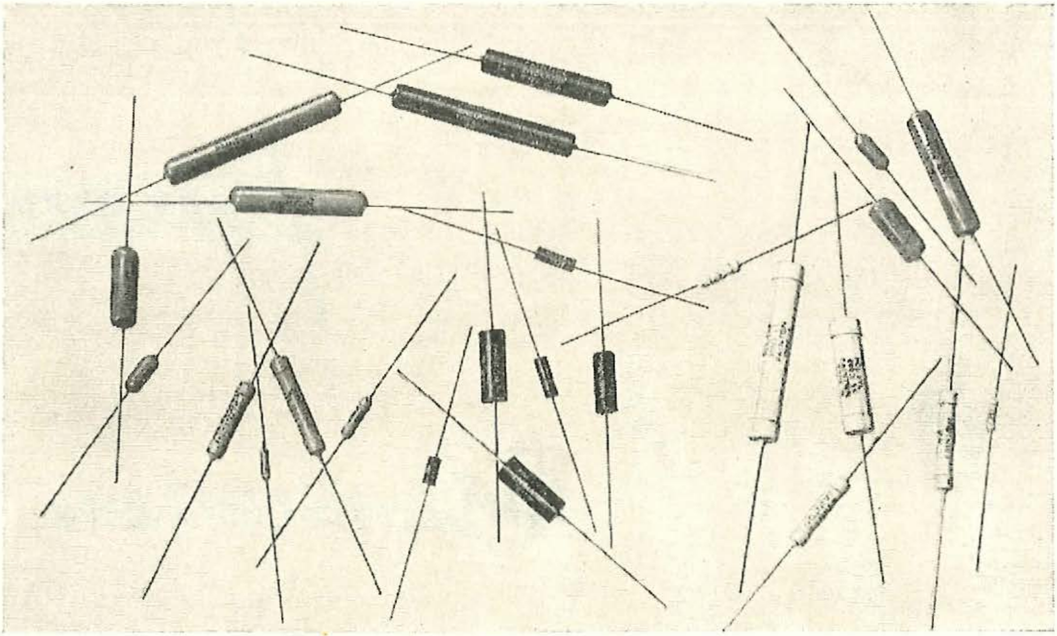
POST OFFICE

tele communications

JOURNAL

ONE SHILLING AND SIXPENCE

WINTER 1968



resistors...

from painton

Choose from Triple Rated Metlohm Metal Film Range, the finest Wirewounds or the High Stability Carbon Series and know that your equipment has the best resistors of their type.

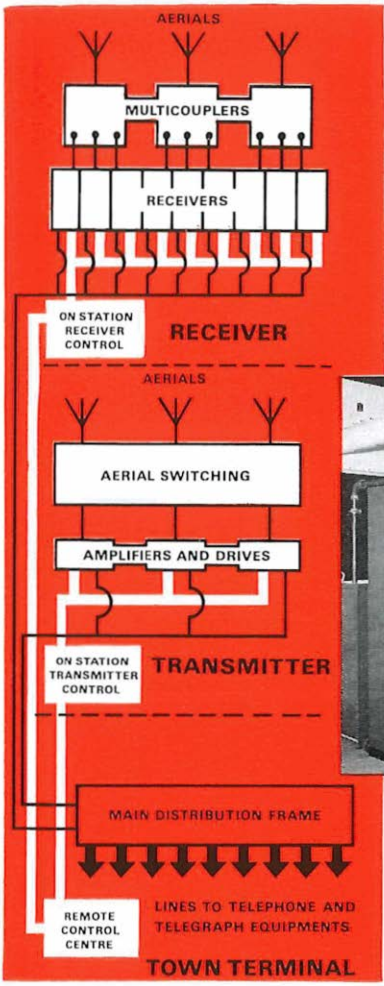
PAINTON

Painton & Co. Limited
KINGSTHORPE · NORTHAMPTON
Tel: 34251 (10 lines) Grams: Ceil, Northampton Telex 31576

AUSTRALIA Painton (Australia) Pty. Ltd. **U.S.A.** Painton Inc. **ITALY** Painton Italiana. **SWEDEN** Svenska Painton A.B. **BENELUX** Painton S.A. **GERMANY** Painton G.m.b.H.

STC Telecommunications

Cut the operational and maintenance costs of your HF radio station right now —with STANFAST

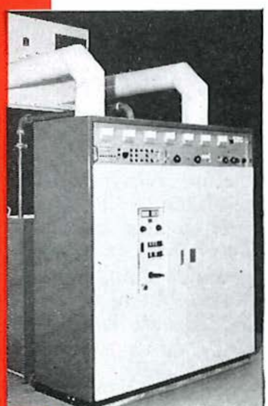


Here's how

STANFAST Systems — the STC concept of automated h.f. radio stations—permit transmitting and receiving installation to be controlled completely by one man from a central location.

STANFAST Systems provide high speed frequency changing, automatic performance monitoring and rapid fault location affording optimum traffic handling capability and maximum revenue.

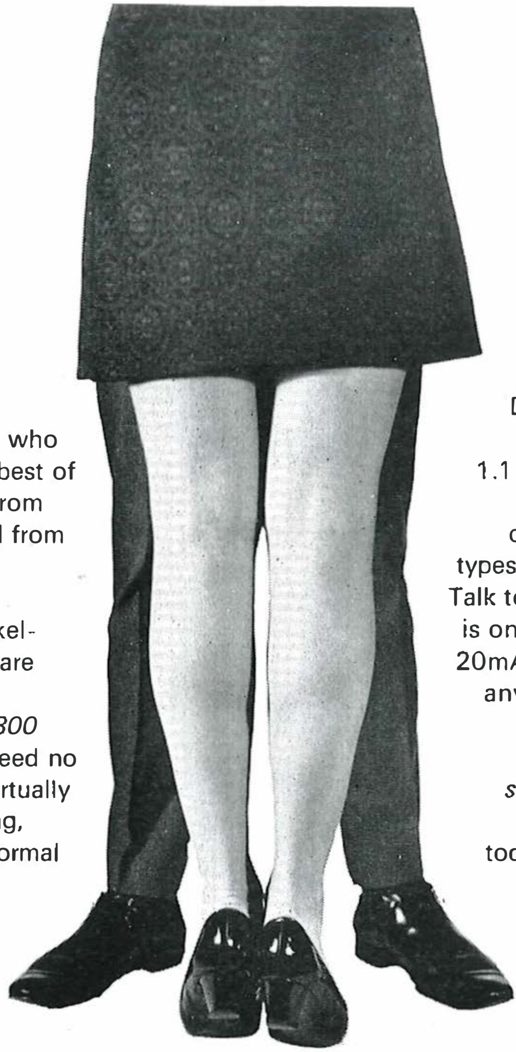
STANFAST Systems use the latest techniques in radio design, demand smaller sites and require less maintenance than hitherto. Initial capital cost is lower and return on investment is greater.



7-10kW ISB AND GENERAL PURPOSE H.F. TRANSMITTER AMPLIFIER TYPE QT 3-A/4
A self tuning linear amplifier suitable for ISB and DSB telephony and single or multi-channel telegraphy.

Standard Telephones and Cables Limited,
Radio Division, Oakleigh Road,
New Southgate, London, N.11.
Telephone: 01-368 1200. Telex: 261912.

Standard Telephones and Cables Limited



DEAC people are *very* co-operative. Designers who come to DEAC get the best of both worlds—freedom from trailing power leads and from the waste of short-lived primary batteries.
DEAC rechargeable nickel-cadmium accumulators are hermetically sealed and *guaranteed for at least 300 charging cycles.* They need no maintenance, and are virtually immune to over-charging, over discharging, and normal physical abuse.

Design small: the smallest DEAC button cell weighs 1.1 grammes. Design bigger: the DEAC range includes cylindrical and rectangular types up to capacities of 23Ah. Talk to DEAC while your design is on the drawing board. From 20mAh to 23 Ah—any voltage, any shape—DEAC can solve your d.c. power problems with compact, reliable, *sealed secondary* batteries. Please write or telephone today for the latest technical information.

You'll be surprised what goes on at DEAC

to give you the most versatile power sources available . . .

Design around a

DEAC

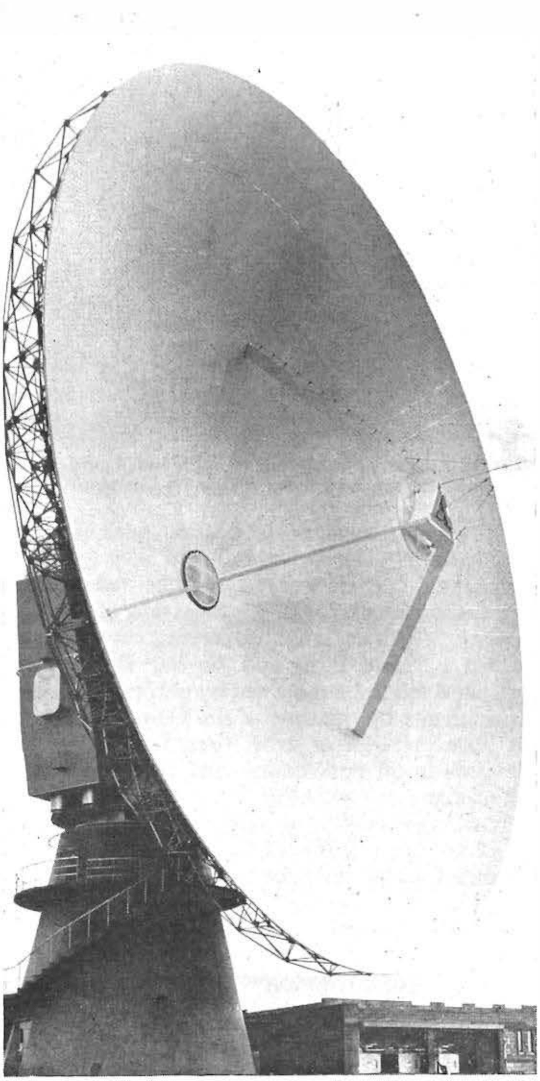
DEAC (Great Britain) Limited, Hermitage Street, Crewkerne, Somerset. Tel.: Crewkerne 3366

Deac Manufacture button cells and their batteries and import Varta cells for distribution and for battery construction.

G.E.C.

LIVE BY SATELLITE FROM MEXICO

By W. G. GEDDES



The Tulancingo earth station in Mexico from which all the television pictures were sent across the Atlantic to Goonhilly, Cornwall.

MILLIONS of television viewers in many countries had a grandstand view of the Olympic Games in Mexico and were able to watch the events as they happened—in black-and-white and in colour.

This was yet another notable achievement in the history of satellite communications since, although television by satellite has lost much of its earlier novelty and is now an accepted means of bringing world events to the viewers' screens as they happen, nothing on the scale of televising the Mexico Olympics had ever been attempted before.

The measure of the success of the operation was nearly 200 hours of high-quality picture transmission which was used by the broadcasters in Europe and elsewhere, either live or recorded, in their television programmes covering the two weeks of the Olympic Games.

Television coverage on this scale required international co-operation and co-ordination of the highest order, and planning began almost a

OVER

IN THIS ISSUE

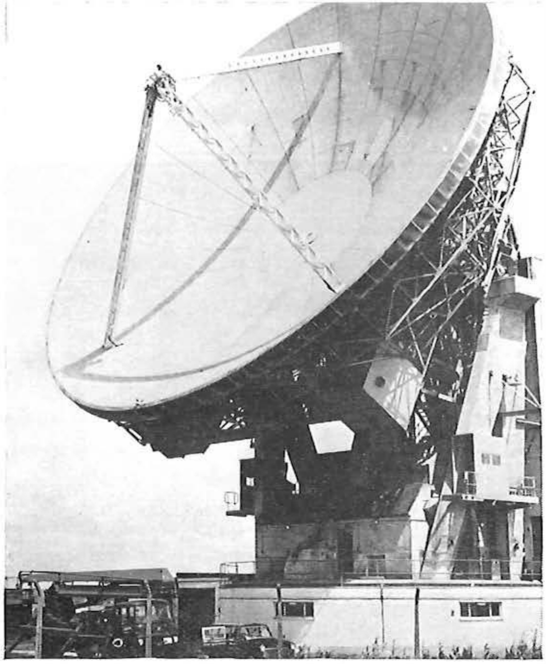
An aerial view of the 80,000-capacity Olympic Stadium at University City, Mexico. Pictures and commentaries went from here by microwave to Tulancingo earth station and from there to Europe.

year before the start of the Games. In Europe, the BBC and the British Post Office played leading parts. The European telecommunications administrations nominated the British Post Office to coordinate Europe's television requirements with the BBC who acted on behalf of the European Broadcasting Union, and the broadcasters selected the BBC, which had developed Europe's first colour converter, to convert the 525-line American NTSC colour standard to the 625-line PAL standard used by most European countries. The broadcasters also nominated Goonhilly as the earth station for reception of the television transmissions from Mexico.

The earliest considerations were quick to show the possibilities, but it was only too clear from the beginning that there were likely to be many snags. The main difficulty was the provision of satellite capacity. The two satellites serving the Atlantic, *Intelsat* I (Early Bird) and *Intelsat* II-F3, were both expected to be saturated by normal telephony requirements by the time of the Games, and held out little prospect of other than limited use for television in off-peak hours—and even that at the risk of many uncertainties.

By far the most promising solution was to use the first of the new *Intelsat* III satellites which was scheduled to be launched over the Atlantic, a

Below: Engineers monitoring satellite transmissions at the main operating console at Goonhilly. Right: Map shows the locations of the earth stations and satellites used for TV and radio coverage of the Games.



The Goonhilly No. 1 aerial, suitably modified, received the TV video signals from Mexico.

month or so before the beginning of the Games, and this formed the basis for the primary plan. While this satellite could cater for most of the requirements, the margin for bringing it into service in time for the Games was very small, and assumed that delivery, launch and injection into orbit all went according to plan.

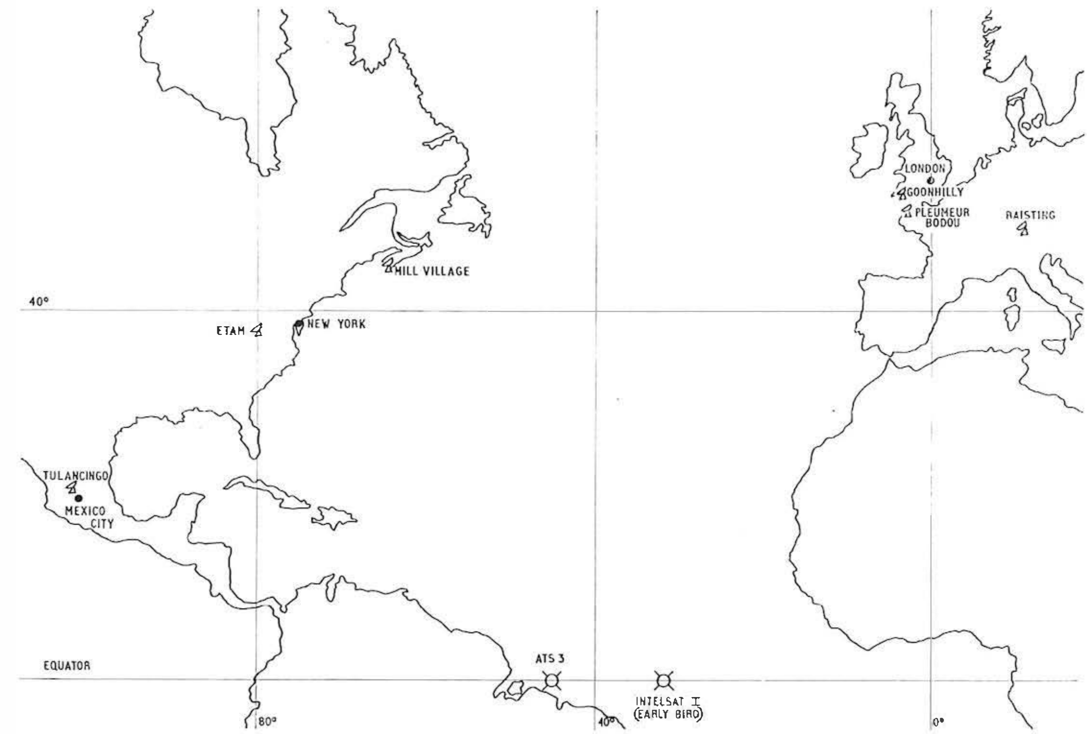
Scarcely any delay could be tolerated and the launch of a satellite and the subsequent manoeuvres which are required to place it in the desired position in orbit, are always attended by a certain element of risk.

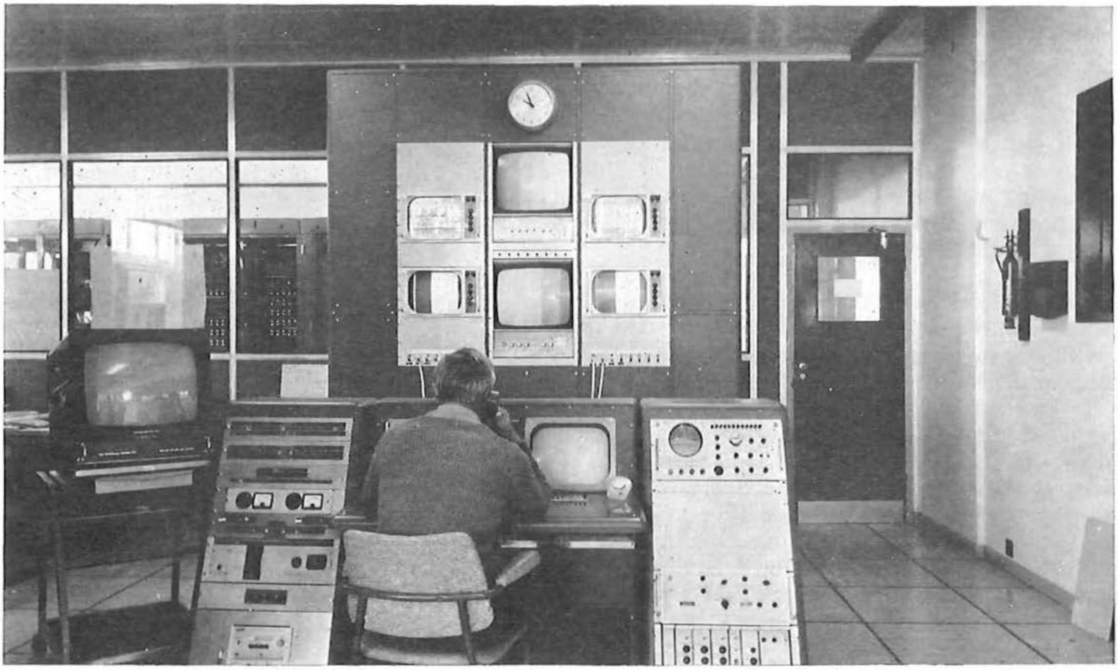
In such circumstances, an alternative plan was highly desirable. It was, therefore, decided to investigate the possibility of using the United States National Aeronautics and Space Administration's *ATS* 3 satellite which had been launched in November, 1967, to carry out experiments in orbit and was in position over the Atlantic. NASA agreed to co-operate and the use of *ATS* 3 formed the nucleus of the contingency plan.

