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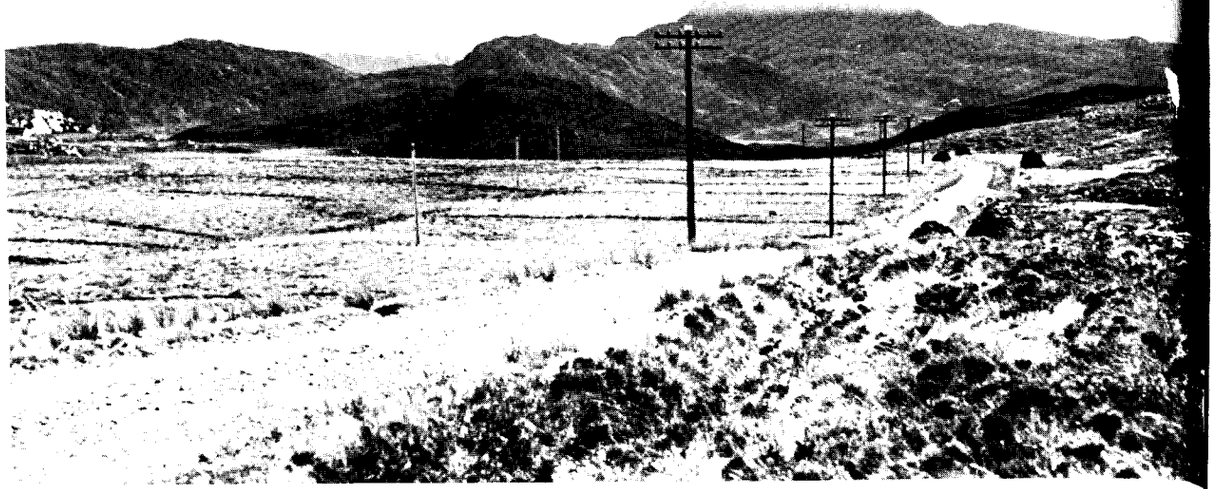
Television Problems

THE ESTABLISHMENT OF THE INDEPENDENT Television Authority adds to the many problems with which the Post Office has had to deal since the B.B.C., using the system invented by the pioneer John Baird, made its first experimental television broadcast twenty-five years ago on September 30.

The Authority, like the B.B.C., will be largely autonomous in its day-by-day operations but a private enterprise service under public control will be closely watched, in more ways than one, by its critics and friends, and will present many new problems of administration. The Postmaster General, as the Minister responsible for broadcasting, is concerned with settling with the Authority such matters as their hours of broadcasting, the time devoted to advertising, the classes of goods and services which should not be advertised, and the methods of advertising. The Postmaster General is also responsible for allocating frequencies and for providing the networks of land line or radio links required for relaying programmes between transmitting stations.

Radio communication is essential for many services today and the frequencies available must be allocated in the most effective way. The police, ambulance, aeronautical, maritime and other services, besides the B.B.C. and the I.T.A., have their claims, and the use of television channels has to be planned in collaboration if interference is to be avoided. As for physical links, the channels in coaxial cables carrying television could alternatively carry as many as 660 simultaneous telephone conversations. The expansion of television must therefore be integrated with other telecommunication needs.



Telephones in the Highlands and Islands

J. M. Ogilvie,
Post Office Headquarters, Scotland

SCHOOL GEOGRAPHY TAUGHT US THAT Scotland, like equally famed Gaul, is divided into three parts. The division in Scotland is, however, wholly geographical and every schoolboy — at least every Scottish schoolboy knows that there are the Highlands, the Southern Uplands and the Central Plain. Although this knowledge may be of little immediate value to the schoolboy other than perhaps in gaining a few examination marks, it is of considerable significance to the public utilities in general and to the Post Office telephone administration in Scotland in particular.

The Central Plain of Scotland, in which are the cities of Edinburgh and Glasgow, is the industrial heart of the country. In this great geographical depression caused, we are told, by the gouging of the ice cap during the Ice Age, are to be found the main coal-fields and industries; and in it some three and a half million of Scotland's total population of over five million live and work. The problems of providing and maintaining telephones for these people, although considerable, are not inherently different from those in other densely populated parts of the United Kingdom, and it is not the purpose of this article to dilate on these. The real problem, which is in many ways peculiar to Scotland, is in extending the telephone over considerable distances and natural obstacles to remote and not readily accessible parts of the mainland, and to the many inhabited islands off the northern and western coasts.

Distance lends little enchantment to a telephone administration, and the Highlands and Islands are areas of great distances. The Telephone Manager, Aberdeen, for example, administers an Area which, in extent, is as large as the whole of Wales and his office is some 200 miles in a direct line from his most distant boundary. The Area has some 390 exchanges and some indication of how widely scattered the population is may be gathered from the fact that 41 per cent. of the total exchange connexions are served by 370 exchanges of fewer than 300 exchange connexions each, some 75 of which have ten or fewer lines and about 170 are served by only one distribution point.

These small exchanges give rise to many peculiar problems of staffing, night and Sunday service and maintenance, and need attention at all levels completely out of proportion to the number of lines concerned. A disproportionate amount of labour is needed for poling and wiring for both initial construction and day-to-day maintenance. The overall lengths of subscribers' circuits and the lengths of the overhead portions of these circuits are both, on average, much greater than in districts which are largely urban.

Routinely the overall average time taken by overhead installation staff for a new exchange connexion in a widely scattered Telephone Area is about 25 man-hours; the corresponding figure for the towns in these Areas is about ten man-hours. The overall Area average is so much higher because of the large amount of work entailed in the rural districts.

Maintenance

Maintenance officers have to travel long distances, often over poor single-track roads. On many of the islands the employment of a resident linesman cannot be justified and access from the mainland is dependent on the weather, and the steamer services or specially hired boats. This handicaps the clearing of faults and increases the risk of prolonged isolation from common equipment faults. Sometimes it is possible to employ part-time men locally, but they are generally capable of dealing with only the simpler faults.

This maintenance problem has discouraged attempts at large-scale automatization of the islands' service, and it may well be that conversion of these exchanges to automatic working may have to await development of a specially robust type of unit automatic exchange (U.A.X.) with a capacity of some 20 exchange connexions and having a high standard of reliability. The reluctance of some Sub-Postmasters to provide continuous service, and public criticism of night switching arrangements whereby subscribers are switched through at night on party lines, emphasize the need for such equipment.

Call Offices

It has been suggested that the best canvassing agents for stimulating requests for new telephones are public telephone kiosks. The call office is in fact often the forerunner of private lines in outlying districts and the public telephone kiosk has become a familiar landmark all over the country from the busiest city to the loneliest mountain road.

A great fillip to the provision of call offices was given by the Tercentenary Concession of 1935, which commemorated the 300th anniversary of the establishment of the Post Office as a public service. Under this concession unremunerative kiosks could be put up in rural areas if the local authority was prepared to pay £4 a year for five years. This resulted in a considerable extension of the telephone service, but over the years it was found that the financial contribution from the local authorities operated too much to the advantage of wealthier districts.

To remedy this, the Tercentenary Concession

Loch Torridon, Ross-shire

The track to Ardmore, Sutherland

was replaced in 1948 by a rural allocation scheme intended to meet every real need for a kiosk without any contribution from the local authority towards the cost of the installation. The scheme, which operates with the close co-operation of the county councils in Scotland, was put into effect in January, 1950, and more than 380 kiosks have since been erected under this scheme alone. The drain on limited resources is heavy as the lines are usually very long and in the more widely scattered areas in Scotland require, on average, about 450 man-hours for each installation.

Engineering Problems

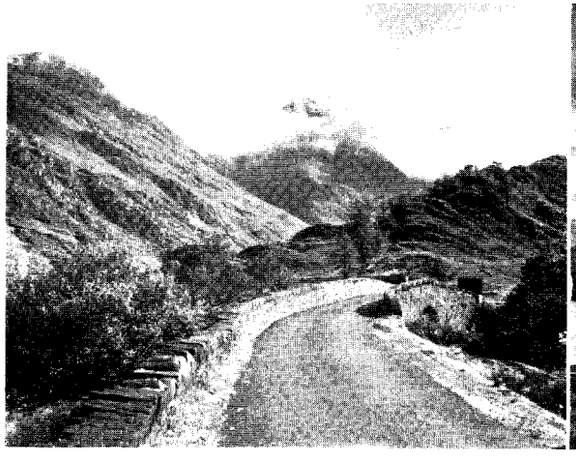
That many of these kiosks have been provided at all is due largely to the ingenuity of local staffs in overcoming engineering problems which, at first glance, seemed well-nigh insurmountable.

Typical of the more remote places where kiosks are being established under the scheme is Ardmore, not far from Cape Wrath, the most north-westerly point of the mainland. The community of Ardmore consists of five or six occupied houses spaced over a distance of about three-quarters of a mile. The houses are about three miles from a main road and access is along a rough and narrow track. About 80 poles had to be put up over this difficult route and a narrow gauge waggon had to be specially designed to transport stores. It was proposed to draw this waggon by ponies, but fortunately motive power was eventually provided by borrowing a "Weasel" tractor. The kiosk was transported in sections by boat along a loch to the nearest landing point. The site chosen for the kiosk was the one most convenient to most people and took into account the position of a few houses remote from Ardmore itself; even so, one house is about a mile and a quarter from the kiosk. Fortunately the countryman's conception of a long walk is different from that of most city dwellers!

The track leading to Ardmore, part of which is illustrated, is classified locally as "reasonably good" track. The picture shows the outcrop of gneiss rock which is so prevalent throughout the Highlands. In terrain of this kind pole construction is made especially laborious and wasteful of man-power by the frequent need for rock-drilling and blasting. Use of explosives for this purpose is a skilled job, the knack of which is acquired only through long experience. It is all too easy a matter simply to blow things up, but the art of blasting a cylindrical hole of the right size to take a pole is a very delicate problem involving just the right depth of drill and size of charge. Almost equally delicate a matter in districts where salmon fishing interests are considerable is the acquisition of the explosive itself!

The view of Loch Torridon on the west coast shows the wild and rocky country where poles have to be erected. The track in the foreground is the only path to two isolated crofts in the hills.

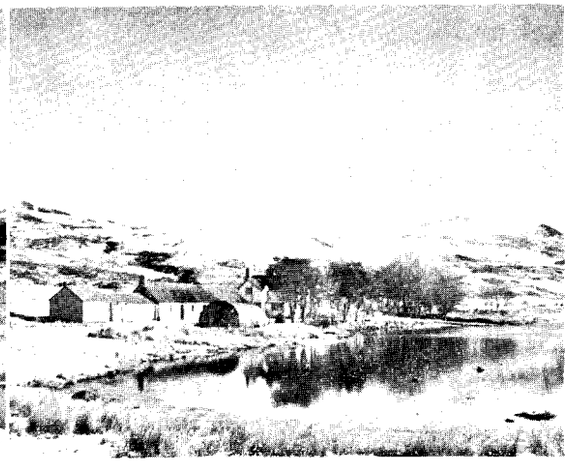
Just as the Highland scene is one of infinite variety so, too, appear to be the problems confronting telephone provision. Large areas of waterlogged peat country present poling problems



Glen Shiel, Ross-shire

Loch Druim Suardalain: where peat is cut

The road to Altnacealgach Hotel



Altnacealgach Hotel

irely different from those caused by rock ground. e difficulty is to find or make a solid foundation the poles, which have to be fitted with base-cks to give stability.

Another difficulty arises from the absence of a ge on many highland roads such as the road Glen Shiel. This prevents poles and other es being delivered direct to the point of ction: instead these have to be set down in k at the nearest convenient point and man-ndled from there onwards.

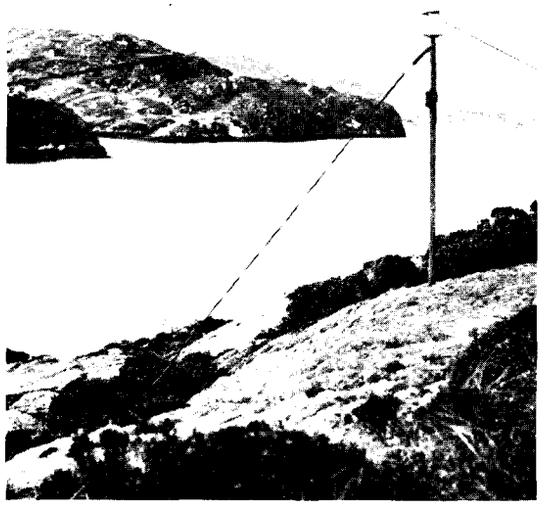
Improved telephone facilities in rural areas so resulted from the Jubilee Concession of 1935 hich commemorated the jubilee of King George and provided for the erection of a kiosk, to ve 24-hour service, outside every Post Office. r Post Offices which already had telephones side the premises, this entailed little more than ecting a kiosk and joining it up as an extension the existing line. In many places, however, the xisting telephone was joined to a party line erving several offices and establishment of outside iosks meant putting up separate lines to each.

The remoteness of some of the Post Offices ade it necessary to erect wires over long distances a high cost in man-hours and materials. The Kildonan and Kinbrace Post Offices in Sutherland re nine and 17 miles respectively from Helmsdale exchange, to which they are connected over one line rented from British Railways. To put up kiosks outside these offices with exclusive lines would have cost about £2,600, and 4,800 man-hours would have been involved in erecting and wiring the 500 poles needed. It was arranged, therefore, for outside kiosks to be established at these offices by continuing to use the existing line temporarily.

The secrecy of telegrams is safe-guarded under this arrangement by the kiosks being disconnected from the line during the hours of telegraph business and being connected only when someone wishes to make a call, and then only after it has been confirmed by listening on the circuit that telegrams are not being passed from the other office. New demands have since arisen at Kinbrace and a new exchange is being set up there which will make it possible to give the two kiosks exclusive lines.

Radio Telephones

Radio is playing an increasing part in meeting the telephone needs of remote districts, particularly those of the islands. For many years there have been in existence in Scotland six ultra short-wave phonogram circuits which have provided the only telecommunication link for the islands of North Ronaldshay, Papa Stour, Whalsay Skerries, Foula in the Shetlands, for Soay off Skye and for Stroma off the north coast of Scotland. These links, which have given invaluable service, were used for passing telegrams to and from the mainland. The equipment, now obsolescent, provided only limited facilities and over the years has become increasingly more costly to maintain. It is now being replaced by specially designed battery operated V.H.F. radio equipment which



Durness showing single wire telegraph circuit

gives direct telephone connexion with the junction and trunk network throughout the whole of the United Kingdom, as well as normal dialling facilities when the radio link is terminated on an automatic exchange.

The telephone kiosk established on August 15, 1953, by this means on the island of Stroma with direct connexion with John O'Groats exchange was used to mark the installation of the 6,000,000th telephone in the United Kingdom, the new service being inaugurated by the Secretary of State for Scotland. Similar new equipment has been used to provide kiosks on the islands of North Ronaldshay and Whalsay Skerries in the Shetland group. The first kiosk to be established on the mainland of Scotland in this way has recently been installed at Eriboll on the north coast.

