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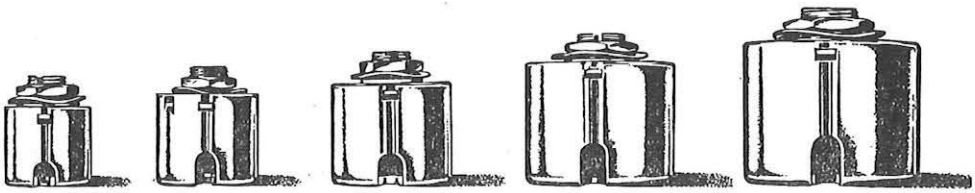

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Contents

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Our New Status

Beginning on the following page Mr. K. Anderson, Deputy Director General and Comptroller and Accountant General, outlines the development of the Post Office Act, 1961 *(which came into force on April* 1*) and discusses the basic implications of the new status it has conferred.*

MUCH PLAY WAS MADE DURING THE PASSAGE OF THE Act with the idea that our new status transforms the Post Office, within the limits of a Government service, into a commercial organization. But in fact the Post Office has been operating more and more as a commercial organization, particularly in recent years. It has, for example, built up its financial position to the point where it now provides two-thirds of the funds it needs for capital expenditure; it has undertaken market research to ascertain the opinions and needs of its customers; it has developed the Friendly Telephone policy, stimulated traffic, introduced such commercial practices as Telephone Credit Cards, Telephone Information services, and the Freefone system, as well as rapidly extending Subscriber Trunk Dialling. It has been particularly vigorous in expanding automatic telex.

The significance of the Act, which was outlined in the White Paper reproduced in the Summer 1960 *Journal*, is that—as the Postmaster General said in the Commons—it has cleared away "the cobwebs of ancient practices", relieved us from the need to seek Treasury approval and Parliamentary Vote for our expenditure, and set up a Post Office Fund under the Postmaster General's control. We can now spend on maintaining and developing our services all the money we earn. On the other hand, the staff remain Civil Servants, the Postmaster General is still responsible to Parliament, and we still have to maintain our social obligations.

The Post Office Act, 1961

K. Anderson, C.B., C.B.E.

IT IS NEARLY EIGHT YEARS SINCE WE FIRST thought that the time had come to repair the damage done by the war to the Bridgeman system, and in particular to re-model our relations with the Treasury. As an interim measure we achieved something in the *Report on Post Office Development and Finance* of 1955. But only now have we carried our ideas to their logical conclusion. These things take time and much patient effort. For instance, there were fifteen drafts of the White Paper on the Status of the Post Office issued a year ago. Of the Bill itself there were nine printed editions before presentation. But the real crux of the operation was to win acceptance of the need for a major constitutional innovation. Since Parliament established its grip upon public revenue and expenditure in the eighteenth century, it had been quite unthinkable that any Department should retain possession of its own receipts, or spend money otherwise than in accordance with a detailed Parliamentary Vote.

New Form of State Enterprise

Of course, we had gone a long way in practice to build up respect for the commercial approach to Post Office affairs, whether in policy or accounting, and to win tolerance for an unusually relaxed observance of the rules of Parliamentary and Treasury control. But make-believe accounting is a poor basis on which to build vigorous policies or to commend them to the public; and tolerance has its limits. Besides, in the light of outside developments there was much to be said for experimenting with a new form of state enterprise, differing from both the ordinary Government Department and the normal Nationalized Industry. So the case for a constitutional revolution took shape and the new Act, passed with the utmost goodwill in all quarters, is now ours to make the best of.

Its provisions which, in their legal dress, are perhaps a little dull and technical, have already been summarized in this *Journal* (Spring 1960, page 79). The purpose of the present article is rather to reflect upon their general implications for us than to explain their particular terms.

In the first place, this Act terminates the long history of the Post Office as a "Revenue Department" and makes it so different from other Government Departments that its true analogues must in future be sought elsewhere. It is in fact clear that the company which the Post Office will mainly keep is that of the Nationalized Industries, whose basis is also commercial. The essence of being commercial is that you charge a fair price for services rendered. Recognition of our commercial character implies that we should be no less concerned with economic pricing and adequate return upon capital than with efficiency in technical performance. Both are measurable, albeit in different terms, and this is the great common ground between accountants and engineers. Of course, we must never forget our social obligations, which mean that up to a point it is necessary to give some people service below cost at the expense of others, who we think should be made to pay more. The important thing is to keep a sense of proportion in relation to these "imponderables". That means insisting upon measuring the cost of any divergence from the economic optimum, even though in the end it may be politically necessary to incur that cost. In short, the Act requires us to be business-like.

Secondly, subject only to the Minister's ultimate obligations as a member of the Government, and to agreement with the Treasury about conditions of service for the staff, the Post Office is now exclusively responsible for the way in which its business is conducted. It stands on its own feet and can no longer blame another Department or "the system" even if it wants to. Such independence is surely to be valued as a sign of maturity and a springboard for progress. Some may feel that the continuance of investment control is an unfortunate limitation from this point of view. Accepting however, that the economic needs of this country make overall control within the public sector

inevitable, there remains ample scope for the exercise of wisdom in planning the programme, in promoting technical development to make resources go further, and in pursuing price policies appropriate to our circumstances. Moreover, our ready access to cheap capital relieves us from one at least of the things that hamper many business concerns.

Thirdly, we shall at last have done with the strain of understanding among ourselves, and explaining to others, the confusions and contradictions of dual accounting. Sheer persistence in boldly treating the Commercial Accounts as realistic has helped us through, but the fact always remained that they were "notional" in many respects and incomplete in others. However ingenious their compilation, they lacked the legal cachet of the Parliamentary Accounts. It will greatly clear the air to have only one set of accounts, in wholly commercial form stripped of all pretence and unchallengeable as the true and fair record of our financial progress.

More Flexible View

Fourthly, we can now evolve a system of internal budgeting and accounting more suitable to our needs as a business. The way is open to take a more flexible view of the budget instead of worrying so much about the precise equation of out-turn with estimate in an exact period of twelve months, and the other fixed requirements of a Parliamentary timetable. More emphasis can be laid upon obtaining value for money as opposed to exact conformity with a prescribed pattern. We can cease to be bound by the conventional forms of estimating where they do not suit our purposes. All this should gradually bring relief from some of the more tiresome chores, but it should also lead to the more effective use of budgets and accounts as a vital tool of management.

Finally, whatever the Act itself may do or say, Parliament and the public have been assured, confidently and repeatedly, that it will be "a renewed spur to enterprise within the Post Office". As to this, no-one is likely to deny that "Bridgeman" has been a word of immediate and lasting inspiration. Yet the actual changes brought about by the Bridgeman Report in Post Office relations with Parliament and the Treasury were not nearly so far-reaching as are those produced by the 1961 Act. It is surely a reasonable expectation that in the coming years this measure will exercise much of the same magic.

New White Paper on Post Office Prospects

Now that the Post Office has its new status under the Post Office Act, 1961, the Postmaster General will publish an annual White Paper about Post Office plans and prospects for the coming year. Capital expenditure will be included and in that respect the new White Papers will replace the White Papers on Post Office Capital Expenditure which have been issued in recent years.

The first in the new series, *Post Office Prospects* 1961–62, forecasts the following results on revenue account, on the basis of prices, rates of pay, etc. and tariffs current on March 1 this year:

	Postal £m.	*Telecommunications* £m.	*Combined* £m.
1960–61			
Income	220	242	462
Expenditure	215	227	442
Surplus (after Exchequer Contribution) ...	5	15	20
1961–62			
Income	230	254	484
Expenditure	223	241	464
Surplus (before taxation and other appropriations)	7	13	20

These surpluses represent returns on net assets of 8 per cent. for 1960–61 and 7 per cent. for 1961–62.

Capital requirements for 1961–62 are estimated at £111 million, made up of £106 million for fixed assets and a £5 million increase in working capital. The £106 million compares with £104 million for 1960–61 and includes £2.9 million for telegraph plant and £83.8 million for telephone plant. It is estimated that £82 million of the £111 million will be found from the Post Office's own resources, leaving £29 million to be met by borrowing.

The section "Plans for the Year" (1961–62) shows, *inter alia*, that the Post Office expects to bring telephone service to 460,000 applicants; the

following table shows the effect on the total of exchange connexions:

	Business Subscribers	*Residential Subscribers*	*Total*
New connexions ...	170,000	290,000	460,000
Less cessations ...	100,000	140,000	240,000
Net increase ...	70,000	150,000	220,000
Connexions at April 1, 1961	1,920,000	2,960,000	4,880,000
Connexions at April 1, 1962	1,990,000	3,110,000	5,100,000

The waiting list at the end of 1960–61 included 6,500 applicants awaiting exchange equipment only; 37,000 awaiting lines to exchange only; 6,500 awaiting both exchange equipment and lines.

One hundred of the remaining 820 manual exchanges should be automatic by the end of the year. About 300 exchanges serving 1,250,000 subscribers should have Subscriber Trunk Dialling. Manufacturers will start installing equipment for 44 new automatic telephone exchanges, including 27 conversions from manual to automatic, and for 162 extensions to existing exchanges. In addition a large number of the smaller exchanges will be converted or extended by the Post Office's own staff. Testing of Highgate Wood electronic exchange should start in the autumn. Trunk circuits are expected to increase from 29,300 to 33,400.

Telex lines should increase from over 7,000 to more than 8,500. European automatic telex, opened with Germany in April, should be available with most of Western Europe by the end of the year. CANTAT will come into service in the autumn. Orders are expected to be placed for the equipment for the new "satellite" radio station (see below).

The Post Office plans to start nearly 300 new buildings, including 150 telephone exchanges and 30 engineering centres and workshops.

An increase of about 3,200 in telecommunication and engineering staff is forecast.

Post Office Satellite Station for Projects "Relay" and "Rebound"

The Post Office is co-operating with the United States National Aeronautics and Space Administration (NASA) and the French Centre for Telecommunications Studies in a programme for transatlantic testing of communications satellites.

Ground stations are to be built in England and France to receive and transmit telephone, telegraph and television signals across the Atlantic using satellites to be launched by NASA during 1962 and 1963 in Projects RELAY and REBOUND. Stations will be equipped with advance radio facilities, having extremely accurate tracking and antenna pointing qualities and capable of conducting tests with active and passive satellites at high frequencies and low power.

Project RELAY, NASA's low altitude active repeater satellite programme which is to be launched in 1962, will weigh less than 100 lb. In addition to equipment for conducting the communications experiments, space-craft will contain instruments to detect radiation damage and other effects of space conditions on critical components.

Project REBOUND is a follow-on of NASA's first passive reflector communication satellite programme, ECHO. It involves placing several rigidized inflated spheres in orbit by using single launch vehicle. The first launch to orbit three spheres is planned for 1963.

RELAY and REBOUND are research and development projects to demonstrate the feasibility, basic concepts and technological approaches and to evaluate various systems to be used in communications satellites.

As far as orbital and other technical considerations will make it possible, other countries will be able to provide the ground facilities to participate in these co-operative experiments.

The site and equipment of the British ground station, and therefore the cost, have not yet been settled, but the station will probably be in the South West. The Post Office expects to order the equipment during the present financial year.

New Trunk Switching and Transmission Plan

A. J. Thompson : H. A. Longley

THE trunk switching and transmission plan at present in use was established more than 30 years ago and has satisfactorily met the requirements of the manual trunk switching system under which operators at group centre exchanges control the routing of trunk traffic. In the present plan, which will be familiar to most readers, each group centre collects trunk traffic from the minor exchanges in its group and is, in turn, connected to a zone centre exchange serving the group centres in its zone. Each zone centre has direct circuits to every other zone centre, and any two minor exchanges can therefore be connected by the links between minor and group, group and zone, and zone and zone. Minor exchanges are connected to their group centre by a direct route but some exchanges, usually the more remote, reach their group centre via an intermediate minor exchange and are known as dependent exchanges.

The foregoing comprises the "basic" network.

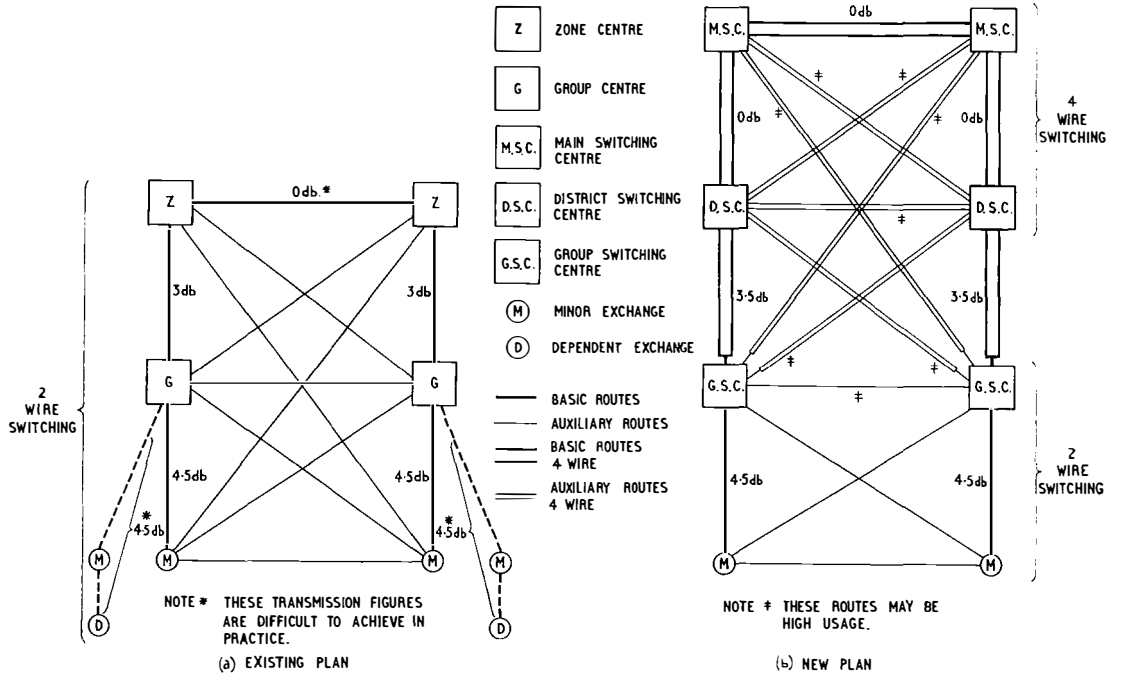


Fig. 1: Existing and new plans compared

There are also a large number of "auxiliary" direct routes which are provided wherever justified by the terminal traffic. The scheme is illustrated in Fig. 1(a) which also shows the maximum permitted transmission loss on each type of link.

Since the principles of the existing scheme were settled the telephone system has expanded rapidly and we now have five times as many subscribers making four times as many trunk calls. The number of local exchanges has increased by 50 per cent. and they are now predominantly automatic, while overhead open wire trunk and junction line plant has been largely replaced by cables. With the introduction of STD, control of trunk traffic has begun to pass from the operator to an electronic or electro-mechanical "brain", the register-translator popularly known as GRACE (group routing and charging equipment); this equipment was described by Mr. H. E. Francis in the Summer 1959 *Journal*.

STD Makes Fresh Demands on the Trunk Network

The transfer of the control of trunk traffic to register-translator equipment introduces a number of new factors which will affect the trunk network. First, it has proved economical to have register-translators at a greater number of centres than there are now group centres and this will lead to an increase of about 50 per cent. in the number of points at which traffic will be controlled. These register-translator control points will be known as group switching centres (GSCs) and, as might be expected, they will include the existing group centres among their number.

Another important new factor derives from the way that trunk calls are to be recorded with STD. The register-translator will not prepare tickets for trunk calls as do operators, but will signal the charges back to the subscriber's meter in the originating exchange where the call charges will be recorded in the same way as local call charges. There would be technical difficulties if meter pulses had to be signalled back through an intermediate exchange, and hence under full STD conditions all local exchanges will be directly connected to their GSCs. Dependent exchanges, as a class, will disappear.

A third new factor is that on automatic calls subscribers rightly expect to receive ringing tone or some other supervisory tone soon after they have completed dialling the required number. A proportion of trunk calls have to be switched through a number of intermediate exchanges before they reach their destination and, to minimize the delay between the completion of dialling and the receipt of tone, high-speed switching and signalling techniques will be used when these calls are switched automatically over several links in the trunk network. These techniques will be made possible by the proposed new trunk plan. The new plan will also incorporate improved circuit exploitation by automatic alternative routing, and will result in greater uniformity in overall transmission quality between subscribers on multi-link calls.

The New Plan

Under the new plan each group switching centre (GSC) will collect trunk traffic from the local exchanges in its group and will, in turn, be connected to one of a number of district switching centres (DSC), each serving the GSCs in its district. Certain DSCs will be nominated as main switching centres (MSC), and all MSCs will be directly connected to each other. This forms the network of "basic" routes over which communication between any two GSCs is assured. Wherever warranted by the volume of terminal traffic, "auxiliary" routes will be provided—for example, between two GSCs or two DSCs, or from a GSC to a DSC other than its parent DSC; the majority of trunk calls will be carried over these auxiliary routes. The circuits between a local exchange and its GSC will normally be 2-wire, and 2-wire switching will be used at GSCs, but circuits interconnecting GSCs via transit centres will be 4-wire using carrier, coaxial or 4-wire amplified audio cable circuits. The DSCs and MSCs are collectively referred to as transit switching centres and the calls which pass through these centres are termed transit calls. 4-wire switching equipment will be employed at all transit switching centres to minimize transmission losses at transit centres and facilitate fast signalling. The 2-wire circuits from minor exchanges to GSCs will be designed to give a loss of not more than $4\frac{1}{2}$ db and the overall transmission loss between GSCs connected together via the transit network will be 7 db, including the switching losses. Thus the overall loss between any two local exchanges should not exceed 16 db. This is illustrated in Fig. 1(b) where the heavy lines represent basic routes and the light lines the auxiliary routes. The auxiliary routes between GSCs will largely be made up from routes which already exist under the present trunk scheme and these routes will carry the bulk of the traffic.