Although a satisfactory solution had been found to the space problem, there were other and equally difficult problems to be overcome on the ground.

On this side of the Atlantic, the new aerial being built at Goonhilly—Goonhilly II—was planned

OVER





A general view of the colour television monitoring console at the Goonhilly satellite earth station.

to be ready for service in September to work with the *Intelsat* III satellite. Once again the margin was fine in which to bring in a new earth station with a new satellite, but by pooling European resources it was possible to develop a plan whereby the French station at Pleumeur Bodou would receive all northern Europe's normal telephone traffic carried by *Intelsat* I, leaving Goonhilly II and the German station at Raisting free to carry the Olympic Games traffic.

It was further planned that Goonhilly II should concentrate on reception of the video signal and that Raisting would receive the additional forty or so sound circuits which the broadcasters estimated would be required for the period of the Games, and also act as standby for Goonhilly II.

The contingency plan employing *ATS* 3—which had a different configuration from *Intelsat* III, and could only be used to carry the video signal plus one sound circuit—required an altogether different arrangement. In this plan Goonhilly I and Raisting were to be modified to work to *ATS* 3, with Raisting acting as stand-by to Goonhilly, and the additional circuits being carried by Pleumeur Bodou working to *Intelsat* I, or by cable.

On the other side of the Atlantic, two new earth stations were being planned to come into operation with *Intelsat* III in time for the Olympic Games but once again the margin was fine.

One was the Mexican earth station at Tulancingo, about 85 miles north east of Mexico City and the other, a new United States earth station at Etam in West Virginia. The plan was for Tulancingo to be the primary transmitting station with Etam acting as standby, and that both these stations would have the capability of working to *Intelsat* III or *ATS* 3.

In the event the contingency planning paid off handsomely. *Intelsat* III was launched in the early hours of the 18th September—with just over three weeks in hand before the start of the Olympics—but the Thor Delta launch vehicle carrying the satellite into orbit went out of control within two minutes after lift-off, and had to be destroyed. Plan A, therefore, quite literally went up in a cloud of smoke, but Plan B held good.

From Mexico City, the television video was routed by microwave to Tulancingo, then via *ATS* 3—22,300 miles over the Atlantic—to Goonhilly I in Cornwall. From Goonhilly the signal was sent by microwave link to the Post Office Tower in London and then on to the BBC for colour standard conversion before being fed into the domestic television network and routed across the channel into the Eurovision networks. Eastern Europe and the Soviet Union were also provided with the same programme transmissions via an interconnection with Intervision, the Soviet bloc equivalent of Eurovision.

The sound commentary circuits for the television programmes and for sound radio were routed either by cable or by *Intelsat* I. United Kingdom circuits from Mexico were routed to New York and then by transatlantic cable to London.

Circuits for other countries were routed from Mexico through the United States to Canada then via the Canadian earth station at Mill Village and *Intelsat* I to Pleumeur Bodou in France, and finally distributed to the required destinations.

The ability to set up a complex communications network on the scale provided for the Mexico Olympics is a measure of the progress which has been made in satellite communications.

Perhaps even more important was the demonstrated flexibility of the system and the ability to maintain service. For this, much credit is due to the communications engineers who were responsible for the actual transmissions in the various countries and to the way they co-operated in overcoming their problems.

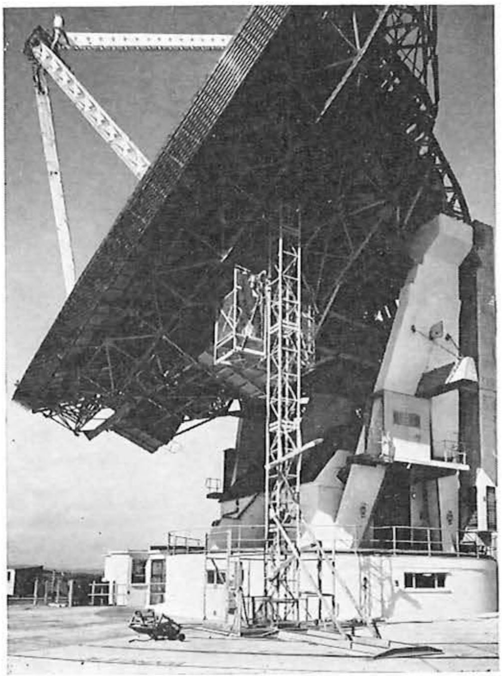
A typical example of this was the voice circuit set up between Goonhilly and Etam with the facility of being extended to Tulancingo for control purposes. In practice Etam had rather more Spanish speakers than Goonhilly, and rather more English speakers than Tulancingo. As a result the Etam engineers played a key co-ordinating role in the control link between Tulancingo and Goonhilly.

The end product of the exercise, and the one by which the public judge the result of all the efforts was the pictures which appeared on the television screens. These were excellent and reports from all over Europe highlighted the quality of the pictures seen by viewers. Here, and rightly so, credit belongs to the broadcasters. The basic ingredient was the video signal relayed from Goonhilly and its consistent excellence was convincing evidence of the high quality of satellite transmission and of the efforts of those at Goonhilly and Tulancingo who were responsible for maintaining the link.

The XIX Olympiad is now history but many stories will be told of the events behind the events. This is one of these stories—and if by chance there happened to be one of these gold medals going spare we should like to see it awarded to *ATS* 3 the satellite upon which so much depended and which responded magnificently, enabling millions to see the Olympic Games—live by satellite from Mexico.

THE AUTHOR

Mr. W. G. Geddes *joined the Post Office in 1965 as a competition entrant from the Regular Army. He is a Principal in the Overseas Network Planning Division of the External Telecommunications Executive.*

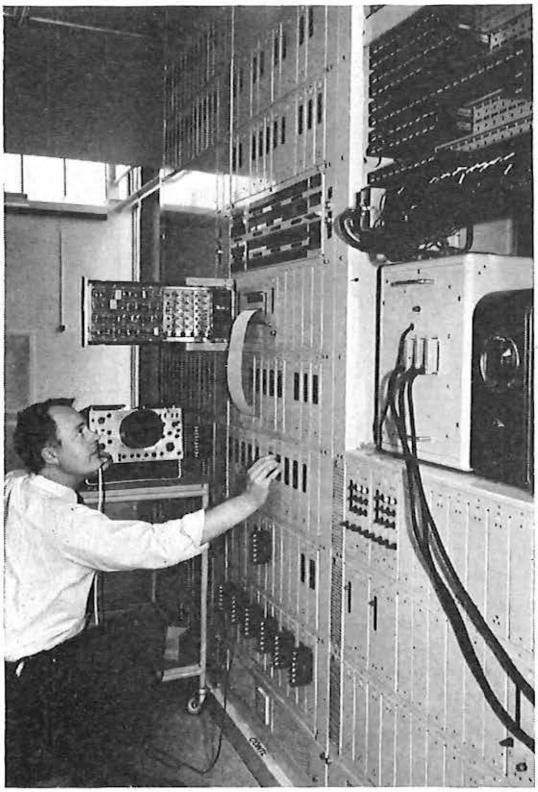


One of the modifications recently carried out to the Goonhilly No. 1 aerial was the installation of an Alimak Solett hoist (shown here) which solves the problem of transporting men and materials up to the maser cabin in high winds. The new hoist is used every 24 hours for carrying supplies of helium in flasks to the cabin, some 40 ft above ground level. The hoist operates on a rack and pinion system, which eliminates ropes and balancing weights. It can be erected to a height of 40 ft in less than three minutes and carries eight passengers or 1,450 lb of material.

The Director of the Management Services Department in Telecommunications Headquarters takes a look at the new structure and discusses . . .

MANAGEMENT PROBLEMS IN THE TELECOMMUNICATIONS BUSINESS

By T. H. SOUTHERTON



As the *Journal* went to press, another electronic exchange was opened—at Southam, near Coventry. The building and equipment cost £80,000. The new exchange has an ultimate capacity of 3,000 and will play a part in helping to cater for increasing demand and improving the telephone service in the Coventry area.

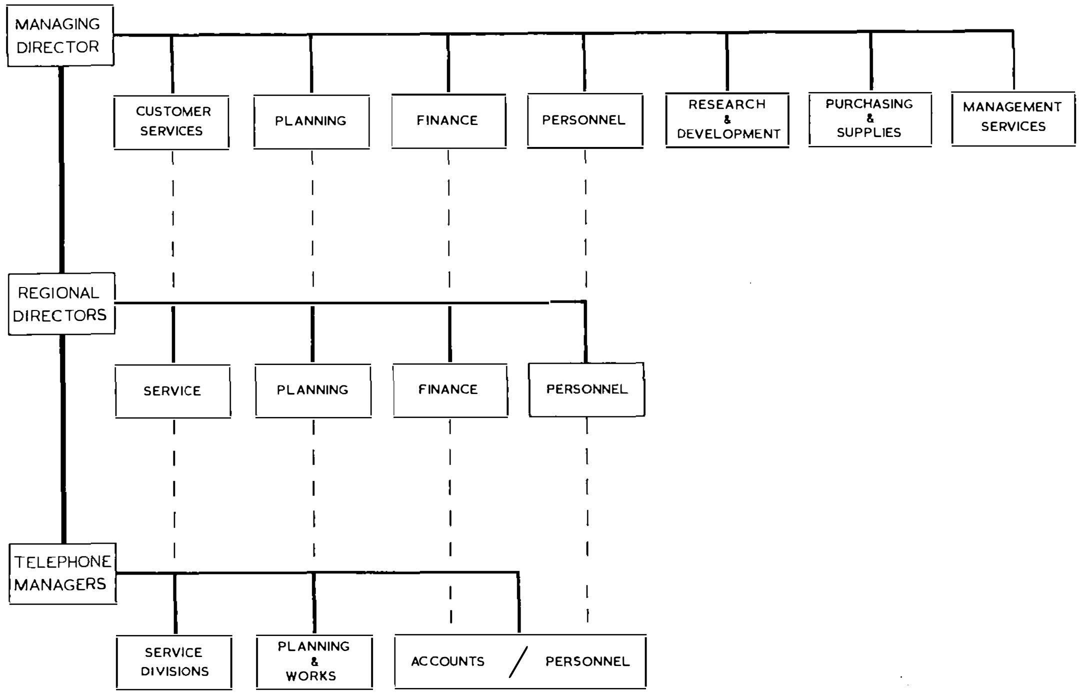
LOOK after your customers, look after your staff, look after your bankers and look after the future. These are the basic principles of any commercial enterprise—without them a businessman will have no business, no staff, no capital and no future.

In the telecommunications business of today these concepts certainly apply and are embodied in the 1967 White Paper on the Reorganisation of the Post Office as the following objectives:

- to develop the most efficient services possible at the lowest charges consistent with sound financial policies;
- to carry on in a worthy manner the Post Office tradition of service to the public;
- to develop relations with the staff in a forward looking and progressive way.

These are the terms of reference as the Post Office stands at the pre-Corporation crossroads. Before examining in detail the management problems which stem from the change in direction, it is essential to understand the nature and character of telecommunications development to the present time.

It has taken some 80 years to build the existing system of 12 million stations under management and administrative structures designed—very effectively—to form and carry out Government policy within the framework of ministerial responsibility to Parliament. Inevitably, we have tended to manage by the rule book; we write, edit, print and distribute ten million sheets of instructions every year among the 16,000 prac-



This simplified chart shows how the Telecommunications business is now organised.

tising managers and their staffs in telecommunications.

The new telecommunications organisation meets the objectives laid down by Mr. Edward Short when he was Postmaster General. He said: "The object will be to group people together according to the tasks to be done, rather than the grades and hierarchies to which they belong, to place the process of decision making closer to the point of implementation and to make that process quicker and surer in operation."

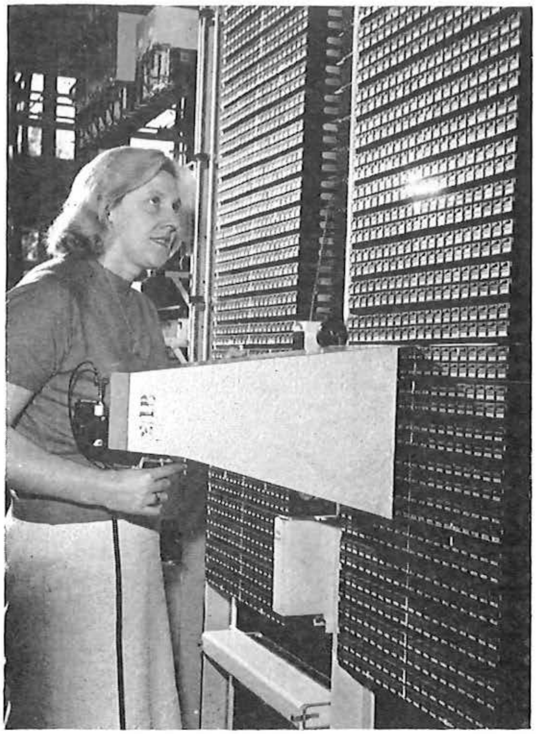
The new structure satisfies this objective, and, in particular, it

- emphasises the line of command;
- assigns overall responsibility for exploiting the existing capacity of the system on the Customer Service Units—selling, installing, operating and maintaining;
- assigns overall responsibility for creating new capacity on the Planning Units;
- provides for the supporting expertise of Personnel and Accounts.

This is a purpose based—not functionally based—structure, repeated right through the organisation and giving rise to the concept of vertical symmetry. In addition to the strong vertical channels of everyday communications which, nevertheless, are not direct lines of authority, the Headquarters organisation includes Research and Development Departments, the Purchasing and Supplies Department and the Management Services Department.

Examination of the basic commercial principles of looking after the customer, the staff and the banker reveals a wide variety of problems. On the question of looking after our customers, public opinion surveys show one factor, at least, which we should regard as eminently pleasing. This is that the public has no complaint about the attitudes of our staff in terms of both courtesy and personal efficiency. The main complaints—Telephone Managers receive 800,000 a year—

OVER



One of the new time-saving systems now being used at many exchanges is meter-photography which speeds the production of subscribers' bills.

concern the fault repair service, provision of service, rental charges, billing mistakes and just a few operator services.

These complaints highlight a number of management problems. For example:

First, the tug-of-war between standards of service and the cost of providing those standards. Every public utility and local authority has this problem in one form or another. Our new organisation should be able to control the conflict because it has brought all aspects of service together in one Customer Service stream and made that stream responsible for both quality improvements and cost reductions.

Second, maintaining the balance between competing demands for the allocation of resources. This too has its national counterpart—roads *v* hospitals *v* schools and so on. In telecommunications we are pressed, on the one hand, to improve existing standards of performance and, on the other, to eliminate the waiting list for new customers. The aim is to do both but where these aims are not compatible, service to existing customers comes before planned growth of the system. The cost is revealing. In the next five years we shall invest £650 million in improving the service, the facilities and the traffic generated by the existing 12 million stations, and in the same period, we shall invest £1,100 million on six million new customers, including provision for the traffic they will generate.

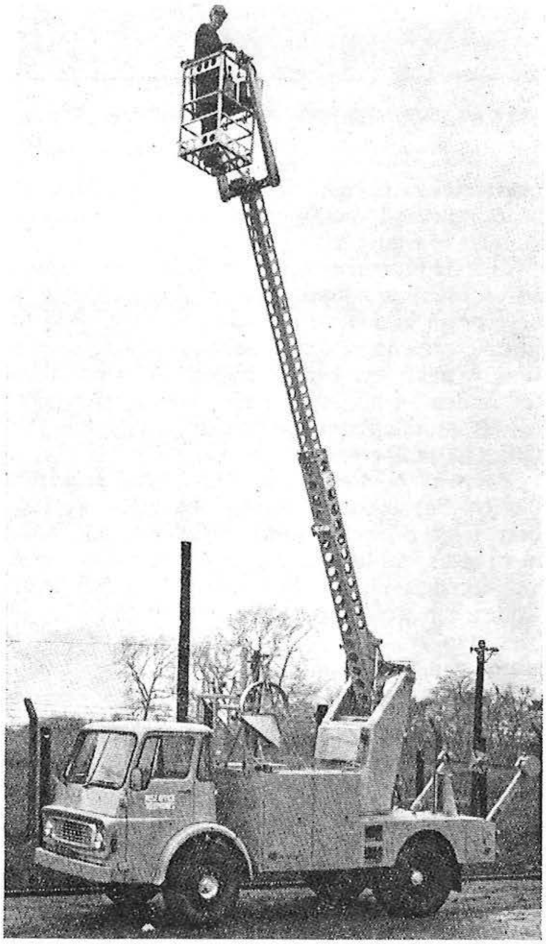
Third, the major problem spotlighted by customer complaints concerns tariffs. Here, management faces the twin problems of public pressure to hold down charges, and Government expectations—if we are to command our fair share of capital—to earn a good return on our assets. There is no single way out of this problem; the solution lies in more automation, better working methods, heavy investment in modern equipment and mechanical aids and massive computerisation of routine processes.

The requirement to look after our staff raises other problems. It is not just a question of welfare and wages. Happiness and satisfaction do not arise out of these things alone; they arise out of the interest created by the job itself and out of its worthwhileness in their own eyes. Management certainly has to remove causes of dissatisfaction in the welfare and wages fields, but their mere removal does not result in lasting satisfaction. With the rise in educational standards now taking place in this country, the new generation coming into our work force will look increasingly for satisfaction at work and this demand will only be met by providing opportunities to make worthwhile contributions to challenging work. If management does not anticipate the problem presented by this new generation, morale will fall, staff turnover will increase and dissatisfaction will multiply.

Part of our aim in the new organisation is, therefore, to give staff the maximum scope for exercising their own initiative in meeting customer requirements: by the need to honour Staff Side agreements; by financial and manpower allocations and by compatibility with the national objectives of the business.

The exercise of initiative is currently held at bay by custom: exchanges of correspondence at lengthy intervals . . . then a meeting . . . then preparation and agreement of notes . . . then follow-up . . . then reference back to senior officials on the

Telsta, **a new aerial cabling machine, is just one example of the new devices being used to speed work and improve productivity.**



official side and to annual conferences on the staff sides.