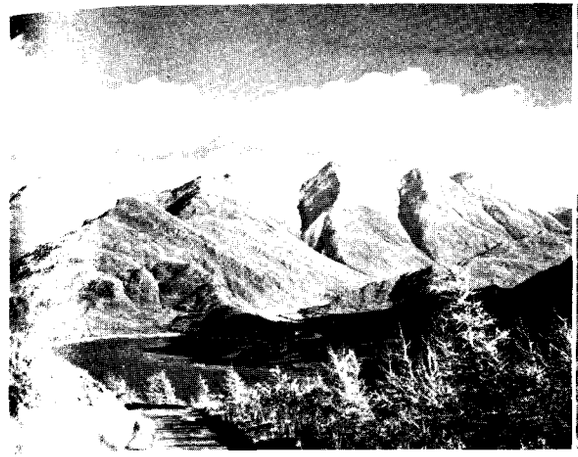
This kiosk is on the opposite side of Loch Eriboll from the exchange to which it is connected, and the alternative to using radio would have been either to lay a submarine cable across the Loch or to erect an overhead route round the Loch. Overhead construction would have entailed some nine miles of new pole route and 13 miles of wiring at a cost of £2,600: the cost of the radio link was £720. Generally the V.H.F. radio installation becomes economic when over six and a half miles of overhead construction can be saved. The equipment works at frequencies between 70 and 90 megacycles per second and requires an uninterrupted optical path between its terminals. Those who have seen the rugged ranges of Highland mountains can imagine the difficulty of meeting this requirement without having to place aerials at elevations more often associated with alpenstock and rope than Post Office construction and maintenance vehicles.

Although many of the larger islands are served by submarine cable for junction and trunk circuits, radio is being used for this purpose too, either separately or to augment the submarine cables. Radio now provides some junction and trunk circuits to the Orkney and Shetland islands, as well as to Lewis and Barra in the Outer Hebrides and to the islands of Mull and Islay.

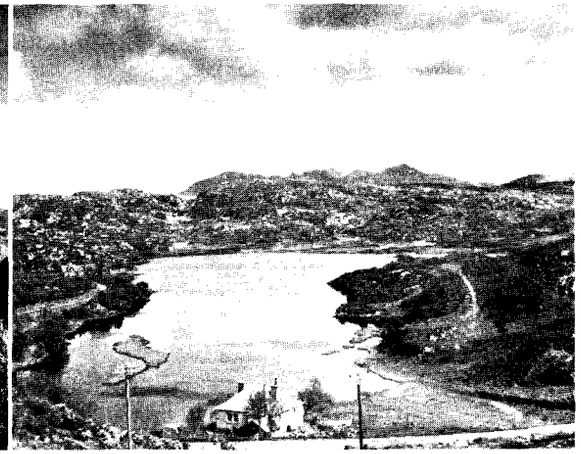
Country Satellite Exchanges

Until 1935, small manual exchanges with fewer than eight subscribers could be established only if the applicants were prepared to pay sufficient rental to cover the cost. As part of the Tercentenary Concession of 1935, exchanges could be set up by using the line to an existing call office as a junction. The country satellite exchange (C.S.X.) equipment is a compact unit fitted to a pole near the call office; it provides all the normal facilities of selective ringing, secrecy and individual accounting. The disadvantages are that only one subscriber can make a call at a time and no signal is given to indicate when the apparatus is already in use. Neither disadvantage proved serious however, in practice, as the calling rates on these exchanges are low.

Ballachulish rural auto exchange



The Five Sisters of Kintail, Ross-shire



Loch Culag, near Lochinver

There are 58 C.S.Xs. in Scotland. The subscribers connected to them live in remote districts where the length of line is well above average. Recently a successful field trial of sharing lines on these exchanges has been carried out. This facility would not increase the capacity of the C.S.X. unit, but it would save line plant and would be particularly valuable in helping to give service to some long outstanding applicants who are far beyond the limits of construction that can be undertaken at present for a single exclusive line and who, without sharing, may have to continue to wait for many years. The magnitude of the saving that can be achieved by sharing may be gauged from a request for service from the North of Scotland Hydro Electric Board's peat project at Aultnabreac in Caithness which could be met by sharing on a C.S.X. at a cost of £35: the cost of providing an exclusive line would be £250.

Plans for joining up a telephone at the Altnacealgach Hotel on the Lairg-Lochinver road are typical of the way country satellite exchanges are being used to give telephones to people who could not otherwise be connected. This hotel is 18 miles from Ullapool, which is the nearest accessible exchange, but it is planned to use an existing call office circuit at Elphin, over four miles away, with which to open a C.S.X. Service to the hotel will then be provided by erecting a new pole route from Elphin. Part of the desolate road this new route will follow is shown in the picture of the road to Altnacealgach Hotel, and the hotel itself is shown in lonely isolation.

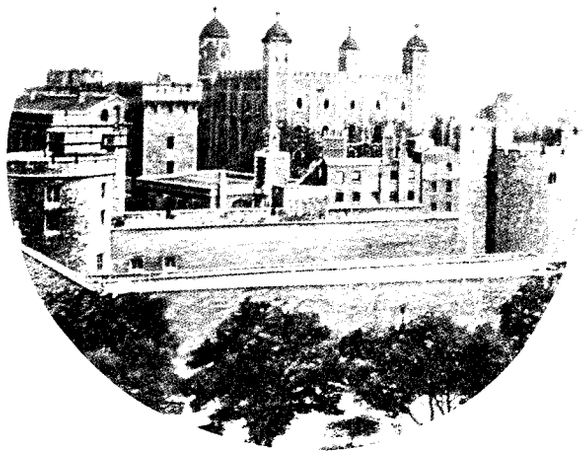
Much is heard nowadays of efforts being made to stop the lamentable drift of population away from the Highlands and Islands and a great deal is being done to revive the economy of these parts by stimulating the basic industries of agriculture, forestry and fisheries; by developing the natural resources of water power and, experimentally, of peat power; and by fostering tourist traffic. In extending the telephone service to these remote parts of the country, despite heavy cost in manpower and materials at a time when both are limited, the Post Office is making a considerable contribution towards the success of these schemes.

Acknowledgment. The author is grateful to Mr. R. S. Cowie and Mr. R. C. Birnie, M.B.E., of the Aberdeen Telephone Area, for the loan of photographs.

Down on the Farm

Let me praise the Post Office telephones – more often a target for grumbles. Urgently needing a part for a machine, I tried to get news from the factory. The salesman who knew all about it was out, soon I too was busy on the farm.

On my return to the house, instead of the usual Box and Cox business of trying to get one another, there was a message asking me to contact the personal call operator of a far-away exchange and immediately I was put through to the salesman at the factory. —*Farmer and Stockbreeder.*



Landmark of Telephone Development

On September 23 Earl De La Warr, Postmaster General, presented to Lord Alanbrooke, Constable of the Tower of London, a gold coloured telephone to commemorate the installation of the 2,000,000th telephone in the London Telecommunications Region. Following are the main points of the Postmaster General's speech, which constituted a brief summary of achievements by the Post Office telephone service.

THIS LANDMARK OF THE 2,000,000th telephone has been achieved by a very considerable effort since the war.

In the London Telecommunications Region, 51 new exchanges have been opened since April, 1945, including 24 which have been converted from manual to automatic working. Whereas before the war nearly one in four local calls made by Londoners had to be made through an operator in a manual exchange now only one in 12 has to be made. In other words, about 92 out of every 100 calls are made through automatic exchanges.

Cables containing 2,000,000 miles of wire have been laid in the streets, enough to go 76 times round the world.

Three Million Since 1939

Out of 6,000,000* telephones in the United Kingdom, no fewer than 3,000,000 have been installed since the beginning of the war.

We have, in fact, in this short space of time connected as many people as have been connected during the whole of the previous long life and history of the service since 1881. The ever-increasing number of new applicants constantly reinforcing the order list has, of course, almost completely concealed the amount of work that has been done and done moreover in spite of many obstacles.

During the immediate post-war years the demands of the export drive took equipment which the Post Office needed for its own purposes. There was the ban on building, and the shortages of steel, man-power and money. There were the years of the war itself, when practically no maintenance was done. This had to be put right before we could expand.

New Exchanges

Now that we have more money to spend on development we have to face the fact that telephone development is a long-term affair. New exchanges take four to five years to build and equip; cables two to three years to plan and lay, especially in congested city areas.

For all that, new plans are now going forward. Within the next 12 months we shall be opening 14 new exchanges in London; 13 new exchange buildings are in course of construction or will be started shortly, and 15 more have been included in next year's building programme.

In addition, many buildings are being enlarged

Lord Alanbrooke puts the 2,000,000th telephone into service

and many of the present exchanges are being extended. Similar progress is being made throughout the length and breadth of the country.

In 1950-51 the capital allowed for telephone development and renewals in the whole country was £41 million; by 1952-53 it had grown to £60 million; for 1954-55 it is £67.8 million, with a million extra allowed in July to make it possible both to recruit and train new engineering staff, and to make the most of the summer months when overtime is of most use. For 1955-56 the figure will rise further to £79.4 million.

It is not enough merely to provide new exchanges and connect new subscribers. We have also to extend the trunk service to carry the additional calls which will be made. Since the war we have provided four additional trunk exchanges in London. We have provided new trunk cables employing the most modern coaxial techniques, and in London we are now handling 12,500 trunk calls an hour, or seven every two seconds. We have made great strides on mechanizing the trunk system and a London trunk operator can now dial straight into the subscriber's house in 42 towns and cities. This system is, of course, being steadily expanded.

We have also done much to improve the quality of the local telephone service in London. This was badly affected by enemy action during the war, but every one of the 1,000,000 switches and 15,000,000 relays in the London automatic exchanges has been individually examined and re-adjusted, and the quality of the service now being given is considerably better than before the war.

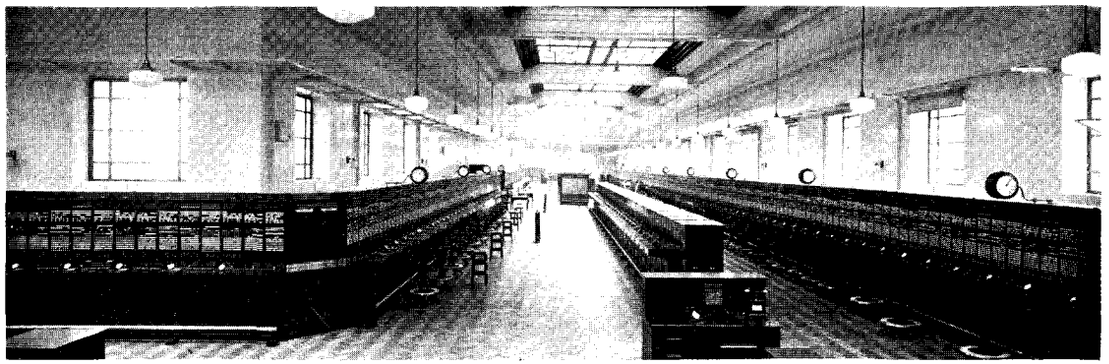
Before the war 9 per cent. of the dialled calls failed for technical reasons; this figure has now fallen to 2.8 per cent. and is still being reduced. In 1950 the speed of answer in London for trunk or toll dialled calls was 12 seconds; today it is a little over 6 seconds. The magnitude of this task of maintaining and actually improving the service can be judged by the fact that 1,600 million calls a year are made by people in the London Region.

The backlog of orders numbers 107,000 in London, or 376,000 in the whole country. We have already reduced this national backlog by 120,000 since 1951, but with new orders coming in at a rate approaching 450,000 a year, nearly twice the pre-war rate, it is not easy to forecast our future progress. But with the immensely increased sum now available for capital investment, I shall be very disappointed if we have not reduced the figure by at least two-thirds in well under three years.

This telephone, which I hope Lord Alanbrooke will accept on behalf of the citizens of both the City and County of London and of that part of Greater London which is covered by the London Telecommunications Region, is a symbol of the efforts of the Post Office to serve its customers and an earnest of our renewed efforts in the future.

The Golden Telephone

*This figure was reached in August, 1953. The total was approximately 6,146,800 by March 31, 1954.



Birmingham Trunk and Toll

A large Provincial Zone Centre

E. J. Richards, Birmingham Telephone Area

BIRMINGHAM IS VERY NEARLY IN THE geographical centre of England and it occupies a most important place in the communications network of the country. It is the largest switching centre outside London for interconnecting trunk calls between other towns. Birmingham is also the centre of an extensive industrial area containing a great variety of large and small engineering firms. It also serves a substantial area of the "Black Country" with its heavier industries. All this business activity results in an enormous volume of telephone traffic and it is not surprising, therefore, that we find in Birmingham one of the largest switchrooms in the world.

The telephone service was introduced into Birmingham in December, 1879, when the Midland Telephone Company opened an exchange in New Street, serving about a dozen subscribers and employing one boy operator. From this beginning a service has grown which now serves some 85,000 subscribers' lines from the main and subsidiary Birmingham exchanges.

Until about 1930 manual exchanges provided service for local working and a trunk exchange for long distance work. These exchanges were of various types and scattered all over the city. Between the wars, industry and population developed rapidly and the Post Office had a huge task to keep pace with public demand. As the manual exchanges were approaching the end of their useful life it was realized that only an automatic system could adequately cope with the problem of constantly increasing traffic, and that a community the size of Birmingham would need a director system similar to that already introduced in London. Under this system subscribers and operators use a dial inscribed below each hole on the dial with letters as well as figures and the first three letters of the name of the exchange required are dialled before the number (for example, HAR 1234 for Harbourne 1234). Toll calls (those up to about 60 or 70 miles) are obtained by dialling TOL, trunk calls by dialling TRU and Directory Enquiries by DIR, while for general enquiries and assistance O (for operator) must be dialled. Coin box users dial O for all calls they cannot get themselves.

Such a director system was planned to include all exchanges within a radius of seven miles of the centre of the city, and in 1931 the first three director type exchanges, Harborne, Northern and Victoria, were opened. A gradual change-over of other existing manual exchanges and the opening of new exchanges followed during the next ten years or so, until at present there is only one manual exchange left within this "7-mile circle".

The original auto-manual board serving the automatic exchanges was in the Midland exchange building, which was extended for the purpose.

This exchange handled all the toll and enquiry traffic for the automatic exchanges and as the number of these was increased, traffic handled at the toll exchange increased. In 1932 an additional toll exchange serving the "Black Country" part of the director area, in the north west, was opened at Tipton. Trunk traffic from the automatic exchanges in common with that from the manual exchanges was dealt with on a delay basis at the old toll exchange which was then situated in the Head Post Office building.

Trunks had been housed in the Head Post Office building for many years and, like the local exchange, was nearing exhaustion. It was, therefore, necessary to consider the future requirements for trunk traffic in Birmingham and, as "Demand" working was then being planned as the solution to the general trunk traffic problem, a new building was planned large enough to cater for both the toll and trunk traffic for the whole of the director area.

A central site was obtained and on this grew the new home of Birmingham's trunk and toll traffic, Telephone House, which was opened in 1936. All the trunks previously handled at the trunk exchange and the toll exchange at Midland was transferred

Birmingham Trunk and Toll Exchange No. of positions on main suites

	No. of Posns.	Traffic Handled
Toll	69	Director Area Toll and Toll Incoming
Toll	53	Director Area Toll and U.A.X. "O" level
Toll	22	Wolverhampton subs. to Birmingham
Enquiries No. 1	33	Toll Enq., Trunk Enq. and official P.B.X.
Enquiries No. 2	30	
Demand	102	Demand Orig.
Tk. Inc. No. 1	60	Incoming and through long distance (15 used for incoming toll)
Tk. Inc. No. 2	63	
	432	

to the Midland exchange; the toll exchange at Tipton was retained in operation for convenience.

