Post Office telecommunications journal

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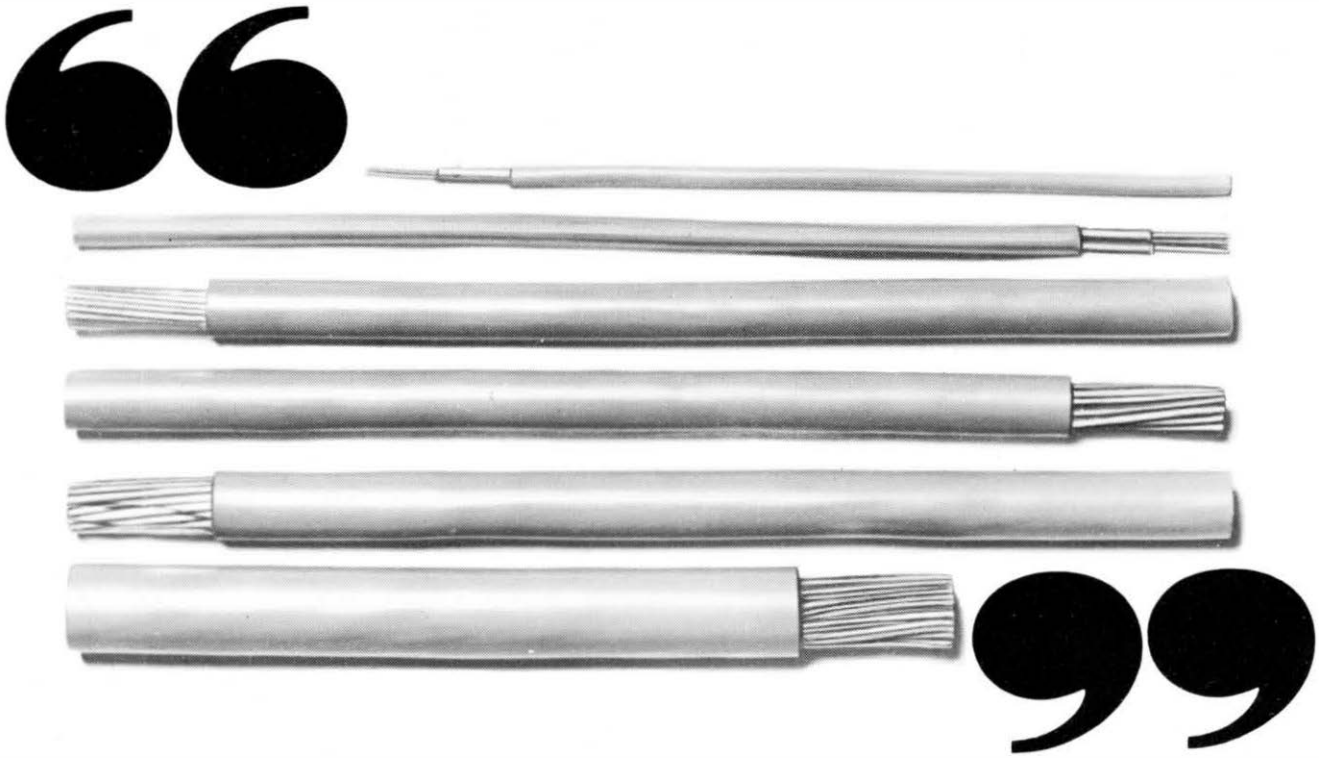

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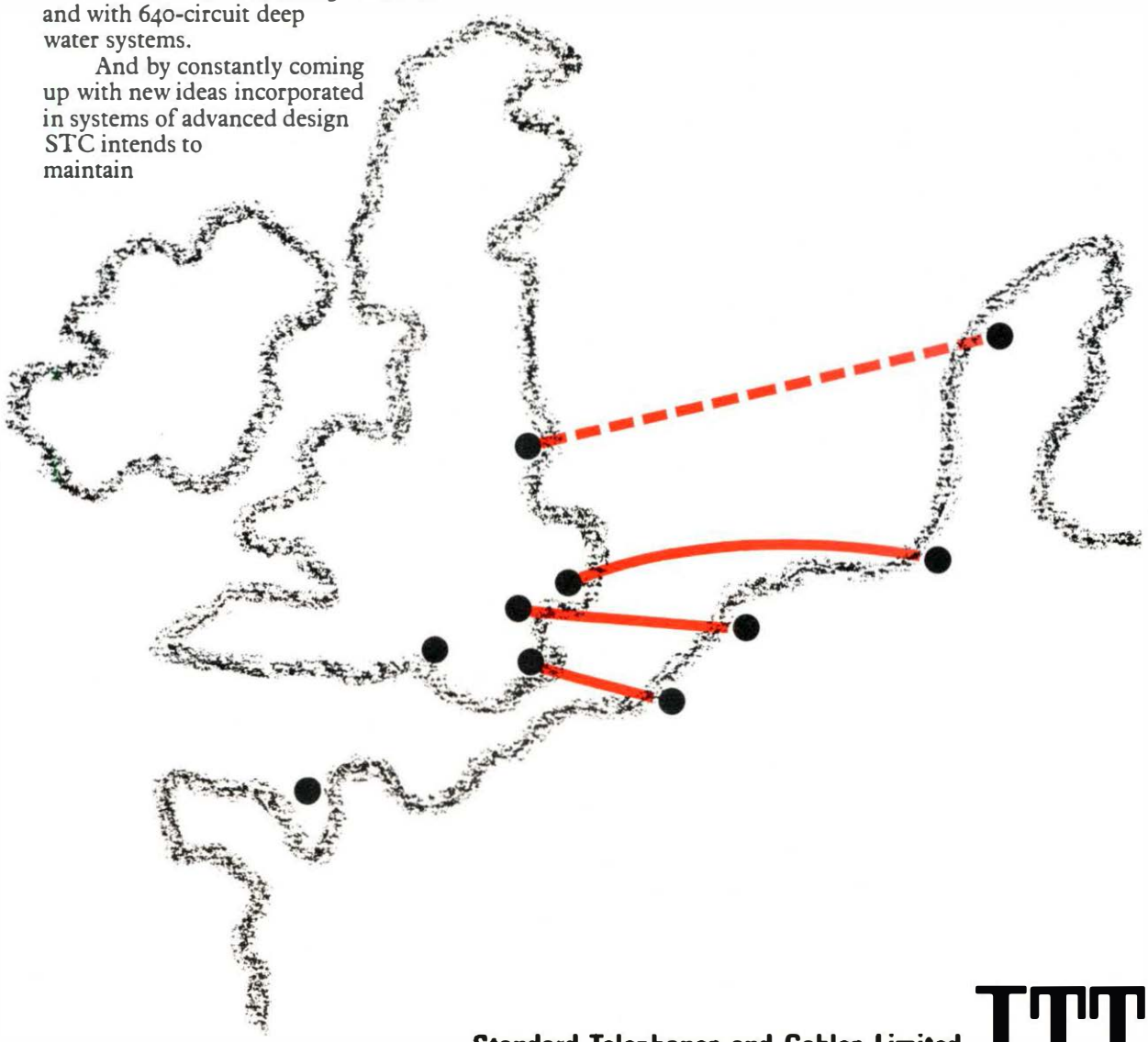

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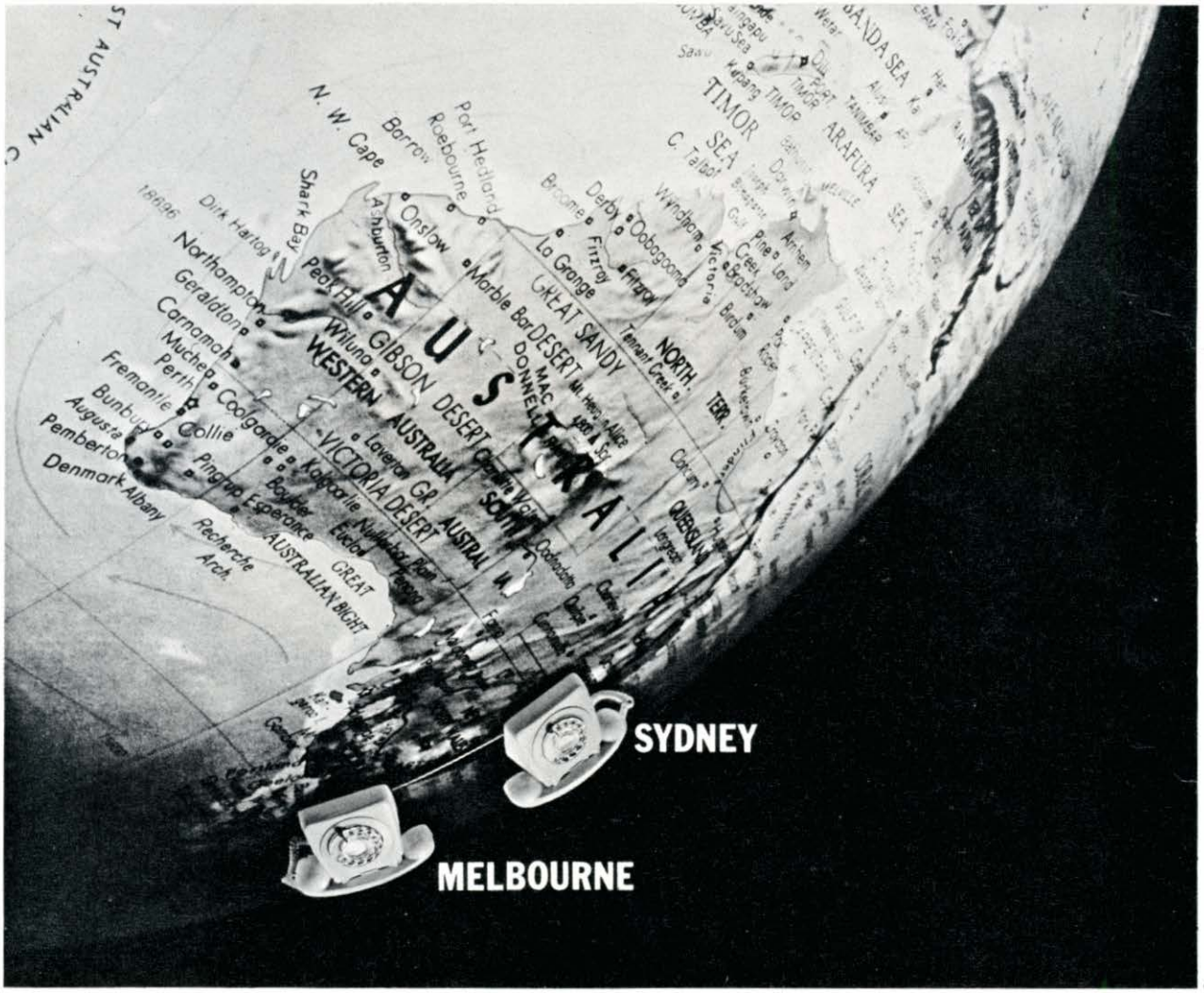

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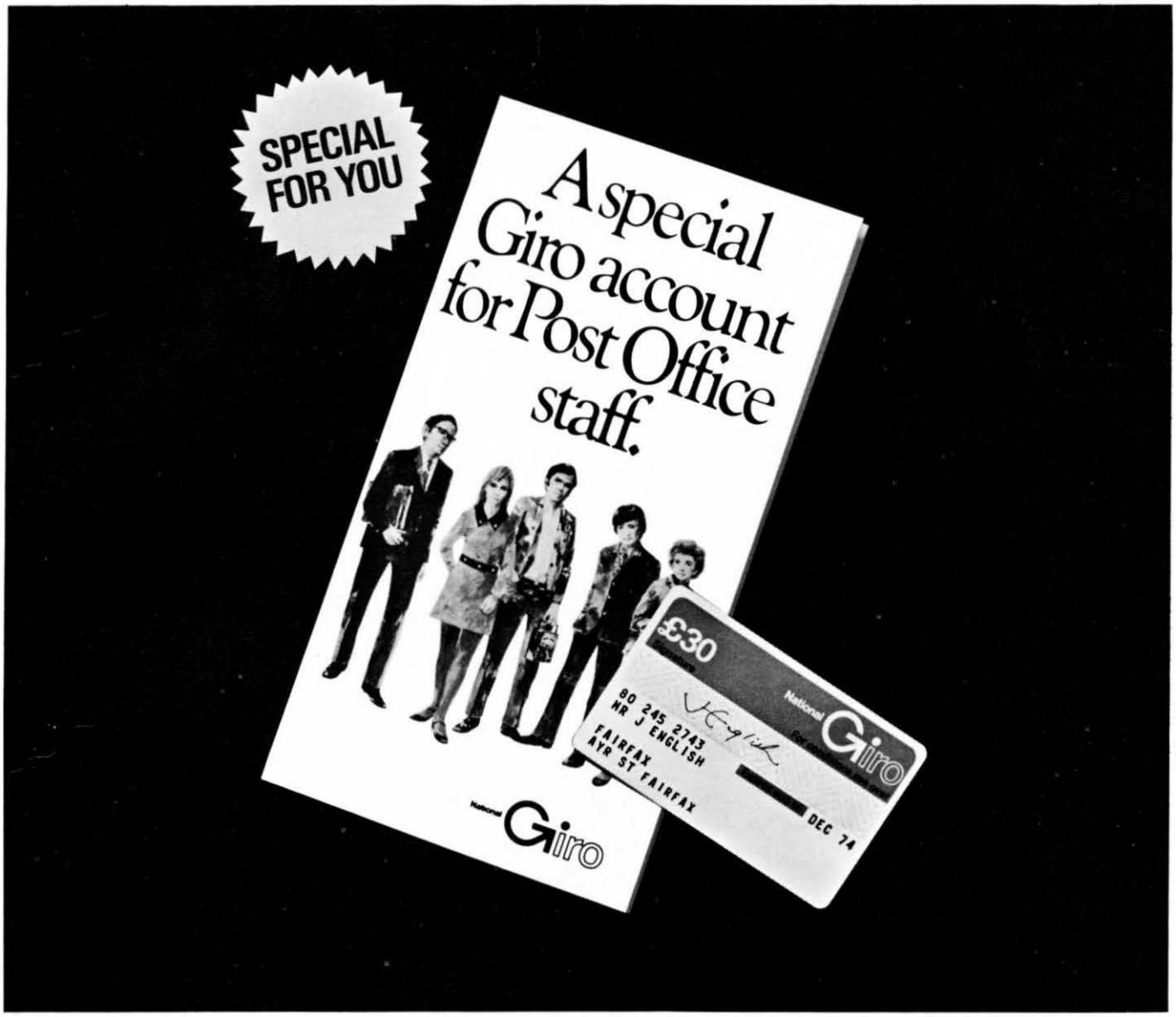

