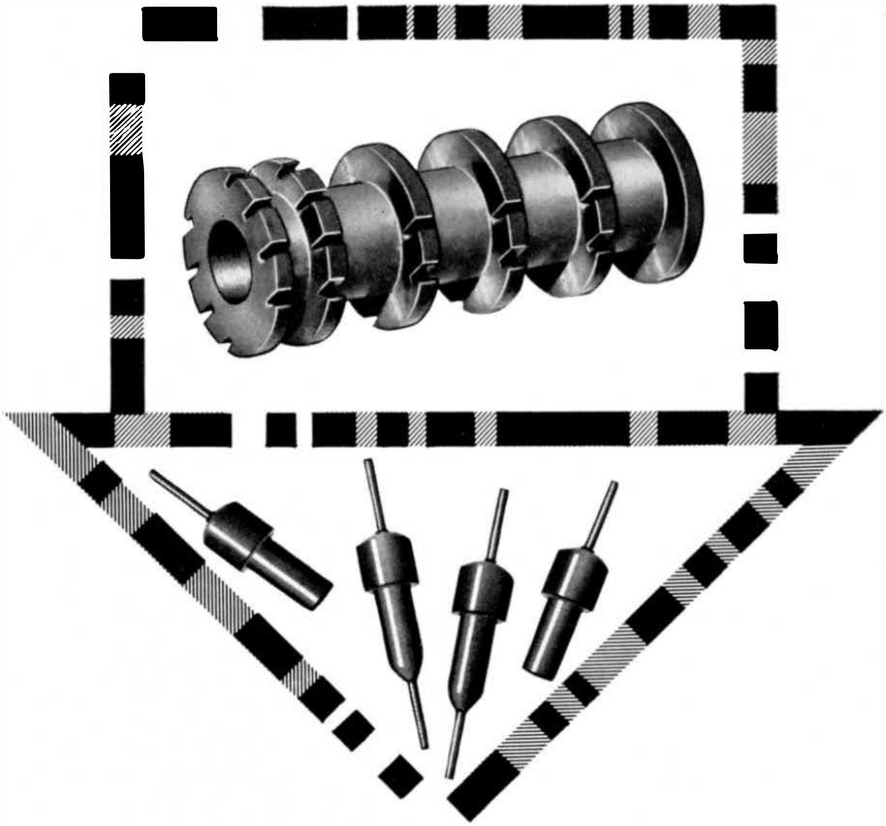
POST OFFICE

telecommunications

JOURNAL

ONE SHILLING AND SIXPENCE

WINTER 1961



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Post Office Telecommunications Journal

Published by the Post Office of the United Kingdom to promote and extend knowledge of the operation and management of telecommunications

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Dialled Trunk Calls

SUBSCRIBER Trunk Dialling will have been operating in this country for three years on December 5. During this period it will have been introduced at about 165 exchanges, with 638,000 subscribers' connexions, enabling these subscribers to dial the majority of their trunk calls themselves. Following Mr. J. M. Harper's article in our Autumn 1960 issue, reviewing customers' reactions to STD at the first three centres, we hope to publish in our next issue a review of the three years' progress.

Many people thought that the introduction of a system under which a subscriber wanting to make a trunk call would have to dial as many as ten digits, instead of merely "O" for the operator, might create great difficulties and so lead to requests for operator help on many calls. But since Her Majesty the Queen dialled the first STD call in Bristol three years ago there has been surprisingly little evidence of this kind. Almost from the beginning, both residential and business callers have themselves dialled 90 to 95 per cent. of the trunk calls they could dial, and 10,000 replies to a questionnaire sent to subscribers with STD have shown that the overwhelming majority prefer the new system. These results bear tribute to the close co-operation between Headquarters departments and the men and women in the field in putting the new system across to the public. They are also a tribute to the designers of the new equipment which has proved so successful, and the engineers in the field who maintain it with such satisfaction to the customer.

The Post Office has set out to make the telephone "Friendly" as well as "Fully Automatic"—almost a contradiction in terms. The public welcome for STD is a measure of its success.

Communication by Artificial Satellite

Sir Gordon Radley, K.C.B., C.B.E., former Director General of the Post Office, gave the Presidential Address to Section G (Engineering) during the Norwich meeting of the British Association for the Advancement of Science in August. We are indebted to the British Association for permission to reproduce part of the address from The Advancement of Science, *Vol.* 18, *No.* 73.

After discussing the development of cable and radio communication, and forecasting, "not many years distant", the use of transistors instead of valves in submarine cables—necessary for transmitting television through long cables—Sir Gordon turned to the prospects of using artificial satellites to expand world communications:

THE artificial satellite which communication engineers propose to use as a means of expanding world communications will act as a repeater station in space, having a line-of-sight path to the earth stations with which it communicates. Because radio communication will no longer depend on reflection from the ionosphere it will be possible to use that part of the radio spectrum between about 1,000 and 10,000 Mc/s. This has a communication capacity several hundred times that of the HF band at present used.

Passive Satellites

The most elementary form of communication satellite consists of a simple reflector travelling round the earth at a height of a few thousand miles. President Eisenhower used a satellite of this kind to deliver a Christmas message in 1958. A more serious test of the feasibility of relaying radio signals over long distances by "bouncing" them from passive reflecting surfaces was made in 1960 when the United States National Aeronautics and Space Administration (NASA) put a 100 ft. diameter metallized plastic balloon into orbit at a height of about 1,000 miles. This was known as the ECHO balloon and was used to reflect telegraph, telephone and facsimile signals transmitted between a NASA station in California and the Bell Telephone Laboratories at Holmdel, New Jersey.

Even when highly directional antennas are used on the ground, only a very small proportion of the energy radiated by the transmitter will hit a passive satellite and an even smaller part will be reflected back and dispersed over the earth's surface. Because of this, very high power transmitters would be needed to achieve communications using passive satellites at heights of interest. It is not only difficult to generate this high power at microwave frequencies but a transmitter of the power required would give rise to considerable interference. For this reason active satellites are more likely to be used for communication purposes. They will contain electronic repeaters which will amplify the received signal before re-transmitting them back to earth.

Active Satellites

The kinds of active satellite which have been most discussed are:

(1) Satellites in circular orbits at heights between 2,000 and 6,000 miles. Each will complete a circuit of the earth in 3 to 8 hours and appear to move fairly rapidly across the sky. A number will be required so that at least one is always visible to both terminal radio stations.

(2) Satellites in circular equatorial orbits at a height of 22,300 miles. At this height, a satellite makes one rotation every 24 hours and therefore appears stationary relative to a point on the earth's surface.

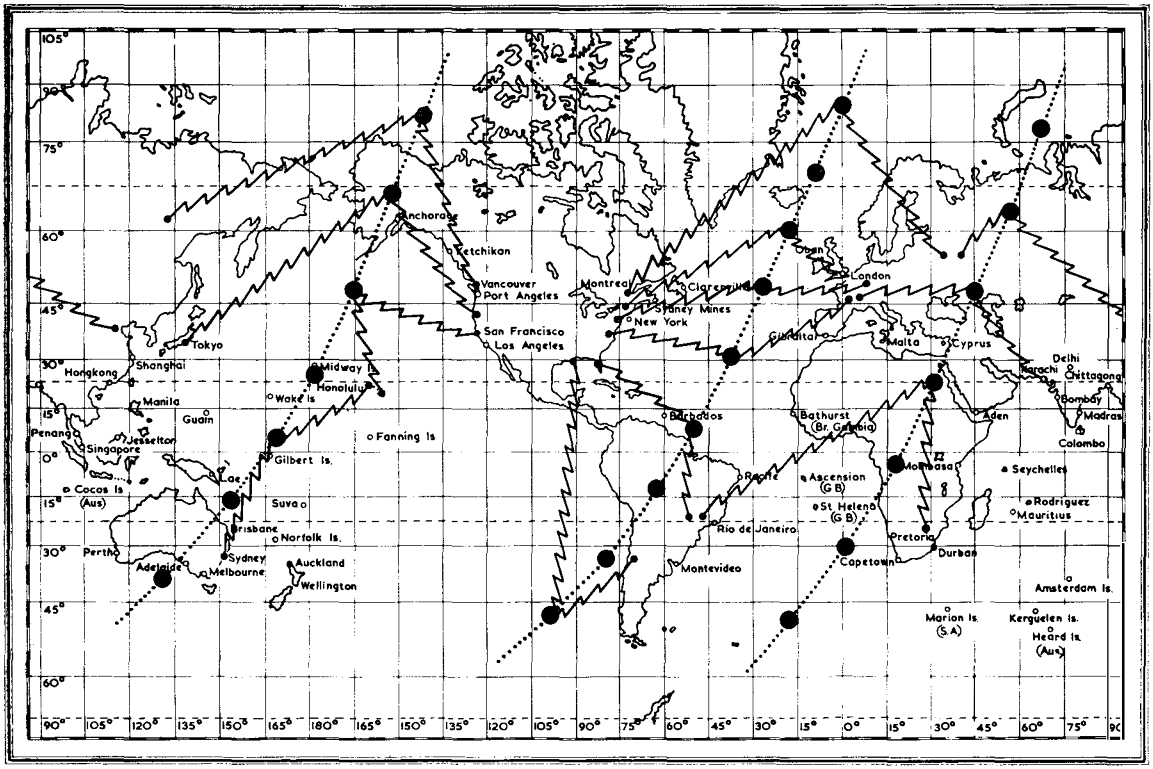


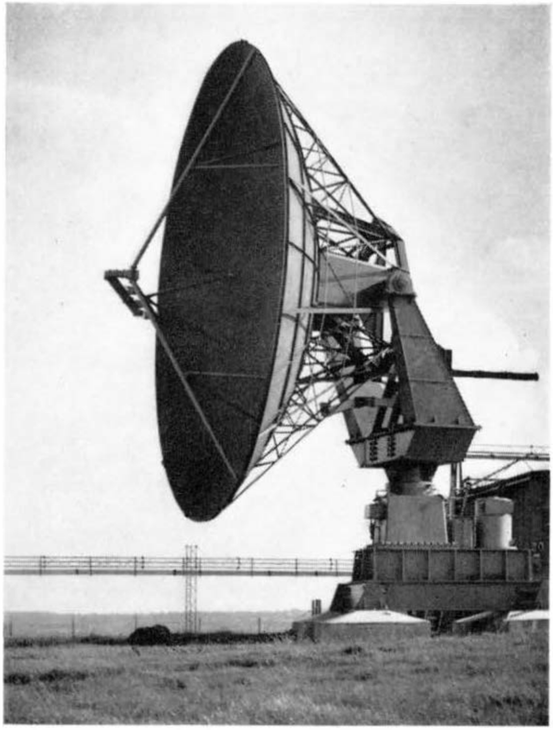
Fig. 1: World-wide communications provided via a system of low-orbiting satellites

An American proposal of the first kind would employ 50 satellites at a height of 3,000 miles to provide world-wide communication as shown in Fig. 1. The satellites are divided into three sets in orbits making angles of 60° with each other. A variant of this, suggested in the United Kingdom, is for the use of satellites in elliptical orbits with perigrees 300 miles high and apogees from 10,000 to 12,500 miles. Provided the orbits can be maintained in their relative angular positions, 12 satellites would provide complete global coverage.

All low-orbiting satellites, active or passive, require steerable transmitting and receiving antennas on the ground which can be continuously directed on to them. Dishes, 60 or 80 feet in diameter, will probably be used. Fig.2 is a photograph of a British antenna of this kind. In a commercial system these would have to be duplicated at each ground station in order to prevent interruption of communications during the period when one satellite is beginning to pass out of view and another taking its place as the communication link. Because of the, desirably, very narrow beam width of the ground station steerable antenna, automatic tracking of the satellite will be necessary. This will be controlled by a signal returned from the satellite.

The second kind of proposal which makes use of satellites with an orbital period of 24 hours has a number of obvious advantages. At this height a satellite will "look at" nearly half the earth's surface, as shown by Fig. 3, and only three such satellites would be required to provide for communication between any two points on the earth's surface.

Because the satellite will remain stationary relative to the transmitters and receivers with which it communicates, the design of the ground station equipment is simplified. On the other hand, the distance of about 45,000 miles which the radio signals have to traverse in a trip, ground-satellite-ground, introduces a delay of 240 milliseconds into



(Courtesy of Marconi's Wireless Telegraph Company Ltd.)

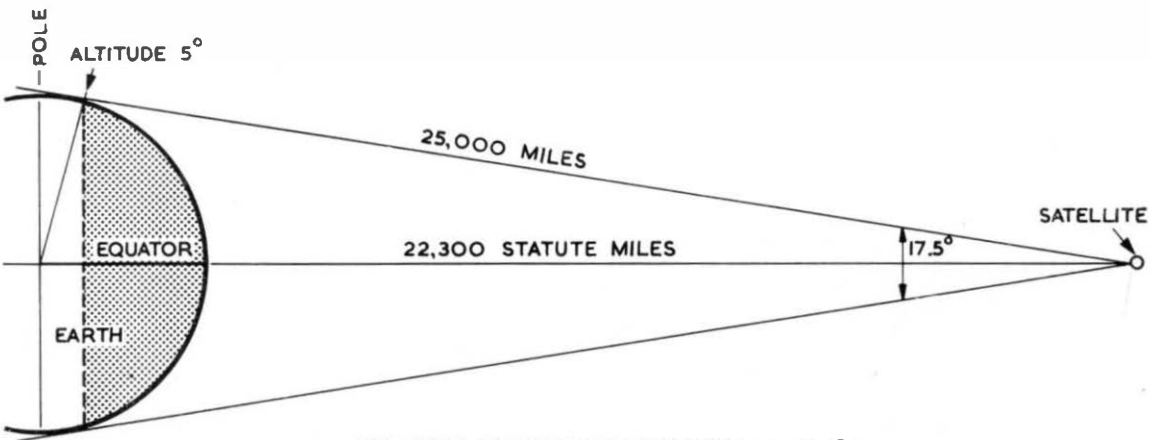
Fig. 2: Steerable dish-antenna

their transmission, or about a half-second before a reply can be received. For the transmission of telegraphy, data, television and many other kinds of communication this does not matter. Communication engineers are as yet uncertain whether delays of this order would be troublesome in a telephone conversation. They are appreciably longer than the delay of the order of 150 milliseconds which will be encountered on the longest wire line yet planned: the United Kingdom to Australia via trans-Atlantic submarine cable, thence across Canada by microwave and onwards by trans-Pacific submarine cable via New Zealand. But to reach Australia via a space system would require two 24-hour satellites with an intermediate ground station. This would bring the round trip delay to nearly one second which certainly would be serious.

Satellite Power Sources

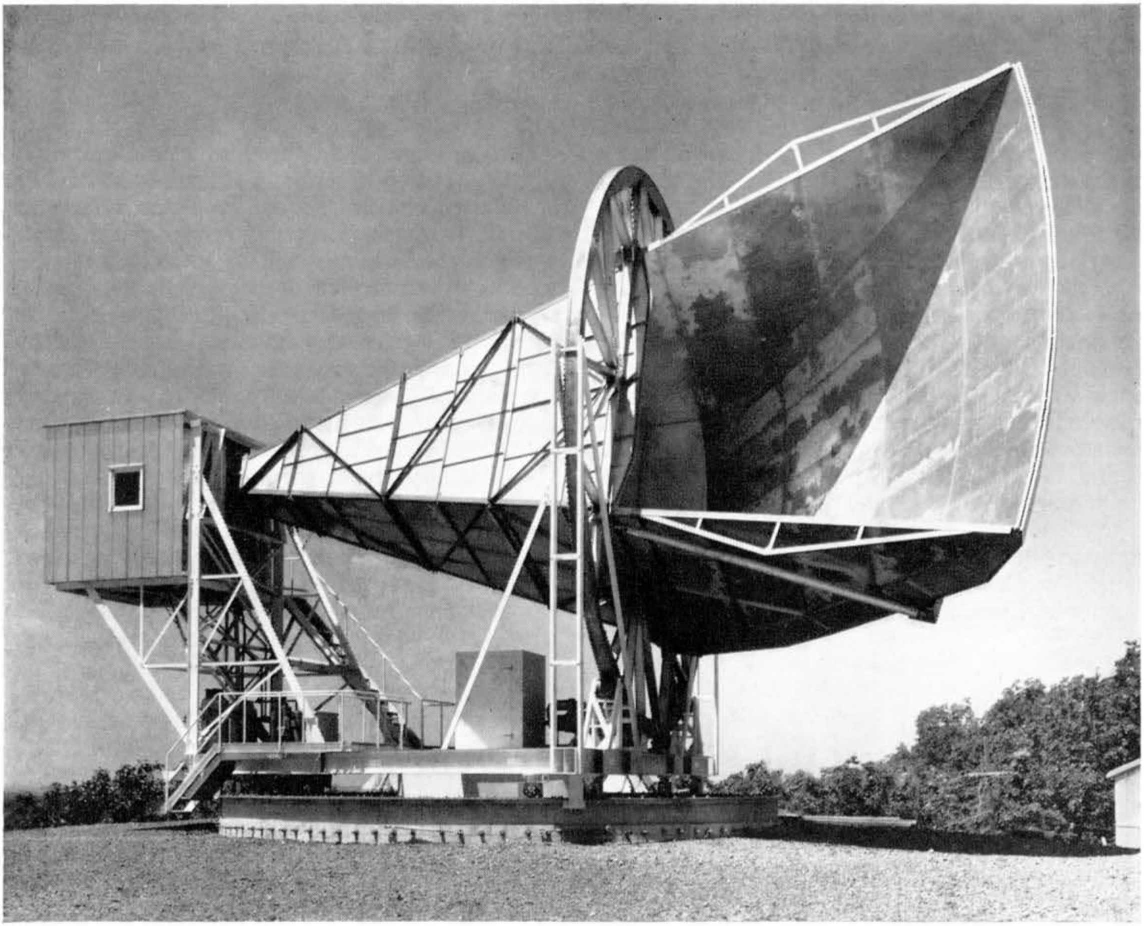
Power to operate the electronic equipment in an active satellite will be obtained initially from the sun although the long-term development of lightweight nuclear sources must not be ruled out. Much work has been done during the last five years on the development of the solar cell, principally by the Bell Telephone Laboratories in the United States. Although the cell, in its present form, is not yet satisfactory for long-term service in a satellite, it seems reasonable to plan on the assumption of its use in the future.

The solar cells may be supported on "sails" at the sides of the satellite, extended after the satellite



GEOMETRY OF SYNCHRONOUS SATELLITE SYSTEM

Fig. 3



(Courtesy of Bell Telephone Laboratories, U.S.A.)

Fig. 4: Horn reflector antenna

has settled in its orbit. They will have to provide an area of 1 or 2 square yards in order to generate enough power to operate the radio transmitter. During the time that a satellite is in the shadow of the earth, power will have to be supplied from storage batteries.

Satellite-to-Ground Transmission

Satellite communication systems will make use of frequencies in the same part of the spectrum as entirely ground-based, radio-relay systems. But the distance between relay stations in a land system is usually about 40 miles compared with 4,000 or much more to the satellite. Moreover, on land, highly directional transmitting and receiving aerials enable signals to be beamed from station to station. Highly directional aerials are almost impossible to arrange on a satellite and, in order to make use of any directivity, it is necessary to maintain attitude control of the satellite.

Taking both the increased distance and the lack of directivity together, the transmission loss between a communication satellite and its ground station may be 80 dB—100 million times on a relative power basis—greater than the loss between two adjacent stations in a land radio relay system.

The problem is not serious in the direction ground-to-satellite, because high transmitting powers can be used, fed into large parabolic antennas directed on to the satellite. It is serious in the other direction because the power of the transmitter in the satellite is limited to 1 or 2 watts and the signals it sends out are dispersed over a very large part of the earth's surface.

Amplification of these weak signals by means of a device which itself has very low intrinsic noise is the nub of the problem. Because of the thermal agitation of its molecules, every element of an electrical circuit produces spontaneous unwanted noise signals at radio frequencies. It has become common to measure this noise in terms of the equivalent temperature of its source; for a conventional amplifier this may correspond to 3,000° K. The invention of the "maser" provided the engineer with low-noise amplifying devices of a new kind. Taking advantage of the principles of quantum mechanics, a very weak incoming signal is able to trigger a great amount of power over a limited frequency range. The problem generally is to extend this range, but masers have been constructed with a frequency coverage adequate for a satellite communications system. An effective noise temperature as low as 20° K has been achieved using a maser receiver in conjunction with the large horn antenna shown in Fig. 4.

Modulation Methods

The economics of satellite communication suggest planning in terms of at least 600 two-way telephone channels, or one two-way television channel. It remains necessary to mention the way in which the messages will be impressed on the radio signal. Information theory tells us that by increasing the transmitted frequency band, it is possible to improve the signal-to-noise ratio without increasing transmitter power. Frequency modulation is a technique frequently used for this purpose. Pulse-code modulation, in reality a method of processing information before applying it to any type of radio transmission, has many attractions. The important feature of both is their relative freedom from interference, but fairly wide bandwidths are required and it is likely that at least 250 Mc/s will be needed by each satellite system for two-way communication on the scale envisaged.