We should try to get away from doing business this way. Senior management must devolve, give people clear job definitions, objectives and guidance and let them get on with it. They will be accountable, but after the event. The telecommunications image would surely benefit if only managers were able to assemble colleagues round a table, thrash out the issues, take account of staff views, note their limits of authority, take their decisions and act on them.

We are working towards this end in several ways. First, the compendium of 597 devolved powers is being thoroughly pruned in order that managers right down the organisation may take decisions which they feel competent to take without being obliged by the rule book to seek Headquarters authority. Second, in order that lower managers can take decisions which are consistent with the national objectives of the business, we are compiling an authoritative list of telecommunications objectives for the use of all our managers. Third, we shall rewrite all our instructions in a more permissive style, on the philosophy that once we get away from direct Government control we need no longer require Headquarters Departments to detail all our procedures in such a way as to try to provide for every eventuality down to the lowest grades in the remotest outstation.

The aim of all this—devolution of powers, publication of objectives, modern instruction practices—is a determination to *manage by objectives* instead of management by rule book. It is perhaps unfortunate that the practice of managing by objectives was so recently formalised and given a distinctive name, because to give anything a name is to suggest a new gimmick.

Management by objectives is not a gimmick; after all what else should we manage by? Intuition? Hunch? Lottery? It aims to give the manager at each level of the organisation broad discretion over the details of how his work is to be handled, provided that he reaches certain precisely defined objectives and stays within certain prescribed limits. We regard this way of

OVER

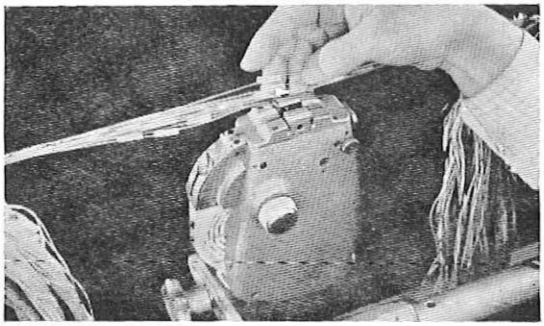
The Telecommunications business is going in for computerisation in a big way. Here, an operator at the London Computer Centre sets up the controls of a magnetic tape deck.

management as right, but it is a way which has been practised methodically by only a limited number of managers.

The requirement to look after our banker raises more problems. Our aim must be to so hold down or reduce our costs that the need for further price increases is delayed as long as possible without the banker having to worry about the return on his investments. Key to this problem is productivity—an area in which the Post Office has a fine record.

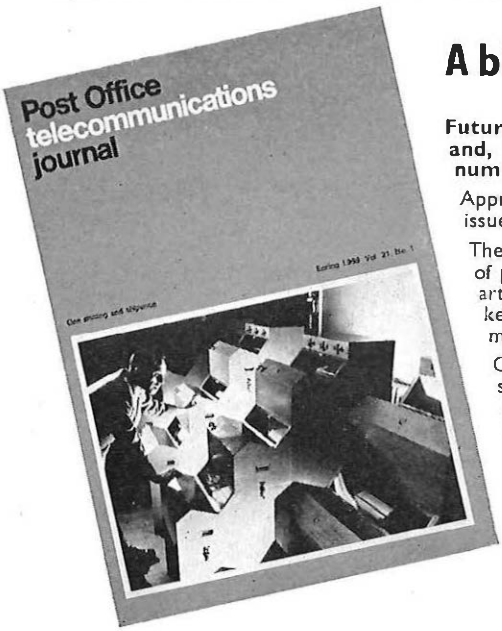
There is obviously no shortage of problems, but by hitting our business objectives we shall best achieve our personal objectives, which for most of us will include a good living for ourselves and our dependants, the satisfaction which comes from a job well done and a determination to set high standards of public service for the generation which will follow us.

Above: The fault repair service is a big cause of complaint. To help solve the problem a new system (illustrated here) by which telephonists handle complaints and leave engineers free to put the faults right has been introduced. Below: Another productivity aid—a new machine for jointing wires in underground cables faster and more efficiently.



THE AUTHOR

Mr. T. H. Southerton, *B.Sc. (Eng)., C.Eng., M.I.E.E., the first Director of the Management Services Department in Telecommunications Headquarters, joined the Post Office as a Youth-in-Training at Derby in 1934. He was in the Engineering Department until 1953 and then transferred to the Factories Department, and was Controller of Factories from 1964-67. He was appointed a Director in October 1967.*



A bigger, better new-style Journal

Future issues of the *Telecommunications Journal* will be different and, we believe, more popular with our ever-increasing number of readers.

Appropriately, the first new-style Journal will be the Spring, 1969 issue—the occasion of our 21st birthday.

The *Journal* will be in a larger format and, although the number of pages will be slightly reduced, it will contain space for more articles which will be laid out in a more attractive style more in keeping with the modern outlook and image of the telecommunications services.

One significant change will be a new-design of front cover similar to the example shown here. The title will be printed on a background colour which changes with each issue and the cover will contain a photograph or drawing illustrating one of the articles in that issue.

We are also changing from letterpress printing to lithography and this will result in a better reproduction of illustrations and enable the *Journal* to make greater use of colour.

The price, however, will remain the same—1s. 6d. If you do not already receive the *Journal*, place an order with your local sales organiser or write to: The Business Manager, Telecommunications Journal, 2-4, Little Britain (Telephone 01-432 3624).

Telex in the Coastguard Service

A coastguard officer sends a telex message from Orlock Head lookout. Telex may become the maid-of-all work soon throughout the Coastguard Service.

TELEX will become one of the chief communications tools in the Coastguard Service if the recommendations of a recent Post Office report* are adopted.

The investigations on which the report is based found that telex had already proved its worth in the busier coastguard district headquarters and the report recommends that *all* DHQ's should have it.

"Time saving in emergencies had been proved and messages both sent and received were no longer subject to possible phonetic error as when the telephone was used," says the report.

It adds that DHQs equipped with telex were able to communicate direct with foreign search and rescue organisations instead of via coast radio stations or the public telephone system.

Telex could also be used, claims the report, to pass details of the movement of ships between DHQs to receive gale warnings and for two-way communication with the coastguard section of the Board of Trade HQ and other Government Departments in London. Time, money and manpower would be saved if tape cutting and automatic transmission equipment were installed in some of the busier DHQs.

The value of telex for transmitting gale warnings is stressed. At present the warnings are sent from the Meteorological Office at Bracknell, Berkshire, to gale warning stations over the public telegraph service via the nearest telegram distribution office in the areas of the stations concerned. The message is then delivered by hand, telephone or telex.

The report found that because of the volume of priority traffic and the method of distribution, transmission from Bracknell never took less than half an hour and there had been delays of up to two hours. "Display of gale warnings to shipping is a vital service and any undue delays in receipt of messages should be considered unacceptable in the light of modern methods of communication," states the report which recommends that gale warning messages be transmitted to DHQs entirely by telex and then passed on to gale warning stations by present methods.

The installation of private manual branch exchanges for terminating exchange lines in the lookouts at DHQs and constant watch stations, with individual extensions to the duty room and coastguard houses is a further GPO recommendation and the need for more modern telephone apparatus generally is indicated.

Another proposal is the provision of a lightweight headset in addition to the normal switchboard answering telephone in all DHQ lookouts to give the watchman freedom of movement while speaking or carrying out other duties.

It was found that many of the coastguard stations which received 999 calls were not fully equipped to take action and passed the messages by telephone to DHQs. The report recommends, therefore, that generally only DHQs should receive these calls. The suggestion is for each DHQ to be provided with a separate ex-directory exchange line for 999 calls terminating in the lookout, preferably on a modern switchboard with a red lamp and red connecting keys for distinctive identification.

The telex system has grown from 6,000 stations in 1960 to about 25,000 by December, 1968, and 38,000 are expected by 1971. At present the British system is the second largest in Europe.

**GPO Telecommunications Advisory Service Report presented to H.M. Coastguard by Telecommunications Headquarters Marketing Department.*

TAKE A CARD TO MAKE A CALL

By J. d'A. COLLINGS

A repertory dialler operated by punched cards is soon to go on trial. It will save subscribers time and trouble and reduce the number of wrongly-dialled calls

Left: Making a call with the Card Callmaker. The subscriber waits for the dialling tone and inserts the card. The Callmaker does the rest.

THE use of punched cards as the memory store is exploited in a novel design of repertory dialler which will soon be tried out by about 40 selected subscribers in the Midlands.

It will be known as the Card Callmaker which, as well as enabling its user to obtain frequently-required telephone numbers without having to refer to a directory or spend time dialling, is expected to reduce the number of calls which are incorrectly dialled.

The first model will be a free-standing unit which can be associated with most kinds of telephone, including loudspeaking instruments. If the trials are successful it is expected to become available to subscribers generally by the middle of 1969.

The Card Callmaker, which is contained in a grey plastic case measuring only five-and-a-half inches high, five inches wide and six inches deep, is connected to the telephone and the electricity mains by two grey flexible cords.

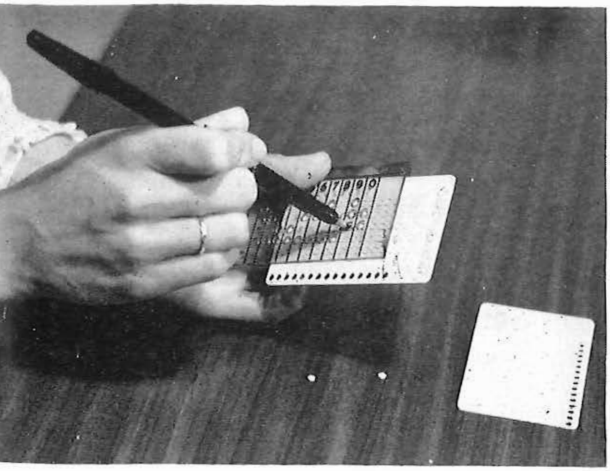
To make a call, the subscriber selects the appropriate card, lifts the handset of his telephone, waits for dialling tone and then inserts the card, which is pre-punched with a pattern of holes corresponding to the number he is calling, into a slot at the top of the new device.

The punched card engages a latch mechanism in the Card Callmaker which feeds the card down in a series of jerks as the dialling pulses are transmitted. The card falls into a transparent tray projecting from the base of the unit when dialling is completed.

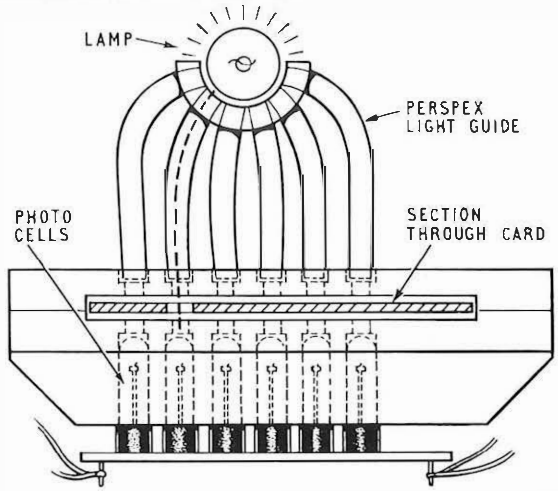
The digit information stored by the holes punched in the card is detected by beams of light (one for each column of holes in the card and one to detect the presence of the card) supplied from a single light source by way of perspex guides which conduct the light round curves and aim it at the card from the rear.

A row of photo-electric cells on the other side of the card, energised by light passing through the punched out holes, controls the dialling out pulse generator and counter.

A red light indicates that mains power is switched on and the subscriber can press a cancel button to reject a card during sending if he dis-



Left: **Preparing a card by punching out the pre-scored holes through a plastic jig. Thirty cards can be stored in the Callmaker.**



OPTICAL SYSTEM

Above: This diagram shows how a card is read. The light travels from the lamp through the optical guide and the pre-punched hole in the card and then on to the photo-electric cells which control the dialling-out process.

covers that he has inserted the wrong card or does not after all require the call.

The subscriber can prepare as many cards as he wishes, each for a different telephone number, and 30 of them can be stored in the moulded recess at the top of the Card Callmaker. A separate card storage box is being designed for subscribers who want to keep a larger quantity.

The cards, of thin white plastic material, are three-and-a-half inches long and two-and-a-quarter inches wide and have a row of pre-punched feed holes down one side. The positions of the holes for digit storage are pre-scored so that the chads can be pushed out cleanly. By adopting a coding system, all the digits from 1 to 0, and an X for the exchange access code on private automatic branch exchanges, can be recorded in five columns of holes.

To help prepare the card with the telephone number, a transparent plastic jig is provided which has the codes for each digit pre-punched in it. In preparing a card, the subscriber writes the name of the correspondent across the top and the digits of the number (maximum 16) along the side, one opposite each row of scored holes starting from the bottom. Adhesive Braille embossing tape can be fixed in the name space so that blind people can use the equipment.

After the card is inserted in the jig, the first digit of the wanted number is aligned under the appropriate column and the chads are pushed out of the card by inserting a pencil or similar object through the holes in the jig. The card is then slid along inside the jig until the next digit is positioned and so on until the punching is completed.

A close watch will be kept on the instruments undergoing trial so that any defects which may be experienced when they are used under field conditions can be quickly eliminated. Subscribers taking part in the trials will be asked to evaluate the device and if they wish, to make suggestions how it could be improved.

The Card Callmaker is expected to have a wide application for many subscribers and to be particularly useful for telephone order clerks in wholesale businesses who make large numbers of calls to the same range of numbers. The quarterly rental will be about £3.

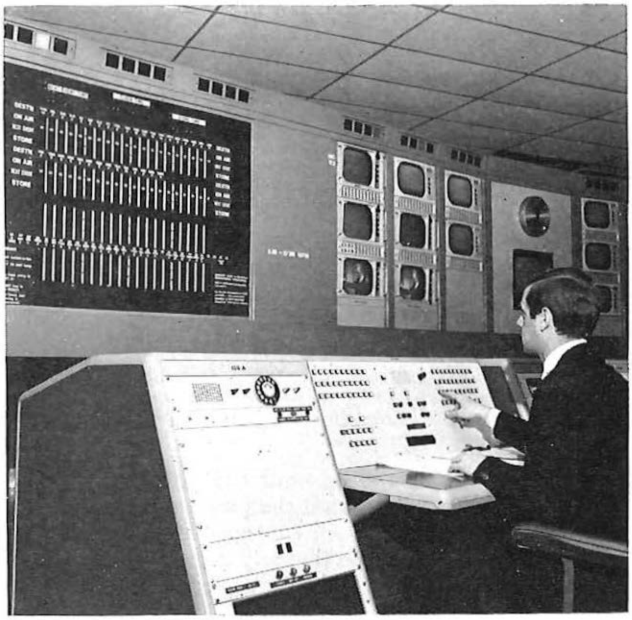
THE AUTHOR

Mr. J. d'A. Collings *is a Senior Sales Superintendent in the Marketing Department at THQ. He joined the Post Office as a Technician at Criggion Radio in 1948 and in 1950 became a Sales Representative at Bedford. In 1958 he moved to GPO Headquarters as an Assistant Sales Investigation Officer and was subsequently seconded for three years to the Central Organisation and Methods Branch.*

This article describes what is involved in one of the Post Office's little-known but vital tasks—providing the links and handling the . . .

NETWORK SWITCHING FOR THE ITA

By R. A. SIMMONDS



The operating console and display panel in the TV control room at the London TV Switching Centre at the Post Office Tower.

NEW equipment designed for handling Independent Television Authority sound and vision traffic has just completed its first operational year with the Post Office.

The use of this complex electro-mechanical equipment has created a number of maintenance problems which have been satisfactorily resolved and the equipment has functioned well.

The Post Office provides a network of vision and sound links for the ITA linking the studios and programme switching centres of the Independent Television companies and ITA's broadcast transmitters. These links are terminated in Post Office Network Switching Centres (NSCs) which have been established in the main population areas where studios and transmitters are located.

The Independent Television service is provided by the companies who produce and interchange programmes. This means that the pattern of connections at the major NSCs changes frequently in accordance with requirements which are scheduled daily by the ITA and that the Post Office has to interconnect the links to establish the required patterns. Switching equipment of various types has been provided since 1956 at the four major NSCs—London, Birmingham, Manchester and Carlisle—to meet this requirement.

Basically, switching equipment provides for the interconnection of sources (incoming) to destinations (outgoing) so that any source can be connected to any destination; that more than one source is not connected to one destination at the same time and that transmission suffers only minimal distortion due to the switching equipment.

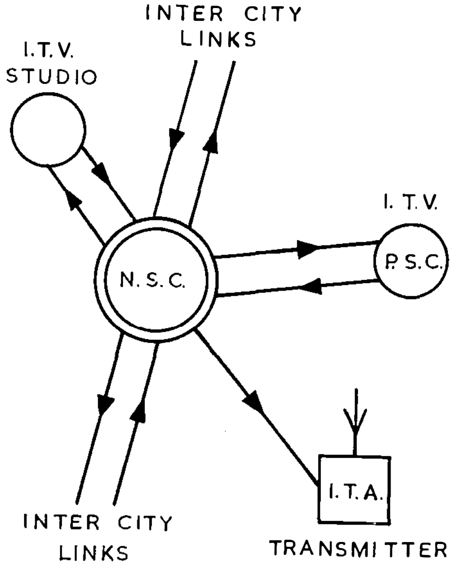
The equipment originally provided at the provincial NSCs for 405-line monochrome transmission was in the form of a manually-operated crossbar matrix, with interlocking push buttons. Each operation has to be performed manually at the required time by the operation of the appropriate control. In London, however, switching requirements increased rapidly and so, in 1958, the Post Office installed and commissioned a semi-automatic switching equipment which ultimately had a capacity of 16 sources and 15 destinations. This was known as Automatic Network Distribution Equipment (ANDE).

This equipment stored information for two consecutive switches and performed the switching operation automatically under the control of an electronic clock, synchronised to the Speaking Clock. The equipment was programmed by the operator and had three information stores, each of which passed through a complete cycle of the functions—*Store*, *Next Event* and *On Air*—in three switching operations.

The main limitations of this equipment were that inadvertent operation of the controls of the pattern *On Air* interfered with programme-carrying links; that connections remaining unchanged, that is "carried through" during a switching operation, were liable to interruption unless special action was taken by the operator; and that sound and vision links were controlled separately.

Nevertheless, this equipment functioned very well in service, but extensions to the Independent Television network, an increase in the number of switching operations required, and the need to provide for programmes in colour on 625-lines led to a decision in 1962 to replace the 405-line equipment at all four NSCs with new and larger capacity equipment designed to 625-line colour standards.