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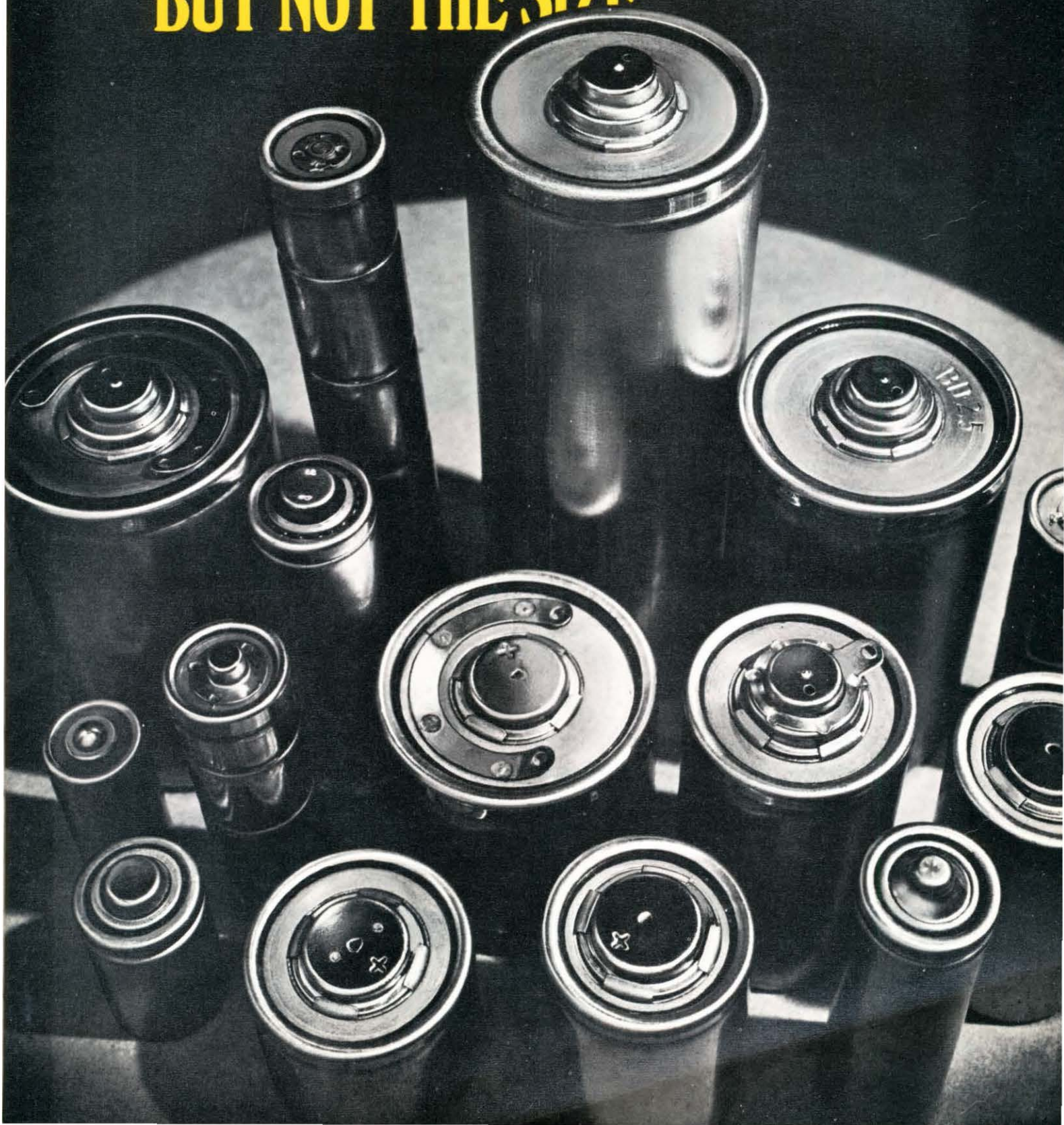
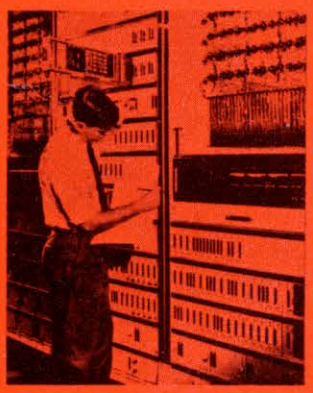
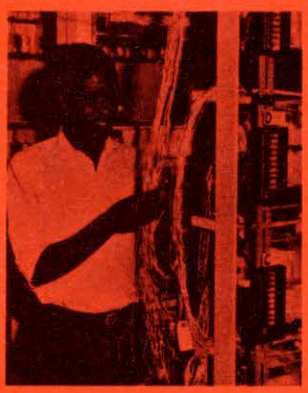
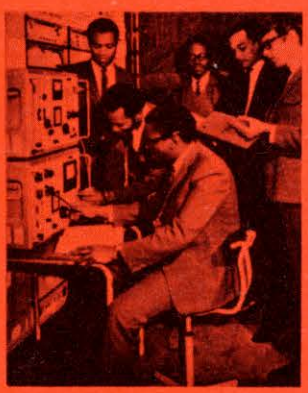


comprehensive telecommunications

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The Post Office Spec. D3000 is a tough one; tough in terms of its requirements for long life reliability, high-temperature tests. But FJ Series TTL ICs are also tough and reliable – so much so that Mullard are the first to get D3000 approval for TTL.

Post Office equipment suppliers can now use these proven devices in analogue and digital transmission equipment.

Initially, all the devices supplied will be from the medium-power FJ Series in ceramic 14- and 16-lead, dual-in-line encapsulations. Fourteen types are already approved and further work is in hand to ensure approval for the entire series, including low-power types.

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Mullard have just published a booklet about voltage reference diodes – specifically, the Mullard BZX90 family. Tough, substantially immune to temperature variation, highly stable . . . ideal for constructing a standard cell with none of the disadvantages of our trusty, but out-dated, friend the Weston Cell.

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NEW SURGE SUPPRESSORS TO POST OFFICE SPECIFICATIONS

Fully met by standard diodes

New Post Office specifications will set tolerances for the diodes used to suppress transients on busbars and thus protect semiconductor devices in power supply equipment.

A tight specification is necessary – particularly with respect to the exponential current pulse.

From standard devices in the comprehensive range of Mullard surge suppression diodes the PO20 (25kW) and PO21 (10kW) diodes were derived.

Both types meet the tight Post Office specification and are just two examples from the range of Mullard surge suppression diodes with power handling capabilities from 800W to 60kW; stand-off voltages from 3.9V to 62V; available in normal and reverse polarity versions.

Injection logic – a promise in store

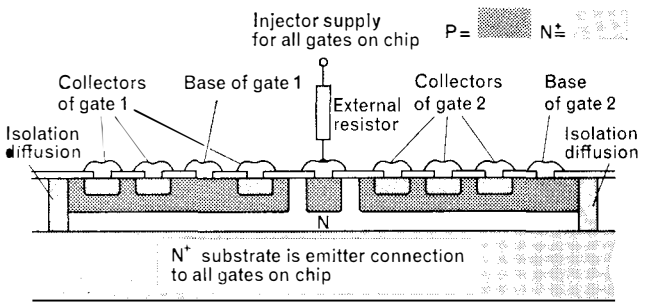
Integrated injection logic devices, currently being experimented with at Mullard Southampton, could result in bipolar ICs with packing densities as high as 400 gates/mm².

Indications are that it will be possible to use I²L to fabricate bipolar integrated circuits comprising in excess of 1500 gates, using standard processing techniques which will have acceptable yields. Furthermore, power delay time products of 0.4 picojoule per gate and operating on less than one volt are possible.

At Southampton experiments are well ahead with a 1024-bit, bipolar, RAM chip. The access time is expected to be appreciably less than 100 nsec and cycle time in the region of 300 nsec. The high packing density and low heat generation are important features of this new technique.

It is too early as yet to forecast when I²L devices will be available commercially, but results are very encouraging.

This interesting technique is discussed in more detail in the next Post Office supplement of the Mullard Bulletin.



Cross-section of a pair of gates with PN injection of minority carriers

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Post Office telecommunications journal

Winter 1972–73 Vol. 24 No. 4

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

Cover: A two-man midget submarine will help bury transatlantic telephone cable in the ocean bed to prevent damage from fishing vessel gear. The submarine, 19ft long and 10ft wide, is pictured being recovered by a mother ship. See page 7.

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THE NEXT 5 YEARS

THE POST OFFICE has announced plans for the investment of £4,000 million in the Telecommunications Business over the next five years. The aim is to be able to meet increasing demands for service speedily, while improving the general quality and range of services provided for the customer.

More equipment is needed to reduce the waiting list, to overcome traffic congestion and to replace old plant. At the same time attention has to be given to the rapid rate of expansion of the system – likely to double in size over the next ten years – and emerging technologies which will lead to more varied and flexible services.

In recent years Post Office telecommunications has sustained one of the world's largest investment programmes, and this must be increased if the aims of quality, expansion and range are met.

Although the emphasis is on spending, the problem of rising costs is being tackled by improvements in efficiency and productivity. During a period when the size of the service will be increased by 50 per cent, staff numbers will increase by only 10 per cent – equivalent to an improvement in output per employee of seven per cent a year.

What will the next five years bring?

QUALITY: The conversion of manual exchanges to automatic service and the provision of STD for all telephones will virtually be completed next year. By 1978 any telephone customer in the UK will be able to dial direct to any other UK customer (see article on the transit network in this issue). There will be continuous improvement in the inland services by reducing to the lowest possible level call failures caused by plant defect or congestion, and the quality of international service will also be significantly better. By 1978 International Subscriber Dialling will be available from 80 per cent of telephones in the UK and the range of the ISD service will be extended progressively.

EXPANSION: The Post Office will be able to serve 16.5 million exchange lines by 1978, compared with some ten million now. The number of telephone calls made will have almost doubled to 23,000 million a year. Telex and data communications services will grow rapidly.

RANGE: Important developments include a wider choice of telephones including the Keyphone (push-button telephone) which will be available for general use by the mid-1970s. There will be more and better facilities available to business customers. The wide range of specialised services, including private circuits, closed-circuit television and radio communication, will be extended and improved.

Parliament has approved the loan of up to £2,000 million for the investment plan. The other half of the £4,000 million must be raised within the Post Office from profits and depreciation. On present trends this means that prices will go up, but the nature and timing of the increases will depend on national economic developments.

FIGHTING 'FLU

Through its Occupational Health Service the Post Office is taking part in a pioneering investigation into the value of mass vaccination against influenza. Free vaccination will be offered to a number of staff each year for several years and its effectiveness will be measured. The results will be of international significance.

P R Gilbert and W J E Stone

INFLUENZA is always with us and almost every winter it becomes news – very often bad news. The respiratory diseases are the greatest cause of absence from work, and of these influenza is frequently the most significant. The epidemic in Britain three years ago was estimated to have resulted in the loss of 26 million working days.

For some time attempts have been made to control influenza by innoculation. The object is to produce an immunity to the disease similar to that which is normally built up by recovery from it, and this is done by injecting vaccine into the body where it stimulates the production of antibodies which combine with the influenza virus and neutralise it. The only instance of large scale vaccination so far undertaken has been in the US Armed Forces where experience during the period 1943 to 1960 suggested that 70 per cent to 90 per cent immunity was obtained. In Britain there have been a number of investigations, but all involved relatively small groups in universities, colleges, schools, offices and factories. Although these limited tests have produced useful experience, no measurement of the effects of mass vaccination on sickness absence has yet been made.

In 1970 discussions began between the Post Office and the Epidemiological Research Laboratory of the Public Health Laboratory Service with a view to measuring the efficacy of influenza vaccination for Post Office staff. The result is the pioneering investigation which is now being run in the Post Office. For the first time anywhere in the world a mass vaccination exercise includes individuals engaged in a wide range of occupations, in varied working conditions and in communities scattered throughout the country. Post Office staff is as representative a cross section of the population as a whole as could be found employed by a single organisation. The experience gained may therefore be regarded as approximating to what could be expected from the whole community.

The investigation began with a feasibility study in North Western Telecommunications Region during the winter of 1970–71. The numbers involved were small, but it demonstrated that a large-scale exercise could be undertaken without serious interruption of services. Last winter the investigation

was extended throughout the Telecommunications Business. Free influenza vaccination was offered in 88 units employing 26,317 people, carefully selected to represent all grades engaged in different occupations and located in urban, rural, coastal and inland sites. Every member of a unit received an individual invitation to participate, and each unit was paired with another – providing a control group for the necessary comparison between vaccinated and non-vaccinated units. (London and Birmingham were excluded mainly because of their abnormal turnover of staff; reasonably static staff during at least each period of winter weather is essential if meaningful statistics are to result. Northern Ireland was also left out because of the emergency situation.)

Including the control groups 41,519 people in 186 different units took part last winter and acceptances ranged from 11 per cent to 88 per cent. The final total of vaccinations was 42 per cent of those invited. While not as high a figure as had been hoped for it was nevertheless considered adequate for the production of significant statistics. Owing to the need to assess the results of the feasibility study and follow this with the organisation of the full-scale investigation, innoculations did not take place until December and special sickness returns were made weekly from January to May 1972 inclusive.

Many who think they are suffering from influenza are in fact the victims of some other infection producing similar symptoms. Against these, of course, the vaccine would not be effective. Short therefore of virological examination of every individual it is impossible to say whether absence due to a respiratory complaint is caused by influenza or not. But if all absences attributed to respiratory diseases in a vaccinated group are recorded the results should show favourable comparison with the records of the corresponding control group since, during an outbreak period, a high proportion will have been due to influenza whether diagnosed as such or not.

In spite of the late start and the absence of any notable epidemic the figures have shown encouraging results. During the period January to May 1972 there was up to 50 per cent more respiratory illness in the non-vaccinated than in the vaccinated units, while the number of certificates submitted for other causes showed no significant difference.

This winter the investigation has continued in the Telecommunications Business and to complete the coverage the Postal Business is also taking part for the first time. A total of about 60,000 staff has been offered vaccination; it is too early to assess the response.

Convincing proof of the efficacy of vaccination can be anticipated only when there has been a general influenza epidemic of considerable proportions. It is therefore necessary to ensure that immunisation is continued until such an epidemic occurs. The period during which the vaccine remains effective is uncertain, and will in any case differ with individuals. Vaccination will therefore be offered annually to the same groups in the knowledge that there is on average a considerable influenza epidemic every five years. But with the advantage of established organisation and more widespread appreciation among the staff of the benefits offered it is to be hoped that there will be a progressive increase in the number volunteering. The closer the acceptance rate approaches to 100 per cent the more conclusive the evidence must be. In the event, however, of a fall in acceptances the records maintained in successive years will still be of value in that they will help to establish periods of immunity – a second aspect of the problem upon which much more information is needed.

The vaccine used is Admune, a standard product, and it is administered quite painlessly and in a few moments on Post Office premises by the staff of the Post Office Occupational Health Service or by local doctors engaged for the purpose. Only pregnancy and allergy to eggs need deter anyone from it.

