their brittle cells as they proceed.

2.—Nests of the White Ant.

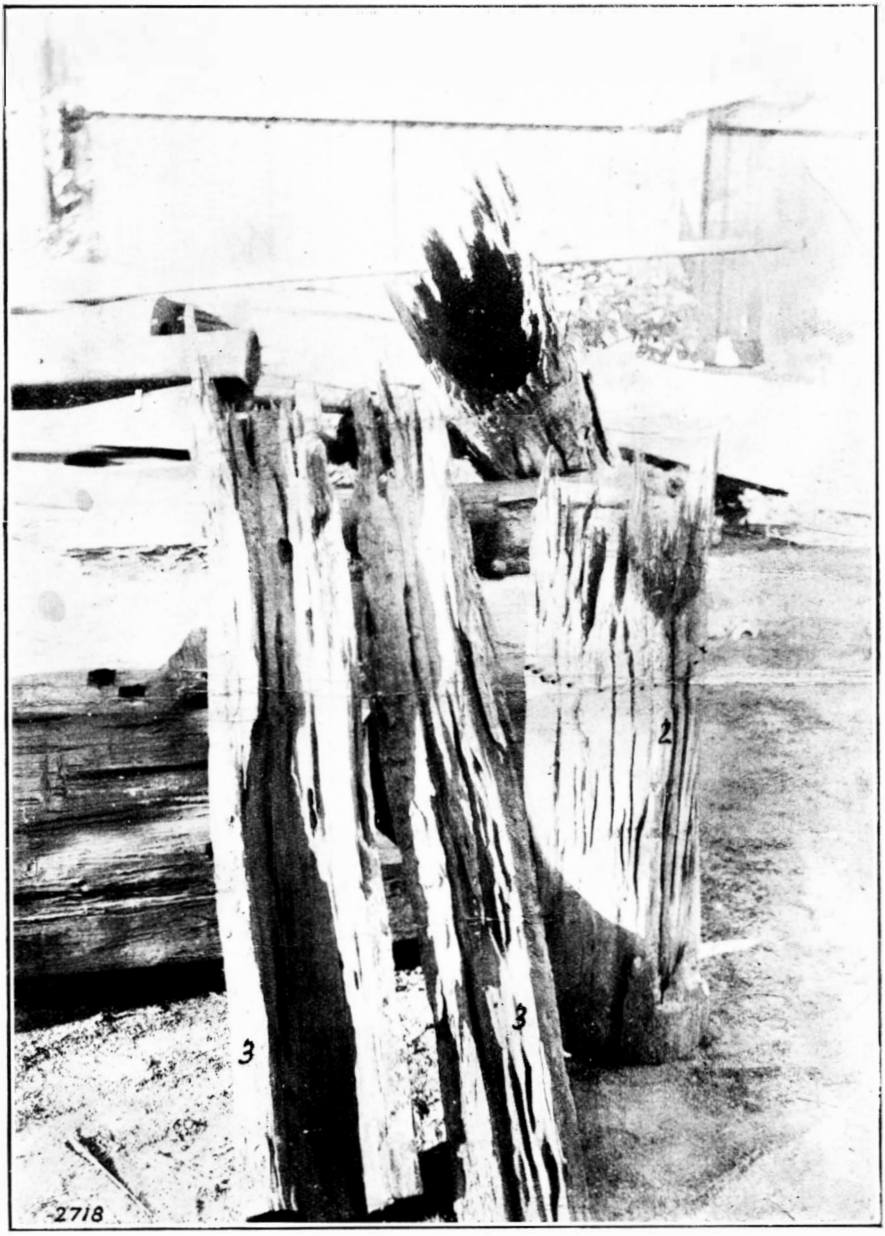
**2** shows the immense height to which these nests are sometimes built. In the case shown it may be stated that the nest (beside which the horseman is standing) has reached up to the wires, which the ants thereupon proceeded to enclose. The height above ground of this particular nest was 32 ft. Needless to say, the result of their activity in this case was that the wire was as effectively earthed as though attached to an earthplate. This, however, is a somewhat exceptional case, and is doubtless due to that prodigality of insect life and energy found in most of the States under the Southern Cross. For, amongst the many gifts which a bountiful Providence has showered down upon this vast Australasian territory, and especially upon Queensland, a superabundance of insect life is amongst the most bounteous. Doubtless they all have their uses and their advantages, but to the harassed telegraph engineer the latter are not always apparent. I have just passed through a district in Northern Queensland where fine healthy-looking spiders weave large fantastic webs across the wires and send out multitudes of long trailers to the ground, whilst their neighbours are busy enveloping the insulators with the same gossamer product. If in despair the engineer puts up a lead-covered aërial cable, a voracious boring beetle rewards his effort by boring neat round holes about the size of a pin-head in the sheathing. In comparison with the white ant, though, these are minor troubles, and in any case are a digression from the subject of this present article.

The rate of destruction due to white ants depends in large measure upon the nature and hardness of the wood. Coniferous woods such as pine, larch, fir, etc., are attacked and rapidly destroyed. Poles cut from these softer woods would be reduced to a powder within three or fourth months of erection, and nothing but a fragile shell would remain. Australia, however, produces comparatively few of these timbers. The harder woods are more abundant, such as iron-bark, bloodwood, stringy bark, cypress pine, and the various gums, and these better resist the attack of the white ant.

**3** shows a pole recently recovered from the streets of Townsville (Queensland), and the picture gives a fairly good idea of how the hardwood pole is reduced to a mere shell.

There are several methods by which poles are rendered immune from the disintegrating attentions of the pest. The one adopted usually and with most success is to poison the pole by boring an augur hole $\frac{5}{8}$ in. or $\frac{3}{4}$ in. in diameter, 18 in. above and 18 in. below ground level. The holes are bored in a downward direction to the centre of the pole with a slope of about 45° and are filled with a solution of arsenic and caustic soda (1 lb. arsenic to 2 lb. caustic soda, and 1 gallon water). The holes are then plugged with wood

to prevent evaporation, and in addition the base and lower portion of the pole is well painted with the poisonous mixture. Other

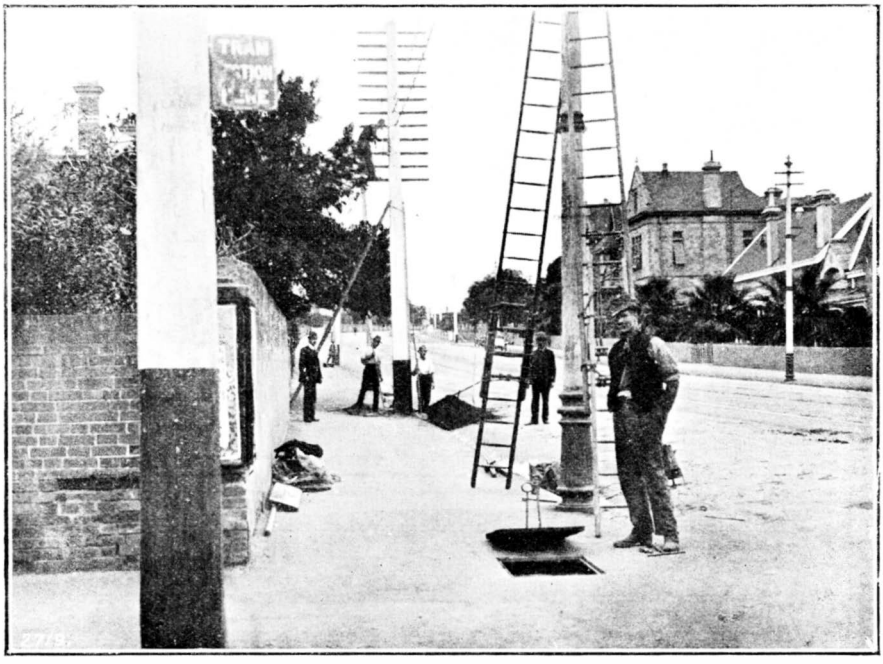



3.—Recovered Pole, showing the Shell to which Timber has been Reduced.

methods employed consist in setting the pole in concrete, or fitting it into a C.I. base, removing the sapwood and charring the base, etc.,

but these are more costly and generally less efficient means of protection.

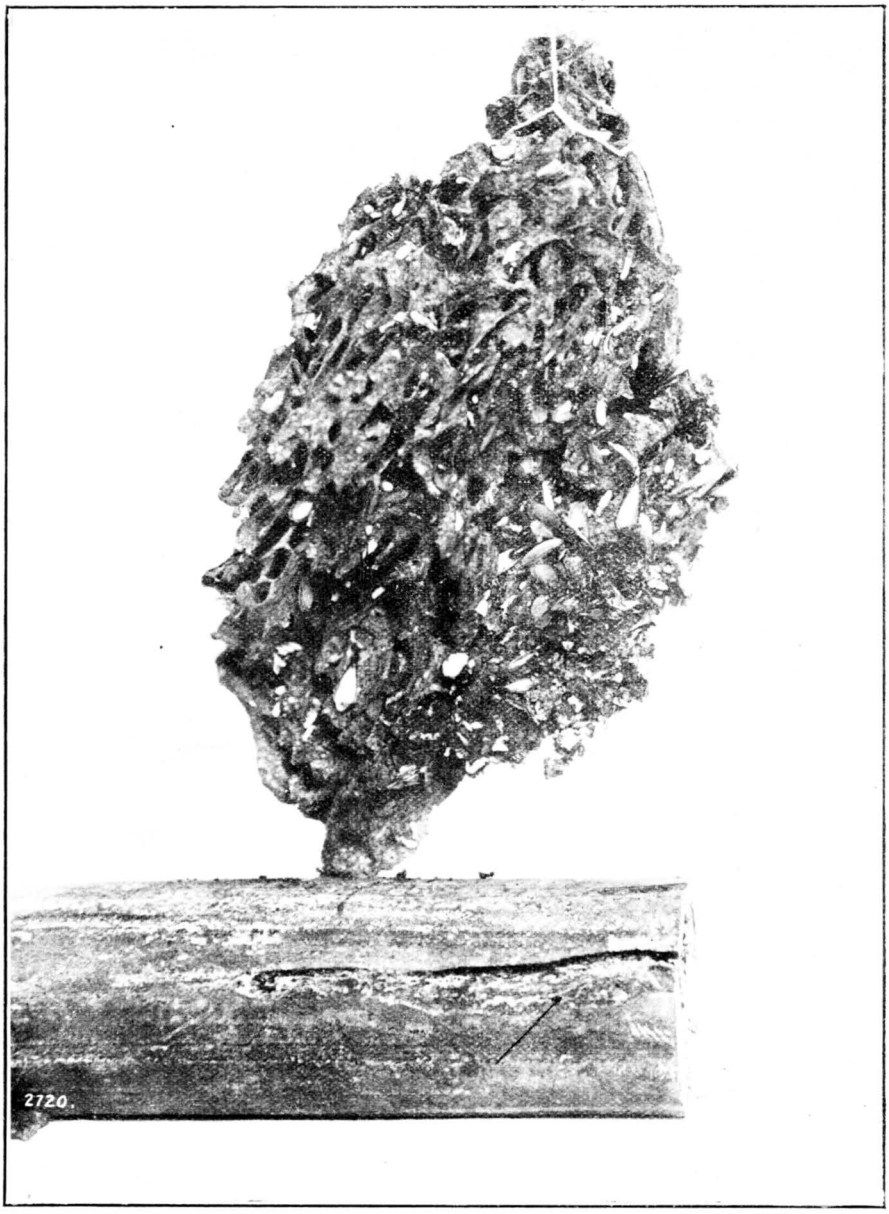
The above, however, are the more or less familiar facts of the subject, but by the kind permission of the Postmaster-General of the Australian Commonwealth I am enabled to furnish the following particulars of a case of serious damage to lead-covered cables by these insects. The damage was first revealed in September, 1911, when faults developed in a 104-pair L.C. P.C. cable lying in an earthenware duct in the streets of Adelaide. The conduit was one of a 6-way earthenware duct laid down in December, 1906, and the



4.—A Street in Adelaide where Lead Sheath of P.C. Cable was Destroyed by Ants.

affected cable was drawn in in February, 1907. Prior to drawing in, the duct had been swabbed out in the usual way. When investigation was made it was found that the lead sheathing was badly eaten away in many places and over a total distance of about 20 ft. Prompt measures were taken to ascertain the precise nature and extent of the damage, and the presence of white ants was discovered in several portions of the Adelaide underground system. In no other case, however, was the insulation of the cables affected. When the faulty cable was withdrawn the usual brown excretion of white ants was found adhering to it. 4 is a view of the scene of the occurrence. The damage occurred near the base of a red

gum pole (which for better protection from the termites had been set in concrete) and about sixty feet from the nearest manhole.




5.—A Piece of the Butt of the Pole adjacent to Damaged Duct.

In this manhole certain wooden plugs fitted into spare ducts were found infested with the ants, as was also a length of Jarrah troughing

containing electric light mains. 5 shows a piece of the wood taken from the butt of the adjacent telegraph pole. It was at first difficult to determine by what means the insects had obtained access to the cable duct at this point, as the ducts had been laid on a bed of 4 in. concrete and both sides and top were protected by concrete 3 in. thick. Further investigation revealed a crack in the concrete, and it was apparently through this crack that entrance to the ducts had been gained. Once inside, the heat of the asphalte pavement would be conducive to their multiplication.

As has been stated only one cable was affected, but as the termites had been found in more than one manhole and the matter was far too important to permit of any risks being taken, special action was set on foot to deal not only with the duct affected, but all other duct routes where the least sign of the pest was visible. The ends of the ducts were sealed with clay, and fumes of carbon bisulphide were pumped through. In order to test the efficacy of the fumes a glass jar partly filled with decayed wood and containing some white ants was placed in an intermediate manhole and the fumes applied until the insects had all perished. This treatment has proved successful, but having regard to the fact that white ants have also been found in the cable conduits in Perth, and that not very long since they attacked the lead sheathing of a tramway feeder cable enclosed in wood troughing in Sidney, close search is now made in all the Department's manholes whenever these are opened for any sign of the presence of white ants.