A contract was placed with the Marconi Company for new switching equipment to a Post Office specification. The equipment for London was to provide, initially, for 30 sources and 40 destinations and ultimately for 40 sources and 80 destinations, and the equipment for Birmingham, Manchester and Carlisle to provide, initially for



Above: A simplified schematic diagram of the television links in a typical city where the studios and transmitters are located.

	Start	*1st Switch*	*2nd Switch*	*3rd Switch*
On Air	A	B	C	A
Next Event	B	C	A	B
Store	C	A	B	C

ANDE 1 Sequence of store functions

	Destination 1	*Destination 2*
Start	Source 1	Source 4
1st Switch	Source 2	Source 4
2nd Switch	Source 1	Source 4

ANDE 1 Typical "carried through" operation on Destination 2

15 sources and 15 destinations and ultimately for 25 sources and 30 destinations. The specification also required that vision and the associated sound should be switched and programmed simultaneously by one control and that "carried through" operations by the operator should not be necessary.

In December, 1967, the new equipment, ANDE2, was put into service in London followed in January, 1968, by the three provincial equipments.

It is in four basic parts. In all four NSCs two parts—the control panel and visual display panel

OVER

Time		Destn 1	Destn 2	Destn 3
	On air	01	12	12
1039.50	Next event	22	11	
1121.00	Store	13	13	

ANDE 11. Typical display including "carried through" on Destination 3

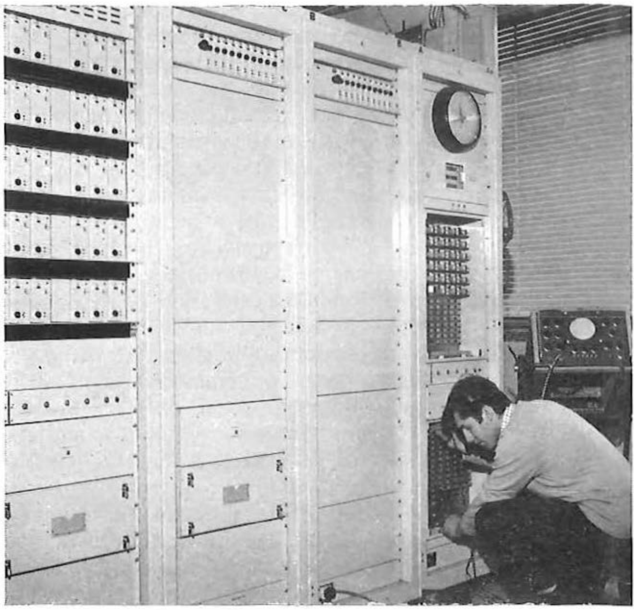
—are in the television control room and the other two—the clock and switching equipment—are in the television repeater station.

The **Control Panel** is mounted in a console and has two modes of operation—Monitor or Operate—controlled by a master switch. In the operate mode all console controls are energised, thus allowing the operator to programme the stores and to control switching operations manually if this becomes necessary. All programming entries are normally made into the *Store* but entries can be made into the *Next Event* store enabling amendments to be made to switching patterns and times to meet late programme changes. The monitor mode enables the operator to monitor vision and sound on all sources and destinations from the console. In this mode all other control functions are de-energised to prevent inadvertent misoperation of the equipment.

The **Visual Display Panel** is mounted on a picture monitor framework in front of the console and gives a digital display of all patterns programmed on the equipment. Each destination has three displays, each showing a two-digit number corresponding to *On Air*, *Next Event* and *Store* connections and indicating which sources are *On Air* and which will be connected to that destination in the next two switching operations.

If no change is required for a particular connection on a switching operation no entry is made and the store display remains blank. As each switch occurs the information moves up one stage —*Next Event* to *On Air*, *Store* to *Next Event* and the *Store* display is extinguished ready for a new entry to be made. Three times are also displayed on this panel. The *Real Time* display shows the actual time of day to one second; the *Next Event* and *Store* time displays show the required switching times for those two patterns.

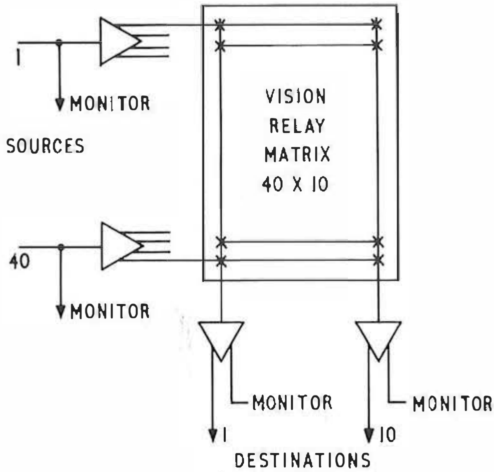
The **Clock** is in two sections. A Post Office designed and manufactured electronic unit generates a very stable supply of 1 sec. and 10 sec. pulses derived from a 500 Hz tuning fork and synchronised with the Speaking Clock. The second section is the Marconi clock and logic unit which is almost entirely electro-mechanical in operation and uses the 10 sec. pulse generated by the Post Office unit to drive chains of Post Office Type-4 uniselectors which form the Real Time clock. This clock is in two identical parts—Real Time and Real Time Comparison—which must be exactly in step with each other for an automatic switch to take place. Two more chains of uniselectors—*Next Event* and *Store Time*—provide the switching time stores and a further chain—*Next Event alarm*—is arranged to give a pre-switch warning three minutes before the *Next Event* time to warn the operator that a switching operation is imminent.



The clock and part of the vision transmission path equipment in the TV repeater station at the Post Office Tower.

When time coincidence occurs between the Real Time clock and the *Next Event* time store a control signal is sent to the switching equipment and a switching operation takes place.

The **Switching Equipment** consists of electronic transmission path equipment and electro-mechanical control and storage equipment. The latter uses motor uniselectors (MUS) because of their high rate of search (200 steps a second). Each destination has three MUS *On Air*, *Next Event* and *Store*. The *Next Event* and *Store* MUS are programmed by the operator from the console and



perform direct current display and control functions on their banks and wipers. The *On Air* MUS switch sound links on two bank levels which have gold-plated contacts to ensure low contact resistance and control the relays in the vision matrix over a further bank level.

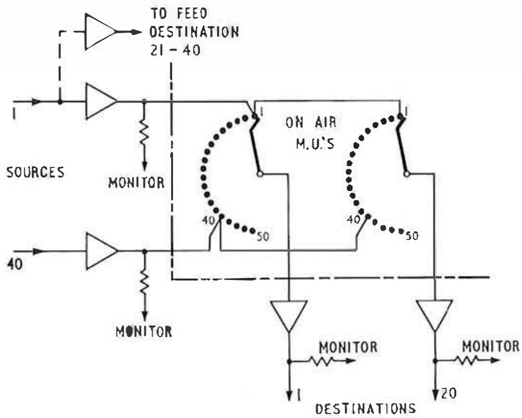
Left: A bank of motor uniselectors in the TV repeater Station which form part of the switching equipment. Above: Simplified diagram of the ANDE II vision path and (below) of the ANDE II sound path.

The sound transmission path is switched on the banks of the *On Air* uniselectors and consists of a source amplifier which can feed up to 20 destinations (two amplifiers with paralleled inputs are necessary if more than 20 destinations are provided) and a destination output amplifier to restore the signal level

The vision transmission path is somewhat different. Each source has an input distribution amplifier with four outputs, each capable of feeding one relay crossbar matrix. The matrix is built up with miniature-sealed relays mounted in strips, one strip per source and each strip having one video input and ten outputs. A matrix can be assembled to accommodate up to 40 sources with 10 destinations but to increase the number of destinations additional matrices must be added.

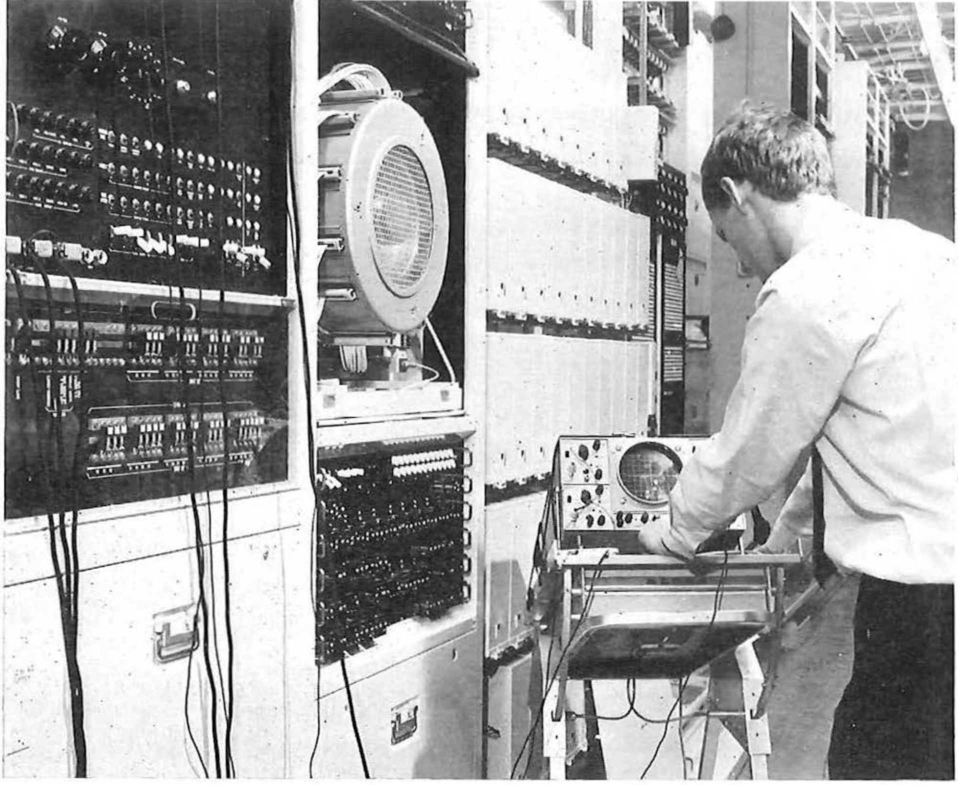
The operation of this equipment requires logical action to translate the switching schedule requirements into the minimum practical number of switching operations. The entry of amended connections due to last minute programme changes can be very complex and a single incorrect operation could affect millions of viewers.

It is hoped that it will give a service as reliable as the original ANDE and thus maintain and even improve upon, the very high standard of performance that the Post Office has given in the past.



THE AUTHOR

Mr. R. A. Simmonds is an Assistant Executive Engineer in the Systems Performance and Maintenance Branch of the Service Department in Telecommunications Headquarters. He joined the Post Office as a Youth-in-Training in the London North West Telephone Area and also served in the London Centre Area before taking up his present post which is concerned with day-to-day maintenance of the inland television network.



Technician 2A Mr. David Gillett carries out tests to the magnetic drum equipment at the new Bastion Exchange.

BASTION WILL RELIEVE THE LOAD

By J. F. BIRT

Bastion joins Citadel, Fortress and Tower in helping to solve London's problem of keeping pace with ever-expanding trunk traffic demand

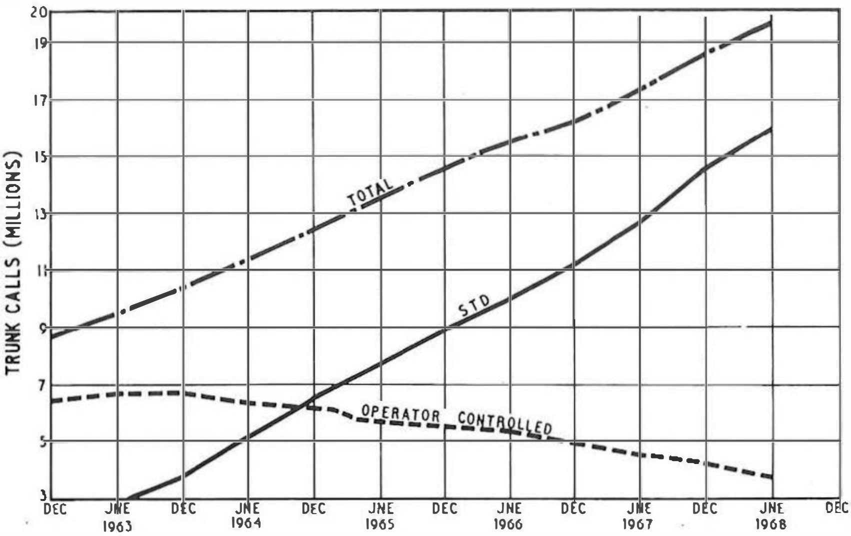
ANOTHER big step forward in coping with London's ever increasing trunk call traffic has been taken with the opening of the new £4 million Bastion Exchange.

Handling, ultimately, some seven to eight million trunk calls a month, the new outgoing STD trunk switching unit brings within sight the end to the general shortage of capacity to deal with London's trunk calls, increasing by somewhat above the national average at sixteen per cent a year.

When fully equipped by G.E.C./A.E.I., complex equipment costing about £3½ million will have been installed. This will be put into service progressively. The first stage provides for 2,000 junction circuits from London director exchanges and 1,600 outgoing trunk circuits spread over 100 routes. Ultimately, the unit will have 6,000 junction circuits connected to it.

The £500,000 building provides 74,000 square feet of accommodation and incorporates a £26,000 ventilation system which circulates cooled air from a central point to discharge outlets near plant requiring cooling. It is designed to maintain a temperature of 75°F over the area cooled which amounts to about 18,000 square feet.

Because of the urgency for the Bastion unit the operation has, since May, 1965, been subject to critical path analysis by the LTR Critical Path Method team. Regular project meetings have been held to review and control progress which resulted in the first stage being ready for use within a month or so of the target date.



This diagram shows the increasing average since 1963 of the total chargeable inland trunk calls — combined full and reduced rates — handled by LTR.

While the majority of the director exchanges to be served by the Bastion unit are, mainly, in London's North Central Telephone Area, each new unit is part of the overall plan to meet the rapidly-increasing demand for trunk service.

But plans for the future, anticipating a further rapid rise in trunk traffic, will include another large outgoing STD unit in central London in about two years' time, the building of which is already well advanced and which, when fully equipped, will dwarf even Bastion.

This will be followed in the years 1972–75 by a measure of decentralisation to seven Sector Switching Centres in outer London, limiting the need for large and expensive building sites in central London.

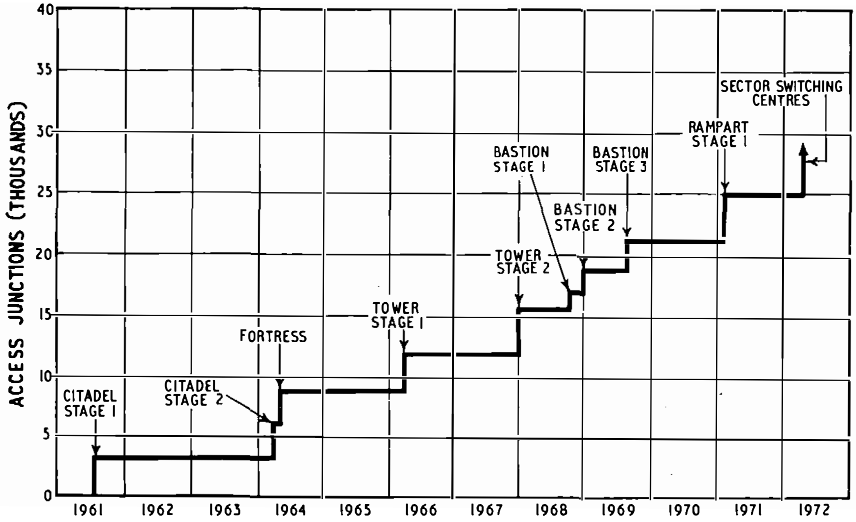
These centres will handle, efficiently and economically, the increasing proportion of London's trunk calls made by customers outside the central business and commercial areas.

Like the other central London STD units—Citadel, Fortress and Tower—Bastion has magnetic-drum register translators which record the STD codes dialled by the London customers and route the calls to their destinations. The trunk switching equipment is Strowger type which responds to signals sent from the register-translators and steers each call to the required trunk route to the provinces.

It is interesting that despite the huge increase in trunk traffic the number of these calls handled by operators in London has steadily fallen. It is hoped that the improving service being provided

OVER

A happy picture of off-duty telephonists taking things easy in the splendid new lounge.



Graph shows achieved and planned build-up of the London Director Area STD unit capacity in usable access junctions from director exchanges.

will encourage customers to dial even more of their own calls and get the benefit of the quicker and cheaper automatic service—98 per cent of customers in the London director area, containing the majority of the Region's 3½ million telephones, can dial most of their own trunk calls.

This does not mean that the operators can be dispensed with eventually. They will always be needed to help customers, to answer inquiries and to provide special services when required.

The opportunity has been taken to expand and improve the welfare amenities for the operating and engineering staff in the neighbouring Temple Bar exchange.

When fully in service, Bastion will take its place with the other London outgoing STD units, not only to meet the current explosive growth of trunk business but to help in the ever continuing challenge of keeping apace with demand.

THE AUTHOR

Mr. J. F. Birt, *who joined the Post Office in 1941 as a Youth-in-Training in the North West Area, LTR, was promoted to TTS in 1955. He subsequently served in Middlesbrough and Newcastle-upon-Tyne and from 1959 to 1964 was a training officer at the Headquarter's Traffic Training School. He was promoted to STS in 1964 and is now temporary CTS in the Traffic Planning Branch of LTR.*

BRIEFLY . . .

The number of telephones in use in London rose by the end of September, 1968, to 3,578,108—an increase of 103,000 since September, 1967. Of this total, 1,849,512 telephones were being operated by businesses and 1,625,057 by residential subscribers.

●

Dr. A. Antoniou, Senior Scientific Officer in the Materials and Devices Division at the Post Office Research Station, Dollis Hill, won the main award in the 1968 Christopher Columbus Prize Fund contest for his contribution to Electronic Letters entited *Gyrators using operational amplifiers.* He was presented with the Scientific Premium by Sir Gordon Radley, former Director General of the Post Office and winner of the Christopher Columbus International Prize in 1955.

Two entries gained Craftsmanship Premium awards. One was for a five-transistor encapsulation welding machine entered by Technical OfficersW. J. Booty and L. J. Clark and Leading Draughtsman J. C. Yeomans; and the other for a 575 MHz high-pass filter entered by Technical Officers J. W. Jacobs, R. F. Gibson and I. L. Holland.