The new switchroom on the top floor was one of the largest in the world, about 100 yards long with a wing at each end giving the effect of another 50 yards in length. It was equipped with the most up-to-date apparatus and was designed to cater for all the trunk and toll traffic for Birmingham for many years. Fate however, decided otherwise, and unprecedented development and growth of trunk traffic immediately before and during the early years of the last war soon made relief necessary. The old Midland manual exchange apparatus room was, therefore, brought back into use, equipped with 70 Demand Trunk positions, and re-opened as a trunk relief exchange handling the trunk traffic originating from subscribers on certain exchanges in the Birmingham group. Even this was soon exhausted and plans had to be put in hand for further relief after the war.

War-time experience had shown, however, that this idea of centralization which had developed to such a high degree in Birmingham, was not altogether a good thing, and post-war developments, as in other large centres, were based on decentralization and limitation of size. Under this policy the principle of "Trunk Control Centres" (T.C.C.) has developed. Each Trunk Control Centre handles all the originating manual board traffic ("O", "TRU" and "TOL") for a group of exchanges dependent on it, the remainder, with all incoming and through traffic, being dealt with at the main exchange.

The first major step in post-war relief was, therefore, the conversion of the old war-time "Trunk Relief" exchange to joint trunk working (that is, handling toll as well as trunk traffic on the same positions) and the provision of another 70-position joint trunk exchange as the first two Trunk Control Centres called Hill Street T.C.C. and Midland T.C.C. respectively. Later, the Tipton toll exchange, which was still in service, was re-equipped with modern switchboard positions and apparatus to form the third Tipton T.C.C.

Further decentralization is planned and ultimately additional Trunk Control Centres will be established at various points some four miles or so from the city centre, each serving the director exchanges in its vicinity. The main trunk and toll exchange is still in Telephone House, however, and is still fully loaded with traffic, but it will be many years before the development of Trunk Control Centres makes any appreciable inroads into the volume of traffic handled at the main exchange.

The Main Exchange Switchroom

A sketch of the main switchroom is shown on page 12. There are four main sections of the exchange in the room: the Toll suites, the Demand Trunk suite, the Incoming and Through Trunk suites and the Enquiry suites.

On the floor below is an additional room

intervals to ensure that the lines are cleared as soon as possible after the calls are terminated.

Because of the effect of the service given by these positions on the trunk service of the country as a whole they receive priority of staffing to ensure, as far as possible, speedy answering and setting-up of calls and, even when a route outgoing from Birmingham has to be operated on a delay basis, normal working is maintained on the incoming suites if at all possible. Only if a most serious breakdown occurs on a route is it the practice to stop connecting through calls on demand.

Pneumatic Tube Distribution Positions (P.D.P.)

The demand suite handles some 12,000 calls each normal day and, therefore, it is not difficult to realize that, to ensure that tickets can be traced without delay, a system enabling tickets to be quickly sorted into some order is necessary. The Pneumatic Tube Distribution Position (P.D.P.) system provides this. The centre of this system is the P.D.P. position in the centre of the switchroom and pneumatic tubes are provided from each demand position. As the demand operator finishes handling a ticket she sends it down the tube to be delivered at the P.D.P. Here the ticket is scrutinized and, if it is completed, filed (in the filing trays provided) in called exchange order ready for pricing. If it is not completed, that is, a suspended call, delay call, A.D.C. call and so on it is despatched, through other tubes, to the proper position for further treatment, returning eventually from that position as a completed call. Completed tickets are thus filed within seconds of the call finishing and it is usually possible to trace a ticket quite easily from details of the called number.

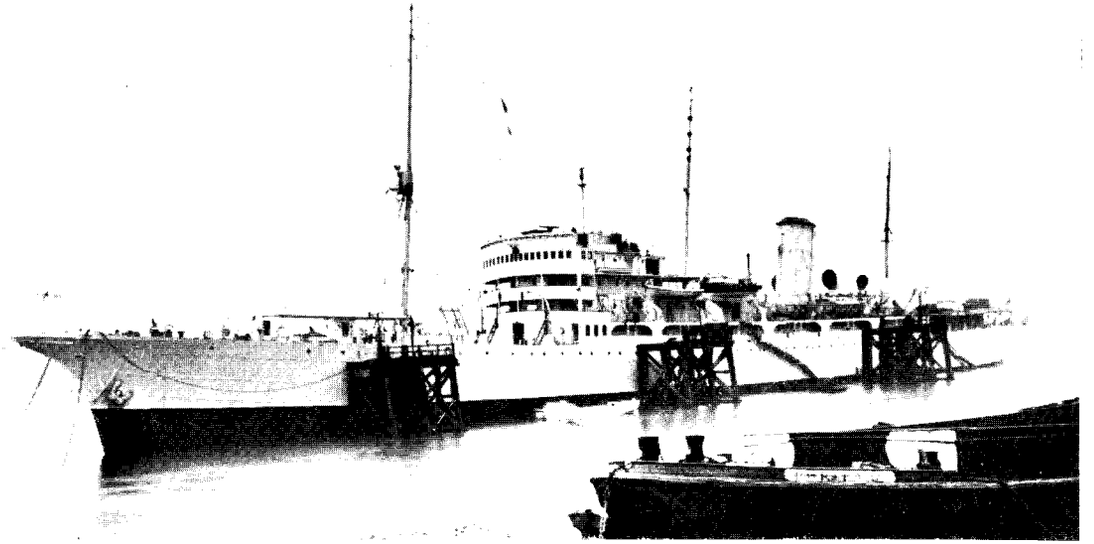
The Enquiry Suites

The two main enquiry suites are in the centre of the switchroom. Most of these positions are used for toll enquiry work: that is, dealing with general enquiries, complaints, reports of difficulties, calls on intercepted lines and requests for assistance in obtaining calls. They are in effect normal monitorial positions but, because of the number of positions which would be required (about 60 in the busy hour) such items as monitors' information cards, routing and changing files and directories are not on the positions; the functions which necessitate reference to these records are segregated on special positions. By this means the number of sets of information is reduced to reasonable limits and a large amount of clerical work is saved. Instead of having the information herself each operator has access to circuits in the multiple to these special points over which she can obtain all the required information.

The special positions for dealing with these enquiries are in a separate room and by far the largest group is that used for Directory Enquiries. Specially designed positions are used for this work, but the method of dealing with the enquiries and the information available is much the same as at other Directory Enquiry centres. The main differences are that calls are fed to the position from a "queue", which ensures callers being answered in order, and that amendments for the local area are carried on drums instead of loose-leaf books. Separate Directory Monitor positions are provided to handle enquiries requiring search in less frequently used sources of information such as street directories, special lists, ex-directory lists and Channel Islands' directories.

Other positions in this room deal with route and rate quoting enquiries and monitors' card references.

Trunk and toll exchange Birmingham: Directory Enquiry positions, showing amendments carried on drums instead of in loose-leaf books



H.M.T.S. "Monarch" at Greenwich showing main aerials between the masts, and whip receiving aerials at stern

Radio on Cable Ships

C. W. Sowton, B.Sc.(Eng.), A.M.I.E.E., & F. J. M. Laver, B.Sc., A.M.I.E.E.,
Engineer-in-Chief's Office

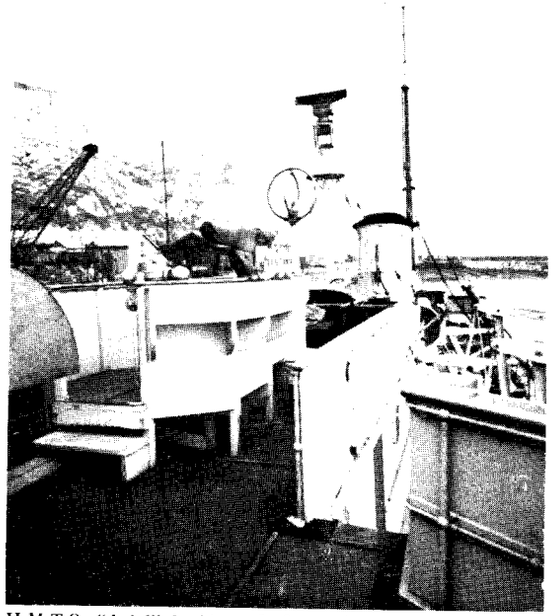
RADIO IS AN ESSENTIAL PROVISION FOR ANY modern ship, and to the seaman it means first of all rapid communication when his n or a nearby ship is in distress. Radio communication also proves its worth when bad weather changes of plan delay or divert the ship from intended course. For cable ships radio communication is invaluable when it is necessary to t the cable or its submerged repeaters from ip to shore. Progress with repair work can be ickly reported, and if necessary the ship can quickly recalled in an emergency for more gent work. Laying and repairing submarine bles becomes well-nigh impossible in really bad eather, and radio weather forecasts are valuable ides in this work.

Communication is not the only ship-board job at radio can do; it can also help the navigator, pecially in coastal waters. The special need for curate navigation in submarine cable work need rdly be stressed, for clearly much time can be ved when cables have to be found and repaired if e exact positions of both ship and cable are known.

It is obvious that the Post Office's cable ships need efficient radio equipment to help them perform their arduous tasks. The Post Office inspects the radio equipment of British ships to ensure that it conforms to the minimum standards required; indeed, the Post Office played no small part in the determining of the standards themselves. Clearly then, Her Majesty's telegraph ships should set an example in radio matters.

All four ships of the Post Office fleet have been refitted with radio equipment of the most modern type. This article gives a general account of the radio facilities provided, but a more technical description of the equipment will be given in an article which is being prepared for the *Post Office Electrical Engineers' Journal*.

The radio equipment of the three smaller ships H.M.T.Ss. *Ariel*, *Iris* and *Alert* differs in some respects from that of the fourth and largest ship, H.M.T.S. *Monarch* and it is convenient to describe it separately. The first need is, of course, for emergency communications, and equipment is provided to meet requirements agreed internationally in 1948 at a conference on the Safety



H.M.T.S. "Ariel" looking aft from the top of the wheel-house. The direction-finder loop aerials are in the centre: a little to the right, and above, the rotating radar aerial can be seen at the top of the radar mast

of Life at Sea. The ships carry emergency transmitters and receivers for the international maritime distress frequency of 500 kc s, and an automatic alarm which is used when the radio operator is off watch to ring a bell if a distress call should be received.

The emergency equipment is operated from batteries so that it is independent of damage to the ship's main electric power supply. Should it be necessary to abandon ship a portable radio transmitter can be taken into a lifeboat, and used to transmit distress calls and signals from which the boat's position can be found. The lifeboat sets derive their power from small hand-operated generators and with a small wire aerial can send reliable signals over a range of many miles.

The main radio communication equipment can be considerably more powerful than the emergency equipment since it operates from the ship's mains and not from batteries. The main radio-telegraph transmitter can operate on any of a number of crystal-controlled frequencies in the bands reserved for the maritime mobile service near 500 kc s and with its output power of some 200 watts has a range of several hundred miles. Although radio-telegraphy is the staple medium of communication there are many uses for a radio-telephone connexion to the ship and this is provided by equipment working on frequencies in the region of 2,182 kc s. Telephone calls can be extended through the nearest of the 12 Post Office Coast Stations to any telephone subscriber. It is clearly a great convenience for both official and personal use, by enabling direct contacts to be established between the ship's commander and headquarters or between the officers and crew and their families.

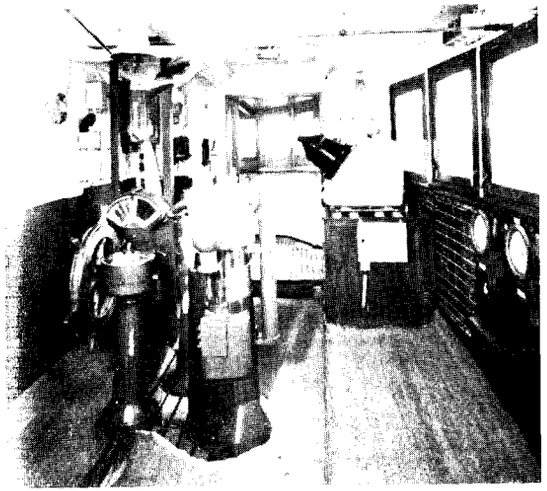
Some cable work, such as the landing of shore ends, involves close liaison between the ship and working parties in the ship's boats. Each ship carries a number of lightweight V.H.F. radio-telephone equipments of the well-known "walkie-talkie" type for this kind of work.

Broadcasting is a popular form of entertainment at sea and in the cable ships the crew can either listen to programmes relayed to various points from a receiver in the radio-room, or they can operate their own receivers. In the *Monarch* arrangements have been made for a single broadcast receiving aerial, with amplifiers to feed signals to the different parts of the ship where the private receivers are used.

The oldest radio aid to navigation is the direction-finder, which has been used at sea for very many years. In its modern form a ships'

Portable radio transmitter and receiver being tested in a life-boat. Power is provided by a generator driven by turning the crank handles

direction-finder has a pair of crossed-loop aerials fitted in a clear situation somewhere on the superstructure of the ship. These are connected by cables to the receiver and radio-goniometer* in the chart-room. The direction-finders fitted in cable ships operate in the 500 kc s band where they are used to take bearings on other ships, coast stations and specially provided automatic transmitters called radio-beacons. They can also be



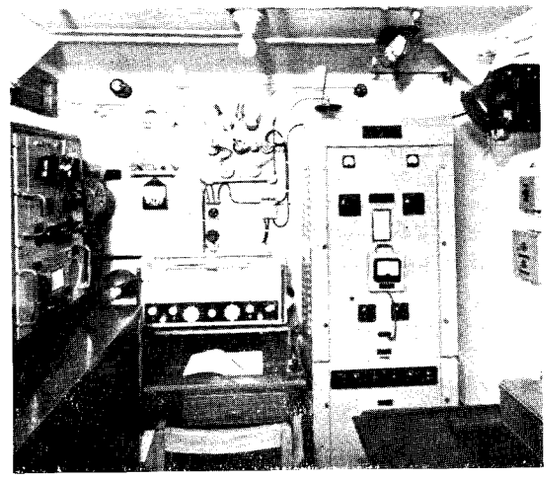
Wheel-house of H.M.T.S. "Alert" showing (right) the radar display unit, with visor

used for signals having frequencies in the region of 2,182 kc s; that is, for taking bearings on radio-telephone transmissions from ships and coast stations and they may be used in this range to take bearings on small battery-operated transmitters fitted to some types of buoy.

Transmitting buoys are coming into us for deep sea fishing and they may be found useful for marking the cut ends of cables, when these have to be left for a short period. Transmitting buoys would, of course, be easier to find than the ordinary type of buoy, especially in bad weather, but they have another radio rival in the buoy equipped with radar reflectors. Radar can be used to find an ordinary buoy, but in any but the calmest seas buoys are somewhat hidden by the waves which produce obscuring signals, descriptively called "sea-clutter", on the radar screen. However, it is relatively easy to fit an arrangement of reflectors to a short mast carried by the buoy, which increases the range at which it can be reliably picked up by a typical ship's radar set from one and a half to six miles.

Radar is an invaluable navigational aid and during the war the cable ships were fitted with Admiralty radar sets of an early type. These sets have now been replaced by modern commercial types of radar developed for use in the merchant marine. The rotating aerial of the radar equipment stands on a high point of the ship's superstructure where it can scan all round the horizon with as unrestricted a view as possible. The bulk of the radar equipment is housed in the radio-room, but the radar screen is, of course, mounted with its operating controls on the ship's bridge where the navigating officers can refer to it quickly and easily.