United States—Post Office Co-operation

Project TSX

The Post Office, the United States National Aeronautics and Space Administration (NASA), and the American Telephone and Telegraph Co., are planning tests of a communications satellite. The satellite, known as Project TSX, is of the active type and is being designed by the Bell Telephone Laboratory. NASA will launch it early in 1962.

The tests are additional to those announced earlier, which involve Project RELAY, an active satellite, and Project REBOUND, a passive balloon reflector satellite. (See Summer 1961 *Journal*).

Project TSX is expected to provide additional design information concerning satellite communication systems; in particular, it is to use higher frequency bands than those planned for Project RELAY.

The tests are to include the transmission of television signals and multi-channel telephony between the American Telephone and Telegraph Company's ground station at Rumford, Maine, and the Post Office Radio Station at Goonhilly Downs on the Lizard, Cornwall.

The Goonhilly Downs station, costing about £500, 000, was to be ready by the middle of 1962, but is now planned to be ready by the late spring when TSX is expected to be in orbit. The station has been described as a miniature Jodrell Bank.

Communication with satellites launched in the United States will be maintained by means of a paraboloidal aerial 85 feet in diameter and steerable in both horizontal and vertical planes. Movement of the aerial will be controlled by a punched paper tape prepared from predicted orbital information by an electronic computer.

Public Relations and Telecommunications

T. A. O'Brien, C.B.E.

THE PRACTICE OF PUBLIC RELATIONS IN THE Post Office is the effort to establish and maintain *mutual* understanding between the Post Office and the public. The word mutual is important. Public relations is essentially two way. As individuals, if we want to establish mutual understanding with someone else, we try to get to know them; to explain ourselves to them and, in all probability, to show them the best side of ourselves.

In a large organization like the Post Office, the basic methods are the same, although there is perhaps a much more conscious effort to establish and maintain this mutual understanding. We try to find out what our customers think of our services; we explain our policies and our services; and we try to show our customers what we are like.

But this is not the whole of public relations. Since the Post Office is owned by the public and everyone is a customer, there are two kinds of "public": those outside the Post Office and those inside. Therefore, in addition to explaining such a vast organization to the outside public we also have to explain ourselves to ourselves, so that the very large staff of men and women working in groups of varying size in every town and village in the country know what we are trying to do.

No organization needs mutual understanding with the public more than the Post Office. There are many reasons for this. Everyone in the country is a customer; a very large proportion of the staff is in touch with the public; we need the co-operation of the public if we are to run our services as efficiently and economically as possible; also we are an inescapable monopoly, and so if people do not like our services they cannot go elsewhere. In the ordinary way there is no safety valve. Fortunately the Post Office is a Government Department and the Postmaster General is responsible to Parliament. This provides a priceless channel of communication. If anyone is dissatisfied with our services, perhaps because they feel that the speed of answer is not what they expect or because they cannot have telephone service when they want it, they can write to their Member of Parliament. Their complaint then reaches the Postmaster General either through a letter or a Question in Parliament.

We have a very large public relations problem not only because of the size of our public, but also because so many people in the Post Office practice or should practice public relations. One naturally thinks of all those who serve or write to or speak to the customers. But everyone who runs or who plays a part however small in running one of our services should realize the value of mutual understanding. Indeed, no amount of explanation can be a substitute for a good and efficient service. Then, too, there are those who make policy; Policy must be clear, if it is to be understood. Finally there is the Public Relations Department which uses the media of mass communication for the purpose of establishing mutual understanding.

Customer Reaction

To understand public relations properly it is essential to separate the effort to establish and maintain mutual understanding into its various aspects. First, we need to find out what the customers think of our services and of us. This is the foundation upon which all good public relations is built and, indeed, should always be the primary consideration.

Our policy has been very clearly stated. In the foreword to *Telephone Service and the Customer*, published in February 1959 (see Summer 1959 issue), the Postmaster General wrote "Methodical and regular surveys of public opinion will be made. We must find out what the customer thinks of our existing services and this will reveal from year to year the success or failure of our efforts". These surveys are carried out by post and are supplemented by more detailed surveys by interview which cover particular aspects of the telephone service. When we bring in a new service, such as STD, we carry out a survey six months or so after its introduction to find out how the customers like it.

As a further means of interpreting the needs and feelings of the public and when Post Office Headquarters requires quicker assessments of public reaction, the information is provided by quarterly assessments of public opinion. These are prepared by the Public Relations Department and are based on the views expressed in Parliament, in the Press, in letters received by Headquarters' departments, and in summaries of opinions received from the Regions. The summaries are obtained from similar sources to those at Headquarters but have the additional advantage of including reports from Head Postmasters and Telephone Managers. These views are all the more important when they are derived from those of local advisory committees.

Public Opinion Surveys

In these ways we combine the scientific methods of *public opinion surveys* which reveal views often not publicly expressed and short-term assessments from a variety of sources of those aspects of our services which have made the public vocal. To know the views, feelings and needs of our customers is the basis of good public relations and, in fact, the foundation upon which successful and good publicity is built.

The Public Relations Department is responsible for ensuring that what the public thinks is brought to the attention of the General Directorate and the Directors. Where possible, and this may take time, the service is adjusted until it meets the requirements of the public. If, however, the adjustment cannot be made, then it is important to explain why. Often this can best be done by an outside body. An example is the Sinclair Committee Report on the Telegraph Service. (*Journal* Winter November 1958.)

The second aspect of our public relations is to explain the policies and services of the Post Office to the public. Most organizations separate explanations of policies from the explanation or selling of services and class the first as Public Relations and the other as Advertising. In the Post Office we use and practice public relations in its widest sense.

The explanation of policies naturally involves Parliament. The Postmaster General is responsible to Parliament and must therefore explain policies to Parliament first. Generally speaking he will present the statement and explanation of policy to Parliament in the form of a White Paper, but he will often announce the outline of the policy in a statement after Questions. In addition he may, as when Group Charging was announced, write personally to each Member to explain how the new policy will affect his constituency.

After he has given his explanation to Parliament, the Postmaster General tells the public directly through the medium of the Press and the broadcasting organizations. For this purpose he holds a Press conference and gives interviews to the BBC and ITV representatives. Because of their importance to the Post Office as sounding boards of local opinion, the Postmaster General sends a newsletter to all members of Post Office Advisory Committees. If the policy is reflected in a change in services, press advertisements, posters and leaflets often follow the initial and more formal announcement as a follow-up to the other national public relations activities at Headquarters.

Depending on the subject, regional publicity is very important in making the public aware of changes. Telephone Managers and Head Postmasters often hold Press Conferences shortly after those of the Postmaster General and explain to the local press what is happening. To help them, Headquarters provides a full brief on the subject and an indication of how the subject will be handled nationally. Likely questions and their answers are also supplied so that local managers can have answers ready.

But however carefully policies are explained, there is always likely to be criticism. Newspapers often consult us on points of criticism and, if the criticism is shown to be unfounded, may decide not to publish. If, however, they feel that publication is justified, they may still be willing to give the Post Office explanation as well.

Criticism is News

As criticism is news it is, of course, often published without consultation. So, if after consultation with the responsible Director, the Public Relations Officer finds that a factual reply can be given, it is sent to the newspaper. Regional Directors also arrange for local newspaper criticism to be answered whenever factual statements can be given without involving protracted correspondence.

The explanation of our services falls into four main groups, publicity to stimulate the use of our services; publicity to secure the most efficient and economical use of our services; publicity to support those of our services which meet competition: for example, the former Cable and Wireless services, and publicity for recruitment.

From time to time we use press advertisements posters, exhibitions, booklets and leaflets to stimulate the use of our services. Examples of this type of publicity are our efforts to stimulate telephony with the Continent, Inland Telex, the use of the Telephone Information Services, and Greetings Telegrams.

Publicity to secure the most efficient and economical use of our services includes Clear and Correct Addressing, Post Early for Christmas, Correct Postage, and Subscriber Trunk Dialling. For these campaigns we use a variety of media according to the size and nature of the problem. For Clear and Correct Addressing, for example, we have used press advertising, posters, a touring exhibition, films, booklets and leaflets. For others, such as the proper packing of parcels, we rely mainly on posters.

Best use of Services

In the telecommunications field, the publicity used for STD is interesting. Here, we are advertising our services and also explaining policy by paid publicity. We have to ensure that when STD is introduced into an area all our customers are aware of the advantages it offers and how to make the best use of the service. This general theme of explaining how customers can benefit to the full extent from the services offered should run through most campaigns.

The STD theme is emphasized by first sending a direct mail letter from the Telephone Manager with leaflets and operational booklets. A fortnight before the service is inaugurated a local exhibition is opened which continues for a further two weeks after STD starts. A film is shown during the exhibition which helps subscribers to understand the new system. Large scale press advertising draws further attention to the advantages of the service.

Campaigns for our cable and wireless services are somewhat different in character. Unlike the monopolistic services we generally offer, these services have to meet competition. In this case, we make our publicity more positive, provided that the services are satisfactory.

A rather different kind of publicity is used for recruitment to meet operational staff needs. We have to make direct and positive efforts to secure staff for different grades, but also have to make long-term efforts to interest children in the Post Office. To help with this we have recently revived the supply of information to schools, and made available to them films, wall charts, booklets and other 'project' material.

To illustrate the third aspect of public relations work—the explanation of policies to the staff—it is difficult to find a better example than the "Friendly Telephone". The staff are often associated with developments of policy at the highest level, and the team which produced the report on *The Telephone Service and the Customer* was composed equally of management and staff. When the policy was decided, the fullest explanation was passed on to the staff so that by knowing the full story they could play their full part in the spirit as well as in the letter of the exercise.

This is how it was done. The Postmaster General explained policy to Regional Directors, Telephone Managers, Headquarters' staff and supervisors in London. He sent letters to Telephone Managers and to Head Postmasters. Every telephonist received a booklet and a personal copy of *Aims of the Telephone Service.* A slightly different booklet was given to all other members of the telephone service, and the "Aims" were displayed as a poster. There was a special edition of the *Post Office Press* wall newspaper, and articles dealing with the subject appeared in the *Journal* and *Post Office Magazine.* A recorded message from the Postmaster General was available for every telephonist to hear.

These were special efforts to launch the "Friendly Telephone" concept but the task of informing the staff goes on all the time. Circulars, the *Post Office Press*, this *Journal*, the *Post Office Magazine*, all seek to keep the staff informed about each other and the policies of management. The Internal Relations Panel of the Joint Productivity Council has extended the supply of available information by issuing a series of news and information sheets.

Revision of Forms

The fourth and final aspect of public relations is building up a picture of the Post Office. The public do this from what they see, hear and read. And the picture that the public sees largely depends on the staff themselves. We hope that it is of friendly efficient and progressive men and women with whom it is worth while co-operating. Telephonists and all who speak on the telephone, engineers who install and maintain the telephones, and sales staff, all help to build the right kind of picture of the Post Office.

Letters and forms which are sent to the public give another kind of picture. If they are simple, clear and friendly, they present a very different impression of the Post Office than the old stock letters and forms which are being revised in co-operation with the Public Relations Department. The layout and typography are being redesigned to fit the wording and produce a definite "House style" or image of the Post Office.

There is also the usually unseen picture, the background of our services. It is equally important although few of our customers know much about it. That is why telephone exchanges have been open to our customers during Telephone Weeks, so that they can see for themselves something of the problems of providing a good service.

To summarize the aims of public relations in the Post Office:

1. Find out the needs, views and feelings of the public and make them known to the administration.
2. Tell the public about the services offered by the Post Office and explain policy.
3. Explain policies to the staff.
4. Help to build up a picture of the Post Office as a body of friendly, efficient and progressive men and women.

If we succeed in achieving these aims, we shall go far to establishing mutual understanding between us and the public. We shall gain their co-operation and fulfil Abraham Lincoln's words "Public sentiment is everything. With it nothing can fail; against, nothing can succeed".

Electronic Computer Exhibition

Electronic computers of the new generation are faster and more efficient than their predecessors and the trend is now towards centralized installations. This development creates a need for line transmission of data in a form suitable for processing, and the Post Office, aware of the value of increased industrial and commercial efficiency, is developing facilities to meet the demand.

At the Electronic Computer Exhibition held in London from October 3—12, the Post Office exhibited communication services suitable for data transmission, and explained how they may best be used.

Different types of transmission facilities are available; for low speed transmission (up to 50 bits a second) there are telegraph circuits.

Private circuits and equipment for preparing, transmitting and receiving punched paper tape, using the standard international 5-unit code, may be rented. Alternatively, if approved by the Post Office, privately-owned terminal equipment may be used.

Data can also be transmitted over the public telex network. The standard equipment uses the standard code, but installations can be modified to enable data in other 5-unit codes to be sent and received on punched paper tape. Privately-owned equipment—which may use a code other than 5-unit—can be connected to a line by means of a special switching device during a telex call set up in the usual way.

A method of detecting transmission errors was demonstrated on the stand. For high speed transmission (500 or more bits a second) there are speech-type circuits.

Private circuits are generally available, having speed capabilities up to about 2,000 bits a second, depending on the type of circuit. Higher transmission speeds require better quality circuits, and special provisioning arrangements may be necessary, adding to the cost and the provision time. Using approved terminal equipment, it is possible to transmit data on the public telephone network by ordinary telephone calls. Speeds of 600 bits a second are obtainable.

Information about a new Post Office modulator-demodulator was also available.

Trunk Circuits for STD in the Director Areas

D. J. Marks

The introduction of STD in London, Birmingham, Manchester, Liverpool, Edinburgh and Glasgow during 1961 was preceded by the biggest concentration of circuit provision work yet experienced on the trunk network.

This exceptional situation was brought about by three distinct causes. First, the opening dates planned for all six areas, linked to the ready-for-service dates of their centralized register-translator units, fell within the three months May-July last. Secondly, a steep rise in the volume of trunk traffic on many routes was taking place and was likely to continue. Thirdly, this project had to be accomplished without detriment to the programme—already announced in the White Paper *The Next Steps*—to introduce STD in 46 non-director areas by December 1960. In the event it was not completed until March 1961 for other reasons.

These projects necessitated an intense concentration of all aspects of circuit provision work. Opening date circuit requirements had to be agreed and these had to take account of the general steep rise of traffic in addition to changes which STD would stimulate. Line and exchange equipment planning, provision, and installation had to be closely co-ordinated. Actual circuit provision work involving the planning of high frequency (HF) group and circuit routings, the preparation and issuing of circuit advices, followed by implementation in the field, required maximum utilization of plant, equivalent to at least four years normal growth; this work was, of necessity, started in early 1960.

The rise in trunk traffic mentioned above, although by no means uniform over the country—some routes have remained steady at about the normal 4 per cent. to 5 per cent. yearly growth—has resulted in an exceptional expansion on many major routes, of which three examples are shown below.

The long-distance circuit requirements (over 25 miles) for the director areas affected altogether some 400 town-to-town routes and involved an increase of some 4,500 circuits on a network of 27,000 circuits at the beginning of 1960. This entailed the provision of about 250 additional twelve circuit HF groups, many more such groups having to be rearranged.

On one major route alone, London to Manchester, some 200 new circuits were provided, and another 200 or so circuits had to be reterminated to cater for the new STD routes; to achieve this 19 new HF groups were provided and a number of others rearranged.

In all, it was found possible to make provision for every long distance circuit required with the exception of some 300 deferred until later in 1961. The circuit advices conveying the details of all the circuit routings were issued by the beginning of December 1960 but it was only by the maximum effort and co-operation between the staffs of the Regions concerned, that the work in the field was completed on time.

Route	Total circuit requirements (approximate) for:			3 years overall increase
	1958/9	STD opening (mid 1961)	Augmented demand to last until March, 1962	
Birmingham —London	530	880	1,110	110%
London —Manchester	570	990	1,080	90%
Glasgow —London	270	380	430	60%

Museum Telephone Exchange

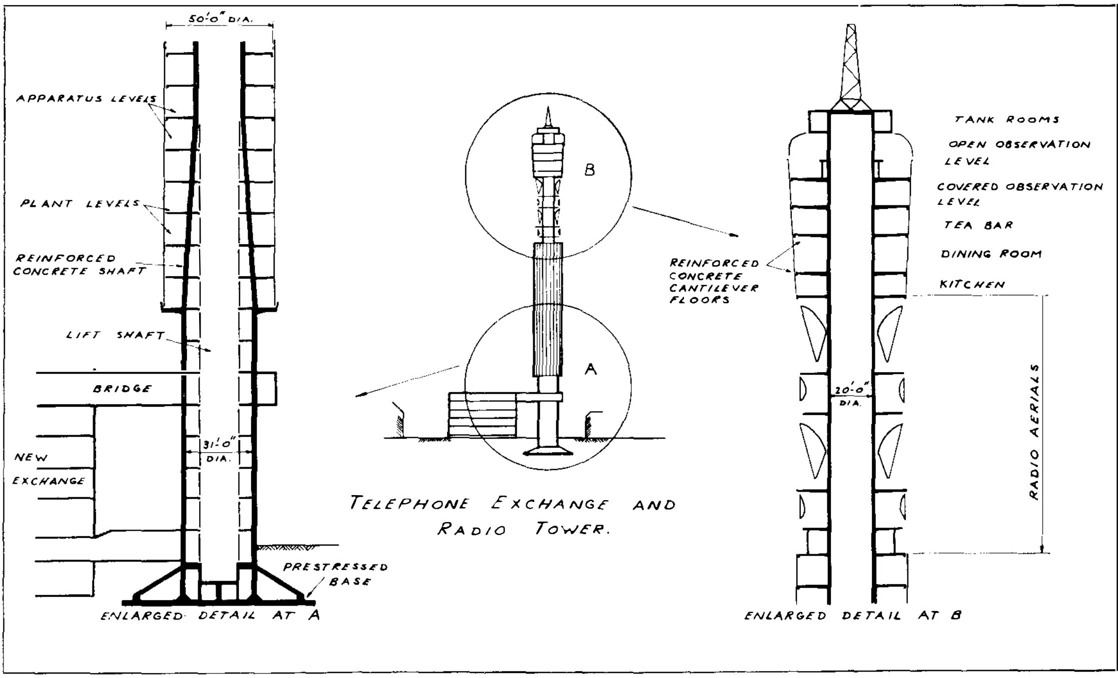
and

Radio Tower

IN the Spring issue we reported the announcement of the Museum Tower project with an illustration of the model. Since then, the design of the tower has been changed, and in June work started on excavations for the extension of Museum Telephone Exchange and erection of the tower.

Expanding telecommunications requirements make it necessary to provide a new exchange building of approximately 150,000 square feet of floor space, mainly for accommodating automatic telephone equipment. The new radio tower, over 500 feet high, is urgently needed so that the high buildings which are going up in London do not obstruct the "line-of-sight" television and radio-telephone links, which radiate from the capital to the rest of the country.

To realize the height of the new radio tower, it is worth comparing it with other well-known buildings. The Eiffel Tower, for example, is twice the height, while St. Paul's Cathedral is a mere 365 feet and Big Ben 320 feet. By building a tower over 500 feet high, the Post Office is providing a reasonable insurance against future obstruction of radio paths, which will enable it to use microwaves more and more in the future for



(*Courtesy of Ministry of Works*)

Opposite: A model of the tower and Museum Exchange extension
Above: Detailed explanation of the tower

trunk telephone traffic. At present, very few long distance telephone calls operate on microwaves and there is as yet none of these links carrying telephone trunk traffic from London. The existing radio mast at Museum carries television signals between London and the BBC and ITA stations on the Isle of Wight, and between London and the ITA stations near Birmingham and Norwich.

The Museum Exchange microwave radio links were first brought into operation when circuits were required between London and Birmingham on the opening of the BBC Midlands TV service.

Increasing attention is being given to the use of microwave links for trunk operation, and there are masts in the north of Scotland which are used for telephone traffic. Other masts will have to be built to provide a network of these links, and there are proposals for towers on the Chiltern Hills and at Manchester. By establishing microwave TV links, the Post Office already has a number of radio stations throughout the country, which will also probably be used for telephone traffic. The 500 feet high Museum tower will provide a long first hop out of London.

The new building, which will be linked to the present Museum Telephone Exchange in Howland Street, off Tottenham Court Road, will occupy a 220 feet frontage to Maple Street. This is approximately 200 feet north of the existing telephone exchange. The new tower is sited so as not to obstruct the "lines of shoot" from the present lattice mast while construction is going on.

The dimensions and basic shape are largely determined by the specific requirements which have to be satisfied. Within these limits it was felt essential to maintain maximum simplicity of form.

Aerial Galleries

The upper part of the tower, which houses the aerial galleries, is circular in shape to enable signals to be transmitted through 360°. A minimum diameter of about 50 feet is needed because of the positioning of the aerial units, and the intervening set-back floor houses wave guide controls.

Below this are apparatus floors, which are circular in shape to maintain consistency of form and maximum visual slenderness.

Windows will be double glazed, the outer panes fixed and cleaned externally from power-operated cradles. Venetian blinds are arranged between glazing. The apparatus floor will be fully air-conditioned from ducting provided in suspended ceilings.

A glass-windowed public viewing platform is provided at a height of about 500 feet and there will be facilities for photography. The public approach will be through an arcade from Maple Street to an internal court over the service yard and car park. Part of the court will be covered as an entrance hall, from which there will be access to the tower lifts.