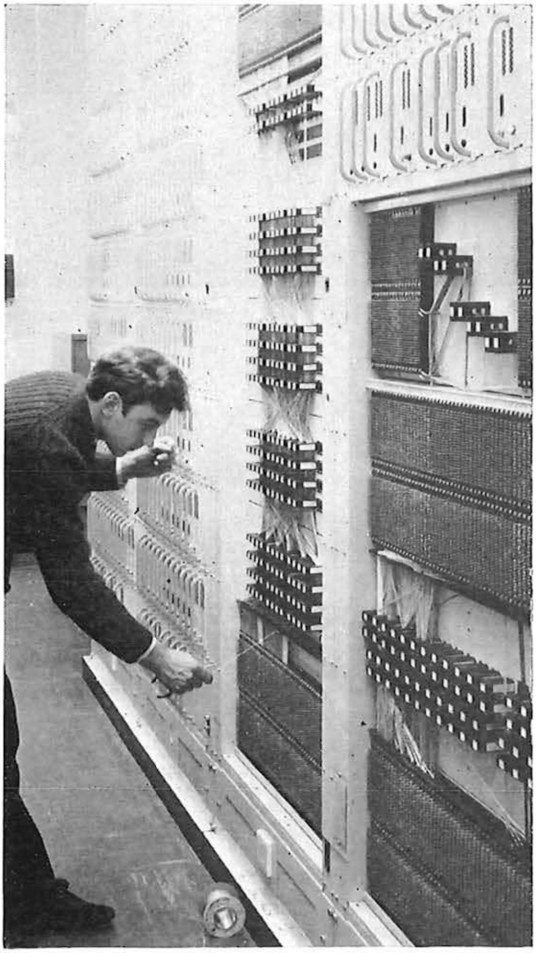
●

Telecommunications Headquarters has commissioned a study of the typography and layout of telephone directories to see whether they can be made easier for subscribers to read. The Work is being carried out by Mr. Herbert Spencer, a senior research fellow in the School of Graphic Design at the Royal College of Art.

Last year, the Post Office issued 17 million copies of its 77 main alphabetical and classified directories which, together, totalled more than 30,000 pages.

With the opening of the country's first electronic exchange . . .

SCOTLAND ENTERS A NEW ERA



An engineer puts the final touches to equipment in the new electronic exchange at Bishopton. Soon, one new electronic exchange will be opened every five or six days.

Monday, September 16th, 1968, was an important day in the history of the Post Office in Scotland. It was the day when Scotland's first electronic telephone exchange was opened at Bishopton, Renfrewshire, a ceremony which marked the start of five years unparalleled growth in Scotland's telephone service.

Within these five years it is planned to give automatic service with subscriber trunk dialling to the entire country and expand the telephone system to allow for a growth of about 280,000 connections. To achieve these objectives there is a heavy programme both for enlarging existing buildings and constructing new buildings. At present there are 35 major building projects in progress involving an expenditure of £850,000 this year, compared with about £450,000 last year.

In addition, 178 major telephone exchange buildings are programmed to start by 1972 at a cost of £7 million. The extension of existing automatic exchanges coupled with the extension of existing STD and International Subscriber Dialling facilities will cost a further £17.7 million by 1971-2 for equipment alone.

This picture of telecommunications development work in Scotland was drawn by the Assistant Postmaster General, Mr. J. Slater, when he opened the new exchange. He went on to explain that these figures did not include Dial House, Glasgow, now being built at a cost of about £2 million. This was the biggest current Post Office building project in the United Kingdom and would serve Glasgow and the West of Scotland as a trunk switching centre.

All this, as well as trunk circuit and other work, would give Scotland the infrastructure of modern telecommunications vital to her industrial and commercial growth. "At the same time," he added, "it will in itself be a certain source of employment for her people.

"In the next few years we will be hearing a lot more about electronic exchanges. They are now rolling off the production lines and, once our programme gets under way, we plan to open an exchange, similar to this, every five or six days until the current programme of 196 exchanges is completed."

An aerial view of HMTS *Monarch* leaving Belfast after her recent annual refit and modification.

MONARCH KEEPS PACE WITH THE TIMES

By D. N. DICK

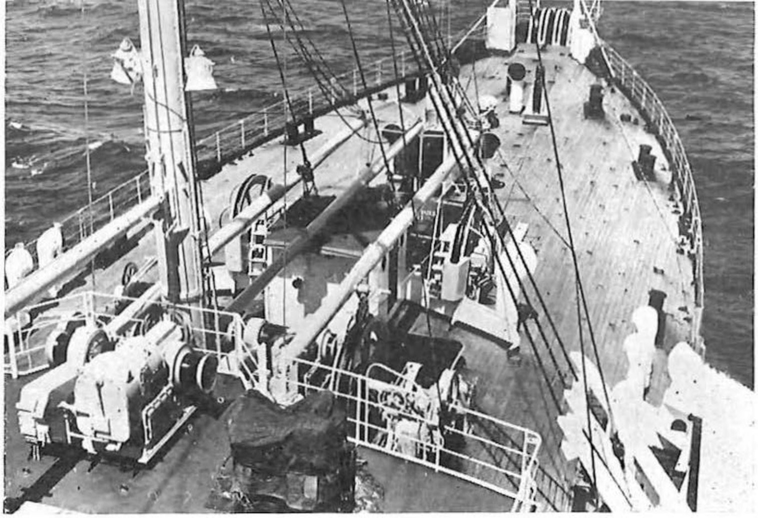
HMTS *Monarch*, the Post Office cable ship, has emerged from another major modification to keep it up to date with the rapidly-changing technology of underseas communications. She is now busy laying part of the 5,800-nautical mile long submarine cable from South Africa to Portugal

THE advance of telecommunications is based on a swiftly-changing teclmology and this is particularly true of underseas communications. An outstanding example, is development of the Post Office cable ship HMTS *Monarch* which, since it was commissioned in 1946, has undergone a series of modifications and improvements, the last of which were completed recently.

New systems have required new methods and new equipment and a vast store of experience has been accumulated which has made *Monarch* the yardstick by which cable laying and repair ships have since been built.

Monarch was designed and built to lay telegraph cable systems so that the introduction of telephone cable systems and the development of rigid-type submerged repeaters necessitated considerable modifications to the ship. These modifications have been carried out in a number of stages, two of which have involved major structural alterations.

Monarch's cable capacity was originally about 2,000 miles of telegraph type cable, the only limitation being the amount of cable which could be coiled into the four cable tanks. The introduction of the telephone cable with rigid type repeaters, presented a new limitation. For accessibility and ease of handling, the rigid repeaters, because of their bulk, were stowed in the centre



A view of *Monarch*'s new foredeck showing parts of the cable machinery contained in the new structure, with the deckhouse removed. The mast has now been replaced with a new bi-pod mast.

castle (cable working deck), between the tank hatches. Hence the limitation on any cable system was the number of repeaters which could be stowed. Added to this was the congestion of the associated bights of cable between the tanks and the repeater stacks.

The first repeater telephone cable laid by *Monarch* was the Aberdeen-Bergen link in 1954. The cable was 302 miles long and had seven rigid-type repeaters spaced about 44 miles apart. The system was designed for 36 telephone circuits. Although this was a relatively short lay, it did demonstrate the difficulties which would have to be overcome if a longer repeatered system were to be laid.

In 1955 *Monarch* laid the first trans-oceanic system, TAT 1 (west to east) totalling 1,938 miles of armoured cable, with 51 repeaters and four equalisers and designed for 36 circuits. The repeaters, spaced about 38 miles apart, and equalisers in this case were the American flexible type designed to conform to a diameter little greater than that of the cable. Consequently these units could be stowed in the tanks, thus obviating the centre castle stowage difficulty. The flexible repeaters are, however, only one-way operation, so that both TAT 1 and TAT 2 subsequently laid by *Monarch* have two cables, making in all rather costly systems.

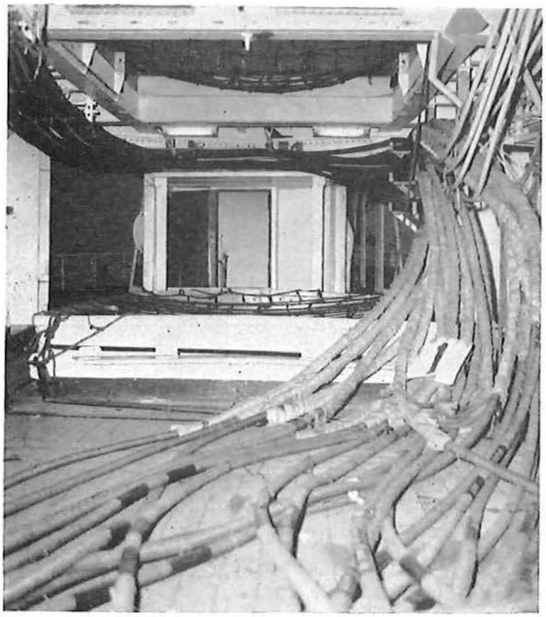
In 1961 *Monarch* laid a further trans-oceanic system—CANTAT. This involved laying 2,072 miles of cable, part of which was armoured and part lightweight. There were 86 repeaters and six equalisers, all of the rigid-type, and the repeaters were spaced in the main lay 26.3 miles apart. This system was designed for 80 circuits.

The congestion of repeaters and cable bights in this and the Anglo-Swedish cable which preceded it meant that it was necessary to site a third repeater stack between the hatches of No. 1 and No. 2 cable tanks. This position, being on the foredeck forward of the ship's superstructure, required the erection of a system of overhead steel work to provide anchorages for all the cable bights and the suspension of a beam for a repeater handling hoist. This situation had become so critical that serious consideration had to be given to some structural modification which would enclose this third stack within the body of the ship if *Monarch* was to be capable of handling further long systems with rigid repeaters.

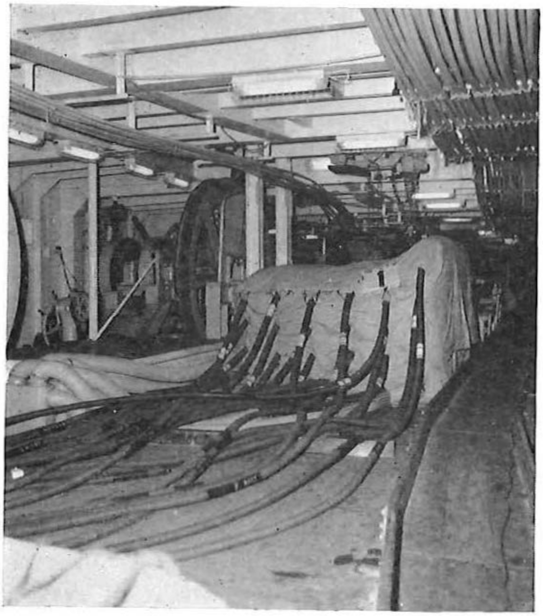
So, in 1962, *Monarch* underwent the first major modification, which involved extending the boat deck some 44 feet forward to house No. 1 cable tank hatch and thus provide protection for stowed repeaters and cable bights to the third stack. The new house also allowed a little more flexibility to the bight stowage arrangement of the third stack.

The centre castle was still somewhat congested in subsequent lays when carrying the maximum repeaters the conditions would permit. The original repeater racks were designed so that a maximum of 40 repeaters could be carried in two stacks each four wide and up to three high and a third stack four wide and four high. The racks were re-designed to increase the stowage to six wide, giving a new maximum of 60. This design was later further modified so that the three high stacks could be increased to four high but, because of the limited headroom, great difficulty was experienced in handling the top layer and so loading capabilities were curtailed to a maximum of 66 repeater and equaliser units.

OVER



Above: Looking forward inside the new arrangement of cable bights associated with repeaters in the fourth repeater stack. Below: Looking aft into the fourth repeater stack. The stack is covered by a tent and fed with cold air through circular ducting.



In 1965, cable systems developments were to increase circuit capacity which involved reducing repeater spacings to about 10 miles. Consequently, if *Monarch* was to be able to lay the maximum length of system which could be loaded—about 1,400 miles—then the repeater stowage capacity needed to be more than doubled to 140.

By a further modification to the existing repeater racks, the width could be increased to eight, but the aggregate increase that could be obtained fell a long way short of the new requirement. Various proposals were considered, but the only real solution was a further extension to the boat deck.

Consultants were engaged to design the new house formed by the extension, replace the existing foremast by a bi-pod mast, remove the forward drum room and re-site the equipment and foredeck winches.

In 1967 Messrs. Harland & Wolff Ltd., Belfast, were awarded the contract for the annual refit and for the modifications. Concurrently with these modifications a more sophisticated transmission test room was set up. The repeater racks were modified to eight wide, the third rack increased to five high, and a new fourth repeater rack made up which would support six repeaters wide by six high.

Other advantages were obtained from this modification, the main one being that the forward cable machinery and dynamometers and the back tension gear, which had hitherto been exposed to the elements and required constant maintenance, is now enclosed.

Monarch was chartered by Standard Telephone and Cables Limited early in 1968 to lay sections of the South Africa-Portugal cable, the first long lay with 9.8 mile repeater spacings. The total length is 5,870 miles of which, when complete towards the end of this year, *Monarch* will have laid 3,294 miles with 348 rigid repeaters and 28 rigid equalisers. Although the greatest number of units to be carried in any one expedition will only be 127, it has been satisfactorily demonstrated that 140 are within the *Monarch's* capabilities.

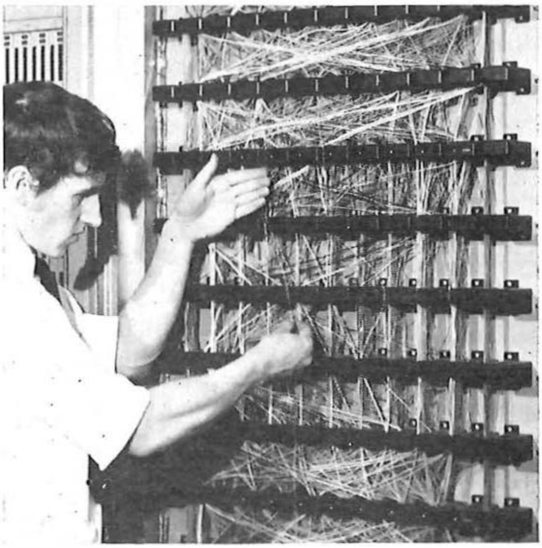
THE AUTHOR

Mr. D. N. Dick, *who was appointed Superintendent Marine Engineer in THQ Submarine Branch in March, 1968, joined the Post Office in 1955 as a junior engineer on HMTS* Iris, *a Post Office cable ship. From 1960-66 he served with HMTS* Alert, *rising to the rank of Second Engineer, and in 1966 was appointed Assistant to the Superintendent Marine Engineer at Post Office Headquarters.*

Important developments are taking place in electronic exchange systems. This article describes the TXE 3 system and a trial carried out with a model of this . . .

DESIGN FOR A LARGE ELECTRONIC EXCHANGE

By E. L. BUBB



Technical Officer Malcolm Harris adds wire to the cyclic store of the TXE 3 model to record the directory and equipment numbers and the class of service of a new subscriber.

THE TXE 2 electronic exchanges now coming into service in various parts of the country have been adopted as the standard design for exchanges in the approximate size range 200–2,000 lines.

Developments currently in hand will enable two units to be interconnected, extending the upper limit to double this figure. However, the trunking and method of control adopted for this system become uneconomic for large exchanges and development of a system—designated TXE 3—suitable for exchanges up to 20,000 lines or more was initiated in 1964.

A small model incorporating all the design features was built to production standards and, after exhaustive testing, put on trial in public service in April, 1968, carrying the traffic of 100 subscribers on the Monarch (606) exchange in the City of London.

Even before this model was completed it became apparent that by redeveloping certain features a significant cost reduction could be achieved. Experience gained during commissioning, testing and operating the TXE 3 model has been passed back to the designers and a cost-reduced version—TXE 4—has now been brought to the stage where a production prototype is undergoing factory tests before being installed in the London area for public traffic early in 1969.

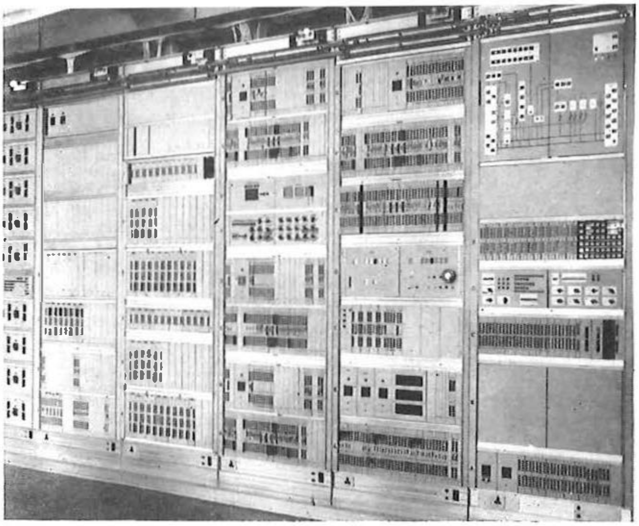
The potentialities of the TXE 4 system in a wide range of applications are considerable. Plans for a full-size local director installation are being considered.

A TXE 3 exchange consists of three main areas:—

(1) Peripheral equipment comprising subscribers' line circuits, junction terminations and other units providing a variety of special functions such as coin and fee checking on coin box calls.

(2) A switching area through which connections are established between peripheral equipment. It is arranged to give three stages of switching on either side of centrally located link circuits.

OVER



A general view of part of the TXE 3 model. This suite includes outgoing junction units, the switching network and the marking and route choice equip-equipment.

(3) A control area which receives information from peripheral equipment and the switching area, and processes this with data held in its own store to determine the actions required. It issues instructions to the other areas and checks their successful completion, making second attempts if necessary.

The inherent flexibility of the system stems in part from each of these areas. If special functions are required on a minority of calls these can be catered for by providing a few peripheral units trunked in on appropriate calls. The switching network is a general purpose one which allows such serial trunking and, in addition, double connections to be made to peripheral terminals when required—for example, during the intermediate stages of setting-up a call or for such purposes as trunk offering. The speed of switching—approximately one-twentieth of a second is required to establish a path through the network—enables the trunking to be changed and peripheral units to be introduced or released, if required, in the pauses between digits being dialled into the exchange.

Finally, in the control area the Main Control Unit operates in accordance with an instruction programme stored in the form of a number of wires threading a bank of magnetic cores. Changes in the operating sequence can be obtained by programme changes involving the re-threading of a number of wires in the store instead of by widespread re-wiring within and between a multitude of separate units.

The system provides all the standard facilities available on current electro-mechanical exchanges and its inherent flexibility will enable new facilities to be added as required.