Some impression of the capabilities of modern marine radar can be gained from two incidents. When *Monarch's* new radar was first installed and being tested on its shortest range, a moving object detected on the screen turned out to be a piece of



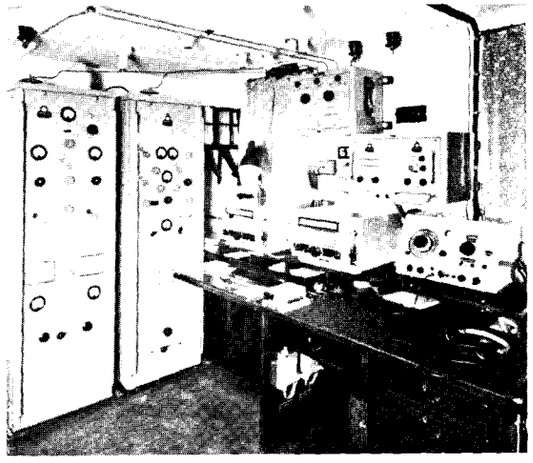
Radio-room of H.M.T.S. "Ariel". The main transmitter (cabinet on the right), and receiver (centre), with aerial switch (above) and on the left the radio-telephone set

floating timber which was observed as it floated downstream for several hundred yards. On the other hand, using the longest range of the *Ariel's* radar the coast of France can occasionally be seen when the ship is lying alongside the quay at Dover.

A most valuable aid to navigation in coastal waters is provided by the Decca Navigator system fitted to all four cable ships. This system depends

*Goniometer: A device used in connexion with the "Bellini-Tosi" direction-finding system. It comprises two coils placed at right-angles and connected to the two crossed aerial loops respectively; a third rotatable coil, connected to the receiver, provides the variable relative coupling of the two loops to the receiver.

on radio signals radiated from a group of stations on land, which are received on the ship and carefully compared. The comparison of any two of the signals, which is completely automatic, enables the navigator to locate the ship's position as somewhere on one of a grid of lines over-printed on his charts. Similarly comparing another pair of signals locates the ship somewhere in another line, and so the ship must be where the two lines cross. The navigator merely has to read the dials of two small meters and plot the readings on his chart, and within 100 miles of much of the English coast the ship's position can be fixed to within a quarter of a mile. The advantages of such a device for plotting the tracks of submarine cables and so helping their subsequent recovery for repair, are obvious. The system is of course completely unaffected by fog or bad weather.



Operating position in H.M.T.S. "Monarch" showing the main telegraph transmitter (cabinets on the left) and receivers (shown on the right)

For Transatlantic Task

Monarch has radio equipment additional to that fitted to the smaller ships, for she makes longer voyages and moreover has been prepared for the exacting task of laying the new transatlantic telephone cable. For this job reliable radio communication throughout the Atlantic crossing, and accurate radio navigation on both sides of the Atlantic will be essential. The radio transmitters installed in *Monarch* are therefore of somewhat higher power than those in the smaller ships, and powerful high-frequency (short wave) telegraph and telephone transmitters have also been fitted.

Monarch's high-frequency radio-telephone transmitter is indeed one of the most powerful and most advanced fitted to any ship in the world, and uses the single-sideband technique employed for the public service long distance point-to-point radio-telephony. The radio aids to navigation provided on the smaller ships are supplemented in *Monarch* by the American Loran (LOng RAnge Navigation) system. The Decca Navigator system is not used in North America but a group of transportable Decca Navigator stations will be specially installed, for the period of the laying of the transatlantic telephone cable, near the Newfoundland coast in the interests of precise navigation over about the last 150 miles of the telephone cables' tracks.

The installation of radio equipment on ships is not without its difficulties. The ships are available only for short periods during their annual refits, and then radio refitting is not the only or even the largest job to be done. Much has to be accomplished in a short time, for it is not simply a question of putting the radio equipment on board and plugging it in! On *Ariel* and *Iris* completely new radio-rooms had to be built on the superstructure. The radio equipment needs electric power at several voltages differing from that provided by the ship's mains, and these have to come from electric machines – motors and generators – fitted in a separate watertight compartment and connected to the radio-room by cables. Aerials have to be rigged and mountings fixed for the direction-finding loops and the rotating radar aerials.

The lay-out of the radio-room itself presents no easy task for space is usually restricted and the equipment must be safe from the dangers of fire or electric shock yet easy to operate and maintain. The engineer in charge of the radio refit has to harmonize the wishes of the ship's commander and the radio officers with the needs and difficulties of the radio and radar contractors and the electricians, ship-wrights and joiners of the ship-yard.

Ariel, *Iris* and *Alert* sail in the Mediterranean as well as in British coastal waters; *Monarch* works in all parts of the world, and all the ships occasionally carry visitors from overseas concerned with cables and telecommunications. The radio equipment now carried by the cable ships demonstrates to their visitors the high quality of the products of British marine radio and radar manufacturers.

Finding the Facts about Telegrams

W. H. Scaife and N. E. D. Noble*

Inland Telecommunications Department

N THE OPERATION OF THE TELEGRAPH SERVICE he Post Office naturally collects statistics about he way the system works; information of this t is needed for both management and admini- ation, and it is normally produced in the m of routine returns prepared by Head Post- sters and others. But at intervals the need is for up-to-date information much more ailed than is given by these routine returns and the same time much wider in scope. In the t this need has been met by taking a census of e country's telegraph traffic, a very specialized which has brought into play some rather usual techniques.

The first full census of this sort was taken in 934; on this occasion the examination was ited to inland telegrams, and some special sses of telegram, such as Press messages and legrams handed in at Railway Telegraph Offices, ere excluded. The record covered one week d particulars of about 650,000 telegrams were llected. The job was notable as being an early xample of the large-scale use by the Post Office punched card techniques – of which more later.

Analysis of the results of this 1934 census xpressed in statistical form many features of the legraph service; for instance, the importance of he service to businesses dealing with perishable oods was clearly brought out. A fact which must ave had some influence when tariffs were being onsidered was that, although the minimum harge was then, as now, for a telegram of 12 ords or less, more than one-third of all messages ontained fewer than 12 words.

In 1935 another record was taken: this was to a arge extent a repetition of the 1934 census, but differed from it in that, to reduce the amount of work, the examination was limited to one telegram in three. At this time the minimum charge was for a telegram of nine words, instead of 12, and the effect of this change was illustrated by the fact that the proportion of messages having fewer than 12 words had risen to nearly half.

If it had not been for the outbreak of war in 1939, there is little doubt that further work of this sort would have been undertaken. As it was, the radical changes in the traffic brought about by the war, and later the process of readjustment to peace-time conditions, could not be ignored, and very limited examinations of the traffic were carried out in 1943 and 1946.

By 1950 the absence of up-to-date information, particularly in the light of the difficult financial position in which the telegraph service found itself, demanded a new large-scale investigation, and arrangements were put in hand which culminated in the taking of the 1951 census.

Purpose and Scope of the 1951 Census

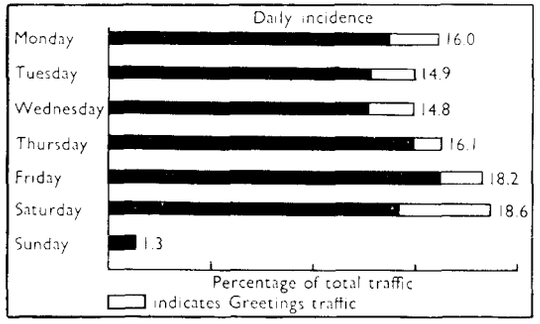
The earlier studies, in 1934 and 1935, may be said to have had a "market research" bias. They were designed, in the main, to supply information about the subject matter of telegrams and the types of business they dealt with, the times and days of the week on which they were sent, and the relative lengths of different types of message – what has been described as the "demand" side of the service. For 1951 it was decided that, while this sort of information was too valuable to be omitted, it should be supplemented by particulars which would illustrate the way in which the demand was met – the "supply" side.

In extending the scope of the study in this way, the object was to secure a record of all aspects of the telegraph system which would serve as a basis for a comprehensive review of the service. This work of reviewing the service shows signs of developing into a continuous process for which

*Lent to Colonial Service, Organization and Methods Department Malaya.

more up-to-date information will have to be provided as time goes on.

In planning the 1951 census it was decided to include all telegrams handled at any stage on the inland system: that is, inland telegrams of all classes, and, in addition, overseas telegrams and radiotelegrams whenever they appeared on the inland system. Altogether records were made of nearly a million telegrams at about 1,400 telegraph offices, making the job both the largest and the most complex so far undertaken.



From the beginning the arrangements were discussed with both the officers in the Regions who would be responsible for putting them into practice and representatives of the Staff Associations, and in this way many difficulties which looked serious at first were circumvented or minimized.

The first job was to decide what information to record, and this was not easy because of the very many questions about each telegram which interested different departments and sections of the Post Office. Practical considerations imposed a definite limit on what could be done, and some pruning was unavoidable. In all, 38 questions were asked about each telegram. The main items were: how, when, and where each telegram was accepted; the distance to the office of destination and the number of transmissions of each type needed to get it there; how, when, and from where it was delivered; how long was spent on each of the main stages of its journey; any special service used; the number of words; the nature of the message (for example, financial, betting, congratulations and so on); and some information about the degree of urgency.

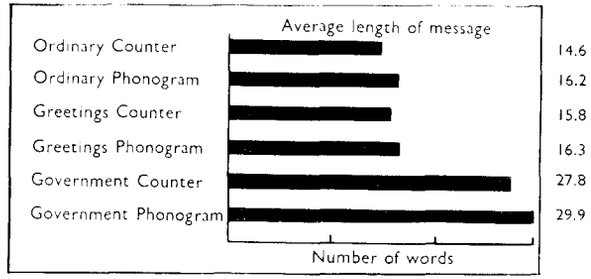
This is an imposing list, but among the items which had to be excluded were the number of unsuccessful attempts to deliver by telephone; the class of telephone subscriber originating a phonogram call; whether there was a telephone at an address to which delivery was made by hand; and the numbers of telegrams originated or received each day by individual users.

Procedure

The procedure was based on a form—Census Form 1—one of which was filled in for each telegram during the week of the census. Part of the information had to be recorded at the delivery office at the time when the telegram was being handled, and the rest was added later at the office where the original telegram form was filed. Much credit is due to the staff at telegraph offices throughout the country, who handled this extra work with such a will that the added delay on the telegrams rarely exceeded five minutes.

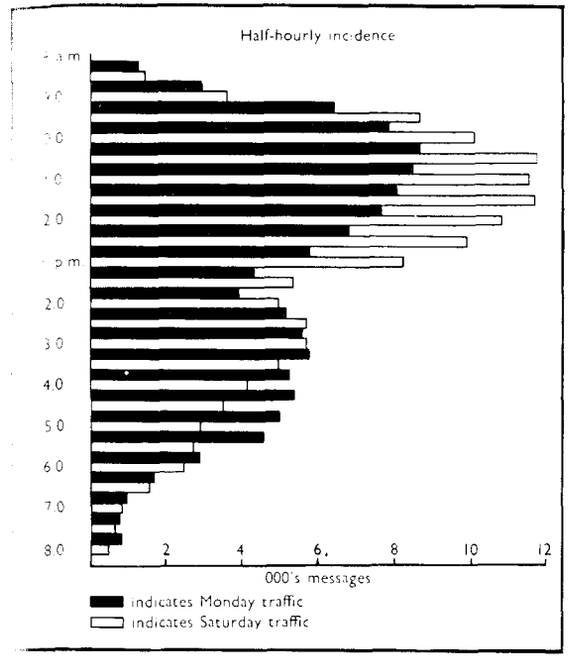
The next step was to translate the answers to the questions on Form 1 into a simple numerical code which could be transferred to punched cards and summarized by punched card machines. For example, the duration of the messenger's run might be 50 minutes; reference to a separate coding list would show that the code for all times between 45 minutes and 1 hour was "4", and this figure would be recorded.

The last stage of the work done manually was to copy the coded answers from each Form 1 on to a special card. Each figure on Form 1 was



taken in turn and a pencil mark made through the corresponding figure in the appropriate column on the card.

The marked cards were sent to the Punched Card Bureau at Post Office Headquarters, where they were fed into a machine which read the marks and punched holes in the cards to correspond with them. This process is called "mark-sensing", and it depends on the fact that, when a



pencil mark is made over one of the figures on the card, it provides an electrically conducting path across the column; the machine searches each column for these paths, and is arranged to punch a hole in a position determined by the position of each mark.

Mark-sensing was adopted for the 1951 census because to punch the cards by hand—the usual way—would have employed a large staff for several months, and the delay could not be accepted. This job was the first in which mark-sensing had been used by the Post Office, and probably the largest for which this technique had been used up to that time; because of this it was watched with great interest by the punched card experts.

Summarization

Most of the summarizing was done on "counter-sorter" machines, as illustrated. Taking one column on the cards at a time, the machines sorted the cards into twelve separate containers—according to where the holes in the particular column were punched—and counted the cards in each container. The twelve batches of cards were then further divided by feeding them back into the machines and arranging for the sorting to be done on another column. In this way it was possible to find out how often any specified item, or combination of items, occurred. The process was quite rapid, as each machine could handle about 10,000 cards an hour. Nevertheless, there were over 760,000 cards for inland messages and over 180,000 cards for other kinds of message, and the whole programme of analyses took several months.

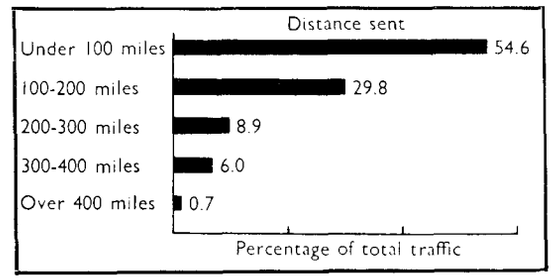
Results

To give all the results here would take too much space, but examples of some national figures for inland telegrams are reproduced.

As might be expected, the results for individual Regions differed from the national averages and from each other. In Home Counties nearly twice as many phonograms were received from call offices as in any other Region. London, rather surprisingly, had the highest percentage of social traffic; it also had the highest percentages of telegrams sent less than 25 miles and of messages addressed to telephone numbers. The Midland Region steered a middle course in all the analyses, whereas North Eastern Region, notable for its high proportion of messages about fish, was the earliest starter, judging by the time of the morning "busy hour" for telegraph work.

In North Western Region more than half the telegrams were delivered by messengers riding bicycles. The South West was the place for telephone delivery of telegrams, and people there were generous users of the reply paid facility. In Northern Ireland the Greetings service did not seem to be popular, but telegraph money orders were well patronized. Greetings telegrams were not very popular in Scotland either, as nearly half the telegrams containing greetings messages were sent from there at the ordinary rate.

Wales supported the Greetings service strongly, handed in most of its telegrams at Post Office counters, addressed nearly all of them to postal



addresses, and held the record for speed in forwarding them after they were handed in.

If we compare the results with those of the 1934 census, it is notable that, whereas twenty years ago there was more business than social traffic, in 1951 social messages predominated; the busiest day had changed from Friday to Saturday, apparently mainly because of the introduction of the Greetings service which might almost be said to have created a new social habit, since the number of messages of a greetings nature had risen from 22,000 to 135,000; and the proportion of messages over short distances had increased.

Business messages, Greetings, and types of traffic like money orders and "Press" accounted for 70 per cent. of the total, and many of the remaining messages were about sport, hotel bookings and so on. The growth in telephones did not produce the expected drop in social messages or in short distance traffic; and of the messages delivered by telephone, over 65 per cent. were also handed in by telephone, so that they might have been telephoned direct if the senders had wished.