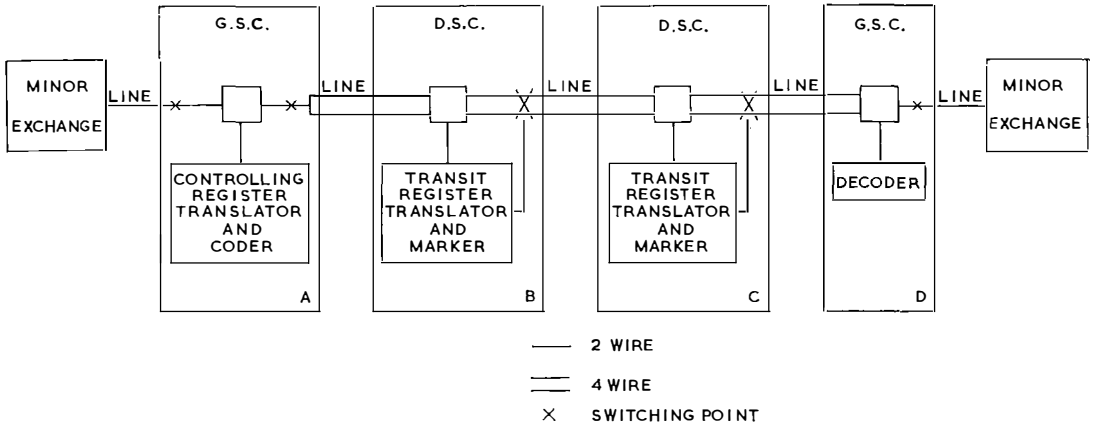


Fig. 2: Routing of a transit call

To enable an STD call to be completed without too long a delay between the completion of dialling and the receipt of tone, the call must be switched as rapidly as possible at each transit switching centre. In our present system the operation of automatic switches is controlled by Strowger (dial type) pulses of 10 pps, which is a relatively slow process. Faster switching can be obtained by arranging for controlling equipment which is common to the whole exchange to mark the outlets necessary to complete the connexion through the exchange and for the various items of equipment to switch quickly to these marked outlets. It is proposed to use motor uniselectors for the switching device with coded multi-frequency signals for the fast signalling system.

4-wire Switching

With present trunk switching the circuit terminations are 2-wire although the trunk circuits themselves are normally 4-wire—that is, two wires or a channel in a multi-channel system carry the speech in one direction, and a separate two wires carry the speech in the reverse direction. In the new trunk plan up to five 4-wire circuits may be used in tandem on a call, and, if 2-wire switching were used at the transit centres, each of the five 4-wire circuits would have to be converted to 2-wire at each end. To give a reasonable overall transmission performance, each link would have to be very carefully set up and maintained. If, however, 4-wire switching is employed at transit centres, the five links virtually become a single 4-wire connexion from GSC to GSC with a termination at each end, thereby easing the provision of a stable tandem connexion. In the new plan the GSC to GSC loss via the transit network is expected to be 7 db and, by using 4-wire switching, satisfactory results can be obtained without involving unduly expensive maintenance proccdure.

Controlling Transit Calls

The register-translator at the originating GSC controls the progress of calls over the trunk network and is known as the controlling register-translator. It is connected in circuit until the call is finally set up, when it is released to handle other calls. There will be transit register-translators at each transit centre whose function will be to switch the call through to the next link in the chain of connexions. When this is done the transit register translator will be released and the control of the call will be reverted back to the controlling register-translator. When the controlling register translator routes a call to a transit centre, it will call into service a multi-frequency coder which will send out multi-frequency digit signals and these can be sent over the line very much faster than Strowger pulses. In fact, the whole of the subscriber's number can be sent in less than one second.

Fig. 2 illustrates the routing of a typical transit call. The controlling register-translator at A and its associated switching equipment selects a route to the required DSC at B, where a register-translator is seized and sends back a "send me the code" signal (technically known as the "transit proceed to

send" signal). By means of multi-frequency signals the national code of the required charging group is then sent to the transit register-translator, which selects the route to C and the call is switched through to C.

The transit register-translator at C is then seized and, in its turn, sends back the "send me the code" signal to the controlling register at A. This causes the controlling register to send the national code again and the register at C routes the call in the same way as the call was routed through B, choosing this time a route to the GSC (D) where a decoder is seized. This coder sends back a "send me the local number" signal (technically known as the "terminal proceed to send" signal) to the controlling register-translator. The local number is then sent in multi-frequency signals which the decoder converts into Strowger impulses to operate the switching equipment at the GSC and the required minor exchange.

The call may pass through up to four transit switching centres although only two are shown in this example. The use of fast multi-frequency signalling between registers and into the decoder, and the use of fast marker-controlled switching ensures that the calls pass over the transit network very rapidly.

Automatic Alternative Routing

There will be two classes of trunk route outgoing from a GSC or transit switching centre, "high-usage" routes and "fully-provided" routes. A high-usage route will have a small number of circuits compared with the traffic offered to it and the consequent heavy loading will result in more efficient use of the circuits. Calls arriving when all the circuits are engaged will be directed to an alternative route. Fully-provided routes will be circuited on a more generous basis in the same way as in the present network and calls arriving when all circuits are engaged will receive engaged tone or announcement. Most large routes and all basic routes will be fully provided, high-usage working being mainly used to increase the efficiency of the small auxiliary trunk routes. To prevent calls overflowing from route to route in an uncontrolled manner, calls overflowing from a high-usage route will be directed to a particular fully-provided route.

The existing group centres will become GSCs and so will some 100 or more of the existing minor exchanges, usually the minors which have a number of dependent exchanges connected to them. Some 40 transit switching centres are planned, their locations depending upon the layout of trunk cables, the amount of traffic that the centre can collect, the direction of the traffic flow, the position of other nearby transit centres and, especially in remote areas, the transmission requirements. It is probable that about six of the most important of these group centres will become MSCs, the remainder being DSCs.

Automanual Centres under the New Plan

Although most trunk traffic will be subscriber-dialled there will still be a need for automanual centres to connect special classes of call, to give assistance to subscribers and call office users on trunk and local calls, and to handle inquiries and other service matters. Such switchboards will, of course, be small by comparison with present conditions, and fewer in number than at present. The degree of concentration is governed by economic and other factors, but it is probable that in the ultimate all the DSCs and about half the GSCs will have automanual boards.

Automanual centre operators will, of course, use the new trunk network for setting up trunk calls. To satisfy the transmission requirements of the new system, an automanual centre should either be at a GSC, serving only the home and dependent charging groups, or at the DSC. In practice the availability of accommodation and economic and other factors will make it necessary to serve some charging groups from automanual centres situated at GSCs other than their own; such automanual centres will be given special facilities which will, in effect, make them transit switching centres for automanual traffic only.

Introduction of the New Plan

It will not be possible to introduce the new trunk transmission and switching plan quickly. It will have to be built up gradually as a complement to the existing trunk network which will be progressively absorbed into the new network. The opening of the first MSCs and DSCs, possibly by 1965, will herald the beginning of a new era in the switching of long-distance calls and the new transit network will bind the existing local exchanges into a truly national numbering scheme.

Two Trials of Small Diameter Coaxial Cable

FOR MANY YEARS MAIN TRUNK CIRCUITS IN THIS country have been provided on cables with coaxial pairs (or tubes) usually of 0.375 inches outer diameter. The associated equipment is valve operated and provides approximately 1,000 circuits (using two tubes) with repeater stations at six mile spacings or 2,700 circuits with three mile spacings. Trials are now starting of a transistorized system suitable for shorter trunk circuits using coaxial pairs 0.163 inches in diameter.

The system is designed to carry up to 300 circuits for distances of up to 100 miles. Two trials are being undertaken, one using between Eastbourne and Hastings, another Brighton to Chichester.

The cables differ slightly but they are similar in the main important details. Both have cellular

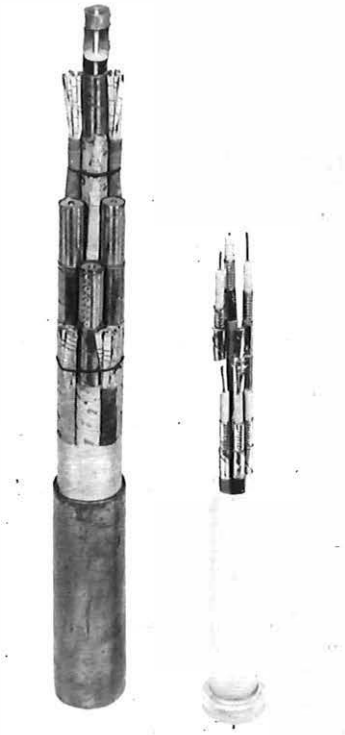


Fig. 1: 0.375" 4-tube and 0.163" 6-tube coaxial cables

Fig. 2: Eastbourne-Hastings route. Intermediate repeater in raised position

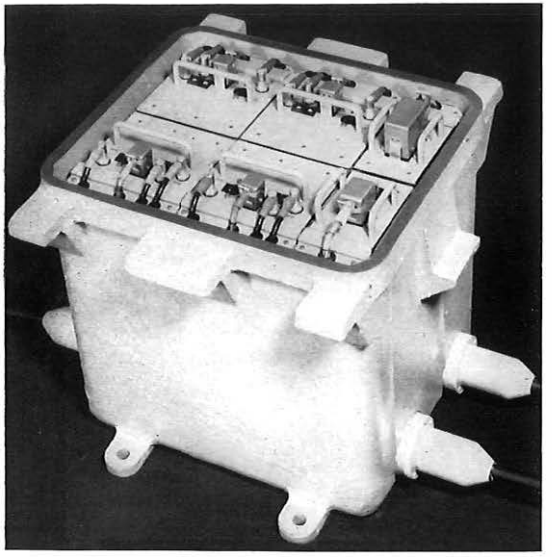
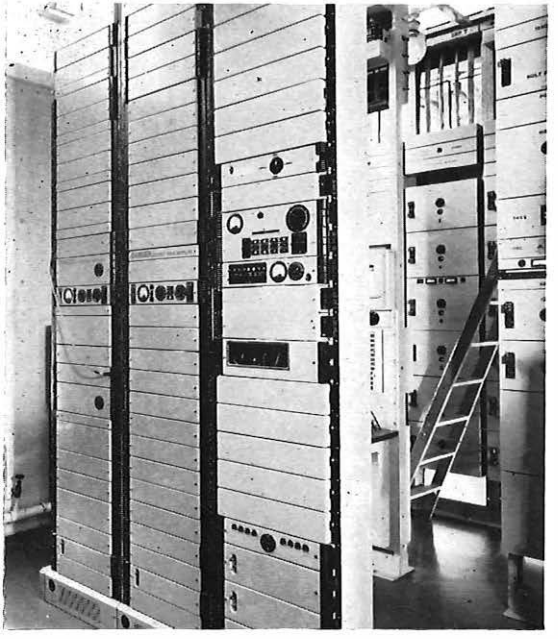


Fig. 3: Brighton-Chichester route. Intermediate repeaters with cover removed

(Courtesy, A. T. & E. Co. Ltd.)

Fig. 4: Eastbourne-Hastings route. Terminal racks at Eastbourne



polythene as the insulator between the centre and outer conductors of the coaxial tubes, and solid polythene to insulate six pairs used for control and test purposes. The cable is sheathed with black polythene. Fig. 1 shows a typical 4-tube 0.375 cable and a new 6-tube 0.163 cable.

The intermediate repeaters use transistors and are fed with power over the coaxial pairs. The repeaters are required to be spaced at 4,000 yard intervals along the route. In one trial the intermediate repeaters are mounted in a container approximately 12 inches in diameter and 5 feet long, set into the box of a footway jointing box. In the second trial a mounting box, approximately 15-inch cube, that can be stood on the floor of a manhole, is used. Fig. 2 shows a repeater being lowered into a tube in the Eastbourne-Hastings route and Fig. 3 a typical box of the type to be installed between Brighton and Chichester.

The terminal stations racks contain the equipment for terminating the main transmission path, amplifiers, filters, etc., the power feeding equipment and supervising equipment to enable faulty intermediate repeaters to be detected and cable faults traced. Fig. 4 shows the terminal racks at Eastbourne.

Experience with these two systems will enable the Post Office to agree with the contractors on a final specification for the purchase of a standard equipment.

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*Elzevir's Dictionary of Electronics and Waveguides —**Russian Supplement*** by W. E. Clason (D. Van Nostrand Company Ltd. 42s.)

The Dictionary to which this is a supplement, covered 2,056 terms in English, Dutch, French, German, Italian and Spanish. The terms were in English alphabetical order and serially numbered, the foreign versions being given against each English term. For each foreign language there was a further section of the book giving the terms in alphabetical order in that language, showing the serial number of each term. The present supplement has two parts. In the first the terms are in alphabetical order in Russian, giving the serial number for each term, and in the second they are in serial number order. Thus translation from Russian or into Russian is facilitated. With the Swedish supplement, previously issued, and the present Russian supplement, the dictionary now covers eight languages.

H. D. Bickley

Fluorescent Lighting and Cream Finish now Standard in Exchanges

AUTOMATIC telephone exchange equipment has been finished in grey for many years past. Some of the original automatic equipment was painted black but a change in finish was made at an early stage, and for about 30 years "light battleship grey" has been in use, the interconnecting cables being constructed (until recently) with a grey outer braiding. The illumination of the equipment has been by filament lamps with metal bowl reflectors and by modern standards the degree of illumination provided has not been altogether satisfactory. This is due, to some extent, to the tall apparatus racks, the poor reflectivity of the equipment and the network of overhead cables. To overcome these limitations and facilitate *in situ* examination of equipment, various types of inspection lamp have been used, while most items of telephone equipment have been designed so that they can be readily removed to well-illuminated benches for test and overhaul.

When the manufacture of plastic sheathed cables was started in the early 1950s it was decided that cream coloured PVC cables should be supplied for exchange cabling. Some improvement in light reflectivity was immediately apparent and this effect was enhanced by applying a matching cream finish to the overhead iron work supporting the cables. With this change in standards everything above rack height was finished in cream but the racks and equipment covers were still in the original grey colour. A Headquarters Joint Committee studying the lighting standards for Post Office buildings in 1957 commented on the poor reflectivity of the traditional grey surface.

In the post-war years the telephone manufacturers had supplied equipment in a variety of colours to meet oversea demands for brighter finishes and the possibility of using some colour such as green for Post Office exchange equipment was considered; in fact a green hammer finish has been chosen for the equipment now being installed for the first electronic exchange at Highgate Wood. The Ministry of Works in the meantime started to apply modern colour schemes to the walls and ceilings of telephone exchanges and the possibility of colour clashes with equipment had to be taken into account. In view of the prior adoption of cream for cable sheaths and overhead iron work and the fact that cream harmonizes with most colours, a field trial of a new exchange using a cream finish extended to racks and covers was begun at Coppermill exchange in London Telecommunications Region during 1958.

As the Headquarters Committee had recommended the introduction of fluorescent rack lighting opportunity was taken to use this at Coppermill. Fluorescent lighting in conjunction with the improved reflectivity of the cream coloured equipment proved most successful and it was found that in many places work could be carried out on equipment racks without using the supplementary lighting normally required in conventional exchanges. Many interested parties have visited the exchange and general approval has been expressed. It had been thought at first that a light colour would show dust and dirt marks more readily than the grey finish and the appearance of the exchange equipment might therefore deteriorate more rapidly. The lighter finish, however, has tended to encourage greater cleanliness and pride in the equipment, with beneficial effects on maintenance.

Cream coloured equipment (British Standard Colour No. 384 Light Straw) has been adopted as the new Post Office standard and in future equipment with this finish will be supplied for all new exchanges and extensions. This cream is also being used for Telex automatic equipment. While this change of standard will lead to a mixture of grey and cream equipment in existing telephone exchanges, it is considered that the advantages of supplying equipment in a cream finish far outweigh any resultant disadvantage.

K. W. Hix

Combined Working in Telegraph Instrument Rooms

R. A. Neate

IT might be thought that a service such as the inland public telegraph service, which becomes less used as the months and years go by, stands in need of little in the way of new ideas. Certainly, problems of expansion and development do not arise as they do in the newer telephone and telex services. But the necessity, in the light of dwindling demand, for imaginative adaptation of existing processes to meet the twin requirements (so often in mutual opposition) of good service and economy, presents in many ways a bigger challenge than that offered by the younger services.

To meet this challenge, a number of new ideas and modifications to earlier methods has been introduced or tried during the past decade, such as motor-cycle delivery schemes with fixed batching intervals, teleprinter automatic switching and combined working in telegraph instrument rooms. My purpose in this article is to describe combined working and to attempt to put it into perspective against the telegraph background as a whole.

Changing Pattern

From as long ago as 1870, when the Post Office took over the operation of public telegraphs from the railway companies, until the introduction of a switching system, made automatic as recently as 1953, the basis of the telegraph system was point-to-point working; that is, the network consisted of a number of fixed links between individual offices. Messages were accepted by telephone or at a Post Office counter by one officer, and passed to another operator who worked out the routings to be used and sorted the messages accordingly. They were then taken to the telegraph instruments connected to the appropriate points for transmission by yet another operator.

The objective was the full exploitation of lines and equipment, both of which were expensive compared with operating staff costs. Maximum use was made of specialized operating skills in achieving this objective but at the same time a large number of less skilled staff was needed to ensure that the various circuits received a steady flow of work.

Technological advances such as standardization of teleprinter working and the introduction of automatic switching have greatly reduced the advantages to be gained by specialization. It is no longer necessary to assign messages to a particular forwarding teleprinter, because any machine can be connected to any other teleprinter on the teleprinter automatic switching (TAS) network. Moreover, the introduction of TAS working has eliminated "through" teleprinter to teleprinter traffic within offices, thus reducing not only the amount of "cross-office" movement of messages but also the number of separate transmissions involved in conveying a telegram from sender to addressee.

Further important changes are, first, in the costs of equipment and of labour, which are very different from those prevailing before the war, with staff costs now predominating while equipment has become relatively cheap. Secondly, the reduction in telegraph traffic has led to a contraction in the size of the teleprinter network; offices formerly equipped with teleprinters now forward their telegrams by telephone to adjacent larger offices. This has produced greater emphasis on phonogram processes at the appointed offices and at the present time only 19 per cent. of traffic is accepted at counters served directly by teleprinter without an intermediate telephone transmission. In other words, phonograms, with telephone-telegrams, now account for nearly 80 per cent. of telegram acceptances.

Considerations such as these have prompted a search for a system of telegraph instrument room working which would permit full exploitation of

Fig. 1: Combined position at Aldershot

TAS flexibility, give freedom from the need for the former specialization, allow elimination of unnecessary work processes, and be in line with the changing pattern of telegram acceptances. We believe that we have found the answer in the system known as combined working.

History of Combined Working

Early post-war thinking about the problems of streamlining telegram processing was concerned with the possibilities of eliminating a keyboard operation. Suggestions had been made that phonogram operators should prepare punched tape concurrently with the typing of the message on the acceptance form, the tape then being used for automatic transmission. It was realized that alteration of words—for example, because of amendment to the text by the customer, during or after dictation, or because of operating errors—would militate against the success of such a procedure. An examination in 1949 of a sample of phonogram acceptance forms was not encouraging, since nearly 50 per cent. of the messages required correction during or after dictation.

In 1951 experiments in preparing punched tape were made in the Central Telegraph Office in

Fig. 2: Combined position at Leeds

London. A page-printing teleprinter, directly connected to a remote reperforator, was installed at a phonogram position and the accuracy of recording was analysed. Again, roughly half the messages required correction, involving a substantial increase in the number of words transmitted.