Influenza vaccination is offered annually to all key personnel in hospitals and other groups in which it is specially desirable that infectious diseases be controlled, and is recommended by the medical profession for all those suffering a chronic disease for whom an attack of influenza can be serious. Yet in the 1957 8 pandemic (world-wide epidemic) one-third of the total population of Britain became infected. There is evidence from many quarters of a demand for a generally available facility enabling anyone who wishes to acquire protection at so little personal inconvenience. The Post Office investigation will go a long way towards showing whether such claims are valid, and whether the substantial cost can be justified.

The Post Office and its staff are therefore pioneering what might become a normal service in the future. In the event of the results showing the efficacy of mass vaccination to be beyond doubt, it could be expected to lead to extension of the facility: first within the Post Office itself, then to some other employers and finally even nationally. Indeed it is no exaggeration to say that anyone volunteering to participate will be assisting materially in the development of national and international policy in this field.

Sister Marion Milne prepares and delivers a jab for Storekeeper Robert Tierney at the Oldham Telephone Engineering Centre.

Dr P. R. Gilbert is the Principal Medical Officer in the Telecommunications Business. His appointment followed ten years with the Post Office as a Medical Adviser while on loan from the Civil Service.

Mr W. J. E. Stone is the head of the group dealing with employee services in the Pay and Grading Department of Telecommunications Headquarters.

Calling men

N W Brown and M M Beales

AN EXPRESS train has crashed and the injured are being rushed to hospital where all available staff have been mustered. Unfortunately, the whereabouts of an off-duty registrar and operating theatre sister are not known, and they are urgently needed.

How to alert them? With a Radiopaging Service such as the Post Office now has on trial in the Thames Valley area the task is simple. Using an ordinary telephone, connected to the public network, a hospital official dials the individual numbers allocated to the wanted staff members and the call is automatically routed to special paging equipment. Almost immediately a radio signal goes out over the air to be picked up by pocket-size receivers carried by the registrar and sister. An audible warning given by the receivers tells the two people they are wanted.

In this case the registrar, out for a round of golf, hears the warning bleeps from the receiver clipped to his golf bag, dashes to the club house and phones the hospital. The theatre sister, on a visit to relatives, makes a similar call. Within minutes both are on their way to assist in the emergency.

The incident is an imaginary one but it illustrates one of the ways in which the new Radiopaging Service might be of vital use. In many less dramatic ways too the service will help to make business more efficient.

While pocket paging systems have been commercially available in the UK since the mid-1950s they have been employed in confined areas such as hospital buildings, factories or offices. Most of them operate by induction from a wire loop placed round the outer wall of the premises; others covering open sites with scattered buildings such as oil refineries or airports make use of short-range radio. With either method a separate control system is needed and an operator has to be alerted to the fact that someone is wanted before sending a message by radio or activating an induction system.

The Thames Valley trial scheme, in contrast, is embracing an area of 500 square miles including Reading and Slough. Any customer within that wide area, no matter how remote his location, will be able to be alerted to the fact that someone urgently requires to get into touch with him.

An ordinary telephone call to the paging service, made perhaps by the customer's secretary or his wife, is all that is needed.

The trial indeed could be the forerunner of a national paging system which would enable customers to be paged widely throughout the country. Recent developments in semi-conductor and micro-circuit techniques have enabled highly sensitive pocket receivers to be produced, so that good, wide-area paging coverage into buildings can be achieved without the need for an excessive number of radio transmitters. These advances, linked to the fact that the receivers can now also accommodate a far greater number of coded signals than ever possible before, have made feasible a free-range national system.

At the heart of the Post Office system is computer-based control equipment which in the Thames Valley trial is connected to the telephone network via a selector level at Reading Group Switching Centre (GSC). This equipment accepts the numbers from the telephone network, relates each to its unique radio paging code contained in its memory store and then controls the transmission of the signals. It is capable of serving 2,000 customers; equipment of this type can readily be extended to cater for up to 100,000 customers.

Each customer is supplied with a pocket radio pager which emits a series of "bleeps" when his paging number is dialled, provided he is

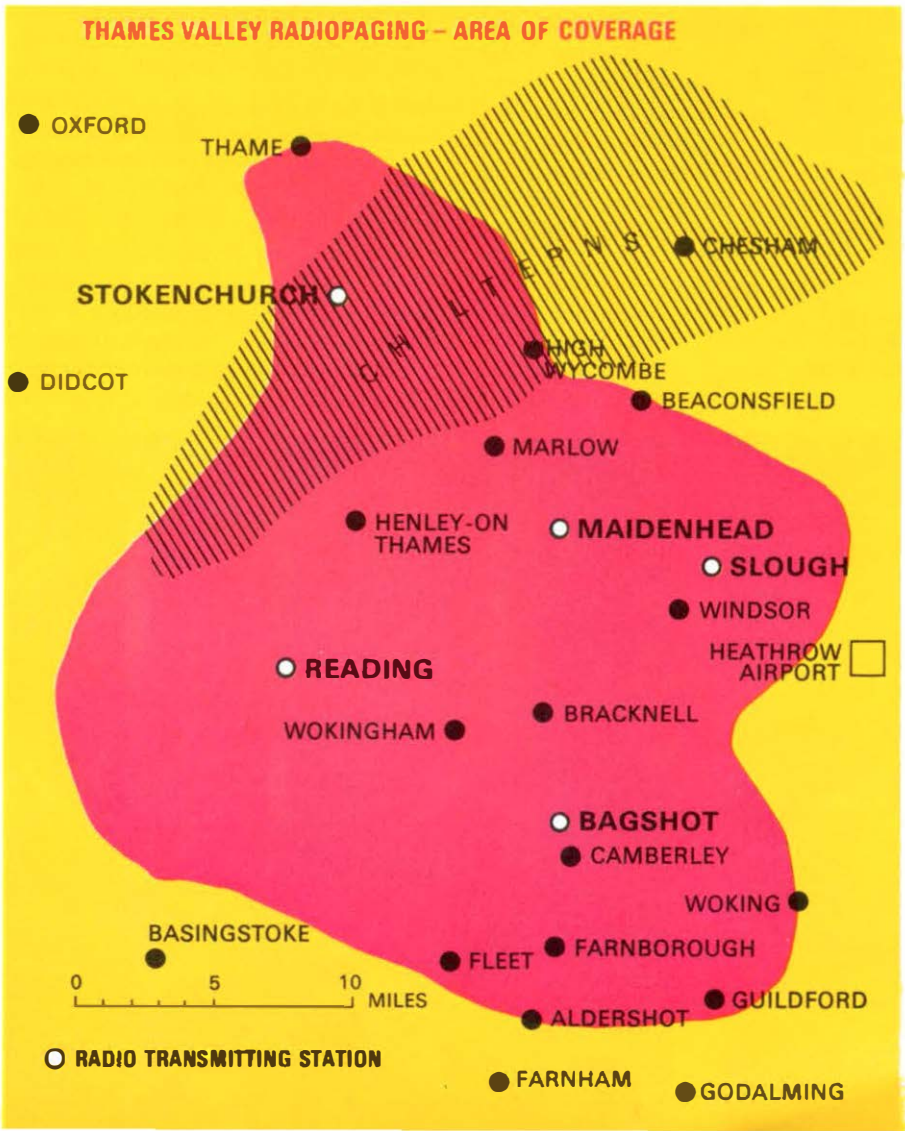
A doctor relaxes with a round of golf on his local course at Henley. If there is an emergency he can be called immediately through the Post Office Radiopaging receiver attached to his golf bag.

on the move

within the trial service area. The paging number consists of 10 digits comprising the STD access digit "O", a three-digit STD code specially allocated to the paging service and a six-digit number which identifies the customer's paging receiver. When a paging number is dialled the STD code causes the call to be routed to the appropriate selector level at Reading GSC and the selectors switch the call to the control equipment which then accepts the remaining six digits. These digits are then compared with the list of radio paging numbers held in the control's memory store. If the number is a valid one the caller is advised by a recorded announcement that his instructions have been accepted and that the required receiver will be paged. If it is invalid he receives number unobtainable tone.

In a valid call the required paging number is automatically noted against the list of customers in the memory store to show that it is to be paged. This list is scanned at pre-determined intervals (every 15 seconds in the trial) by the output section of the control equipment. If calls are waiting to go out over the air a signal is sent to activate the paging service transmitters, and when they are switched on an answer back is received. Then the coded signals which activate a customer's paging receiver are generated in the output section and are passed to the transmitters. When all the calls have been sent the transmitters are automatically switched off.

Radio coverage of the trial area is achieved with five VHF transmitters arranged to work simultaneously. Two of these transmitters use aerials on Post Office microwave towers – one at Stokenchurch, high in the Chilterns in the north of the area, and the other at Bagshot in the south. The height of these towers affords good coverage on either side of the Thames Valley. The other three transmitters are in the Valley itself. One is on the roof of British Rail's tower building in Reading, another is on the roof of Slough Telephone Exchange and the third is located at the Telecommunications Engineering Centre, Maidenhead. This latter aerial will be moved to the roof of the Telephone Exchange building which is under construction and which will be one of the tallest buildings in the town.



Selection of the transmitter sites was based on experience gained from tests made in London using several types of paging receiver. In these tests the more sensitive receivers could be alerted within buildings some eight miles from a transmitter located in the Post Office Tower. The range at which signals can be received is largely affected by the losses suffered in penetrating buildings and the receiver sensitivity. The body of the user can also shield the receiver and so reduce the signals reaching it. In this respect it is interesting that the shielding effect is less when the receiver is carried clipped to the belt, as is common in the USA, than when it is carried in the breast pocket where the structure of the body has a greater screening effect. Closely spaced transmitters of relatively high power are needed to combat the losses although the exact requirements will vary with the topography and the level of building development in the area to be covered.

The paging receiver being supplied initially to a customer is $4\frac{1}{2}$ in × $1\frac{3}{8}$ in × $\frac{3}{4}$ in and weighs about four ounces. They are extremely robust and can survive being dropped from carrying height on to a concrete floor. The receiver has a three-position switch – "on", "off" and "memory". With the switch "on" the reception of a correctly coded signal will cause the sounder to bleep rhythmically for about eight seconds, unless the switch is depressed momentarily to cancel the alerting signal. With the switch in the "memory" position a call will be stored but the "bleeper" will not sound until the switch is later moved to the "on" position. This facility will probably be appreciated by persons attending meetings who do not wish to disturb others. With the switch "off" there will be no response to a paging signal. When a receiver is switched on the "bleeper" sounds if the battery is serviceable; when the switch is momentarily depressed the test "bleep" is muted and the receiver left in an operational state. If no test "bleep" is heard the battery should be checked and replaced if necessary – something

which can easily be done by the user.

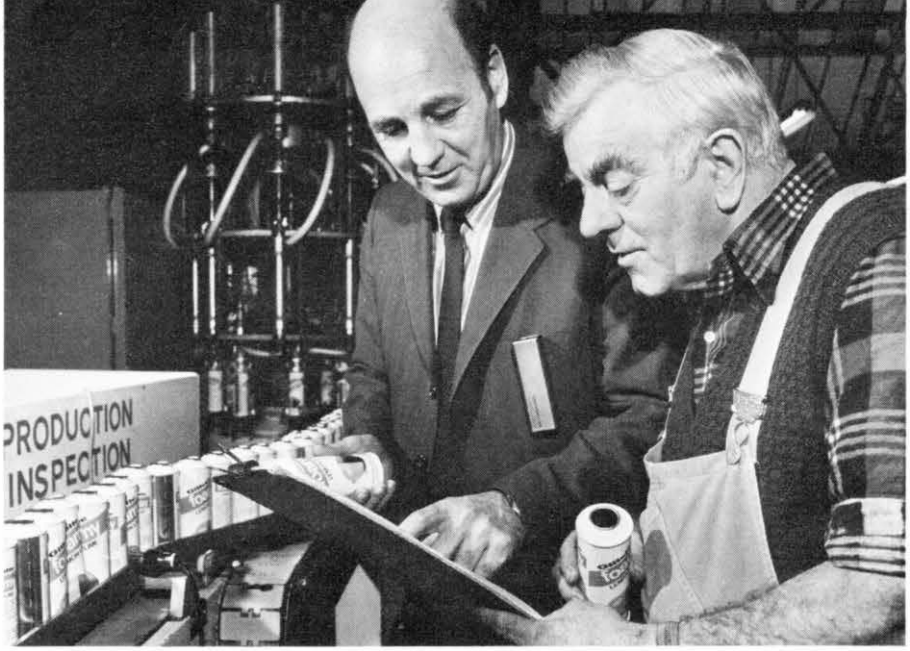
The receiver employs a battery economiser circuit which ensures that the single 1.5 volt alkaline cell gives several months' service. This circuit operates by cyclically switching the receiver on and off. Because of this a method had to be devised which ensured that receivers were "on" during the transmission of paging calls. This is achieved by preceding the paging calls with a preamble signal. The duration of this signal is matched to the on off cycle of the battery so that a receiver is always "on" for part of a preamble signal. Immediately it detects the signal the receiver locks itself in the "on" position so that it is in an active state when the paging signals are sent out. By queueing paging calls in the control equipment and transmitting only at intervals of not more than two minutes it is possible to achieve a considerable saving in battery power.

The receiver to be used initially will be made up of several integrated circuit modules mounted on a fibreglass board. Two of these modules are of the plug-in type and form the decoder which recognises its unique code and triggers off the "bleeper". There are 60 versions of the decoder module and by combining any two modules it is possible to preset a receiver to respond to one code out of a range of 3,540. During the period of the trial receivers of a new design having a capacity of 100,000 codes are expected to become available.

Since no physical installation work is required to give service to a customer, orders can be processed with the minimum of delay. On receipt of an order Sales staff advise the paging control centre; a paging receiver is selected and details of its code and associated paging number are fed direct into the control equipment by teleprinter machine. A paging call is made to confirm that the receiver is working before it is posted to the customer.

Public paging is a liberator. No more need the man or woman who must be on call remain within earshot of a telephone. Now in the Thames Valley they will be able to move around freely – in a car, bus or train, or on foot indoor or out. By carrying a Post Office pager they need never be out of reach.

And what of the future? If the trial confirms the experience of administrations in other countries that public paging is popular with the business community, the Post Office will have a firm basis for considering the extension of the service to other parts of the United Kingdom.