It was at first thought that the lead sheathing had been destroyed by the cutting action of the insects' mandibles, but subsequent analysis tends to show that the damage was probably caused by formic acid deposited on the cable sheathing by their operations. In any case the significance of the incident will not be lost upon telegraph engineers who are responsible for the maintenance of lead-covered cables in districts infested with the white ant, and to whom hitherto they have been regarded as destructive only to poles and ground timber. J. M. C.

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## MULTIPLE WAY DUCT-WORK.

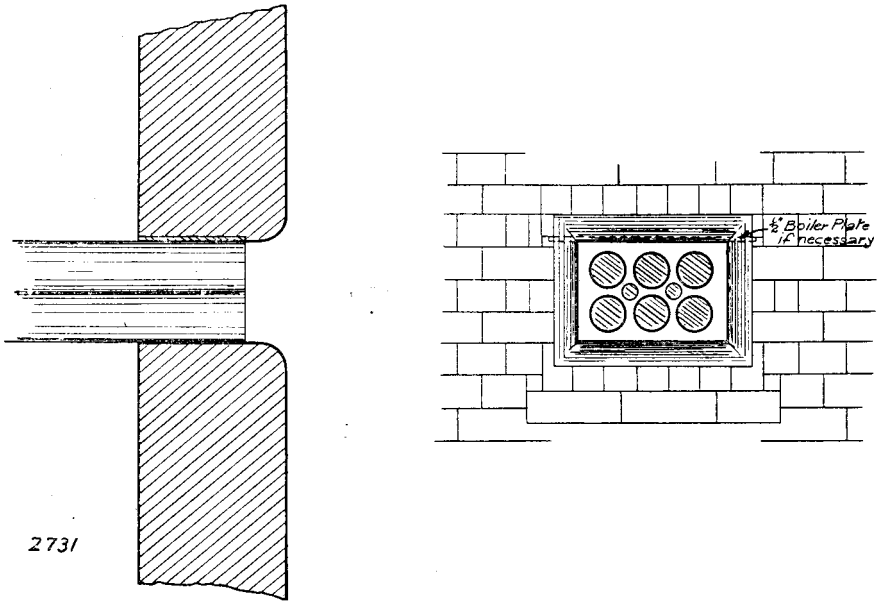
By J. WHITEHEAD.

THERE is, at present, every indication that the use of multiple way ducts, in preference to C.I. pipes, will become general in connection with the Department's large underground schemes, where more than one pipe would be necessary.

A very large scheme, known as the London-Aylesbury-St. Albans

underground route, has just been completed on which these ducts were used. The total trench mileage is approximately fifty miles. The ducts used vary in type, according to the local requirements, the route near London being 9-way, reducing to 2-way beyond Watford. Occasional 3-way and 6-way sections were laid to accommodate local telephone cables.

The route is intended to carry "loaded" cables, and manholes to take the loading coils have been constructed, spaced 4078 yards apart. Specially large manholes are required for these purposes, and types known as F 8 (footway special), internal dimensions 8 ft. by




I.—Sketch showing the Recessing of the Ducts in Smaller Manholes and Double Junction Boxes.

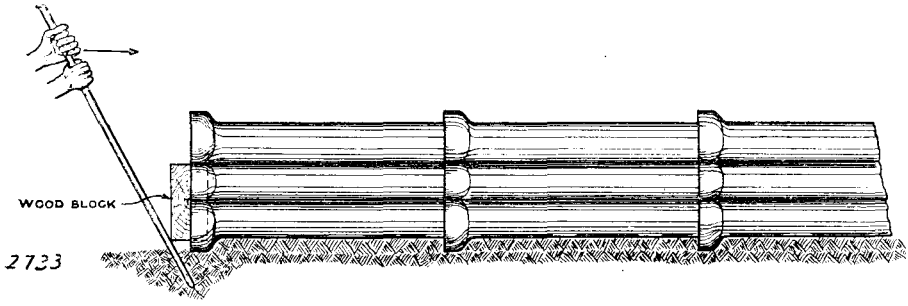
5 ft. 6 in. by 6 ft., and C 8 (carriage way special), internal dimensions 7 ft. by 7 ft. by 6 ft., have been built.

In the 9-way sections the jointing chambers consist of F 5 or C 4 and other large type manholes. In the 6-way sections F 2 and C 2 manholes have been built, and in the 3- and 2-way sections double junction boxes are placed under all made-up pavings, buried jointing couplings being used under inexpensive pavings, such as gravel, ordinary macadam, and under grass margins.

The internal length of a C 2 manhole is 4 ft. and of a F 2 manhole and double junction box 4 ft. 3½ in., which does not allow sufficient room for jointing main cables with the standard 2 ft. sleeves. As there are no terminating pieces or their equivalent supplied with multiple way ducts, when the work was arranged the

question arose as to whether it would not be necessary to build larger jointing chambers to allow of sufficient jointing room. The difficulty, however, was overcome by what is known as "recessing," *i.e.* terminating the ducts, 4 in. or more, in the brickwork of the chambers in the manner illustrated in the sketch (1). The top, and side edges of the bricks at the end of the recesses, are chamfered and rendered with cement, which gives a smooth run for the cable drawing-in rope.

The ducts are made of brown stone-ware well burnt and glazed. The ordinary duct is 2 ft. 6 in. long with spigot and socket ends, lined with Stanford's compound to ensure a true fit. This compound consists of tar loaded with limestone dust and sulphur. The lining adheres so firmly to the stone-ware that it cannot be removed without taking some part of the stone-ware away with it. The spigots and sockets present a well-finished appearance and fit




2.—Jointing and Aligning the Ducts.

accurately and closely; the depth of the socket is $1\frac{3}{4}$ in. and the spigots $1\frac{1}{2}$ in.

The ducts are issued with a red paint mark on that side of the duct which must be face upwards, and a black paint mark on the side which should rest on the bottom of the trench. Instruction to this effect is given by means of an adhesive label pasted on occasional ducts by the maker. It is very important that this instruction be observed, or true alignment will not be obtained, and the ducts will show a tendency to twist and fail to lie perfectly flat in the trench.

In preparing for the laying of the ducts, the trench in all cases should be well rammed, so as to make a firm bedding for the conduits, and at all points where the sockets rest, the trench should be scooped out, so that the body of the duct rests upon solid ground. The depth of the trench is specified in the contract for each particular case; generally it is 18 in. under footways and 2 ft. under roadways. There are, of course, circumstances where additional depth is necessary, but these cases are left to the discretion of the supervising officer. The line must be kept as straight as possible. If it is necessary to deflect from a straight line a slight

"set" may be given to the joints. With regard to the "set" experience has shown that not more than $\frac{1}{8}$ in. per joint should be given. Anything greater leaves the joint open and admits of the free ingress of water. This "set" gives a deflection of approximately 1 ft. in ten ducts, for $8\frac{1}{3}$ yards; for most purposes this is found to be enough.

In making the joints, the linings of the spigots and sockets should be well luted with the jointing mixture or compound. The first mixture used, consisted of four parts resin and one part Russian tallow boiled together and applied hot by means of a brush. Afterwards a mixture, consisting of eleven parts Canadian tar to nine parts vegetable pitch, was tried; both these mixtures have, however, been superseded by a compound of coal-tar, French chalk and palm pitch, which gives very satisfactory results. It is essential that the surfaces of the linings be thoroughly cleaned before the luting mixture is applied. The ends of the ducts having been served with the luting mixture, the spigot end of the duct to be laid is thrust into the socket of that already set in the earth and forced home. This is done by means of an iron bar used as a lever, with a piece of wood inserted between the end of the duct and the bar, to take the thrust (**2**). It is very important that close attention be given to the jointing. The ducts must be properly forced home, and where possible laid in true alignment. Only one duct should be laid and fixed at a time, not a series of two or three. When a "set" has to be given the face of the joint should be thoroughly plastered with the jointing material used.

At buried joints in the 2- and 3-way sections, stone-ware jointing couplings were used. Each "coupling" consisted of five pieces of stone-ware in all—viz. four splits, and one double spigoted duct. Pending the making of the joints in the cables, these couplings were sealed with clay round the flanges of the splits, but when permanently sealed hot bitumen was used. It has since been found, however, that these couplings are not sufficiently strong and they have now been superseded by cast-iron couplings.

Each completed section is tested by drawing through an iron mandril $9\frac{1}{2}$ in. by $3\frac{1}{8}$ in. and a piece of 3-in. lead cable 6 ft. long.

As the ducts are laid it is usual to draw an iron mandril through each hole, so that the contractor can detect at the outset any defective alignment, which would be much more difficult to remedy if left until the section was completed, as the removal of the obstruction would then entail taking out and replacing a larger number of ducts. By lifting the ducts into the form of an arch the top duct can be removed. When restoring the ducts great care should be taken to re-lute all joints which have been disturbed.

The next illustration (**3**) shows an arrangement which is usually adopted by contractors in working the mandrils through as the

work proceeds. A portable wooden framework carrying reels to the same number as bores or holes in the new duct line is

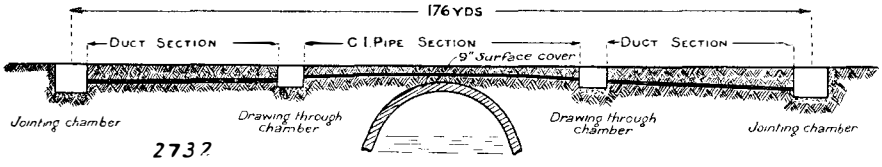
3.—9-way Duct with Reels and Ropes for passing Mandril forward.

fixed over the opening from which the work is proceeding. The reels are fixed on spindles to move freely, and carry a sash-line or thin rope, the free end of which is attached to the mandril drawn from duct to duct as they are laid; the mandrils are drawn

forward by means of an iron rod 2 ft. 6 in. long, with a small hook at the end. This, the duct-layer inserts into the conduits, hooks the eye of the mandril, and pulls it through. The rope pays out from the reels without any attention being required. When the length or section is completed the mandrils are withdrawn and the rope is used to draw in a stouter one for pulling through the standard mandril and test piece of cable. The latter is drawn through without any lubricant, and is quickly reduced in diameter. It is therefore necessary to replace it by a fresh piece fairly frequently. A stock of test pieces should, therefore, be kept at hand for the purpose. After passing through about fifteen lengths, the test cable is usually reduced about $\frac{1}{8}$ in. in diameter and a fresh test piece is necessary.

The ducts are requisitioned and supplied in lineal yards.

In addition to the regular $3\frac{1}{4}$-in. holes in the large ducts there are small holes $1\frac{1}{2}$ in. in diameter, four being in the 9-way size and two in the 6-way. These small holes will take cables up to $1\frac{1}{4}$ in. diameter.




4.—CROSSING A CULVERT.

Care is necessary in handling the ducts to avoid breaking the socket flanges, which are easily damaged. All ducts chipped or fractured are discarded.

The ducts do not lend themselves to the easy negotiation of bridges, culverts, and other obstructions of a similar nature, especially if the depth of cover is small. In such circumstances the difficulty may be overcome by inserting a short section of iron or steel pipe as shown in 4, suitable drawing-through chambers being built on each side to admit of standard length of cable being drawn through. It is found that, generally speaking, these bridges or culverts, which are not infrequent on provincial main roads, are constructed with two $4\frac{1}{2}$-in. ringed arches, and, on account of the heavy nature of modern road traffic, cutting through them is inadvisable.

The width of trench for 2- and 3-way ducts is 18 in., ditto for 6-way in two lines of three, and for 9-way 24 in.

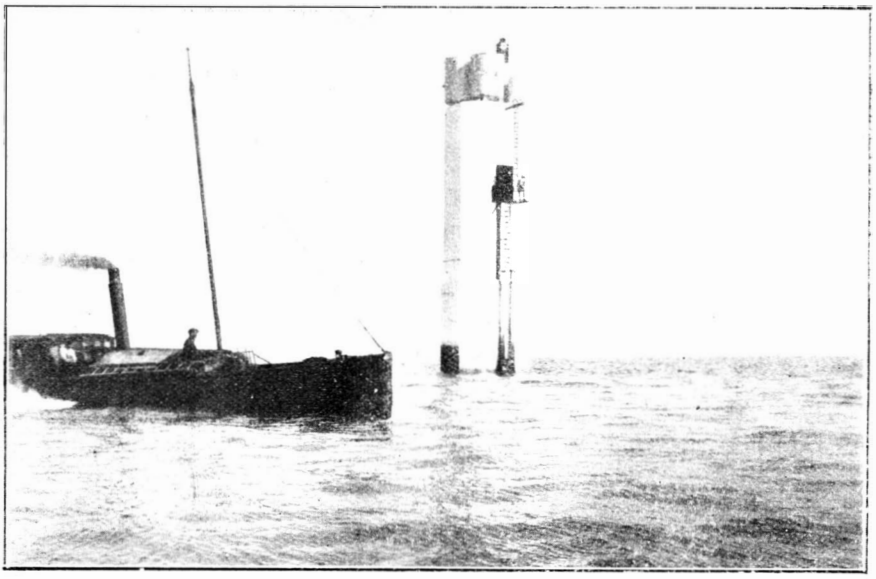
| | cwts. | qrs. | lbs. | |
|---|---|---|---|---|
| Weight of 9-way ducts is | 1 | 2 | 0 | each |
| ,, 6-way ,, | 1 | 0 | 10 | ,, |
| ,, 3-way ,, | — | 2 | 14 | ,, |
| ,, 2-way ,, | — | 1 | 19 | ,, |

# ELECTRICAL DEVICES AT PLATTE FOUGÈRE LIGHTHOUSE.

By Edwin O. Catford.