The 1951 census has been one of the main sources of the information on which telegraph policy in the last two or three years has been built. This information is now three years old, and the need for something more up-to-date is being emphasized by the probability that the recent changes in telegraph charges will produce important changes in the volume and character of the traffic.

The most urgent calls for information are being answered by taking *ad hoc* returns which are relatively simple to arrange and which do not require elaborate organization. However, records of this kind are almost inevitably either too incomplete to meet the needs fully, or too laborious from the point of view of the staff who have to take them; the question how best to produce the information which will be wanted in the future is one that has been attracting attention for some time.

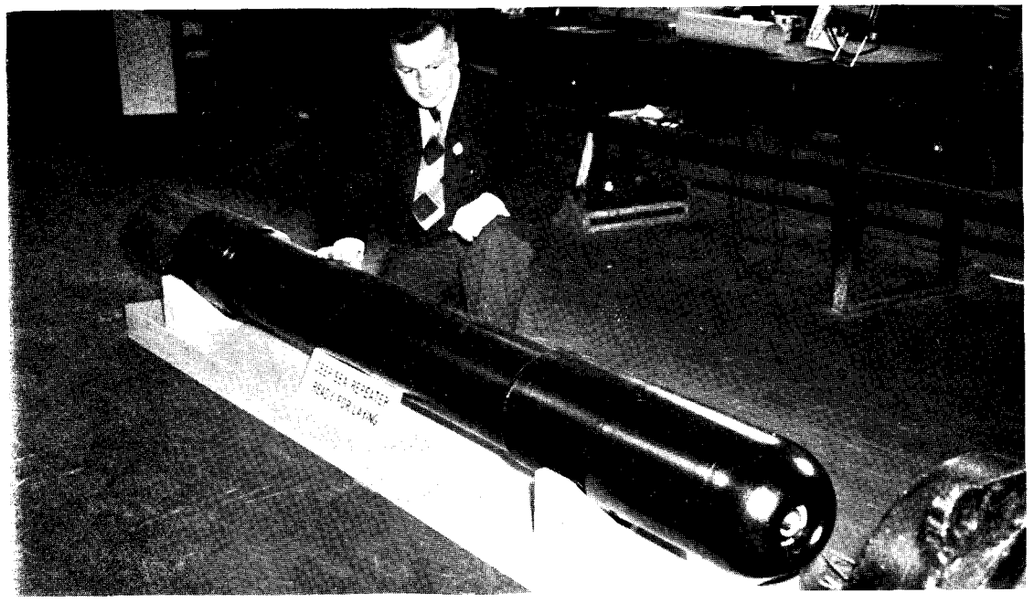
It is perhaps unlikely that another full census on the lines of the last will ever be taken. The amount of work involved in a job of this sort is very large, and because it has to be concentrated into a short space of time it places a strain on the organization. There is also the fact that extensive planning is needed beforehand, and the subsequent process of analysis takes a long time. Current ideas are turning in the direction of a continuous sampling of telegraph traffic, which would avoid some of the disadvantages of a census, in that the work would be evenly spread and could therefore be arranged conveniently, and, when the scheme was working, up-to-date information would be coming forward continuously and would be available whenever it was wanted.

However, continuous sampling brings problems of its own. There is some loss of accuracy as compared with a complete record, but this can be kept within acceptable limits; more important is the requirement that the selection of telegrams for the record should be carried out in such a way that the results of analysis are free from bias or distortion.

The original copies of telegrams are filed, and there should be little difficulty in arranging to extract a sample from these, from which much of the required information could be obtained; but to record the complete history of a telegram involves collecting some particulars while it is in transit: not all the details required can be obtained at any one point and some are not normally recorded in permanent form at all so that there is a danger that collection of all the items will become too complicated to be workable in practice.

An element of compromise usually enters into a project of this kind, and these problems, with others involved in the practical application of continuous sampling, are at present being examined, with the object of developing a suitable scheme for introduction early next year. It is possible that, with a new routine record of this sort, the existing returns which were mentioned at the beginning of this article can be rationalized and simplified.

Counter-Sorter Machine



Research Station Shows New Techniques

"Open Day" at Dollis Hill

H. B. Law, B.Sc.(Tech.), A.M.I.E.E., Engineer-in-Chief's Office

SOME 450 VISITORS FROM INDUSTRY, THE Universities and Government departments went to the Post Office Engineering Research Station on Friday, September 24, to see examples of current developments in line and radio communication. The Station was also open on the previous day, to senior Post Office staff and the Press, and on the Saturday, to friends and families of the Station staff. Since the last Open Day, in 1951, considerable advances have been made, notably in the application of repeaters to submarine cables and in electronic telephone exchange developments, and the occasion provides an opportunity for a brief review.

Electronic methods of switching are being studied as alternative to the electromechanical methods now in use in telephone exchanges. Not only are the electronic devices not subject to wear but they can also be made extremely fast in operation so that common equipment can be time-shared among a very large number of circuits. Much effort is directed towards the practical application of the new methods and an electronic P.A.B.X., which has been built to gain experience, was demonstrated on Open Day. Speech and signalling information from the lines amplitude-modulate 10-kc s pulse trains and these are interleaved to form a 99-way time-division-multiplex transmission system by which the speech circuits may be interconnected. Selection is effected by gates under the control of registers and a marker. The P.A.B.X. has an ultimate capacity of 99 lines, but the design can readily be extended to large public exchanges of 10,000 or more lines.

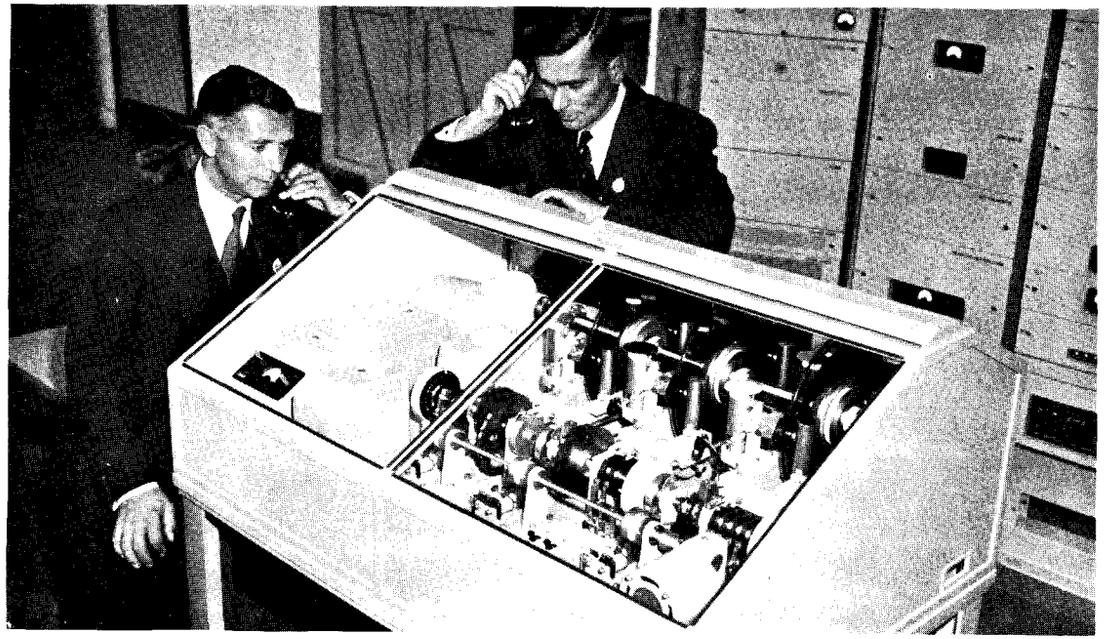
Perhaps the most striking development in telephone transmission in recent years has been the great increase in circuit capacity of submarine

cables obtained by using submerged repeaters; the large group of exhibits devoted to this class of work attracted particular interest. Among the items shown was a deep sea repeater similar to that which will be used on the British section of the transatlantic telephone cable. These repeaters must function without attention in deep water for some 20 years and the need for extreme reliability has involved research and development over a wide field. The amplifier itself has two amplifying paths in parallel, so that failure of any one component will not seriously degrade the performance of the repeater.

The component units are manufactured under rigidly controlled conditions. The difficult problem of valve failure has been intensively attacked and high-slope pentode valves showing every expectation of very long life are now made at Dollis Hill. A technique for sealing cable glands to withstand hydrostatic pressures of four tons per square inch has been developed, and telemetering devices for measuring shocks, spin, inclination, pressure, and so on, within a dummy repeater have been designed so that the stresses encountered during cable laying can be assessed.

Transistors can replace valves in some circuits; they offer advantages in saving space and, notably, power consumption. A series of exhibits showed the preparation of germanium crystals of controlled electrical properties, the testing of diodes and transistors, and a number of circuit applications. Two transistor line amplifiers were shown, one for speech and the other for music, the former having reached the stage of field trials.

Centrimetric radio relay links, hitherto used mainly for television purposes, are now being applied to the transmission of multichannel telephony signals and this is leading to more stringent performance requirements for the links, and consequently for test equipment. Developments were illustrated by a wide range of components, filters, propagation-measuring equipment and test equipment. A simple and effective way of assessing the overall performance of a system was demonstrated. When many channels of a multichannel system are active, distortions in transmission cause a general rise in noise level. For test purposes the system is loaded with wide-band noise to simulate the many active channels; the applied noise spectrum has a few narrow gaps



Prototype on display of a new Speaking Clock, which is driven electrically from a quartz-crystal controlled oscillator

in its frequency spectrum, representing quiet channels, and the noise in these channels is measured at the end of the system.

The bulk of the long-distance overseas telephone and telegraph traffic of the U.K. is carried by short wave radio. Unfortunately the short wave bands are overcrowded and it is becoming very hard to find suitable allocations for new services. The search requires skilled operators and is very tedious. An automatic scanning receiver, which was demonstrated, has been designed to give a printed chart showing the occupancy of a band in terms of time and frequency; gaps in the chart, corresponding to little-occupied parts of the band, indicate where the manual search can profitably be concentrated.

Some kind of directional beam aerial is usually employed for transmitting and receiving on short wave point-to-point services and it is important to know the performance of the various kinds of aerial and to be able to compare them. Full scale tests are expensive in both time and material, but, by using scale models, experiments can be carried out indoors at comparatively trifling expense and the effects of obstacles, such as masts and buildings, can easily be determined. Demonstrations were given of a model equipment having a scale of 1:200.

New Speaking Clock

The prototype model of an improved speaking clock was shown in operation. The speech signals are reproduced from sound tracks on rotating glass discs in much the same way as in the pre-war design of speaking clock that provides the TIM service in the U.K., but the new design of clock is controlled by a quartz-crystal vibrator, which makes it a much more accurate time-keeper. The old clock requires correcting signals from the Royal Greenwich Observatory at hourly intervals to keep it correct within 0.1 second, whereas the new clock will keep correct within 0.005 second with correcting signals only once per day.

Another exhibit was a quartz clock of the type used extensively in time observatories. The temperature of the controlling crystal of this type of clock has to be closely regulated; any gross disturbance, such as would be caused by a power failure, may impair the accuracy for many weeks and observatory installations have hitherto included elaborate and expensive emergency power supply arrangements to ensure continuity of power supply. The new clock incorporates a simple but effective scheme whereby the emergency power supply is drawn from an ordinary car battery.

Some of the processes in the production of piezo-electric quartz vibrators were demonstrated. A notable development in this connexion is a new form of saw for cutting quartz crystals. For certain applications, such as the frequency control of mobile radio equipment, very thin quartz vibrators are required. Sawing these out of the raw material, which is expensive, is a wasteful process because much of the material becomes worthless sawdust. The wastage can be reduced by making the saw blade very thin, but in conventional quartz-cutting saws this results in loss of rigidity. The new saw combines thinness with rigidity by keeping the blade in tension. The sawcuts made by it are less than half as wide as those made formerly.

"Candid Assessment" of Transistors

Summarizing a "candid assessment" of transistors—an examination intended to clear up the confusing impression created by "highly coloured reports"—B. R. Bettridge, A.M.Brit., I.R.E., of General Electric, writes in the first issue of *Communications and Electronics:*—

(1) Early prophesies concerning the future of transistors were mainly unrealistic, not in what could be done, but rather when it could be done.

(2) There is now a sufficient range of different types of transistors, at various stages of development, to enable a great proportion of receiving valve functions to be taken over.

(3) The time required to get all these devices into mass production is unlikely to be less than three years.

(4) When they are in mass production, the prices of transistors can be expected to be competitive with thermionic valves.

(5) Transistors are not likely to be confined to replacing valves in existing applications; many new uses will be found for them.

A view of Deeside showing Balmoral Castle and Lochnagar (3,786 ft.)

TWO SCOTTISH

ABERDEEN

From the pleasant greenness of Deeside to the rugged grandeur of the Highlands, from the fertile farms on the Moray Firth coast to the rough grazing of the Islands, this extensive Area of 14,000 square miles covers a territory steeped in Scottish history.

The Area serves nine northern counties as well as the Islands of Skye, Lewis and Harris, and the Orkney and the Shetland Islands. The most northerly subscriber in Great Britain is Muckle Flugga lighthouse in the Shetland Islands.

Aberdeen, known as the Granite City, contains many fine buildings including the university — one of the oldest in Europe. The port, well-known for the trawling industry, was in use hundreds of years ago. As a seaside resort and tourist centre, Aberdeen provides for many thousands of holidaymakers each year.

Inverness, a fine town at the mouth of the River Ness, is the second largest in the Area. Historically, it has claim to be called "The Capital of the Highlands". In the beautiful scenery of the glens mighty dams are now being built which will turn the waters of the lochs into electricity. These hydro-electric schemes and the economic revival of the Highlands are making big demands for telephone facilities in remote places.

Probably no Telephone Area in Great Britain is more varied. The Area contains the smallest exchange, Shieldaig, with two exchange connexions, and the largest exchange in Scotland, Aberdeen Main with 9,600 exchange connexions. Besides submarine cables to the Islands there are inland submarine cables—across the lochs. Some exchanges and rural call offices are connected to the telephone system by radio. Much of the Area is sparsely populated. A quarter of a million poles are needed for the long overhead routes serving 391 exchanges and providing service to the 45,000 exchange connexions and 68,000 stations.

The telephone staff in the Area, including operators, is 1,950 and the annual revenue is £1,500,000.

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Left to Right: R. C. BIRNIE, M.B.E., A.M.I.E.E., Area Engineer; J. B. DUFF, E.R.D., Area Engineer; A. MORRISON, Chief Clerk; R. E. JORDAN, Telephone Manager; Miss M. R. G. BRECHIN, Secretary; W. HOLT, Chief Telecommunications Superintendent; S. J. HURST, Senior Sales Superintendent

TELEPHONE AREAS

SCOTLAND WEST

The Scotland West Area covers the west of Scotland *from Dumfriesshire in the south,* with the romantic Gretna Green just inside the Scottish border, to Mallaig in the north. It includes the North and South Uist in the Outer Hebrides and the islands off the west coast both south and west of Skye.

The Area is spread over approximately 10,400 square miles of territory, almost as large as the Home Counties Region, but not so compact. The variety of type of community is infinite, ranging from the rich agricultural and grazing areas of the south through the industrial areas of the Clyde-Forth valley to the remote farms and crofts of the Western Highlands and Islands. It encircles, but does not include, Glasgow and stretches each side of the Firth of Clyde, which is the *delight of yachtsmen and the scene of many* annual trips of great liners and ships.