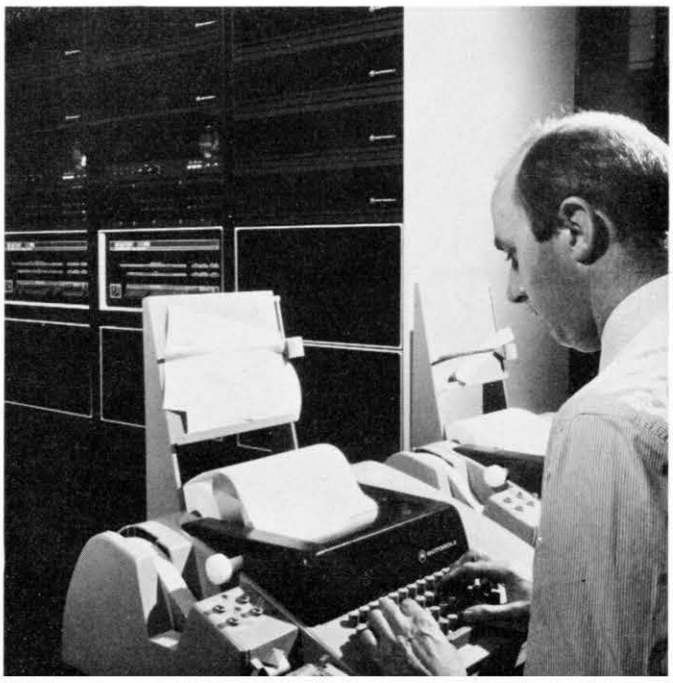
A manager at the Reading factory of Gillette Industries tries out a Radiopaging receiver on a visit to the factory floor. If he is wanted the receiver in his lapel pocket will "bleep" a warning within seconds of his secretary dialling his unique Radiopaging number. The receiver would operate outside the factory anywhere within the trial area.

Mr N. W. Brown is an Executive Engineer in the Line and Radio Branch of Telecommunications Development Department. He is concerned with the radio aspects of Radiopaging.

Mr M. M. Beales is a Senior Telecommunications Superintendent in the Facilities Branch of the same Department and is involved in defining facilities for the Radiopaging numbering scheme and control equipment.

A Technical Officer at Reading Trunk Exchange programs the Radiopaging computer. It is done simply by selecting the appropriate switches on the front of the computer equipment drawer.

Co-author Maurice Beales feeds a new customer's code number into the information store of the computer during a test run of the Radiopaging equipment shown in the background.



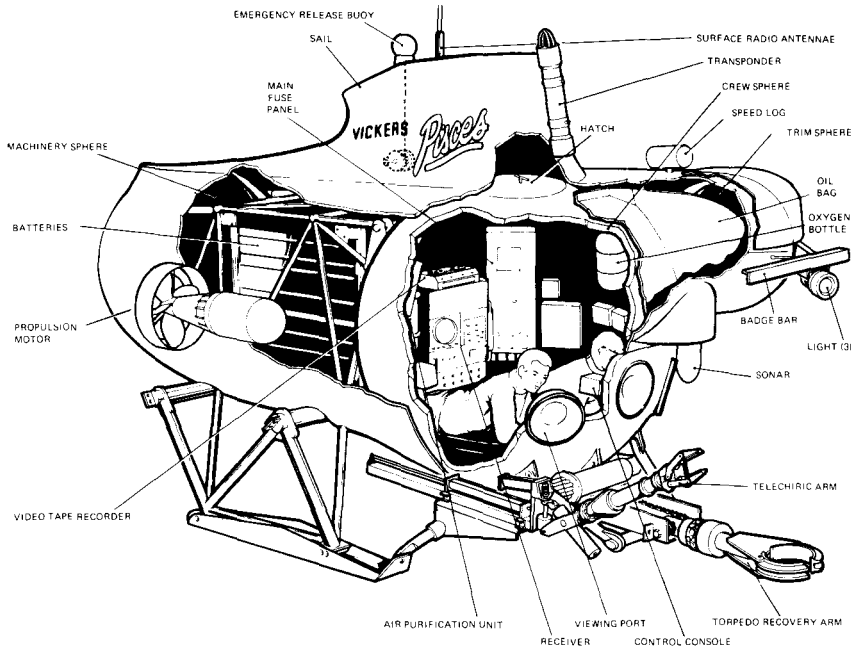
The global revolution

Mr Edward Fennessy, Managing Director of Post Office Telecommunications, traced the growth of global communication from the undersea telegraph cable to the satellite links of today in a lecture to members of the Institution of Electrical and Electronics Technician Engineers. In the concluding section of the lecture printed here Mr Fennessy reflects on recent achievements and the challenges that now have to be faced as international communication expands by more than 20 per cent a year.

THE WORLD today regards satellite communication as a normal feature of daily life, but let us recall that ten years ago those who forecast today's achievement were regarded in many quarters at the best as lacking in commercial judgement. It can never work – it could never pay – who wants it anyway? Those phrases were commonplace. It has only been because of the dedicated work of those who had the vision of the potential of the space age that the impossible has been achieved in less than ten years. It is a lesson that all young men should mark and profit by.

There were many who saw no future for the communications satellite: there were equally some who saw in it the death of the submarine cable. What is the outturn a decade later? Primarily because the submarine cable had and still has great potential for development it has been able to respond to the challenge of the satellite.

TAT 6, now in the planning stage, will provide in one cable 4,000 circuits between Europe and the USA. On high-capacity routes such as this the cable will continue to compete in economic terms. And who can say what waveguide and optical fibre technology may bring by way of further leaps forward? However, the satellite has the very great merit that it is capable of bringing global communication to many countries that could not be as economically linked by submarine cable. At the same time it has the definite limitation that because the signals have to travel over 44,000 miles for the journey into space and back they are subject to a delay of a quarter of a second. This delay is acceptable for one link, but not for two in tandem. Com-



A midget submarine will help to lay and maintain the new Cantat 2 undersea telephone cable which is to link Britain and Canada. The submarine and its two-man crew will work with a cableship to bury a 170-mile section of Cantat 2 beneath the ocean floor on the Canadian continental shelf.
The cableship, equipped with a seabed plough, will bury the cable to a depth of between 12 and 18 inches. It is, however, unable to bury the torpedo-shaped repeaters inserted in the cable at regular intervals and will simply lay these on the bottom of the ocean. The submarine uses powerful water jets to shift the sand so that the repeaters can sink. Then the jets push back the sand. Cable burying aids are attached to the arms shown in the diagram of the submarine's equipment. The midget submarine will also uncover the buried cable should it be necessary to bring it to the surface for repair.
The decision to bury Cantat 2 was made by the Post Office and the Canadian Overseas Telecommunications Corporation, joint financiers of the £30 million project, because of the need to avoid damage to a high-capacity cable. Cantat 2 will carry up to 1,840 telephone calls at once – more than twice as many as all the other transatlantic cables combined – and it would have been particularly at risk from the gear of trawlers operating the rich fishing grounds off the Canadian shelf. The burying of cable at the UK end is also being considered.

munications to New Zealand, for example, must make use of a submarine cable for part of the route to avoid a double satellite hop. For this reason alone the two systems will be competitive but complementary as far ahead as one can see in this world of rapidly changing technology.

Global telecommunications of today are well served by the submarine cable and the satellite. High quality speech and colour television can be communicated world-wide on an ever increasing scale and at increasingly lower cost. Global telecommunication traffic flows in main streams, not unlike the trade routes of generations ago, linking the business centres of the world; governed not by the vagaries of wind and problems of navigation, but by the great network of communication links established over the last century.

Within five years the number of international calls will soar from 60 million to 130 million. In ten years international telephone circuits between the UK and the world will have grown to 35,000. These circuits will handle 346 million calls a year.

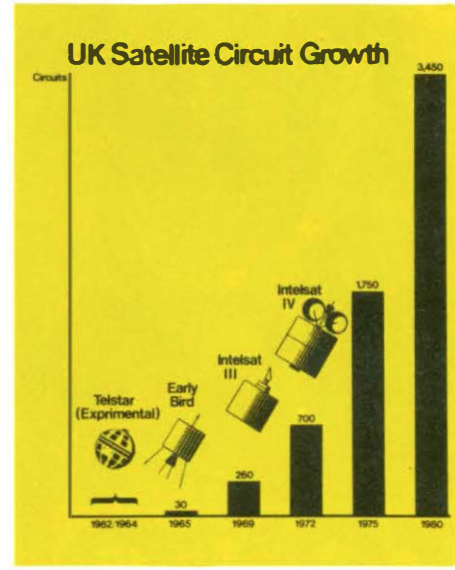
The submarine cable and the geostationary satellite have given us ability to provide almost unlimited circuits between all countries at economic costs, and with the bringing into being of this great and expanding global network it might be imagined that no significant problems remain to be solved. But this is not true. This global network must effectively interwork with the national telecommunications systems of the world, and this involves complex technical problems of interworking national systems with their own individual standards.

The ultimate aim must be fully global International Subscriber Dialling. Today about 65 per cent of the 32 million outgoing calls from the UK are dialled by the subscriber, and ISD is available to virtually the whole of the USA and Canada.

By 1982 90 per cent of all UK international traffic will be subscriber dialled.

To achieve this a very major expansion of circuits and the international gateway exchanges is necessary and the Post Office is planning accordingly. Between 1972 and the end of 1978 we shall invest £100 million in the international telephone service and some £15 million in the international telex service.

It is in this area of international switching that there remains a great technological challenge. We can transmit thousands of conversations via a satellite



no bigger than a London bus 22,000 miles from the earth, yet require vast buildings packed floor upon floor with switches and control equipment to connect those circuits to the customers. This is the bottleneck of global communications and it is here in the area of digital technology and large-scale integrated circuits that we must look for a technical advance to match that which we have achieved in space and in the depths of the oceans.

The dial everywhere network

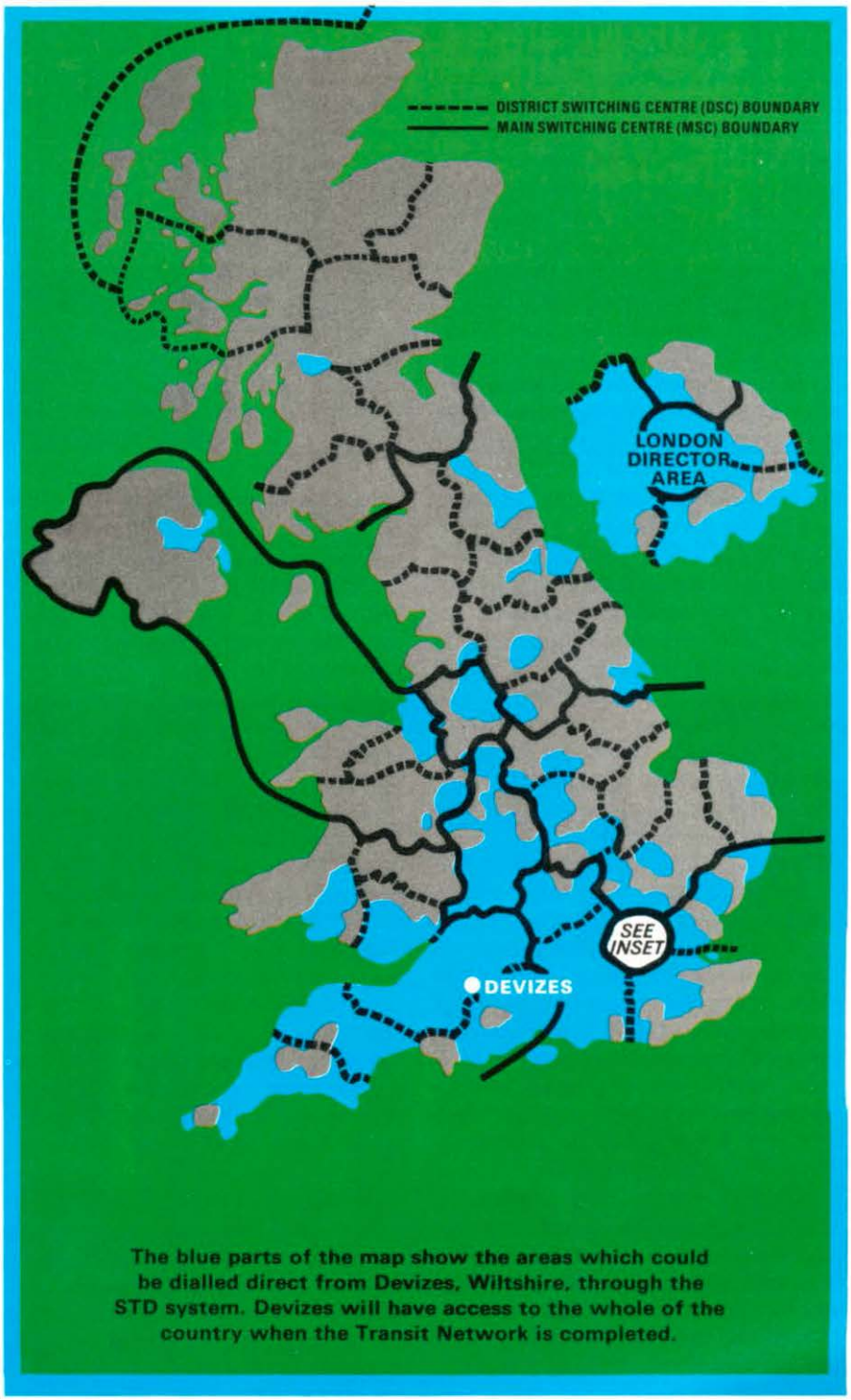
J R Smith and S W H Ockmore

BY THE END of next year virtually all local exchanges will have been converted to automatic working, and this will lead to any customer in the UK being able to dial his own calls direct to any other customer by 1978. This full Subscriber Trunk Dialling (STD) access will be made possible by the completion of the transit network which the Post Office is currently installing.

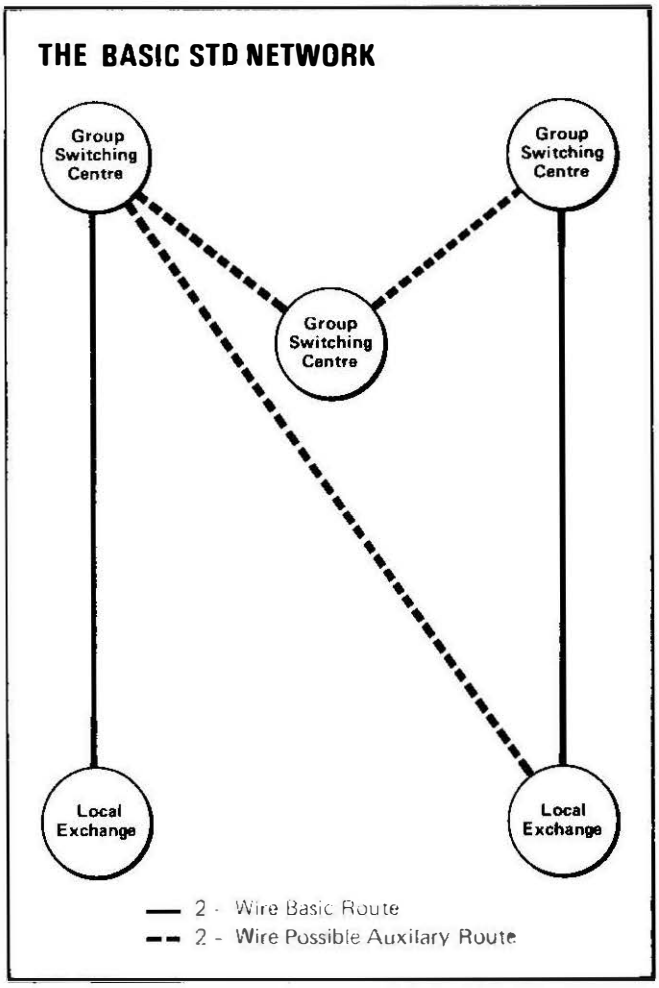
The STD system, introduced in 1958, has two planned phases. The first of these has been progressively expanded over the years so that today the basic STD system provides an automatic service between the great majority of the country's telephones – 83 per cent of trunk calls can now be dialled direct by the customer. Designed limitations of the basic STD network are overcome by the introduction of the transit network which constitutes the second phase of the STD programme.