A little over three years ago the writer was placed in charge of a lighthouse, which, being the first and only one of its kind, presented plenty of scope for study. Various problems presented themselves, which, owing to the unique character of this lighthouse,

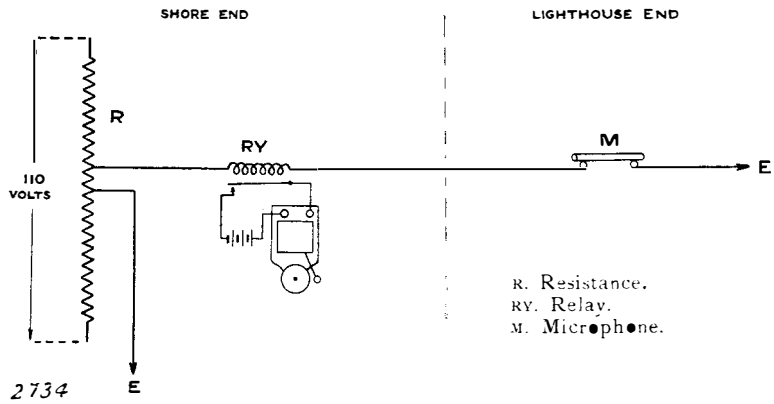


1.—Platte Fougère Lighthouse. View from Landward Side, Pilot's Launch passing.

could not be solved by reference to past experience elsewhere. How the writer met these difficulties may be of interest. In every case simplicity and reliability were essential in order that the apparatus might be handled and understood by technically untrained attendants.

The lighthouse is a concrete tower built on Platte Fougère rock, nearly a mile and a quarter from the N.E. of Guernsey, a coast strewn with rocks, and very dangerous to navigation. During fog, power is transmitted from the engine-room ashore to an electric motor on the lighthouse. Air is then compressed into three tanks on the summit of the tower, and a clock, wound by compressed air, allows a blast to pass every ninety seconds through a siren and horn. This fog signal has been heard at a distance of more than 30 miles.

Two lightkeepers reside ashore, where the generating plant is established, and on the approach of fog have to start a 25 h.p. oil engine directly coupled to a 11½ k.w. three-phase generating set, which transmits about 15 amps. at 600 volts through the submarine cable. The cable is probably the heaviest armoured rock type yet made with G.P. insulation. It contains three power cores of 19/17 copper and two wires of 7/23 copper. The latter were provided in order to work a drop switch on the lighthouse, by which, in the event of the breakdown of one motor, a spare motor coupled to a second air compressor could be at once started in its place. How these two wires have been put to many other uses in addition to the single one for which they were provided is here narrated.




2.— Fog Signal Tell-Tale.

## Fog Signal Tell-Tale.

The man in charge of the engines ashore is responsible for the correct working of machinery more than a mile distant, and it is of the first importance that he should have some means of knowing that the fog signal is performing its duty. The horn being directed away from shore towards the N.E., the men in charge are behind, in the very worst position for hearing it. Moreover, the atmosphere conveys sound in a most capricious way, so that a fog signal, which on occasion is heard along the coast of France thirty miles distant, and is quite ordinarily heard in Alderney twenty miles away, is on many days barely audible ashore just over a mile distant. Some means had to be found by which each blast could be signalled to the engine-room. Obviously, this device must be operated by the vibration of the blast itself, and the first experiment was to construct, with the aid of arc lamp carbons, what is probably the largest microphone ever put to use. This was placed inside the lighthouse, so

that by listening ashore each blast could be heard by telephone. Listening at the telephone entailed waste of time and took a man from other duties, so that an electric lamp was substituted, which ceased to glow at every blast. Watching this lamp, however, had almost the same objections as the first method, so that the present device was finally adopted, by which a bell rings in the engine-room at every blast. The signal acts instantaneously, the actual sound of the blast reaching shore five seconds later.

This tell-tale has been an invaluable aid, and when the exact time of the blasts has been obtained from the tell-tale, it is remarkable how much easier it is to catch the sound on days when they are very feebly audible. The tell-tale is arranged to respond only to the full blast, and on one occasion the siren stuck with the ports open, so that the air escaped each time in a huge gasp instead of a blast. These gasps could be heard ashore, the day being good for hearing, but this was not enough to operate the tell-tale, which thus indicated in the engine-room that something was wrong at the lighthouse. The microphone consists of sixteen arc lamp carbons arranged four in series and four in parallel, and the current required, at about ten volts, is taken from the 110-volt exciter by means of the potentiometer method (see **2**).

### Gas Supply Tell-tale.

The light shown in the lantern is from an acetylene burner flashing every ten seconds, and is turned on at sunset and extinguished at dawn by means of a clock which requires winding every three months, a small by-pass flame remaining always alight. The acetylene gas required is supplied from two steel cylinders, each containing enough gas to last about one month, and before the cylinders in use are exhausted they have to be changed for full ones in order that no interruption of light may occur. Formerly no means existed for ascertaining how the acetylene was lasting, except by paying an inspection visit. This led to many boat trips, which, in winter particularly, had often to be undertaken in unpleasant and dangerous weather in order to prevent any risk of failure of light through shortage of gas. Many of these boat trips carried with them all the spice and excitement of adventure, and the writer well remembers one Sunday evening in particular when, the light having failed to come on, a visit was undertaken to rectify matters. Before one could leave the lighthouse again night had fallen, and as the boat could not remain close with the sea then running, a jump had to be made quickly as the boat swung up on a wave. In the darkness the writer found his feet not in the boat but in the sea, but having fortunately caught hold of the side of the boat, he was quickly hauled in.

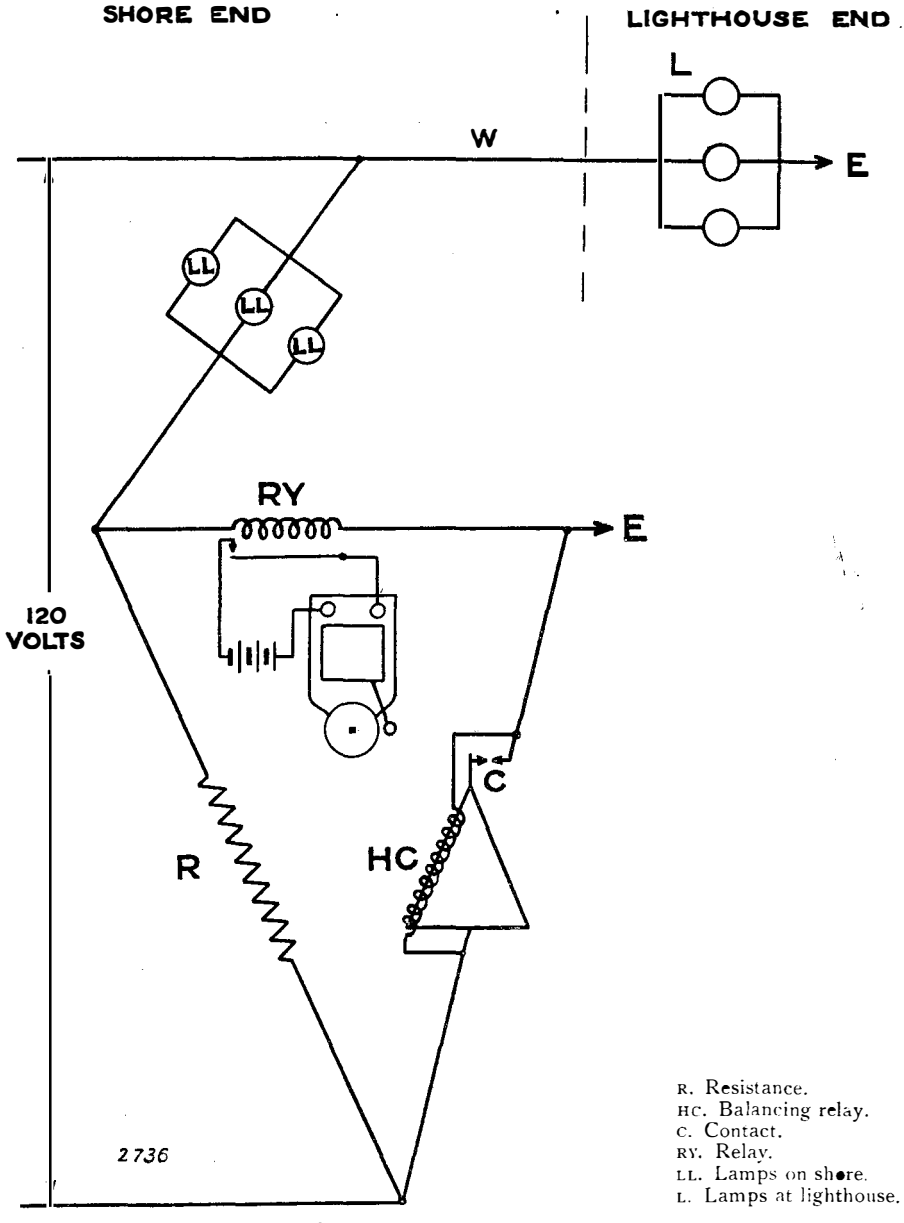
These considerations led the writer to fit an arrangement by which an alarm is given ashore so soon as the gas pressure at the lighthouse falls below a certain amount which represents a fortnight's supply. To speak more correctly, a bell rings every hour so long as the gas supply is ample, so that any failure of battery or bell is equally indicated. When the bell ceases to ring at the hour a button is pressed, and if the bell then rings it shows that bell, battery and all shore-end connections are in good order, and the boatmen are notified that a visit must be paid to the lighthouse on the first fine day. Emergency visits in bad weather or late in the day have been largely eliminated, and a practical illustration of the utility of the device may be given by mentioning that the first year's boating charges amounted to £33. In July of the second year this device was fitted, and for that year the boatage charges were reduced to £18, while for the third, being the first complete year under the new conditions, the charges have amounted to £9 only.

## Electric Light.

The light may fail from other causes than shortage of gas. More than once the by-pass flame has become extinguished from some unknown cause, and when this has happened during rough weather, several days have elapsed before it was possible to reach the lighthouse to relight the gas. For this reason electric lamps have now been fitted in the lantern at Platte Fougère, so that in the event of failure of the acetylene light it is possible to work an electric light in its place. The flasher in use is of the thermic type commonly used in connection with shop signs, in which the passage of current causes a contact arm to alternately expand and contract, thus closing and opening the circuit for the light. This flasher cannot be adjusted to work at a regular speed, and were the electric light in constant use or were there any other lights in the neighbourhood for which the lighthouse might be mistaken, a rotary switch driven by a small electric motor or by clockwork would need to be used to ensure exact timing of the flashes. For occasional use the present arrangement serves very well and several captains have expressed a preference for the electric light. Since the acetylene burner occupies the focal position in the lantern the electric light is at a disadvantage, and therefore three electric lamps, each of about the same candle-power as the single acetylene burner, are provided. The net result seems to be that in clear weather, at any rate, the electric light can be picked up at a much greater distance than the acetylene light.

It being essential that the man in charge shall know what is happening at the lighthouse it is arranged that every time

the electric light flashes in the lantern of the lighthouse an electric bell rings in the engine-room. Experience has shown




R. Resistance.
HC. Balancing relay.
C. Contact.
RY. Relay.
LL. Lamps on shore.
L. Lamps at lighthouse.

3.—Electric Light Check.

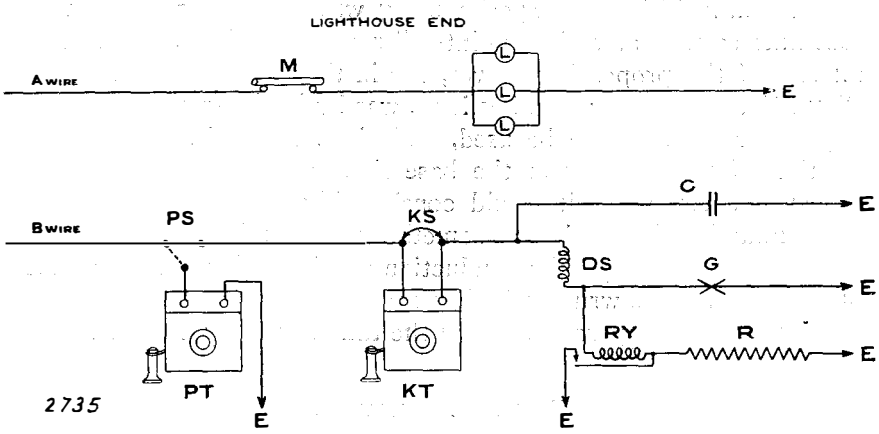
that an audible signal is far preferable to a visible one, and it must be mentioned that the man in charge of the engine cannot readily watch the actual light from the lighthouse because

the principal windows of the engine-room face S.E. and S.W. respectively, while the lighthouse lies to the N.E. Electric lamps as now made are fairly robust, but the fog-signal when working causes very great vibration, and therefore it has been arranged that in the event of the filament of a lamp breaking while the electric light is in use, the signal-bell will announce the accident by ringing continuously instead of only at each flash. This is accomplished by means of a Wheatstone bridge arrangement, three lamps ashore balancing the three at the lighthouse. Should the bell ring continuously it can at once be proved whether this is caused by the failure of a lamp at the lighthouse by taking out a lamp ashore. If the bell then stops it shows conclusively that two lamps only remain at the lighthouse. Thus the lamps, although over a mile distant, are nearly as completely under observation as if they were at hand ashore. One Tantalum and two Osram lamps for 105 volts are in use, about 15 volts being lost in the cable (see 3).

### An Ocean Telephone Call Office.

It was very soon found that during visits to the lighthouse a telephone for the use of the keepers was indispensable. This instrument is in one of the chambers of the lighthouse and can only be reached by the keepers themselves. Lately it occurred to the writer that a telephone outside the lighthouse accessible to all who care to climb the ladder might prove of value, and thanks to the kind permission of the supervisor, Mr. Julius Bishop, this has now been fitted. The primary object of the new telephone is to obtain news of the approach of mail boats during fog, when, guided by the sound of the fog signal, they frequently creep up to within two ships' lengths of the lighthouse before dropping anchor. In future, any pilot knowing of the presence of a mail boat may at once telephone this news to the Central Telephone Exchange of Guernsey, where it will be placed at the service of any subscribers making inquiry throughout the island. It is hoped that pilots will make themselves familiar with the telephone, so that when any sudden emergency calls for its urgent aid there will be no doubt or uncertainty as to its use. The act of opening the door disconnects various tell-tale and other lighthouse devices from the cable, leaving the pilots' telephone in their place. By ringing up in the usual way, the lightkeepers ashore, one of whom is always on duty day and night, can be called, and thence the telephone is plugged through to the Exchange. On leaving the telephone it is essential that the lighthouse door shall be properly closed, and to safeguard against forgetfulness it is arranged that the pilot using the telephone cannot lift the trap-door to reach the ladder until the door is first entirely closed. Only one wire in the submarine cable is available for the telephone, so that an

"earth return." is used, with a transformer ashore to connect with the Guernsey system. Speaking is good even when 18 electrical horse-power is passing through the power-cores of the same cable to work the fog signal. The instrument in use is of the usual type in a walnut-wood case, all coils, etc., being well paraffined, this being preferred to the watertight "mining" telephone with iron case, which seems to invite leakage and condensation troubles. For the present the keepers' telephone inside the lighthouse is being retained, since the pilots' telephone is in a somewhat exposed position and is more likely to get out of order; should that happen, the second telephone will prove an invaluable aid (see 4).