High mountain ranges and the sea lochs deeply indenting the coastline combine to give the Area some of the most magnificent scenery in the British Isles, which attracts a considerable amount of tourist and holiday traffic. Indeed the lochs are the principal hydrographic feature of Scotland as a whole, both on the mainland and in many of the islands. The largest in Scotland and in Great Britain is Loch Lomond (24 miles long).

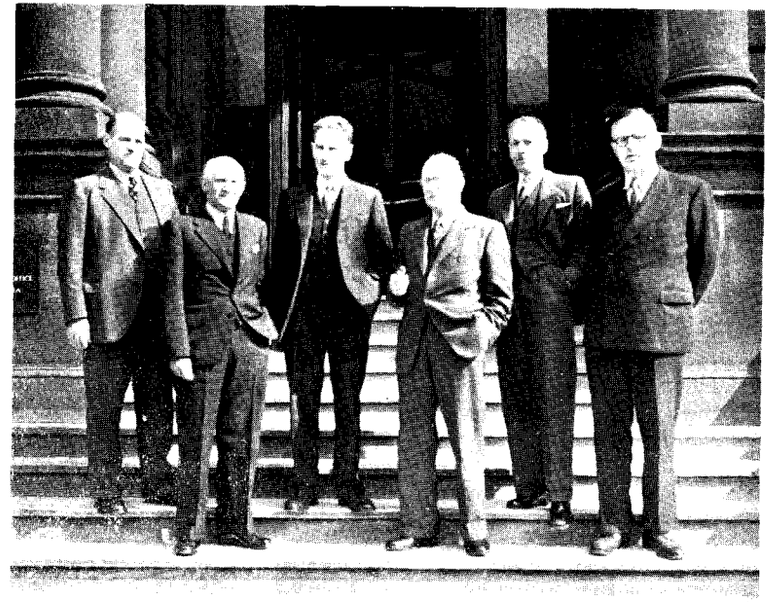
Road and rail communications, because of the lochs and high mountain ranges, are difficult and costly less so for telephone development, but the nature of the terrain presents a constant and exciting challenge.

The Area headquarters are in Glasgow, about seven miles at the nearest point from the area controlled, and it was *the first of those few* Areas whose headquarters are situated in another Telephone Area.

There are 70,783 exchange connexions in the Area and 3[illegible] exchanges of which 276 are automatic.

The total staff (excluding telephonists) is 1,630 and the annual revenue is £2,000,000.

Crofter's cottage in the island of Islay



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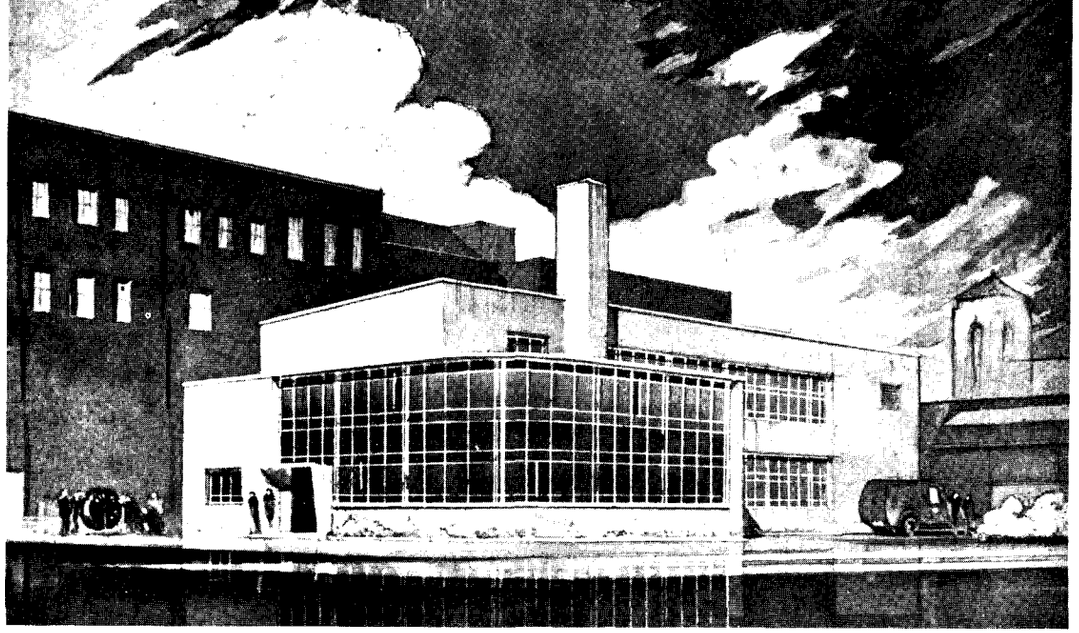
Right: L. R. MASON, Chief [illegible] A. BROWN, Chief Telecoms. [illegible] J. H. ROBERTS, B.Sc., [illegible].E., Area Engineer; S. [illegible] [illegible] A.M.I.E.E., Telephone [illegible]ager; M. V. YOUNG, Senior [illegible] Supt.; E. J. FRENCH, B.Sc., A.M.I.E.E., Area Engineer



Before The Building Starts—

C. O. Horn, B.Sc., A.C.G.I., M.I.E.E.,

Deputy Regional Director, London Telecommunications Region

THE OPENING OF A NEW TELEPHONE EXCHANGE brings something different to different people: to the community, a new building to grace the locality; to the residents, the most up-to-date service possible; to many people, the chance of getting on the telephone; to the Telephone Manager, a planning job out of the way, but responsibility for a new building and plant; to his staff, the culmination of forecasts, plans and calculations.

The fact that much planning will have gone into the design of a new exchange will be obvious but, apart from the technical considerations of equipment quantities and design and the lay-out of the external line plant which must go with the new exchange, only a few realize the intricate details which have to be settled even before the building is started.

It may take five years or more from the time the site for a medium sized exchange is settled until the time the exchange is ready for service. Preparation and approval of preliminary sketch plans take about seven months, and perhaps another three months may be needed to prepare and approve the final sketch plans. Preparing the final working drawing, and the tender, and letting the building contracts will occupy about a year; the building construction may then take about 18 months to two years; and 18 months more are needed to install, test and open the exchange.

In total all this adds up to the fact that the need for a new exchange must be appreciated considerably more than five years in advance. In difficult places it can take two years to find and acquire a suitable site and in the past the Telephone Manager's staff has had to plan as much as seven years ahead. These periods can become much longer if there is delay in agreeing sites or plans at any stage, or if there are changes in plans or requirements. The acquisition of sites was always difficult and before the war in extreme cases it was necessary to obtain compulsory powers by promoting special sites bills in Parliament for specific exchanges.

The Town and Country Planning Act of 1947 ...de recourse to a Sites Bill normally unnecessary ... made it possible for site acquisition to run ...currently with the initial planning for a new ...lding. In this article it is proposed to say ...ething about the Town and Country Planning ... and what goes on behind the scenes in pre-...ation for the start by the building contractor. ... many considerations which really "trigger" ... the start of a new building that is, appreciation of the fact that one will be necessary "x" ...rs hence will not be touched on.

The Town and Country Planning Act legislated ... county development plans to be prepared. As ... preliminary to their preparation, certain ...horities (including the Post Office) could ask ... Planning Authority (the County or County ...ough Council) to "designate" sites within the ...nty for which they saw a future need for their ...pective purposes. This procedure was designed ...allow development to be on approved plans, ... machinery was laid down by which acquisition ...particular sites by individual parties could be ...ued over or rejected.

...n due course, a proposed County Development ...n is published and owners and other interested ...ties can then lodge objections to the designation ...particular sites. Objections are heard at a public ...quiry under the chairmanship of an inspector ...minated by the Ministry of Housing and Local ...vernment. Eventually an approved County ...velopment Plan emerges, one which should ...er for the needs of industry and commerce, ...using, open spaces and so on, to an orderly plan ...ended to improve on that virtually uncontrolled ...wth which was a feature of the past.

...By the provisions of the Act, certain Govern-...ent departments ask for the designation of sites ...ey would like to have within a prescribed five ...rly period. Once a plan has been approved by ... Minister of Housing and Local Government, ... has to be reviewed by the County Planning ...thority at the end of the five years; interested ...rties can then designate any further sites they ...ght need in the next five years and the process ...ll be a continuous one. Assuming there are no ...jections, or that objections are overruled by the ...inister after the enquiry, a designated site ...comes available for purchase by agreement, ... by compulsory powers in the last resort. If ...mpulsory powers are sought there are further ...pportunities for interested parties to object. In ...fault of agreement the price is settled by the arbitration of the Lands Tribunal (the District Valuer).

By this means, therefore, the Post Office (as well as other bodies) now has a reasonable chance of securing a site it needs, at the time when it is necessary to occupy it, provided the need was seen sufficiently far in advance for a designation to be asked for.

The niceties of designation, the hearing of an enquiry, and the compulsory purchase procedure, which it is sometimes necessary to invoke, are separate issues which can sometimes become quite complicated; however, let us consider a case in London where a 10,000-line new exchange is needed and a site has been acquired. At this stage the site—acquisition of this would have been handled by the Director of Land and Accommodation of the Ministry of Works—is made available to the Architects' Division of that Ministry.

The architect will have received from Regional Office "schedules of requirements" (not entirely for architectural purposes only) he will previously have had rough schedules to assess the size of site required. The schedules of requirements give the number of staff likely to be working in the building at the planning date and particulars of the space required for apparatus, switchrooms, stores and the like. From these, the architect prepares preliminary sketch plans (P.S.Ps) and sends copies to the Regional Office. The Staff and Buildings Branch of the Regional Office circulates copies of the P.S.Ps simultaneously to all interested parties, that is, Engineering Branch, Telephone Branch (Telecommunications Branch outside London), Finance Branch and Telephone Manager.

These various Branches are required (within four weeks in London) to give agreement in principle to the general disposition of the building within the site and the general functional divisions within the building itself. If general agreement is not forthcoming (there is, of course, close personal contact between members of the interested Branches) a meeting of all parties is held quickly and the position summarized to the architect who provides amended P.S.Ps. Apart from the general agreement as to disposition and functional division, detailed comments are given in London by the Telephone Branch on the size of the switchroom, the disposition of its windows and so on. The Engineering Branch considers engineering aspects including the lead-in arrangements and the position of the cable chamber, the

need to have heavier equipment on the lower floors and such things as the proposed placing of stores and repair rooms in relation to engineering working rooms. To save time, direct consultation takes place between the Engineering Branch and architect over purely technical points.

The Telephone Manager will have domestic comments to put forward, but he has additional responsibility if the exchange is to be in a Head Postmaster's District and will have an auto-manual board to be staffed by the Head Postmaster. The Telephone Manager than arranges for the Head Postmaster to see the plans and to get his comments. The Finance Branch comments on the financial aspect of the scheme with particular reference to its probable cost in comparison with similar existing exchanges. If amended P.S.Ps have been prepared these, too, are circulated as before; but since the amendments will have been made to meet the requirements of the Branches and or Telephone Manager, approval of the amended P.S.Ps should not take long. When agreement to P.S.Ps (original or amended) is forthcoming the Staff and Buildings Branch shows the plans to Staff Side representatives so that Staff Side approval in general terms can be assumed and final plans safely put in hand with the Ministry of Works.

Final Sketch Plans

Having received agreement to the preliminary sketch plans the architect prepares final sketch plans (F.S.Ps), estimates costs more precisely and puts forward tentative building dates. His Department submits the F.S.Ps (with the estimated cost) to the Regional Office where they are immediately checked to see that they agree with the approved P.S.Ps. Copies are then circulated for agreement simultaneously to Telephone (or Telecommunications), Engineering and Finance Branches; if necessary, the latter advises on the draft report to Headquarters requesting financial authority for the project.

Final sketch plans being approved, the architect prepares a third set of plans, namely, preliminary working drawings (P.W.Ds). These are forwarded to the Engineering Branch which adds details for lighting, ventilating, cabling and lifts. A copy of the P.W.Ds also goes to the Telephone Manager who prepares details for clocks, fire alarms and other miscellaneous requirements and returns these to the Engineering Branch for incorporation in the plans for lighting, ventilating and so on, which that Branch has in hand. When all these additional items have been carried into the P.W.Ds the Ministry of Works prepares final working drawings and forwards copies to the Region. These also are checked and any last minute alterations settled direct with the architect.

Although final working drawings should apparently complete the whole story, the heating arrangements for the building are nevertheless treated separately since an independent contract or contracts will be involved. Separate heating plans are therefore prepared by the Ministry of Works and these are commented upon by the Regional Branches concerned.

In due course, the Ministry of Works invites tenders, places the building and heating contracts and confirms the forecast building dates. The forecast dates are passed on to the Regional Branches concerned and the contract price is communicated to the Finance Branch.

Colour Schemes are Important

There is yet one other point—the colour schemes. It is well known that welfare policy has moved from the rather lifeless colour schemes of the past and embarked on pastel shades, possibly with differing schemes on different floors. The change has been a welcome improvement and the Staff Side is given opportunity to comment on proposed colour schemes. Normally this consultation takes place through Accommodation Sub-Committees at Regional and Area level, but in a large building there may be conflicting interests and it seems only right that in such circumstances the architect's views should be heard. In the London Telecommunications Region it is now the practice for the architect to meet Staff Side representatives to tell them why he had suggested certain colour combinations and just what modifications could, in his opinion, be accepted without clashing with the architecture of the building he has designed.

In all, there is a tremendous amount to be done before a start can be made and the excavations begun for a new building. This involves a great co-operative effort by a large team of people in both the Post Office and the Ministry of Works—architects and engineers, estate surveyors and solicitors, telephone managers and their staffs, and sometimes head postmasters, members of all or nearly all the branches of a regional headquarters.

Multi-link Dialling—
the latest phase of Trunk Mechanization

H. Beastall,
Inland Telecommunications Department

THE TERM "TRUNK MECHANIZATION" IS comparatively new and has been applied to current developments in the extension of dialling by trunk operators over long distance circuits.

In the general sense, the process of mechanizing the trunk service has been going on for many years, but the latest phase is different since it uses a new type of equipment which permits multi-link dialling and thus opens the way for dialling over a much greater range of calls. When fully developed it will enable any trunk operator to dial calls direct to subscribers on distant automatic exchanges throughout the country and to reach the distant operators at a manual exchange.

Thirty Years Ago

As far back as the 1920's, when "no delay" or "Toll" working was introduced on the shorter distance circuits, facilities were provided on some of these routes so that the operators could themselves dial the subscribers in other towns, but on longer lines, generator signalling was necessary and the trunk operators had to call the distant operators by ringing; they also had to ring off at the end of a call. This system worked well enough under delay conditions, but when the speedier demand system was introduced from 1932 onwards, a strong need was felt for signalling and dialling facilities on long distance trunk circuits similar to those available on the shorter distance lines.

The earliest trials of the new signalling system, known then as "Two Tone Voice Frequency Signalling" were carried out on a single circuit between London and Bristol in 1935. This system, now called "Two Voice Frequency Signalling" (or, by our engineering colleagues, "Signalling System A.C. No. 1"), enabled us for the first time to dial over the distances common to our long distance trunk telephone network. In 1939, when the first 2 V.F. routes were opened permanently to public traffic, operators at zone centres were able to dial the numbers of called subscribers in some distant cities without the assistance of another operator.

The number of 2 V.F. dialling routes increased rapidly and by the end of 1941 most of our zone centre operators were dialling into the automatic systems in terminal zone centres over long distance trunk routes. This led to considerable savings in the number of operators at zone centres and in the time taken to set up trunk calls, both of these being very valuable achievements at that critical stage of the war in Europe. By reducing the number of manual operating positions required to handle incoming traffic it also avoided some difficult accommodation problems which would otherwise have arisen in providing for the increase in long distance trunk traffic.