In the five subsequent years, further thought was given to this problem and an alternative scheme was suggested using a typewriter and a teleprinter on the same position. As a result, the first experimental combined positions were installed at Aldershot in 1956. These were formed by adapting the existing single-tier phonogram positions and the layout has since been altered to that shown in Fig. 1.

Further experimental installations were made at some half dozen other telegraph offices. The results were sufficiently encouraging to justify two more experiments, under more closely controlled conditions than hitherto. Accordingly with the full cooperation of the staff associations, the instrument room at Leeds was converted to combined working in late 1959, followed by Sheffield early last year. Observations were made of the quality of service and of traffic levels both before and after the new equipment was installed. The results amply justified earlier hopes for combined working and accordingly in April 1960 the new system was adopted as the future standard layout for all but the largest offices employing phonogram automatic distribution equipment, and the smallest (generally those justifying up to four teleprinters with separate working) where the savings inherent in combined working are not readily realizable.

The System in Outline

In essence, combined working, as its name implies, enables the *same* telegraph operator to accept a phonogram from a customer, determine the TAS routing for the message, set up the TAS connexion, and transmit the message to the distant TAS office. Each operating position is equipped with a phonogram panel (20 or 40 line keyboard), a telegraph typewriter, a routing file, and a teleprinter, with associated dialling unit giving access to the automatic switching network. Fig. 1 shows the layout of equipment developed at Aldershot; Fig. 2 shows a combined position at Leeds. It will be noted that the placing of the dialling unit and of the typewriter is reversed at Leeds (compared with Aldershot) and that the Leeds equipment is in some other respects somewhat different. There is no fundamental significance in these differences. The layout at Leeds, using the extended L-shaped table, gives more room between the various pieces of equipment, while that at Aldershot probably follows more closely the natural sequence of operations in processing a telegram from acceptance as a phonogram to transmission. Fig. 3 gives a general view of the suite of combined positions at Leeds.

The System in Operation

Obviously combined working minimizes the physical movement of telegrams because the message has no longer to be conveyed between the phonogram suite and the forwarding teleprinters. At a combined position, the telegraphist has all the equipment to hand for the complete processing operation.

Further, whereas under earlier methods of working sudden pressure on the phonogram positions had to be met by moving staff from the teleprinter suite—which took time to complete, was inefficient, and often unpopular with the staff—combined working gives immediate access to both phonogram and teleprinter equipment, and the Supervisor can direct effort to either in accordance with the flow of traffic. There is therefore a marked reduction, compared with the former layout, in the movement of staff, not only in respect of non-operating duties but also for those engaged on operating work.

The normal method of working provides for the telegraphist, having accepted a phonogram and determined its routing, to set up the required TAS connexion and to transmit the message. If other calling signals are waiting, further messages are accepted from callers while the forwarding of messages in hand is left in abeyance for the time being. At normal traffic levels this procedure works well because occasional traffic peaks are balanced by similar periods of light traffic. When substantial heavy pressure occurs, as can happen for example, on a Saturday morning, it may be necessary to adopt a system akin to "suspended call" working in telephone operating and in effect to "book only", the message being forwarded by a separate operator using a separate teleprinter. Alternatively, operating can be split by employing two telegraphists at one combined position, one to deal with phonogram acceptances and the other with routing and forwarding.

Counter-accepted telegrams (less than one-fifth of total acceptances at teleprinter offices) are forwarded from one or more teleprinters specially provided for the purpose. At printergram centres, messages from telex customers for onward

transmission as telegrams (about 4 per cent. of total acceptances) are injected into the normal combined working stream at convenient positions.

Further Operational Advantages

Rationalization of the process chain achieved by combined working avoids employing a separate operator on circulation and distribution duties. A further advantage flowing from a shortening of the process is that there are fewer occasions when subsequent operators in the operation sequence have to re-absorb some of the information their predecessors have already acquired. Information is subconsciously carried forward when one operator does the whole process, thus avoiding duplication of effort.

Combined working has also facilitated streamlining certain of the statistical processes in telegraph instrument rooms as a direct consequence of the reduction of movement of message forms within the office.

On a less material plane, it seems likely that the more comprehensive function of the telegraphist at a combined position gives the operator greater satisfaction. The ability to take a message from a caller, and to see it through to the distant TAS office carries with it a satisfaction denied to the operator who forms merely a part of the process chain. A further aspect is the creation of conditions more conducive to team spirit, in that mutual assistance in handling telegrams is more readily achieved and is more readily apparent. Moreover, the new layouts help to establish a more favourable working environment; elaborate and unsightly conveyor systems are no longer necessary and the L-shaped tables instead of phonogram suites are more attractive and more in keeping with office conditions than the former layouts. The staff who use the new installations have responded favourably to them, which augurs well for future pride of craft.

Besides the development of new methods of handling telegrams from telephone users, a great deal of work has been done on processing telegrams coming in to a TAS office from distant teleprinters. Here again the principle followed has been to bring

Fig. 3: Suite of combined positions at Leeds

the tools to the telegraphist rather than, as the older method often involves, moving the telegraphist from machine to machine. An example of the method adopted is shown in Fig. 4. Three teleprinters have been fitted, one above the other, in a "stack", so that the tape feeds are accessible with minimum movement to the telegraphist. Circuit arrangements are such that the machine nearest to hand for a seated telegraphist receives most work under normal conditions. It will be noted that the tape feed from the top machine in Fig. 4 is different from the other two. This is an experimental device to overcome difficulty with tape tear-off which has occurred in some measure from the least accessible teleprinter.

The keyboards are used at present primarily for testing, but their possible use in facilitating a streamlining of inter-office enquiry (RQ/BQ) traffic is being reviewed.

Fig. 5 shows three "stacks" in the layout adopted at Leeds. The photograph also shows the segregation positions, where it is determined whether a message should be delivered by telephone, by telex, or by messenger, and whether any special delivery instructions are applicable. This position has been placed immediately adjacent to the incoming operators to eliminate the need for separate distribution of messages and to allow combinations of segregation work with incoming "gumming" work at quiet periods. Also shown are the positions from which telegrams are delivered by telephone, and by telex, and the positions where messages are addressed and enveloped for hand delivery. Again, these positions are arranged to avoid a separate distribution duty and to facilitate the combination of different functions at slacker periods.

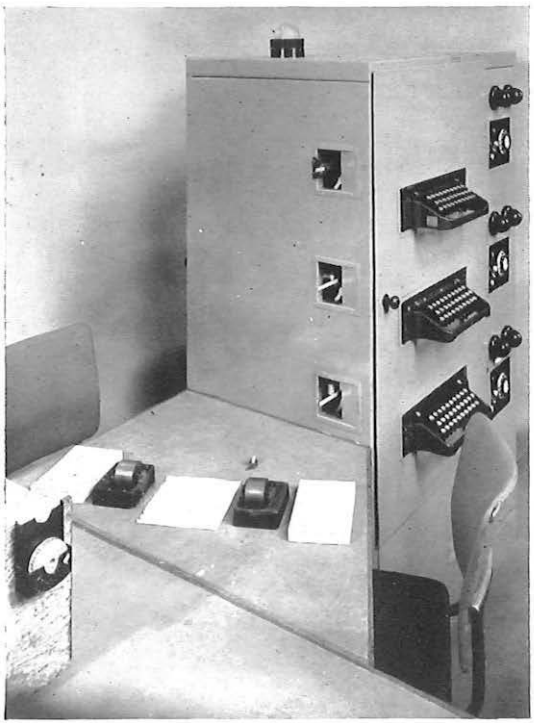


Fig. 4: Stacked incoming teleprinters

Fig. 5: Incoming positions at Leeds

Cost Comparisons

In general, combined working involves for a given traffic level somewhat more equipment than older layouts demanded. On the other hand, accommodation requirements tend to be appreciably smaller and above all, the less skilled work in instrument rooms, formerly in fact done by very junior staff, is largely eliminated. The ultimate net effect has been calculated as reducing telegraph

running expenditure by some £100,000 a year. To this can be added that improvement in pride of craft and in satisfaction with the job, which play such a real part in creating good morale.

A Further Development

Suggestions that onward transmission should be carried out during reception of a message from the caller were referred to earlier in this article. For a number of reasons, some of which have been mentioned, the idea has not hitherto been pursued very far and effort has been directed to the scheme of combined working described. Now, however, encouraged by present-day statistics which indicate an increasing proportion of messages which need no correction, an experiment is in progress, at Stoke-on-Trent and Swansea and shortly to be extended to Exeter, in the simultaneous acceptance and onward transmission of messages. Much work remains to be done before coming to firm conclusions about this scheme, but early indications are promising.

In a relatively short article, all the work which has proceeded concurrently with and has facilitated the main project of combined working cannot be described. One brief reference can perhaps be permitted, however, to the change from the former telegraph routing information based on a multitude of telegraphic addresses to the system of routing based on post towns which was introduced in July of last year. The condensation of routing information to visible index file size, which this has made possible, has been a major contribution to the success of combined working, quite apart from other advantages inherent in the post town routing scheme.

My grateful acknowledgments are due to all those earlier workers in the telegraph field whose notes have been so valuable in the compilation of this article.

"MONARCH" is Laying CANTAT

"We are about to set out on a great enterprise," said Miss Mervyn Pike, Assistant Postmaster General at a luncheon on March 23 at Greenwich Maritime Museum, wishing Captain Bates and H.M.T.S. *Monarch* a good voyage when they set out, a few days later, to lay the first section of CANTAT, the new Anglo-Canadian cable, which itself will be the first section of the 30,000-mile Commonwealth round-the-world telephone cable.

Miss Pike and Press representatives, with Post Office and Cable and Wireless Ltd., officials, had spent an hour looking round *Monarch* while she was loading the new lightweight, polythene insulated cable from the works of Submarine Cables Ltd. *Monarch* cannot carry on one journey all the 90 British-type bothway repeaters and seven submerged equalizers that will be spliced on board along the 2,100-mile route; she will complete the lay by October in three trips. As we reported in our Spring issue, *Monarch* has been refitted both to carry the new cable and the engineering equipment needed, as well as to improve crew accommodation. The latest Decca radar system has also been added.

The luncheon was given by Cable and Wireless Ltd., who will own the cable (£8m.) jointly with the Canadian Overseas Telecommunication Corporation, the Post Office operating the British end. The deep-sea sections of the cable will be of the Post Office-designed lightweight cable, which is designed to overcome the twisting difficulties inherent in armoured cable and is one-fifth the weight of the latter.

After lunch many of the visitors were shown round Submarine Cables Ltd. Greenwich Works which, since the Erith factory was equipped for making TAT1, has been converted to manufacture the lightweight type. The successive manufacturing processes were demonstrated; the inner copper conductor, in strip form, being wrapped round the tensile steel stranded wire "backbone" and box seamed; the polythene insulating core being moulded round the conductor, and followed by the aluminium return conductor tapes, polythene film separator, aluminium screening tapes with polythene film interleaved, impregnated protective cotton tape and, finally, the outer polythene sheath. The overall diameter is $1\frac{1}{4}$ inches.

The main cable (CANTAT A) will run from Oban, Scotland, to Hampden, Newfoundland, and thence overland to Corner Brook. H.M.T.S. *Alert* will lay a 450-mile extension of conventional cable (CANTAT B) from Corner Brook to the south bank of the Gulf of St. Lawrence for the Canadian Overseas Telecommunication Corporation.

Radio Station to be Built in Chilterns

An impression of the radio tower
(Courtesy, Ministry of Works)

FOLLOWING a local public enquiry in January, the Government have agreed to the erection of a Post Office radio station on land to the west of the London-Fishguard road (A.40) belonging to Kiln Farm in the Chiltern village of Stokenchurch, Buckinghamshire.

The station is needed urgently to meet growing demands for trunk circuits, and to extend television facilities to main centres of population; it will be the key station to the West of London, serving heavily loaded routes to the North and West, and meeting demands to the East.

The Post Office have undertaken to use materials which will merge into the background of the countryside, and will screen the site by tree planting. The station will probably comprise a radio tower about 250 feet high and a single-storey building of about 5,000 square feet. The tower will be cylindrical; the upper part, which will contain the aerials, will be about 75 feet high and 55 feet in diameter; the lower supporting structure, which will taper slightly, will be approximately 175 feet high and 45 feet mean diameter.

The building will probably be one of a new range of standardized buildings for stations of this type, and will include an apparatus room 50 feet wide and 55 feet long, and a power room half as wide and of the same length. There will be a small separate battery room and the usual welfare facilities.

Six other sites in the area were considered, but the Inspector in his report to the Minister of Housing and Local Government recommended Kiln Farm in the interest of doing the least harm to the Chiltern landscape, and for technical reasons. A four-year search of the area had produced only seven possible sites, and there was not enough possibility of discovering more sites by further search to warrant deferring the programme for establishing a network, of which the Chilterns station is a key point.

The Post Office hopes to complete the building and tower by the end of 1962 to give adequate time for equipping during 1963. This will meet the requirements for linking the station with the new London radio terminal at Museum exchange (see page 60, Spring issue), which should become available in the middle of 1963.

Avo International Transistor Data Manual, edited by C. E. Bull (Avo Limited, 35s.), provides information on approximately 3,000 transistors and includes obsolete, obsolescent, current production and prototypes. Data from 90 transistor manufacturers and distributors are listed, including those of American, European, Japanese, Australian and East European origin. Information is also given on transistors having Services Common Valve (CV) specifications.

Telephone Engineering Centres

C. T. Polhill

IN earlier years most of the engineers employed on the construction and maintenance of telegraph and telephone circuits had their headquarters at post offices, telegraph offices and telephone exchanges. Their accommodation requirements were re-examined in 1929, with the result that new standards were recommended for full-time staff employed in operational buildings, mobile staff employed on the external services, and for engineering stores. The expansion of the telephone service led to an increase in engineering staff and the growth of the motor transport fleet with the result that accommodation at telephone exchange buildings and staff headquarters became totally inadequate for the mobile staff and their vehicles, and the overflow had to be housed in rented or leased premises often at some considerable distance from the operational centre.

A further review in 1937 resulted in a recommendation that the headquarters of staff on external construction, jointing, apparatus fitting, and mobile maintenance duties should be at the same place as the stores and vehicles they would use. This policy of concentration at engineering depots was adopted because separation resulted in loss of efficiency and wastage of time and vehicle mileage, but the scheme had to be deferred for financial reasons when war broke out.

During the post-war years a few engineering depots were planned and built where they were vitally needed. The need of funds for more important projects such as telephone exchanges and repeater stations prevented development of the scheme on a larger scale.

A further study of accommodation standards to meet present requirements confirmed that the policy of concentrating the "external" engineering services is sound. Of a total engineering staff exceeding 66,000 some 15,000 are employed on full-time duties in telephone exchanges, Telephone Managers' offices and repeater stations. Most of the remaining 51,000 men work on the "external" engineering duties, using about 16,660 vehicles, 1,700 trailer-type mechanical aids, 2,100 portable aids and 1,350 stores-handling devices to assist them in their work.

External engineering accommodation in Telephone Managers' headquarter towns, and towns of comparable size, should be designed with the most efficient layout to meet the requirements for a staff of about 120–160 men with their vehicles and stores. A recent study group recommended that the premises should be known as Telephone Engineering Centres (TECs)—or Telephone Service Centres (TSCs) where a sales or traffic office will be associated with the engineering accommodation—and that such premises should be where the engineering staff can do their work efficiently and economically.

Fig. 1: Combined dining room and lounge

Fig. 2: Two-storey building with offices and welfare rooms above the covered storage area

At the planning stage the size of a TEC-TSC will depend on a number of factors, such as the telephone density of the area to be served and its geographical layout and extent. It will not be practical to recommend a rigid size but about 150 vehicles represent the economic limit for a single garage of convenient size, and this is one of the deciding factors in setting the upper limit of a Centre to serve a territory of about 50,000 stations at the 20-year forecast date. Requirements in very large towns can be met with two or more TECs, each serving a territory of about 50,000 stations with one Centre serving the requirements of staff working in the middle of the town and the remaining TECs in the suburbs. In certain areas of very high telephone density as in London, a TEC can be designed to serve a territory of up to 70,000 stations where the staff-transport ratio is high and a single garage for up to 80 vehicles can cover the transport requirements throughout the territory.

At the other extreme, where there are territories of lower telephone density, it would be uneconomic to serve an area of 50,000 stations from a single Centre because the average distance the staff and vehicles would have to travel to and from their work would be excessive, and in those places a TEC will need to be planned on a smaller scale. Where there is a need to outstation engineering staff in self-contained territories of low telephone density the area to be served by a small TEC may vary down to some 18,000 stations. In isolated districts small staff groupings can be headquartered at operational sites such as telephone exchanges when the accommodation requirements for the mobile engineering staff will be relatively small, so as to keep the size of site within reasonable limits.

The accommodation at a TEC-TSC will normally consist of:—

(i) offices, and welfare rooms;
(ii) workrooms and separate workshops;
(iii) section stock and works order stores, yard storage including cable compound, and pole stacks;
(iv) lock-up sheds for foremen, and for cement, sand and ballast;
(v) garage or hardstanding for vehicles;

and such optional facilities as

(vi) motor transport workshops and storerooms;
(vii) workshops for kiosk assembly, and for the maintenance of mechanical aids;
(viii) teleprinter overhaul workshops;
(ix) any other special requirements.

The various items of accommodation in each section will be grouped together to achieve the most economical functioning within a Centre. The welfare accommodation will be provided for joint use by all Post Office staff; Fig. 1 shows a typical dining room with adjoining kitchen. Offices can be provided for the officer-in-charge and for other engineering supervisors, including space for installation and works control rooms if these are needed away from the Telephone Manager's office. It may be undesirable to erect single storey buildings for each requirement, because of building costs or the limitation of the site, and in such circumstances the architect might plan a two-storey building to meet some of the requirements. In Fig. 2 the offices and welfare rooms are on the upper floors of the main building with the section stock and works order store at ground level. The buildings in the left foreground are workrooms and

Fig. 3:
Assembly
and
general
workroom

Fig. 4:
Combined
section stock
and
works order
stores

workshops; foremen's lock-up sheds are shown on the right.

A general workroom as shown in Fig. 3 will be required for the assembly of staff who are not at the Centre all day, for part-time writing work which they perform and for miscellaneous engineering work. At the larger Centres this workroom can be sub-divided into separate workrooms where the overall noise-level in a single large room might cause inconvenience to other room users, and separate workrooms would then be used by such staff as jointers and apparatus fitters. Additional workshops for renovating apparatus, cable repairs, assembly of kiosks, teleprinter overhauls, repairs to mechanical aids, and the maintenance of electric light and power equipment can be provided as required.

Storage accommodation will consist of a combined section stock and works order store so that full use can be made of stores-handling appliances. There will be a serving counter at which the storekeeping staff will deal with stores transactions; the posting of tally cards and stores clerical work will be done in the storekeeper's office. Fig. 4 shows bays of metal shelving assembled as storage bins.