4.—AN OCEAN TELEPHONE CALL OFFICE.

PT. Pilot's telephone. PS. Pilot's switch. KT. Keeper's telephone. KS. Keeper's switch. DS. Drop switch.

## AUTOMATIC FOG ALARM.

The writer has devised an automatic fog alarm, which so far remains on paper only. This consisted of a selenium cell fitted on the lighthouse at 15 ft. distance from the lantern. So long as the light flashed on the cell every ten seconds an alarm bell ashore would be prevented from ringing. When fog obscured the light, or when it failed from other causes, the alarm would be given ashore.

## INDUCTION.

The Guernsey-Alderney and Guernsey-England telegraph cables lie parallel with the lighthouse cable at not many yards' distance from it, and at one time Post Office engineers feared that some inductive disturbance might result in the telegraph cables when the fog signal was at work. Careful tests, however, showed these fears to be groundless, and the fact that speech is possible from the light-

house, using an earth return, is additional proof of the absence of inductive effect.

### Wireless Telephone: Guernsey to Herm.

Another project which the writer regrets has not come to fruition is the linking up of the small island of Herm with Guernsey by means of a wireless installation on the Skerries model. Herm, with less than two score inhabitants, obviously could not contemplate an expensive system with complicated machinery, and the simplicity and cheapness of the proposed experiment seemed greatly in its favour. Moreover, Guernsey with its network of telephone lines seemed to offer exceptional facilities for experimenting with a number of different base lines earthed at various points all round the island. The chief interest of the proposal, however, lay in the fact that the cable to Platte Fougère, nearly 1¼ miles long, was by kind permission of the Supervisor permitted to be used, and since the addition and subtraction of the cable from the base line would scarcely alter the inductive effect, while it would considerably affect the distance of sea conduction, it was hoped something more might be learned of the relative parts played by conduction and induction in this method of telephony. The writer still has some hope that something may result from this proposal, although the time has not yet come for it.

### General Remarks.

The wire used for connecting the various devices described is 3/20, which for mechanical and other reasons seems the smallest desirable. Eight hundred megohm insulation is used, and in the writer's opinion this is quite as reliable and lasts fully as well as more highly priced grades of insulation. Makers often provide fittings with the smallest possible terminals, leading to the objectionable practice of inserting one strand of wire in the terminal and cutting the other strands short. To ensure terminals of ample size the writer finds it advisable to use no cut-out or switch rated under 10 amps., even where less than one ampère is involved.

To guard against failure of apparatus depending on a battery it seems wise to provide fully double the number of cells that would at first seem necessary.

To guard against electrolytic troubles double pole contacts are used, so that no possible battery leakage can take place through the cable when apparatus is not working. With the electric light and other apparatus worked from the exciting current it is arranged that polarity is reversed every time a change is made from one generating set to the other.

The neutral point of the three-phase power circuit is not earthed.

For resistances the writer uses carbon filament lamps, whenever possible, owing to their convenience and absolute safety, always using at least two in parallel, so that no device depends on a single filament. So far as possible all batteries, resistances, fuses, etc., are placed at the shore end of the cable, where they can be under constant observation, all apparatus remaining at the lighthouse being reduced to the simplest form. For the protection of the engine-room the writer depends more upon entirely concealed door contacts than upon bolts and bars. Visitors sometimes think they will have a look round the engine-room without troubling anyone, and are surprised to find that directly they have opened the door an attendant appears on the scene.

When Baby Catford was four months old he used to be put to sleep out on the common, with a telephone instead of a nursemaid to let his mother know when she was wanted. So long as the boy's mother could hear the ticking of a clock that lay beside the boy but could not hear him crying she knew all was well, and no failure of the telephone could occur without being known.

Another matter of domestic interest might be referred to. The writer possesses two cats, and because they catch fish as other cats catch mice, visitors sometimes come the five miles from town purposely to see them. They have their own electric bell, which they habitually ring to gain admittance to the house, a little shelf on which they stand making the necessary contact.

## STRUCK BY LIGHTNING.

IT does not frequently happen, I suppose, that a domestic incident forms the subject of a communication to this JOURNAL. The occurrence I have to relate, however, is by no means an everyday one, and as it concerns an experiment in high potential electricity —albeit an involuntary one—it may, perhaps, be found of interest to some few of my colleagues. As a matter of fact it is at the express request of a prominent member of the Institution that I am sending this account for publication.

About a quarter to two a.m. on May 30th, during a violent thunderstorm, I was unfortunate enough to have my residence struck by lightning. The house is situate in a high and very exposed position, and the rain driving tempestuously into the children's room (seen to the right of the photo) caused me to hasten thither, in response to their cries, to close the windward window. Whilst so engaged I remarked the extreme rapidity with which the thunder followed the flashes, and realised that I was at no great

distance from the centre of the disturbance. Instead of lingering to watch the display as is my wont, I felt a distinct relief upon retiring from the window after mopping up the worst of the water from a dressing-table which stood there.

I proceeded to the bath-room and was standing within a few inches of the bath when the crash came. It was an appalling, nerve-shattering experience. I cannot easily describe the sound of that discharge, but the noise was, of course, deafening. It was a titanic, reverberating *bang* with a metallic ring at the end of it, and not for a moment to be confounded with even the loudest thunder-clap. It goes without saying, perhaps, that I knew on the instant what had happened, and my first sensation was one of surprise at finding myself still alive and the house standing. But this was no time for speculation. I dashed to the back room, where, by the grace of Providence, I found all safe, though naturally the youngsters were in a state of terror. Having brought them into the front bed-room and calmed them somewhat, I descended to the lower regions to ascertain the damage and to search for fire, which the strong smell of sulphur which pervaded the house seemed to suggest.

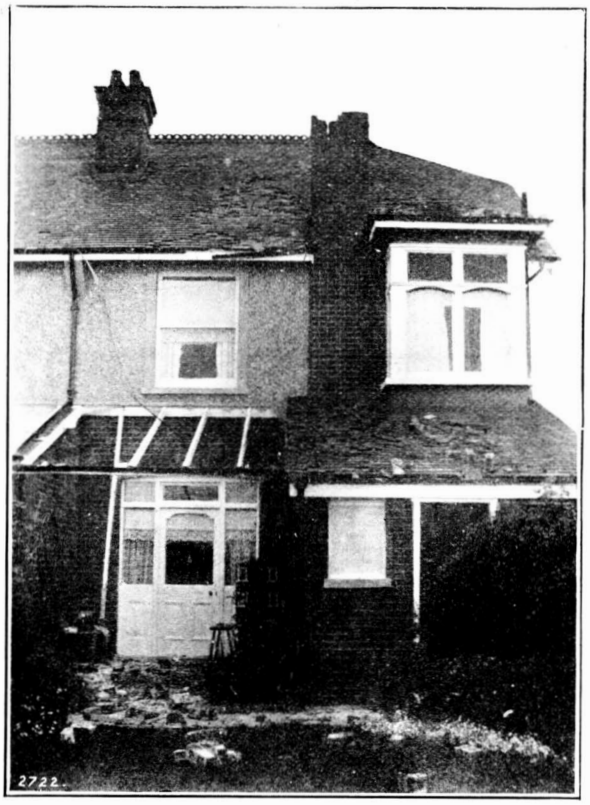
On opening the kitchen door a scene of desolation met my gaze. No fire, but the whole floor was strewn with wreckage, and it took some little time to make out, in the dim light, precisely what had happened there. The mantelpiece lay before me upon a pile of *débris*, and all around were fragments of the stove, tiles, rubble, soot and miscellaneous articles. Strange to say the clock on the wall above the fireplace was still ticking merrily, though a later examination showed that two of the pins clamping the movement to the case had been shaken out.

Finding no further internal damage I reascended and observed the rain coming through the ceilings of the two back rooms, showing that the main roof had been holed, and I could also make out that masses of brickwork had fallen on and through the roof of the rear extension and had also cleared the whole of the glass from a 10 ft. by 10 ft. verandah (1).

As the rain soon ceased there was nothing to do but to wait for daylight.

Subsequent investigation showed that the point which was first struck was a galvanised iron elbow extension surmounting the rear chimney-stack, and this was confirmed by a neighbour who happened to be looking in the direction of my house at the moment, and who described the phenomenon as a ball of light, about a yard in diameter, which appeared to rest for a second or two on the chimney and then to explode and disappear. The charge, no doubt, found a more or less easy path through the probably damp soot of the chimney, but on reaching the kitchen grate—which I should state was of sitting-

room pattern—it apparently had to make contact with the boiler behind in order to get to earth *viâ* the hot and cold water systems, and in so doing was forced to spark across the gap: hence the disruptive effect upon the fireplace. As the boiler is inaccessible without removing the surrounding fire-clay I have been unable to make a thorough examination of it, but the probability is that the soot and scale would obliterate any physical evidence of the passage of a



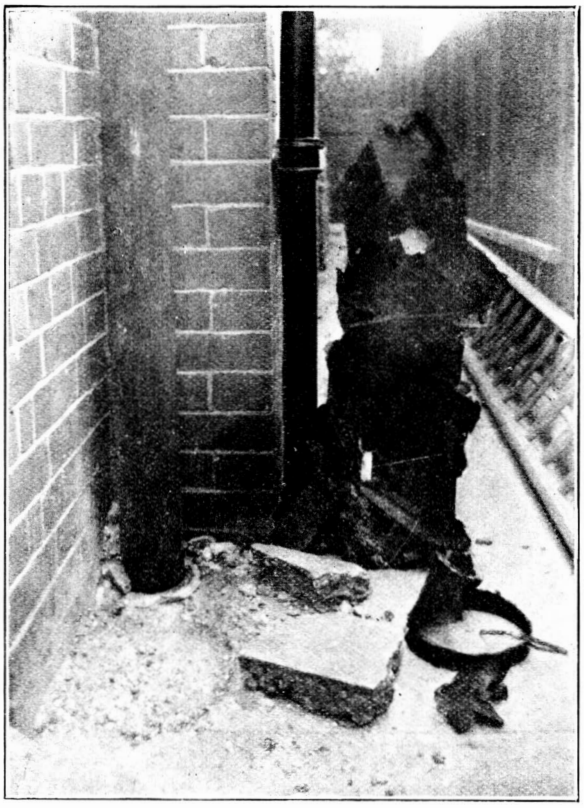

**I.**—View of the Back of the House after Flash.

current. Incidentally, it would be interesting to know what would have been the effect had I been *touching* the enamelled iron bath at the critical moment, and also whether there is any connection between this assumed path of the current and the fact that to me—judging from the location of the sound of the discharge—it was apparently the bath itself which had been struck whereas the actual points of contact were in a totally different direction.

It is somewhat remarkable and certainly most fortunate that no portion of the charge worth considering passed down the other chimney of the stack—that of the children's room. The only effect

on the grate of that room was a slight loosening. There would be a certain amount of soot in this chimney, but the absence of a boiler no doubt made all the difference.

The whole of the charge did not, however, pass down the chimneys, and this appears to me to be a point of interest. Amongst the material lying by the side of the house I observed, near the base of an iron ventilating shaft, two slabs of cement work, measuring together



2.—Damaged Concrete at Base of Ventilating Shaft.

about a square foot by 3 in. thick, which had been lifted up and deposited close by. The galvanised wire cap at the top of the pipe was thrown down, and though this shows no mark of violence, it would appear that the current divided, and possibly the major portion leapt across and down from the chimney top to the cap of the shaft. There is no other way in which to account for the displacement of the cement, and, in fact, this is precisely what might be expected to occur, as the shaft terminated just beneath the cement in an earthenware duct, hence the easiest path to earth would lie under the concrete. The socket of the duct was broken away, and the slabs

and also the particles of cement left behind bear distinct traces of the passage of the current, the heat generated having calcined the surfaces and caused the formation of little glassy nodules. No doubt the resistance presented by the duct socket and the fact that the earth beneath the concrete was in a dry state explains the bursting up of the slabs (2).

The chimney-stack was 12 ft. high, and was solidly built of the heaviest bricks I have seen used in dwelling-house construction. Masses of brickwork were flung in all directions, some pieces being 60 ft. distant, and only about 6 ft. of the outer wall of the stack remained. The lead flashing at its base was melted in places, and the "elbow" at the top was torn to shreds, bits of it being found


3.—The Cause of the Damage.

scattered in various parts of both front and back gardens. The larger pieces I have included in the photo showing the base of the ventilating shaft, but I fear they will not show up very clearly in the reproduction. The damage done also included nearly 1000 tiles broken besides gutterings and snowguard carried away, not to mention the wholesale destruction of garden stock. It may be of interest to state, however, that the fire insurance companies concerned accepted liability both in regard to the fabric and the contents of the house, although no actual fire occurred.

I am glad to be able to give a photograph of the identical flash of lightning that caused this havoc. It was sent to me by a local chemist who was exposing some plates half a mile away, and a comparison of times and the topographical evidence of the photo itself remove all doubt on this point (3).

In conclusion, lest some should incline to commiserate with me, let me say that, on the contrary, I should be congratulated on the whole upon my good fortune, for both builder and surveyor have assured me that had the stack fallen *en masse* on the roof it would inevitably have crashed through on to the bed where not only lay my two children, but where also my wife was sitting at the time endeavouring to reassure them, and, had this happened, not one of them, except by a miracle, could have survived.

B. F. GILLETT (Croydon).

## BOOK REVIEW.

'Graphs in a Cable-ship Drum Room,' by E. Raymond-Barker. Published by H. Alabaster, Gatehouse & Co. Price 2*s.* 6*d.* net.