Structural Considerations

The main cylindrical profile of the tower, which will be 54 feet in diameter, occupies the upper four-fifths and is constructed around a tapered shaft of about half this diameter. Because of the variations in the use of different sections, modifications have had to be made in the structural form. These make the Museum tower different from the few towers of similar height and purpose in other parts of the world. The total weight of the tower and its foundation is approximately 13,000 tons.

The unusual proportions of height and shape, and the compressibility of the clay subsoil foundation, present major problems of structural design to achieve the required stability. Slender towers are sensitive to variations in wind and sun conditions, and in this instance excessive deformation of the axis would interfere with the alignment of the aerials, and disturb the transmission beam. The maximum permitted angular deflection is limited to twenty minutes of arc.

The cylindrical form of the tower offers less wind resistance, although it is estimated that gusts of 75 mph may result in a deflection of 10 inches. Movements of up to two inches may be expected from the effect of solar heating.

Structures of this type present a special problem of stability which may arise from "steady" wind conditions of quite low intensity causing transverse oscillations. These could, in certain circumstances, build up into movements of serious magnitude. This has happened in the past, the best known example being a large suspension bridge in the United States which collapsed for this reason. The conditions which cause this phenomenon are difficult to predict accurately by calculation, but wind tunnel tests on the scale models of the tower have been carried out by the National Physical Laboratory to investigate this possibility.

The stability of the tower will be assisted by the bridge deck which connects with the main building at 80 feet above the ground. The deck transmits a maximum horizontal wind force of

(Courtesy of Ministry of Works)

Excavation work on the site

500 tons, and the structure of the adjacent main building is stiffened to provide this restraint. The attachment of the tower to the deck is so arranged as to provide a lateral stay, without resisting vertical deformation relative to the main building.

The main stability of the structure is provided by an internal hollow reinforced concrete shaft, tapering from 35 feet to 22 feet diameter. This shaft will contain the high-speed lifts, the ventilation ducting and service cables to the equipment.

The lowest section of the tower rises 115 feet above ground level and the shaft in this section is provided with internal stiffening rings. The next section of the tower, from 115 feet to 355 feet above ground, provides 17 floors. The lower three contain the high velocity ventilation plant, while the remainder will house the microwave apparatus. This section is enclosed with about 50,000 square feet of glass cladding.

The third section will house the platforms for the main aerials and these are unclad in order to minimize interference with the transmission beams.

The fourth and highest section will contain a restaurant and kitchen. The restaurant, nearly 500 feet above the centre of London, will have a revolving floor which moves at about 6 feet a minute to give customers a wonderful panoramic view of London. One complete revolution of the floor will take about half an hour. As well as a restaurant, the tower will have a tea and snack bar and two public observation platforms—one covered and one open. Two high-speed lifts will go to the top of the tower.

The main shaft rises a further 31 feet above the top observation gallery and houses the lift motor rooms and control gear.

Surmounting the concrete shaft there will be a steel lattice tower approximately 45 feet high, designed to carry additional aerials.

These are some of the interesting details of the completed tower, but the construction itself involves a novel departure from usual building practice. The first stage involved construction of a boundary retaining wall of reinforced concrete. Because of the nature and locality of the site, the architect decided to use a technique developed by an Italian firm. This obviates the noisy operation of driving metal piles and plates, and both machinery and labour were imported from Italy.

In this process, the "rig" mainly consists of a specially designed grab, which cuts out a deep trench the exact width of the final wall. The sides are prevented from collapse by progressively filling the trench with a soft mud-like substance called Bentonite. The steel re-inforcement is then placed in position and concrete is pumped through pipes to the bottom of the trench. As the trench fills the surplus Bentonite is drawn off, diluted and disposed of through the sewers.

Planned to be in service in mid-1964, the tower will gradually rise above surrounding buildings. It is one of the few of its kind in the world, and as the construction develops, we hope to bring you progress reports in pictures.

STD in the Houses of Parliament

It is just ten years (August and November 1951 issues) since the late M. A. R. Kenyon wrote the history of telecommunications services in the Houses of Parliament. Although there have been several developments in the Post Office during the last decade, their effect on the Peers, Members, and permanent staff of Parliament has been marginal. The increase in the London local call area on the introduction of Group Charging was, for example, no doubt appreciated, but the benefits of the Friendly Telephone service were apparent in the Palace of Westminster long before 1960, where the tradition of personal service has always been carried on by Post Office staff.

Subscriber Trunk Dialling facilities became available to WHItehall subscribers on August 19 but many people in the Palace did not experience its advantages until Parliament resumed on October 24. Members who wish to make telephone calls can do so by using one of the 700-odd extensions from the WHItehall 6240 PBX, anywhere in the Commons, or by visiting one of the two suites of call offices where Post Office attendants obtain their calls and usually collect the fee. Peers have similar facilities on a smaller scale but visitors, and to some extent the Press, have to use the ordinary multi-coin box cabinets which are in the various parts of the Palace to which they have access.

The telephonists on the PBX, a 13-position CB10, formerly obtained long-distance calls by using trunk subscriber circuits which terminate on the Royal Suite at London Trunk Faraday Exchange or, if these were all engaged, by dialling "100" over their local exchange lines. They can now dial many of these calls direct by STD, however, and since two cord circuits on each switchboard position have been modified to give through-clearing supervisory conditions, the installation of cyclometer type meters on the switchboard enables the staff to assess immediately the charge for any call.

The attendants also obtained trunk calls by using cabinets in which the telephones are connected directly to trunk subscriber circuits, and local calls from other cabinets with barred-trunk telephones. A few trunk subscriber circuits are being retained until more exchanges are accessible by STD, but most of the cabinets in the attended suites now have telephones connected to the new type of barred-trunk equipment. Some are permanently barred, but others have the optional barring facility, enabling the attendants by holding the keys to obtain trunk calls, or restrict the cabinets' use to local calls, as occasion demands. A clock type meter associated with each optionally barred-trunk line facilitates immediate charging for trunk calls. The multi-coin boxes, of course, are now of the pay-on-answer design.

Several Members of Parliament have received inaugural STD calls from their constituencies in a specially fitted cabinet, and all seemed to be favourably impressed with the system's advantages.

P. J. Chapman

Tailoring Circuits to Service Needs

H. A. Longley

Mr. Longley presented the following paper under the title "On the determination of the number of circuits" at the Third International Teletraffic Congress held in Paris during September, 1961.

A TELECOMMUNICATIONS network must give a grade of service which on any call is acceptable to the users of the service, and it should do this for a minimum expenditure on lines and exchange plant.

Accepting that the standard formulae give the relation between the traffic and the loss or delay for a given number and arrangement of circuits, an important practical question is how the losses or delays are to be distributed throughout the network to achieve these aims. For brevity this Paper mentions only "loss", but most of the considerations apply also to "delay". In this context "loss" means calls which fail to find a free circuit immediately, and "grade of service" is the proportion of such calls. For example, a grade of service of .02 means that 2 calls in every 100 in the busy hour fail to find a free circuit.

The problem may conveniently be divided into two parts:

(i) Whether and how the loss shall be varied with the number of circuits in the group.

(ii) What level of loading is appropriate for a given group of circuits having regard to the cost of the circuits and the function of the group in the network.

It has been said that if the number of circuits in a group is determined by prescribing a fixed proportion of loss independent of the number of circuits, then

(*a*) larger groups will have insufficient margin of capacity to cater satisfactorily with overload conditions;

(*b*) smaller groups will have a greater margin of capacity than is necessary to meet service needs.

Consider first the case of the larger groups. The statement above derives from a recognition of the fact that the average density of traffic varies in practice from busy-hour to busy-hour and seasonally, and will inevitably exceed the designed capacity at times. The reasons for this are complex, being connected with the unpredictability of public activity, the problem of selecting representative periods and durations for traffic records, the difficulties of estimating for growth, and so on. Whatever the reasons, it is common experience that the traffic level in any group will tend to vary both above and below the level for which provision has been made on different days of the week and in different seasons.

For a given grade of service the average load carried per circuit increases with the number of circuits in the group. With large groups a comparatively small increase in the volume of traffic from that on which provision was based will result in a disproportionately large deterioration in the grade of service. Hence, if groups of circuits are provided on a constant-proportionate-loss basis which is satisfactory for medium-sized groups, the large groups will be too sensitive to the upward variations in traffic level met with in practice.

It has, therefore, been the practice to prescribe that the loss shall not rise above a certain limiting proportion for a specified increase in traffic when circuits are otherwise provided on the constant-proportionate-loss basis. For a group provided to give a grade of service of B, it is prescribed that the grade of service shall not become worse than r.B (where $r > 1$) with an increase of traffic of X per cent. Thus, in the United Kingdom, certain external circuits were, until recently, provided to give a grade of service not worse than .02, subject to the proviso that with an increase in traffic of 10 per cent. the grade of service shall not become worse than .04. In this case the proviso governed the provision of all groups of more than 17 circuits: above this size the grade of service became progressively better than .02 at the

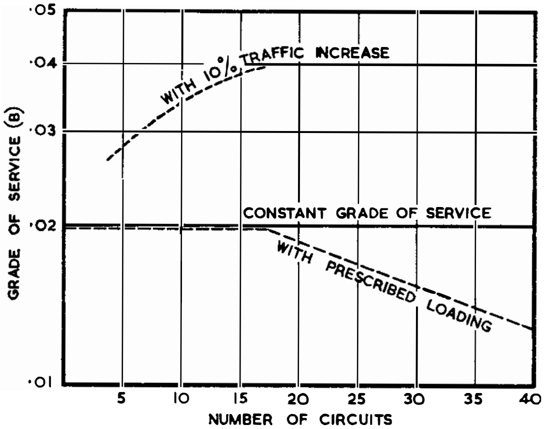


Fig. 1: Grades of service given by old standard (nominal .02)

prescribed traffic loading. For 17 circuits or less a constant grade of service was progressively better than .04 with a 10 per cent. increase of traffic when the size of group was smaller (see Fig. 1).

The question naturally arises whether the abovementioned proviso should not be applied to the provision of circuits in groups of any size, thereby securing a better loading of small groups. This calls for some consideration, however, because whereas the application of the proviso to larger groups results in an improvement of the grade of service, its application to smaller groups worsens the grade of service.

It seems likely that callers tend to judge the grade of service not so much by the proportion of their own calls that fail due to congestion as by the interval—measured in days, weeks or months—between such failures. Hence it may be argued that, since smaller groups carry fewer calls in a given period than do larger groups, a greater proportion of loss will be tolerable on small groups than on large. In other words, the grade of service that is acceptable may be an inverse function of the traffic carried by a group. The considerations mentioned earlier are no less true of small groups than of large; both are subject to variations in traffic density about a mean, and a basis of provision which compensates for this in large groups should be no less adequate for small ones.

In the light of the foregoing the British Post Office has recently adopted for a trial period the "r.B+X per cent." formula as the basis of provision for all groups of external circuits except the shortest, subject to a further proviso mentioned later. Such a basis may be viewed either as one giving a grade of service which improves with the size of group, or as a constant-proporticnate-loss basis with a built-in margin against traffic variation. In the scale of provision currently on trial r=2, and X=10. The resultant relationship between grade of service and size of group is shown in Fig. 2. Further study is required to establish whether the values chosen for the constants are the best. As a matter of interest the relationship which results when r=3, and X=20 is shown in Fig. 3.

Another factor bearing on the loading of smaller groups has recently received attention. A telephone system grows continuously, and this necessitates additions to the number of circuits in the switching groups comprising the network, usually at intervals of a year or more in anticipation of growth. But while traffic intensity is a continuous variable, circuits can be provided only in whole numbers. The general effect is to create a margin of plant over and above the true requirement, with the result that the grades of service actually experienced are much better than the grades of service adopted as standard. Furthermore, the difference between the maximum permissible loss and the actual loss is greatest for groups with few circuits.

The margin due to this factor ranges from almost nothing to nearly one additional circuit's capacity, with an average of a half, and it is a matter of chance what fraction of a circuit margin exists in any particular group. Calls usually take into use more than one link, and calls involving external links invariably do so. The probability

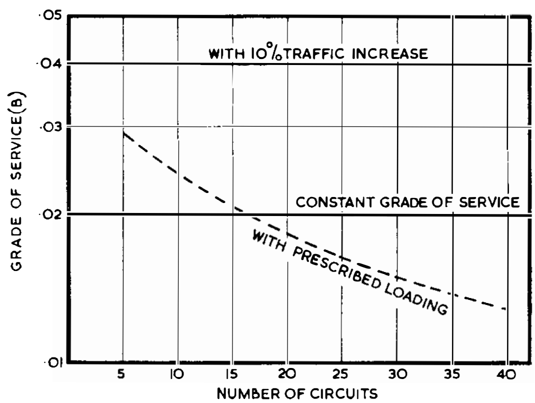


Fig. 2: Grades of service given by prescribing .04 (max.) loss with 10% traffic increase

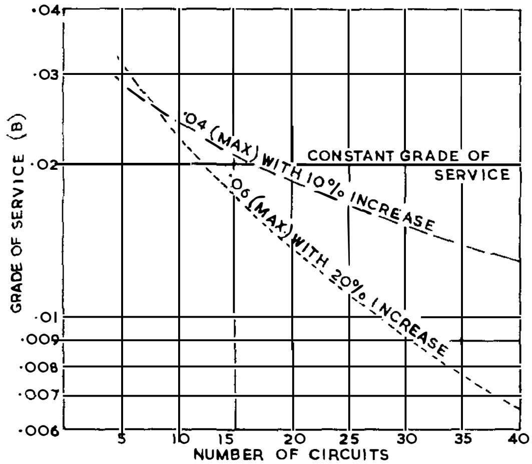


Fig. 3: Effect on grade of service of varying the overload proviso

of all groups involved in the same call having a nil margin of circuit capacity is small. It may be considered, therefore, that the use of traffic-capacity tables, in which the traffic shown is the maximum to ensure the prescribed grade of service for a given number of circuits, incurs an over-provision of one half a circuit per group throughout the system. This can mean a substantial additional capital outlay in a large system.

These considerations are deemed to justify applying the standard grades of service, not as maxima but as means. A convenient way of applying this principle is to allow the capacity of a group to be exceeded by half the increase in capacity from an additional circuit before augmenting the group. In large groups the application of grades of service as means, instead of as maxima, has an insignificant effect, but in small groups it adds appreciably to their traffic capacity.

This principle has accordingly been incorporated in the trial basis of provision for longer external circuits already mentioned. The resultant relationship between grade of service and size of group is shown in Fig. 4; for purposes of comparison a standard based on Moe's Principle with an improvement of 0.1 erlang is shown in Fig. 5.

For internal circuits and short junctions the present constant-proportionate-loss standards are, again for a trial period, currently applied as means instead of maxima. The variation in grade of service at the maximum permissible loadings for a mean grade of service of 0.2 is shown in Fig. 6.

Now we will turn to the question, how should grades of service be determined for the various kinds of group in a network? A national telecommunications network comprises a large number of types of link with a wide range of cost. Clearly expenditure should be minimized by prescribing a heavier loading for the more costly circuits, while cheaper circuits should be more lightly loaded in order to preserve the overall grade of service.

Cost cannot, however, be the sole criterion of grade of service because:

(*a*) the function of a given group in the network must be taken into account when deciding the appropriate standard to apply;

(*b*) a lower grade of service is permissible on groups of circuits serving lines with low calling rates than on those serving high calling rates;

(*c*) although theoretically, in order to secure the most economic condition, the grade of service should be a function of the cost of the circuits, a strict cost relationship results in an unacceptably poor service on the more expensive circuits.

The functions of different groups in a network differ widely. Some groups will be used only for single-link traffic: others may carry traffic passing over a number of links in tandem, perhaps ten or more, including internal circuits. In order that the overall grade of service between two telephones should not vary too greatly, as between those calls which take into use many or few links, it is reasonable to specify grades of service for individual links having some regard to the number of other links which may be taken into use. In doing so a number of factors have to be remembered such as the existence of unabsorbed margins against growth, non-coincidence of busy hours, and seasonal variations which help to ensure that rarely are all groups at peak load together. Also, that calls between remote exchanges being less frequent, may permit a worse overall grade of service than average. In general, however, direct routes between exchanges can have a less generous grade of service than routes between groups of exchanges, and these in turn, a less generous grade of service than routes used for tandem switching.

Subscribers' calling rates and calling habits can both influence the appropriate grades of service. Only a fraction of a subscriber's calls are made during the busy hours, and where there are

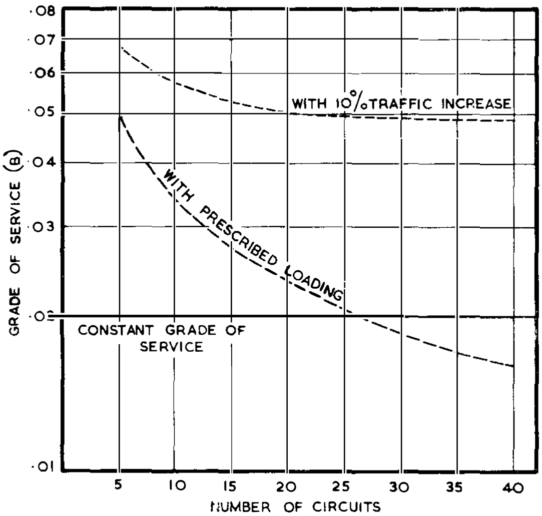


Fig. 4: Grades of service given by new standard (.04 mean with 10% traffic increase)

seasonal variations traffic will be at the maximum permissible level only during a limited number of busy hours. Hence the proportion of a subscriber's total calls that fail due to congestion is much less than the proportion that fail in the busy hours. Lines serving private residences, which are in the majority, have low calling rates together with a lower "busy hour to day ratio" than business lines and are therefore less affected by busy-hour

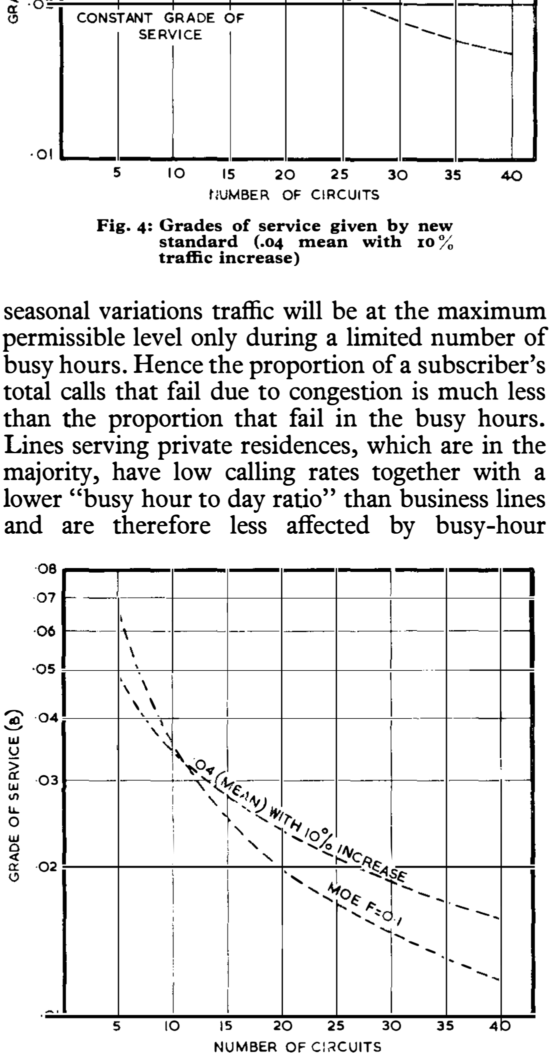


Fig. 5: Comparison of new standard with standard based on constant improvement (Moe's principle)

congestion. Moreover, the lower a subscriber's calling rate the longer the interval between failures of his calls due to congestion. Hence where low calling rate lines can be segregated in an exchange, for example at line-finder or final selector stages, a higher proportion of loss than the average can be prescribed.

It is only by giving careful consideration to circuit costs in fixing grades of service that the most economic operation of a system can be achieved. Nevertheless, it would not be desirable to carry economic considerations to the point where the proportion of failures would be intolerably high on subscriber-dialled calls. This is especially important with national dialling, where the subscriber expects a reasonable grade of service on every call he dials and, in fact, pays more for longer distance calls than for short distance ones.

A basis of plant provision which avoids the difficulties associated with a fixed grade of service was advocated by Erlang. This is the "constant improvement" method, or Moe's Principle. Under this principle, the cost of augmenting a group is equated with the saving from lost calls thereby made effective. With this method, which is claimed to produce the most economic arrangement of plant for a given overall grade of service, the constant of service is the "improvement", that is the reduction in the number of lost calls brought about by the addition of one circuit to the group. The value of the "improvement" is related to the cost of the circuits in the group. The grade of service is thus different for every size of group and cost of circuit, and on the more expensive routes might be unacceptably high. Furthermore, there is the difficulty of establishing a monetary value for the saving from lost calls in order to arrive at a value for the "improvement". Nevertheless, the principle is valuable in indicating the kind of relationship that exists between grades of service, sizes of group and costs of circuits which will result in the most economic use of plant.