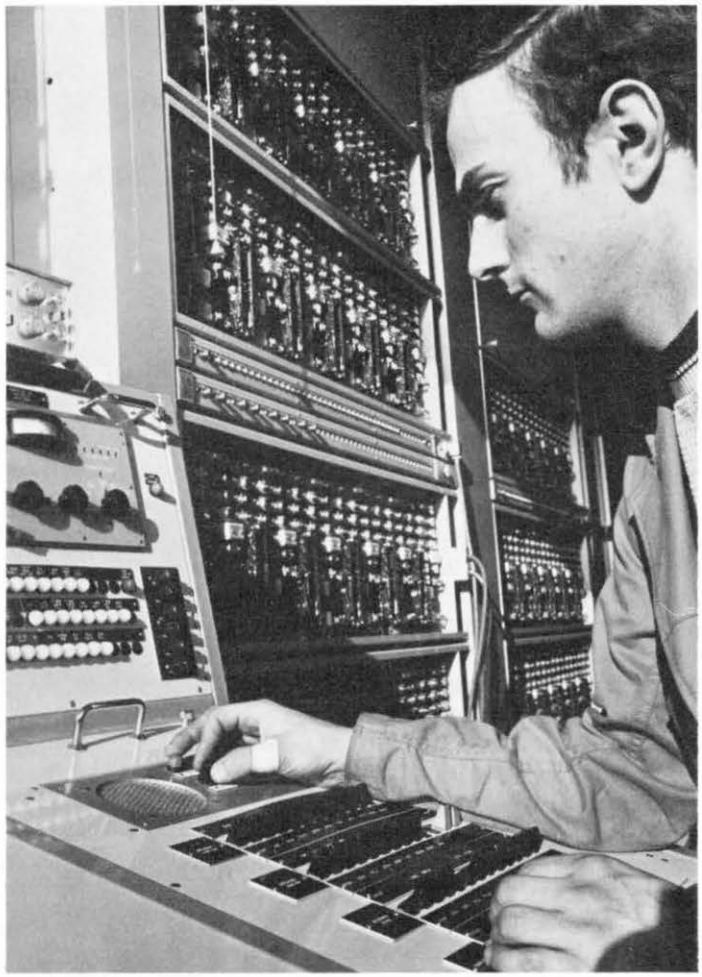
For the introduction of STD telephone exchanges were divided into Groups. Each exchange within a group is directly linked to a Group Switching Centre (GSC) and GSCs are interconnected as justified by traffic quantities. Only three GSCs may be linked for the connection of a trunk call – that is not more than two GSC to GSC links in tandem. If more than two GSC links are involved there is an unacceptable drop in transmission performance, although at least three GSC links, sometimes more, would need to be interconnected if the basic STD system were to cover the whole country. Also to provide the number of extra routes necessary would have meant the introduction of additional routing digits, and only a limited number of these digits are available at GSCs. In any event, extra routing digits would have the disadvantage of increasing the average post-dialling delay (the time between completion of dialling and receipt of ringing or other supervisory tone) experienced by the customer.

To overcome the limitations of the



The blue parts of the map show the areas which could be dialled direct from Devizes, Wiltshire, through the STD system. Devizes will have access to the whole of the country when the Transit Network is completed.





A Technical Officer tests the line signalling system equipment in the TXK4 installation at Reading. The new Reading Main Switching Centre has about 150 racks of TXK4 equipment, and is the largest transit switching centre in the country so far. It will be capable of handling nearly 12,000 calls in the busy hour.

basic STD network and enable full STD to be achieved the concept of a transit network which would pass calls between GSCs was evolved. To accomplish this task all GSCs have been divided into groups with each GSC within a group being directly connected to a transit switching centre (TSC). To obtain a measure of economy in the provision of line plant, and to provide a backbone network, nine of the 36 transit switching centres to be provided will be fully interconnected to each other.

These nine new switching centres will be known as Main Switching Centres (MSC) and the others as District Switching Centres (DSC). By connecting an existing Group Switching Centre to its home District Switching Centre and in turn connecting this to a Main Switching Centre a basic transit network will be provided. And because all Main Switching Centres will be fully interconnected with each other it will be possible to connect two Group Switching Centres together by using up to five transit links – that is originating GSC to home DSC; home DSC to home MSC; home MSC to foreign MSC; foreign MSC to foreign DSC; foreign DSC to terminating GSC.

In addition to these basic routes there will be auxiliary routes which make it possible for many calls to bypass some of the five-hop stages and to be connected much quicker. These are being provided where justified by traffic quantities, for example between two DSCs. As a result it is estimated that less than one per cent of transit calls will in fact require five-link routings and that 52 per cent will use only three links.

All the basic routes, and auxiliary routes outgoing from the transit switching centres, will be dimensioned on a fully provided basis – that is there will be sufficient circuits to carry the traffic at the required grade of service. The auxiliary routes from the Group Switching Centres into the transit centres will also be on a fully provided basis or, if the traffic level is small, on a high-usage basis. A high-usage route will have a small number of circuits in relation to the traffic offered to it, and the consequent heavy loading will result in more efficient use of the circuits. However, using circuits in this way gives a low grade of service and to ensure that a large number of calls do not fail, calls which find the high-usage circuits engaged will automatically be allowed to overflow on to the basic network.

The possibility of automatic alternative routing is being studied. This ensures that, on a busy route, the call is automatically switched to another path.

The limitations in the existing STD system are overcome by a combination of fast signalling techniques supplemented by a fast-switching exchange system. To enable the required transmission standards to be met all calls through the transit network will be switched on a four-wire basis. This will allow full advantage to be obtained from the use of the fast signalling system and ensure that the post-dialling delay experienced by the customer, even on a five-link call, is not excessive.

To achieve this latter aim two signalling systems are used. The first is a line signalling system which sets up a connection between adjacent exchanges and the second is a multi-frequency signalling system, Signalling System Multi-frequency No. 2 (SSMF 2), which is used to transmit the information needed to route a call through the network. Rather than require a number of dc pulses to represent a digit, as is the

case with conventional signalling systems, SSMF 2 achieves this function by using a combination of two different tones (ac pulses). It is possible with this method to transmit digit information in a shorter time.

A call can be routed through the transit network by using only the first three digits of the customer's national number (ABC digits) because it is these digits which contain the identity of the GSC serving the local exchange. The ABC digits are transmitted in SSMF 2 form between the originating GSC and each of the transit switching centres in turn. It is only when the call has reached the terminal GSC that the remaining digits need to be transmitted over the line.

It works this way. First, by using the line signalling system a connection is set up between the originating Group Switching Centre and the first transit switching centre (TSC). The latter, after an exchange of tones to prove the suitability of the circuit, will transmit in SSMF 2 form a "transit-proceed-to-send" signal back to the GSC which then immediately transmits to the transit switching centre the ABC digits in SSMF 2 form. The TSC is then able to set up a connection through itself and establish a circuit to the next TSC along the route.

A check is made on circuits in a TXK4 equipment rack at Reading.

This second TSC then sends a "transit-proceed-to-send" signal back to the originating GSC which responds by repeating the routing digits. And so this procedure is repeated until the final TSC sets up a connection to the terminal Group Switching Centre. The latter then sends a "terminal-proceed-to-send" signal to the originating Group Switching Centre which only then transmits the remaining part of the number necessary to set up the call to the called subscriber. Until they are actually required these extra digits are stored at the originating GSC.

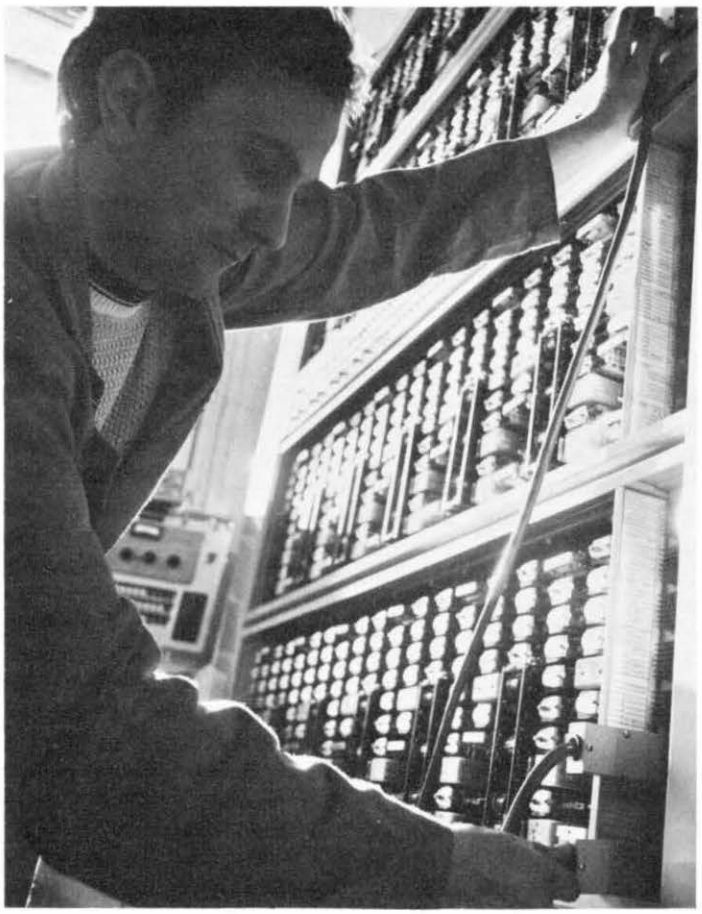
This method of signalling gives a post-dialling delay of approximately 10 seconds on a five-link transit call but only $5\frac{1}{2}$ seconds for a three-link call which will constitute the majority of transit connections. These times could be increased if adverse conditions are met at TSCs but, nevertheless, they compare favourably with the five to six seconds post-dialling delay experienced on the existing STD network.

The transit network at present being installed was planned to meet needs up to 1975. The network, however, is now expected to meet demand until about 1978. The long term plans provide for the network to be extended at national trunk traffic growth rates to meet requirements up to 1981 and then for a further series of extensions to meet needs at 1985. These extensions will almost certainly result in an increase in the size of existing basic routes and a reduction in the number of auxiliary links. This is because studies have indicated that the pattern of transit traffic between GSCs is likely to be so volatile as to change even from day to day, making it difficult to dimension economically some smaller auxiliary routes.

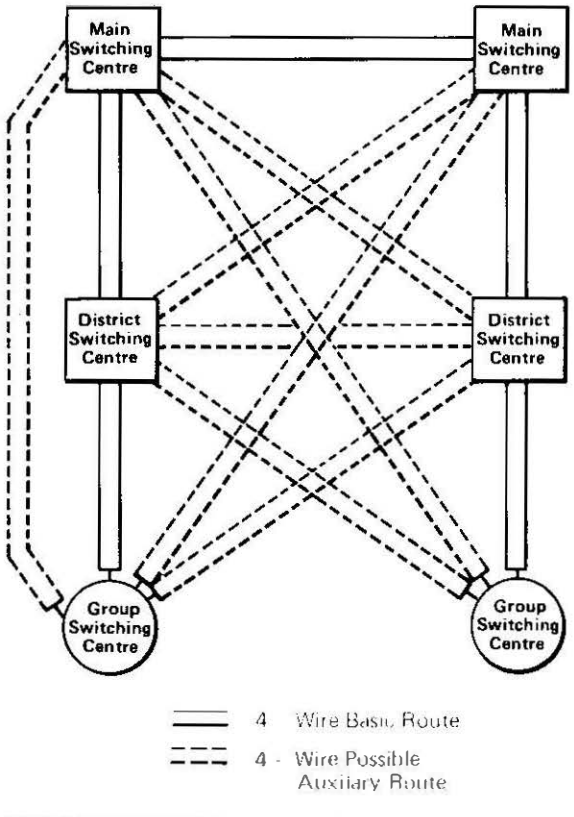
Fast switching by TXK4

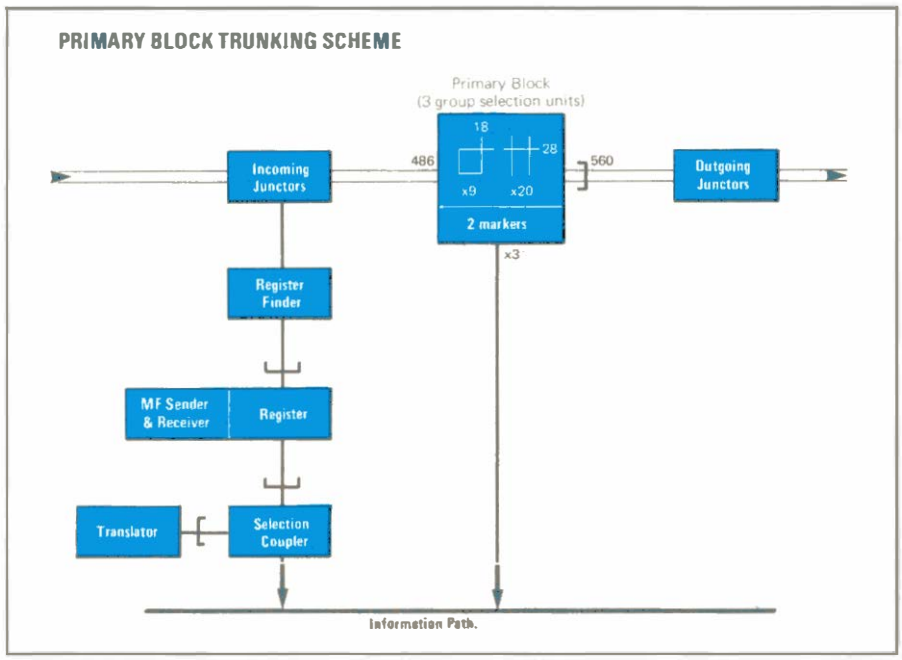
THE EXCHANGE system chosen for use in transit switching centres is the proprietary Standard Telephones and Cables BXB 1121 Crossbar system. It has been suitably adapted for transit working and designated TXK4 by the Post Office.