This little brochure is a reprint of a series of articles published in the 'Electrical Review,' January 17th, 1913, *et seq.*, and is intended as an aid to young fellows on first joining the staff of a cable-ship. It deals in a simple way with the principal calculations necessary in connection with the laying of cables—calculations of the cable drum constants, length of cable paid out or picked up, rate of paying out or picking up, amount of cable slack, and the taut wire measuring gear.

Graphical methods of making these calculations, together with a transparent disc calculator for obtaining cable slack or other percentages, designed by the author, are described clearly.

There is one novel point in connection with these graphs which will probably be found to have a wide field of usefulness. Every fifth vertical and horizontal line on the squared paper is continuous, while the intervening lines are printed in *dots* and *dashes* corresponding to the figures 1 to 4 in the Morse code. The curves also, representing, say, various percentages from 1 to 20, are marked in *dots* and *dashes* corresponding to the Morse code figures. This method of construction, especially on large sheets of squared paper, will considerably facilitate working, as the position of any point on the curves can be easily read from the Morse code figures without the irksome necessity of following a line throughout its length to refer to the figure in the margin.

A. G. L.

LONDON-PARIS ELECTROPHONE.—Successful experiments were recently made over the new loaded Anglo-French trunks in the transmission of music from the Paris Grand Opera to London and from Covent Garden to Paris. After some preliminary difficulties had been overcome very successful hearings in both directions were provided.

# HEADQUARTERS NOTES.

## Post Office (London) Railway: Interesting Engineering Project.

Post Office enterprise, particularly on the Engineering side, has come somewhat prominently before the public notice recently, and the proposal to construct a postal tube railway in London has attracted a great deal of attention.

The object of this railway is to enable the Post Office to accelerate the transmission of mails and parcels, to reduce its expenditure on road vans, and to relieve to some extent the congestion of traffic in the streets of the Metropolis. The scheme is, therefore, one of considerable public importance.

The railway, which will be worked and controlled by electricity, will extend from Paddington to the Eastern District Office in Whitechapel, a distance of just over six miles. Access will be given from the Great Western Railway Station to the Paddington District Office, and there will be intermediate stations at the Western District Parcels Office, the Western District Post Office, the West Central District Post Office, the Mount Pleasant Sorting Office, the General Post Office (King Edward's Building) and the Great Eastern Station at Liverpool Street. The depth of the tube will vary between 28 and 87 ft. below the surface of the ground, and it will take a course through the London clay at a minimum depth of 10 ft. below the top of the clay. The tunnel—which will be lined with the usual cast-iron segments—will be 9 ft. in diameter and will have two tracks of 2 ft. gauge, one for the "up" line and one for the "down" line, with a clear walking space between the tracks of 1 ft. 6 in. At the stations, separate tunnels, having an enlarged diameter up to a maximum of 25 ft., will be provided for the "up" and "down" lines; they will be on the same level and have a distance between them of about 20 ft. with passages to provide accommodation for lifts, elevators, shutes, and control cabins. Access will be provided by means of passages from one tunnel to the other to connect the two platforms, which will be constructed on the inside of each tunnel, thus forming a combined island platform. At certain stations provision will be made for subsequent extensions in northerly and southerly directions.

The trucks, which will be made of steel, will be capable of taking the largest receptacle at present in use in the Post Office. These receptacles will be transferred from the several post offices to the subjacent stations by means of spiral shutes or elevators, whence they will be transferred in trolleys to the trains. The mail receptacles,

on arrival at the stations, will either be trolleyed to the base of an elevator or lift, or, at the more important stations, will be dropped through openings in the station platform on to a continuously moving band conveyor, which will transfer the mail receptacles to the elevator, where they will be automatically picked up and raised to the sorting office level.

Between the stations the maximum speed of the trains will be thirty-five miles an hour, but when running through stations, the speed will be reduced automatically to about twelve miles an hour. Trains intended to stop at a station will be automatically reduced when nearing the station to a speed of six miles an hour. Changes in speed will be brought about by variations in the pressure of the current provided for driving purposes. The section of the track adjacent to a platform at which it is intended a train shall stop will be made "dead," and the train brought to rest by an electric brake automatically applied.

The trains will be controlled by men located in the control cabins at the several stations (referred to above). No drivers will be employed on the trains themselves; that is to say, the trains will be worked on the "distant control" principle. As was pointed out to the Select Parliamentary Committees by Mr. Slingo, the distant control method itself is not novel—every application of electricity is an illustration of it—but this will be the first instance of a railway designed solely for the transmission of mail matter on a commercial scale and utilising trucks without drivers.

The capital cost of the scheme is estimated at £964,000.

The scheme has been prepared by the Engineering Department, but Mr. H. H. Dalrymple-Hay, who holds the premier position in London as consulting engineer for tube railways, has been called in to assist the Engineer-in-Chief in the design and construction of the Tube, so that this portion of the scheme, which falls outside the usual scope of the work of the Engineering Department, is in good hands. The equipment has also been carefully thought out, but as this portion of the scheme will be put out to tender on somewhat open lines, it is probable that many of the details will be subject to variation. Concurrently with the equipment of the railway the present generating station at Mount Pleasant will be dismantled.

### Exchange Equipments.

An order has been placed for the equipment of a new C.B. Exchange at Purley for 1200 lines.

Orders have been placed for extending the existing equipments at Edinburgh, Langside, Lee Green, Lincoln.

Installation of C.B. equipment has been commenced since the last issue of the Journal at—

| | |
|---|---|
| Barnsley (New Exchange) . | . 480 lines. |
| Kilmarnock ,, . | . 440 ,, |
| Llanelly ,, . | . 400 ,, |
| Museum ,, . | . 9720 ,, |
| War Office (New P.B. Exchange) | . 500 ,, |
| Avenue (Extension) . | . 420 ,, |
| Doncaster ,, . . | . 280 ,, |
| Ibrox ,, . . | . 120 ,, |
| Kingston ,, . . | . 540 ,, |

## Insulated Wire for Crossing Unguarded Power Circuits.

A covered bronze wire for the above purpose has been added to the list of standard articles. The conductor is about 60 mils in diameter, weighs 55 lbs. per mile and has a resistance of 28·6 ohms. at 60° F. It is insulated with a double layer of specially prepared paper and a lapping of cotton, the whole being braided with jute yarn impregnated with a weather-proof composition. The weight of the completed wire is about 134 lbs. per mile; say 5 lbs. to a 65 yards span.

At each end of the span which crosses the power circuit the insulated wire is terminated in the following manner: A covered binder is first passed round the the lower groove and twisted for one or two turns close to the insulator, leaving the two ends to form a double binder; then the end of the covered bronze wire is taken once round the lower groove and laid beside the main wire for a distance of 7 in. from the centre of the insulator. The double binder is then tightly and closely wrapped round the two for a distance of $2\frac{1}{2}$ in., after which the end of the bronze wire is turned sharply back and wrapped three times round the termination; finally the wrapping of the binder is continued along the main wire for a distance of 1 in.

The covering of the bronze wire is removed for a distance of $1\frac{1}{2}$ in. for jointing to the tail piece of the bare line wire of the adjoining span, which is terminated on the upper groove. The connection between the tail pieces is made by means of a nib joint, *i.e.* the ends of the two wires are inserted into the same end of a copper jointing sleeve and the whole given two complete turns to ensure good electrical and mechanical connection.

## Rupinised Wood Poles.

The Ruping process of creosoting having been adopted by the Post Office it is thought that a few words on the subject may be of interest.

The theory of this process is that it gives as good penetration of

creosote oil and as great duration of life as was obtained by the methods formerly in use, although only half the quantity of oil is required. These results are obtained by first forcing air into the timber and thereafter forcing in oil. When the pressure is taken off the expanding cushion of air forces the unabsorbed oil out of the sapwood, leaving as a preservative only so much as saturates the walls of the cells.

Briefly, the details of the process may be described as follows: The timber, properly seasoned and dressed, is enclosed in a cylindrical iron tank, and air is pumped in until a pressure of 50 to 55 lbs. per square inch is obtained.

Creosote is then run in and the pressure gradually raised to 135 or 140 lbs., the temperature maintained being about 130° to 140° F. When the pressure is taken off the surplus oil is driven back into the storage tank.

After the poles are taken out they rapidly become dry on the surface, and they are consequently much less objectionable to handle than poles creosoted by the ordinary process.

It is contended that owing to there being little or no free creosote oil in the timber the surrounding soil does not become saturated with it by exudation after the poles are erected.

But perhaps the principal advantage claimed for this process is economy, the amount of creosote oil retained by the timber being, as stated above, only about one half of that retained with the ordinary method, viz. 5 to 6 lbs. per cubic foot as against 10 to 12 lbs. As the price of creosote has considerably increased of late years this is an important consideration.

## COUNCIL NOTES.

MEMBERS of the Council of the Institution of Post Office Electrical Engineers, for the year 1913–14:

W. Noble, Esq., Chairman.

| | |
|---|---|
| Mr. J. Sinnott<br>Mr. W. Cruickshank | Engineer-in-Chief's Office. |
| Mr. J. Brown | Exec. Engineers, London. |
| Mr. F. McMorrough | ,, ,, Provinces. |
| Mr. H. E. A. Wenman | Assist. Engineers, London. |
| Mr. T. Patterson | ,, ,, Provinces. |
| Mr. T. Barradell | Sub.-Engrs. and C.I., London. |
| Mr. H. Cranage | ,, ,, Provinces. |
| Mr. W. T. Harris | Clerical Staff, London. |

| | |
|---|---|
| Mr. P. A. Corney<br>Mr. T. McMullen | Clerical Staff, Provinces. |
| Mr. J. W. Atkinson | Treasurer. |
| Mr. T. Smerdon | Secretary. |

A meeting of the newly elected Council for the Session 1913–14 was held at the Institution of Electrical Engineers, Victoria Embankment, W.C., on June 10th last. Mr. W. Noble presided and offered a cordial welcome to the new members: Messrs. J. Brown, W. Cruickshank, H. Cranage and W. T. Harris.

It was reported to the Council that Treasury authority for free travelling of Senior Inspectors and Inspectors as Associates of the Institution had been obtained, and it was decided to recommend to the members the amendment of the rules to admit Inspectors in addition to the Senior Inspectors and Probationary Sub-Engineers, which had already been approved.

## "President's Award" Competition.

Three papers were submitted for adjudication, two on an engineering subject and one on a clerical matter. The adjudicators awarded the prize of three guineas for an essay on an engineering subject to Mr. A. B. Eason, Assistant Engineer, Engineer-in-Chief's Office (*nom-de-plume*, "Strax"), for his paper entitled "Pneumatics." They decided that the only essay on a non-engineering subject was not worthy of a prize.

A communication from the London Centre *re* proposed alteration of the Constitution of the Institution was considered by the Council.

The proposals were suggested with a view to bringing the constitution of the Institution more into line with that of other scientific bodies and to place the representation on a more satisfactory basis, and involved the following alterations:

(1) The control of London business to be by the Council with the consequent disappearance of the Metropolitan Committee and the formation of a local centre at the headquarters of each Provincial District with the exception of the South-Eastern District, which would be attached to London.

(2) The appointment of salaried officers to be made by the Council from members of the Institution.

(3) Proportional representation of members, including Superintending Engineers, Staff Engineers, Assistant Superintending Engineers and Assistant Staff Engineers.

(4) The members of Council to hold office for three years—one third retiring annually.

The proposals were fully discussed and the following resolution

proposed and carried: "That, after full consideration, the Council are of opinion that it is inadvisable to adopt the suggestion of the London Committee for altering the constitution of the Council."

The following appointments were made by the Council for the Session 1913—1914:

*Board of Editors.*

| | | |
|---|---|---|
| Chairman | . | Mr. J. Sinnott. |
| Members | . | Messrs. J. W. Atkinson and W. T. Harris. |
| Managing Editor | | Mr. W. Cruickshank (from August 1st, 1913). |

*Library Committee.*

| | | |
|---|---|---|
| Chairman | . | Mr. J. W. Atkinson. |
| Members | . | Messrs. J. Brown, H. E. Wenman, W. T. Harris, T. Smerdon. |

*Librarian.*

Mr. J. Smerdon.

*Editing Committee.*

(Four Members) (Chairman of Council and Secretary *ex-officio*).
Messrs. T. Purves, A. W. Martin, J. W. Atkinson, J. Brown.

WINTER PROGRAMMES.

The Secretary was instructed to press the Local Secretaries to supply details of their Winter Programmes in order that the display cards might be issued prior to the commencement of the session.

The next meeting of the Council will be held in London on October 7th.

SUBSCRIPTIONS.

Members are reminded that subscriptions are now due, and their attention is directed to Rules 5 and 8 in connection with this matter. It is desired to complete the collection of subscriptions by October 31st, and perhaps members will be good enough to remit through their local secretaries before that date.

ASSOCIATES.

The amending of the Rules to admit Probationary Sub-Engineers, Senior Inspectors and Inspectors as Associates of the Institution has now been approved by the members, and local secretaries are asked to forward a copy of the special circular which has been issued to each of the eligible officers in their district. It is hoped that all will avail themselves of the opportunity of joining the Institution as associates.

T. SMERDON (*Secretary*).

# LOCAL CENTRE NOTES.

## LONDON CENTRE.

DURING the recess the Committee have been engaged in the preparation of the programme for the forthcoming Winter Session.

The meetings will be held as usual in the Lecture Theatre of the Institution of Electrical Engineers, Savoy Place, W.C., at 6 p.m., the opening date being Monday, October 13th. Mr. A. B. Eason will read a paper on "Telegraphic Traffic and Power Plant for Pneumatic Tubes in Post Offices."

A successful visit took place to Messrs. Siemens' Works on Wednesday, August 27th. A party of forty members took part, and they met with a very cordial reception from the firm. Mr. H. C. Price, a member of the Committee, represented the Institution on this occasion.