With such a variety of factors, the problem of deciding the relative values of grades of service for various kinds of groups in a large network is somewhat complicated. Fortunately, it is desirable to limit the number of scales of provision so that the number of tables in use is reduced. The procedure may involve the following steps:

(*a*) classifying the various groups according to the different criteria of cost, function and other characteristics;

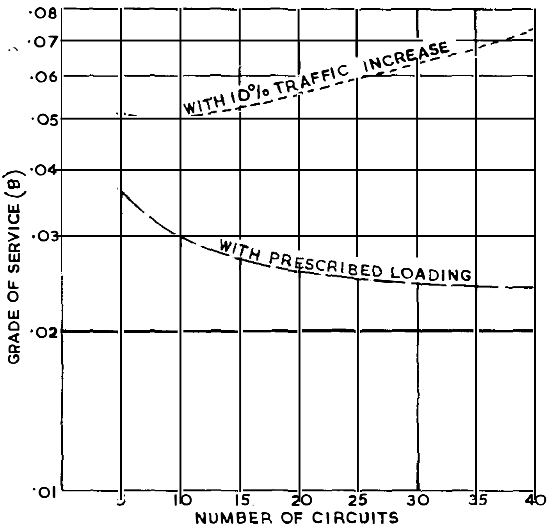


Fig. 6: Grades of service given by prescribing .02 loss as a mean

(*b*) constructing a system of scales of provision between limits that have proved workable in practice;

(*c*) allocating a scale of provision to each class of circuit bearing in mind all the relevant factors.

The aim of such an exercise must be to ensure an acceptable standard of service from subscriber to subscriber at minimum cost. Clearly the subscriber-to-subscriber grade of service on calls of different types and over different distances will be related to the number and classes of links taken into use. Because of the variety of factors involved the acceptable overall grade of service can be determined only in the light of experience.

Whatever the principle adopted, underlying the basis of provision, it is inevitable that a number of decisions have to be taken about the standards that are to apply to the different classes of group.

Conclusions

(1) Provision of groups of all sizes may be based on a prescribed grade of service with a built-in margin against traffic increases.

(2) Grades of service may with advantage be applied as "means" instead of as "maxima".

(3) The standard of provision appropriate to a particular class of group depends upon its function and other factors, as well as the cost of the circuits concerned.

Fleet Permanent Exhibition

The most modern equipment used in telecommunications is displayed alongside some surviving examples of earlier days at a new permanent exhibition which has just been opened in Fleet Building, London. Telephone instruments used in 1885 and telegraph apparatus of even earlier vintage are shown.

Among other exhibits is a double needle telegraph instrument, installed about 1851 at Buckingham Palace, and a replica of a manually operated switch used to ring the division bells in the House of Commons in May 1941, before the Chamber was destroyed. Sir Winston Churchill commissioned this replica.

Working models range from the earliest automatic telephone exchange demonstration sets to a modern display of Subscriber Trunk Dialling equipment.

Members of the Post Office have given many of the exhibits, some of which are on loan from other collections.

The exhibition is open to the general public from 10 a.m. to 5 p.m. on weekdays, except Saturdays, and admission is free.

New VF Telegraph Equipment

The Post Office has now in service a new voice-frequency, frequency-modulated telegraph system which is fully transistorized. The system conforms to the standard CCITT requirement providing 24—120 c/s spaced channels on one speech circuit.

Apart from its use on normal telegraph networks at a modulation rate of 50 bauds, the system is also capable of operating at higher speeds and, with time division multiplex equipment, will provide two 50-baud telegraph channels on each 120 c/s spaced channel.

Development is now in progress to enable this to be extended, also by means of time division multiplex equipment, to provide up to three 50-baud telegraph channels in each 120 c/s telegraph carrier. This development employs a principle known as "characteristic distortion compensation", on which work is now being done at the Post Office Research Station, Dollis Hill. The main use foreseen for this very high efficiency of utilization is over very long submarine cables, and it is envisaged that on a 3 kc telephone channel, some sixty 50-baud telegraph channels may be provided when demand arises.

Conference at Torquay

H. C. Greenwood

MORE than 150 delegates, representing the nineteen countries whose postal and telecommunications administrations are members of the Conference of European Postal and Telecommunications Administrations (CEPT), gathered in the Town Hall at Torquay, Devon, from September 11 - 22 this year, under the Chairmanship of Sir Robert Harvey, K.B.E., C.B., Deputy Director General of the Post Office. The organization's second Annual Conference was formally opened by the Postmaster General, the Rt. Hon. Reginald Bevins, M.P., who was accompanied by Mrs. Bevins. The Mayor and Mayoress of Torquay were among the distinguished guests present at the inaugural ceremony.

The Conference of European Postal and Telecommunications Administrations was founded in 1959 to examine ways of improving the postal and telecommunications services in Europe and to foster collaboration in these spheres, and the first annual reunion took place in Paris in October 1960. The member-administrations take it in turn to manage the organization for a year, providing the secretariat and arranging the Annual Conference. The United Kingdom took over these duties from France after the 1960 Paris Conference and is now preparing to hand them on to the Federal Republic of Germany, the managing administration for the coming year.

The CEPT constitution provides for a Plenary Assembly with two main Committees, one Postal and the other Telecommunications, each with a number of Working Groups. At the beginning of the Torquay Conference, the Telecommunications Committee, presided over by Col. D. McMillan, C.B., O.B.E., Director of External Telecommunications of the Post Office, had four Working Groups, "Radiocommunications", "Telegraph", "Telephone", and "Television and Sound".

Although each of these Groups has, of course, considerable interest in the use of artificial satellites for communications in its own particular field, none is alone able to deal with all the varied aspects of this new sphere of telecommunications, so the Committee set up a new Working Group "Telecommunications by Artificial Satellites". This new Group will maintain close contact with the other four, which have on their agenda the estimation of traffic requirements—telephone, telegraph, data, television, and so on—for satellite links and the study of frequency requirements for this purpose. The object of this is to enable the countries of the CEPT to keep abreast of new developments in satellite communications and to be ready to meet the challenge of the "space age" in telecommunications. A number of CEPT countries are already building ground stations to participate in tests with American launched telecommunication satellites in 1962.

Capt. C. F. Booth, Deputy Engineer-in-Chief of the Post Office, was appointed Chairman of the new Working Group. Mr. H. Bornemann (Federal Republic of Germany), Mr. D. Van Den Berg (Holland) and Mr. R. Vargues (France) were confirmed in their appointments as Chairmen of the Telephone, Television and Telegraph Working Groups, respectively, for a further year. In place of Mr. H. A. Daniels, who was unable to accept reappointment as Chairman of the Radiocommunications Working Group in view of his promotion to Director of Establishments and Organization of the Post Office, the Telecommunications

Committee appointed Dr. F. Nicotera (Italy).

The Working Groups' examination of the questions set for study by the Telecommunications Committee is not restricted to the brief period of the Annual Conference; the work continues throughout the year either by correspondence or by meetings of the full Group or of sub-groups which study particular aspects of a question. Twenty-one questions were under study during 1960-61 dealing with a wide variety of operational and financial matters, including the establishment of a European transit centre for inter-continental telephone and telex traffic, notably with North America; reduction of the variety of rates for inter-continental telephone traffic; broadcasting from ships and aircraft outside national territorial limits; conditions for the issue of licences to radio amateurs; and, technical problems arising from development of the Eurovision network.

Reconciling the differing practices and requirements of nineteen countries comprising the larger part of Europe is no easy matter and quick solutions to the more complex problems facing CEPT cannot be expected. Understandably, the Working Groups felt the need to continue their study of several questions during the coming year. Nevertheless, the exchange of information and views in advance of the Conference enabled them to report some progress to the Telecommunications Committee at Torquay on each of the questions under study, and further headway was made in discussions during the Conference. The study of six of the questions was completed and recommendations on the following matters were approved by the Plenary Assembly:

Steps towards standardization and reduction of telegraph transit rates in the service between CEPT countries.

Introduction of a "Telexogramme" service, between CEPT countries wishing to participate. Provisional regulations for this service were also agreed. (A "telexogramme" is a telegram transmitted over the telex network from a telegraph office in one country direct to a telex subscriber in another country).

"Préavis" telephone calls during the busy Christmas-New Year period.

Development of a European land mobile radiotelephone service.

Conditions for the combination of speaker circuits into a conference network in relation to Eurovision transmissions.

The CEPT already has close contact with the International Telecommunication Union—and on the postal side with the Universal Postal Union—by virtue of the fact that all CEPT members also belong to the international Unions. The Conference was honoured by the presence in Torquay of Dr. Weber, Director of the International Bureau, UPU, Dr. Sarwate, ITU's Deputy Secretary-General and Mr. Rouvière, Director of the CCITT. Decisions were taken at Torquay to forge further links between the CEPT and other organizations.

On television and sound matters there is already close co-operation with the European Broadcasting Union. The Torquay Conference plans to extend this by collaborating with the EBU in a practical test of the advantages and drawbacks of an EBU domestic notice (Special Notice 17) about sending levels over international programme circuits and by jointly studying the possibility of standardizing the characteristics of modulation meters. It also decided to seek the assistance of the American Telephone and Telegraph Company, as required, during the continued study of questions concerning the proposed creation of transit centres in Europe for intercontinental, and in particular, transatlantic, telephone traffic; of the International Electrotechnical Commission on the study of interference from industrial, scientific and medical installations; and of the CMTT (the Joint CCITT-CCIR Committee on television transmissions) on certain problems connected with the proposed permanent Eurovision network.

Eleven new questions were set for study and the CEPT now has a total of twenty-seven questions to consider during the coming year.

Essay Competition

Essays entered for the Institution of Post Office Electrical Engineers' Essay Competition, 1961-62, should be with the Secretary of the Institution (GPO, 2-12 Gresham Street, London, E.C.2) by December 31.

The competition is open to all staff up to and including Technical Officers. The subject may be anything connected with telecommunications, but, while technical accuracy is essential, a high technical content is not absolutely necessary.

Essays should be between 2,000 and 5,000 words, with a certificate saying that they are the writer's own unaided work.

Prizes are 6 guineas and 3 guineas, and there will be five Certificates of Merit.

Meeting Increasing Demand for Inland Trunk Circuits

H. Barker, B.Sc.(Eng.), A.M.I.E.E.

SO long as trunk traffic grows at a uniform annual rate or fluctuations are small, the installation of trunk line plant to carry increasing traffic can follow a well organized plan. The circuit requirements five years ahead are shown in schedules of circuit requirements prepared annually by the Traffic staff, and these are reviewed by the Engineering Department in November and December. Those trunk routes on which there is insufficient plant to meet the four-year or five-year requirements are scheduled for attention.

Plans to expand the routes concerned are prepared in broad outline in the early months of the following year and are then collected into a programme of works. These works are started in the succeeding financial year, and are usually completed in three years, but may take four or five years if the scheme is a big one. It is expected, therefore, that at the time of initiating a new scheme on a particular trunk route the existing plant will be capable of lasting for at least a further three years, and possibly five years.

While the growth of the trunk network continued as it did for many years—at a reasonably regular 4 per cent. increase a year—there had to be between 12 per cent. and 20 per cent. spare plant according to circumstances, on any route investigated when the annual works programme was being prepared. The planning engineer could then confidently say that his relief scheme, if not provided in advance of need, would at least be ready for service by the time the spare plant was used up.

The very rapid and sustained increase in trunk traffic during the past three years, augmented by the effects of the STD programme, has placed a great strain on this method of planning.

Past experience suggested that the rapid increase in trunk traffic would not be sustained for long and the five year circuit forecasts, so vital in planning extensions to the trunk network, thus did not at first reflect the continuance of the high rate of increase in trunk traffic. Current five-year circuit estimates allow for the high rates of growth of trunk traffic to continue.

For three years in succession on the London-Birmingham route the forecast of the circuits required in five years were taken into use in a little over one year. Over the three-year period there was nearly a 100 per cent. total increase in circuits, against a forecast increase of only 13 per cent. before expansion began and the STD programme was accelerated. The London-Birmingham route is an extreme instance, but similar conditions have occurred to a lesser extent over most of the trunk system.

The greatest increases in requirements have been on the main inter-city routes. This is fortunate as, in general, circuits under 30 miles in length are all provided on audio cable plant while the longer-distance circuits, say above 60 miles in length, are provided on high-frequency plant, with intermediate distances depending on circumstances. On these inter-city routes the rate of increase of trunk circuits has been about 15 per cent. a year, and it has been possible to meet the high rate of demand which in a three-year period has amounted to something approaching 50 per cent. increase in the network, because nearly all such routes have been converted to high-frequency working. By good fortune—or perhaps one should say good planning—ample line capacity was available.

It is important to distinguish between the demand for line capacity and the demand for terminal transmission equipment. A pair of coaxial tubes has a capacity of 960 telephone channels if amplifiers are installed every six miles, or 2,700 circuits with amplifiers every three miles. Thus, even a two-tube cable has a large circuit capacity. On main routes it is usual to lay six-tube cables and on other high-frequency routes four-tube cables. Line capacity is therefore provided in very large instalments and can normally be expected to last for at least 10 years.

The terminal transmission equipment by which the separate telephone channels are injected into and extracted from the high-frequency path, can be installed very much more quickly than a cable can be laid and it is usually installed in small quantities to meet about three years' expected growth. In 1958, when the rapid increase in trunk traffic started, there was a considerable number of spare coaxial tubes on the main routes on which only line amplifiers had to be installed and terminal equipment fitted. Even the working tubes still had considerable spare capacity. Further, an unusually high spare proportion of terminal equipment was available.

The initial two years of rapid expansion were catered for by using this spare line capacity and spare terminal equipment, and during this period exceptional measures were taken to install additional equipment on the coaxial cable network. As the expansion continued and the five-year circuit forecasts have been increased, to take account of what appears to be a new set of circumstances, practically every spare coaxial tube in the country has been equipped with amplifiers, or plans have been made to do so. At the same time orders have been placed for new coaxial cables, for radio links and for large quantities of terminal transmission equipment.

Fortunately the audio cable portion of the network has not experienced the same high rate of growth as the longer high-frequency routes and, in the audio network, there was a high proportion of spare cable pairs provided for projects which were subsequently dropped. Had this not been done it is doubtful whether the amount of additional cabling needed could have been provided in time. Certainly the cost would have been extremely high.

Capital Expenditure

One of the principal planning problems is to meet the very high rate of circuit demand within the capacity of the cable and equipment contractors, and within set limits of capital expenditure. At a rate of growth, for example, of 10 per cent. a year spread evenly, the size of the trunk network would have to be doubled in seven years. The total cost of the existing trunk line plant at present prices would be approximately £250 million. If, therefore, its size had to be doubled using plant of the same type, £250 million would have to be invested. This, spread over seven years, would require an expenditure of £36 million a year. However, this is not necessary, for three reasons.

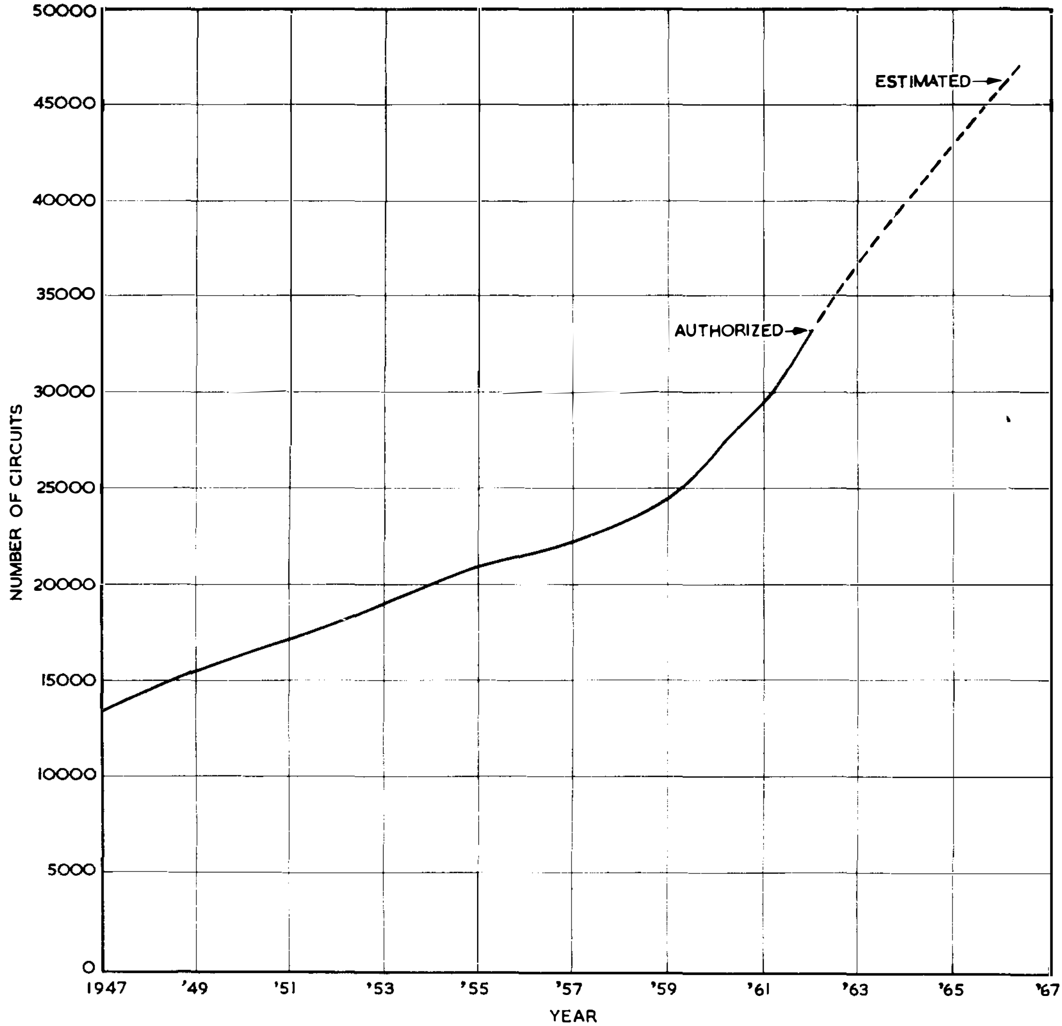
First, the increases required on the longer routes already served by high-frequency cables are considerably greater than those served by the audio cables, and the capital cost of long-distance high-frequency circuits is considerably less than that of audio circuits of similar length. Secondly, it is general policy to provide middle-distance circuits, formerly needing audio cables, by high-frequency systems. The Engineering Department is constantly striving to make the utmost use of this more economical type of plant, coupling with it the rearrangement of existing audio plant to provide the very short circuits. Thirdly, the use of two-wire instead of four-wire amplified working on audio cables halves the cable pairs required for the shortest trunk circuits.

Even so the very high rate of growth over the past three years which, in preparing circuit estimates is being assumed to continue for some years, might be expected to call for additional cables on every existing route in the country within a short period. It is hoped that alternative high-frequency methods, discussed later, can be used to help defer the provision of cables.

Transmission Systems

Up to a few years ago, circuits on the largest long-distance routes were provided by coaxial cable, on shorter routes by audio cable and, intermediately, both for distance and size of route, 24-circuit carrier cables. More recently the 24-circuit carrier cable has become uneconomic, as has also the 60-circuit type of carrier cable for general use which has been laid on a number of routes. Thus, the planning engineer at present can use audio cables for the shorter distances and coaxial cables or radio links for the longer. The standard 0.375 inch coaxial cable is capable of providing 960 circuits on each pair of tubes but it is expensive when used to provide, say, less than half this number of circuits.

A new type of coaxial cable of smaller diameter and with buried amplifiers using transistors has been designed and installed experimentally on two routes. This will provide cheaper circuits on routes where the requirement over a 10 year period is between about 100 and 600 circuits at distances of 30 miles and above. It will be used extensively in meeting the increased demand for trunk circuits on routes which have previously been served by audio cables. Its value lies in low capital expenditure compared with that of a large audio cable or standard coaxial cable. At the same time, because



Growth of public trunk circuits

of its small diameter, it can frequently be drawn into a duct over existing cables, thereby also saving the cost of new ducts and the very long time necessary to lay them.

One increasing problem the Engineering Department has to face is providing for small numbers of circuits, say up to 6 or 8 a year, on routes served by audio cables where all the pairs in the existing cables are in use and where additional cabling, either audio or high-frequency, would involve considerable capital expenditure. To avoid this, it is planned to add groups of carrier circuits on selected pairs in the existing audio cables. In this case the loading coils have to be removed and the number of pairs which can be operated is then limited by the effects of crosstalk. Nevertheless, it is hoped that a considerable amount of new cable-laying can be avoided, or at least that new cabling can be deferred for a few years until the present peak of work has passed.

Another method of increasing the circuit carrying capacity of the existing cable network is by converting amplified audio circuits, less than about 30 miles long, from 4-wire to 2-wire working. This policy, decided about four years ago, is now saving more than a million pounds a year on new cables and is enabling additional circuits to be provided in very much less time than would otherwise be possible. Two new designs of 2-wire repeater have been introduced, both operating with transistors.