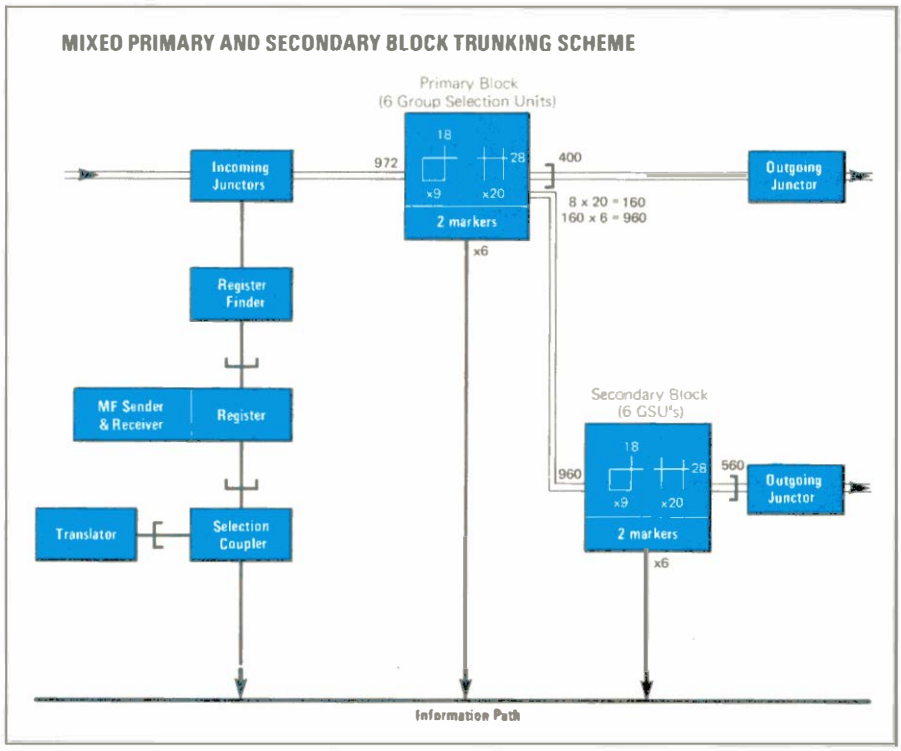
With this system the incoming junctors (relay sets) act as interfaces between the line circuit and the exchange equipment (see diagrams overleaf). They connect calls via register finders to the registers and their associated MF receivers. The registers control the setting up of the call through the transit switching centre (TSC). They also control the return of the "transit-proceed-to-send" MF signal to the controlling GSC and check the returned ABC digits before transferring them, in dc form, via the selection coupler to the translater. The



THE TRUNK TRANSIT NETWORK







translated information required to set the call up through the TSC is then passed back to the selection coupler where it is stored to be available as required. The selection coupler acts as a concentration point for the connection of the short holding time equipment and provides access to the information path.

The information path is an internal signalling path used to permit the rapid transfer of information between registers, selection couplers and markers during the setting up of the connection.

The diagrams also show the other main part of the TSC, the Group Selection Unit (GSU), which is the switching area of the exchange and contains the crossbar switches for connecting the call through the exchange.

A GSU contains two sections of crossbar switches called primary and secondary sections, interconnected by link circuits. The link circuit connecting pattern is arranged so that every primary section has access to every secondary section. The use of the link circuit principle reduces the number of crossbar switches required to interconnect the inlets and outlets although a penalty is incurred due to the introduction of link blocking or congestion.

This occurs when no free link circuits are available to connect an inlet to the required outlet. The TXK4 system reduces this in three ways. Firstly by the use of conditional selection, which ensures that only the free available paths between the primary section inlet and the secondary sections which have access to the required outgoing route are selected. Secondly, by duplicating route appearances – circuits are given duplicate appearances on routes having less than 15 circuits thereby providing more link circuits for selection. Thirdly, and most important, is the use of interaid. Interaid is a form of internal overflow trunking which by use of the spare inlets and outlets of the crossbar switches enables alternative paths to be set up for routing the call through the GSU.

For larger TSCs where more than 162 incoming circuits are required but no more than 560 outlets are necessary additional GSUs can be provided with their outlets commoned. This can carry approximately 300 erlangs of traffic. For TSCs which require more than 560 outlets some of the outlets of the primary block can be taken to a secondary block. This secondary block is a second switching stage comprising a number of GSUs connected in a similar manner to those of the primary block. This trunking scheme, known as mixed primary and secondary block working, can carry 1,800 erlangs.

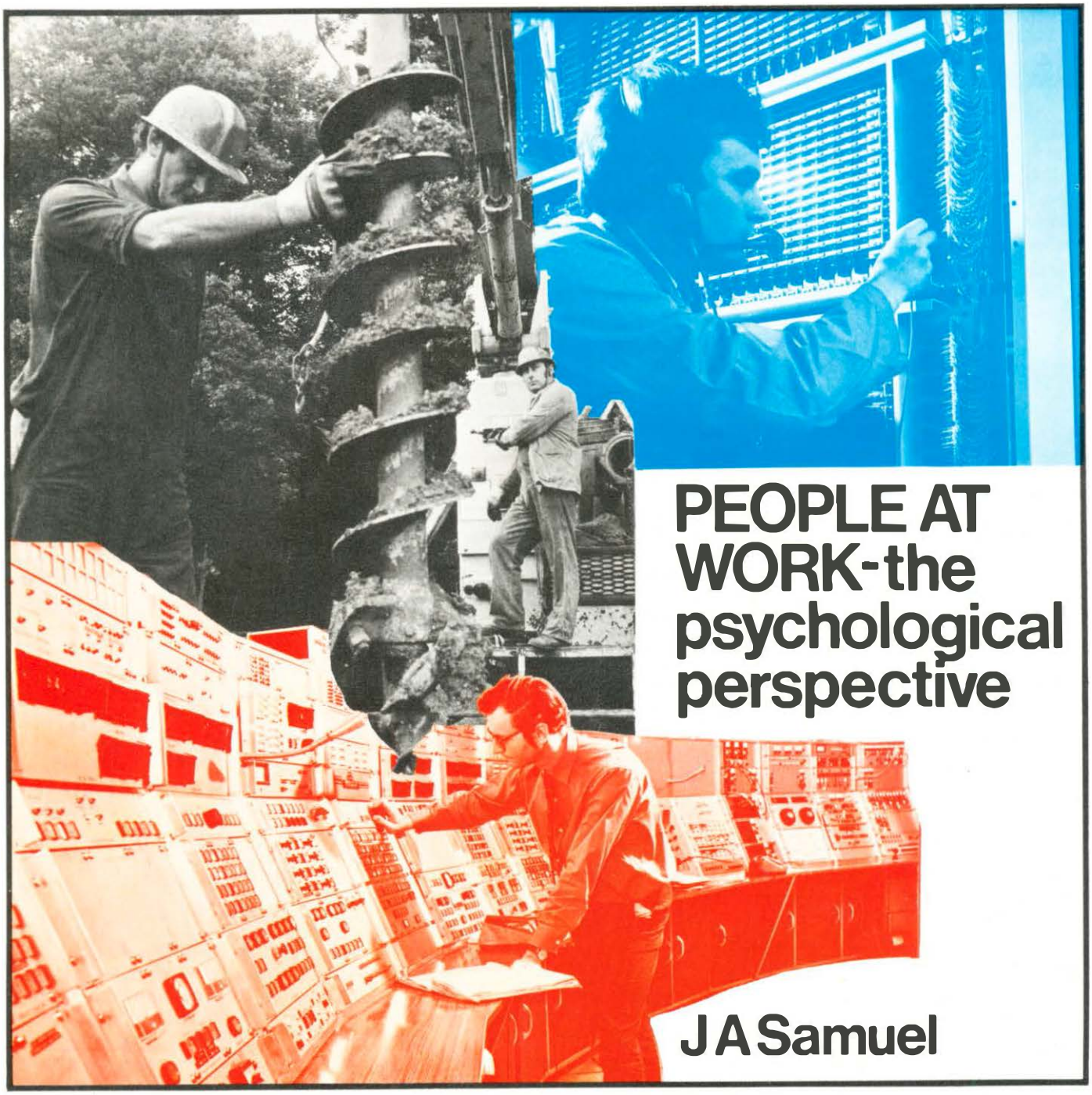
To ensure that switching times do not become excessive on multi-link calls no more than two stages of switching is permissible at a TSC. Although this limitation restricts the provision of further switching stages the maximum size of a TSC is not limited to 1,800 erlangs. If a wholly secondary block trunking, one where all the traffic is routed over two switchblocks, is employed the TSC could carry a maximum of 25,000 erlangs of traffic.

The TXK4 system is readily adapted to numerous other trunking schemes and the size of a TSC is unlikely to be restricted because of the lack of a suitable trunking configuration.

The choice of trunking is, in general, a question of the most economic solution at the traffic level concerned. However, other considerations apply, such as ease of initial installation, future extension, accommodation aspects and overall switching times. The final solution will be a balance of all these factors.

Mr J. R. Smith is head of the group in Network Planning Department at Telecommunications Headquarters responsible for the engineering standards and implementation of the transit network.

Mr S. W. H. Ockmore, also of Network Planning Department, is head of the group concerned with the traffic routing and programming of the transit network.



PEOPLE AT WORK-the psychological perspective

J A Samuel

THERE ARE FEW firms today who purchase machinery and equipment without careful prior evaluation. Apart from matters of cost, reliability, delivery time, suitability for the purpose, many other factors are considered in advance of a decision being reached. Mistakes, when they are made, can be both costly and often obvious.

Having obtained the machinery it is usual and sensible to make fullest use of its capacity and facilities. Optimum maintenance and servicing schedules will maximise its useful life. From time to time the machine may be adapted to meet new circumstances and situations. These considerations are commonplace in relation to an organisation's material assets but they are much less appreciated in terms of the organisation's human resources. Today we are still in the process of learning that these processes apply equally to employees and that neglect, or indeed lack of awareness, of their necessity can have serious consequences.

To recruit and select an individual to do clerical work in the Post Office can represent a £50,000 investment decision. The choice of a trained engineer or someone to perform a management task may represent an investment of £150,000. This is what may be paid in salary in return for their services over a full career. Having committed this sum on behalf of the business it is surely sensible to ensure that it is well spent and not wasted. This means obtaining the right sort of person for the work to to done, which itself means understanding in some degree of detail the nature of the job. In time, and with rapid technological development, even if the right individual has been employed originally, his job may change or indeed disappear. This implies that the incumbent must be helped to adapt and modify his behaviour to meet the new situation. He must be helped to develop his latent talents and he must be provided with new skills, in fact retrained.

Though widely adaptable, people are not wholly adaptable so that in some cases the revised job may be beyond the capacity of an individual. Again a decision is required either to redeploy the individual or to restructure his job.

Telecommunications has for long been good at installing, maintaining, adapting and developing its equipment. It is now finding that an increasing proportion of its resources and effort are necessary to maintain, adapt and develop its staff. The welfare, safety and occupational health specialists largely concern themselves with the physical environment, but important though these are, they are not by themselves wholly sufficient. Every individual works in his own unique psychological environment. This is made up of his own interests, aspirations, attitudes, fears and circumstances modified by his perception of his role, status, relationships and place in the working environment. Our understanding of each of these attributes, their effect one upon another and how they might be influenced to optimise the psychological environment is as yet limited. There are many theories, but little in the way of generally accepted lore as to what is best under all circumstances and in every situation. Though we are beginning to accept its importance, our approach to bringing about change is essentially pragmatic. It will remain so for some time to come.

Some hesitant steps towards an understanding of the changes in the psychological environment of some groups of staff in Telecommunications have already been taken. These have raised more questions than they have provided answers, but at least they are giving pointers towards the sorts of things which may need to be done to bring about a desirable change.

A study of wastage among clerical staff working in Telephone Area Offices showed that no single working environment will be seen as the most favourable by everybody. A desired increase in responsibility for some will be seen as an intolerable burden by others and will lead to an increase in their anxieties and fears. Even remuneration is seen differently; the amount, the method of payment and the basis of calculation may be totally acceptable to one person and unsatisfactory to another. Evidence from this study, and from elsewhere, revealed that the introduction of Telephone Billing Stage 3 (the computerisation of customers' accounts) was a worrying experience for many people working in Telephone Accounts Groups. This change so altered the job that for some it resulted in apprehension, frustration and boredom.

This sort of situation is not confined to clerical work. The introduction of the Telegram Retransmission Centre in the International and Maritime Telecommunications Region will mean that fewer people will be required for the traditional work of the Overseas Telegraph Operator. For those no longer needed adaptation and retraining will be necessary. By identifying their potential to acquire new skills, by taking account of each individual's interests, inclinations and suitability it is hoped to redeploy those so inclined, into other duties in Telecommunications. For the Operators who are still required the nature of their work will change.

While correct assignment and placement is an obvious and desirable first step, this does not necessarily lead to an individual being satisfied and his manager regarding his work as satisfactory. A job consists of more than the work content within it. The style of supervision, the awareness of the purpose of the work, the quality and the quantity of the work load, a recognition of achievement – these and many other things contribute towards the full and willing utilisation of an individual's talents. Not to use staff to their fullest capacity is not only economically wasteful, it is also to some extent degrading to the individual.

Perhaps few would disagree with the argument so far, but many might say what practical steps can be taken to deal with the problems? In an organisation as large as Telecommunications how can every individual be in the job which best suits him and which fully utilises all his talents? After all, thousands of jobs are the same but every individual is unique. Tailoring every job to match the job holder is clearly impossible. Even if it were feasible, people leave, retire and are promoted so the work force is never stable. These are sound arguments against the possibility that, even if we understood and could take account of every psychological factor involved, we shall never develop the ideal work environment for all. They are not, however, convincing reasons why some of the worst anomalies and difficulties should not be remedied.

Job restructuring can be undertaken. A process which should mean not just functional grouping of activities but more importantly reorganising a duty to make it psychologically meaningful and whole. Single activities might be grouped together into a complete task, with a beginning, a middle and a recognisable and purposeful end. This would be more satisfying and make more sense to an individual. Especially is this so in situations where a man is expected to repeat, *ad infinitum*, a single activity, one of many before the product emerges. The classic example of this approach is on the motor car assembly line where one man will spend all his time tightening a set of nuts or screws; he will never complete and perhaps may never see the complete article. The shortcomings of this ultra functionalisation have been recognised by some firms who have organised so that an individual or small group can now build a complete unit, albeit a sub-unit of the final product. It is of interest that a major motor car manufacturer has recently announced its intention of going over to this form of working in two new factories. A restructuring approach can be taken in most fields of work, and clerical work is no exception. We must beware of assuming, however, that what is a whole task from an administrative or operational view is necessarily seen as such by the man who does the work.