Within two further years we were dialling through the distant automatic equipment using special dialling codes to reach minor exchanges in the zone groups and other groups in the zones, but so far the facility of dialling long distance calls was available only to the operators at the zone centres; operators at group centres had to depend on the incoming operator at their zone centre to do the dialling on through calls.

Operators at a group centre were first given long distance dialling facilities through their zone centre in 1944, when operators at Bath, a group centre in the Bristol zone, were given dialling access via switches at Bristol to the 2 V.F. route from Bristol to London. A similar, but more comprehensive, scheme was introduced at Leeds in 1947, several group centres near Leeds being given access to 2 V.F. routes from Leeds to other zone centres.

New Problems

At the end of the 1939-45 war we found ourselves with a system, in embryo, which allowed operators at group centres to dial via their home zone centre to exchanges in other zones. It was

realized that before further progress could be made in operator trunk dialling several issues had to be decided. The most important of these were the fundamental lay-out of a mechanized trunk service, the development of improved long distance signalling and dialling equipment and the decentralization of the London Trunk and Toll Exchanges. This last subject had already received much attention but it had to be reconsidered in closer relation to the national operator dialling scheme.

Immediately after the war a Post Office Headquarters committee known as the Trunk Mechanization Steering Committee, and a number of working parties were set up to design a trunk system to be worked mainly on a mechanized basis. They recommended a system based on non-director principles (that is, using numerical codes to designate the various exchanges and switching without translation) and incorporating a new type of motor driven switch. This system is now being introduced gradually throughout the country in accordance with a plan controlled by the Trunk Mechanization National Programme Working Party.

The first part of a new automatic trunk exchange was opened on February 27 this year. This was the outgoing component of an exchange with the rather formidable title of London Trunk Non-director Faraday Exchange. The complete programme provides for all the automatic trunk switching equipment to be working in about eight years' time. The total cost of the new equipment is about £12 million.

As already mentioned, the object of the trunk mechanization scheme is to enable a controlling operator to complete a trunk call to any subscriber in the country without the assistance of any other operator, but this cannot be fully achieved until all our local exchanges are automatic. In the meantime, for calls to manual exchanges, arrangements are to be made for the controlling operator to dial to the distant local exchange operator.

General Principles

The way in which a typical trunk call will circulate when mechanization is complete throughout its route is illustrated in Fig. 1. As at present, the calling subscriber will dial a code through his local automatic exchange to reach a trunk operator at his local group centre where the call will be controlled. This group centre trunk operator will choose a circuit from her manual switchboard to

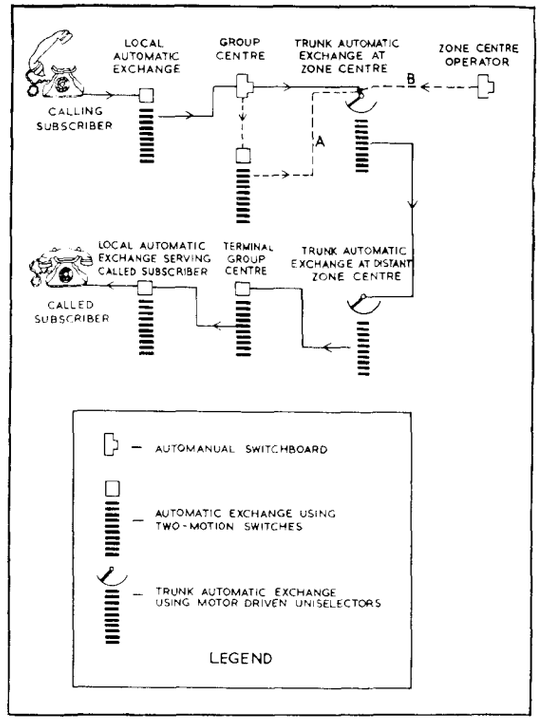


Fig. 1

her zone centre and will dial a series of code digits followed by the digits of the subscriber's number. The code digits will operate switches at the zone centre to select a circuit to a distant zone centre and further digits will cause a circuit to be selected to the terminal group centre and thence to the local automatic exchange where the remaining digits will select the called subscriber's line.

In some cases, the group centre operator will select the first trunk link in the chain by dialling through the trunk automatic equipment in her own exchange. This method of selecting the first trunk link will be used commonly also where the controlling operator is at a zone centre. Fig. 1 shows these variations by broken lines, (A) and (B) respectively.

The change to an automatic trunk system is perhaps best illustrated by the arrangements which will exist in London. Whereas formerly a trunk operator at, say, Mayfair Exchange had to get another operator in London to assist her in completing a trunk call to, say,

Manchester, the same Mayfair operator can now dial direct to the Manchester subscriber through the recently opened outgoing component of the London Trunk Non-director Faraday Exchange. A second trunk automatic exchange in London, London Trunk Non-director Kingsway, is now being brought into service; this will enable operators in the provinces to complete automatically trunk calls to places beyond London which have at present to be switched manually at London. The last stage of the present plan for London will be the opening, early next year, of the incoming component of the London Trunk Non-director Faraday Exchange which will switch traffic from provincial group centres to exchanges within the London group.

The Trunk Automatic Exchange

The motor driven uni-selector (Fig. 3) is used throughout. This is a switch of large capacity and with a very short operating time, the rotating selector arms being driven over the fixed contacts at a rate of approximately 200 contacts per second.

Circuits incoming from distant zone and group centres have access to the automanual board for assistance in case of difficulty, to the local exchange to complete calls to subscribers within 15 miles of the exchange, and to outgoing trunk routes to zone and group centres for the completion of through calls.

The operators controlling trunk traffic originated locally have access to the same outgoing routes. This access is shown in Fig. 2. The local controlling operators may be in one or more switchrooms (Trunk Control Centres) one of which will be associated with the trunk tandem exchange and will deal with the incoming trunk assistance traffic in addition to controlling locally originated trunk traffic; other Trunk Control Centres will be in buildings remote from the trunk tandem exchange.

Each Trunk Control Centre will control trunk traffic originated in a part of the group.

Delay Conditions

If, at any point in the chain of connexions, all the circuits on a required route are engaged or the route is being worked in delay, the controlling operator must be told at what point she is meeting the condition so that she can re-book the call at the appropriate exchange. This is done by a "congestion and delay announcer". This machine, constructed on similar lines to the TIM announcing equipment, announces congestion, the duration of the expected delay on a route and the name of the exchange at which the condition is being met. The announcements are heard only on trunk circuits coming into the exchange (see Fig. 2).

When a route is being worked in delay, access to the route from incoming trunk circuits is barred but the route is left open to the local controlling trunk operators. The announcements applied to

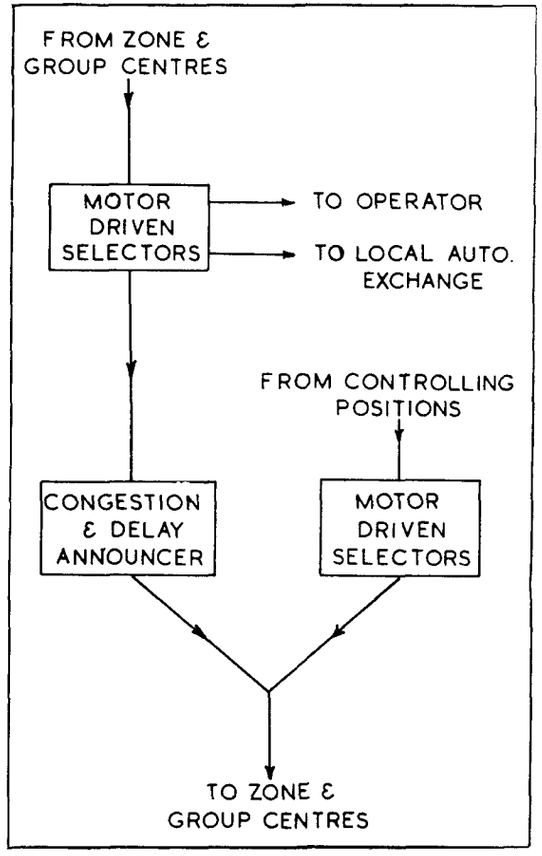


Fig. 2

the routes in delay are selected under the control of the Trunk Exchange Supervisor.

Pilot Tests

When all development work had been completed and planning had reached a suitable stage, a pilot installation of trunk mechanization equipment was installed. This consisted of small quantities

of switches and signalling equipment of the types which would be used in the complete scheme, installed at various centres throughout the country. It was subjected to searching engineering and traffic tests, including the switching of public traffic, for a period of some twelve months in 1951 and 1952. A few minor modifications of equipment were made during these tests but no major changes were found to be necessary.

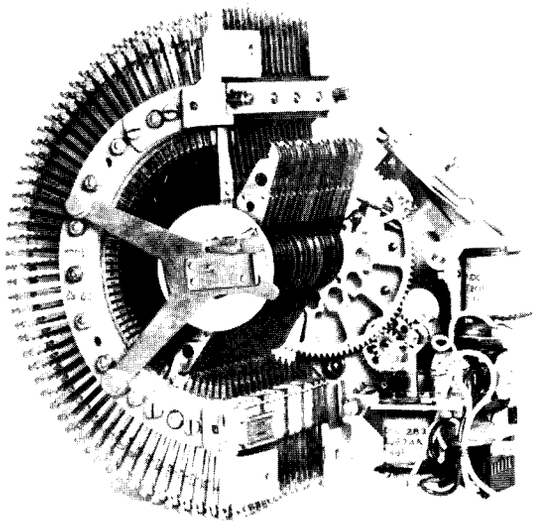


Fig. 3

The basic scheme outlined above is elaborated according to local conditions. In London, as already mentioned, there will be two trunk automatic exchanges switching (mainly) traffic terminating in or originating from London and traffic passing through London, respectively. The control of trunk traffic originating in London is carried out at five Trunk Control Centres and, in addition, at a number of auto-manual switchboards which also handle local assistance traffic.

At certain provincial cities some of the traffic terminating in the city as well as traffic originating from some of the subscribers in the city area will continue to be carried by the old 2 V.F. equipment for a time. Letter codes are used on calls to director areas dialled via the old type 2 V.F. equipment; initially, therefore, although the basic mechanized system will use non-director switching, letter codes will still be dialled on some calls.

What will trunk mechanization give us in terms of service advantages?

There will be a considerable reduction in the time that a caller has to wait for trunk calls to be set up over several circuits in tandem. On the majority of calls (about 90 per cent. from zone centres) it is expected that the controlling operator will have to dial no more than nine or ten digits. After dialling, ringing tone will follow in about 4 seconds and the total time to set up one of these calls should be less than 20 seconds, a considerable improvement on the time taken with manual switching at intermediate centres.

Automatic trunk exchanges are expensive; the two London exchanges will have equipment costing more than a million pounds each. But during the next eight years we shall be constantly improving the automatic trunk service in both speed and efficiency. At the end of that period there should be few automatic subscribers to whom a controlling operator anywhere in the country cannot dial. The basic design of the system will nevertheless be flexible enough to allow the introduction of whatever new developments in long distance working the future may have in store, such as the dialling of trunk calls by subscribers.

Inland Telecommunications Statistics

In the three months ended June 30, 1954, there were 104,000 new demands for telephone service and 97,000 new subscribers' exchange connexions were installed. The number of shared service connexions at June 30 was 776,000 compared with 742,000 at March 31 and the number of outstanding applications was 376,600 representing an increase of 500 during the quarter.

73,819,000 inland trunk calls were made of which, 18,801,000 (25 per cent.) were at the cheap rate. In the corresponding quarter of the previous year the figures were 67,891,000 and 17,329,000 (26 per cent.).

The number of inland telegrams (excluding Railway and Press) amounted to 7,313,000 including 1,356,000 (19 per cent.) greetings telegrams. In the same quarter of 1953 the figures were 8,759,000 and 1,598,000 (18 per cent.).

At the end of June, 1954, there were employed, 47,124 telephonists, 8,348 telegraphists and 55,288 engineering workmen. The corresponding figures at June, 1953, were 48,546, 9,172 and 54,289.

Chairman: Col. J. Reading, M.B.E.

Fifty Years of the Post Office Telephone and Telegraph Society

Hon. Sec.: G. R. Clayton, B.Sc. (writer of this article)

THE EARLIEST ACCOUNTS OF THE POST OFFICE Telephone and Telegraph Society deal with transactions in October, 1904, but unfortunately the minutes contain no record of meetings earlier than October, 1906. There is no doubt of the authenticity of these first accounts so it must be assumed that any minutes taken of meetings prior to October, 1906, have been mislaid. After some investigation the present Committee has satisfied itself that the Society started to function in October, 1906, and, it follows, that the meeting which will inaugurate the 1954 5 session will also be the fiftieth anniversary of the Society's formation.

Where are the Women?

Fifty years old—it is no mean achievement that for half a century meetings of the society have taken place, winter after winter, with but one interruption, forced by the war years 1939-45. During that time more than 250 papers have been prepared, delivered and discussed; the authors have been drawn from many ranks and their papers have covered practically every subject of interest to telecommunications and near-telecommunications people. Both men and women have contributed by papers and discussion, though it is regrettable that in later years contributions have been almost entirely man-made and man-delivered.

In retrospect this regrettable tendency may be ascribed to the Society's haste to bridge the gap of telecommunications development during the war years, and to catch up on the rapid telephone development immediately after the war. Any leeway has now been made up and in this, its fiftieth year of existence, the Society has had leisure to choose a programme of meetings attractive at least in part, if not in its entirety, to the whole of its membership, a programme which covers some of the most recent development in telecommunications but provides opportunity to ramble over lanes crossing the telecommunications highway. This year's programme should serve the purpose for which the Society exists at least as successfully as recent programmes.

The constitution states "the object of the Society is to promote interchange of ideas on telephone and telegraph matters; to encourage the preparation of papers of interest to its members and to arrange monthly meetings during the winter for the presentation and discussion of such papers". But there is more to it than that. During the earlier years two similar societies were operating in the southern and western districts of London. To a large extent they covered the same field of subjects with a strong bias towards technical papers and discussion although the Society of Electrical Engineers was also in being.

New Fields, New Name

The other societies had been amalgamated into the major Society by the time the Post Office took over the telephone service in 1912 and, coincidentally with the take-over, the Society extended its field of membership, and thereby the range of its interest, to include the telegraph service and changed its name from "The London Telephone Society" to its present one.

After the war-time interruption the Society further extended its field of membership to include all Post Office and Cable and Wireless employees in the United Kingdom. Inevitably, the membership is drawn from the departments and regions in London, all of whom add their quota. Most of the departments and the regions conduct their own informal meetings during the winter months to discuss matters of domestic interest.

PROGRAMME, 1954-55

Wednesday, October 20, 1954:
50 Years of Telecommunications by F. I. Ray, Esq., C.B.E., Regional Director, L.T.R.
Wednesday, November 17, 1954:
Postage Stamp Production by B. T. Coulton, Esq., M.A., Messrs. Harrison & Sons, Ltd.
Wednesday, December 8, 1954:
Human Factors in Management by Dr. W. E. Chiesman, M.D., F.R.C.P., Q.H.P., Treasury Medical Adviser.
Wednesday, January 12, 1955:
Visit to B.B.C. Television Studios, Lime Grove, W.12.
Wednesday, January 19, 1955:
Film Show. A short programme of selected sound films.
Monday, January 24, 1955:
Visit to B.B.C. Television Studios, Lime Grove, W.12.
Wednesday, February 16, 1955:
The London Telephone Directory by W. J. Bentlett, Esq., Telephone Controller, L.T.R.
Monday, March 14, 1955:
Telex Service by F. G. Phillips, Esq., I.T.D. and A. N. James, Esq., E.T.E.