Microwave Radio-Relay Links

A few years ago it was decided that a network of microwave radio-relay links would be built to supplement the high-frequency cable network over the main routes of the country, and work on a radio system from London to Scotland was started about three years ago. Further, to meet the requirements of the commercial television network and the increased BBC television coverage, new vision circuits have been needed in considerable numbers. These have been established principally by building new radio routes which form part of the network ultimately envisaged. As a result, many hundreds of miles of microwave radio routes have already been constructed or are being built. When the full capacity of the coaxial cables on the same routes has been used, telephone equipment will be added to the radio links. Thereafter for some years, the provision of large numbers of new trunks on these routes will be by radio.

One of the problems of using radio is to extend the circuits into the trunk exchanges in the centres of cities in face of the difficulties imposed by the erection of increasingly high buildings. This can be achieved in one of two ways. The radio station outside the city can be placed on the highest convenient ground available, as at Manchester and Bristol, and the circuits completed into the centre by coaxial cable, or by building a high radio tower in the centre of the city. The 500-foot tower now being built at Museum Telephone Exchange will bring six trunk radio routes into central London and will at the same time enable short-distance radio links to be provided for trunk and junction working as needed.

The conversion of the trunk and junction network to high-frequency working, whether by cable or by radio, reduces the amount and cost of plant along the length of the circuit at the expense of providing very large quantities of terminal transmission equipment. This terminal equipment, which at present is being approximately doubled every six or seven years, could result in both expense and delay in building new repeater stations. It is hoped, however, to avoid this. Modern equipment designs using miniature components with transistors in place of valves have reduced the space occupied by high-frequency terminal transmission equipment to one-tenth in the past 10 years. Further progress is likely during the next five years. The effect of this will be that the space remaining in repeater stations can be used much more effectively. Additional equipment can be installed often in a crowded station by replacing old and bulky equipment at the end of its useful life, and installing modern compact equipment. The power consumption of the new equipment is much less than that of the old and the space occupied by power plant is also reduced.

One problem in meeting the increased demand for trunk circuits is the load placed on repeater station staff in bringing new equipment into use and lining up new circuits. To some extent the difficulty is eased because so many of the circuits are needed between high-frequency terminal stations. Except for their end connexions they are therefore available in blocks of 12 at least. To assist still further the Engineering Department has suggested that where possible main route circuits should be ordered in units of 12 so as to fit the standard of the high-frequency network.

Staff

Up to the year 1958-59 additional trunk circuits —those over 25 miles long—were provided at the rate of about 1,000 a year; in the current year the number of new circuits will approach 5,000. To enable this greatly increased number of circuits to be provided the effort of the repeater station staff has to be available where it can produce the greatest effect. The Engineering Department has gone to considerable trouble in the past to find routings for individual circuits when the direct routes were full and several existing circuits have often had to be rearranged to enable one new one to be provided. It is no longer generally practical to do this and sometimes it may be necessary to overlook individual circuits where there are difficulties in provision to enable larger quantities on other routes to be set up.

Looking further into the future the Engineering Department is working on the standardization of routings and the possible use of a computer so that circuit records and circuit routings can be mechanized.

The Personnel Department

THE Personnel Department shares with its twin, the Establishment and Organization Department, the main responsibilities for staffing the Post Office.

Oversimplifying, it is the job of the Establishment and Organization Department to decide the grading and number of posts needed for the work of the Post Office, and the pay, hours and annual leave applicable to those posts. It is the job of the Personnel Department to determine how the posts shall be filled, and to look after the main questions to do with the conduct and care of staff and of the Post Office's relationships with them as individuals and with their Staff Associations.

The annual cost of staff in pay, pensions, and so on, amounts to two-thirds of all Post Office working expenses—just under half in the telephone service and about three-quarters in posts and telegraphs—so efficiency in every aspect of staff work is as vital as in the rest of our operations. It is vital not only for good business reasons but for the well-being of the men and women who make the Post Office what it is.

Most personnel policies are greatly dependent for their practical effectiveness on the foresight and skill in staff management of local managers throughout the Post Office and on Regional Directors, their Staff Controllers and other senior officers to whom extensive powers are devolved. This is implicit in all that follows about the work of the Personnel Department.

The Appointments Branch is responsible for the policy and procedures of recruitment and promotion. To make selection more efficient new methods are always evolving. Moreover, with full employment, we must seek to foster public interest in Post Office careers, and to assess the changing educational and economic factors which govern the supply of recruits, in relation to our own changing pattern of demand. Such assessments have in recent years led us to redouble efforts to recruit more A-level people, for example, as

(Left to right seated): Mr. A. HIBBS, Assistant Secretary, Staff Branch; Mr. J. M. NEWTON, Director; Mr. R. J. S. BAKER, Assistant Secretary, Training and Welfare Branch. (Standing) Mr. C. G. OSMOND, Controller, Investigation Branch; Mr. R. MARTIN, M.B.E., Assistant Secretary, Appointments Branch; Mr. D. C. BALAAM, Assistant Secretary, General Branch; Mr. C. McCARTHY, Commandant, Management Training Centre.

Assistant Engineers and Telecommunications Traffic Superintendents, and to secure a larger future supply of good graduate engineers through the new Student Apprenticeship Scheme.

Though the extension of opportunities for higher education points to this need for more recruits at higher levels, it is equally necessary to make the best use of the capacities of all recruits and particularly to see that those with ability entering at junior levels should have good scope for advancing up the ladder. Many different ways and means help to these ends—the apportionment of vacancies at higher levels as between promotees and direct recruits, further education and training, the development of talent by managers and supervisors, selection procedures which encourage cross-promotion of promising people from one field to another, and promotion pooling schemes and redundancy measures designed to reduce inequalities produced by changing events.

In conjunction with operational departments, the Personnel Department makes many individual appointments including those of Telephone Managers and most of their more senior staff. This simple statement summarizes many hundreds of man-days of selection board interviewing each year and many subsequent headaches in determining individual promotions.

The Training Division has an advisory role in respect of most operational training, which is controlled by the respective departments. But it is more directly responsible for clerical and executive staff training, including that of Telephone Area staff, and it runs the Headquarters Training Centre where many thousands of Instructors have first learnt something about teaching methods. The Personnel Department is also responsible for the Management Training Centre at Eastbourne.

The Staff Branch, the General Branch and the Welfare Division are between them responsible for general policy in many important fields too diverse to summarize adequately—health, and medical retirements; discipline; rights and responsibilities in relation to political and other activities outside the job; accident prevention—which is currently under close study; compensation for accidents and the difficult associated problem of criminal attacks on Post Office people; uniforms; subsistence and travel; personal and occupational welfare services; and superannuation. Except in this last field, most case-work has been devolved. But the Personnel Department still retains some—the local staff work for all the administrative departments at Headquarters, and the more exceptional or serious cases arising elsewhere. The Post Office employs about 1 in 65 of the working population and in so large a cross-section of humanity practically everything that men can do or suffer happens to Post Office people—and often the Personnel Department is somehow involved. This case-work experience is a useful safeguard against any tendency to forget the people behind the policies.

The Investigation Branch exists to detect crime against the Post Office and to advise operational Departments on preventive measures. This is the one Personnel Department branch whose staff are dispersed throughout the country and themselves undertake all their own field operations. Their work is of course mainly concerned with crime in the postal, counter, remittance and savings services, but there is a busy Telephone Section which discreetly tackles quite a variety of dishonest practices.

Negotiation and Consultation

An important Staff Branch function is responsibility, on the official side, for the machinery of negotiation and consultation with the recognized Staff Associations both individually and collectively through the two Whitley Councils and their many offshoots. For example, the Branch organized with the Associations concerned the changes in local Whitley arrangements which became necessary when control of telephone operating staff in certain areas began to be transferred from the Head Postmaster to the Telephone Manager. On new developments it advises other Post Office departments on appropriate methods of staff consultation and, from time to time, it helps to overcome temporary difficulties in the working of the consultative machinery.

The Personnel Department as a functional arm of the administration aims at serving both management and staff. To do this it tries when framing its policies to take into account both management and staff opinion. Few instructions are issued without full consultation with the interested Headquarters departments, with Regional Directors, and through them with local managers. Equally, of course, almost every aspect of personnel work is of the closest interest to the Staff Associations and the Personnel Department is continuously in consultation with them on a multitude of topics.

Everyone has his own opinion on how best to handle human problems, but a tradition of goodwill helps to secure a large measure of agreement.

Telecommunications Engineering Consultative Services

R. B. Dickinson, M.B.E., A.M.I.E.E.

IN very many countries today the telecommunications services are being greatly expanded to meet growing social and economic needs. Not all the administrations concerned have the background of experience which the British Post Office has gained throughout the long years since it assumed complete responsibility for national telegraphic communications in 1870, and almost complete responsibility for the United Kingdom telephone service in 1912.

It is therefore quite natural that the telecommunications administrations of those countries, many of which are members of the Commonwealth, should turn to the British Post Office for advice and assistance, and to United Kingdom manufacturers for those types of equipment which have stood the test of time in this country.

This assistance is given in a variety of ways, according to the individual requirements of the countries concerned. Help can be given to some countries by training key personnel in various aspects of telecommunications engineering; in others, problems of planning, installation or maintenance can best be solved by senior officers from the overseas administration visiting the Post Office Engineering Department and discussing with specialists the subjects with which they are immediately concerned or the projects for which they will be responsible. Straightforward technical enquiries can usually be answered by letter, and supplemented by Engineering Department standard drawings or specifications.

Many overseas administrations and telephone companies which have adopted United Kingdom equipment and British Post Office methods use our Engineering Instructions. As an indication of their world-wide distribution, nearly 200 files of Engineering Instructions have been set up in places so far afield as Hong Kong, St. Vincent, and the Falkland Islands. By arrangement with the Post Office Supplies Department each file is kept up-to-date by newly issued Engineering Instructions and amendments to existing ones.

Facilities for studying all aspects of telecommunications practice are provided for students from overseas administrations. Training facilities afforded to engineers from those administrations and similar telecommunications authorities are such as to cover telecommunications engineering for all concerned with planning, installing or maintaining systems which use the types of equipment standardized by the Post Office and manufactured in the United Kingdom. This particular aspect of the technical service rendered to overseas telecommunications administrations was dealt with in the Spring 1958 *Journal* by Mr. A. O. Milne in his article on "Training Commonwealth and Foreign Engineers".

Last year training programmes were arranged for 149 engineering students from overseas. Some came to the Engineering Department as holders of scholarships awarded by such authorities as the Council for Co-operation in South and South East Asia (the Colombo Plan), the International Civil Aviation Organization, the United Nations Technical Assistance Administration, the United Nations Programme of Technical Assistance, Organization for European Economic Co-operation, the British Council, the Federation of British Industries and the Nuffield Foundation. The majority, however, were accepted for training at the request of and by arrangement with the overseas administrations concerned. At any given time more than 40 junior engineers from about 20 different countries were simultaneously undergoing training.

To augment this training and to enable visiting engineers to discuss specialized equipment or to

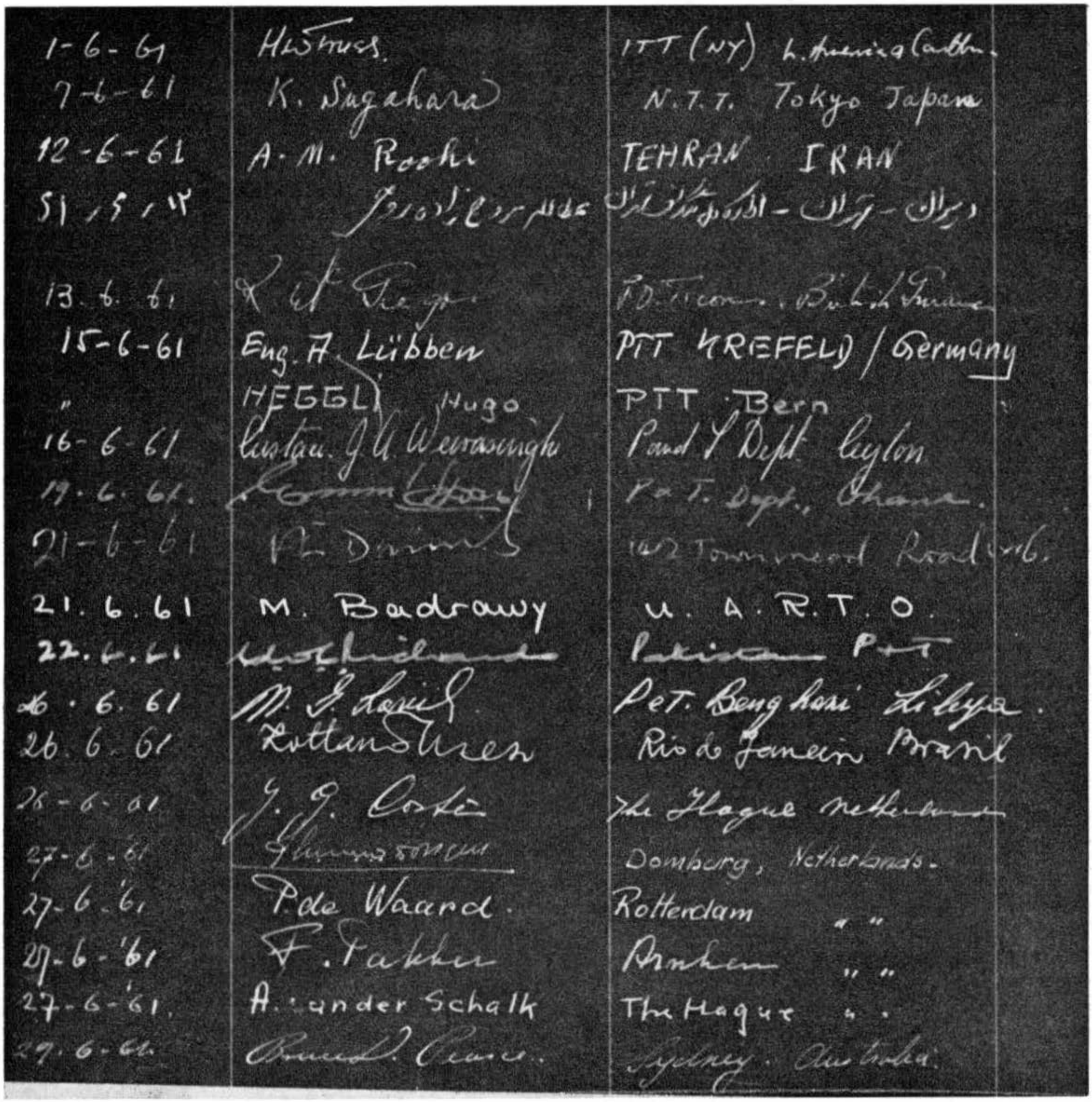


Fig. 1: World-wide visitors

see manufacturing methods arrangements are sometimes made, with the collaboration of the British Council, for short periods of attachment to selected equipment manufacturers.

Answering technical enquiries, receiving visitors and trainees from overseas and the provision of engineering documentation to other countries are some of the responsibilities of the Engineering Department's Consultative Services Group. By the nature of its work, and the service it strives to give, the Group is perhaps better known in such places as Helsinki and Hong Kong, Khartoum and Karachi, Stockholm and Sydney and Teheran and Tokyo, than by many here in the United Kingdom.

Briefly, the Group's function is to assist overseas telecommunications administrations and their representatives who visit the United Kingdom, by endeavouring to obtain any technical information required concerning British Post Office methods and procedures in matters relating to telecommunications engineering.

The greater part of this advisory service, which is also available to applicants in the United Kingdom, is given by written replies to enquiries about telecommunications engineering practices, procedures and equipment; some 2,000 such enquiries are received each year from as many as 77 different countries. Many of these technical enquiries received through the post are dealt with simply by supplying copies of appropriate standard Engineering Instructions, drawings or diagrams, but replies to the majority can be prepared only after they have been carefully considered by the relevant specialist branches of the Engineering Department. Some indication of the scope of this type of service can be gained from the following list of the subjects of 36 technical enquiries received from 13 countries which were in hand on one day recently.

Bank cleaning tools and 3,000 type relays	Lamp signalling
Service observations	Mechanization of telephone accounting
Methods investigation	Electrolytic corrosion problems
Gas pressure alarm systems	Joint use of power poles
Selector gauges	Line connectors
Dust-proofing of equipment	Exchange power plant
PVC bank insulation	Tester for pulse regenerators
Contact cleaners	Relay timing testers
Lubrication of selector banks	Cathode interface in valves
Loudspeaking telephones	Selector banks
Inspection of radio equipment	Barretters
Rotary detents—2,000 type selector	New MDF and fuses
Uniselector cleaning brushes	1st code selectors
Rural carrier equipment	External plant construction
New type MDF	Allocation of radio frequencies
Stamp vending machines	Test desks
Caribbean Area telecommunications plan	Factory repair of telephone dials
	Conference repeaters
	Cleaning procedures in Post Office factories

Arrangements are made for engineers from overseas to have discussions with suitable technical experts of the Engineering Department on subjects and specific projects in which they are particularly interested; about 175 such visitors are received yearly. Fig. 1, extracted from the Consultative Services Group Visitors' Book, shows some of the visiting engineers who took advantage of the service during the month of June. The two visitors who arrived on June 21 came from the Postal and Telegraph Department of Ghana and the United Arab Republic Telecommunications Organization.

Post Office engineers on loan to overseas telecommunication administrations in an advisory capacity have recognized the value of the service in enabling them to secure rapid and authoritative information on subjects which may be outside their own immediate responsibility.

Nearer home, the Consultative Services Group is technical adviser to the Board of Trade, Colonial Office, Commonwealth Relations Office, and the new Department of Technical Co-operation, in matters concerning the export of telecommunications equipment and the selection of candidates to fill overseas telecommunications engineering appointments. Assistance is also given to film companies by technically editing scripts and checking illustrations for films dealing with telecommunications matters, and to the Public Relations Department in all matters concerning engineering publicity.

Wide Variety

Undoubtedly there are very many jobs in the Post Office which require a more profound knowledge of detail but there can be few which offer such variety and such a wide field of interest. With about thirty letters coming in each day and the same number to be sent out there is no lack of opportunity for action.

While correspondents from all over the world continue to seek information about United Kingdom telecommunications practices there is every reason for satisfaction. Considering present projects to use artificial satellites as intermediate stations in terrestrial communications, it may be that in time communications will be established with other inhabited worlds; when that time comes the Consultative Services Group will be prepared to add these to its ever-growing list of enquirers.

The Electronic Engineering Association have issued at 3s. *A Guide to the Repair of Printed Board Assemblies*.

They point out that certain assemblies are either heavily coated or potted in epoxy resin; they are classed as throw-aways and repair is not practicable. The scope of the *Guide* is therefore limited to assemblies where there is either no such coating, or a thin coating of epoxy resin is used for protection.

The Post Office stand at the Radio Show (described in our last issue) attracted 203,000 people: 40 per cent. of those who visited the Show.

Cable Damage by Road Work

A. F. G. Allan, A.M.I.E.E.

"*Headquarters 4169? . . . LMD4/1? . . . Carlisle Repeater Station here . . . I have a fault report . . . Carlisle-Glasgow coaxial cable . . . tubes 1 and 2 disconnected . . . fault north of Lockerbie, but not yet definitely located . . . Suspected damage caused by road works . . . will let you know further details as soon as possible*".

SUCH a message is typical of the first report received in the Engineering Department of a major cable breakdown. A similar report is made for each cable fault which results in such a breakdown, whatever the cause. Immediate reporting is essential, for important decisions have to be made about arrangements for alternative routing of telephone traffic, or making a television channel available to the BBC or ITA without long delay and subsequent loss of programme time.

Over the past few years, strenuous efforts have been made by Engineering Department, Regional, and Area staff to improve the standards of cable maintenance, and they are well on their way to reducing to an absolute minimum most faults which in the past would have seriously interrupted service.

The present fault rate on trunk cables is not considered to be high; on every 100 miles of major trunk cable in the country—and there are some 44,000 miles of such cable—only ten faults are likely to occur in a year. Of these more than half will not affect service in any way. Nevertheless, the good maintenance engineer should be a perfectionist, and with the increasing application of gas pressurization to cables, maintenance staffs are beginning to look forward to the day when, although faults may still occur because cables are subject to hazards such as corrosion, cracked sheaths caused by metal fatigue, and defective joints, loss of service will be a thing of the past.

That great enemy of the cable maintenance man —*water*—will be unable to damage the conductors by entering a cable through a sheath fault; internal gas pressure will bar the way effectively. Catastrophic failures will be avoided and emergency call-out of precision testing and jointing teams in heavy rain in the middle of a Sunday night will become just a memory.