Drums of cable, manhole frames and covers, poles, and other engineering stores which can be stored in the open without deterioration, will be in the adjoining yard storage space, as illustrated in Figs. 5 and 6. Within the storage area additional space may be needed for handcarts and trailer tool-carts, a ladder rack, lock-up sheds for storing cement, sand and ballast, and cylinders of propane gas, and an explosive store; the space can be provided to meet local requirements.

When a large vehicle fleet is to be accommodated the vehicles can often be serviced and washed after normal engineering hours, thus allowing the staff using the vehicles in daytime to spend a maximum amount of effective time on telecommunications work. The garaging area within a Centre will include space for petrol pumps, oil store, washing and greasing bays, and where the number of vehicles justifies using motor transport staff a

Fig. 5: Yard storage compound

Fig. 6: Pole stack stagings with concrete walls

motor-transport workshop and storerooms for motor parts will also be provided.

Centres will need to be carefully sited to ensure that waste vehicle mileage and ineffective time costs are kept to a minimum. To achieve this the Telephone Manager prepares an Area Fundamental Plan showing the locations of staff and vehicles within the Telephone Area at the time of opening, and for the following 20-year forecast period. Staff and vehicles for the forecast period will be estimated to support the sales development figures on the expected growth of the telecommunications services. From the information recorded on the completed plan it is possible to determine the localities where engineering staff will eventually be placed throughout the entire telephone area.

A programme can then be drawn up for planning the size and selecting the most suitable location for each TEC-TSC, and to decide on dates when individual buildings should be provided or altered over the whole of the 20-year planning period, so that new and extended premises are planned as part of an overall scheme. In this way, Centres can be provided to meet accommodation requirements in five-year units with subsequent extensions up to maximum size, thus avoiding the possibility of overlapping or duplicated building schemes which might result from the planning of each Centre on an individual basis. A new site may not be required where existing accommodation can be modified to conform to the latest standards.

Mechanization of Telephone Billing

A major step towards the complete mechanization of telephone accounting was taken by the Post Office with the installation at Portsmouth of punched card and electronic machinery. With the other eight cities in which similar units are already working, this installation will ultimately help to deal mechanically with almost all the telephone accounts in the country.

At present some 10 million telephone bills are prepared in a year. The reintroduction of quarterly telephone accounts with Subscriber Trunk Dialling will increase this total to at least 21 million by 1966. However, as increased STD will mean that most trunk calls will be dialled, the amount of work in preparing individual accounts is expected to drop considerably.

In 1960 some 800 million individual tickets were prepared for telephone calls. By 1966 this is expected to fall to 450 million, and by 1967 to 350 million.

The extension of the mechanized system will enable quarterly billing to be widely extended without employing the large numbers of additional staff which would otherwise be necessary.

The total cost of the equipment in all nine places is £850,000.

The Accountant General's Department

EVERY large business needs an organization to carry out its accounting processes and to make proper financial appraisals of its activities. The Accountant General's Department provides these services, and some others, for the Post Office.

The Department's work is very diverse, including such extremes as launching legislation and sorting postal orders. It has nearly 3,000 staff, distributed among some 30 branches or divisions, and the working equipment ranges from the humble plus adder to an electronic computer.

The AGD's responsibilities include advising ministers on questions which are predominantly financial, as well as formulating advice at all levels on the financial aspects of other matters. It also has a special responsibility for conducting relations with the treasury.

A large number of staff deals with the internal accounting of the Post Office. This work involves scrutinizing, checking and collating accounts from the many thousands of points at which money is handled. This is partly designed as a safeguard against inaccuracy or fraud and is supplemented by on-the-spot audits, carried out either by the AGD itself or by local auditors acting under the Department's guidance.

These local accounts are analysed and summarized in the process of building up the central Post Office accounts. This work is part of an annual cycle starting with the formulation of estimates and ending with the publication of the final

Left to right: Mr. N. F. HOLMAN, Deputy Director of Finance and Accounts II; Mr. H. W. BARNES, Deputy Director of Finance and Accounts I; Mr. H. G. LILLICRAP, Deputy Director of Finance (Policy); Mr. K. ANDERSON, CB, CBE, Deputy Director General and Comptroller and Accountant General; Mr. S. WOOD, Chief Statistician; Mr. E. W. SHEPHERD, Director of Finance and Accounts

accounts for the financial year.

Another large group, at Bickley in Kent, constitutes the central administration of the remittance services—Postal Order, Money Order and Postal Draft. The sorting, checking and correspondence required absorb the labours of a staff of about 1,000.

Other branches are concerned with calculating individual rates of pay, as a check on the accuracy of local pay points. The AGD itself pays Headquarter staffs, and is also now making payroll calculations for 37,000 other Post Office staff in the London area by an electronic computer, operated by a specialist section (London Electronic Agency for Pay and Statistics—LEAPS). The AGD hopes not only to increase the payroll load to more than 100,000 staff, but also to extend the use of the computer for other purposes as experience is gained of its potentialities.

The AGD not only ensures that Post Office staff are paid their due rates during service; it also pays their pensions after retirement. This is the function of a group of staff at Harrogate whose personal service provides a continuing link with the Post Office that pensioners apparently much appreciate.

Costing is an aspect of AGD work which is growing in scope and importance. This is increasingly putting into the hands of Post Office management vital information about the cost, and hence the profitability, of Post Office services.

There are also sections handling accounts between the Post Office and other United Kingdom Government Departments or postal and telecommunications administrations abroad. Another responsibility is handling the astronomical sums of money which flow through the Postmaster General's Account on their way, for example, from customers to pay points or from Post Office counters to other departments.

The Chief Statistician's Division also forms part of the AGD. It has a special role to play in advising the Post Office on statistical methods. The Division also conducts or directs some enquiries itself, using modern sampling techniques which permit the economical and accurate gathering of information required for Post Office management.

Vision Links to the South West

When the Independent Television service was extended to the South West of England on April 29, five new Post Office vision links came into operation.

Two of these links are major engineering projects, the first inter-connecting London and Bristol by coaxial cable and the second interconnecting Bristol and Plymouth by line of sight radio link. Two shorter links, using line of sight radio transmission, connect Plymouth with the new ITA broadcasting stations at Stockland Hill in Devon, and Caradon Hill in Cornwall.

The link from London to Bristol is provided in a coaxial cable containing six tubes, two of which are used for television and the remaining four for telephone trunk service. The vision circuit, which is 140 miles in length, is equipped with carrier line equipment to operate in the $\frac{1}{2}$ – 4 Mc/s frequency band.

The main radio link between Bristol and Plymouth is 125 miles long and has four intermediate repeater stations. The radio link to Caradon Hill consists of one short hop of 16 miles, while that to Stockland Hill is 67 miles long and goes through two of the intermediate repeater stations of the main Bristol–Plymouth route. Programmes can thus be fed to the ITA transmitters either from the studios in Plymouth or from the national network which is accessible at Bristol or London.

The radio equipment used on these links operates on frequencies of about 4,000 Mc/s. Each link is provided with protection equipment which will be automatically switched into service in the event of breakdown. The intermediate radio stations are unusual in that the radio signals are amplified directly at micro-wave frequency.

It is essential that each station is within line of sight of the next. For this reason the radio stations have to be built on high ground and great care was taken in the choice of location and in the design of each station to make them as inconspicuous as possible.

At each end of the main radio link vision signals are extended distances of approximately four miles from the radio terminals into Post Office television centres in Bristol and Plymouth by means of coaxial cables equipped for unbalanced video transmission.

Railway Electrification and Post Office Lines

D. W. R. Cobbe, A.M.I.E.E.

RAILWAY ELECTRIFICATION, WHICH STARTED in this country in 1883 when Volk's Electric Railway running on the foreshore opened at Brighton, has been in the news recently with the opening of a number of electrification schemes in the London area, Glasgow and Kent. While the Kent scheme has consisted of an extension to the existing well-tried Southern Region DC electrification, and has been introduced without apparent difficulty, the remaining schemes, which use high voltage AC, have suffered some teething troubles.

In the circumstances this article, which is concerned mainly with the difficulties which might arise under AC electrification, might be construed as adding weight to the case for DC as against AC, and it is perhaps desirable to put the matter, so far as the Post Office is concerned, into perspective by saying that DC electrification also has its difficulties, mainly from corrosion to underground cables from stray currents. These difficulties are in consequence not so immediatcly apparent but are nevertheless expensive.

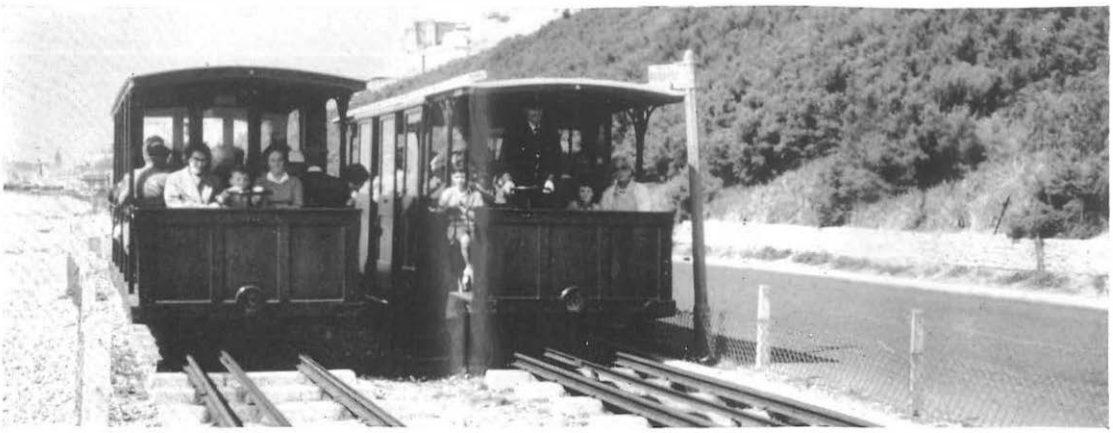
The Transport Commission's adoption in 1956 of the 50 c/s AC system as standard for future electrification (other than on the Southern Region) was preceded by the introduction of the system in several countries from as long ago as 1930, but notably more recently in France where over 3,000 kilometres have been electrified on the new system. Other countries, including India, Japan, the U.S.S.R., China and Portugal, have working, or under installation, 50 c/s electrification schemes. In Scandinavia, Germany and Switzerland, AC systems working at the lower frequency of $16\frac{2}{3}$ c/s are operating. Thus, AC traction is well established, and in the light of such experience the Post Office has had to consider possible repercussions on its telecommunications network and to negotiate with the Transport Commission about measures to overcome difficulties.

The AC system, like the electricity grid system, takes advantage of the economies of high voltage; 25 kV working permits lighter construction of overhead equipment, and an increase in distance (to 30-40 miles) between sub-stations as compared with DC. The train motors still operate, however, on a DC basis since such motors have characteristics most suitable for traction. Thus, the train equipment consists basically of a transformer, rectifiers and DC motors.

Despite the high voltage employed, the power required to operate a train is such that the current in the overhead wire is likely to be several hundred amperes, and this current returns to the substation via the rails and earth. Since telephony uses currents of the order of milliamps or even microamps, it is not surprising that the magnetic fields from the current flowing in the loop formed by the contact line and rail/earth return may cause induced voltages in telephone wires and cables in proximity to the railway sufficiently great to interfere with telephone speech and signalling.

The possible interference (in the form of noise) to speech arises from the presence of harmonics of 50 c/s in the traction current which extend in frequency up through the voice range ("mains hum"), and the interference to signalling from the larger 50 c/s component which is enough to interfere with relay operation, and cause false supervision or "wrong number" troubles.

Another form of coupling between railway and telephone plant is possible—electric (or capacitative) coupling which arises only on open wires or aerial cables not having a metallic sheath which either cross or run very close to the railway. Generally, only subscribers' lines come in this category.



Volk's Electric Railway, Brighton
(now owned by Brighton Corporation)

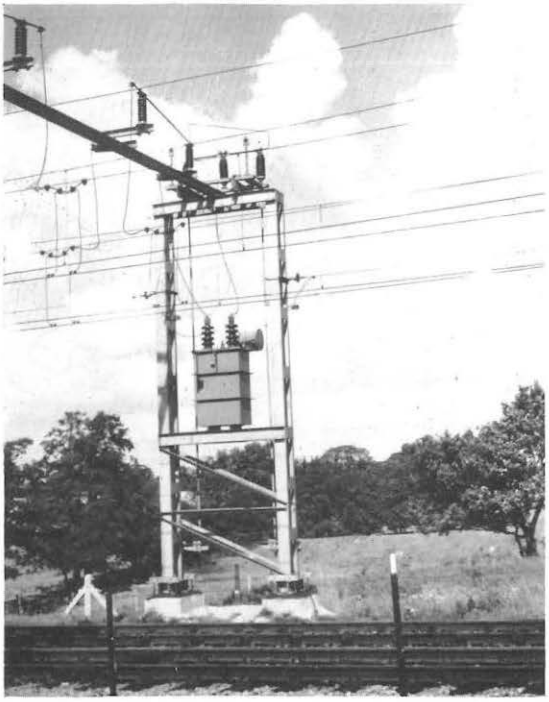
Of the two forms of coupling described, the magnetic was considered potentially the more serious since it could affect the junction network; for example, it was estimated that some 1,400 such circuits would be liable to excessive interference in the Manchester-Crewe area, and the work necessary to make such a large number of circuits of many different designs immune from interference would be prohibitive, particularly bearing in mind the relatively short time between the decision to electrify and its implementation.

Discussions with the Transport Commission led to decisions to equip the initial electrification schemes with booster transformers and, in most schemes, return conductors which have the effect of confining the traction currents very largely to the railway system and thereby reducing the interference due to magnetic induction. Railway telecommunications and signalling cables are, of course, also affected by interference and these measures in general also reduce the interference on the railway plant. The reduction is not, however, as great as that given to more remote plant such as the Post Office network.

Besides their cost, booster transformers do, of course, constitute an embarrassment to the railway since their insertion increases the impedance of the power feeding system and can cause a drop in voltage of several kV at the train. For this reason the latest schemes such as Euston-Crewe which include sections where Post Office plant is not so likely to be affected, will probably not be equipped in some sections with such measures of suppression at source. There are also certain areas in large cities and towns where, because of clearance difficulties for 25 kV requiring excessive engineering works, a lower voltage (6.25 kV) is being used, and in such areas the distance between sub-stations is much reduced. In some of these schemes the transformers may not be required, and experiments are planned to determine the effect of omitting them.

When considering the interference which has arisen to date, we must bear in mind that there is frequently a considerable delay between the incidence of the interference, the noting of it by a subscriber, the reporting of it, and finally the association of the complaint with the possibility of induction from a source external to the Post Office. This is largely because the interference is intermittent—and, of course, many subscribers are tolerant. In practice it can be six months or more after the opening of a line before one can be reasonably certain that the troubles, if any, are known.

Thus it might be early yet to assess the full results of the first few schemes, but the number of subscribers' lines affected to date (February 1961) has been well over one hundred. The majority of these have been because some shared service lines are using obsolescent equipment (Bell Set No. 41) in which a connexion to earth is made at each subscriber's telephone via a bridge-rectifier network which itself is capable of causing noise in the presence of quite small 50 c/s voltages; these bell



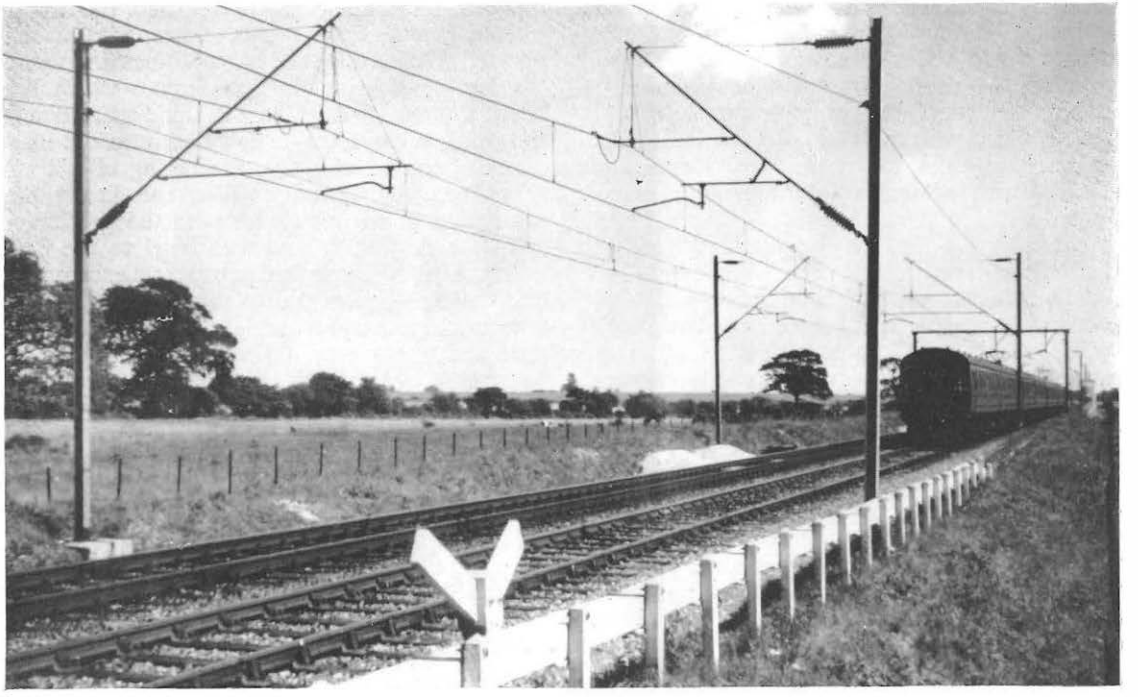
sets have long been known to cause trouble, and fortunately, replacement by a "thermistor" type telephone provides a simple cure. Another cause of complaint has been induction into PBX power leads causing noise on all extension-extension calls. In this instance the cure is provided by an electrolytic capacitor connected between power lead and earth at the PBX.

Those occurrences, which are due to magnetic induction, are where subscribers' cables run very close to the railway for several hundred yards (for example, through gardens backing on the railway or along a road beside the railway) and for these booster transformers will not necessarily be effective. In addition, there have been the previously mentioned instances of electric induction into open wires, where the only available cure is to place the circuits in an underground or metallic-sheathed cable.

So far as junction circuits have been concerned,

Opposite: Booster transformer, on the Colchester-Clacton line

Below: Catenary system, Colchester-Clacton line



the troubles have been minor, although some difficulties have been caused by equipment of an insufficiently high standard of balance. These difficulties merely serve to emphasize that maintenance standards need to be higher in the presence of a disturbing magnetic field.

On the whole, the introduction of electrification may be said to have been accomplished to date without undue difficulty but a series of diverse problems will continue to arise because of the variety of equipment in use, and although an experimental assessment of the usefulness of booster transformers has been made, a field assessment is still required.