At the upper end of the scale the Institution of Post Office Electrical Engineers, numerically the largest and best known, caters principally for the Engineering Department. The Telephone and Telegraph Society stands between this one large and the many small organizations. It provides a common meeting ground for members of all the Departments within the Post Office where the individual can add his contribution to the discussion of a subject frequently falling outside the range of his official activities. It brings together in one room people from many different departments, remote from official control, to read and hear matters with which they or other people in the Post Office are intimately concerned.

That there is a need for such an organization is demonstrated in the way the membership continues to increase. The various departmental meetings show that Post Office people as a whole are anxious to learn more about their own jobs, and want to know what the man or woman in the next room does for a living. Through the Telephone and Telegraph Society we can learn of some of the problems affecting the jobs across the street and across the river, and so keep abreast of progress made by the telecommunications service of the Post Office.

Fifty years ago the Society was brought into being to further the interests of the people employed by the National Telephone Company in the services which provided them with their livelihood. Five decades later the same Society provides Post Office and Cable and Wireless employees with similar opportunities to get to know more about the telecommunications world.

London "TIM" has answered 180,000,000 Calls

London telephone users make approximately 700,000 calls every week to "TIM", the speaking clock, and they have made nearly 480 million calls since the service began 18 years ago, on July 24, 1936. Since 1938, "TIM" has been extended to cover 22 other large towns and it is planned to cover more. Two installations, one at Holborn Exchange, London, and the other in Liverpool, provide the service and all "TIM" calls are connected to amplifiers supplied by one of these. The clocks give service which is accurate to 1 10th of a second.

The sound tracks, which are recorded on four glass discs, consist of phrases and numbers from which the complete announcements are built up by focusing beams of light on to the appropriate tracks in turn. The beams of light pass through the sound tracks on to photo-electric cells which respond by generating electric currents, which are then amplified to give a volume of speech sufficient to permit some hundreds of subscribers to listen to the announcements simultaneously.

New Cars for TV Detection

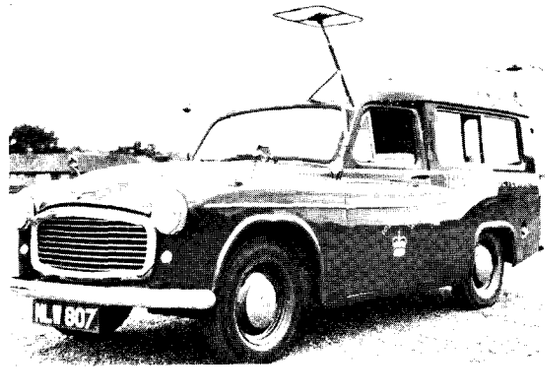
ON SEPTEMBER 10 THE POSTMASTER GENERAL launched a fleet of nine new cars whose task will be to traverse the country with the ırpose of increasing the number of television ences by detecting defaulters.

Since television was started again after the war, 1946, some three and a half million people ve taken out television licences, but there is ll a number who use sets without being licensed. For some time the Post Office has had detector ns on the road which are able to pick up signals d to determine from which direction and which use they are coming. If the owner thus identified not on the licence list, one of the enquiry team ls on him to find out whether he has a licence corded somewhere else. If not, the owner will reported and may in time be prosecuted.

The success of the comparatively small effort herto made caused the Post Office to decide to v nine new Hillman Estate cars, and to equip m, with a view to one car working in each ectorate region.

The cars have been fitted with equipment signed and developed by the Post Office search Station at Dollis Hill.

The detection equipment uses the magnetic luction field set up by the line-scanning coils the television receiver. This field contains strong rmonics of the fundamental line-scanning equency of 10.125 kc s, and these can be picked



Loop Aerials

up by the sensitive receiver used in the detection equipment at distances of up to 100 feet, or more in many cases.

Each car has three horizontal loop aerials which are tuned to the second harmonic (20.25 kc s) of the line frequency. These are mounted on the roofs of the cars in an "L" formation. The outputs of the loops can be switched in turn to the input of the radio receiver and its audio output can be heard on a loudspeaker or indicated on an audio level meter. By noting the relative levels of the signals from the three loop aerials the operator can tell clearly whether the receiver is in front of, or behind, or to right or left of, the detector car. For example, when the car is cruising along a road and passes in front of a house on the near side of the road, where a television set is working, the signals received from the fore and aft loop aerials are equal, while that from the off-side loop aerial

The new Television Detector Cars


Detection Equipment

is weaker than that from the others.

The strength of the magnetic induction field varies inversely as the cube of the distance, thus enabling the operator to discriminate between neighbouring receivers. The brick walls of ordinary houses have little or no effect on the magnetic induction field at the relatively low frequency used.

Each car is also provided with a portable set of detector equipment, which can be carried into blocks of flats or other buildings where a number of television sets may be installed, and this enables the enquiry officer to pin-point each set more conveniently than can be done from the car in the street.

Early reports from the Regions in which the cars are operating indicate that they are proving successful.

NOTES AND NEWS

Growing Cohesion of Commonwealth Cable and Wireless System

New Post Office Telex Service

Sir Stanley Angwin, Chairman Commonwealth Telecommunications Board

THE MAJOR EVENT RECORDED IN THE THIRD General Report (to December 31, 1953) of the Commonwealth Telecommunications Board is, naturally, the Anglo-Canadian-American agreement to lay a transatlantic telephone cable, work on which has started: an article on this project appeared in the *Journal* for February-April, 1954; but there are many other items of considerable interest.

Preparations are also being made to construct radio receiving and transmitting stations at Vancouver to supplement the Pacific cables.

The Report comments that "these developments and the provision of additional radar relay facilities at Barbados, Colombo, Nairobi and Singapore demonstrate the growing cohesion of the Commonwealth system, combined with maximum flexibility".

In addition to the opening of new direct radiotelegraph, radiotelephone and phototelegraph circuits, work was started on a new 76-position exchange in London to cater for increasing international telex requirements. The number of Anglo-Continental telephone circuits was increased from 385 to 420. Cable and Wireless Limited took delivery of 4,500 nautical miles of submarine cable during the year for renewals and repairs to their approximately 149,000 nautical mile network.

Traffic declined in 1952 but from March, 1953, there has been a general "upward tendency" and indications point to a greater measure of stability if not a continued increase, in the future.

The United Kingdom National Body undertakes the greatest amount of basic research, at the Post Office Engineering Department's Research Station at Dollis Hill, London, and at the laboratories of Cable and Wireless Limited. Results of research, in which the Post Office and the Company co-operate with the Department of Scientific and Industrial Research, the universities and the telecommunication manufacturing companies, are made available to the Board and circulated to all National Bodies.

Among technical developments during the year, field trials of semi-automatic working on the United Kingdom–Continental telephone services, begun on the Amsterdam and Paris routes in 1952, were extended to Brussels, Zurich and

Milan; a new design for the shore ends of telegraph cable to reduce noise and allow higher speeds has been used at Porthcurno and St. John's on the transatlantic section; and consideration is being given to the practicability of omitting armouring from submarine cable sections laid in deep waters beyond the reach of tidal movements.

★ ★ ★

Administrative Changes. Sir Gordon Radley, C.B.E., Ph.D.(Eng.), who has been Engineer-in-Chief since 1951 and was for some time a member of the Editorial Board of this *Journal*, has been appointed a Deputy Director General of the Post Office.

His appointment is consequent on that of Sir Ben Barnett, K.B.E., C.B., M.C., who was at one time Chairman of the Editorial Board and has been a Deputy Director General since 1949, to an additional post of the same status to deal solely with broadcasting. The new post is for a limited period only.

Brigadier L. H. Harris, C.B.E., Controller of Research since 1949, has succeeded Sir Gordon Radley as Engineer-in-Chief, and Mr. G. J. S. Little, C.B.E., G.M., Assistant Engineer-in-Chief, has become Controller of Research.

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Sir Robert Fraser

With the appointment in September of Sir Robert Fraser as Director-General, the Independent Television Authority, established under the Television Act, 1954, to operate commercial television in competition with the B.B.C. was able to proceed with preparation for its operational career.

Announcing the appointment of Sir Robert Fraser, Sir Kenneth Clark, Chairman, said three Marconi transmitters had been ordered and orders were about to be signed for three Pye transmitters. One was ready for installation at the Crystal Palace. All sets are to be on sites now used by, or planned for use by, the B.B.C. For the time being the Corporation and the Authority will have to use the same masts.

Each transmitter will have a radius of about 35 to 40 miles. The first three stations will cover about half of the country and the Authority hope to open stations at the rate of one every three months until their coverage is similar to that of the B.B.C. Stations will be opened next year in London, Birmingham and Holme Moss.

The Authority will allocate time to programme contractors, from whom they will receive their main revenue. The programme contractors will sub-let time to advertisers, but advertisements must be clearly distinguishable and recognizably separate from programmes, and the amount of time given to advertising must not be so great as to detract from the entertainment, instructional or informational value of programmes.

The Authority may make provisions for programmes, other than those with contractors. The Postmaster General may, with Treasury consent, advance up to £1,000,000 in the first year, and up to £2,000,000 in all during the first five years, to meet initial expenditure and to provide working capital.

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New P.O. Telex Service. The third and final stage was completed in November. This marks the culmination of a project which was inaugurated by the Report of the Telex Development Study Group, issued in November, 1949.

The old telex service, which will now be closed down, was introduced in 1932, and was operated over the public telephone system. It was possible to offer only a limited range of teleprinter communication, and this and the fact that full telephone rates were charged, made the service unattractive, except for local communication, and its development has therefore been slow.

The new service is operated over a network of sixteen manual teleprinter exchanges, linked by voice-frequency telegraph channels, and is entirely independent of the telephone exchange system. It provides, for the first time in this country, a public teleprinter service with full intercommunication throughout the United Kingdom, and to most European countries, together with New York and Washington.

The use of telegraph instead of telephone circuits has enabled a reduction in telex trunk call charges, which will now be at roughly half the corresponding telephone rates. To simplify the

charging scheme on the manual system, and to facilitate conversion to automatic working later, the country has been divided into 50 charging areas for the purpose of calculating charges for calls between subscribers. All telex subscribers within a charging area will have their call charges measured from a common point within that area. This differs from the old telex service which followed the telephone practice of regarding the local telephone exchange as the measuring point. The annual rental for the new service is £160.

As a first step in the final stage, Sales staff in Telephone Managers' Areas visited all subscribers on the old service in June and July, and offered the new service. Roughly 70 per cent. accepted, and the service opened with a total of about 1,700 lines. Conditions for the new service are laid down in a set of Telex Regulations, but service will still be provided under agreements, all of which have been negotiated with subscribers by Area Sales staff during the past two months.

The transfer of subscribers from the old to the new service, which took place over a period of a fortnight, was arranged so as to avoid interruption of service for individual subscribers. Interworking between the old and new services was not technically possible, and for this reason printergram centres, and Cable and Wireless and cable companies' offices were connected to both the old and the new systems for the period of the transfer.

A considerable list of new applicants has been built up, and special efforts are being made to develop the service as rapidly as possible. In about five years it is planned to begin the conversion of the system to automatic working, providing for nation-wide subscriber dialling. The extension of subscriber dialling into the international field later is also contemplated.

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Midland Directories. Consequent on the division of Birmingham Telephone Area into Birmingham and West Midland areas, which was discussed in our August-October issue, plans are being discussed to issue separate directories for the northern and southern parts of the West Midland Area.

The new Birmingham Area is more or less a self-contained unit, and it is proposed to issue one directory for the whole Area, but there is little community of interest between the northern and southern parts of West Midland. As the two directories for this Area will be smaller, and cover less ground, the proposal involves abolishing the four existing local directories.

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Telephone Directory Typography. "Bell Gothic" type, which was developed in the United States specially for telephone directories, has been used for the latest issues of the York and Swansea directories in place of the Modern face normally used.

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New North Sea Link. A telephone cable has been laid between Norway and Scotland, providing 36 lines. H.M.T.S. *Monarch*, the Post Office ship, will lay the cable; Mr. Rynning-Tonnesen, Norwegian Telegraph Director, was on board with Sir Gordon Radley and Mr. R. J. Halsey of the United Kingdom Post Office.

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Cable under Ice. To provide service for some 200 telephone subscribers, a cable was laid under the ice covering Lake Ramsay, near Sudbury, Ontario, reports the *Blue Bell*, Bell Telephone Company of Canada employees' magazine. A tractor drew the cable across the ice, and a 16-inch cut, three-quarters of a mile long, had to be made in the ice to lay it. The cut was first made by power saw but had to be laboriously completed by hand.

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T.A.T. on T.V. On September 19 the B.B.C. Television Newsreel featured preparations for laying the new transatlantic telephone cable, showing H.M.T.S. *Monarch* sailing up the Thames and the place off Erith where part of the river bed is being removed to enable her to berth for loading. Other shots included the new factory, to be opened by the Postmaster General on November 12, which is being built to make the cable, research work on submarine repeaters at the Post Office Research Station, Dollis Hill, and Oban, Scotland, where the main cable will start its run under the Atlantic. Diagrams were shown of the route from Scotland to Newfoundland thence to Nova Scotia, and finally overland to the United States.

Correction. We regret that in the honours in *Notes and News* (August-October issue) the award to Lt.-Col. D. T. Gibbs, E.T.E., appeared incorrectly. It should have been M.V.O.

Book Review

THEORIÉ ET TECHNIQUE DE LA TRANSMISSION TÉLÉGRAPHIQUE. Vol. 1: Théorie—avec extension à la transmission de l'Information par R. Roquet. 252 pp., 178 diagrams. Frs. 2,750

Most books on telegraphy have been handbooks describing machines, methods or systems. Few indeed have dealt with telegraph transmission theory: M. Roquet's book is, therefore, a very welcome and valuable addition.

This volume (in the French language) approaches transmission problems entirely from the theoretical aspect. The treatment is based on novel and original concepts, and introduces a new telegraph language issuing from the *semantic* or significant.

Ignoring the waveform in the transmission medium, telegraph distortion is measured from the signals reconstituted by the tongue of a telegraph relay, or equivalent device, here called the *sematcur*. There follow *sema*, *sematème*, *sematome*, *semation* and *semagramme*, used alone and in combination with auxiliary words, these terms being defined as they occur. A separate list of definitions, or an alphabetical index, would perhaps have been more useful for reference than the three-page list of these terms given in numerical order of the pages.

The work is divided into three sections, preceded by an introduction which postulates the requirements of the receiver, the transmitter and the transmission medium. The first main section, entitled Semantics, deals with signal formation and leads up to distortion in synchronous, start-stop and other systems.

The second section, Modulation, Modulats and Démodulation, discusses modulation by single and double current, amplitude, frequency and phase; also precorrection, bandwidth requirements, the shunted capacitor, and the differential and bridge duplex.

The concluding section on practical problems has chapters on precorrection, duplex and start-stop working.

The subject is handled in a logical manner, but the reader may be occasionally perplexed at statements such as (p. 27): "Un sématème est totalement arythmique lorsqu'il n'est ni isochrone, ni arythmique". R.N.R.

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

Contributions. The Editorial Board will be glad to consider articles of general interest within the telecommunication 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."

GPO