Increasing technical sophistication, social development and economic necessity all point to the need to reconsider the relationship between the man, his job and his role in the organisation. There are probably only two underlying theories of work. The one tends towards the assumption that a man does as little as he can and that work has to be so ordered and organised that fear of sanctions against him will compel him to do what is necessary. The alternative assumes that providing the task and the individual are compatible and the psychological environment appropriate a man will be self-motivating. The latter approach seems the only viable possibility in today's rapidly developing and changing social climate.

Such a radical change of approach has widespread implications, not only for staff but for those who control and organise staff. Supervisors and managers will be more and more concerned with creating those conditions in the whole working environment which will allow each individual to function most effectively. This means recognising the amount of responsibility an individual can and should carry, giving support and encouragement, recognising his accomplishments and having regard to and satisfying his aspirations and ambitions. Above all it means understanding that even in a large unit each member is different and a uniform approach is inappropriate. For those having responsibility for others the challenge is considerable, but so are the rewards for those who meet it.

Mr J. A. Samuel is Head of Psychological Services Branch in Management Development Department. Before joining the Post Office four years ago he was with the Ministry of Defence (Navy) and the British Iron and Steel Research Association.

Three case studies

The growing concern with the problems of people and their jobs is illustrated by three studies carried out by Post Office psychologists for the Telecommunications Business.

STUDY 1—Clerical wastage. *This arose from a concern at the apparently high turnover of clerical staff in Telephone Area Offices. Several hundred clerical staff who voluntarily resigned from 21 TAOs over an eight-month period were interviewed and completed a detailed questionnaire. A group of non-leavers, matched for age, sex, length of service and type of duty completed the same questionnaire. Analysis of both questionnaires and interviews revealed a considerable amount of evidence on the feelings of clerical staff towards their work, working conditions, pay, promotion prospects, training, supervision etc. Information also became available about particular features which appeared to be associated with leaving rather than staying. There were, for example, significant differences between the way leavers and non-leavers perceived their jobs in terms of the variety in their work, the initiative they could display, the mental and physical demands placed upon them and the importance which they believed their work had to the functioning of the TAO. The Business is now giving detailed consideration to the findings.*

STUDY 2—Induction of managerial and professional staff into the Post Office. *The recruitment, selection and training of graduates is expensive and often lengthy, and as the Post Office tends to engage people for a career and not just a job, rapid and successful induction is important. By interviewing a sample of graduates soon after entry and again a year later it is hoped to discover something about their initial expectations and attitudes and how these are modified by time and experience. Managers, particularly those who have graduate staff, are also being interviewed. The practical outcome, it is hoped, will be the identification of those factors which result in early and satisfactory induction into the business.*

STUDY 3—The morale of fitters in the London Telecommunications Region. *Part of the problem is in defining and understanding what is meant by morale, and determining in what way morale influences work behaviour. Semi-structured group discussions with inspectors, technicians and fitters have been held in two Telephone Areas. A considerable body of information, which is being collated and analysed, is available about attitudes and feelings towards work, its organisation and other aspects of the work situation. However, a major difficulty of enquiries of this nature is in establishing acceptable and valid indices of the level of morale, and thus determining the effects of change upon it. Attempts are being made to get over this problem.*

Top: Why do some clerical staff give up their jobs, while others in a similar position enjoy their work?

Middle: Is this student entrant, learning about a PCM exchange, happy about the way she was introduced into the Post Office?

Bottom: What sort of work affects the morale of a London fitter?

In the steps of the film pioneers

ON A MOUNTAIN IN SCOTLAND ▲
A camera crew shoots a scene from "In Touch" which describes how the Post Office is providing communications for the Scottish Highlands and Islands. It shows a trenching machine preparing the way for the burying of cable over rough moorland. This film is being shown to a wide audience.

UNDER A BUSY ROAD IN OXFORD ▶
The Post Office Cine Unit descends into a cable tunnel at Oxford to prepare a film about the trunk network which will be used for training and recruitment.
The cameraman is in a child's pushchair and was pushed along the narrow gangway to obtain a tracking shot of the run of cables.

THE POST OFFICE is in the communications business and it is not surprising that it uses a wide range of media to communicate with the general public and its staff. Since the early days of the "talking picture" the Post Office has used film to inform – and entertain – a huge audience. It was involved in the production of some of the first and most famous documentary and industrial films.

Today, anything up to 20 telecommunications films may be in the course of production in any one year. They cover a wide variety of activities and are made with an equally wide variety of audiences in mind. Some have such general appeal and entertainment value that they are distributed by MGM/EMI and the Rank Organisation to support major feature films on general release. For example, the film "Communicate to Live", which is about data communication, was shown at London's Leicester Square Theatre along with "Catlow" starring Yul Brynner. The films seen in cinemas, and others with a similar wide appeal, are also shown to film societies, clubs and schools. Others have a specific audience in mind – like business and professional organisations, or a particular group of Post Office staff. Most of them can be borrowed from Regional Public Relations Officers or from a number of film libraries throughout the country.

Films are an effective means of reaching out to almost every section of a community, and large numbers of people can be kept informed of the kind of work the Post Office does. As well as describing the services available films can also advise people how to make the best use of services and equipment. And they can often be a good way of getting a message across to Post Office staff in training. Safety at work, for example, can be hammered home effectively on film by bringing a situation "alive" in words and pictures.

The films are made either by the Post Office's own small Cine Unit, operating under a professional director who is commissioned for each particular job, or alternatively, an entire production will be contracted out to a film company. Generally, films for wider showing lasting perhaps 20 to 30 minutes are contracted out while the five or ten-minute "quicky", very often for use inside the Post Office, is made by the Cine Unit.

Among current productions by outside companies are "The Badger Account", which is aimed at informing the business community about the proper use of telephone installations, and "The Grutzbacher Memorandum" which is about telex. Also in the pipeline from the Post Office Cine Unit are a number of training films and two dealing with specific aspects of safety at work.

Although Post Office producers make a point of resisting any temptation to introduce artistry for art's sake, preferring instead to concentrate on achieving the objectives set by the business, their films have been attracting a number of creative awards at the major international festivals.

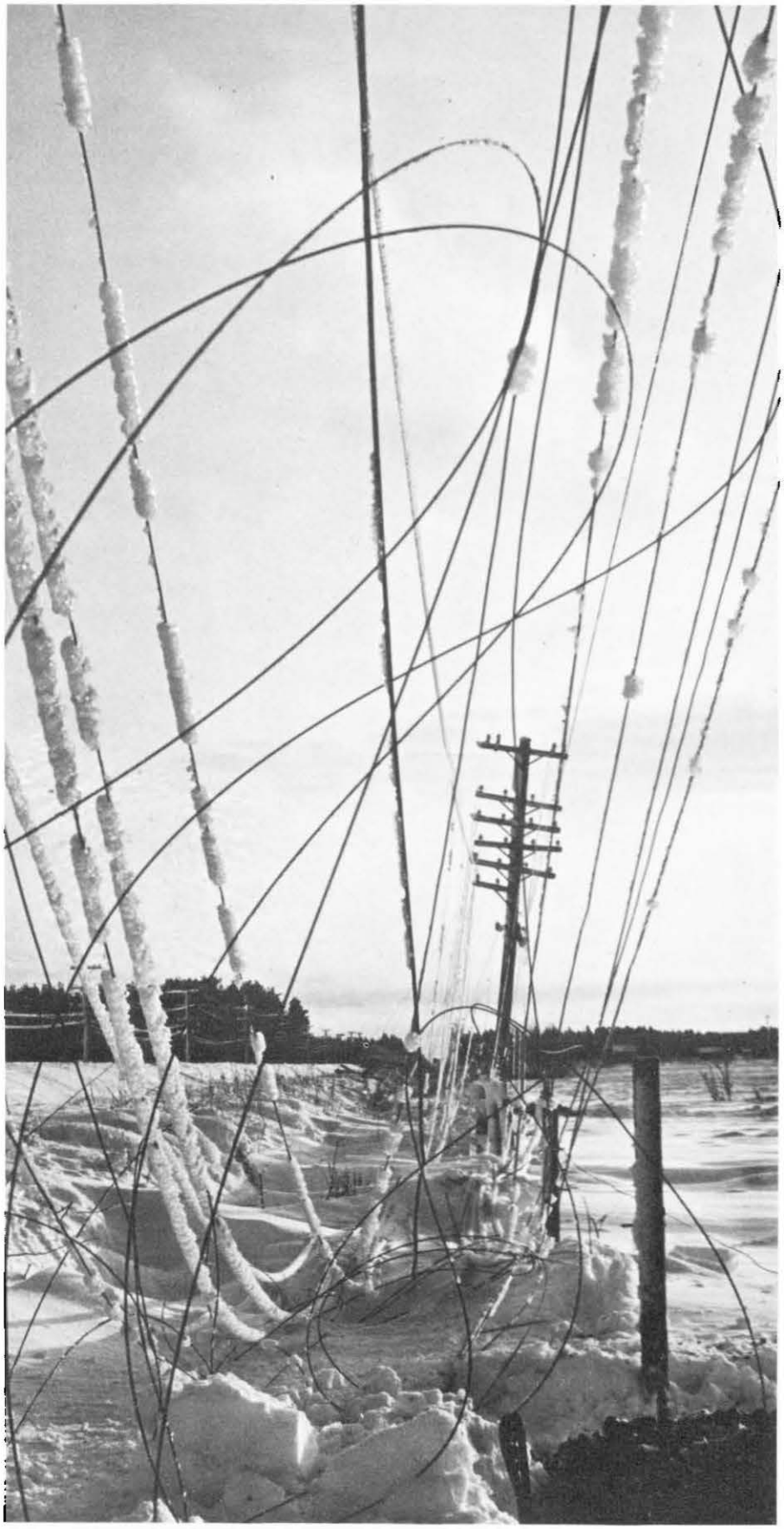
"Communicate to Live" was declared the best in its class at the British Industrial and Scientific Film Association's Festival, and was awarded a Certificate of Creative Excellence at the Fifth USA Industrial Film Festival in Chicago. "No Ordinary Cargo", which is about the work of a Post Office cableship, won a prize in the Geneva international festival and another award at BISFA.

The high standards set by the early pioneers are still very much in evidence in today's films.

It was in the early 1930s that the Post Office entered the world of movies and through the GPO Film Unit produced a series of documentaries now regarded by experts as among the all-time greats of their kind.
With these pioneer movies the late Professor John Grierson, then head of the Unit, added a new dimension to the art of film – and a generation of talent.
"Night Mail", probably the best known of the documentary classics produced by Grierson, has music by Benjamin Britten and script by W H Auden, now major talents in their fields. And there were other little known names employed by the Unit who were also destined for fame, the most notable perhaps being writer J B Priestley.
Shortly after the start of the Second World War the Unit was taken over by the new Ministry of Information and made propaganda films for the Home Office, eventually changing its name to the Crown Film Unit. After the war films for the Post Office and other Government Departments were handled by the Central Office of Information.
But in 1961 the Post Office again began making its own films and today the Publicity Division of Marketing Department controls film production for the Telecommunications Business. A similar organisation operates in the Postal Business for films with a postal theme.

ANCIENT AND MODERN ▶
"Communicate to Live" (see film strips) traces the history of man's attempts to communicate with his fellows, from the first written messages to the electronic revolution. It looks at the growing use of data communication and some possible future developments. These scenes show Faraday at work in his laboratory and a hospital operation, with information about the patient on a visual display unit.

Impressions of Europe



The Continental winter brings special problems. In Scandinavia many open-wire circuits are still in use, and a number break as a result of ice and storms.

As Britain goes into Europe we take a look at telecommunications on the Continent. Roy Howard, Deputy Controller Planning in North East Telecommunications Region, was seconded to NATO as a Technical Consultant at the SHAPE Technical Centre in The Hague. It enabled him to obtain first-hand experience of a number of administrations and the communications systems they operate. In this article Mr Howard gives his personal impressions.

ONE OF THE first impressions one gets when travelling through Western Europe is how the telephone service somehow mirrors the general national characteristics of the nation which it serves. For example, the German system is a model of thoroughness, and so far as the customer is concerned seems to work like a well-oiled machine. On the other hand the regulations attached to its use, applications for connection and so on, are truly formidable.

Conversely, the Italian system seems to be as volatile as the Italian personality. When using it one wishes sometimes that the telephone instrument could express itself physically in the way that an Italian often does; one suspects that such actions would be more satisfactory than the strange noises which sometimes emanate from it.

The stolid nature of the Dutchman is reflected in the solid form of his telephone and the adherence to a very well-defined set of rules for its use. His strong commercial sense is very evident in the method of billing by means of a printed and punched business machine 60-column card which is also the accounting document. Payment is very simple – the card is handed over a Post Office counter with the cash or sent to a bank or the National Giro. Part of the card is torn off for a receipt at the counter, or the bank returns the torn off portion with their regular statement. Also, the time allowed for payment is so short that it is customary to arrange payment through friends if one is intending to be away for longer than three weeks at the expected time of arrival of

a telephone bill. Holland has been quick to grasp the importance of telecommunications, and as befits a country so commercially minded much use is made of telex. The aspect of this which first so intrigues the visitor is its widespread use for hotel bookings. In the majority of the larger (and many of the smaller) hotels telex is also used for ordering supplies and for other business transactions.

Throughout Western Europe one can note the importance placed on telex. Where firms in the United Kingdom advertise their telephone numbers many German and Dutch firms publicise their telex number, omitting reference to their telephone even though they possess one.

In all countries the costs of telephone services are a subject for much discussion. However, cost comparisons are extremely difficult to make. Flat rate systems appear in Scandinavia, rental systems similar to that employed in the United Kingdom can be found in the Netherlands and Germany, with some countries giving a number of "free" local calls plus rental. The different systems coupled with the variable rates for calls and for distance add up to a multitude of variations in charges. Residential rentals range between £9 in Italy and £27 in Norway; business rentals from £11 in Luxembourg to £27 in Norway and connection charges from £7 in Luxembourg to £63 in Denmark.

For many countries the charges vary from place to place. Connection charges can also vary in some countries according to the amount of wiring required; in Norway a capital contribution (repayable with interest) of £58 is also required.