This outline is necessarily brief and a more detailed account may be found in the Institution of Post Office Electrical Engineers Printed Paper No. 217, but it may give some idea of the problems which the Post Office has to face arising from railway electrification.

Telecommunications Statistics

	Quarter ended 31st December 1960	*Quarter ended 30th September 1960*	*Quarter ended 31st December 1959*
Telegraph Service			
Inland telegrams (excluding Press and Railway) ...	3,054,000	3,523,000	3,080,000
Oversea telegrams:			
Originating U.K. messages	1,675,586	1,694,248	1,670,646
Terminating U.K. messages	1,660,963	1,698,065	1,637,824
Transit messages	1,245,752	1,435,165	1,542,529
Greetings telegrams	733,000	860,000	725,000
Telephone Service			
Inland			
Gross demand	138,683	135,144	115,948
Connexions supplied	123,256	111,699	106,558
Outstanding applications	156,724	155,181	132,691
Total working connexions	4,958,536	4,889,308	4,727,017
Shared service connexions	1,133,504	1,129,928	1,128,871
Total inland trunk calls	106,199,000	*107,282,000	95,875,000
Cheap rate trunk calls	23,982,000	26,858,000	20,225,000
Oversea			
European: Outward	764,983	*751,773	719,176
Inward	ø747,412	*763,654	718,999
Transit	3,681	*3,745	400
Extra-European: Outward	76,775	*70,517	69,521
Inward	ø81,000	*80,584	80,182
Transit	ø17,400	*17,314	20,748
Telex Service			
Inland			
Total working lines	6,749	6,459	5,689
Calls from manual exchanges	319,000	422,000	614,000
Calls from automatic exchanges	203,000	266,000	287,000
Metered units from automatic exchanges ...	8,971,000	6,515,000	2,547,000
Oversea			
Originating (U.K. and Irish Republic)	766,299	712,653	635,020
Terminating (U.K. and Irish Republic) ...	716,411	648,917	605,937
Transit	13,070	12,979	7,948

* Amended figure. ø Estimated figure.

We are starting a *Revolution in Telecommunications*

The Postmaster General being detained in the House of Commons, Mr. W. A. Wolverson, a Deputy Director General, read his annual speech to the Telecommunications Engineering and Manufacturing Association on February 15.

As well as reviewing general developments in telecommunications the Postmaster General reported that following letters between British and American experts, the Post Office was to erect a ground radio station with a large aerial system for satellite communication tests.

WE ARE AT THE BEGINNING OF A REVOLUTION in telecommunications—a revolution which will be complete only when anyone in this country will be able to dial calls to anyone else with a telephone anywhere in the world.

Let us see what that means.

First, we have to finish the conversion of all manual exchanges to automatic and this we shall do by 1970. We are making good progress; of a total of 6,000 exchanges only 840 are still manual and this figure is being reduced at the rate of two a week.

Second, the programme for subscriber trunk dialling is now gathering momentum. So far, it has now been introduced at 38 exchanges and by this time next year we shall have it at 300 exchanges, covering $1\frac{1}{4}$ million subscribers. Our experience of STD is that not only do customers dial 95 per cent. of their calls, but that it is followed almost at once by a big increase in the number of calls.

But the introduction of STD is not the only way of getting people to use their telephones more. Six months ago I reduced the cost of local calls from home telephones in non-STD areas, from 3d. to $2\frac{1}{2}$d. At the same time I cut the charge for cheap night trunk calls and extended the cheap rate period to the whole of Sunday. In one respect, at least, these changes are bringing grist to the mill. Since the charges for evening and weekend trunk calls were reduced six months ago these calls have shot up by 10 per cent. more than the normal increase. That is the way to do it.

In trunk traffic generally—that is day and night—an annual increase in traffic of over 10 per cent. has now been maintained for nearly three years. Of course this has to be matched by further supplies of trunk lines and trunk equipment and, in its turn, this calls for a tremendous effort on the part of both our Post Office engineers and our contractors.

It also calls for the fullest exploitation of new techniques. These include greater use of micro-wave radio for national trunk communications.

The biggest need for more trunk circuit capacity is, of course, here in London at the heart of our trunk communications. We recently decided that we needed a micro-wave radio network. The key point in this network will be a radio tower* capable of clearing the large numbers of tall buildings which are now going up in London. I hope to start this year and to have it fully equipped by 1964. When the network of which the tower is the key feature is finished, it will not only ensure that the trunk telephone requirements for London can be met for many years to come, but it will also provide the capacity for a considerable expansion of television channels for broadcasting.

Yet the rate of increase in overseas traffic is even more striking and I believe this increase is likely to go on as long as we can improve facilities. It was largely for this reason that the Commonwealth round-the-world cable scheme was conceived.

The link between Canada and the United Kingdom will be open this year and other links will follow. Orders have recently been placed by Cable and Wireless Ltd. for the manufacture in the United Kingdom of the cable and associated equipment for the Australia-New Zealand-Canada link. These contracts are valued at £18 million.

In addition to providing for the increasing traffic these trans-oceanic cables have also made it much easier to solve the problem of semi-automatic working over inter-continental circuits.

*See *Journal*, Spring 1961, page 60.

In fact semi-automatic working, by which operators in this country can dial subscribers in other countries is already in operation with the Netherlands, Belgium, Germany, France, Denmark, Sweden, Norway, Switzerland and Austria and I expect it to be in operation with Italy very soon.

Agreements have been reached on the fundamental facilities to be provided for subscriber dialling between the countries in Europe and additions have been made to the specifications to cover this method of operation.

Equipment is also being designed to allow subscriber dialling to the continent from London for subscribers whose exchanges will progressively be equipped for STD. I hope that the service will be ready early in 1964. The rest of the country will follow as soon as possible.

We have also reached agreement with the American Telephone and Telegraph Company, the Canadian Overseas Telecommunications Corporation, and France and Germany, on the facilities to be provided, and the techniques to be employed, in providing those facilities for semi-automatic operation between North America and Europe. I hope the service will open in the spring of 1963. Meanwhile, we have agreed with our Commonwealth partners that the same techniques can be applied to semi-automatic working over the Commonwealth Pacific cables when they are in service in 1964.

I am sure we must not lose sight of the ultimate goal of world-wide subscriber dialling. The design of semi-automatic equipment has been arranged so as not to preclude the advent of subscriber dialling and the International Consultative Committee on Telephones and Telegraphs (C.C.I.T.T.) has set up a special commission to look at this.

But, to think of world communications only in terms of cables is like thinking of National Defence in terms of rifles. We can keep our feet on the ground and yet look to the stars.

It seems pretty certain to me that, in the lifetime of most of us, satellite systems will come into use.

A United Kingdom Government team, which included representatives of the Post Office, recently visited the United States to study satellite communication system developments in that country. This week there was a return visit here when we discussed with the Americans plans for tests of satellite communications across the Atlantic. As a result of these and other studies, I am convinced of the technical feasibility of such systems, though, of course, there are still many technical and operational problems to be solved.

I am sure that our industry will have an important part to play in the development of the communications equipment, of the equipment for satellites and the ground radio stations for satellite systems. And I am equally sure that the ability and ingenuity of British engineers and scientists is such that they will make a substantial contribution in this field.

I am glad to tell you that we have now decided to go ahead with the erection of a ground radio station with a large steerable aerial system for satellite communication tests (*see page* 104).

Of course no one really knows what the costs of operating satellite systems will be, but we shall know more about this when we have had some experience with an experimental communication satellite.

Fleet Building Opened

The Lord Mayor of London, Sir Bernard Waley-Cohen, opened Fleet Building, London's new telecommunications centre, on April 10. Sir Bernard also unveiled, by remote control from the platform, a commemorative stone, and nine external ceramic murals designed by Miss Dorothy Annan, to symbolize telecommunications.

Fleet Building was originally conceived during the war, to cater for the developments expected after the war, but the devastation of the City, causing many businesses to move out of London, deferred consideration until 1948, when active planning was started. Now it has to cater for the large number of office blocks being erected on the bombed sites. The plans have been modified since they were described in the Summer 1958 *Journal*.

The building rises to 14 storeys, two of which are below ground level. London Automatic Telex Exchange, opened last December 12, is in the basement. Two Telephone Managers' offices—City and Long Distance—have been installed; by concentrating the staffs of two Telephone Managers in one building the Post Office has been able to dispose of a number of smaller buildings in which the work has hitherto been scattered uneconomically.

The equipment for Fleet Exchange, which is now in Faraday Building, is to be transferred to Fleet Building, and there is space for another exchange if necessary.

Engineering workshops, stores and an installation office are on the lower floors.

Providing a Telephone

H. M. de Borde

THE FIRST TELEPHONE MANAGERS WERE appointed 25 years ago in March 1936. A principal object in devolving authority for telecommunications to Directors of Regions and Managers of Areas was to unify control of staff concerned with two main functions; first, servicing existing installations, including maintaining satisfactory service from plant and operators, and collecting revenue; and secondly, planning and providing new service, from forecasting the number of likely customers in every part of an Area to connecting new service in customers' premises.

The new organization quickly proved its worth and greatly eased our problems during the war. Since, then, our two main problems have been to overtake the wartime backlog and to cater for the unprecedented new demand. Solution of these problems has been made more difficult by competing demands of other public services for available investment capital.

In most Areas the arrears of work on the provisioning side of the Telephone Managers' organization are now much reduced, although there are inevitably some black spots. It is perhaps of interest to review against this background how a typical Area in the London Telecommunications Region provides service.

Development Forecasting

Every part of a Telephone Area is regularly and systematically reviewed by the Development Team of the Sales Staff. Future plans for growth of both exchange equipment and line plant are determined on the basis of these reviews which cover a period of 20 years ahead.

The team goes into a territory and reviews every part of it in detail. It has information about the existing telephone penetration and, with the help of the local authorities, builders and estate agents, attempts to forecast future development. It is expected to grade tenancies into categories on the basis of their rateable value, and is guided in assessing the degree of telephone development to be expected in each category by statistical information about the average level of penetration in the present and past years.

The equipment section of the Traffic Division forecasts in detail the telephone traffic to be catered for in each exchange area and initiates action to ensure that exchange equipment will be available in good time to meet the foreseeable demand. Estimates of telephone requirements derived from the sales development studies are examined in relation to the site, building and equipment capacity limits of existing exchanges. Equipment requirements are normally planned for the next five years; often a simple extension to an existing exchange may be all that is needed but a watchful eye has always to be kept on the building and site situation because a long time may elapse before a suitable site for a new exchange can be found, and a building erected.

Careful planning and assessment of priorities are essential to ensure that limited funds are used to the best advantage. There are still exchange areas where service cannot be provided because limits of expenditure have prevented orders for equipment being placed in time to meet the expected demand.

Line Plant

More than half the capital cost of providing a line is for the cable linking the subscriber with the exchange; line plant shortages (because our capital resources are limited) are in fact responsible for many of our unfulfilled orders at present, despite shared service. The Engineering Development Group are responsible for planning main and distribution cable networks, and here again the starting point is the sales development forecast. From this forecast the engineer has to draw up a scheme which will provide a pair of wires to join every prospective customer to the exchange. Poles, joint-box covers, pillars and cabinets are the visible evidence of the external plant network of the Post Office. Fig. 1 illustrates the place each of these occupies in the system.

In providing wires for prospective customers, we cannot be sure exactly where the orders will come from. We must therefore provide more wires locally than we can justify joining to the exchange. The pillar or cabinet provides a convenient method of terminating local cables so that individual pairs of wires may be joined through to the

exchange as orders arise; smaller cables can therefore be used, particularly in the early stages of an area development, than would be required if all wires had to be carried through to the exchange. In addition, it is relatively easy to switch pairs of wires from one part of an area to another where unforeseen development may be taking place. The system is flexible, economical and admits of easy expansion to meet increasing demand. (Fig. 2.)

The subscriber's telephone is finally connected to the cable network by overhead wires from poles served by underground cables, or direct from cables via joint boxes in the footway, or by polythene cables laid direct in the footway, usually in a grass verge—see Fig. 3.

One of the Telephone Manager's greatest worries is providing service on new estates. The Post Office is often criticized because it is the last public utility to provide service. Certainly it is often uneconomic to provide telephone service on a new estate until it is in a fair way to being completed, because Post Office cables are more easily damaged than the plant of other utilities and, if laid before drains, sewers and roads are completed, will almost inevitably be damaged. (Fig. 4.) Quite often, too, the first houses built and occupied are at the far end of a new estate, and access by underground cable is impracticable.

The most economical arrangement for new estates, particularly where there are grass verges, is to distribute by polythene sheathed cable laid direct in the ground; unfortunately this type of cable is very vulnerable to the workman's spade or pick. It may be argued that the answer is to lay cable at a greater depth or with greater protection, but against this we must set the already heavy

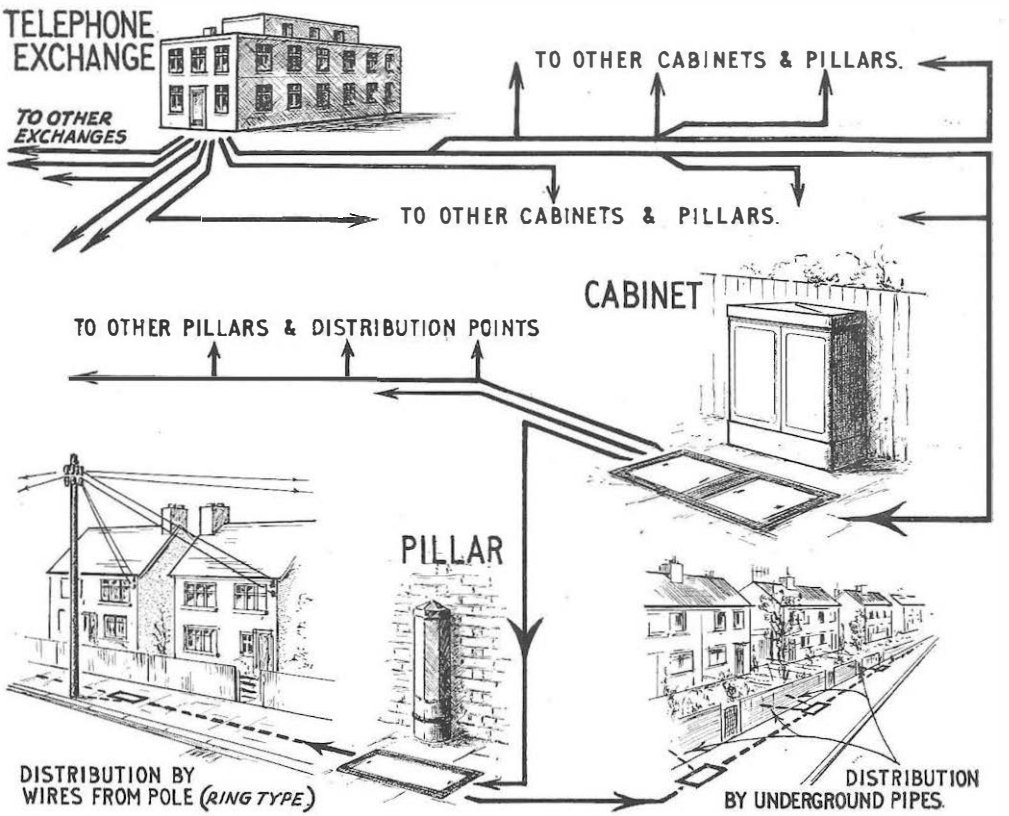


Fig. 1: Typical main and distribution cable network in urban area

Fig. 2: Interior of cabinet and associated footway jointing box

capital cost of telephone provision and the consequent need to avoid any further increase in the costs which our customers would have to bear.

Fig. 3: Contractor's men laying polythene cable in footway

The Engineering Construction Group is responsible for providing line plant. Contractors do some of the work; in general, they lay ducts under Post Office supervision and the Telephone Manager's technicians pull in and joint cables.

Taking the Order for a Telephone

The sales staff are usually the first to hear from a prospective customer, and are responsible for preparing the "order" lists, one of which is maintained by the sales clerks for each exchange area. Equipment and line plant for most applications will be known to be available, but where there is a doubt the sales clerk has to consult the routing officer of the local Installation Office. If plant is available an advice note is issued; this is the works advice on which plant is appropriated and the telephone installed and provides for the subsequent accounting. The advice note normally has nine copies of differing colours which circulate to the various units concerned in providing service; there is also in London a supplementary pack of five copies which supplies the information needed for directory purposes.*

If the routing officer reports that line plant is not available, or that shared service only can be provided, the sales clerk's work becomes more complicated. In many places a relief cable scheme may already be in hand or at least planned, and the customer can be told how long he may have to wait. Where, however, line plant is not likely to be available in the near future, the strength of the applicant's claim has to be viewed in relation to the amount of work that would be involved in providing service. For his guidance the sales clerk has tables of priorities showing the amount of engineering normally permitted for each category of applicant; naturally, business users and those concerned with essential services figure higher on the table than residential applicants. If the amount of work is greater than can be justified, the applicant has to be told that his request will be kept on the order list until it can be dealt with. When shared service only is possible we may have to ask an existing exclusive line customer to share; this often involves a good deal of persuasion and unavoidable delay.

Inevitably, deferment because of shortage of equipment or line plant introduces many complications and frustrations in the daily work of an Area Office staff. It creates additional work in the form

*See "*The Function of the Advice Note*"; Journal, *February-April* 1955.

Fig. 4: Polythene cable damaged during building operations

of correspondence, interviews and so on and demands closest co-ordination of all staffs involved in providing service to ensure that the Area's resources are used to the best advantage.

Installing the Telephone

The installation staff are apportioned geographically between a number of Installation Offices, each of which is fully equipped to deal with the normal work of the territory covered, although there may be some measure of specialization on such work as providing PBXs or telex installations. Each Installation Office has its own stores, routing office, despatch office and fitting staff.

Once an advice note has been issued the Installation Office is responsible for completing the order. The routing officer has records from which he can quote the actual pair of wires in a cable to be used for a new circuit; the information is needed by both the external staff who will join up the premises to the pole or jointing box and the exchange engineer who will join up that pair of wires on the main frame in the exchange to the exchange equipment serving the number allotted. The nature of the external work to be done will vary according to the distribution system used in the district; it may be a simple connexion to a pole or underground cable or involve providing a number of poles and overhead wires. More complicated applications may involve, additionally, converting a neighbouring installation from exclusive to shared service. Finally, the telephone is fitted in the subscriber's premises and tested at the exchange to ensure that it is in good working order.

The average cost of providing a telephone, taking into account the capital value of the plant directly needed, is now about £120. Of this sum,

Fig. 5: Technician working on pole-head of ring type distribution pole

75-80 per cent. consists of line plant cost. Inevitably, therefore, much effort has been directed to reducing this component.