The composition of the Committee for the year ending March 31st, 1914, is as follows :

*Nominated Members.*

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|---|---|
| Chairman | Mr. A. W. Martin. |
| Vice-Chairman | Mr. J. M. Shackleton. |

*Elected Members.*

| | |
|---|---|
| Headquarters Staff | Mr. E. Lack, Mr. C. W. Burge. |
| Executive Engineers | Mr. H. C. Price, Mr. J. G. Hines. |
| Assistant Engineers | Mr. E. J. Wilby, Mr. W. Dolton. |
| London Clerical Staff | Mr. A. E. Everett, Mr. E. H. M. Slattery. |
| S.E. District Staff. | Mr. J. Cowie, Mr. F. Penfold. |

*Co-opted Members.*

| | |
|---|---|
| Local Librarians, London District | Mr. G. F. H. Henderson, Mr. C. A. Eastop. |
| Local Librarian, Metropolitan Power District | Mr. R. Smerdon. |
| Local Librarian, S.E. District | Mr. H. Longley. |
| Honorary Secretary | Mr. W. G. Owen. |

Mr. Burge will act as the representative of the Institution at Headquarters.

# THE LONDON CHAMBER OF COMMERCE AND THE TELEPHONE SERVICE.

We are indebted to the London Chamber of Commerce, through the courtesy of Mr. Charles E. Musgrave, Secretary, for permission to reproduce the "Minutes of proceedings of a deputation which waited upon the Rt. Hon. Herbert Samuel, M.P. (Postmaster-General), on July 4th, 1913, on the subject of 'The Telephone Service.'" The minutes were issued in pamphlet form by the Chamber, and in view of the importance of the subject matter to our readers we have no hesitation in printing the report practically verbatim.

The Deputation consisted of—

The Rt. Hon. Lord Southwark (President), Mr. F. Faithful Begg (Chairman of the Council), Mr. L. A. Martin (Deputy Chairman of the Council), Mr. Arthur Serena (Treasurer), Mr. Stanley Machin (Vice-President), Mr. J. S. Daniels (Chairman of the Postal, Telegraph and Telephone Committee), Mr. J. M. Dick (Deputy Chairman of the Postal, Telegraph and Telephone Committee), Mr. S. Kutnow (Member of the Postal, Telegraph and Telephone Committee), Mr. Charles Hopton (Member of the Postal, Telegraph and Telephone Committee), Mr. Charles E. Musgrave (Secretary).

The Postmaster-General was accompanied by Captain Cecil Norton, M.P., Mr. A. M. J. Ogilvie, C.B., Mr. L. T. Horne, Mr. G. F. Preston, and Mr. C. W. Hurcomb.

The recommendations which the London Chamber of Commerce desired to put forward related to:

(*a*) The terms of the contract which telephone subscribers are obliged to sign, and which is considered inequitable from their point of view.

(*b*) The system of registering calls and the urgent necessity of adopting some contrivance whereby calls are registered at both ends of the wire.

(*c*) The provision of additional junction lines.

(*d*) The desirability of modernising the London telephone exchanges.

(*e*) The necessity of accelerating the improvements in the trunk line service.

(*f*) The need for greater efficiency of and supervision of telephone operators.

(*g*) The inconvenience of the "pillar" instrument.

(*h*) The increased cost of telephone facilities.

The deputation was introduced by Lord Southwark, who said that the members had come in a friendly spirit to discuss the service with the Postmaster-General and to assist the Department and the commercial community, because the Chamber thought it was undesirable that the Postmaster-General should have an idea that everything is going on satisfactorily. There would be only three speakers, Mr. Faithfull Begg, Mr. Machin, and Mr. Daniels.

Mr. Faithful Begg: I am glad, Mr. Samuel, that Lord Southwark has emphasised the fact that we are not here in any hostile spirit, that we are not here as captious critics in any sense at all, although we shall have to bring before you certain points which we think require attention. We are rather, as Lord Southwark has said, anxious if possible to assist the Department to bring about changes which we think are necessary, and which probably the Department itself knows are matters which should properly be brought under your attention. We might make the general criticism that the whole system requires very considerable improvement and alteration, but I will not occupy your time with any general consideration of that kind—we shall probably agree to a large extent in that—but rather bring forward specific points to which we think attention might be directed. I will try to be as brief as possible, because we know your time is very valuable.

The first question which I am asked to mention to you is the subject of the registration of calls, to which I shall refer more fully in a minute, but in connection with that there is one point I wish to make now, and it is a very serious and very important point, namely, what we think is the inequitable character of the contract which a subscriber is called upon to enter into. I have a copy of the contract here, and the particular part of it to which we take serious exception is in Clause 15, where it says: "The expression 'certified'

means certified under the hand of an appropriate officer of the Post Office, and any such certificate shall be conclusive evidence of the matters certified." Well, in connection with that I need only quote the dictum of a judge, Judge Lumley Smith, who said that a subscriber by signing this agreement places himself entirely in the hands of the Post Office. Well, we submit that is not fair in a business matter of this kind that a subscriber should in that way be practically barred from any legal remedy. For one reason alone I think that is so, because we all know the sentimental effect of irritation in a man's mind if he is suffering, or thinks he is suffering, under an injustice, and moreover from another point of view it appears to me of great importance, because it must inevitably relieve officials from that proper sense of responsibility which would be upon them if they knew the subscriber was not in that practically helpless position. In connection with that, it may be referred to, I think, that the Post Office itself from time to time has to admit that allowances have to be made to subscribers, and that unaccountable inaccuracies do occur in connection with the registration of calls and the service generally. That, as I say, is a very important point, and we strongly urge that it should be seriously considered, and that some concession should be made; that the Department should not attempt to hold itself in any sense above the law. We quite recognise that it would have to be done in a very cautious manner, but that the subscriber should not be put in the position to which I have referred is undoubted.

The POSTMASTER-GENERAL: What alternative would your Committee suggest? We deal now with about a million calls a day in London, and by what method would you have the accounts assessed? Would you leave it for evidence for the subscriber to state on oath that he had not made certain calls, and the Department to place its records before the Court? Obviously the operators cannot remember whether the calls have been made or not during a certain period.

Mr. FAITHFULL BEGG: I am not authorised to make any definite suggestion, but I think the suggestion there is that if some method of registration at both ends could be arranged it would meet the difficulty. We have it in evidence from one of our members that for years he has endeavoured to keep a proper record of his calls, and that he has never succeeded in getting within reasonable reach of the amounts that the Department has called upon him to pay.

The POSTMASTER-GENERAL: If there were a subscriber's meter as well as a meter at the Exchange that would be accepted as sufficient evidence? You do not suggest that that clause in the contract should be simply deleted, and that there should be the possibility of litigation over every account?

Mr. FAITHFULL BEGG: Of course the matter is exceedingly difficult, and I am not authorised to make any definite or specific suggestion. I was rather asked to direct my remarks to the fact that it was inequitable that there should be no remedy as at present, and the clause in the agreement which I have read practically puts the subscriber in that position; but I will leave that point to Mr. Daniels if he will kindly take it up. Of course the inaccuracies are numerous, but possibly not excessive. I understand that in the London Telephone Service it is claimed that for every 100 accounts sent out something like 12 per cent. are disputed. We may differ whether 12 per cent. is an excessive amount or otherwise, but on that I might say the chances are that many people do not dispute their account who otherwise would, because busy men say, "Oh, well, pay it and let it go." But the official figure given to us is, I understand, the number of disputed accounts.

The POSTMASTER-GENERAL: Not disputed, but with regard to which inquiries are made.

Mr. FAITHFULL BEGG: It is given to me as disputed.

The POSTMASTER-GENERAL: I am informed that these are inquiries which after the first explanation drop to 2 per cent., and that only 2 per cent. are disputed after the information which is asked for has been given. Twelve per cent., of course, would be a very large figure if it were the case that 12 per cent. of the accounts were really traversed by the subscribers.

Mr. FAITHFULL BEGG: I will not further argue the point. Of course we admit that

any proposal to return to a flat rate is impracticable. We do not sympathise—the London Chamber never has—with the idea that the flat rate can be perpetuated. The flat rate was an empirical device for the purpose of getting at a basis of charge, and in the early stages it worked fairly well, but to-day and in recent years it is not a system which can be logically advocated. Therefore we do not suggest that any return to a flat rate would be a matter which we at all events would support in any sense.

The next point I am asked to refer to is one which is a constant source of irritation, and that is where the reply "engaged" is given. I am afraid some of these points are rather trite but I have to go through them. The Chamber thinks that the information they have points to that being caused largely by the insufficiency in the number of junction wires, and that by increasing the number of junction wires a remedy in a large measure for that would be found and should be found. Of course it is very difficult for the operator to give a correct explanation always, but we do not think, for instance, that the reply "engaged" should ever be given if it is a junction wire which is not available or if they are overcrowded at the time, because that causes misunderstanding. Inquiries are made by the man who does not get his connection and he finds that the man at the other end was not using his telephone, and that reacts on the credibility of the official. We therefore suggest that care should be taken that that reply is not given unless it is the subscriber who is wanted that is engaged.

The next point I am asked to refer to is the question of the up-to-dateness or otherwise of the apparatus throughout the London exchanges. Our Committee was very courteously invited to visit the system in London and to see for themselves how things were done, and they visited the Avenue Exchange and were very interested by what was shown to them on that occasion. But the very fact that the Avenue Exchange is, as I understand, in such good shape points at all events to the other exchanges not being similarly well equipped, and we understand that alterations are being made, improvements are going on. But the Committee fears that in a large measure the apparatus in parts at all events of London is in many ways obsolete, and is of opinion that it is very important that changes which we believe are going on should be pressed forward in order to bring the whole of the London system up to the same standard of excellence as exists in the Avenue Exchange.

The POSTMASTER-GENERAL: Can you mention any particular places?

Mr. FAITHFULL BEGG: I am not authorised to, and I am not sure the Committee has the information. I was not present when this visit was paid.

The next point is the trunk service, and there we think it may be admitted that the trunk service is beginning in certain directions to show improvement, but those of us who visit America are quite satisfied that the trunk service in this country is not in anything like the shape of the trunk service in the United States. I do not think anyone who visited the United States would say that the trunk service here could be compared with the trunk service over there.

The POSTMASTER-GENERAL: Would you be ready to pay the fees that they charge in the United States?

Mr. FAITHFULL BEGG: I knew you would ask that question. Personally, yes. I have always been one of those who said, "Give me a good service and I don't care what you charge for it." But I know that is the answer and it is a very good one. I have some details with regard to the delays which occur, but I think I may leave that point by simply saying what I have said, that we do not consider that the trunk service in this country is what it ought to be, and we hope that the trunk service will be materially improved in the early future. The importance of the trunk service I need not emphasise, because in business now trunk calls have become and are becoming a very important part of their work.

I was asked to mention specially what the Committee noted with great pleasure—the general arrangements for the supervision of operators at the Avenue Exchange, the method of observing them without their knowing they are being observed, so as to see that their work is properly carried out, and in connection with that it is hoped that the rest of London will be given the benefit of similar advantages as soon as possible.

The next point is the question of the inconvenience of the "pillar" instrument. There is a good deal of technicality in connection with that. I am not sure that I personally am qualified to go into the particulars of that, but what I am asked to mention is the irksomeness of lifting the instrument about, which was unnecessary in the case of the old hand-combination instrument, and there is also one point in connection with it which is of great importance. We understand that it is impossible to connect an exchange with an extension for a long or short period of time and thereby dispense with a switchboard attendant. I am told that is so, and that it is a grievance which is felt considerably in many quarters. I understand you have already recognised in some way the reasonableness of this, and that efforts are being made to see whether some improvement cannot be brought about.

There is one other very important point to which I am asked to refer, and that is the question of the rates themselves. Now at the time of the transfer I think it may be fairly said that specific assurances were given or general assurances that the result of the taking over by the Post Office would not be anything in the nature of a general advance in rates, and I think the public, rightly or wrongly, concluded that as a matter of fact they would get their telephones for less. I never shared that view, but I think it was a more or less general view, and we are told—and I think there is evidence throughout the country—that there are very serious complaints of increases in rates. I have been given one instance—I am prepared to admit that it is probably exceptional, but I was asked specially to mention it. It was a case of a certain firm which had two lines with two internal extensions and two external extensions, and paid for an unlimited service £20 per annum for the two lines. Now that firm has three lines with five internal and three external extensions for which you charge £57, and the service is limited. I only give that on the authority of the Committee, but I am quite sure the Committee would not have put it forward without chapter and verse for it. Generally speaking, the Committee is of opinion that it can be shown that the changes which have taken place have in the main been in the direction of a considerable increase in rates. What we ask is that there should be an inquiry into that point in order that it may be really ascertained whether or not there has been anything that can be called a general increase in rates since the Post Office took the system over. I understand, Sir, that you yourself have indicated that you would not be averse possibly to that course being taken, and in any case we desire most heartily to support that suggestion.

Now these, Mr. Samuel, are all the points I am asked to refer to except that I want to make one inquiry, and that is if you can tell us generally how the automatic system is developing and whether you have reasonable expectation that the working of it will be successful and that the extension of it may be looked forward to. I do not think the public has very much information about it, and it would be interesting, if you felt it possible, to give us some information as to what you think the future of that system will be.

I hope I have stated these points temperately and not said anything that even the Department might feel was unduly harsh upon them. While we sympathise with these complaints and sympathise with the irritation which they have caused, we are quite aware of the extreme difficulties of the situation, and I conclude by saying that the real object and aim of the Chamber and of the Committee is not to make trouble in any sense or form, only to criticise so far as circumstances justify and put itself at the disposal of the Department in any possible way with a view to helping in the solution and removal of those difficulties to which I have been privileged to refer.

Mr. STANLEY MACHIN: Mr. Samuel,—Mr. Begg has stated very fully the chief points which the London Chamber of Commerce wish to bring before you. Perhaps, therefore, I shall not be misunderstood if I briefly refer to certain details, endorsing as I do all that he has said, especially in connection with the way in which the Chamber approach you in this matter. We feel that it can only be to the advantage of all concerned that the users of the telephone—and I think we may be regarded as representing absolutely the users in the City of London—should come into contact with the heads of the Department in the most friendly way.