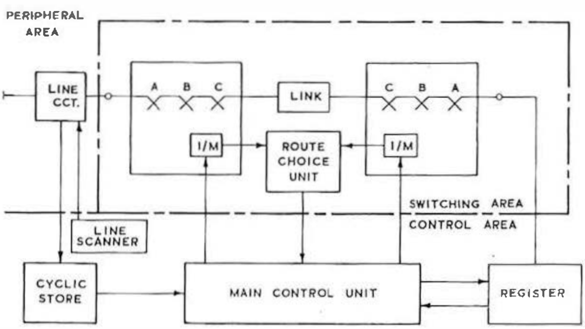
The main principles of the new system can be appreciated by considering the steps in establishing a particular call from a subscriber on a director exchange to one on an adjacent exchange.

Line scanning circuits sequentially examine the state of each line, junction and so on by means of a pulse many times a second and immediately after each pulse a data store (the Cyclic Store) offers the Main Control Unit permanent information relating to the line. When a calling condition is detected, the scanning pulse is passed to the Main Control Unit indicating to it that a new call has to be set up and busying it temporarily to further calls. As the first steps in dealing with the new call the Control records the directory number and class of service (shared service, PABX line, incoming junction register, TOS and so on) information offered by the Cyclic Store and allocates one of its associated group of up to 30 registers.

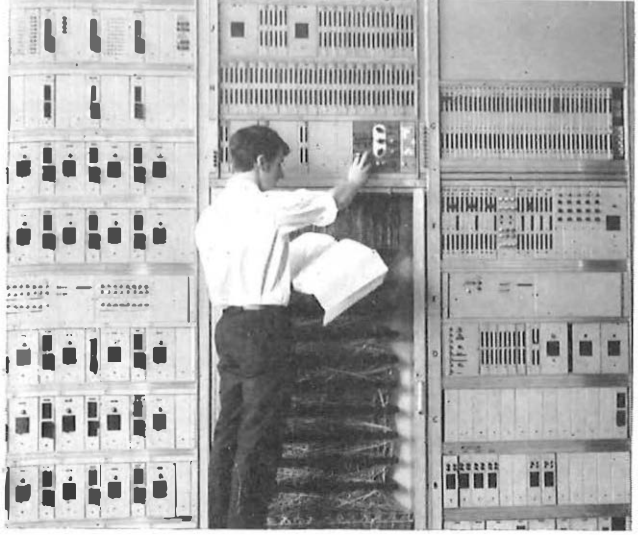
The registers are connected to peripheral terminals of the switching network, in the same way as subscribers' lines, junction circuits and other units and the Main Control Unit proceeds to issue instructions to the network to connect the subscriber and register terminals.

The switching network is composed of reed relay cross-points arranged to give three (A, B and C) stages of switching on either side of a number of linking circuits. The A-stage switches concentrate traffic from the peripheral terminals on to B–C-stage arrays which are internally connected to provide full accessibility between every B-switch terminal and every C-switch terminal of the array.

Each array forms one plane of a sub-unit and, depending on the size of exchange and the average



Block diagram of the TXE 3 system showing the three main equipment areas.



TO Malcolm Harris tests one of the two main control units. The programme store, which has a capacity of 2,000 45-bit instructions, occupies the lower half of the rack.

calling rate, four, six or eight planes and up to about five sub-units would form the complete switching network of an exchange. Each peripheral terminal has access via the A switches to each plane in one sub-unit and the linking circuits connect C switch terminals of each plane with those of the adjacent planes in all sub-units.

A simple switch enabling two subscribers to be connected to two others can be constructed, but extending this to larger sizes becomes increasingly uneconomic. Nevertheless, by splitting the network into two stages, considerable economy can be effected.

To connect the allotted registers to the calling line, the Main Control Unit asks the interrogator-markers on each plane to identify all free paths from the subscriber to the central, "through" type, links and from the register to the links. This information is returned to the Route Choice Unit which then identifies those link circuits which are available to both peripheral terminals and selects the most suitable, according to predetermined rules chosen to make maximum use of the network. Its decision is signalled back to the Main Control Unit which then instructs the interrogator-markers to mark the chosen pair of paths, starting from the link out through the C, B and A stages of one plane to the subscriber, and then from the other side of the same link, through C, B and A-stages in another plane to the register.

The register then checks the connection, connects battery via a transmission bridge to the subscriber and sends dial tone. Normally, the whole process will have taken about one-fifth of a second —less than the time required for the subscriber to lift the handset to his ear—but under heavy traffic conditions when many calls are competing for use of the control equipment this delay may increase slightly.

The Main Control Unit, having completed its immediate tasks for this call, is free to deal with other demands. It retains a record of the calling equipment number against the identity of the register and notes the stage which has been reached in the progress of the call.

The subscriber dials the required number and as each digit is received it is stored in electronic circuits within the register which will call for the Main Control Unit after each digit and ask for instructions. Until sufficient digits have been received to determine the outgoing route from the exchange, the instruction will be "apply again after the next digit" and the Main Control Unit will return to serving other demands.

When sufficient digits have been received, the Main Control Unit will be able to determine the required path through the exchange, the routing digits to be sent (if an outgoing call is indicated), and which of the received digits have to be repeated forward. It will advise the register accordingly and then set the paths necessary to

OVER

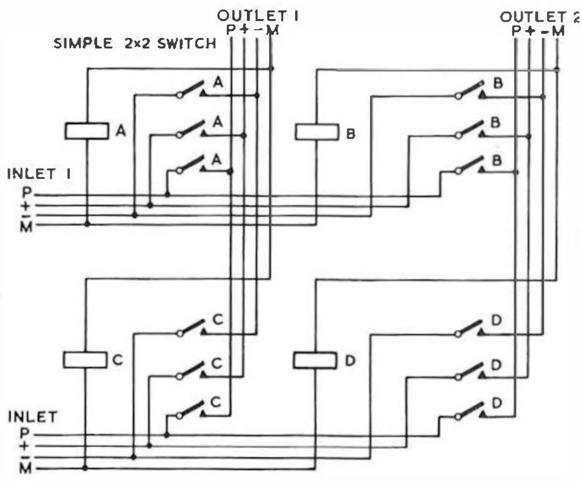
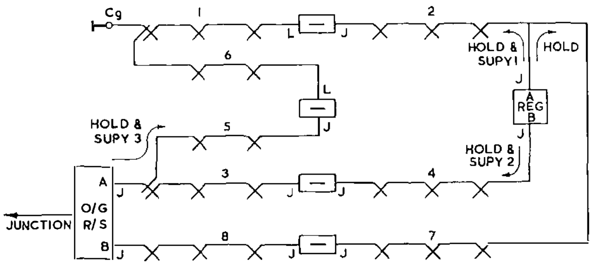


Diagram of the simple 2 by 2 switch.



LOCAL SUBSCRIBER TO O/G JUNCTION
(USING A COMBINED REGISTER SENDER)

This diagram shows the paths used in connecting a local subscriber to the outgoing junction, using a combined register sender.

allow the register to signal forward and finally extend the caller to the required number or junction.

In the same way that it set a path (path 1, 2) to the register A terminals, the Main Control Unit now proceeds to set-up paths to the chosen outgoing junction termination. Paths will be set up from the "A" pair of terminals on the junction unit to the "B" pair of terminals on the register (path 3, 4), and from a second connection to the subscriber's A-switch to a second connection on the junction "A" terminal A-switch (path 5, 6). The register then checks the complete loop 2, 1, 6, 5, 3, 4, transfers its digit-receiving circuits to the "B" pair of terminals and releases the original (path 1, 2) connection to the subscriber. The "A" terminals of the register are finally connected to a "B" pair of terminals on the junction unit (path 7, 8) and the pulsing-out circuit within the register is connected to its "A" terminals. The Main Control Unit is again released to attend to other demands, leaving the register to continue with further stages in establishing the call.

Dialling-in continues over paths, 6, 5, 3, 4 and the digits are stored in the register. Meanwhile, the digits transferred from the Main Control Unit are pulsed-out over path 7, 8, followed by the numericals from the stored incoming train. When sending has been completed, paths 3, 4 and 7, 8 are released, the "A" junction unit switches the outgoing line from terminals "B" to terminals "A", the register releases, and the subscriber is left connected through to the distant exchange ready to receive ringing tone. Supervision of the call is transferred to the outgoing junction relay-set.

In the subscriber to register and junction connection so far described, the transmission bridge has been located in and supervision exercised from either the register or outgoing junction termination and so a "through link" has been utilised to give a direct connection through the network. Metering is carried out by the junction unit which applies a pulse of positive voltage to the P-wire to operate the subscriber's meter at appropriate intervals.

By employing two phases of metering pulses and choosing the one appropriate to an X or Y subscriber the system is able to give separate metering to shared-service lines without requiring each party to have a separate line termination on the system.

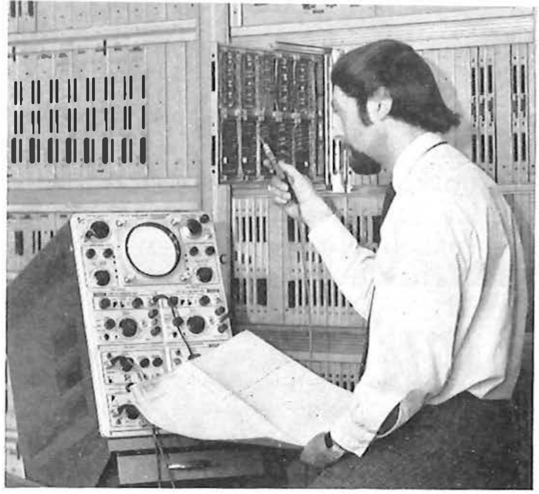
On calls which terminate on the exchange a transmission bridge and supervisory circuit need to be introduced within the switching network. This is done by employing a "bridge link" in the final connection. To allow metering on own-exchange calls these links also contain local call timing elements which pulse the P-wire in the desired "X" or "Y" phase at the appropriate times.

Similar procedures will be followed for any other type of call. In every case the Main Control Unit will decide, in accordance with its programmed instructions, what connection pattern is appropriate in the circumstances indicated and issue orders for setting the paths.

Security against the effects of equipment failure is provided in different ways in the various parts of the system. Although reference has been made to a single Main Control Unit, the system is designed to be equipped with up to 12, any one of which can deal with any call. Each can deal with the processing for approximately 6,000 messages an hour and sufficient will be provided to handle the exchange traffic, although for security a minimum of three would be provided at any exchange.

Within each Main Control Unit information is handled in a "two-out-of-five" code which enables errors to be detected, and the output of the programme store is duplicated to give additional protection. Registers are provided in groups of up to 30 on each Main Control Unit and, as with the Main Control Units, security against the effect of failure of an individual is obtained by sharing the traffic over a group.

Each cyclic store serves a large number of circuits and possibly translations, and up to 20



Technical Officer Mr. Terry King tests a plug-in unit in one of the interrogator markers.

stores can be accommodated. Most of its internal circuitry is duplicated for security, while "two-out-of-five" coding of its information allows errors to be detected and prevented from extending further.

Because the switching area, including the interrogator-markers, is divided into self-contained sub-units and each terminal on the network has access to one sub-unit in each plane of the exchange, a failure will not isolate any terminal. The interrogator-markers have been designed with self-checking features which will detect the majority of faults occurring in them and block them to further traffic. The caller is protected against failures which are not detected in this way —for example, a defective cross-point—by the Main Control Unit making a second attempt to set a path if the register fails to detect the expected completion of a new path. The route choice mechanism is such that the second attempt is almost certain to be made through different parts of the network.

The functions of the Route Choice Unit and the generator supplying pulses to the various parts of the exchange cannot readily be protected by a "shared load" approach. In these cases several identical units are operated together so that if any one gives a different answer from the others its output will be disregarded for control purposes.

The TXE 3 model was originally planned to include the minimum number of each type of unit to enable the design to be confirmed by laboratory testing of a minimal non-director configuration. Subsequently, however, a decision was taken to extend testing to service in live traffic serving a block of 100 subscribers' numbers on Monarch director exchange. Installation was in hand in the Telecommunications Development Department's Circuit Laboratory by this time and the single Main Control Unit had been programmed to give non-director operation, but the flexibility of the system was illustrated by the ease with which it was adapted. Additional units, including a second Main Control Unit, were added to give traffic capacity and security, and the Main Control Unit programme was amended to provide director facilities. Provision was made for centralised service observations, trunk offering, test access and so on and, to illustrate the system capability, demonstration lines were equipped with keyphones, subscriber-controlled transfer and other facilities which would not be required by subscribers who would be connected during the trial.

Outgoing junctions were provided to the Group Switching Centre and tandem exchanges and a further group of outgoing circuits was connected to selectors giving access to the Monarch first code train for calls to other Monarch subscribers, manual board and so on. The lines and final selectors of subscribers 1300—1399 were connected through changeover keys at the manual board to allow service to be given by either the Strowger or TXE 3 equipment.

The TXE 3 model has given satisfactory service, except once when service was restored to the Strowger equipment for a short time as a safeguard while locating and clearing two coincident, unrelated, component failures which had seriously reduced the traffic carrying capacity of such a small unit. The incident did not cause the exchange to fail and its effect in a full-size exchange would have been a reduced, but tolerable, grade of service affecting only some calls. The experience gained from the model has confirmed the validity of the basic design.

The incidence of component failures has been very low since the equipment was switched into service and the security arrangements have given the protection intended.

THE AUTHOR

Mr. E. L. Bubb joined the Post Office in 1936 as a Youth-in-Training, spending most of his early years and until 1957 at the Research Station, Dollis Hill, which he left on transfer to the former Telegraph Branch of Inland Telecommunications Department. In 1967 he was promoted to Assistant Staff Engineer and is now in the Telecommunications Development Department where he is concerned mainly with electronic exchange developments.

Traffic has been increased and the service for customers improved by the introduction of a new system which enables subscribers to dial . . .

ACROSS THE ATLANTIC ON DEMAND

By R. W. CHANDLER

THE introduction of the "on-demand" telephone service for trans-Atlantic calls between London and North America has proved extremely successful.

It has yielded an immediate bonus since it is now no longer necessary to have to revert calls back to London customers requiring North American calls.

It has stimulated traffic, improved the service for the public and enabled the Post Office to handle calls to North America more efficiently and to use circuits and operators more productively.

It has also enabled simplified ticket and revised operating procedures to be introduced which, together, have reduced the time an operator now needs to spend on handling calls. Finally, it has provided a useful first step in preparing subscribers for the introduction of International Subscriber Dialling to North America.

The new "on-demand" service was introduced on 8 July to encourage callers to make ordinary calls in preference to personal calls by offering them a cheaper and faster service for ordinary calls only. Previously, all calls—ordinary and personal—had to be booked with an operator who called the subscriber back when his number was available.

Now, for ordinary calls only, callers simply dial 107. This new dialling code gives direct access from the London Director Area to the International connecting operator who puts the caller straight through, thus saving time both for the customer and the operator. By confining the

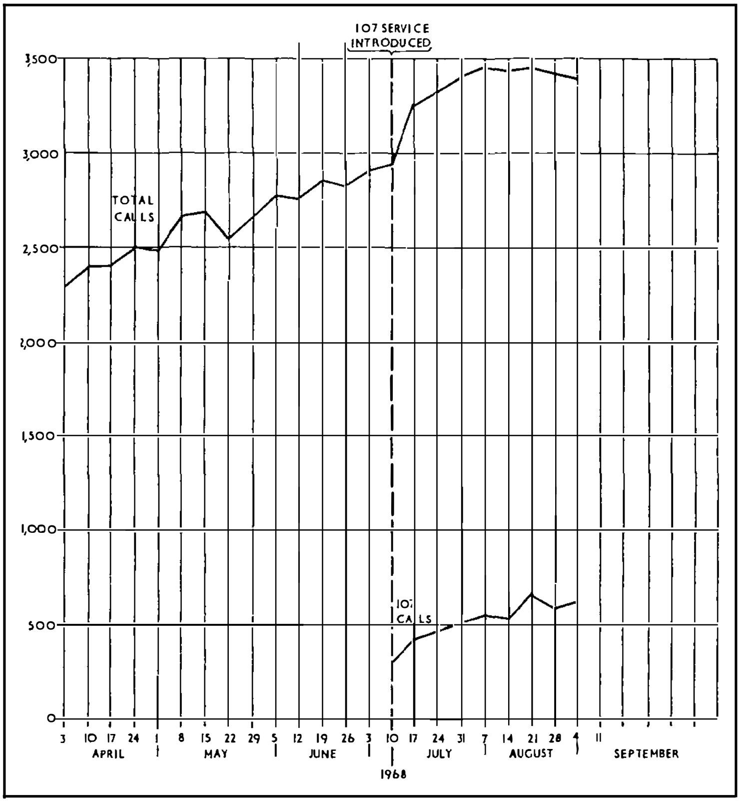
A view of the 107 suite at the International Exchange in Wren House, London.

new service to simple, straightforward ordinary traffic we are better able to ensure the quick, efficient, handling of each call.

After keying the required number in North America, the operator withdraws from the circuit and is free to handle other calls. Full supervisory conditions are given. Each set of connecting cords on her switchboard is equipped with the usual supervisory lamps—one controlled from the caller's telephone and the other from the called party's telephone. The former remains dark while the call is being set up since the caller is waiting on the line and as soon as the other darkens (indicating that the called number has answered), the operator starts the timing mechanism as an overlapping operation. When the conversation is completed both supervisory lamps glow and the timing stops automatically.

The personal call and other miscellaneous services are still obtained by the subscriber dialling 108 and booking his call with the operator who calls him back. It meets a very real need, particularly for businessmen. On this service, the operator starts the timing device only when the called person has been obtained. She must, there-

This diagram shows how the number of calls from Britain to North America has increased since the new 107 "on-demand" service was introduced in July, 1968. The total calls curve has been adjusted to eliminate the effect of the summer seasonal variation.



fore, keep a close watch on the progress of the call. This procedure is more time consuming for the operator than the "on-demand" system and circuits are occupied for a longer time.

The success of the new 107 service was apparent immediately after its introduction. On average, a London caller who often under the old system had to wait for up to 35 minutes before his call was connected, found that he could get through within 90 seconds after asking the operator for the number. By the end of the first month ordinary traffic had increased from 25 to 35 per cent of the total traffic to North America and, more surprisingly, there was no reduction in the number of personal calls. The overall traffic had increased.

It has also been found that the segregation of on-demand ordinary traffic from personal call traffic allows the two traffic streams to be controlled more efficiently.

The new service is planned for extension to other overseas countries in due course and will be made available from the provinces in the United Kingdom as soon as possible. It will play an important part in preparing subscribers for the introduction of International Subscriber Dialling (ISD) between Britain and North America which it is hoped to achieve in 1969.