I have already referred to cabinets and pillars, and to polythene cable laid without duct, which secure useful economies in plant costs. Further economy measures are the use of smaller gauge conductors, made possible by the higher resistance limits to which the new exchanges will operate, coupled with the use of 700 type telephones, which possess improved transmission characteristics. A recent innovation is the use of line connectors which will be installed at points distant from the exchange to serve groups of 10 or 20 customers, only two to four pairs of wires being used to connect them to the exchange.

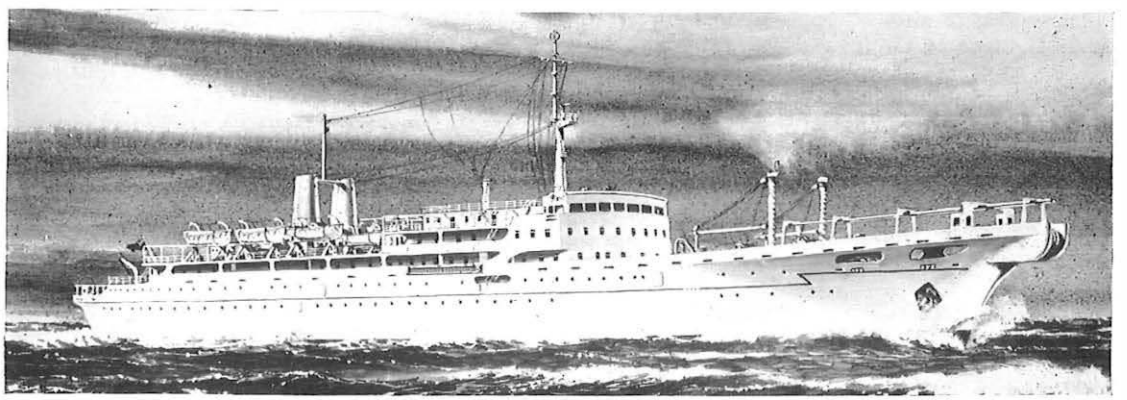
Shared service has also made a contribution by enabling us to defer expenditure on new line plant when it would just not have been possible to provide it on the extensive scale needed to meet the demand. There are now about one million shared service subscribers and the use of this method of providing service has helped to keep down the order list during the period of widespread shortage of plant following the war.

A recent development in London is a device by which an engineer installing a telephone can test the apparatus and exchange connexion without the exchange engineer intervening. This, known as the subscriber's apparatus and line tester, will help further to reduce the engineering effort and hence the cost of installing a telephone.

Many other parties are concerned in providing service. Their work can hardly be described in detail in an article of this length but I may mention the exchange clerks responsible for exchange records, the engineers who prepare the fault cards, the clerical force who prepare the initial and future accounts, compile the directories and arrange for their supply to new customers. Provision of service is, indeed, a combined operation including almost every section of the staff of a Telephone Manager's organization.

The organization for providing service to an expanding community must be efficient, adaptable, and sensitive to the changing needs of the community it serves. It is always in the public eye and must be prepared to face criticism about whether it is discharging its responsibility impartially in the public interest. After 25 years of trial, I think it may fairly be said that the Telephone Manager's organization has acquitted itself with modest success as the instrument of Post Office policy in meeting local service needs.

New Ship for Round-the-World Cable



An artist's impression of the first cable-laying ship to be originally designed to lay deep-sea repeatered telephone cables, such as the projected 28,000-mile Commonwealth round-the-world cable. Cammell Laird, Birkenhead are building her for Cable & Wireless Ltd. The unusual two-funnels-abreast feature is to allow cable working spaces to run through the superstructure without obstruction, to enable cable work at bow or stern. The new ship, which is 8,000 tons gross and will cost £1,900,000 to build, should be ready by summer 1962

Cable Damage Committee issues Charts for Trawlers

THE Cable Damage Committee, formed two years ago by the principal submarine cable owners on both sides of the Atlantic to consider means of reducing damage to cable by fishing vessels, has started issuing a series of charts showing the positions of communication cables in depths to 500 fathoms round the seaboards of north-east America and Western Europe.

The charts, which are contained in information folders with texts in five languages—English, French, German, Spanish and Portuguese—are based on official Admiralty charts. The co-operation of the USSR is being sought with a view to producing folders with texts in Russian. (Last year a Russian trawler caused a break in the first trans-atlantic telephone cable.) Swedish and Norwegian versions are also probable.

The Committee issues the charts free to trawler owners and to such interested organizations as fishery protection bodies and oceanographic and cartographic institutes.

The Post Office is a member of the Committee, with Cable & Wireless Ltd. and American, Danish, French, German and Italian cable authorities. A number of other European PTTs and the Canadian Overseas Telecommunication Corporation are actively co-operating. The Post Office provides the Secretary and Headquarters are at Mercury House, London (C & W Ltd.).

The problem of the risk of damage by trawlers to submarine cables is particularly serious since Britain, Canada, the United States and European countries have laid and are planning to lay repeatered telephone cables which are expensive in comparison with the cost of the conventional telegraph cables. They are also more difficult to lift for repair. Further, as these newer cables carry telephone and telex messages, as well as telegrams, the possible interruption of communications is most serious.

Apart from being subjected to wear and tear from movement on the ocean bed, caused by tides and currents, submarine cables have always been liable to be caught and damaged by ships' anchors. Cable owners have had to face this risk and to foot the bills for repairs. Trawling in relatively shallow waters has also represented a hazard to cables for many years.

A greater hazard in recent years has, however, arisen from the use of much larger trawlers for fishing in deep waters. Records show clearly that many cable interruptions in recent years have been caused by these trawlers. It is the "otterboard" of the trawling gear that usually causes the trouble, particularly if it has a defective shoe or protruding bolts; cables get caught up too, between the forward end of the otterboard, the bracket and the trawl warp. Experiments to improve the otterboards are now being conducted on behalf of the White Fish Authority; the aim is to design an otterboard which will ride above the sea bed.

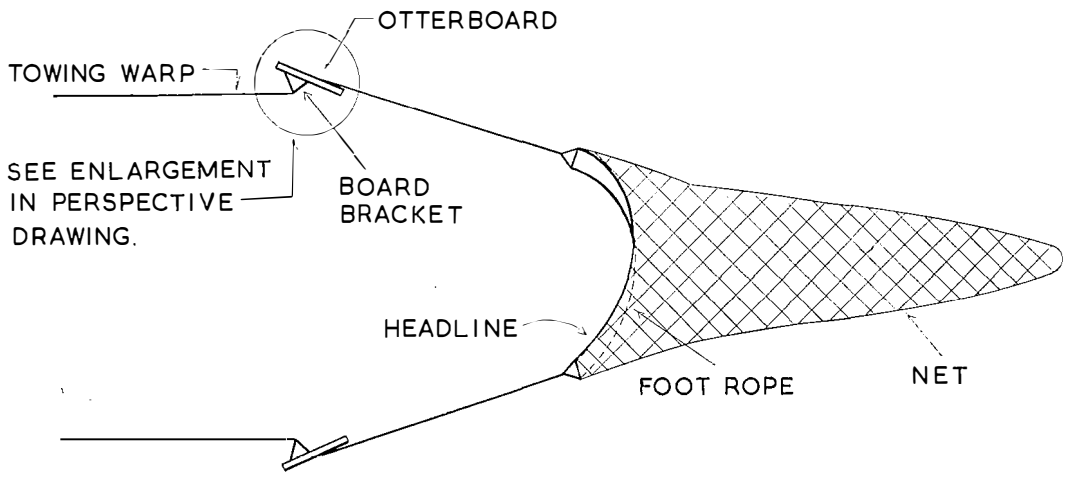
Repairing cables is expensive; the running costs of a repair ship can amount to anything up to £1,000 a day. The total annual repair bill for all the world's submarine cables is estimated to amount to several millions. An interrupted cable ceases to earn revenue and its owners have to pay their competitors to carry the traffic until the cable can be repaired. The owner's customers also suffer by the inevitable delays in transmitting their messages.

Trawler skippers are only too anxious to avoid fouling cables, for it usually means losing valuable fishing time as well. The existence of the cables themselves constitute a trawling hazard (although the trawler owner can claim compensation from the cable owner for loss of gear through entanglement) just as the trawlers constitute a hazard to cables.

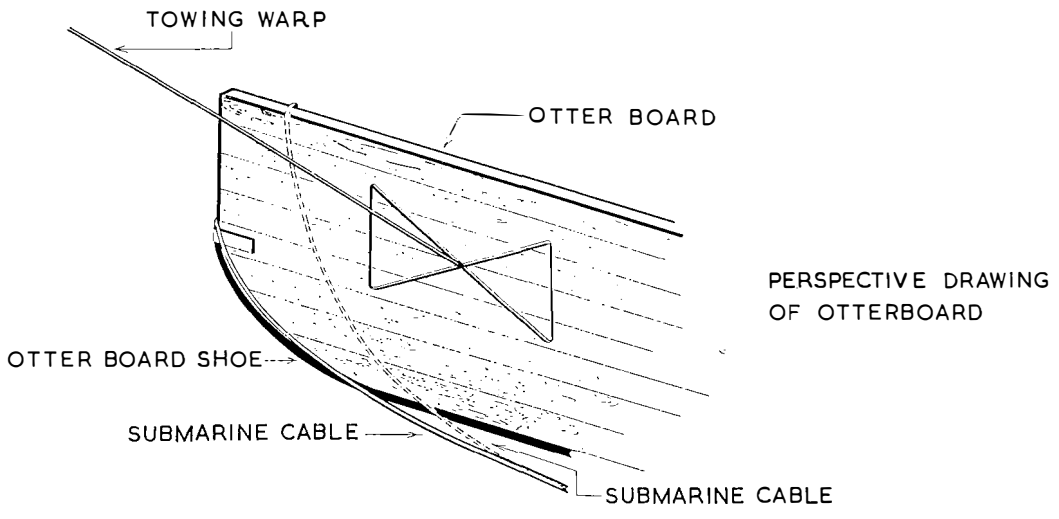
The Cable Damage Committee soon recognized that one of the principal difficulties that trawler skippers faced arose from the absence of charts showing the position of submarine cables. Some cable owners had issued cable charts but these had merely shown, by shading, areas in which cables were laid; the actual routes were jealously guarded

secrets. After two years' work the Committee was able to persuade all the interested authorities in a dozen different countries that the secrecy attitude was wrong, and eventually everyone agreed that the charts should be issued.

The Committee do not imagine that the charts will automatically solve the problem but they hope that the charts will go some way towards helping fishermen to avoid cables and, by establishing goodwill between fishermen and cable owners, lead to closer understanding of each other's problems and mutual efforts to solve them.



How a cable may be fouled by an otterboard; each trawl is fitted with a pair of otterboards, usually wooden reinforced by iron and weighing up to a ton, designed to open the trawl mouth laterally, on the sea-bed



PERSPECTIVE DRAWING OF OTTERBOARD

Development of Meter Check Equipment

A. E. Harvey

FOR many years a facility has been provided at automanual switchboards intended to indicate to a telephone operator the working of an individual subscriber's meter on local calls completed automatically. The principal purpose has been to enable the operator to produce a written statement of these locally dialled calls and their metering, which could be used to demonstrate the accuracy of the Post Office record to subscribers who persisted in disputing their local call accounts. This was called the "meter observation circuit" but in practice it had certain weaknesses.

In the first place it depended on a telephonist always being free to observe the dialled call. Moreover, it did not enable the dialled number to be recorded, and with multi-metering the multiple operation of the subscriber's meter could not be verified. There was also a technical objection to the circuit itself in that it might adversely affect the observed call.

The development of an improved facility was hastened by the introduction of subscriber trunk dialling: STD. It was realized that bulk billing, with which trunk as well as local calls are charged on the basis of subscribers' meter readings, would widen the scope for metered call disputes, and it was judged essential to have some means by which the proper periodic metering of all dialled calls could be easily checked. The record should be such that it could be produced, if necessary, to a complaining subscriber in a form which he would find both acceptable and convincing.

Mainly because there was a large stock of surplus teleprinters, first efforts in the design of the new apparatus sought to adapt teleprinters. This resulted in the production of adapting relay sets,

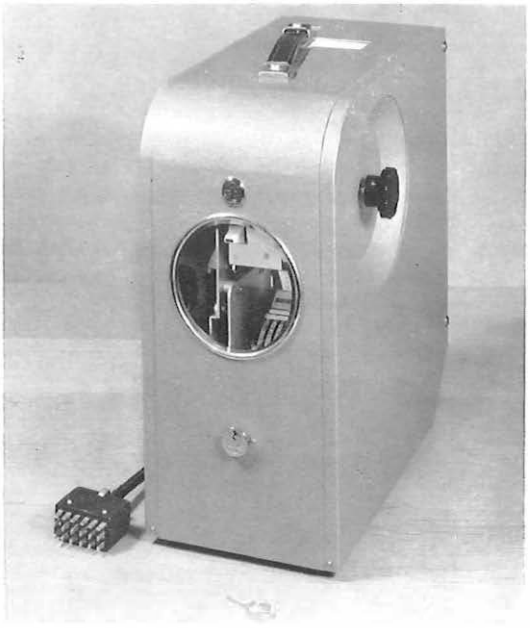


Fig. 1 (a): Meter Check Printer No. 2A
(Courtesy, Ericsson Telephones Ltd.)

and teleprinter-type equipments were brought into use at one or two early STD exchanges. Their drawbacks were soon realized and attempts were made to find more convenient apparatus.

Meter Check Printer No. 1 (Bell) and No. 2A (Post Office)

Several machines were known to have been developed on the Continent for deriving a printed record of calls on a subscriber's line. The Post Office had been using a Swiss "Zoller" machine experimentally for some years.

The most suitable machine for larger scale adoption was considered to be the one made by the Bell Telephone Company in Antwerp and, after an initial sample had been tested, a number of these printers was imported. A relay set to enable the printer to be associated with standard Post Office equipment was designed and assembled in this country and the equipments have been available for some time to Telephone Managers. These "Meter Check Printers, No. 1" were intended to deal with local call account disputes, in anticipation of a more severe test when trunk calls also became metered.

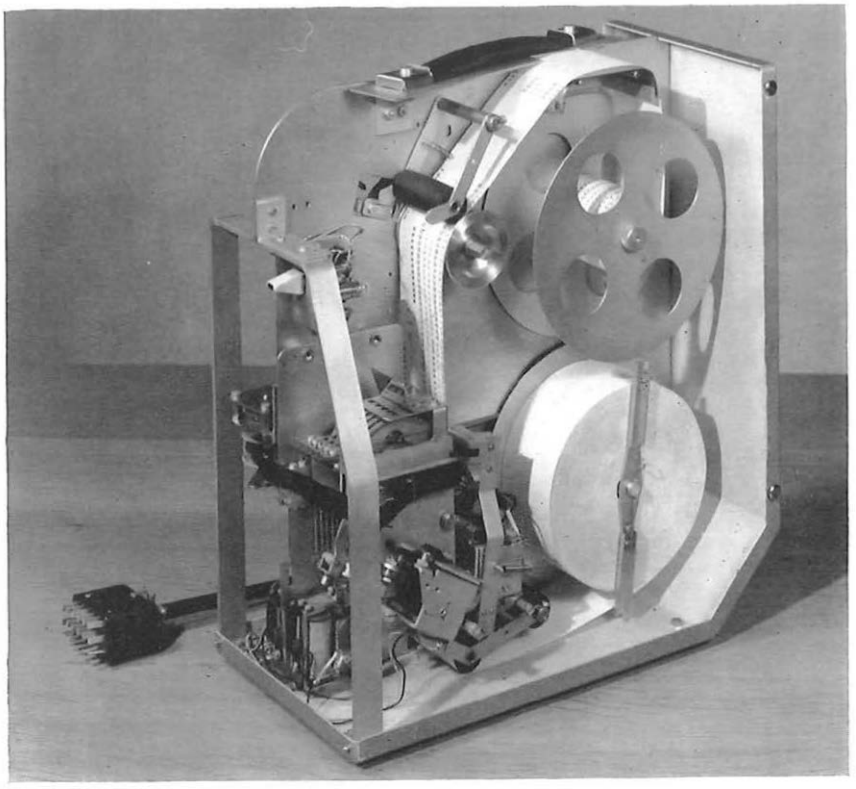


Fig. 1 (b): Meter Check Printer No. 2A, cover removed *(Courtesy, Ericsson Telephones Ltd.)*

For several reasons it was thought desirable to develop a standard printer for manufacture in this country and the Engineering Department and Ericsson Telephones collaborated in designing a printing recorder incorporating as far as possible normal Post Office telephone equipment sub-assemblies. This had a dual effect; not only were costs kept down but maintenance was made easier. The standard Post Office "Meter Check Printer, No. 2A" is shown in Figs. 1(*a*) and 1(*b*). It uses the same relay set as that designed for the Bell printer.

Fig. 2 shows various types of call as they appear on the paper slip. Printing takes place in eight parallel tracks, as shown in the table opposite.

The date as well as the time is printed for each incident recorded in the first, second or third track, and full timing information is also printed by itself when an incoming call is answered. A "take-up" spool is provided inside the printer so that the record can be conveniently stored until needed. A small writing aperture under which the paper slip passes enables manuscript entries to be made, if necessary, before the record reaches the spool.

Track	Detail	Record printed
1st (left hand)	*Receiver lifted*	—
	Digits dialled	Numerals
	Receiver replaced	—
2nd	*Incoming call: seizure*	I/C
	Incoming call: release	I/C
3rd	*Pulse on answer*	M
	Subsequent meter pulses	M
	Multi-metering pulses (pre-STD)	Numerals
	Coin pulses	M, 2 or 4
4th	*Weeks*	Numerals
5th	*Days*	Numerals
6th	*Hours*	Numerals
7th	*Minutes*	Numerals
8th (right hand)	*Seconds*	Numerals

To help in checking the proper functioning of the printer on a little used line arrangements have been made for the time to be printed about 1 p.m. each day unless a call is being recorded at the time.

Examples of Recorded Calls

The calls recorded on the tape in Fig. 2 are as follows :—

(*a*) An outgoing local call to 23456. Metering occurred once.

(*b*) An outgoing STD call to Cardiff 23456. (The national code for Cardiff is OCA2, equivalent to 0222.) Metering occurred when the call was answered and subsequently at 12 record intervals indicating periodic metering at the maximum inland rate.

(*c*) An incoming call, answered after three seconds.

(*d*) An unanswered incoming call.

Other Uses and Provision of Meter Check Equipment

Apart from its use when accounts are disputed the new equipment can be used in other ways.

For statistical purposes, the printer is not associated with an individual line but is used instead to record calls from a large number of sources. With the prototype statistical installation at Bristol Central exchange, for example, the printer is connected indirectly to the register access relay sets from which each "n th" STD call is chosen to be recorded. The choice is made by an electronic counting apparatus and the installation is known as "1-in-n" equipment. Summarization of the paper tape from the printer gives results for STD calls which are statistically comparable with the manual trunk call analysis based on telephone tickets.