A perfect illustration of the way in which modern methods assist both the engineering and the operating staff when severe damage occurs

(above): Cables—unearthed by trenching machine—showing teeth marks

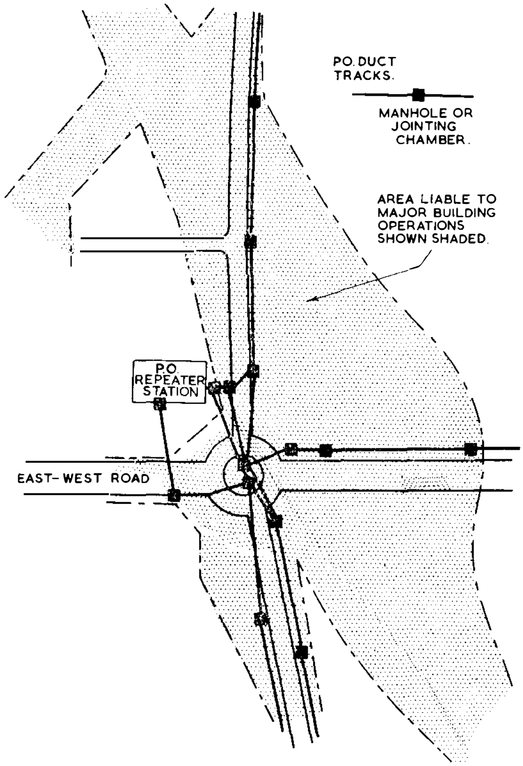


Fig. 1 (a): Present road plan

happened as recently as January 1961. An aerial cable in Home Counties Region, on which several small automatic exchanges depended for their sole outlet to the main network, was brought down by falling trees. Several spans of the cable, with the sheath cracked in a number of places, fell to the ground and for some distance lay in ditches filled with water. In the past, this would have meant an immediate serious breakdown. Dependent exchanges would have been isolated and emergency call-out of testing and jointing teams would have become essential. In addition, new lengths of cable would have been necessary to replace the water-logged sections. In fact, nothing like this happened as the cable was gas pressurized and no water could enter. The internal pressure was maintained by supplying additional gas at the main exchange end as it was lost at the cracks, and the cable continued to provide normal service.

However, the fault report message quoted above said " . . . suspected damage caused by road works . . . ", and nowadays nine out of ten of all such reports of major cable breakdowns result eventually in a final report of " . . . cable and duct torn up by bulldozer . . . " or similar damage caused during road works.

Such stress has been laid on the need for new roads, for the reconstruction of old ones to meet modern requirements, and so much money has been allocated to meet this demand, that every year new motorways and major reconstructions are in progress for hundreds of miles all over the United Kingdom. The emphasis is on speed of completion and with modern earthmoving machinery, such as scrapers, levellers, dumpers, and power-driven hand tools, the need for rapid work becomes even greater.

The magnitude of the difficulties facing both the road builders and Post Office planning, works and maintenance staffs, and the problems they have to solve, cannot be fully appreciated except when in close contact with the various projects. In a short isolated section of road works or a simple bridge reconstruction cables can usually be diverted for a period to put them out of the immediate danger area. But, today, the scale of construction is often so great that temporary diversions become impossible.

Two types of road operation present great difficulties and are the most serious causes of damage. First, there are the new main motorways. In general these traverse new ground over much of their routes and do not follow the traditional road system. In the open country motorway construction causes the Post Office little trouble but at some points a new motorway may have to drive right through an established junction.

Such a situation arises with the junction illustrated in Fig. 1. (*a*) shows the present road plan—note that all the roads are in the same plane—and that the Post Office duct and cable routes lie under the roads only where crossings are inevitable and the manholes are "safe"; that is, jointing parties and other Post Office men can enter or leave them without the risk of being knocked down.

The shaded area will be a major road "battlefield" before becoming the layout shown in Fig. 1 (*b*). It is not difficult to imagine the prospects of maintaining full and uninterrupted service on all the cables in the affected area.

Another type of difficult road reconstruction project is illustrated in Fig. 2. Here a small, though major, road which follows the natural valley contours is to be remade throughout into a dual carriageway trunk road, all the curves and grades being removed. The Post Office track and cables have to be completely renewed, but until the new road is substantially completed and the new duct track laid alongside, both the existing road and cables have to maintain a service. Service on the road can be restricted for many months, but it is hardly possible to restrict telephone traffic on the

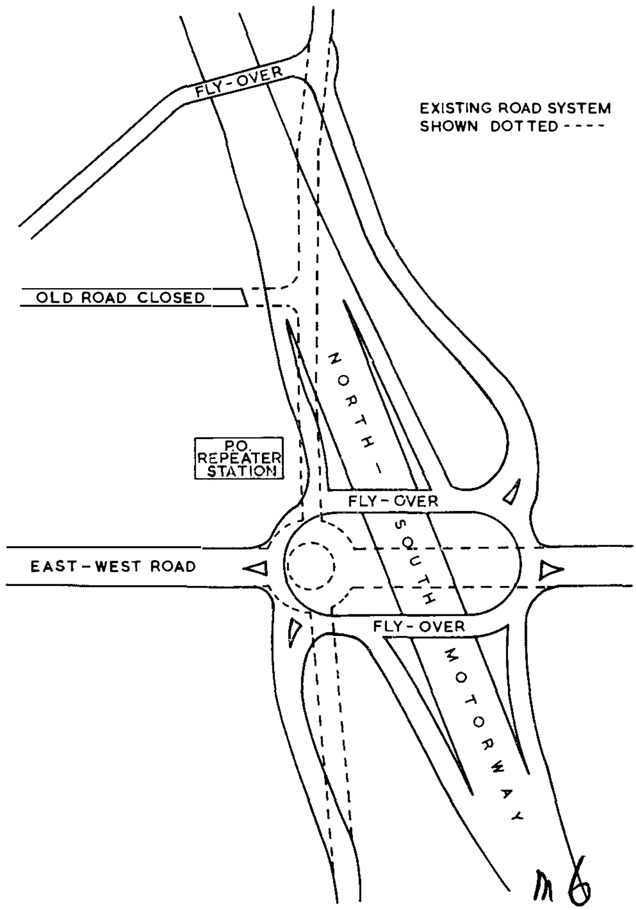


Fig. 1 (b): New road plan

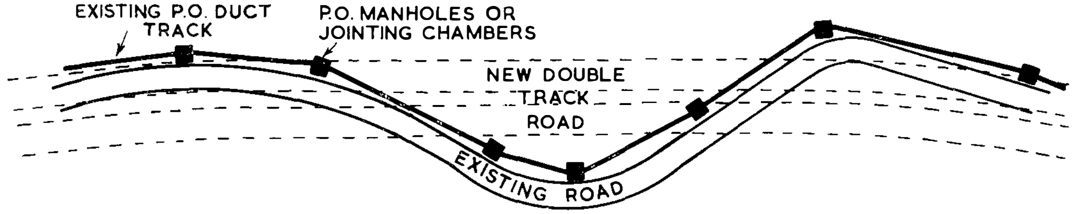
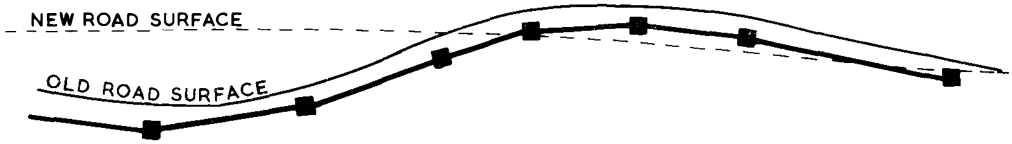


Fig. 2 : Change of line

Fig. 2 : Change of level



cables to the same extent and there is no chance of providing diversionary routes.

The situation illustrated in Fig. 2 occurs in many parts of the United Kingdom and it is not unusual for sections over five miles long to be dealt with at one "bite". In fact, on one 74-mile road, some 69 miles are being reconstructed on the lines of Fig. 2, and at any one time, three or four 5-mile sections may be at the mercy of bulldozers.

This extract from the MU (main underground) cable statistics gives an indication of the problem caused by damage:

Year	*Number of Damage Cases*
1948-9	109
1955-6	265
1960-61	333

It is significant that in the five year period 1955 to 1960 the number of cases of damage increased by nearly 50 per cent., although the number of miles of main underground route increased by something less than 10 per cent.

To these figures must be added a similar number both on junction (CJ) cables and the local distribution network. But the worst effects are felt in the main network—the spinal cord of the system—where breakdowns can have serious results on the service, particularly under Subscriber Trunk Dialling (STD) conditions.

The Post Office Engineering Department is taking every precaution, but many aspects of this problem are outside Post Office control. A national road scheme is planned, but the execution of the work is devolved on County authorities who in their turn place contracts with road builders. The Post Office must be advised of the intended works and should be in a position to move its plant to a safer route if there is any likelihood of danger during the road operations. But, understandably, County plans are rarely static. As time goes on the opportunity to incorporate new techniques arises and plans are altered—for instance, roundabouts and fly-overs may be introduced.

If the Regional or Area engineers find that existing tracks are liable to be damaged they tell the road contractors the exact line and depth of the Post Office plant. The contractor's maps are marked and the line of the track is marked physically on the site with wooden pegs on the grass verge, or by paint lines or other markers on the road surface if the track lies under the road. Post Office engineering staff then act as watchers and the contractor's foremen are taken over the route. But one watcher cannot be allocated to every workman and even when the duct track is carefully marked (in some places the track may be exposed so that there is no doubt about its existence) damage occurs.

Fig. 3: Cables damaged during bridge building

Fig. 4: Shattered 6-way duct

Even with closest co-operation between the Post Office, the County authorities and the road contractors there is always the possibility of an accident. Fig. 3 shows an example of this where a bridge-building operation should not have concerned the cable track in any way. The building operations on the new bridge, however, affected the supports of the older bridge and its side collapsed. The cables, all of which were damaged, can be seen hanging in a loop. Other accidental incidents show clearly the dangers of lack of close supervision. In some instances failure of the man at the controls of the road-building equipment to have the necessary information results in damage to the cables.

Fig. 4 illustrates one such event. Although the line of the Post Office track had been notified the bulldozer completely shattered the 6-way duct track, damaging many cables. The position of the original track is shown by the single complete section of duct underneath the marking board, just to the right of the centre of the picture. The cables have been repaired and have been moved to the left and lowered below the original line.

It might be argued that it was short-sighted of the Post Office to lay cable tracks under or alongside roads. It must be realized, however, that in many parts of the country an alternative route would be impracticable owing to the topography of the terrain. Even where direct cross-country tracks are practicable wayleaves would have to be negotiated with numerous landowners. There is a distinct advantage in following the roads because access for cable-laying and for maintenance is easier when transport of heavy stores and equipment is necessary.

There can be little doubt, therefore, that the reasoning which determined that Post Office cable routes should follow the natural lines of communication—the roads—was correct. But in an era of rapid modernization and expansion of the road system, it certainly creates a big problem for those responsible for the daily working of the cable system.

Fleet Building

An earlier article in the *Journal* described the planning of Fleet Building, which was formally opened in April this year. The building houses the automatic telex switching exchange, which gives access to the whole of the United Kingdom, the Continent and other places abroad. It has many interesting features, which make it an ideal setting for London's new telecommunications centre.

Built on a site which is situated within the City of London, it is approximately square in shape and has a frontage of 230 feet to Farringdon Street, 250 feet to Stonecutter Street, and 230 feet to Shoe Lane. It consists of 15 floors, the lower six being designed to take heavy loading for Post Office equipment, and the upper nine floors for lighter office loading.

The plan of the building was dictated by operational requirements, and was chosen to suit Post Office apparatus lay-out at street level in Farringdon Street. A number of murals and display cases have been provided to add interest and to exhibit Post Office activities. The whole of the Stonecutter Street frontage at street level is taken up with the Refreshment Club.

An assembly hall fitted with a stage meets the requirements of both official and social functions of the Post Office and the staff, and there are facilities for showing films. Two nearby conference rooms can also be used in conjunction with the assembly hall.

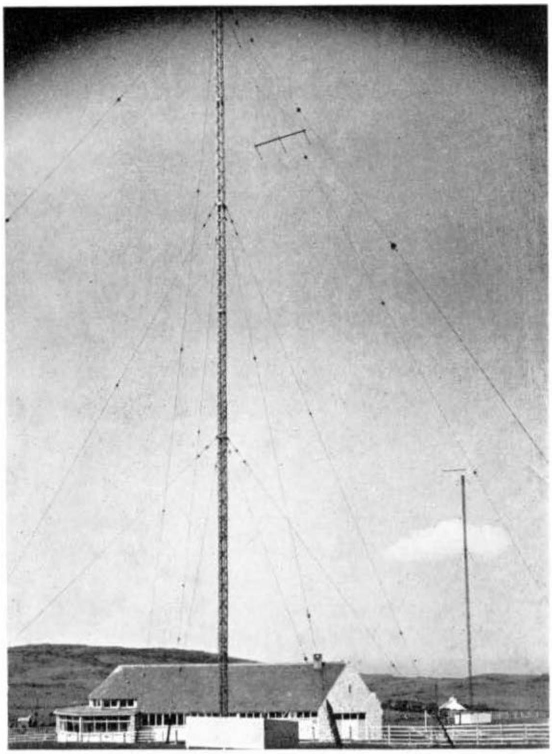
Part of the sixth floor has been specially designed as a recruitment centre. Here, telephonist staff will be interviewed, tested and medically examined for London Telecommunications Region. On the fourth floor a specially designed area is fitted for sales demonstrations, and existing and new equipment is on show. The accommodation has been designed to be as flexible as possible, with movable, fully glazed partitions. The top floor of the building is used for training. Rooms are provided for foreign language classes and telegraphic instruction, and special acoustical absorption is used in them and also in the corridor.

Until the ground floor apparatus space is needed for installation of equipment in a few years time, part is being used to provide additional room for engineering training. In about a year, London Inland Telegraphs will move into the building when the Central Telegraph Office closes down.

Medium and Short Range Ship-Shore Radiotelephone Services

G. F. Wilson

Two previous articles have appeared in the Journal *on the Ship-Shore Radiotelephone Services. In the Winter 1958 issue Mr. N. Bourdeaux described "Medium Frequency Radiotelephony for the Merchant Navy". The Autumn 1959 issue carried an article by Mr. L. T. Arman on "VHF Maritime Services". Both dealt with new developments. In the present article the author brings the story up to date, and describes the use which has been made of these developments since the services were introduced.*



Anglesey Radio Station

RADIOTELEPHONE service for ships at sea was first made available through Post Office coast radio stations in 1928. The object was to bring public correspondence and safety services within reach of the smaller vessels on which it would be uneconomical to employ a skilled morse operator.

In those early days the service was confined to the exchange of radiotelegrams: there was no way of connecting ships to the inland telephone system. However, by 1934 a "simplex" system had been devised which enabled calls to be made between ships and telephone subscribers on shore, but this arrangement permitted only one-way speech. The operator had to follow the conversation, switching the channels manually from "send" to "receive", as necessary. The Engineering Department was, of course, alive to the need for apparatus which would permit full two-way conversation in the manner of an ordinary telephone call and by 1938 they had produced a prototype voice operated device for this purpose. At this time service was available only through selected coast stations and the annual load was about 3,000 radiotelephone calls and 50,000 radiotelegrams.

After the war the service grew rapidly and until recently all available resources had to be devoted to meeting the needs of those small vessels that depended entirely on radiotelephony for their safety and public correspondence service. Recently, however, two important developments have been possible. First, the provision of Very High Frequency (VHF) short range service relieves the congested 2 Mc/s bands and provides service for those ships that carry radiotelephony primarily for port operations. Secondly, additional 2 Mc/s channels have been made available to give service to passengers on deep sea ships. Today, telephone connexion between suitably equipped ships within 250 miles of the United Kingdom coast and telephone subscribers on shore can be established as easily as making an ordinary trunk call. The eleven coast stations now handle about 140,000 radiotelephone calls and 70,000 radiotelegrams each year.

Fig. 1: Landsend radiotelephone operating position

Naturally, the rapid development since the war has involved a number of interesting engineering and operating problems. Among these are utilizing to best advantage the limited number of radio channels available, developing suitable transmitting, receiving and terminal equipment and providing operator controls to give maximum flexibility in the use of this equipment.

Frequency Usage

The demands for frequencies in the 2 Mc/s bands used for the medium range service are very heavy, indeed so heavy that there is little likelihood of obtaining more space in this part of the spectrum for maritime mobile services. When it is considered that the rate of growth of radiotelephone service has been even greater in the Scandinavian and North Sea countries than in the United Kingdom it will be appreciated that during peak hours the medium frequency channels are almost intolerably congested. To meet this situation two lines of development are possible. The first is to encourage ships to use VHF for their communications when they are within range of coast stations equipped to use the international VHF maritime mobile channels. With this in mind coast stations in the densest shipping areas—Humber, North Foreland, Niton and Landsend—have been equipped for VHF service. If the demand warrants similar provision will be made at other stations in the future.

The second measure is to encourage use in the Medium Frequency bands of single sideband (SSB) emission, which has been successfully and quite extensively used in high frequency services for some time. At present the international medium frequency service uses double sideband (DSB) emission which is wasteful of spectrum space. It requires a bandwidth equal to double the highest audio frequency in the emission; in theory at least. If SSB were universally adopted for the MF service the channels available would be doubled.

Unfortunately, there are a number of problems, particularly in regard to the international calling and distress frequency (2182 kc/s), that will have to be resolved. Nevertheless it is the United Kingdom view that useful progress can be made by encouraging those ships that do not depend on 2182 kc/s for their safety to use SSB for public correspondence service. Accordingly, when Anglesey, Landsend, Niton and North Foreland were equipped to give passenger ship service transmitters and receivers were installed which are capable of either DSB or SSB operation. The large passenger ships are being encouraged to fit similar equipment and a number have already done so. In fact, when in May this year s.s. *Canberra* established SSB communication with Landsend Radio, the United Kingdom became the first country to use SSB for medium frequency public correspondence service.

In the post-war re-equipment of the coast stations multi-purpose transmitters were installed which were capable of giving either telegraphy or telephony on a number of frequencies, thus providing very good reserve against breakdown and maximum flexibility of operation. Variable tune receivers were used to permit reception of any of the ship-shore channels. These arrangements were entirely satisfactory for the small craft service, particularly at those stations where only one, or occasionally two, channels were needed. However, where a multiplicity of channels is needed provision of a multi-purpose transmitter for each channel would obviously be uneconomical. For this reason single channel transmitters and receivers have been installed for the VHF and passenger ship services.

Terminal Equipment

In order to achieve duplex working in the ship-shore service separate radio channels, with adequate frequency separation, are used for the "send" and "receive" paths. This is equivalent to a 4-wire circuit. The engineering problem is therefore to extend the 2-wire landline to the 4-wire ship-shore circuit in such a way that speech incoming from the landline is fed to the modulator of the coast station transmitter and kept out of the receive circuit. Speech from the ship is fed to the landline and prevented from reaching the transmitter. The latter is particularly important because a leakage from the ship-shore path to the coast station transmitter would constitute a feed-back loop causing "circuit howl".

From the pre-war prototype radio terminal equipment quite complicated apparatus was developed for the high frequency (HF) point-to-point services. However, for the medium and short range services the requirements are not so stringent: for example, it is unnecessary to provide against deep fading. It was therefore desirable to use less complicated and relatively inexpensive equipment for these services. The Voice Operated Device with Constant Amplifier (VODCA) developed for the Thames Radio Service adequately met the MF medium range service requirements and was adopted as standard equipment for the small craft service.

Principal Components

Briefly VODCA has three principal components:

a hybrid transformer which effects the junction between the two radio channels (outward and inward) and the two-way landline. In the outward direction the speech modulates the transmitter at a level which is rendered constant by the action of a constant volume amplifier (CVA). In the inward direction the speech operates a thermionic valve relay (TVR) which, in effect, disconnects the transmitter;

the CVA which ensures that a constant level of modulation is maintained despite variations in the length of landline and subscribers' voices, and

the TVR which is, in effect, a voice operated switch that "gates" the transmitter from "send" to a quiescent condition when receiving.

The VODCA does not provide a duplex circuit in the normal sense, but its voice operated switching permits duplex working so long as ship and subscriber do not talk at once.

Although VODCAs have served well in the MF service they have some inherent weaknesses. For instance, when receiving signals from extreme range there is some liability for the TVR to operate by peaks of noise or heavily modulated signals on adjacent channels, resulting in clipping and clicks. While these effects are tolerable to the experienced small craft user, they would obviously be undesirable in the VHF and MF passengers' services which have been introduced in the past year or two. Accordingly, the Engineering Department has evolved a new Voice Operated Constant Amplifier (VOCA) which is used with a separate hybrid transformer and an expander in place of the VODCA. The principal difference in this arrangement is that the "gate" circuit has been dispensed with. The expander serves to reduce noise level

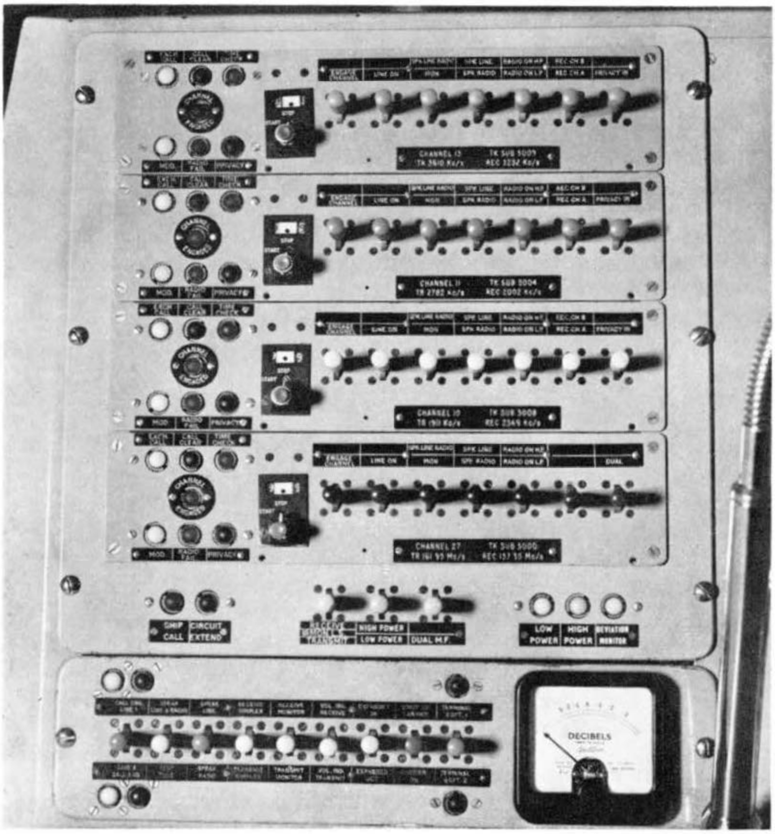


Fig. 2: Landsend radio control panel

during pauses in speech and in the absence of speech so that, under normal operating conditions, a "gate" is unnecessary. The VODCA is not only suitable for the VHF service for which it was designed, but is also used for the 2 Mc/s passenger ship channels.