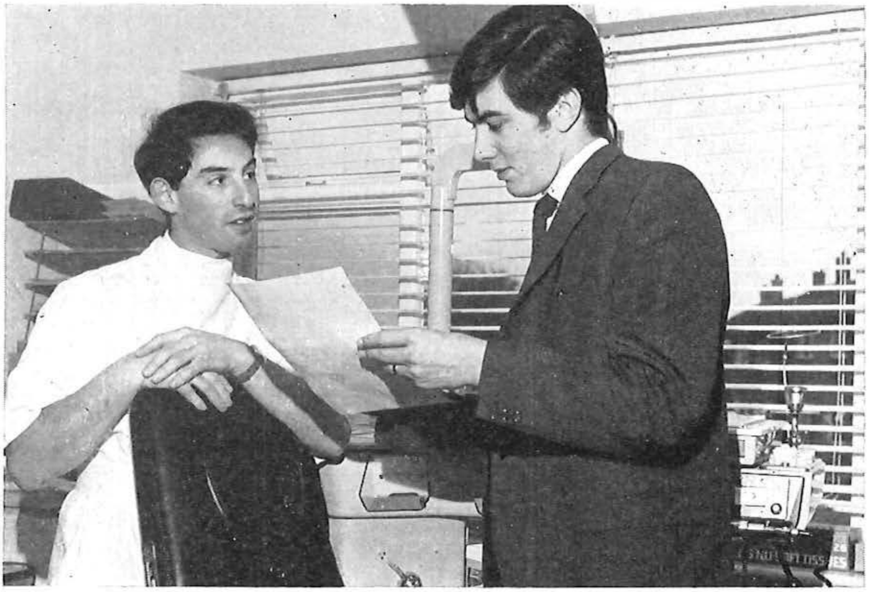
This important extension of the ISD services depends on the satisfactory conclusion of talks at present taking place between the British Post Office and the other administrations. It will require the provision of more trans-Atlantic circuits and more switching equipment in the International Switching Centre in London. The measures for this next step forward are already in hand.

THE AUTHOR

Mr. R. W. Chandler, MBE, *who retired from the Post Office at the end of September, 1968, after 41 years service, joined as a Probationary Inspector in 1927. Since 1959 until his retirement he was a Principal Telecommunications Superintendent in charge of the Telephone Operations Section of the External Telecommunications Executive.*

From TIM, through WEA and UMP to (possibly) Bedtime Stories

The search goes on for new telephone information services. The latest idea, supported by market research, is for childrens bedtime stories



Sales Representative Richard Walker interviews a dentist in the Oxford Telephone Area and notes his remarks on the questionnaire

A MARKET research report issued recently by the Marketing Department of Telecommunications Headquarters recommends a new telephone information service to be called "Childrens Bedtime Stories."

At first sight this might appear far fetched. But is it?

After a slow start, the range of telephone information services offered by the Post Office has grown steadily. The first dates back to the earliest days of public telephones and grew out of the need to handle spontaneous calls from telephone users wanting to know the time.

The telephone system was then wholly manual and the instruction to operators receiving such calls was to announce: "*The time by the exchange clock is . . .*" and to avoid reference to "correct time" in case the exchange clock was wrong! But, with the conversion of the telephone system from manual to automatic and the development of recording techniques, the value was recognised of using recorded announcements for telephone information services.

A sophisticated Speaking Clock was developed, capable of announcing the time every ten seconds to a very high degree of accuracy and the Post Office introduced it to the telephone public as TIM. It was an immediate success and today attracts many more callers than all of the other information services together: 225 million calls in 1967-68, an increase of 17 per cent over the previous year.

By A. W. HASSAL

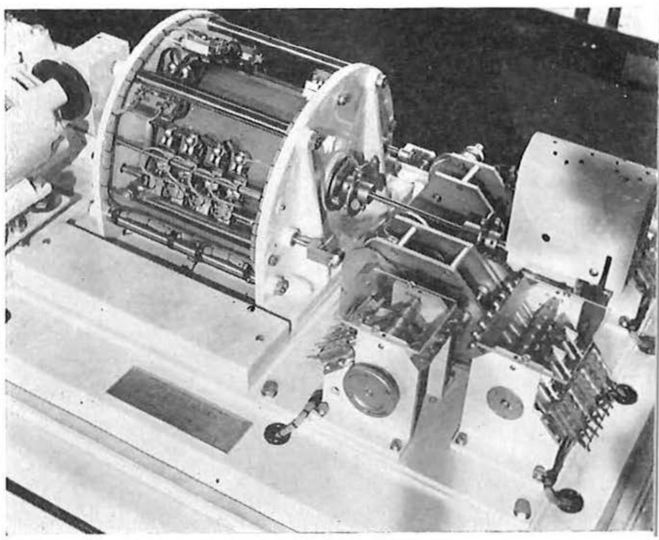
The success of the Speaking Clock showed that recorded telephone information services encourage use of the telephone, can be operated economically and contribute to the profitability of the telephone service. A search for other information services began and six more are now operating: Weather Forecasts, Motoring Information, Test Match Score, a Teletourist Service in four languages, Recipe Service and Dial-a-Disc. Although the last is available in only a limited area and is aimed at a particular age-group, its success has exceeded expectations. About thirteen million calls were made to Dial-a-Disc last year, a calling rate bettered only by the Speaking Clock.

Not all exchanges have access to all the information services which, however, are provided as equipment becomes available and whenever they are expected to be profitable. Ideally, telephone information services should not give rise to traffic peaks and callers should be able to obtain the information they want within a few minutes.

At the end of 1967, the Marketing Department was asked to continue the search for more information services by employing market research techniques. A questionnaire was prepared listing eight possible information services and co-operation was obtained from the Sales Divisions of ten Telephone Managers' areas, one in each Region. All members of the public visiting Sales Bureaux in the ten areas during a particular week in January and those visited by Sales Representatives on two days of the same week were invited to take part in a short market research interview. The public responded well. More than 1,200 interviews were completed and there were only four known refusals.

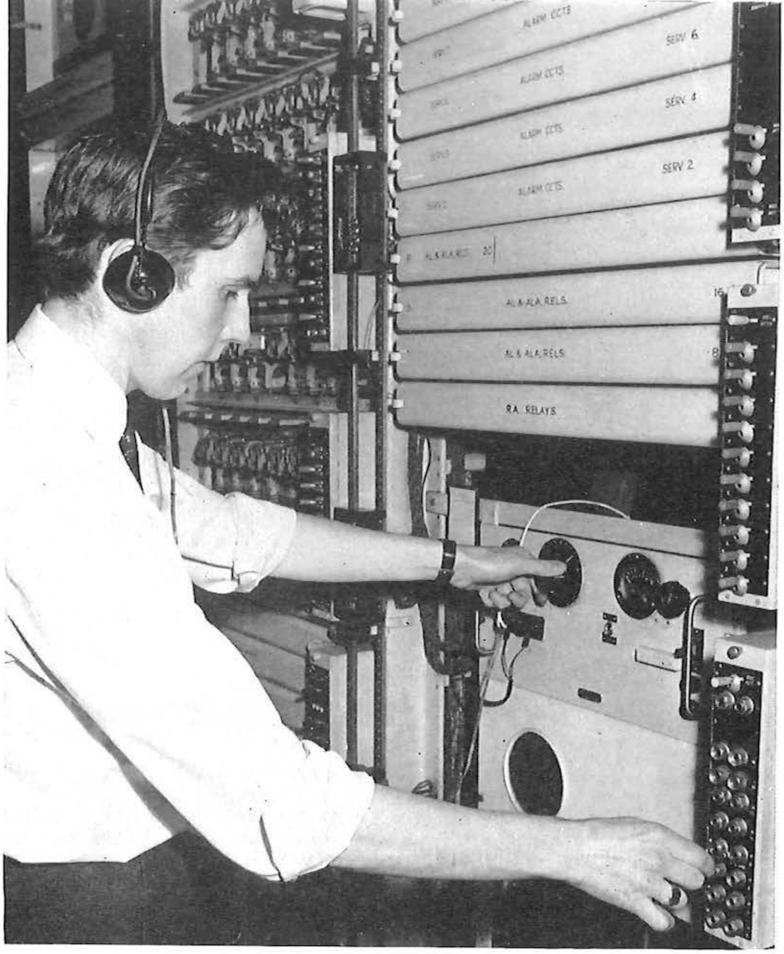
During each interview, the respondent was asked if he could suggest any new telephone information services that the Post Office should introduce; and if he thought he would use, and if so how often, any of the eight possible telephone information services that were listed on the questionnaire.

Not many customers were able to give a positive answer to the first question but this was not unexpected. A list of possible subjects for information services had been compiled in Headquarters over many years and it was already realised that original ideas would arise only occasionally. But the search continues.



Miss Pat Simmons, the Post Office's Girl with the Golden Voice, with the Speaking Clock equipment at the London Trunk Control North. Below: One of the pair of speaking clocks on which Miss Simmons' recorded voice tells the time every ten seconds day and night.

OVER



Engineer Robert Williamson adjusts the levels on the information services equipment at Trunk Control North in Judd Street, London.

Transferring a "pop" record on to tape for transmitting the number over the Dial-a-Disc service which was introduced in 1966.

Replies to the second question showed that of the eight possible services listed on the questionnaire, three aroused particular public interest. Thirty-two per cent of all those interviewed thought that they would use a Cricket Score Board service on average 3.3 times a week. This was the highest level of declared interest but the expected calling rate confirmed the view that very few people would want to know the up-to-the minute scores in county cricket matches. Public interest in county cricket has been declining for some years but this is not the case with Test matches. The Test Match Score service is very popular and attracted eleven million calls during all the five Tests in the 1968 series against the Australians.

Of those interviewed, 31.5 per cent said that they would use a Football Results service on average 1.4 times a week. The low forecast calling rate illustrates that football is not a good subject for a telephone information service. Its use would be confined almost wholly to Saturdays during the football season and, since most games last only

THEY GAVE THE TEST SCORES

This is the team of Post Office girls who obtained and recorded the scores for the Test Match Service during the 1968 series between England and Australia. They are (from left to right): Mrs. Ellen Moelly, Miss Yvonne Biddulph, Miss Pamela Hawes, Miss Margaret Woodin, Miss Thelma Cumberbatch, Miss Pat Weighall and Miss Sheila Keogh.

The girls worked in teams of three, led by an editor—Miss Weighall and Miss Keogh, both Telecommunications Traffic Officers—who was in direct touch with the Test Match grounds. The two telephonists in each team took it in turns to record the latest score and check the telephone commentary against the information from the grounds. The average time between getting a new score from the ground and recording it was 25 seconds.

★

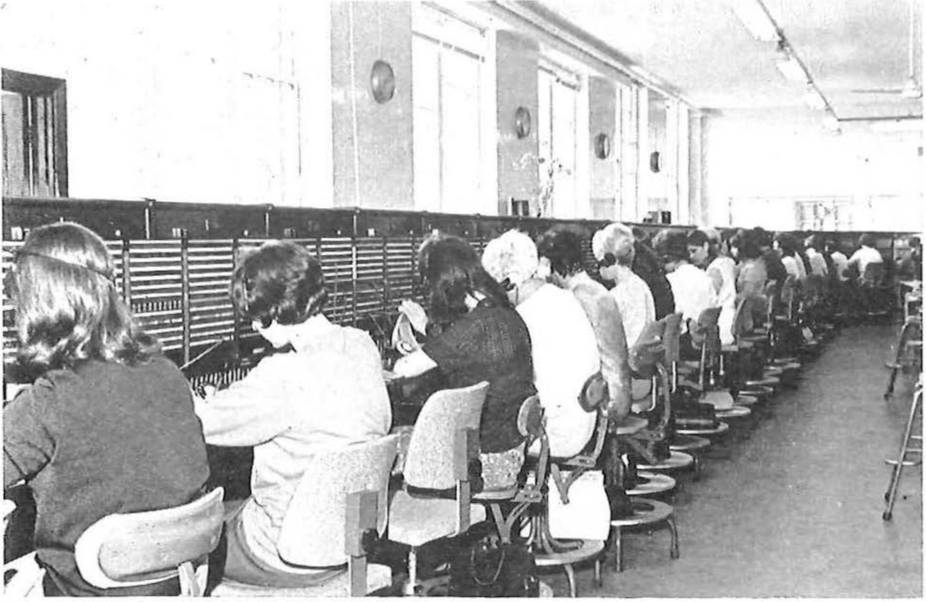
an hour-and-a-half public interest is maintained only for that time. Only the final scores and perhaps the half-time scores are sufficiently newsworthy to attract callers to a Football Results information service and, because they are widely publicised on radio, television and in the Press, it is most unlikely that the Service would be a success.

The service with the greatest potential appears to be Childrens Bedtime Stories—24 per cent of all people interviewed thought that they would use it on a significantly high average of 5.5 times a week. This service has several attractions. It would be unlikely to suffer seasonal fluctuations, it should attract use of the telephone outside the day busy hours and it would instil the telephone habit. But there are many problems to overcome before the Service could be launched, not least the question of where the Post Office can find an endless supply of stories of the right length and content. It is possible, however, that the telephone service might soon compete with radio and television in the world of childrens entertainment. The day may not be far off when toddlers will reach for the telephone to hear about Tom Thumb's escape through the co-axial tube or Captain Scarlet's attack on the Post Office Tower.

Footnote: *The "Dial-a-Disc" service, which began in Leeds in December, 1966, is now available in a number of centres throughout the country, including Bath, Bournemouth, Bristol, Bradford, Cardiff, Chesterfield, Exeter, Gloucester, Guildford, Grays (Essex), Huddersfield, Leicester, Middlesbrough, Newcastle-upon-Tyne, Plymouth, Southampton, St. Albans and Swansea. It will be extended to other towns as equipment becomes available.*

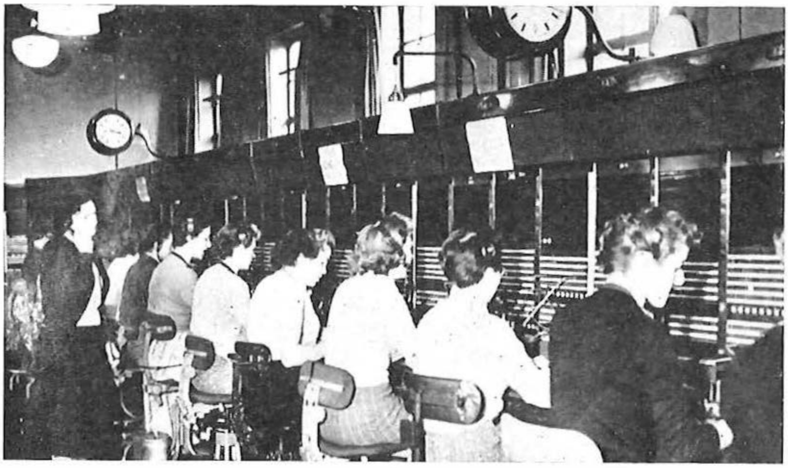
THE AUTHOR

Mr. A. W. Hassal, *who joined the Post Office as a Youth-in-Training in Liverpool in 1941, became a Sales Representative in the Liverpool Area in 1955 and was appointed Assistant Sales Investigation Officer in the Sales Division of the old Inland Telecommunications Department in Post Office Headquarters six years later. He is now Assistant Controller Sales, Marketing Department in Telecommunications Headquarters with responsibility for market research into subscribers' apparatus and services.*



NEW: A view of the new switchboards at the Burnley Exchange.

NOW NEW SWITCH-



OLD: The Burnley Exchange as it was before the switchboards were modified.

TO improve working conditions for the staff, many of the older sleeve control switchboards throughout the country are to be modernised and their height reduced from the present 6 ft 4½ ins to 4 ft 8½ ins — the same height as the modern "low-type" positions.

This welcome move has been made possible by the reduction in the space required to house the switchboard multiple. With the spread of subscriber trunk dialling, fewer circuits are now needed in the outgoing multiple and this has meant that the top part of the multiple is no longer used. At the same time, the recent decision to recover separate labelling strips has led to a reduction in the size of the answering multiple.

The idea to modernise the older switchboards originated independently in the Blackburn and Birmingham Telephone Areas. In 1966 the Telephone Manager at Blackburn decided to lower the height of the switchboards at the Burnley Exchange to help improve working conditions there. Early in 1967 the same motive prompted the Telephone Manager at Birmingham to arrange for switchboards at the Hill Street Trunk Control Centre to be similarly modified.

The new woodwork needed at both exchanges was made at the Post Office's Birmingham Factory. At Burnley, local engineers carried out the work in the switchroom while at Birmingham the Factories Department undertook the job. By working on only one switchboard section at a

NEW: The Hill Street Trunk Control Centre after its recent face-lift.

BOARDS FOR OLD

OLD: The Hill Street TCC in 1966. Working conditions are now much more pleasant.

time the task was completed in both exchanges without any interruption to telephone traffic.

The Exchange Superintendent at Birmingham Hill Street Exchange, Mr. E. L. English, told the *Journal* that telephonists there warmly welcomed the better working conditions which modernisation had brought, particularly the improved outlook. "Now, when a telephonist looks up, she can see out of the exchange window. This can mean quite a lot to an operator facing a switchboard at close range for several hours at a time." The switchroom at Hill Street was also redecorated and an acoustic tile ceiling was installed.

A perceptible improvement in staff morale is reported from both exchanges since modernisation was carried out.

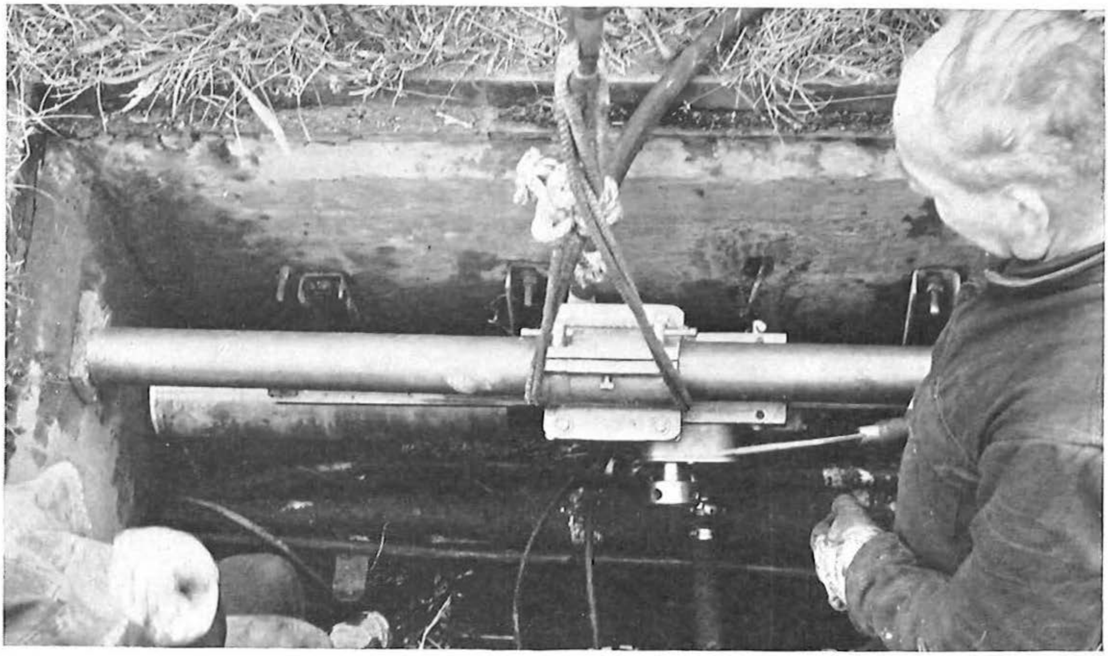
The recent announcement of a national switchboard conversion programme is part of the Telecommunications Headquarters' policy to improve working conditions in switchrooms wherever possible. The programme will apply to all exchanges which are expected to remain in service after January, 1974, and where conversion will result in worthwhile benefits in working conditions.