Another use for the printers has been in association with a trunk circuit so as to record details of the calls carried on the circuit. In this way information can be extracted about the circulation of trunk calls, their durations, the proportion of effective to ineffective calls and a number of other features of interest from a service viewpoint. The printers are not intended, of course, to supplant normal service observations.

Finally, the printer is not necessarily limited to use on "ordinary" lines. It can readily be applied to coin-box lines; with the pay-on-answer coin-box it will record coin-pulses in the form "M", "2" or "4", indicating the insertion of 3d., 6d. or 1s. respectively.

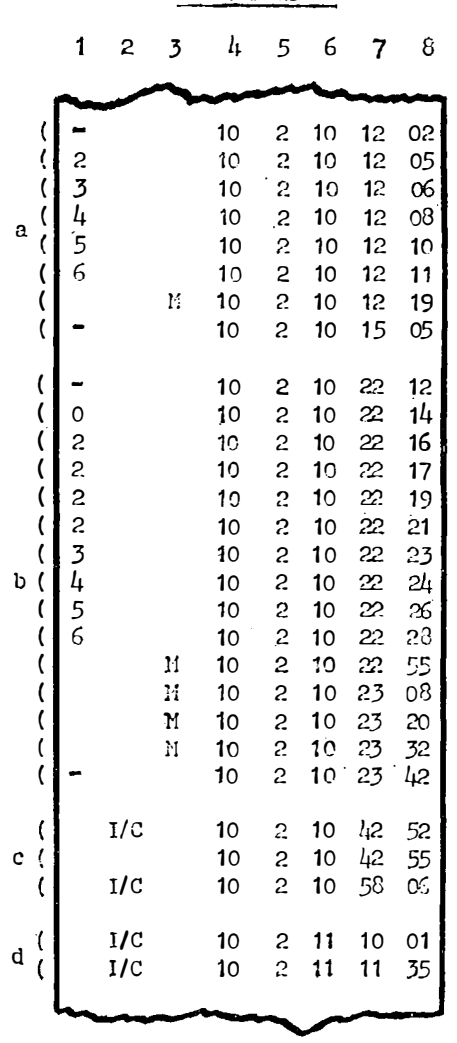


Fig. 2: A portion of paper slip from Meter Check Printer No. 2A

The meter check printer is being provided on a standard scale at exchanges equipped for subscriber trunk dialling. Some of the equipments will be portable so that they can be moved from one exchange to another to meet a temporary need. The printers are not very expensive and it is hoped that they will become a useful addition to existing facilities for investigating the telephone service as the customer experiences it.

Ship-Shore Facsimile

H. J. P. Fell and F. J. Clarke

THE POST OFFICE COAST RADIO STATIONS under the Wireless Telegraphy Section of the Radio Services Department, have faithfully served shipping with radio communications for over fifty years. The history of the technical development of coast station services is the history of radio development in general.

The latest service to be introduced is ship-shore facsimile transmission organized by the Wireless Telegraphy Section and the Engineering Branch of the External Telecommunications Executive. The Ministry of Agriculture, Fisheries and Food asked for the service for transmitting echo sounder data and chart references from the Fishery Research Vessel *Sir Lancelot* to the Ministry laboratories at Pakefield, Lowestoft.

Sir Lancelot was engaged in fishery research in the North Sea area, exploring the movements of herring shoals with the aid of the latest electronic echo-sounding device and producing data to help the fishing fleets. The data were to be transmitted over ranges of 20 to 200 miles to the nearest coast radio station and thence by landline exceeding 300 miles to the Pakefield laboratory.

The operation was planned at a joint meeting of all concerned with the assistance of Post Office engineers who are experts in picture transmission. It was decided to use existing radiotelephone call procedure and equipment in the 2 Mc/s band with sub-carrier frequency modulation (SCFM).

With the SCFM system the light intensities are translated into audio frequency tones, 1,500 cycles corresponding to black and 2,300 cycles to white. These tones are then used to modulate a radio frequency carrier at a constant depth. This system was preferred for radio work as it would eliminate fading difficulty which would cause a signal with conventional amplitude modulation to fluctuate. Muirhead Mufax transmitters and recorders would be used with a Helix speed of 60 rpm to limit emitted bandwidth to normal channel widths.

Preliminary tests were arranged by the WTS and ETE with the co-operation of Marconi International Marine Communication Company, Muirhead & Co., the Inland Telecommunications Department, Norwich Telephone Manager and the Engineering Department. Provision was made for transmission from the ship by radio to the nearest coast station, and via that station's terminal equipment and the ordinary telephone network to the Pakefield laboratory for recording. This necessitated fitting a switching facility at the laboratory to permit changeover from telephone to recorder.

It was considered that attenuation over the telephone network would not affect the success of the operation, but if any difficulty did arise from this it would probably be caused by the "tail" from Pakefield exchange to the laboratory. This difficulty could be overcome if necessary by jumpering the Pakefield line direct to Lowestoft telephone exchange.

The operational methods were to be aligned to those used for radiotelephone calls. The timing and monitoring would be by the coast station operator, and the calls passed over the telephone network on an uninterrupted call basis.

The initial tests were made on September 10 1960, using SCFM as arranged. *Sir Lancelot* used the Mufax chart transmitter with the Marconi Albatross radiotelephone transmitter. The signals were detected at Humber Radio on a standard Marconi Mercury receiver and passed to landline via a voice operated constant amplifier device (VODCA). A normal exchange line at the laboratories was diverted to the recording room with the changeover switching facility. The overall circuit is shown in Fig. 1.

Further tests were made during a trip by *Sir Lancelot* to Kristiansunds between September 13 and 28. During the outward trip eight recordings were taken, using Humber, Cullercoats and Stonehaven radio stations, as the vessel moved north. Range presented no great problem—pictures were taken when the ship was 250 miles east of Stonehaven—and it was concluded that

with MF working in the 2 Mc/s band, ranges up to 150 miles from each coast station could easily be covered.

Interference from other ships caused no serious difficulty; only the frequency content between 1,500 and 2,300 cps of interfering signals was portrayed on the recording and usually the required printing could be read through the interfering bands.

The pictures taken on this outward trip were encouraging but unsatisfactory, as echo produced a vertical trace approximately three or four times the width of the original; horizontal traces were faithfully recorded. The echo was typical of line reflections, but it was considered prudent to check the radio equipment used at the coast stations for phase distortion before considering landlines. This particular test is never applied to coast station equipment on acceptance as speech quality is unaffected by delay. The echo error on recordings was computed to be 3040 μsecs. The time delays between modulating frequency limits through the audio section of the Mercury receiver and the VODCA were measured in terms of angular phase shift. In relation to the time magnitude of chart errors the phase distortion in the radio equipment was found to be negligible.

The routing between Humber Radio and Pakefield was checked and levels were measured. The signal levels at Pakefield were considered reasonable, but the signal-noise ratio on numerous test calls was found to fall within the limits of −15 to −21 dbs and further tests proved the high level noise to be 100 cycle hum originating in Pakefield exchange on all cord circuits. Band-pass filters in the Muirhead recorder would exclude some or all of this hum from masking picture quality but it was considered that a fault of this nature on Post Office equipment should be cleared.

On recommendation by Norwich Area Pakefield exchange was by-passed and a physical pair off Lowestoft exchange was provided for the tests on

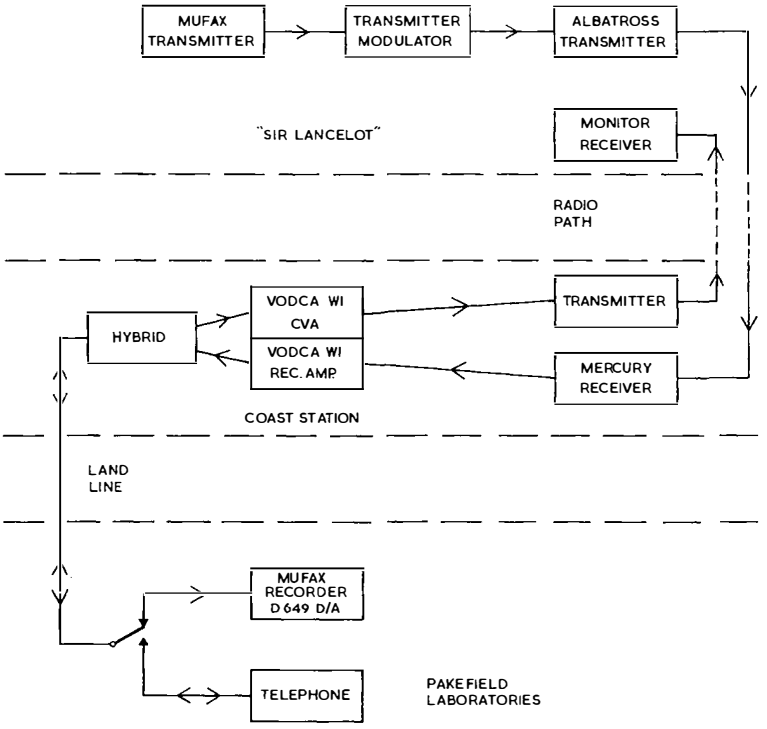


Fig. 1: Block of facsimile tests—September 1960

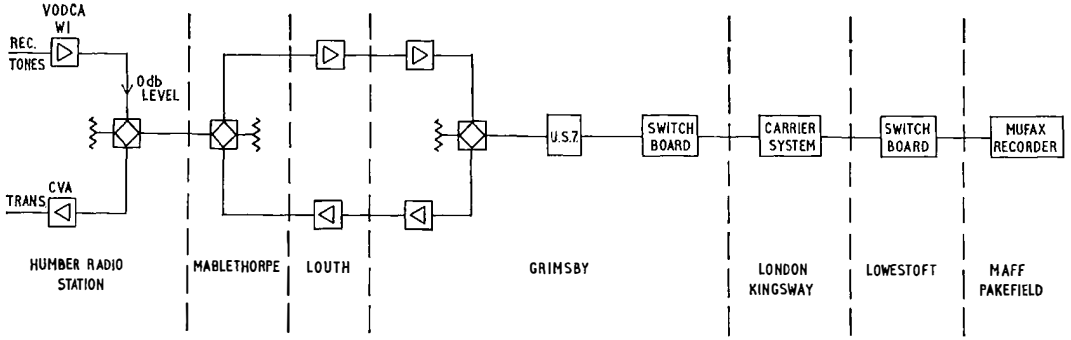


Fig. 2: Landline routing Humber Radio—Pakefield

the return trip of *Sir Lancelot* from Kristiansunds. The line termination at the laboratory was examined and the retardation coil and DC isolating capacitor in the primary of the line transformer were recovered to ensure a 600 ohms closing of the line.

During the return trip 14 recordings were taken using Stonehaven, Cullercoats, and Humber radio stations. A major improvement was obtained. The operating procedure proved highly successful, and the noise level on the alternative Lowestoft line was 16 dbs lower than on the original Pakefield line.

More tests were made via Humber Radio during a North Sea survey between October 14 and 20, and the picture quality was further improved by changes in the hybrid balance on the coast station VODCA. With the excellent co-operation provided by Lincoln Telephone Area special monitoring was set up and tests were made over a number of sampled circuits, as illustrated in Fig. 2, for line attenuation and balance. Without resort to a complicated network a lift in balance over the whole of the picture spectrum was achieved by using a reactive element (600 ohms + 0.4 microfarad) at the sending hybrid. This was used for picture working and the accuracy that can be achieved by careful attention to sending and closing impedances was proved by the quality of chart recordings. The highlight of these transmissions was the faithful reproduction of a very small type newsprint column taken from a local Lowestoft newspaper carried on board.

During these tests spectrum scans of *Sir Lancelot's* emissions were taken by RadControl, Baldock. These indicated that out of band emissions were excessive because of the transmission of third order interproducts at a level of −12 dbs below that of the normal sidebands. Investigation on the ship's return proved that this was caused by overmodulation from the Mufax equipment. The levels were reduced to normal depths.

A final series of tests were made to Pakefield from *Sir Lancelot* in the English Channel via North Foreland Radio on November 21 and 22, during which photoscans taken by Baldock verified that interproduct emissions were now within the Geneva Regulations of the International Telecommunication Union of −40 dbs on the carrier. The further test recordings at Pakefield revealed that the level to line from the coast stations should never exceed −3 dbm, and the hybrid balance at the coast station should be at least −20 dbs over the transmitter frequency limits to ensure good picture quality.

The tests made on these separate surveys were thorough and extensive as it was considered necessary that the service should be of good and reliable commercial quality before offering it to the customer. It can now be claimed that such a service for facsimile is practicable by the use of existing equipment and the public telephone network landlines without further capital expenditure by the Post Office.

The success of the tests was due to the excellent co-operation given by all the Post Office departments concerned, and by the Ministry of Fisheries, Marconi International Marine Communication, and Muirhead's.

An Appreciation

Frederick Ivor Ray

ON March 31 Frederick Ivor Ray, CB, CBE, Director of Inland Telecommunications and Chairman of the Editorial Board of this *Journal* since December 1956, retired from the Post Office after a long, varied and colourful career. He was a real telecommunications man and a great personality.

In nearly 40 years of official life he covered a good deal of ground in every sense of the word. Starting as an Assistant Engineer at Dollis Hill Research Station in 1922, he was soon in charge of the Engineer-in-Chief's Circuit Laboratory at the dawn of the automatic era. In the 1930s he became head of an Engineering Section in Central London during the Kingsley Wood days of rapid expansion of the telephone service. And when the first 12 Telephone Managers were appointed in 1936, F. I. Ray, still in his thirties, was given charge of Scotland West Area. If one may judge from the stories he tells of the years he spent in Scotland, they must have been among the happiest of his official career.

In rapid succession he became Telecommunications Controller in the North Western Region and Controller of Telephones in London, a post of great responsibility during the war years when London's telephone service suffered much damage from bombing but, like the city it served, always carried on. At the end of the war he came, as an Assistant Secretary, to Post Office Headquarters where he had the formidable task of reviving telecommunications planning to meet post-war needs. Then in 1948, he became Director of London Telecommunications Region and for eight years guided the destinies of London's telephone and telegraph services with great drive and vision. Many big projects in London bear witness to the imagination he showed during that period in planning for the future.

In all these years F. I. Ray acquired a vast experience of every aspect of telecommunications work and some very definite convictions about what could be done to improve and develop the services in this country and these were to inspire much that he did in his last five years of service, as Director of Inland Telecommunications. These exciting years brought great changes—the introduction of group charging, the launching of subscriber trunk dialling and the automatization of the telex service. On all these major developments F. I. Ray made his mark and to all of them he gave drive and impetus.

But perhaps his most distinctive personal contribution as DIT sprang from his conviction that the Post Office had much to learn from other countries. Two of the results of this will long be remembered.

First, he undertook a programme of visits to European countries to make comprehensive comparisons of each system with that of the United Kingdom and to see what lessons could be learnt about reducing the cost of telephone service. The team he led visited France, Germany, Switzerland, Sweden, Holland and Belgium, and their reports opened up for the Post Office and, we can be sure, for the other administrations too, many new ideas on traditional telephone problems.

Second, in 1958 he conceived and led a visit to the United States of America by a joint Official and Staff Association team, which produced the report *Telephone Service and the Customer*. The then Postmaster General (Mr. Marples) was so attracted

by the report that, early in 1959, he went with Mr. Ray to see the Bell system for himself. From this report developed the "Friendly Telephone", and many were the seeds it sowed which have since borne fruit, from improvements in telephonist training and supervision to the introduction of telephone credit cards. It has been read all over the world; and it is a fitting testimony to his contribution in this field that the report is always spoken of in the Post Office as "The Ray Report". In the *Journal's* Spring number last year he contributed an article based on a lively and informal talk he had given in Headquarters on developments arising out of the Report of a year earlier.

F. I. Ray was a stimulating personality. He put tremendous energy and enthusiasm into everything he did. There was never a more buoyant character; and he was always cheerful, friendly and approachable. His fertility of ideas—good, sometimes not quite so good, but always original—seemed inexhaustible and the resourceful way in which he tackled the most intractable problems was quite remarkable. But the quality for which he was held in most esteem and that of which I believe he was proudest was his ability to contribute to discussion of any aspect of telecommunications from first-hand knowledge. The great wealth of experience which he brought to every job—including the chairmanship of the *Journal's* Editorial Board—will be greatly missed.

A. Kemp

When we were Young!

Mr. Ray is the first, seated on the left, in this photograph of young men at Dollis Hill in the early 1920s. The young man at the far right, standing, retired in 1960 as Sir Gordon Radley, Director General. Others still serving are Mr. N. Bourdeaux, first on left, standing, now Senior Executive Engineer; Mr. H. R. Harbottle, sitting next to Mr. Ray, now Staff Engineer; and Mr. W. E. Hudson, sitting, fourth from left, now Chief Regional Engineer, Home Counties

Notes and News

Brave Technician Honoured.—Mr. Frank White, Technician I in South West Area, London Telecommunications Region is to receive the George Medal for his bravery when a lorry carrying a heavy cable gang, of which he was foreman, skidded off the road. A 16-ton crane, brought to pull the lorry back on to the road, slipped on its side in the soft earth, pinning a member of the gang underneath by his foot. Mr. White crawled under the crane and remained there for about three hours, supporting and comforting the injured man, despite the danger of the crane slipping further and crushing them both.

* * *

***Ariel* to the Rescue.**—In the early hours of April 19 HMTS *Ariel*, returning from repairing a submarine cable in the Irish Sea, received a distress message from the Dutch vessel *Tuskar* saying that she was sinking. *Ariel* went to the assistance of *Tuskar* and was able to pick up the Captain, his wife and members of the crew from a rubber dinghy. By 6.45 a.m. *Ariel* anchored at Port Erin, the survivors having been provided with hot baths, clothes and breakfast. Later, after arrangements were made for them to be cared for ashore, they were taken off by the Port Erin lifeboat.

* * *

Credit Cards.—The Postmaster General said recently that more than 38,000 telephone credit cards have been issued and about 150,000 credit card calls are made every month. The credit cards can also be used for calls *to* this country from 51 other countries, including Canada and the United States.

Director of Inland Telecommunications

Mr. A. W. C. Ryland, Director of Establishments and Organization in the Post Office since 1958, has been appointed Director of Inland Telecommunications—and thus *ex officio* Chairman of the *Journal* Editorial Board—in succession to Mr. F. I. Ray, who has retired; an appreciation of Mr. Ray starts on page 145.