Mr. Begg referred to the trouble caused in regard to calls by there being no court of

appeal; there seems to be some difficulty as to how this could be adjusted. On my own responsibility I would suggest the possibility of some advisory committee being appointed to adjudicate upon these points, which would protect the Department from litigation and satisfy the users that their individual grievances were being dealt with carefully and impartially. That is simply an idea that has occurred to me, and I leave it with you for what it is worth.

I should like to mention a little practical experience which, as a manufacturer, I have had during the last twelve months. It certainly does go to show that telephone users have had very much more trouble recently than in the past. Reference was made to the service in the United States of America, which which you are no doubt far better acquainted than I am. We are informed that a trunk delay of even a few minutes there becomes a matter of inquiry, whilst here it is not an uncommon thing for us to have delay of half or three quarters of an hour on a trunk call. I need hardly say that such conditions render the telephone almost useless: it is quite impossible for traders to wait twenty minutes, half an hour and oftentimes much longer still for a possible reply to their call: the telephone becomes practically useless. Then, sir, the number of false calls —that is, rings where the subscriber called is not wanted at all—provides an experience which to us is new to the last few months, but which does not decrease and is a source of very great annoyance. These matters are perhaps trivial, but we think they should have special attention.

Then, again, it would seem that the Department is called upon to undertake more than it can carry out. Yesterday I had occasion to ring up the secretary of an organisation and could get no reply at all, and the reason, I hear to-day, is that the telephone has not been fixed in his new office. It is in the building, but he is told that it cannot possibly be ready for use for a fortnight. There may be some special reason in this instance, but it does seem strange that in the City of London a commercial undertaking must wait a fortnight, although the wires are already in the building, before an instrument can be made fit for use.

Mr. Begg referred to the question of cost. I here speak for myself, but I really think I express the opinion of City business men when I say that we consider that efficiency is absolutely of the first importance, not regardless of cost but regardless of any reasonable cost. With us time, as with you, is very valuable, and efficiency and reliability are to us of very much more importance than a nominal increase of cost, although of course I do not suggest that the present charges are too low.

May I again say that our object is to assist the Department in every way, and if some advisory committee can be formed such as I have suggested to deal with complaints, so that representative commercial men may be constantly in touch with your department and bring before you any complaints or suggestions, I think it would prove more satisfactory.

Mr. J. S. DANIELS: I simply rise to second all that has fallen from Mr. Begg, and particularly to emphasise one of the points he has mentioned, that, namely, having reference to the legal position from the Post Office point of view and from that of the subscriber. I think it is an inequality which should be remedied by some means, and I would suggest that the means should emanate from the Post Office itself; it is a very unreasonable thing for a man to be told he has no remedy whether his accounts are correct or not. I have a suggestion to make which I think might help to alleviate much of the trouble caused at present with regard to the payments; instead of yearly payments I should like to suggest that you should accept, from subscribers, half-yearly payments or even quarterly payments; if you should adopt that suggestion I anticipate in the space of two or three years that half of your troubles with regard to accounts would be wiped off your slate. Otherwise, I wish to support everything that has fallen from the two previous speakers. The Postal, Telegraph and Telephone Committee have done their best to bring the question impartially before the Council of the Chamber, and their recommendations and views have been generally adopted.

The POSTMASTER-GENERAL: Lord Southwark and Gentlemen,—I speak quite sincerely when I say that I am grateful to you for coming here to-day and for representing the

views of commercial men of London with respect to the development of the telephone system. I am at one with you in recognising that in the organisation of the modern commercial world, and for social purposes as well, an efficient and reasonably cheap telephone service is not merely a desirable thing, but is an absolutely essential thing, and any steps that are taken by the representatives and leaders of the commercial community to assist my department and myself in providing the public with that essential thing are most cordially welcomed by us. I have no complaint to make of the manner in which the considerations you wish to bring before me have been stated to-day. You recognise that difficulties have existed arising out of the transfer of the vast system of the National Telephone Company to the State, for which allowance must be made.

I welcomed very cordially the statement of Mr. Faithfull Begg that the flat rate is recognised not to be the ultimate sound basis for charging for telephone service, and I was grateful for the expressions of approval that he made with regard to the supervision of operators at the Avenue Exchange. I am informed that the supervision is precisely the same at all the Exchanges, and that therefore any testimony to its excellence at that one Exchange must be applied to our telephone system generally.

There are, of course, complaints with regard to the service, and because I have, from time to time, suggested in Parliament and elsewhere that a proportion of these complaints, especially some of those that are made by writers in the Press, are exaggerated, it has therefore been represented that I regard the present telephone system in London and in the country generally as perfect, and that all complaints are ill-founded. That is not so; I have indeed said the opposite in most emphatic terms again and again, and if I think it is my duty to point out that many of these complaints are in fact untrue, have no basis at all, and that many others are couched in most exaggerated terms, that does not prevent me, nor does it prevent my officials, from recognising to the full that the telephone service has not yet reached that standard of efficiency generally which we should desire to see it attain, still less has the telephone service in the United Kingdom arrived at that development, from the point of view of the number of subscribers served, which it ought to reach in a busy and thriving industrial country such as that in which we live. Having made these few preliminary remarks, let me deal one by one with the points which you have been good enough to bring before me.

The first related to the terms of the contract which telephone subscribers are required to sign as a condition of the provision of the service. I quite realise that when a subscriber thinks that the number of calls charged against him is more than it accurately should be, he may feel a sense of grievance if he finds that his agreement provides him with no form of legal remedy, but when you come to consider the alternative, we are faced with very great difficulties. I believe it is the case, so far as is known by my Department, in every telephone system throughout the world, that subscribers are required to accept the records of the service as the basis of the accounts which they receive. As I mentioned in a brief interruption when Mr. Begg was speaking, we deal now with about a million calls a day in London, and if it were left for us to prove before a court of law whether or not particular calls had been made on particular days, you can see how almost impossible it would be to conduct the service at all. The system which is at present in use for registering calls in London is the same as is in use in New York and in every large American city. It was in New York a few years ago minutely examined by a body of experts and accountants employed by a committee of the New York Merchants' Association, and they reported that the system was as exact and accurate as any that could be devised. And within the last few days the Advisory Committee which has been formed in Liverpool, consisting of representatives of the Liverpool Corporation, the Chamber of Commerce, the Docks Board, the Cotton Exchange, and other representative bodies in Liverpool, made an inquiry in Liverpool with respect to the system there, which is the same as that in use in London, and the Chairman reported a few days ago to the Liverpool Chamber of Commerce that the method in vogue at the Post Office for registering the number of calls made was found to be perfectly satisfactory. A Committee of your Chamber in 1908 also investigated the system in London and reported favourably upon it. Whenever any subscriber makes complaints with regard to the accounts rendered to

him, in every way possible care is taken to check the working of our automatic meters. They are tested by the engineers ; the account books are examined for clerical errors, and if necessary test checks are kept on the subscriber's lines in order to ascertain what calls are actually being made. On the other hand, subscribers very frequently, while they are convinced that not more than a certain number of calls are being made, may be unaware of the use that is being made of their telephones in their absence by their domestic servants in their houses or by clerks or office boys in their offices ; and cases are not infrequent where it has been ascertained on more careful inquiry that the subscriber himself who made indignant protest as to the number of calls for which he was charged, was not aware of the surreptitious use that was being made of his instrument without his authority and in his absence. That is one of the reasons why complaints are made. There is another reason. In our system we do not charge, of course, for ineffective calls. If a subscriber makes a call and is given a wrong number, and then calls a right number, if he does not inform the operator that he has been given a wrong number, he may be charged for both calls. I propose to send a circular to subscribers drawing their attention to this, and mentioning that this is one of the safeguards against being charged unduly on account of ineffective calls.

The suggestion has been made that there should be a meter put on the subscriber's instrument which should work jointly with the meter at the exchange and enable him to see day by day precisely what his account is going to be. There have been the greatest engineering difficulties in devising such a meter. It would be quite easy to devise a meter which would register a call every time the subscriber rings up, but that would not be satisfactory, because it would register ineffective calls as well as effective ones, and to devise a meter which would only register when then there is an effective call made would mean either bringing in the operator at the exchange or else endowing machines with powers of discrimination which even the ablest inventor has not been able to provide them with. In no system in the world are such meters in general use. I have been pressing upon my Engineering Department for some months past, however, the advisability of devising some meter which would get over these difficulties, and they have been at work endeavouring to provide a meter which would serve all the purposes required, which will not involve costly and revolutionary changes in the existing equipment, and which will not be unduly expensive ; and they are at the present time hopeful of having provided a device which will meet these requirements. It is now under experiment, and I should not like to pledge myself until the experiments have advanced further. The instruments have been made and they are now in use, and the experience so far enables one to be hopeful that they may on further test prove to be practicable, and if this turns out to be so I shall be able before long to offer to subscribers a meter—of course they will have to be charged a little extra for it—which will register calls on their own instruments, so that they can make representations if they think the record is mounting up against them unduly quickly. I will also consider the suggestion made by Mr. Stanley Machin, which is new to me, that some form of committee should be established to which complaints might be referred.

The next point which was mentioned was the provision of additional junction lines. It was suggested that the number of engaged calls in London is swollen partly through the insufficiency of junction lines. Well, the operators are instructed that whenever they are unable to effect communication owing to a junction line being engaged they should say "junction engaged" and not "number engaged." That is the instruction to them, which should undoubtedly be observed, and we take whatever means are in our power to secure that it should be observed. You may say that that cannot be so, because the number of cases in which that answer is given is so extremely small.

Mr. FAITHFULL BEGG : I have never heard of it before.

The POSTMASTER-GENERAL : It is sometimes given. But it is also the case that the number of calls which fail through the insufficiency of junction lines is exceedingly small. I think the Committee which went to investigate the Avenue Exchange were under a misapprehension. They inquired whether the subscribers were told that the lines were engaged when junction lines were not free, and they were informed that sometimes it

might be the case. And that is quite true, but it is very rarely the case indeed. As you know, we have a most elaborate system of observation in order to enable us to collect statistics. 44,000 calls have been observed during the first six months of this year by the clerks whose duty it is solely to observe calls and collect statistical material. It is found that the number of calls which were ineffective through junction lines being engaged has steadily fallen. In 1907 and 1908 the number of calls which failed from that cause was from 1 to 2 per cent. In 1909, 1910 and 1911 it never rose above 1½ per cent. In 1912 it fell from 1 per cent. to less than ½ per cent. during the latter half of that year. That has been due to a very rapid increase in the number of junction lines provided. In 1908 there were provided in London 672 new junction lines; in 1909, 674; in 1910, 1347, in 1911, 2138. After the transfer we had to provide a largely increased number of connections with the ex-National Telephone Company's Exchanges and the number of new junctions increased in 1912 to 2648, so that the number in that year was nearly four times as many as three or four years previously. We caught up arrears very largely last year, and this year it will not be necessary to provide quite so many lines, but in the first six months 992 have been provided.

The deputation suggested that the London Telephone Exchanges should be modernised. Well, there again we are taking action of the most extensive kind. During the present financial year I shall be spending altogether, taking the country as a whole, about £3,000,000 in new telephone construction and development out of capital in this one year, that is apart, of course, altogether from the purchase money of the National Telephone Company's plant, and apart from all expenditure on ordinary renewals. It is for new exchanges, new trunk lines, and new subscribers' equipment. Before long I shall be going to Parliament to ask for authority to borrow another £10,000,000 for the development in the next few years of the national telephone system. I should like to say that it is anticipated it will not be necessary to go to the money market for this money, but that it can all be provided from funds in the hands of the National Debt Commissioners without floating any new Government loans.

Already in London all the principle exchanges, except the Bank Exchange, are of modern type, and they differ only in small details from the Avenue Exchange which your deputation visited and the equipment of which they approved. All except the Bank Exchange are of the type which is in use in New York and in the principal American cities, and represent the highest development of the manual switchboard system. Plans are now being made which will involve the scrapping of the equipment at the Bank Exchange and the transfer of the subscribers to a more modern exchange. We have scrapped the Company's Westminster Exchange and their old Avenue Exchange, and have provided newer and better exchanges. Since the transfer, sixteen of the Company's Exchanges in the outlying parts of London have been closed on account of their being not so efficient as modern exchanges should be, and the subscribers transferred to properly equipped exchanges. Five of the old Post Office Exchanges—Wimbledon, Chiswick, Ilford, Reigate, and Epsom—have been replaced by new exchanges. In the centre of London two wholly new exchanges have been opened—Regent and Park—with a capacity of 10,000 lines and 8000 lines respectively. A new Victoria Exchange with a capacity of 10,000 will replace the existing Victoria Exchange in the present autumn. Before the end of the year there will be a new exchange—Museum—in the neighbourhood of the British Museum, with a capacity of 10,000 lines. Before the end of next year we shall have two more new exchanges, each of 10,000 lines, which will be called Charterhouse and Tower. In addition to all this there have been considerable extensions made to twenty-eight other exchanges in London in order to meet increasing demands for service. When it is realised that all this tremendous expansion in buildings and equipment has been made at the very time when there was the difficulty caused by the amalgamation of two great staffs, and at the time when the higher officials were largely engaged in the arbitration proceedings to settle the price of the Company's plant—the biggest arbitration on record—I think it will be realised that the Department has been doing its very utmost to cope with the immense task placed before it.

With respect to automatics, the experience has been that the automatic system is of

most value where most of the calls are to subscribers attached to the same exchange, and not where most of the calls are from one exchange to another exchange. If you have an ordinary provincial town of moderate size where all the subscribers are connected to one exchange in the centre of the town, that is the ideal field for the use of automatic apparatus. But where you have, as in London, a system where the majority of the calls are made from one exchange to another exchange, there the use of automatics is not so expedient, and for that reason mainly at the present time we are not proposing to instal automatic apparatus in these new London exchanges. It would not be, so I am told, from an engineering and financial point of view, expedient to do so. We have experimented at Epsom with an automatic exchange, and the experiments have been very successful, and I am informed that the subscribers are quite satisfied. We have also experimented on ourselves here and established an Official Exchange on automatic lines. The instrument is here on my table. We have experimented on the principle of *fiat experimentum in corpore vili*, and our own experience here has been satisfactory. We are also proposing to instal automatic apparatus in four or five provincial exchanges in various parts of the country, some up to 10,000 lines, and tenders are being asked for from contractors who provide automatic apparatus.