In preparation for the programme, which it is hoped to complete by the end of 1970, the Post Office Factories Department have carried out a value analysis of the work to ensure that the methods and materials used will produce acceptable modifications as economically as possible.

A new kind of drill is making life much easier and safer for external gangs of engineers. It is also helping to save money. The secret lies in a revolutionary type of cutting head made of industrial diamonds

DIAMONDS ARE AN ENGINEER'S BEST FRIEND

By R. HANNAH



The new Diamond Core Drill in use in a manhole in Inverness

DROPPING diamonds into manholes is about to become standard practice for external gangs of engineers throughout the country to solve a problem which has been plaguing Post Office engineers ever since the advent of co-axial cable.

The diamonds, industrial variety, are the vital part of a revolutionary new machine—the Diamond Core Drill—which can grind its way through anything from reinforced concrete to the toughest steel.

The problem was how to stop the soldered joints of the solid copper centre conductors in the older type co-axial cables from breaking. This was being caused when the concrete walls of manholes and joint boxes had to be broken down to allow new cables to be fed in. Until now the walls have had to be broken up by the crude method of hitting them with a hammer—the vibrations inevitably breaking the conductor joints. As a result the walls had to be rebuilt and the joints repaired by skilled jointers who could have been more efficiently employed elsewhere.

In addition, the jointers who have had to braze the joints for extra mechanical strength—something now being done on all co-axial cable at the manufacturing stage—could get on with the job only late at night when telephone traffic was at its lowest.

Now, at one step, the Diamond Core Drill has cleaned up the mess and slashed the expense. In a simple operation the Drill can grind its way through the concrete walls and their reinforcing steel bars in a swift, clean operation and with no vibrations to harm the soldered joints.

Holes can be bored in the duct walls to any dimension by simply fitting the appropriate cutting head—a canister of steel with a diamond core for a cutting edge—to the drill.

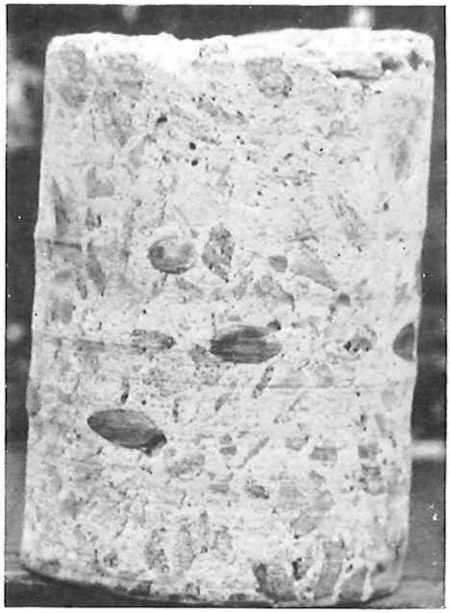
The first Post Office owned drill has been purchased by Telecomms Headquarters in Scotland and has been working efficiently there since September following successful field trials. Other Regions are or will be hiring the drills from the few specialist firms in England who provide them. Because of the extra distance and, therefore, additional unproductive time involved in taking the drills north of the border, hiring in Scotland was considered an uneconomic proposition. But with the drills now on the market at around £450, comparisons between hiring costs and ownership could be interesting.

The drills are easily operated from existing Post Office engineering equipment, grinding a way through the concrete duct walls at around 450 revolutions a minute. Scottish engineers are now claiming up to 60 feet of drilling from a single cutting head costing about £60.

The drill is powered off a single tool air compressor by standard compressor tool fittings. The drilling head is water-cooled and this, too, has proved a simple operation, carried out in Scotland from the 30-gallon water tank on the standard box building vehicle by means of a gravity feed from the tank to the drill.

The crane on the same vehicle is used to lower the one hundredweight drill into the ducts where it can be jacked between the end walls by its own jacking equipment.

So far, in Scotland, engineers have confined the drill's use to ducts and surface boxes but tests have also shown that it could be invaluable when new cable has to be laid into existing telephone exchange buildings. It will not only bore its way quickly through walls and floors with the minimum of disturbance but will also create practically no dirt or dust in exchange buildings where air cleanliness is vitally important to the proper working of the equipment.



This picture shows a piece of concrete cut from a manhole wall by the new diamond core drill. Note how cleanly the cut has been made.

While comparative costings of the drilling operation with the old methods have still not been detailed, Scottish engineers, who are now completing two jointing boxes a day with the drill, expect savings to be considerable.

Diamonds, it seems, have become the engineers' best friend.

★

Lectures on three subjects of interest to telecommunications staff are being given by Post Office Telephone and Telegraph Society of London speakers in the next three months.

The first, on 21 January, is "Computers—their application in telecommunications" by Mr. J. A. Hannant, of the Management Services Department. On 25 February, Mr. F. E. Williams, of the Research Department, will speak on "Human factors in design"; and on 18 March, Mr. D. G. Hunt, of Telecommunications Development Department, will talk on "Developments in trunk communications." All three lectures will be given at the Assembly Hall, Fleet Building, Farringdon Street, London EC4, starting at 5.15 p.m.

Membership of the Society is open to all grades of all London-based Departments.

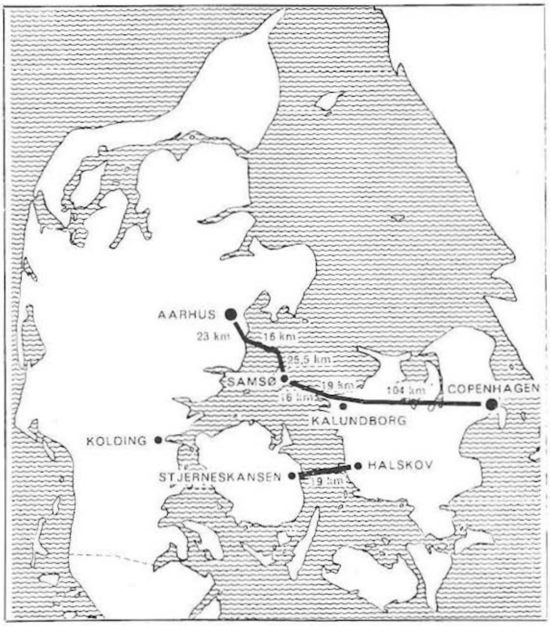
PAN AM's NEW MESSAGE SWITCHING DEVICE

Pan American World Airways offices in Jamaica have eliminated manual telegraph tape message handling by introducing a small, solid-state device known as the Pulsecommunications Teleprinter Selector which enables teletypewriter stations in the island to be polled by a computer-operated message switching system.

Using the selector, Pan AM staff prepare messages in punched tape form on their teleprinters which automatically feed the information into the computer.

Right: Betty Sanborn, of Pan Am, prepares a message tape on the teletype machine equipped with the new teleprinter selector.

EXPANSION IN DENMARK



Work has started in Denmark on a big telephone expansion project which involves the installation of a series of co-axial cables linking several large towns and providing an additional 16,200 telephone channels. The main towns to be linked will be Copenhagen, Kalundborg, Samso and Aarhus and Halskov and St. Jerneskansen.

The World's Telephones are Doubled in Ten Years

The number of telephones in use throughout the world more than doubled between 1956 and 1966 and at the beginning of 1967 subscribers' connections rose to more than 208 million. Just over half of these (about 106 million) were in North America, one third (67 million) in Europe and one tenth (21.7 million) in Asia.

Thirty-one countries had over half a million telephones in operation on 1 January, 1967. The United States headed the list with 49.9 connections per 100 inhabitants, followed by Sweden (47.9), New Zealand (39.8), Canada (38.9) and Denmark (29.1). With 664 calls per year per inhabitant, the Canadians were the world's most enthusiastic telephone users. The Americans were second with 648 calls per person and the Icelanders third with 575.

Israel all-automatic

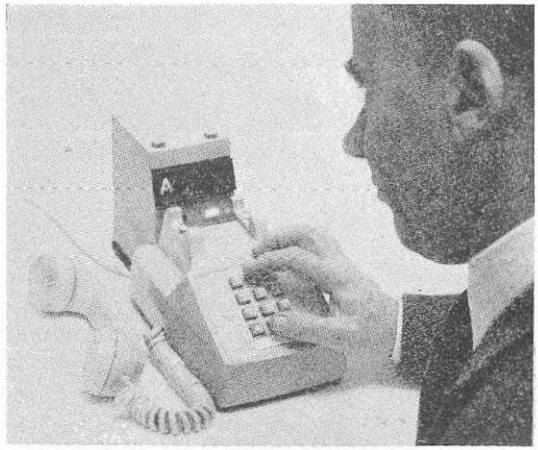
With the closing down of the Dimona exchange, the last manual exchange in the country, Israel's telephone system is now completely automatic. The number of subscribers' lines in Israel is now over 250,000 and the number of telephones in use more than 400,000.

TOUCH-TONE TELEPHONES FOR THE DEAF

The Bell Telephone Laboratories are carrying out experiments which may help deaf people to communicate by way of a "touch-tone" telephone by reading letters and numbers flashed on a small screen. The visual display is produced by tones generated by the telephone instrument.

Touch-tone push buttons generate a sequence of letters, numbers, end-of-word, and end-of-sentence signals, one at a time, in the windows of a display device attached to the telephone.

Tests carried out so far indicate that with a little training a user can attain a coding rate of eight words a minute which could be doubled after further practice.



The touch-tone telephone with the experimental ▸ visual display device attached.

SWEDEN EXTENDS ISD

Mr. S. Lundkvist, Swedish Minister of Communications, dials the first ISD call to West Germany.

Automatic telephone service was recently introduced between Stockholm and West Germany. Swedish subscribers can now dial their own calls to subscribers in Denmark, Norway, Finland (during certain hours of the day), and West Germany. More than 40 per cent of international calls originating in Sweden are now dialled by subscribers themselves.

Automatic service between Sweden and Britain and a number of other European countries is planned for introduction in 1969 and by 1972 the Swedish Telecommunications Administration hopes that Swedish subscribers will be able to dial at least 75 per cent of their own international calls.

IN BRIEF

Early in 1969, a submarine co-axial cable will be laid across the Mediterranean between Barcelona and Pisa to provide the first such links between Spain and Italy. The new cable will have a capacity of 480 simultaneous speech channels and also route calls between Italy and other Mediterranean countries.

Another new submarine cable, linking Morocco and France was brought into service recently. It connects Tetouan and Perpignan and, initially, is equipped with 48 circuits.

* * *

Two new microwave communications systems are to be set up in Brazil—linking Rio de Janeiro and Sao Paulo and Rio de Janeiro and Brasilia.

The Rio de Janeiro to Sao Paulo link, a 6 Gc/s system with nine radio stations along its 240-mile length, will have a capacity of 1,800 circuits. The second link between Rio and Brasilia will consist of two 4 Gc/s radio circuits with 960 channels.

* * *

Ghana's new Subscriber Trunk Dialling network has been brought into service. Its backbone is a 1,200-mile microwave radio chain of stations along which are situated fully automatic public telephone exchanges. The microwave route is remotely controlled by a comprehensive telemetry system and is also used for transmitting telegraph signals for an automatic telex network and television programmes from Accra.

INDEX to Volume 20

Spring 1968—Winter 1968

ALPHABETICAL INDEX

GROUP INDEX

GROUP INDEX (*continued*)

* *"Technical articles of a page length or over, appearing in* Telecommunications Journal *are also indexed in the* British Technology Index *seven or eight weeks after publication in the Journal."*

Telecommunications Statistics

(*Figures rounded to nearest thousand*).

	Quarter ended June, 1968	Quarter ended March, 1968	Quarter ended June, 1967
Telegraph Service			
Inland telegrams (Incl. Press, Railway Pass, Service and Irish Republic)	2,034,000	2,068,000	2,257,000
Greetings telegrams	503,000	580,000	548,000
Overseas telegrams:			
Originating U.K. messages	1,762,000	1,808,000	1,760,000
Terminating U.K. messages	1,795,000	1,781,000	1,767,000
Transit messages	1,528,000	1,616,000	1,667,000
Telephone Service			
Inland			
Net demand	174,000	248,000	177,000
Connections supplied	181,000	226,000	180,000
Outstanding applications	234,000	241,000	217,000
Total working connections	7,483,000	7,387,000	7,024,000
Shared service connections (Bus./Res.)	1,404,000	1,396,000	1,359,000
Effective inland trunk calls	281,698,000	280,940,000	253,156,000
Effective cheap rate trunk calls	62,899,000	58,807,000	55,247,000
Overseas			
European: Outward	2,856,000*	2,638,000*	2,390,000
Extra-European: Outward	275,000	248,000	227,000
Telex Service			
Inland			
Total Working lines	23,000	22,000	20,000
Metered units (incl. Service)	58,709,000	58,223,000	52,706,000
Manual calls (Incl Service and Irish Republic ..	29,000	28,000	29,000
Overseas			
Originating (U.K. and Irish Republic)	4,096,000	4,237,000	3,599,000

*Part estimated.

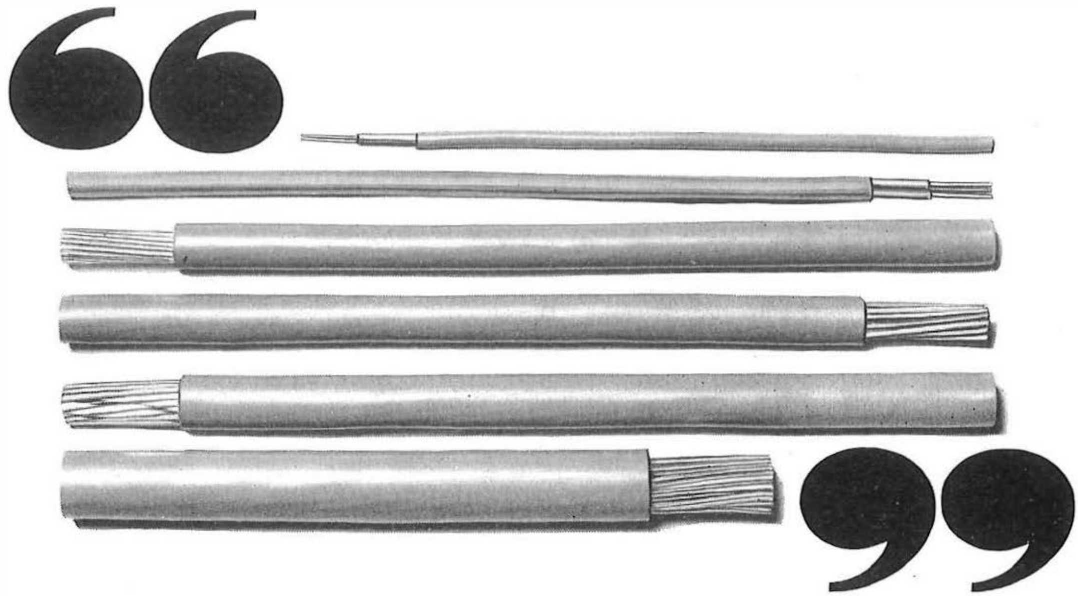
Publication and Price. The *Journal* is published in March, June, September and December, price 1/6. The annual postal subscription rate is 6/6 to any address at home or overseas.

Advertisements. No official responsibility is accepted for any of the private or trade advertisements included in this publication. Communications, advertisement copy, etc., should be addressed to Sawell & Sons Ltd., 4 Ludgate Circus, LONDON, E.C.4. (Telephone: FLEet Street 4353).

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 Post Office.

Correspondence. Communications should be addressed to the Editor, Post Office Telecommunications Journal, Public Relations Department, GPO Headquarters, St. Martin's-le-Grand, LONDON, E.C.1. Telephone: 01-432 4345. Remittances should be made payable to "The Postmaster General" and should be crossed "& Co.".

GPO

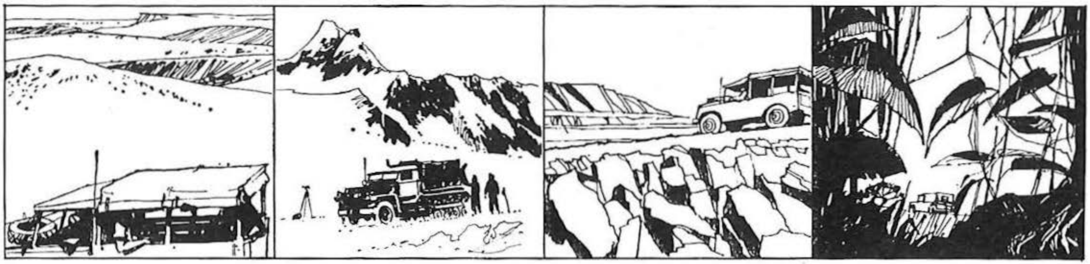


The new 'WESTMINSTER' solid-state radiotelephone ...from PYE

designed for world markets

The new range of 'Westminster' solid-state radiotelephones is ready for operation anywhere in the world. Pre-production models successfully endured every possible combination of adverse climatic, regional, shock and vibration extremes for over a year. This exacting field-test programme has proved the 'Westminster' range of radiotelephones suitable for global operation.

The 'Westminster' range is type-approved in many countries; dash, universal or motorcycle versions are available.



Pye Telecommunications Limited, Cambridge, England.
Telephone: 0223 61222 Telex: 81166

MR 43

The Post Office Telecommunications Journal is printed for Her Majesty's Stationery Office by the Swindon Press Ltd., Victoria Road, Swindon, and is published quarterly in December, March, June and September by H.M. Postmaster General at the Post Office Headquarters, London, E.C.1.