Operating Controls

The standard radiotelephony operating arrangement adopted in the post-war re-equipment of the coast stations consists of a console containing a variable-tune receiver and remote controls for the transmitter and VODCA, as well as landline connexion and dialling facilities. These controls enable the operator to select any unoccupied transmitter, to change from telegraphy to telephony as required, to select the required frequency and to transmit or receive at will. The VODCA panel enables him to speak to either ship or landline subscriber, or both together, to adjust levels as necessary and monitor both sides of the conversation. The operator can avail himself of any free transmitter but he can work only one ship at a time.

The higher quality calls obtainable in the VHF and passenger ship services means that an operator can work two calls simultaneously, and the control panels at the "passenger ship" stations—Anglesey, Landsend, Niton and North Foreland—have been designed to take advantage of this. Fig. 1 illustrates these arrangements at the radiotelephone operating positions at Landsend Radio. Landsend, in addition to its small craft equipment, has three remote passenger ship channels, that is single channel transmitters and receivers, and remote VHF calling and working channels.

The operator can control any of this apparatus from the main radiotelephone console. The left hand panel provides selection and control facilities for the small craft transmitters; in the centre there is the small craft variable-tune receiver and above it test and performance check facilities for the remote VHF equipment. The three top left-hand strips are the controls for the 2 Mc/s passenger ship channels, below these is the VHF control panel (a double strip) and at the bottom the controls for the small craft service VODCA. The operator at this position can, when circumstances permit, work two passenger ships; a passenger ship and a small craft; a passenger ship and a ship on VHF, or a small craft and a ship on VHF.

The passenger ship and VHF controls are "multiplied" to the second working point on the extreme left of the picture. Thus the operator at this auxiliary position is capable of picking up spare capacity from the main position to work ships in similar combinations.

The number and lay-out of control panels varies from station to station according to the number of channels provided. The close-up (Fig. 2) shows how the three passenger ship channels, VHF and small craft VODCA controls have been brought together at Landsend. It also gives some idea of the engineering "know how" that went into the evolution of the control panels and the operating skill needed to take advantage of the facilities provided.

Intermodulation Products and Aerials

This has been a survey of the services as seen through operational eyes, but there is another and perhaps more interesting story yet to be told. That is the account of how intermodulation and similar problems inherent in operating a multiplicity of channels from one site have been overcome and how an aerial has been developed which simultaneously carries three 2 Mc/s transmissions.

A Telephone for Subscribers with Weak Voices

W. T. Lowe

There are a number of telephone users who are extremely handicapped because they can speak only in a soft whisper, at such a low level, in fact, that they are virtually inaudible on a telephone. Sometimes this disability is only temporary, such as after a severe throat operation, and normal speech may return after several months if the vocal chords are not overstrained during that period. In other circumstances the affliction is permanent, perhaps caused by a lung complaint or malfunction of the vocal chords. Whatever the cause or the duration of the complaint, a weak voice imposes a severe limitation on a person whose work involves frequent use of the telephone.

Several years ago a special telephone—No. 262 CB—was developed to assist these subscribers by amplifying their speech signals. Its transmission performance is quite satisfactory but it has shortcomings because it includes a valve amplifier using dry batteries which require frequent replacement. Also the equipment is bulky and draws attention to the user's affliction. In addition, an old style 200-type telephone is used and the amplifier cannot readily be adapted for use with the new 700-type telephones.

A modern equipment using a transistor amplifier has now been developed to overcome these difficulties and replace the earlier telephone. It consists of a small amplifier unit used in conjunction with a standard Telephone No. 710. The two items are shown in Fig. 1. The amplifier unit is usually mounted out of sight under a desk or on a skirting board. When the "ON" key on the telephone is depressed the amplifier is switched into circuit and all speech signals are then considerably amplified and transmitted to the telephone line. At the end of the conversation the "ON" button is automatically released on replacing the handset on its rest, thus ensuring that the amplifier is not inadvertently left switched into circuit. This is important when the telephone may be used by another person speaking normally as the high level signals which would then be transmitted could distress a subscriber at the distant end.

The "OFF" key is provided so that changeover from the amplified condition to normal can be

Fig. 1: Telephone and amplifier unit

effected while a call is in progress. There are two vacant push button positions on the telephone available for other purposes, enabling this equipment to be used on different types of installations. The older valve version can be used only on direct exchange lines. The subscriber also has a choice of the standard range of colours available for telephone instruments.

The amplifier unit consists of a small plastic box, 6 x 5 x 2 inches, housing the transistor amplifier components. These are readily accessible when the cover is removed, as shown in Fig. 2. The amplifier requires no dry batteries as it draws its power from the telephone line. This is very

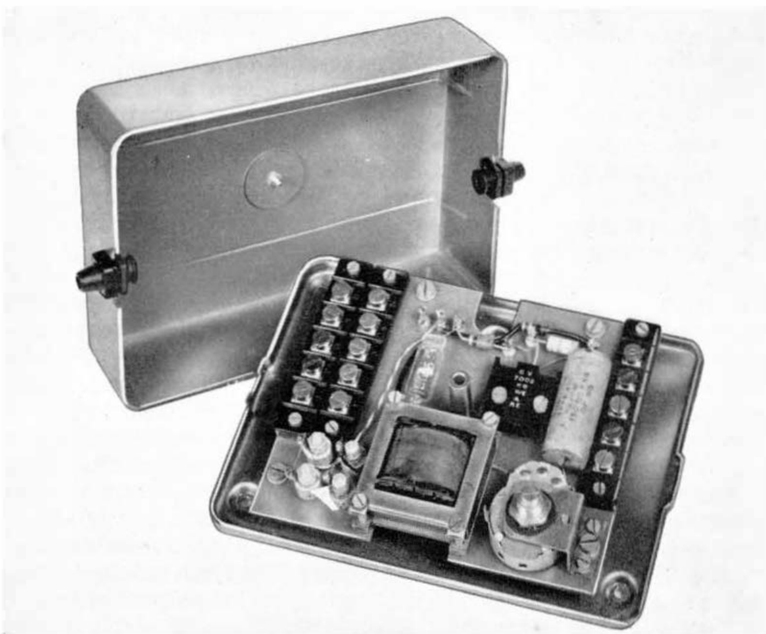


Fig. 2: Layout of amplifier unit

convenient from a maintenance point of view but it raises a problem in the design of the amplifier because telephone line voltages vary over a wide range. An amplifier designed to work on the lowest voltage might be damaged by the higher voltages. The difficulty has been overcome by introducing stabilizing components in the amplifier circuit to compensate for changes in the line voltage.

The gain of the amplifier can be altered by a potentiometer control shown at the bottom right of Fig. 2. It is adjusted by the installation officer so that the subscriber's speech is transmitted to line at approximately the same level as that from a subscriber with normal voice. This is judged by a simple listening test carried out at a distant telephone. When using the faint speech telephone the subscriber hears the normal level of sidetone in his receiver while talking. The presence of the speech amplifier introduces slight attenuation of the incoming speech signals but the effect on intelligibility is negligible.

It is confidently expected that subscribers will find this new amplifying telephone easy to use and of considerable help to them. In some instances they may even find that the effort required to speak on this instrument may be appreciably less than that required for normal conversation.

Telecommunications Statistics

	Quarter ended 30th June, 1961	*Quarter ended 31st March 1961*	*Quarter ended 30th June 1960*
Telegraph Service			
Inland telegrams (excluding Press and Railway) ...	3,056,000	2,809,000	3,086,000
Oversea telegrams:			
Originating U.K. messages	1,611,180	1,612,965	1,593,251
Terminating U.K. messages	1,589,335	1,605,658	1,555,448
Transit messages	1,326,267	1,367,833	1,399,936
Greetings telegrams	757,000	673,000	725,000
Telephone Service			
Inland			
Gross demand	149,296	161,853	123,022
Connexions supplied	129,428	133,425	108,415
Outstanding applications	174,007	169,825	145,432
Total working connexions	5,104,344	5,036,827	4,835,104
Shared service connexions	1,145,757	1,141,780	1,129,676
Total inland trunk calls	114,100,000	107,776,000	100,918,000
Cheap rate trunk calls	27,633,000	24,294,000	22,700,000
Oversea			
European: Outward	843,376	793,938	753,375
Inward	802,987	767,105	719,950
Transit	3,885	3,500	3,325
Extra-European: Outward	74,737	75,006	69,082
Inward	85,314	84,147	77,073
Transit	19,115	18,346	17,055
Telex Service			
Inland			
Total working lines	7,476	7,089	6,181
Calls from manual exchanges	*	*	487,000
Manual Calls from automatic exchanges (including Assistance and Multelex)	2,000	3,000	264,000
Metered units	17,255,000	15,849,000	†5,315,000
Oversea			
Originating (U.K. and Irish Republic) ...	483,876	827,024	648,142
Terminating (U.K. and Irish Republic) ...	see note	see note	607,574
Transit	15,984	16,504	11,577

* Conversion to automatic working completed December, 1960. † Amended figure.

Note. Since the introduction in several European countries of subscriber dialling of oversea telex calls statistics of incoming calls are not available in the United Kingdom.

OUR CONTRIBUTORS

A. F. G. ALLAN ("Cable Damage by Road Work") is a Senior Executive Engineer in the Engineering Department Main Lines Development and Maintenance Branch. He entered the Post Office in 1932 as a Youth-in-Training attached to the Training Branch and was subsequently transferred to Research Branch, being closely concerned with the early development of 2-Frequency VF signalling systems. On the outbreak of war he was closely connected with the design, provision and installation of special line terminal equipment for Radar Station chains. Transferred to the War Group of Lines Branch in 1942, for four years he was concerned with RAF communication networks. From 1946 to 1949 he was on loan to the Air Ministry, returning to Lines Branch to assist with the communication build-up consequent on the return of the USAF to the United Kingdom. Since the middle of 1960 he has been responsible for the maintenance and development of the main cable network.

R. B. DICKINSON ("Telecommunications Engineering Consultative Services") is an Executive Engineer with Equipment Branch of the Engineering Department. Before joining the Post Office he spent ten years in Canada in telecommunications and hydro-electric engineering, followed by periods with two United Kingdom manufacturers installing telecommunications equipment for the Post Office. Early in the last war he was Technical Adviser to the Chief Signals Officer Anti-Aircraft Command and, at later stages, was adviser on Coast Defence and Anti-Aircraft communications to the New Zealand Army Headquarters and to the Chief Signals Officer, Allied Land Forces, South West Pacific. He will be well known to many oversea readers.

H. C. GREENWOOD ("CEPT Conference at Torquay") was Secretary of the Telecommunications Committee of the CEPT Torquay Conference. He entered the Post Office, from the Colonial Office, as an Executive Officer in 1952. After eight years in the Postal Services Department he was appointed Private Secretary to two successive Deputy Directors General, Sir Ronald German, CMG, and Mr. W. A. Wolverson, CB. On promotion to Higher Executive Officer earlier this year, he joined the Radio Services Department where his interests include matters affecting the International Telecommunication Union and other international organizations.

W. T. LOWE ("A Telephone for Subscribers with Weak Voices") entered the Post Office Engineering Department in 1936 as a Youth-in-Training in the Midland Region, and was promoted to Assistant Engineer in the Local Lines Branch of the Engineer-in-Chief's Office in 1948. In 1951 he moved to his present position as Executive Engineer in the Subscriber's Apparatus and Miscellaneous Services Branch.

T. A. O'BRIEN ("Public Relations and Telecommunications") has been Public Relations Officer of the Post Office since May 1952. Before the war he was on the advertising and marketing side of Rowntree and Co. and one of their associated companies and then with J. Walter Thompson Co., the well known advertising agents. He served during the war in the Royal Artillery. After the war he was first assistant to the Director of Public Relations, Board of Trade. He spent four years at the Home Office as Public Relations Officer before coming to the Post Office.

G. F. WILSON ("Medium and Short Range Ship-Shore Telephone Services") is an Assistant Inspector of Wireless Telegraphy in the Wireless Telegraphy Section of the Radio Services Department. He entered the Post Office as a Sorting Clerk and Telegraphist in 1927 and joined the Wireless Telegraphy Section as a radio operator in 1935. He served as Radio Officer in HMTS *Alert* from 1938 to 1942 when he came ashore to become Officer in Charge at Seaforth Radio. After serving as a Ship Radio Surveyor he was promoted to Radio Assistant Superintendent in Headquarters in 1952 and to his present position in 1958. His present work is the operation of the ship-shore radio services.

H. BARKER ("Meeting Increasing Demand for Inland Trunk Circuits") is an Assistant Engineer in the Engineering Department and is engaged on the planning and provision of the Trunk and Television Line Networks. He joined the Post Office in 1928 and after five years of Area work on local lines, he was transferred to Trunk Line work in the Engineering Department. He served with the RAF from 1939 to 1946 and has also had two periods of peace time secondment to the Air Ministry. On his return to the Engineering Department after the war he worked first in the Subscribers Apparatus and Miscellaneous Services Branch, and has been in his present job since 1953.

H. A. LONGLEY ("Tailoring Circuits to Service Needs"), a Principal in the Inland Telecommunications Department, is well known to readers as one of our regular contributors. His recent articles are "Charging for STD Calls", Winter 1959, and "New Trunk Switching and Transmission Plan" which he wrote jointly with Mr. A. J. Thompson, for the Summer 1961 issue. An outline of Mr. Longley's career is given in the Winter 1958 issue.

D. J. MARKS ("Trunk Circuits for STD in the Director Areas") is a Senior Executive Engineer in Main Lines Planning and Provision Branch of the Engineering Department working in the Lines Utilization Section at Dollis Hill.

Mr. John Innes, C.B., died on August 17, aged 72. He joined the Post Office as an engineer. From 1940 to 1942, until he joined the Ministry of Fuel and Power, he was Director of Telecommunications. He became Managing Director of Cable & Wireless, Ltd., when it was nationalized in 1947, remaining until 1950, when he became a director of Telegraph Construction and Maintenance, Ltd., until 1959.

Notes and News

Mr. John L. Young

John L. Young, Editor of the *Journal* since early 1952 retired on September 30. In those 9½ years there have been great developments in the world of telecommunications, and their comprehensive coverage and attractive presentation in the pages of the *Journal* owe much to John Young's editorship.

He joined the Post Office from Cable and Wireless Limited where he was Deputy Public Relations Officer; before that he dealt with the Commonwealth Press representatives at the Ministry of Information. So he came to many of the mysteries of telecommunications as something of a stranger and always declared his amateur status. However, this was really an asset in his work as Editor because most of the articles in the *Journal* are not intended for the experts in the field to which they relate but are for the general reader with an interest in telecommunications. John Young's fresh mind and his own gift for simple and direct expression often brought light into the more obscure passages and those overloaded with technical jargon.

If John Young was something of an amateur in the world of telecommunications he was certainly a complete prefessional in the worlds of printing and publishing. He acquired a profound knowledge of printing in his early days in the family firm in Nottingham. At one time he was editor of World's Press News. He contributed to the Penrose Annual and the Monotype Corporation Magazine, and his book "From the Manuscript to the Bookseller" had three editions and is still used today. From his great store of knowledge and experience in these fields he contributed many ideas for improving the presentation and printing of the *Journal*.

The task of the Editor is not an easy one. Articles are written voluntarily and the authors are invariably busy people with many other claims on their time. But John Young with his modest, unassuming manner could nevertheless show great persistence and tenacity of purpose in the pursuit of copy and always managed to produce an interesting and well balanced issue.

He had other Post Office jobs of course. He had a hand in most Post Office publications. It was also one of his duties to produce material on every Post Office subject under the sun for speeches by the Post Office Ministers at public functions, and he never seemed to be at a loss.

Readers of the *Journal* and the Editorial Board owe John Young a great debt of gratitude. His work for the *Journal* has made him a host of friends and he takes into his retirement the good wishes of every one of them.

* * *

Colourful Greetings.—Two new greetings telegram forms were brought into use in October. One is designed for all special occasions and the other for 21st birthdays.

A herald on horseback among a gay pattern of trees, flowers, ferns and ornamental grasses proclaims the general greetings, while the Key of the Door is the main theme of the 21st birthday form.

A sister for GRACE?—According to Bell Telephone Laboratories in the United States, a mechanical telephone operator called Audrey—Automatic Digital Recognizer—will eventually replace dials on telephones. Audrey will transform spoken numbers into electrical impulses and automatically obtain the numbers. However, as lisps, dialects and accents seem to confuse her intricate mechanism, she will not make her debut until she can understand any accent from a Texas drawl to a Scots burr.

* * *

Hearing Aid Handsets—A 700-type handset, incorporating a transistor amplifier in its handle, which was introduced for deaf subscribers has proved popular in use. So far, 5,000 have been fitted during the year.

* * *

Telephone credit cards are now valid for telephone calls made from Australia to the United Kingdom. The charges for such calls will be the same as for ordinary outgoing calls to Australia; that is, £3 for three minutes and £1 for each additional minute or part of a minute.

The Australian Post Office have also introduced a credit card facility which means that holders of these credit cards can make calls to Australia from the United Kingdom without payment at the time.

* * *

More than a quarter of a million telex calls—nearly 80 per cent. of the total oversea calls from the United Kingdom—are now subscriber-dialled to subscribers in nine European countries. Extensions to Italy, Finland and Norway are expected by the end of the year.

* * *

During the 22 days of Test matches this year, 5,980,199 calls were made to the telephone Test Match service. The record year was 1957, when 7,306,260 calls were made during the matches against the West Indies. Last year, 2,660,340 calls were made for scores in the Anglo-South African Test matches.

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

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

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

GPO

60,000

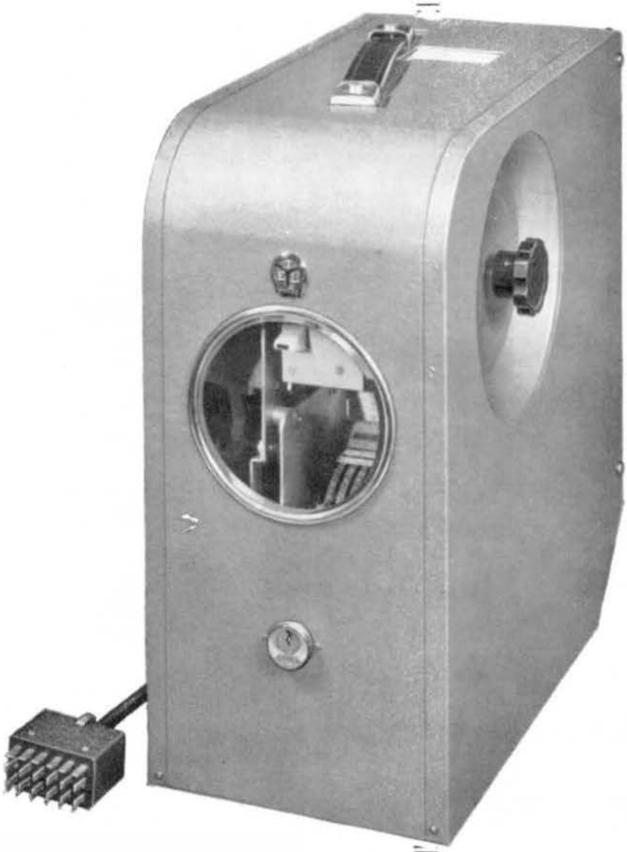
lines of print from the...

Designed specifically for recording the time of events on a Subscriber's telephone line, this RECORDER will print

FOR INCOMING CALLS:-
Time of connection, answer and completion.

FOR OUTGOING CALLS:-
Time of connection, digits dialled, meter pulses and completion.