The deputation also raised the question of accelerating the trunk line service Nearly half the traffic on the trunk lines in this country is concentrated on two hours of the day, and the other half is spread over the remaining twenty-two hours. That fact makes proper provision for trunk line service a very difficult problem, because, if we are to provide a no-delay service during those two hours——

Lord SOUTHWARK: Which are those two hours?

The POSTMASTER-GENERAL: In the middle of the morning, ten to twelve—or anything approaching a no delay service, we shall have an immense amount of plant, representing a vast expenditure of capital, lying idle, in fact half the plant during the other twenty-two hours of the day, and it will easily be seen by a body of business men what a serious financial proposition that is. In the United States of America the fees for trunk service are from two and a half to three or four times as high as in England, and while we could provide an exceedingly rapid trunk line service if we charged similar fees, even allowing for the higher prices in America, I think the public would complain if we doubled the cost of our trunk line service. But with our present fees we are making very large extensions. You are no doubt specially interested in the trunk line service from London. There are at present 520 trunk lines coming into the Trunk Exchange in this city. We are adding 30 per cent. now at once: the lines are being constructed; 180 lines are being added to the existing 520, increasing the number by 30 per cent immediately. I am spending £300,000 on a new underground cable from London to Birmingham, which will provide three times the present number of wires when it is completed, for communication between London and Birmingham and the North—it will serve Manchester and Liverpool—and the West of England. It will take some time to carry through an engineering work of such magnitude as that, but the work is about to be put in hand. The sum which is being spent now on the development of the trunk service throughout the country is £1,800,000 and while a good deal of that is for trunk services not directly communicating with London, it will improve the service throughout the country and indirectly affect the trunk service with London.

The deputation raised the question of the supervision of telephone operators and the need of greater efficiency. Here again we have been passing through a period of transition, on account of the absorption of the National Telephone Company's staff. Their operating staff were paid considerably less wages than our operators were paid; the scale of pay for their supervisors was only about the same that we pay to our rank and file operators. Further, the hours were different for the telephone operators, the meal intervals were different and were less generous, and owing to the Telephone Company's operating staff being put upon the Post Office conditions we had to employ a large number more girls to do the same amount of work. In addition to that the natural growth of work has involved a great increase of staff, and as a result, between January 1st, 1912, and May 31st of this year we have had to bring into the London service no fewer

than 1335 new women operators as well as 201 new male night operators. All these girls and men have had to be trained and have had to be made accustomed to their duties. This increase of staff is also partly due to the fact that we give longer holidays than the Company did, a fact which makes the service more expensive but should make it more efficient. There is one supervisor to every eight operators continuously watching the work of the girls, and, as you know, the detailed working of the system is most carefully checked by the staff of clerks whom I have already spoken of, who without the knowledge of the operators are able to keep a watch on the way in which the work is being done. The average time before a call is answered is now about five seconds, taking London as a whole, and the percentage of effective calls on the London system, which was 65 per cent. last year, is now raised to 70 per cent. partly owing to better supervision.

One other point is the pillar instrument. The pillar instrument is the standard form used in connection with the central battery system throughout the world. It is universally in use in the large cities of the United States which are held up to us as models for imitation, and where the working has frequently been examined by officers of my Department. I have officers in the United States now being educated in American methods, and visits are frequently paid by the superior officers of the Department. And I myself in a few weeks' time am about to visit Canada, and, I hope, some of the principal cities of the United States, and shall there obtain such knowledge of the telephone working as I am able to secure.

The hand-combination instrument has an electrical efficiency of only 70 per cent. of the pillar instrument, and that is the only reason why the pillar instrument has been installed. The hand-combination instrument is much more comfortable for use, and we should not have pressed the other on the subscribers, nor would it have been done in the United States, were it not that the hand-combination instrument is only 70 per cent. as efficient as the other. For some years we have invited manufacturers and inventors to furnish us with a hand-combination instrument as efficient as the pillar, but none has been forthcoming. A fairly satisfactory instrument has lately come under notice and an order for 500 has been placed. It is not quite as efficient, but we are experimenting, and I should like to say now, in case it should come to the ears of any ingenious inventor or manufacturer, that we should most cordially welcome any hand-combination instrument which can be devised which is as efficient for telephone purposes as the pillar instrument.

With respect to rates, my policy has been to effect no change at all in the existing system of rates until the whole can be overhauled. I think that you are under a misapprehension if you have been informed that there has been any general change, whether by increase or by decrease, in the charges for telephone service. What has happened has been that the policy prior to the transfer has been continued, namely, that where a subscriber has had a flat rate service, but wishes to change his service or to extend it to any considerable degree, he must then go on to the measured rate. That has been our policy for some time past, and that policy has been continued. If the change is of a trivial character, we do not disturb our subscriber, but if he is putting in a new equipment, and extending the service, we seize the opportunity to bring him on the measured rate, which is, as Mr. Faithfull Begg has very candidly stated, the right system of charge for telephone subscribers. And that is the explanation of the particular cases which he has mentioned to-day. Otherwise there has been no general change, and I do not think that it is desirable or necessary to have an inquiry whether there have been any considerable changes, because we know there have been no such changes.

With regard to the future, the case is different. There, indeed, we are contemplating certain alterations. The suggestion made by Mr. Daniels that we should allow payment at shorter intervals than a year is under serious consideration. I agree with the expression of opinion made to-day that efficiency is more important than cheapness; and while it would be wrong to charge subscribers more for the service than it actually costs to provide, with a small profit to the Exchequer in consideration of the large amount of public capital involved, at the same time I think it would be a grievous error, in the hope of getting some small measure of popularity by immediate reductions, either to imperil

the future efficiency of the service by lowering the standard of operating or the standard of equipment, or to run the risk of financial loss in the future. For that would fall on the taxpayers of the country, and at the same time would render future Governments unwilling to allow that further extension of telephone supply and that large expenditure of public capital which is desirable if the system is to be as wide-spread as it should be.

It will be necessary if the new scale of rates is not generally accepted—and I am afraid it would be unduly sanguine to expect that any new scale would be generally accepted—it will be necessary to have an inquiry by a committee, because it would obviously be very wrong for me to force on the community at large, without opportunity being given to your Committee and other similar Committees to make representations, a new scale of rates. It is necessary to make careful inquiry into the cost of the service, and we are invoking outside actuarial assistance with a view to ascertaining what different forms of service do cost, because it is important that we should put our charges on a basis which future experience will show to be justified. A mistake now may have the most disastrous effects in the future. While I am anxious to announce the new scale as soon as possible I do not want those engaged on the work to be unduly hurried, with the result that errors, and irreparable errors, might be made.

I am very grateful to your Committee for coming here to-day and making these representations. I am anxious that I and my Department should keep in close touch with your Chamber, if you would allow us to do so. I believe it is of immense advantage that the Department should be in communication with the leading representatives of commercial interests in the great cities of the country, and on my own initiative in seventeen towns already telegraph and telephone advisory committees have been set up. Usually the Chamber of Commerce has taken the first step locally at my request and has added to its own representatives members of the local corporation, dock board, if there is a dock board, cotton exchange, wool exchange and so forth, so as to form committees really representative of the business of the town. Seventeen of these committees have already been formed and twelve more are in process of formation. The local district managers and postmasters are instructed to render them every assistance, and Mr. Ogilvie, the indefatigable head of the Telephone Department here, has visited many of these cities and answered inquiries and complaints. We are providing the committees with statistics of the service and with statements of the developments we have in prospect, and I am quite sure that it will be of immense value to the Department, and therefore to the public, if frequent communication can be maintained between such committees and the Department. What has been done elsewhere should, *mutatis mutandis*, be done in London. Of course, London is so vast, the interests concerned are so great, the number of representative bodies so large, that possibly it may not be practicable to form a combined committee of all the associations and public bodies concerned. That, however, you might perhaps yourselves consider. At any rate your Committee represents the Chamber of Commerce, which as I know—I was myself for some years a member in order to learn what was being thought by commercial men—is very representative of the business men of London, and we shall be most happy to act with you as we are acting with combined committees in provincial towns. You have only to ask and the heads of the telephone service will be most happy to meet you and explain any points. If you desire to visit our exchanges, you will be most welcome visitors. If you desire statistics or information as to future plans they shall be furnished to you. I hope the Department and yourselves, working hand in hand, both having in view a desire to serve the public interest, may effect a continuous improvement in the telephone service of the metropolis.

Lord SOUTHWARK: Mr. Samuel, on behalf of my colleagues here, I have to thank you for the very cordial reception you have given to the deputation, and for the very practical, satisfactory, and important public statement that you have made to-day. I am sure it must be gratifying to my colleagues, and I am sure it will also be very interesting and most gratifying to the public at large. I can assure you that it has been our desire to render assistance. The action that we have taken in the past seems to have been a very successful one, because you have so cordially received our suggestions and dealt with them in such a kind and business-like way. I am sure my friends were very gratified when

you referred to the increase of junction wires. With regard to the trunk service, I asked what hours were the busy ones, because I think if it was known to the public at large that the service was most used during two hours of the day, many could use the service at other hours. We are very much gratified by your closing observations with regard to the Advisory Board. We realise that you appreciate the services that the Telephone Committee of the Chamber of Commerce have rendered, and that it is the sort of service you would like to have continued. Whether we are working in the most perfect way or whether we can improve upon it will be considered.

The deputation then withdrew.

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# STAFF CHANGES.

## POST OFFICE ENGINEERING DEPARTMENT.

PROMOTIONS.

| Name. | From. | To. | Date. |
|---|---|---|---|
| Stannage, G. | Exec. Engr. S. Eastern Dist. | Asst. Supt. Engr. S. Wales Dist. | 1 : 7 : 13 |
| Comport, G. H. | Exec. Engr. Scotland W. Dist. | Asst. Supt. Engr. S. Midland Dist. | 1 : 7 : 13 |
| Youngs, C. J. | Exec. Engr. S. Wales Dist. | Asst. Supt. Engr. S. Wales Dist. | 1 : 7 : 13 |
| Terras, J. S. | Exec Engr. N. Wales Dist. | Asst. Supt. Engr. N. Western Dist. | 1 : 7 : 13 |
| Lakey, T. | Asst. Engr. N. Midland Dist. | Exec. Engr. Eastern Dist., Norwich Sect. | 1 : 7 : 13 |
| Wise, F. H. | Asst. Engr. Eastern Dist. | Exec. Engr. Eastern Dist., Ilford Sect. | 26 : 6 : 13 |
| Patterson, T. | Asst. Engr. S. Midland Dist. | Exec. Engr. S. Eastern Dist., Croydon Sect. | 1 : 7 : 13 |
| Scott, W. | Asst. Engr. S. Wales Dist. | Exec. Engr. S. Wales Dist., Tech. and Develop. Sect. | 1 : 7 : 13 |
| Horton, F. D. | Asst. Engr. Engr.-in-Chief's Office | Exec. Engr. Scotland W. Dist., Hamilton Sect. | 1 : 7 : 13 |
| Gillett, E. J. | Asst. Engr. N. Eastern Dist. | Exec. Engr. N. Wales Dist., Birmingham (Outer) Sect. | 1 : 7 : 13 |
| Tattersall, J. T. | Asst. Engr. N. Eastern Dist. | Exec. Engr. N. Eastern Dist., Hull Section | 1 : 7 : 13 |
| Gill, R. | Engr. 2nd Cl. N.E. | Asst. Engr. N.E. | 1 : 7 : 13 |
| Pittman, W. C. | Engr. 2nd Cl. N. Mid. | Asst. Engr. N. Mid. | 11 : 7 : 13 |
| Mears, T. | Engr. 2nd Cl. E. in C.O. | Asst. Engr. E. in C.O. | 1 : 7 : 13 |
| Butterfield, J. C. | Clerk 2nd Cl. N. Eastern Dist. | Clerk 1st Cl. Scotland E. Dist. | 7 : 9 : 13 |
| Devey, J. E. | Clerk 2nd Cl. N. Midland Dist. | Clerk 1st Cl. N. Wales Dist. | 7 : 9 : 13 |
| Cooke, J. | 3rd Cl. Clerk Provs. N.W. | 2nd Cl. Clerk Provs. N. Mid. | To be fixed later. |
| Hewins, H. J. | 3rd Cl. Clerk Provs. N.W. | 2nd Cl. Clerk Provs. N.E. | ,, |

# STAFF CHANGES.

## TRANSFERS.

| Name. | Former. Rank. | Former. District. | Present. Rank. | Present. District. | Date from which to take effect. |
|---|---|---|---|---|---|
| Martin, J. | Asst. Supt. Engr. | S. Wales | Asst. Supt. Engr. | S.E. | 1 : 7 : 13 |
| Smart, E. V. | Asst. Engr. | E. in C. O. | Asst. Engr. | London | 1 : 8 : 13 |
| Taylor, J. L. | ,, | London | ,, | E. in C. O. | 1 : 8 : 13 |
| Lawson, R. | Proby. Sub-Engr. | ,, | Proby. Sub-Engr. | ,, | 1 : 8 : 13 |
| Gill, B. J. | 1st Cl. Clk. (Provs.) | Sc. E. | 1st Cl. Clk. (Provs.) | N. | 17 : 8 : 13 |

## RETIREMENTS.

| Name. | Former. Rank. | Former. District. | Particulars. | Date from which to take effect. |
|---|---|---|---|---|
| Lougheed, W. | 3rd Cl. Clk. | E. in C. O. | Superannuated | 19 : 7 : 13 |
| Hudson, J. A. | ,, | E.L. and P. | Apptd. District Supt. of Post and Telegraphs, North. Nigeria | 22 : 7 : 13 |

## DEATHS.

| Name. | Rank. | District. | Date. |
|---|---|---|---|
| Grace, H. | Engr. 2nd Class | E. in C. O. | 30 : 6 : 13 |
| Taylor, T. | 3rd Cl. Clk. | S. Mid. | 9 : 5 : 13 |



## COMMUNICATIONS.

All Remittances and Communications should be addressed to the MANAGING EDITOR, P.O.E.E. JOURNAL, Engineer-in-Chief's Office, G.P.O. West, London, E.C.

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