Mr. Ryland is 47 and is the son of the late Mr. A. E. Ryland, who retired in 1946 as Telephone Manager, Newcastle. Becoming an Assistant Traffic Superintendent at Gloucester in 1934, after unestablished service on the engineering side, the new DIT later became an Assistant Surveyor stationed at Shrewsbury. After seven years, 1939–46 with the Army Postal Services, in which he reached the rank of Colonel, he rejoined the Post Office in 1947 as Assistant Postal Controller, Midland Region. He returned to Headquarters in 1949, serving in the Postal Services and the Public Relations departments, and later becoming Principal Private Secretary to the Postmaster General. In 1955 he was promoted Assistant Secretary, going to the Establishments and Organization Department, of which he became Director three years later.

* * *

Freefone Service is now being used by more than 130 firms, said the Postmaster General on April 12.

OUR CONTRIBUTORS

K. ANDERSON ("Post Office Act, 1961") has been Deputy Director General since 1954 and Comptroller and Accountant General since 1952 when he came to the Post Office.

He has had wide experience of administration, especially on the financial side, since he entered the Service in 1928. During nearly twenty years at the India Office he was prominently concerned with problems of constitutional reform and of currency and banking. In 1947 he went to Germany as Deputy Financial Adviser to the British Military Governor and played a considerable part in the currency reform there. A year at the Imperial Defence College in 1949 was followed by a spell at the Treasury co-ordinating overseas trade and financial negotiations.

He designed the proposals in the White Papers on *Post Office Development and Finance, 1955*, and the *Status of the Post Office, 1960*.

H. M. DE BORDE ("Providing a Telephone") who is Telephone Manager of North Area, London Telecommunications Region, entered the Post Office in 1926 as an Assistant Superintendent of Traffic Class II. He was seconded to the Personnel Department of Post Office Headquarters in 1946 for duties in the newly formed Training and Welfare Branch, where in 1949 he was appointed Chief Executive Officer, with responsibility for the Headquarters Training Centre for instructors, training methods and the development of training for supervision. He returned to London in 1952 as Deputy Telephone Manager for North-West Area, London, and was appointed to his present post in 1959.

F. J. CLARKE (joint author, "Ship-Shore Facsimile") is a Radio Superintendent in the Wireless Telegraphy Section of Radio Services Department. He joined the Post Office as a Boy Messenger in 1925, serving as Sorting Clerk and Telegraphist, Radio Operator, Radio Overseer and Radio Assistant Superintendent. He was employed for five years as a Marine Radio Surveyor inspecting ships' radio apparatus, and also served with the Control Commission, Germany, in the Radio Section of the Posts and Telegraphs Branch. Since 1953 he has been at Post Office Headquarters.

D. W. R. COBBE ("Railway Electrification and Post Office Lines") is a Senior Executive Engineer in External Plant and Protection Branch of the Engineering Department. He entered the Post Office in 1939 as a Youth-in-Training in Southend Area of Home Counties Region. After training in that Area, he spent most of the war years at a DTN station in Bedford Area. In 1945 he was transferred to Telephone Branch for two years, and after a brief spell in Research Branch moved to his present Branch where he has been engaged on interference problems. In 1950 he was seconded to the Iraq Petroleum Company for an investigation in the Middle East into interference problems concerning the cathodic protection of oil pipe lines, and has since studied railway electrification problems in Norway, Sweden, France and Germany. More recently he was a member of a team of engineers who were sent to Pakistan by the United Kingdom Railway Advisory Service to study the potentialities of electrification of several sections of the North West and East Bengal Railways.

H. J. P. FELL (joint author, "Ship-Shore Facsimile") joined the Post Office in 1932 as a Youth-in-Training at Rugby Radio Station. Promoted to Probationary Inspector by limited competition in 1939, the war years were spent on the provision and maintenance of Post Office MF and HF direction finder systems. His present duties as an Executive Engineer cover the maintenance of radio and radar maritime equipments on cable ships, at Radio Services Department coast stations, and at MTCA coastguard stations.

A. E. HARVEY ("Development of Meter Check Equipment") contributed "Revising the Exchange Charging Records" to the Winter 1958 *Journal*, and his career is outlined in that issue.

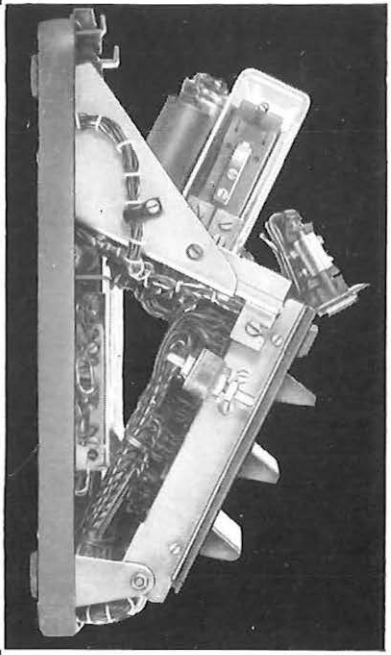
H. A. LONGLEY (joint author, "New Trunk Switching and Transmission Plan") is a Principal in Telephone Mechanization Branch of the Inland Telecommunications Department. He wrote "Simplified Charges" for the Winter 1958 issue, "Telephone Attachments and their Problems" for Spring 1958, and "Charging for STD Calls" for Winter 1959. His career is outlined in the Winter 1958 *Journal*.

R. A. NEATE ("Combined Working in Telegraph Instrument Rooms") joined the Post Office in 1935 as an Assistant Traffic Superintendent in Western Telephone District headquarters at Exeter. A short spell on loan to the newly established South West Regional Office at Bristol was followed by service at Taunton and again at Exeter until his promotion in 1949 to Oxford as Senior Telecommunications Superintendent. He came to Post Office Headquarters in 1958 as Chief Telecommunications Superintendent in the Inland Telecommunications Department, and later the same year was promoted to his present rank of Principal in charge of the Telegraph Operational Division.

C. T. POLHILL ("Telephone Engineering Centres") is an Executive Engineer in the External Plant and Protection Branch of the Engineer-in-Chief's Office. He joined the Post Office in 1920, and was Youth-in-Training, Skilled Workman and Inspector on installation and maintenance duties. He was appointed Chief Inspector in 1944 in Tunbridge Wells Area and in 1950 took up his present post which includes the planning of external accommodation, section stock organization and stores-handling appliances.

A. J. THOMPSON (joint author, "New Trunk Switching and Transmission Plan") is an Assistant Staff Engineer in the Equipment Branch of the Engineer-in-Chief's Office. He came to Engineering Department headquarters in 1949 from Home Counties Region where he was particularly well known in the old Eastern District. His work has been particularly concerned with the engineering aspects of implementing the trunk mechanization schemes leading up to STD.

NEW STYLE CORDLESS SWITCHBOARD



Attractive appearance is an essential consideration when designing subscribers' apparatus, but important, too, is small size. Both these objectives have been achieved in this **lamp signalling** switchboard, designed in conjunction with the B.P.O. to supersede the existing indicator signalling 2 + 4 switchboard housed in a bulky, outmoded wooden cabinet. Although considerably smaller than its predecessor, it provides two more extensions and has a total capacity for two exchange lines and six extensions.

Much of the reduction in size has been obtained by the adoption of a new 4-wire principle for local extension lines. This has enabled certain additional facilities to be provided with fewer components, as for example, operator re-call and secretarial 'hold'.

A grey plastic drop-on cover, with a simple release action, provides easy access to all components conveniently arranged on a 3-section, hinged chassis of drawn steel. The key and lamp panel is tastefully finished in a durable coating of grey P.V.C. and the ivory coloured key handles are shaped and marked to facilitate operation.

Power for transmission and signalling is normally derived from a mains driven unit.

ERICSSON TELEPHONES LTD.
ETELCO LTD.

HEAD OFFICE: 22, LINCOLN'S INN FIELDS, LONDON, W.C.2
TELEPHONE: HOLborn 6936

Customers Appreciated Telephone Week

Reports from Post Office directorates and regions, and some hundreds of cuttings from local newspapers show that Telephone Week, which the Postmaster General inaugurated on April 10, was a great success in attracting the public to visit telephone exchanges.

In his inaugural speech the PMG said that the Post Office, two years after launching the "Friendly Telephone" policy (*Journal*, Summer 1959) was trying to bring customers and staff closer together, to help them to meet face to face, to get to know one another over a cup of tea.

"However much we may mechanize we shall always offer personal service. The telephone operator will always be ready and willing to help callers. I hope many people will look into their local exchange this week, meet the men and women who serve them, and get them to talk about what it means to provide telephone service through which every telephone can be almost instantly linked to any one of 8,000,000 other telephones in the country."

The PMG, saying that the first need of a commercial organization is to understand its customers and help them to understand how the organization works, said he was glad Telephone Week was being held just as the Post Office Act 1961 had come into force.

* * *

The revised Q code as approved at the International Telecommunication Conference at Geneva in 1959, which comes into operation this year, is included in the 13th edition of *Learning Morse* (Iliffe Books Ltd., 1s. 6d.) by H. F. Smith, former Editor of *Wireless World*. The book also contains descriptions of equipment, including a transistorized practice set, and a series of practice groups and rhythmic groups.

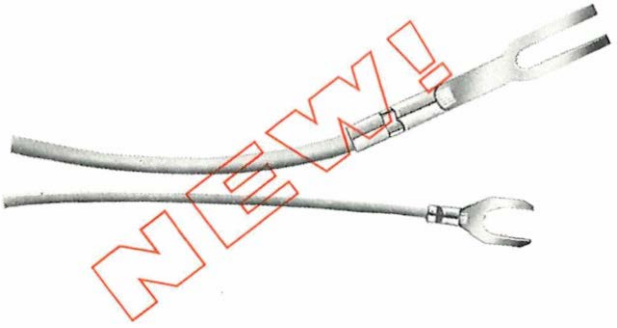
* * *

Telephone Tahiti. Calls can now be made to most places in Tahiti between 5.0 and 5.45 p.m. at a charge of £4.8.0 for three minutes.

Publication and Price. The *Journal* is published in November, February, May and August, price 1/6. The annual postal subscription rate is 6/6 to any address at home or overseas.

Contributions. The Editorial Board will be glad to consider articles of general interest within the telecommunications field. No guarantee of publication can be given. The ideal length of such articles would be 750, 1,500 or 2,000 words. The views of contributors are not necessarily those of the Board or of the Department.

Communications. Communications should be addressed to the Editor, Post Office Telecommunications Journal, Public Relations Department, Headquarters, G.P.O., London, E.C.1. Telephone: HEAdquarters 4345. Remittances should be made payable to "The Postmaster General" and should be crossed "& Co."



*AMP TELEPHONE TERMINALS

A-MP announce two new approved equivalents of G.P.O. terminals. These are STA 16 switchboard tag and STA 188 which is identical to STA 163 except that it is suitable for 7/.0048" stranded wires. These are of course additions to the existing range which covers the standard STA 163 and STA 174 types.

STAND 301 AT THE RECMF EXHIBITION

USERS OF A-MP TELEPHONE TERMINALS INCLUDE :

A.E.I.
A.T. & E.
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South Africa: Distributor: E. S. Mowat & Sons (Pty) Ltd. 51-57 Milne Street, P.O. Box 437, Durban, Natal, South Africa

Associated Companies in: U.S.A., Australia, Canada, Holland, France, Germany, Italy, Japan and Mexico

AP. 151

Designed, primarily for use by private and public telephone operators and approved by the G.P.O., STC Lightweight Headsets are now being widely used for other applications Authorities and operators concerned with audio monitoring and control have quickly recognized the advantages in comfort and sensitivity provided by this new design

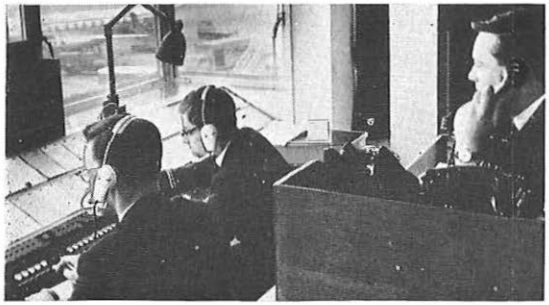
Wider use for **STC** *Lightweight Headsets*

The "Rocking Armature" principle which gives improved sensitivity and frequency response—an important STC development in telephone receiver design—has been incorporated into these instruments.

The main advantages of this STC product are: extraordinary light weight, a high degree of comfort, stability and manoeuvrability and constant level of transmission regardless of head movement. Available in black or ivory nylon plastic which is virtually unbreakable.

*Write for Brochure D/*104

STC Lightweight Head Receiver in use at Broadcasting House. These instruments have been adopted by the B.B.C. for use in their London and provincial studios.



At London Airport, B.E.A. Apron Control have recently reorganised their communication facilities to cater for their 400 air movements a day peak load. The controllers use STC Lightweight transmitter/receiver headsets to assist them with strain-free operation.

SWITCHING SYSTEMS GROUP

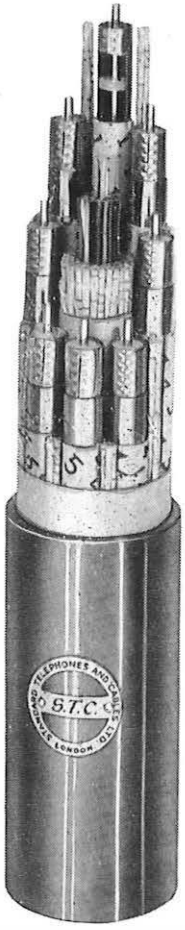
60/1D

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2

TELEPHONE DIVISION: OAKLEIGH ROAD · NEW SOUTHGATE · LONDON N.11

FIRST 8 TUBE COAXIAL CABLE IN SOUTH AFRICA



STC is manufacturing, to supply to the South African Post Office, communication cables containing 4 and 8 coaxial tubes type 375 PDWI incorporating paper and polythene insulated control and supervisory circuits. The cables, to be installed on the Durban—Shepstone 7 400 Mc/s microwave route, will provide entrance facilities at the terminal and repeater station sites.

STC are also supplying terminal and repeater equipment for the 7 400 Mc/s microwave system.

CABLE AND WIRE GROUP

61 108

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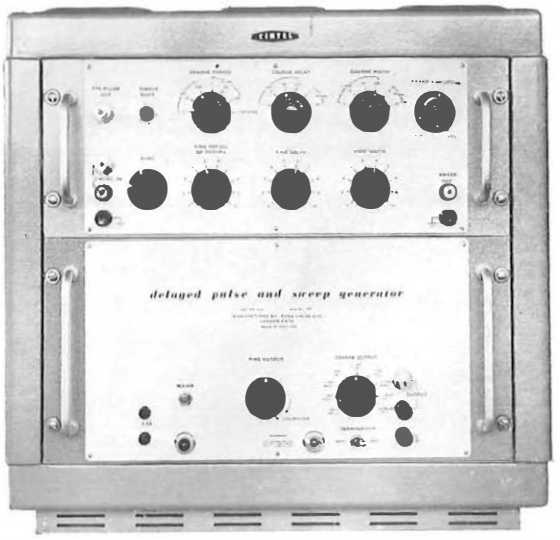
TELEPHONE CABLE DIVISION : NORTH WOOLWICH • LONDON E.16

DELAYED PULSE AND SWEEP GENERATOR

A versatile pulse generator designed to meet the need for a comprehensive instrument covering a wide range of pulse work. Four main facilities are provided: a pre-pulse, a main pulse delayed on the pre-pulse, a negative going sawtooth and a fast rising pulse formed from a pure line.



BRIEF SPECIFICATION

Period

Continuously variable from 0·9μsec to 1·05sec i.e. 0·95c/s to 1·1Mc/s. Accuracy ±5%.

Pre-pulse

40mμsec. 8V peak in 75Ω, positive going.

Main pulse

Width: Variable from 0·09μsec to 105msec ±5%.

Amplitude: Control gives 4:1 attenuation of each of four maximum outputs as follows:

5V max in	75Ω	rise time 10mμsec
10V max in	150Ω	rise time <20mμsec
25V max in	600Ω	rise time <40mμsec
50V max in	1000Ω	rise time 50mμsec

Polarity: Positive or negative going.

Accuracy: ±2%.

Delay

Conclusion of pre-pulse to advent of main pulse, delay variable from 0·09μsec to 105msec. Accuracy ±5%.

Sweep

D.C. coupled negative going sawtooth same width and delay as main pulse.
15V peak max.

Cable pulse

Obtained from short circuited pure line.
One positive and one negative going pulse coincident with main pulse.
25mμsec wide 3V max in 75Ω, rise time <8mμsec.

Sync, trigger or single shot facilities provided.
Full data available on request.

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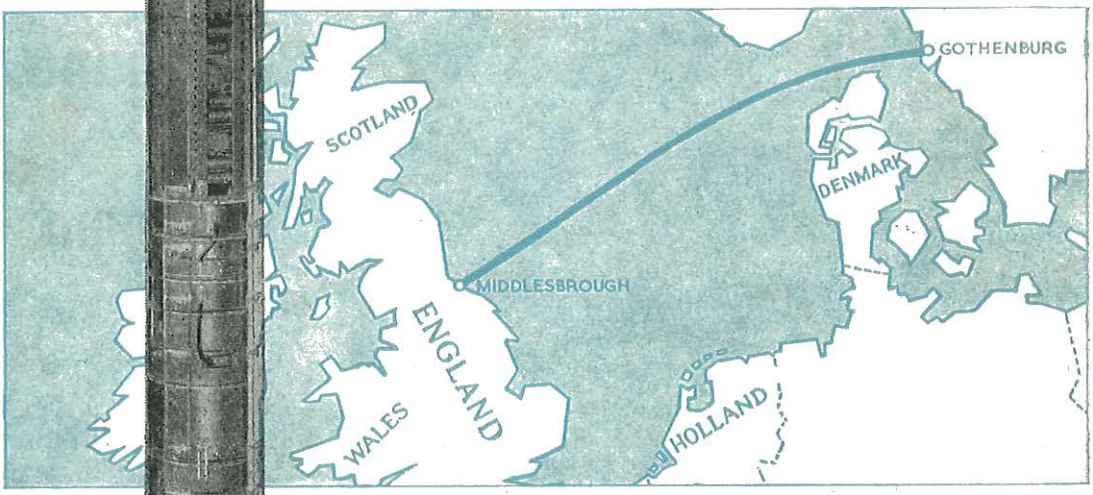
STC

Anglo-Swedish submarine cable telephone system

jointly owned by the B.P.O. and the Swedish Royal Board of Telecommunications was put into service in October, 1960 and is

the longest 2-way telephone system on a single submarine cable

Using 29 submerged repeaters and one submerged equaliser, it will handle 60 telephone circuits of 4 kc/s spacing over the 509 nautical mile (943 km) cable supplied by STC. STC have also supplied more than 40 racks of equipment for installation at the Middlesbrough and Gothenburg terminals.



The internal unit of an STC submerged repeater.

STC is one of the few commercial organisations in the world, technically equipped to plan, design and supply complete submarine cable communication systems.

Publication C/2050 lists major STC submarine telephone installations.

STC COMMUNICATIONS GROUP

61/2C

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