ERICSSON printing recorder



Flexible in design, the unit can be readily adapted to other requirements and could find many applications in the field of data handling.

special features

- Autograph aperture for manuscript entries on record.
- Paper may be manually advanced with cover on.
- Paper may be fed out of the unit through rear of cover.
- Rear of base is cut away to permit wall, rack or table mounting.
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POST OFFICE TELECOMMUNICATIONS JOURNAL

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NEW CINTEL ALL-
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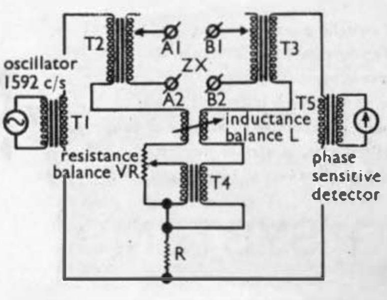
Accurate within ±one per cent of full scale on the inductance and resistance ranges -0·005μH to 30mH and -500μΩ to 3300Ω respectively.

THE BRIDGE is an all transistor version of the well-known valve model of the same name, which it now supersedes.

This new version retains the same rigid specification with the added advantages of greater scale length, increased accuracy, improved reliability, printed circuit construction, simpler and quicker operation from either mains or battery and no warm-up period.

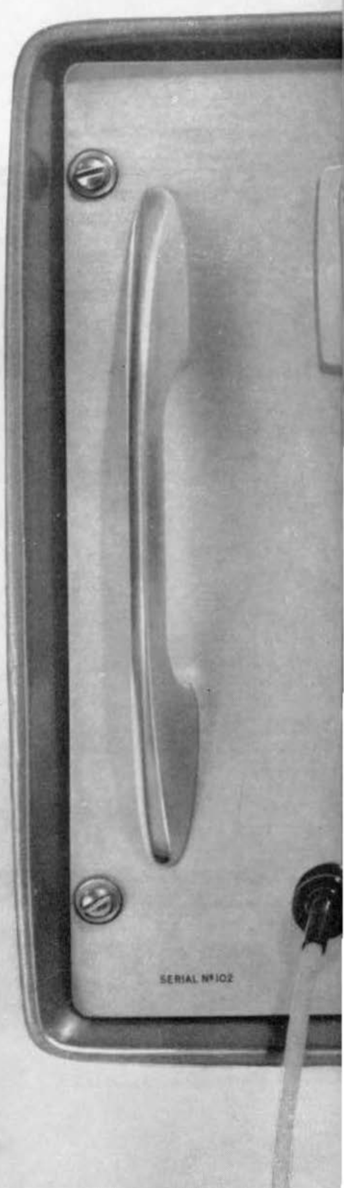
APPLICATION. The instrument has been designed essentially to meet the demand for a bridge capable of accurate low self or mutual inductance with a wide variety of applications.

It may be used to measure the a.f. Inductance of small coils which have a low Q value at audio frequencies, such as radio and television receiver tuning coils. It can also be applied to the measurement of correcting inductors, loading coils, the inductance of transmission lines, cables and circuit 'strays'. This latter application is particularly useful in high frequency circuits. The bridge may also be used for measuring any mutual inductance within its range; for example, that of I.F. transformers. A particularly useful application of mutual measurement is in the setting up of artificial transmission lines. Measurements can be made step by step along the completed line, each section being treated as a three-terminal network. Mutual resistance can also be measured with precision.



A further use of the bridge is for the accurate measurement of low resistance values, the first scale reading being 100 microhms.

A complete technical description is available on request to . . .



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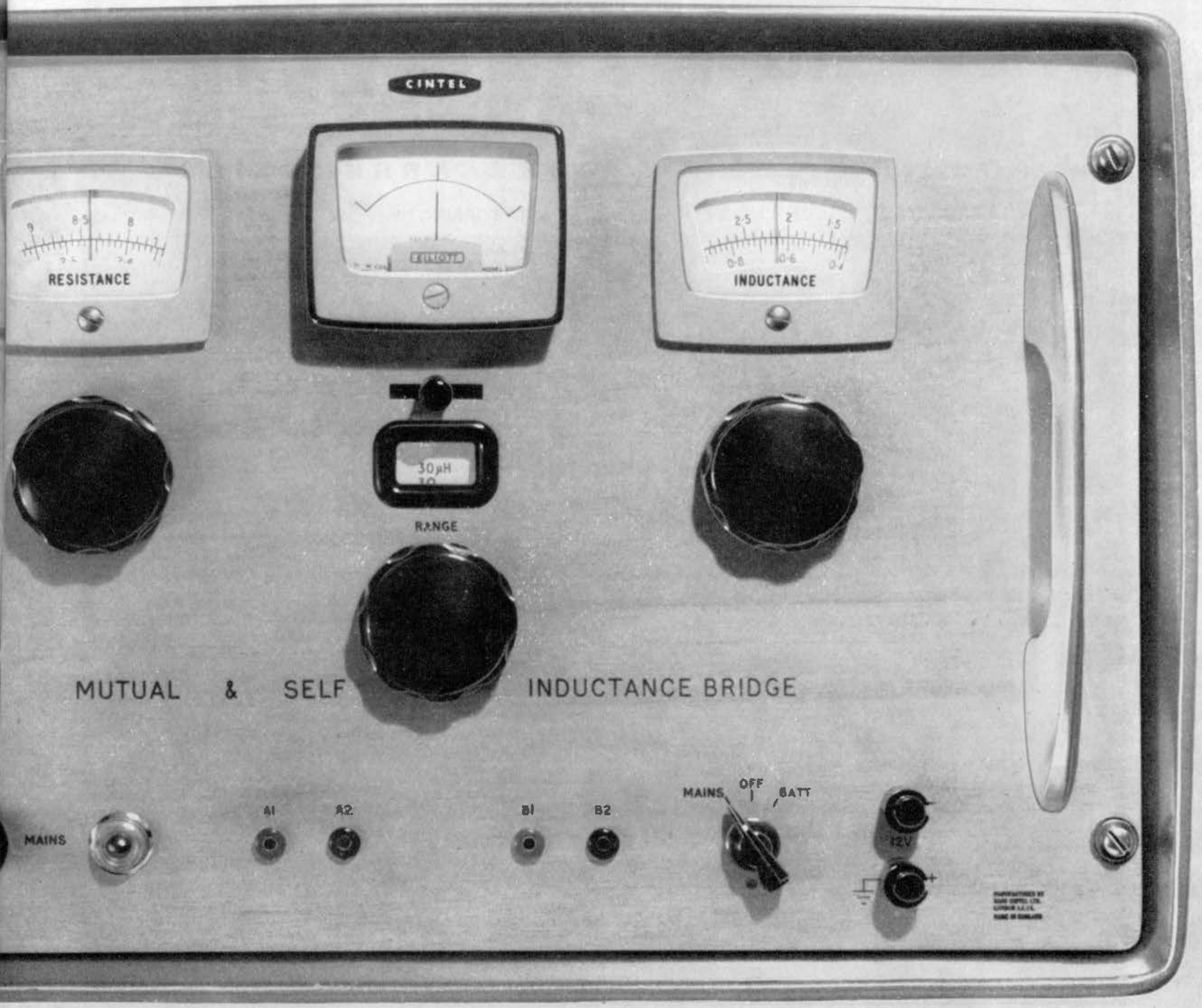

A NEW Military HF Packset, the HF 156

The HF 156 manpack Transmitter/Receiver is a thoroughly reliable, robust, fully sealed and entirely self-contained portable set for active service in extreme climatic conditions. Six crystal-controlled channels, extreme simplicity of operation and exceptional range on voice and CW are some of the many features that stood out during extensive User Trials in the Far East.

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

WIDER USE FOR STC lightweight headsets

R.M.S. Windsor Castle Radio Officer wearing STC lightweight headset.

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

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

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

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

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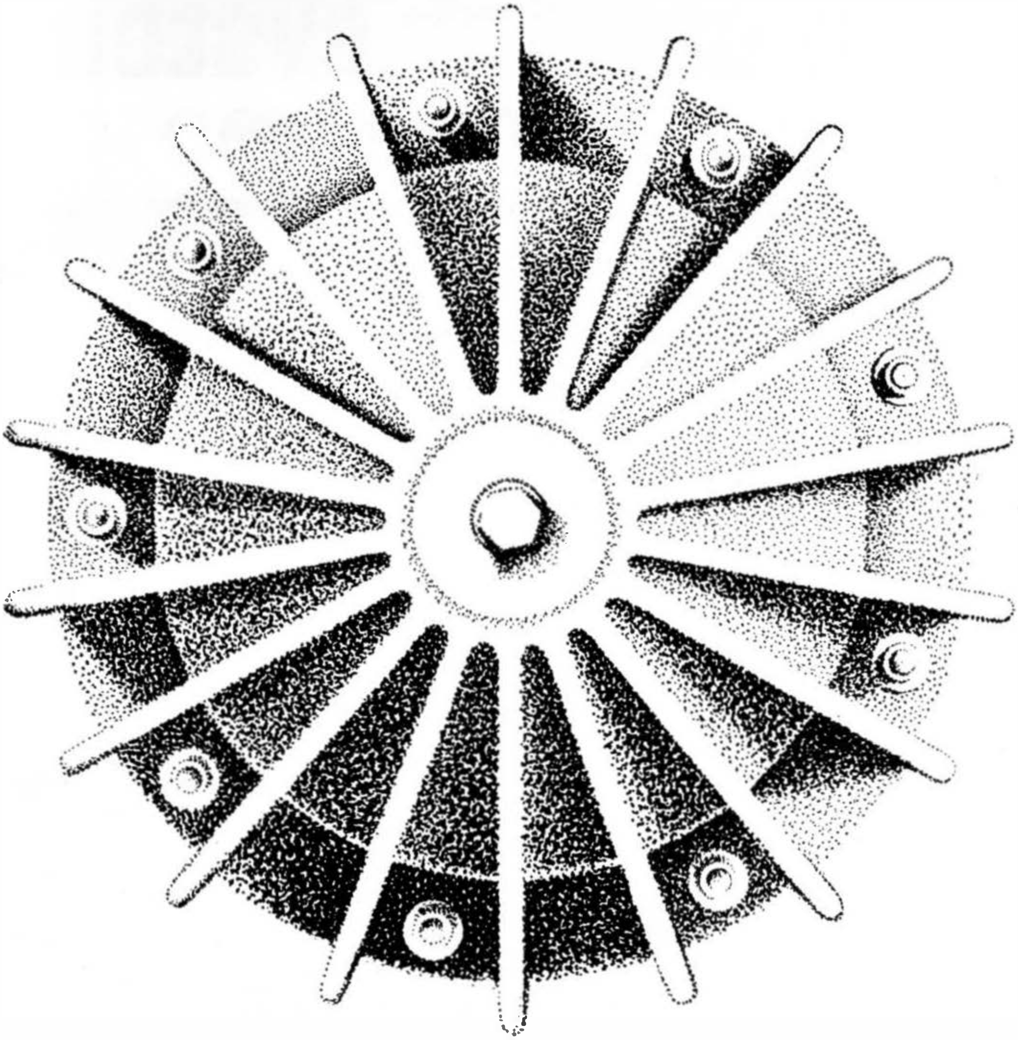
61/ID



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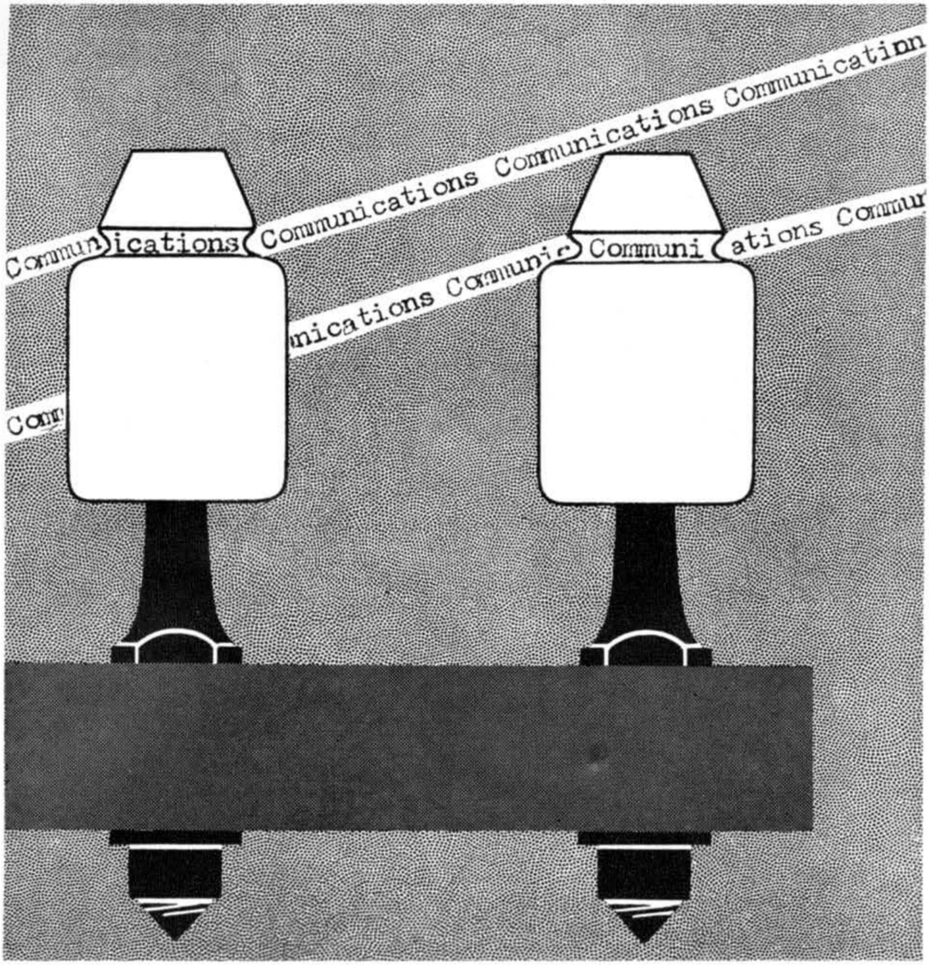

Spanning continents—linking nations—transmission lines carry the sound of civilisation to every corner of the globe. *They must not fail.* That is why so many of the world's leading Telephone Authorities specify BJB galvanised forgings and steel work. They know they can rely on them for years of safe, efficient service.

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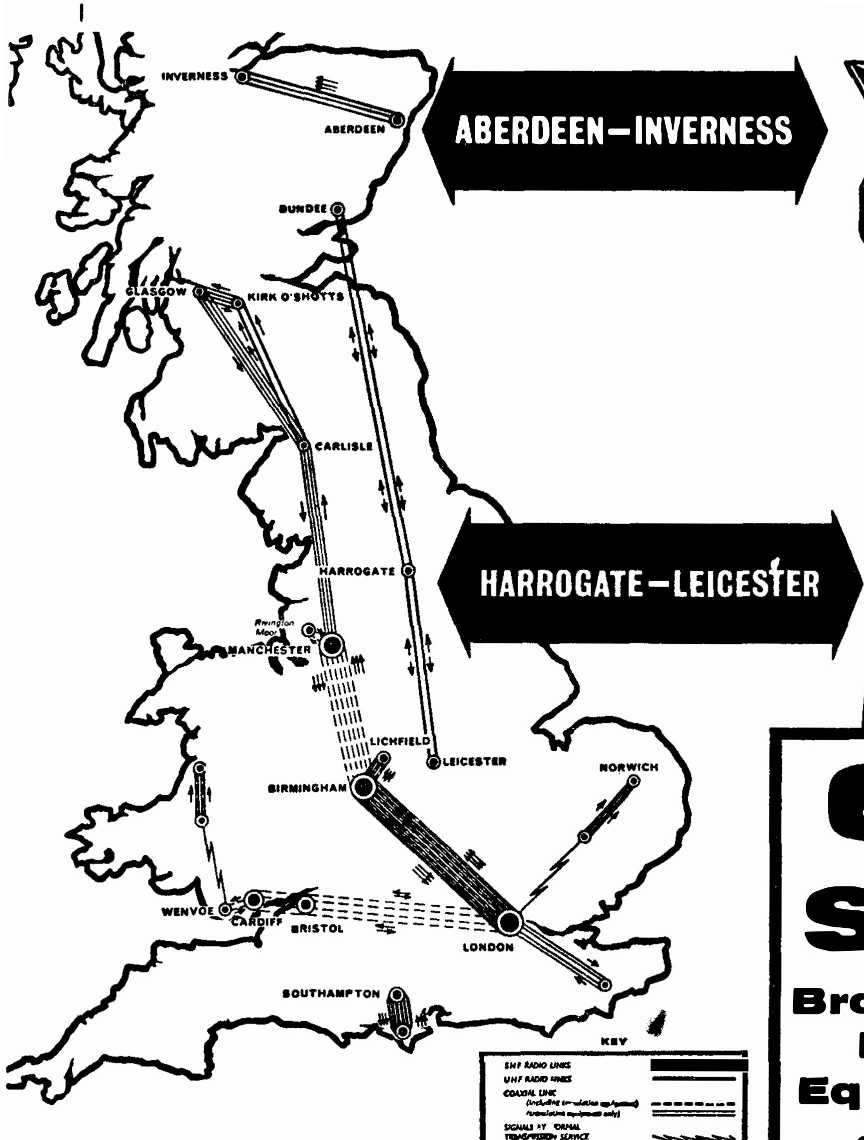

G.E.C. has been awarded contracts to supply and install three radio channels between Aberdeen and Inverness and two bothway radio channels between Harrogate and Leicester. The Harrogate-Leicester link is an extension of the link already announced between Dundee and Harrogate, and is the second stage of a new national broadband microwave network for telephony.

The North of Scotland link will carry television signals from Aberdeen to a new transmitter near Inverness.

Both systems operate in the 6000 Mc/s frequency band and can be extended by the addition of further RF channels. The equipment conforms to the latest CCIR recommendations.

For further information, please write for Standard Specification SPO 5555

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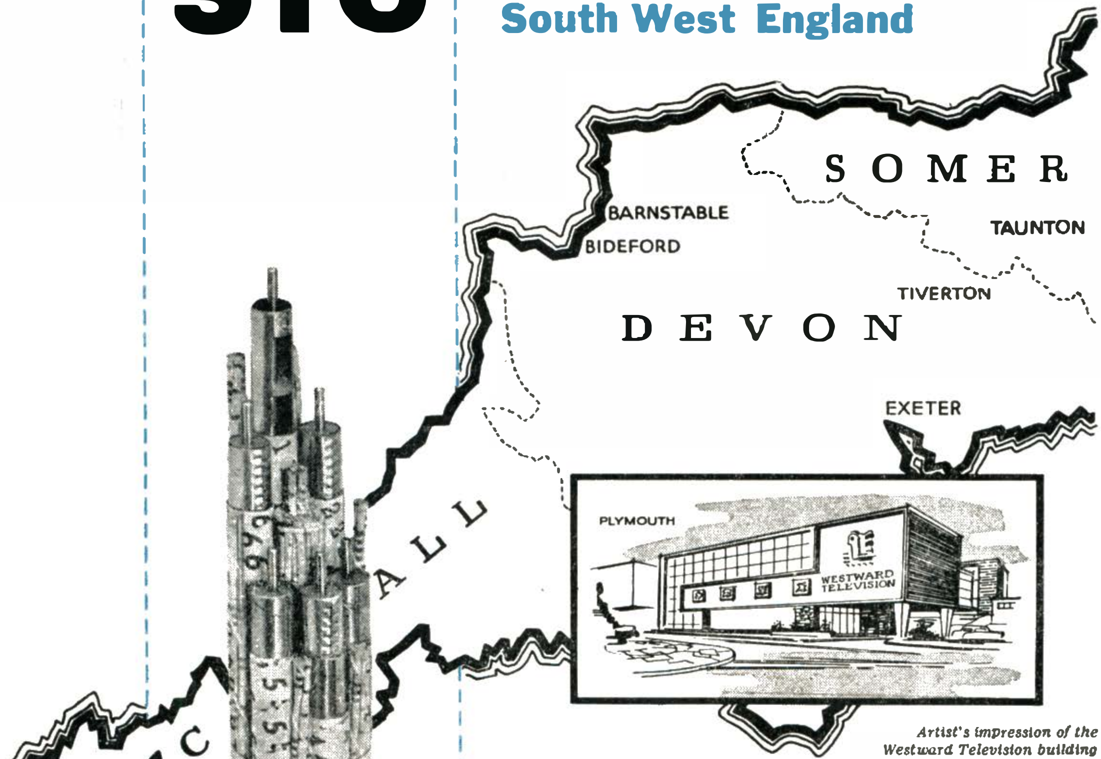
STC

TV CABLES FOR ITA
South West England



Artist's impression of the Westward Television building frontage, Derry's Cross, Plymouth.

Type 375 PDWI 6-core coaxial cable.

STC has manufactured, and installed in the Plymouth area for the British Post Office, coaxial cables Type 375 PDWI containing 4 and 6 cores. These STC coaxial cables, providing high-quality circuits, will be used to carry to the Independent Television Authority transmitter, programmes from the contractors, Westward Television Limited. Westward's coverage extends to Weymouth in the east and Weston-Super-Mare in the north.

ANOTHER STC COAXIAL CABLE FOR THE U.K. TELEVISION NETWORK

The new STC Telephone Cable catalogue, B/102, describes these and other cables and is available from

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61/7B