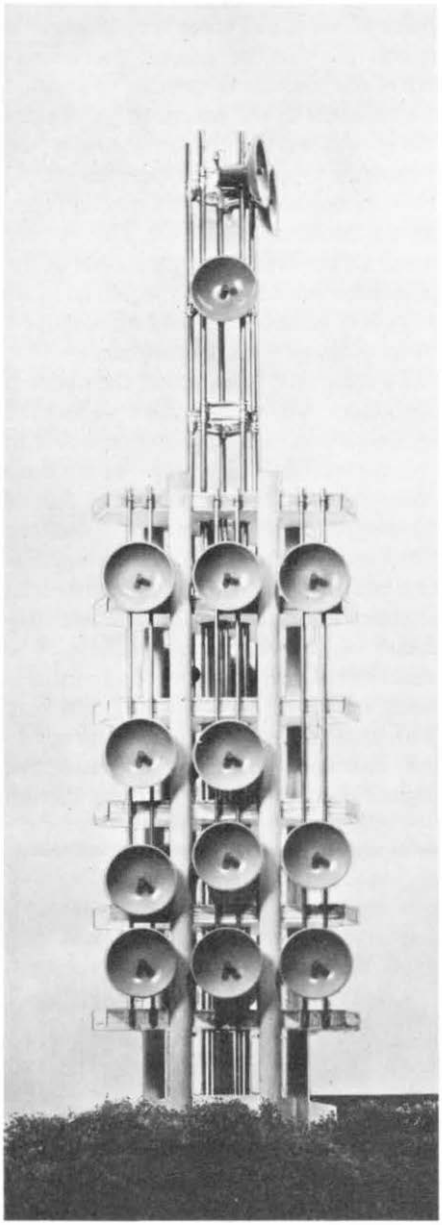
Telephone habits vary too. Consider the use made of public telephones. Commonplace on the Continent is a special "fire and police" telephone which is only usable for emergency calls. These apart, public telephones in the street are a far from common sight – notably in the Netherlands, France and Germany. On the other hand in cafes, railway stations, hotels and similar public places the telephone is freely available for customer and public usage on payment of the appropriate money to the proprietor of the establishment. In this way vandalism is much reduced because the telephones are under immediate observation by the people responsible for the establishment. It does however reduce the availability of public telephones late at night and in the early morning, and this at times can be a serious detraction.

Use of the telephone also varies considerably from country to country. The average British subscriber for example makes much less use of his telephone than does his opposite number in Sweden.

The use that is made of individual telephones must of course be affected by the habits of people, the number of connections to the system, and to some extent by the number of people waiting to be connected. Germany has a very large number of "waiters" which must be affecting to some extent the usage made of individual telephones there. The habit of talking rather than writing, noticeable among Italians and Dutchmen, is reflected in the use that they too make of each individual telephone.

Likewise, the attitude of the administration to its customers differs widely from country to country. It is generally true to say that the continental administrations take a much "harder" line with their customers. One example of this has already been instanced in connection with billing in Holland, another is the attitude to enquiry and directory enquiry calls. Some administrations charge the customer for these services because, they claim, this results in far fewer calls upon these unproductive services thus saving administration costs.

One particular method of approach to the customer is worthy of special men-



A model of the striking new tower which is to be built at Tolsford Hill to handle microwave communications with Europe. It is made of ferro-concrete, and will replace the existing steel structure which will shortly be loaded to capacity. Work on the tower will begin this summer.

Improved link with the Continent

IN A DRIVE to strengthen communications with Europe the Post Office is to enlarge its microwave radio link across the English Channel to France. In a two-stage programme over the next two years capacity will be nearly trebled.

The route, from the microwave radio station at Tolsford Hill near Folkestone to Fiennes in France, has a present capacity of over 2,000 simultaneous telephone calls. It is to get an extra 3,600 telephone circuits, 1,800 of which will be in service by November next year and the remainder by the end of 1974. A new radio mast is to be built at Tolsford Hill to take the expanded system of aerials that will be required, and to cope with future demand.

The Folkestone–Fiennes route is a vital communication artery with Europe. As well as handling calls to and from France – people in Britain make nearly three million calls there a year – it also carries many international calls routed across France to other countries, principally Italy, Switzerland, Spain, Greece and Yugoslavia. The link also carries Eurovision TV services.

Communications with the Continent account for the biggest slice of the Post Office's international telephone traffic. Of the 23 million overseas calls from Britain last year, 18 million were to Europe. By 1975 there are expected to be 80 million telephone calls a year between Britain and the Continent.

The Folkestone–Fiennes extension is part of a big programme to improve telephone services with Europe generally. By 1978 expanded microwave and cable links will boost the total number of telephone circuits to the Continent to 20,000 – more than double the existing number.

tion. This is the access system used to Dutch switchboards. The customer hears the number he is in the waiting queue of callers at the time he makes the call and as the queue shortens he can hear his position being reduced number by number. In this way the customer knows his position. It is a common practice among Dutch customers to hang up if the first announcement is above number 8 in the queue. If the queue is full at the time the call is made the customer gets busy tone. Variations of this system may be met in other countries.

The number of telephones per head of population can bring to light some interesting comparisons. Sweden for example heads by far the European nations, which may account in part for the fact that in that country one sees very few public phone booths. People make use of their own or other peoples' phones rather than the public ones.

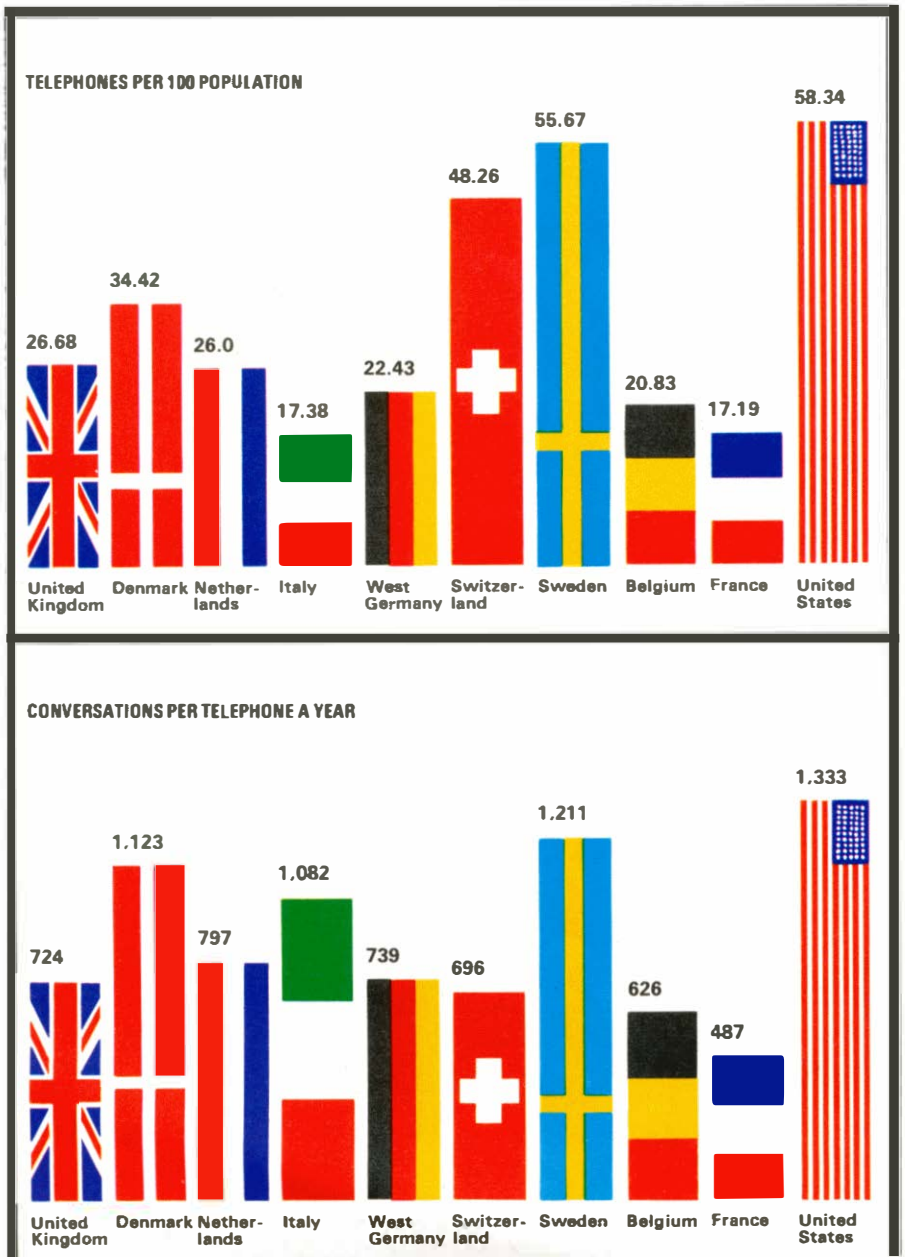
As one comes in contact with the different administrations one is struck by the common purpose of them all – a desire to give a good service at a reasonable cost. To the uninitiated, the ways of going about it can seem very strange. It is here too that the general characteristics of the individual member of a nation are reflected in the nature of his organisation. As an illustration consider the Germans. Generally the German people are very orderly, clean and tidy and they have a desire to remain so. This is very much reflected in the organisation of the telephone administration which is, in its way, very orderly, tidy and ultra-correct in its dealings with its customers.

In France and Italy, where the national characters are much more volatile, a liveliness and flexibility is noticeable in administrations' dealings with their public although there is a great deal of bureaucracy. Nowhere in Western Europe of course is there an administration built on the lines of a truly commercial organisation such as those commonly found in the western hemisphere. The majority of the European administrations are Government-owned and run. This must have a bearing on attitude to the customer; only in a commercial organisation proper is met the dictum that the customer is always right. In many countries the attitude is "what we have is best for the customer" and not "what the customer wants is what he should be provided with." Nevertheless there has always been a willingness to provide a service even if it has not been exactly what the customer requires.

As one would expect the six Common Market countries are very well interconnected telecommunicationally. There is a very marked degree of International Subscriber Dialling (ISD) between them, but here too one notices marked differences in the performance of the systems as one goes from country to country by telephone. For example, it is well known that one has to wait a very long time for a call to be connnected through the French system because the techniques used do require some considerable time to ensure satisfactory connection.

The differences in tones too are very noticeable and can be disturbing at times until one gets used to them. When living in a small country such as the Netherlands one has frequently to communicate with ones neighbours and this possibly explains one reason why the Dutch people seem to use the telephone very freely indeed for international communications and why so many people are fully familiar with the various tones and services provided by ISD. Naturally the Dutch nation has made it its business to be in direct communication with its neighbours by telephone and telex and virtually all the communications with the immediate neighbours are done by automatic systems. As one goes further south in Europe the amount of automatic equipment becomes less and one meets manual systems more frequently.

The ease with which one can communicate by International Subscriber Dialling obviously has a distinct bearing on the amount of traffic which is generated by the countries on the Continent of Europe and to some extent their concern and frustration at the barrier that the English Channel presents both physically and to some extent telecommunicationally. The shortage of circuits between the continent and the United Kingdom has been a serious drawback to the commercial communications of the Common Market and the United Kingdom. With the enormous increase in the number of circuits that are now being brought into service these frustrations should be reduced, but the market is growing rapidly and there is no doubt at all that with Britain's entry the traffic will increase still further and the enlarged community will have the problem of coping with this enormous growth.



VANDALISM
an uphill struggle

ALTHOUGH the fight against vandalism is still an uphill struggle there are some hopeful signs for the future. This was the view expressed by Mr Frank Lawson, of the Post Office Service Department, at a London conference on vandalism.*

Mr Lawson, Head of the Service Policy Division, said the 76,000 public telephones, many of which are sited in remote rural areas, town centres and housing estates had proved to be a natural target for the vandal. During recent years there had been, each year, between 121,000 and 171,000 cases of vandalism. Some kiosks escaped completely, but others were damaged almost daily. In some areas kiosks were often vandalised immediately after repair and before a call could be made from them.

The damage was sometimes due to thwarted attempts to obtain money from the cash boxes, but in other cases it was either senseless destruction or vicious behaviour. There was one instance where chemicals had been sprinkled around and inside kiosks which resulted in users being burned.

The Post Office and the community paid heavily for vandalism, said Mr Lawson. Repairs and replacement costs alone had been as high as £565,000 in one year. In addition money was stolen from cash boxes. The cost to the community, however, could sometimes be even greater. Public telephone kiosks met a social need and provided a vital link with the emergency services. In remote rural areas in particular a street telephone could often be the only lifeline, and loss of service could place lives at risk.

"For the last few years the figures had presented a depressing picture," said Mr Lawson. However, there had been indications recently that matters were beginning to improve. "The cost of repairs and replacements fell by over 20 per cent in the last year, and the amount of cash stolen was the lowest for some years," he added. About one per cent of boxes were now affected at any one time and this represented a considerable improvement.

The improved situation was due to a number of factors. Specially strengthened equipment had been introduced and had now been fitted in a large number of locations. The handset and connecting cord in public kiosks had been made vandal-resistant, design and lighting had been improved and polycarbonate material was being used in place of glass. Maintenance effort had also been greatly increased and was paying dividends. Alarms had been fitted to many kiosks and in co-operation with local police had been most effective.

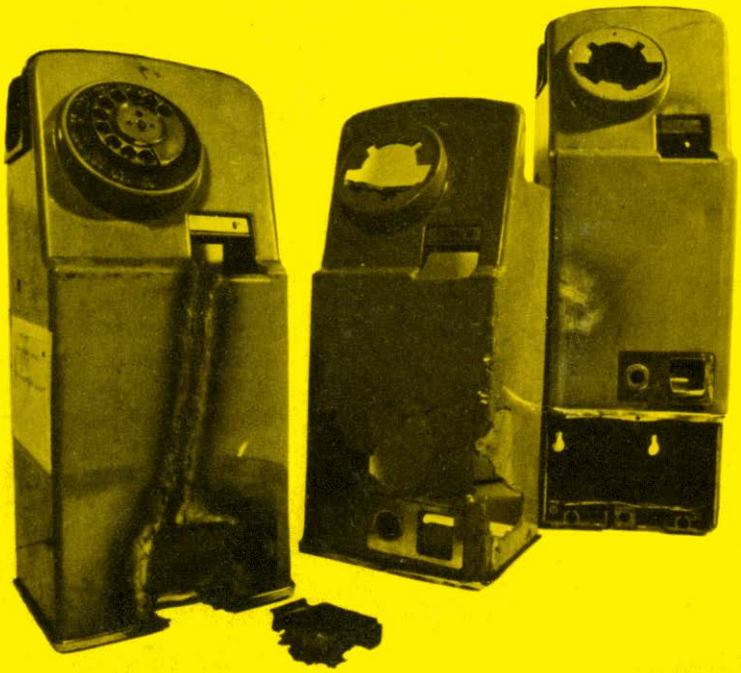
There were signs of an increased public awareness of the problems and a desire to help, although there were still members of the public who were reluctant to co-operate, possibly because of fear of violence.

The Post Office was always willing to consider radical solutions and suggestions from the public and a number of such ideas had been put forward.

The fully vandal-proof kiosk was very attractive as a concept, but it gave rise to technical and other problems. A pay-to-enter kiosk was often suggested, but this would provide a further target for vandals and prevent the making of free calls to the emergency services.

Thus the fight against vandalism was continuing. "Our consolation can only be that after losing several rounds we are beginning to score points on behalf of the public, and each year we will try that much harder," Mr Lawson concluded.

* *The conference on vandalism was attended by local authority representatives, probation officers and social welfare workers and was sponsored by the journal "Council".*



STREAMLINING INSTALLATION

EVERY YEAR AN increasing amount of telecommunications equipment is installed in customers' premises all over the country. Not only is there more of it, it has become much more sophisticated.

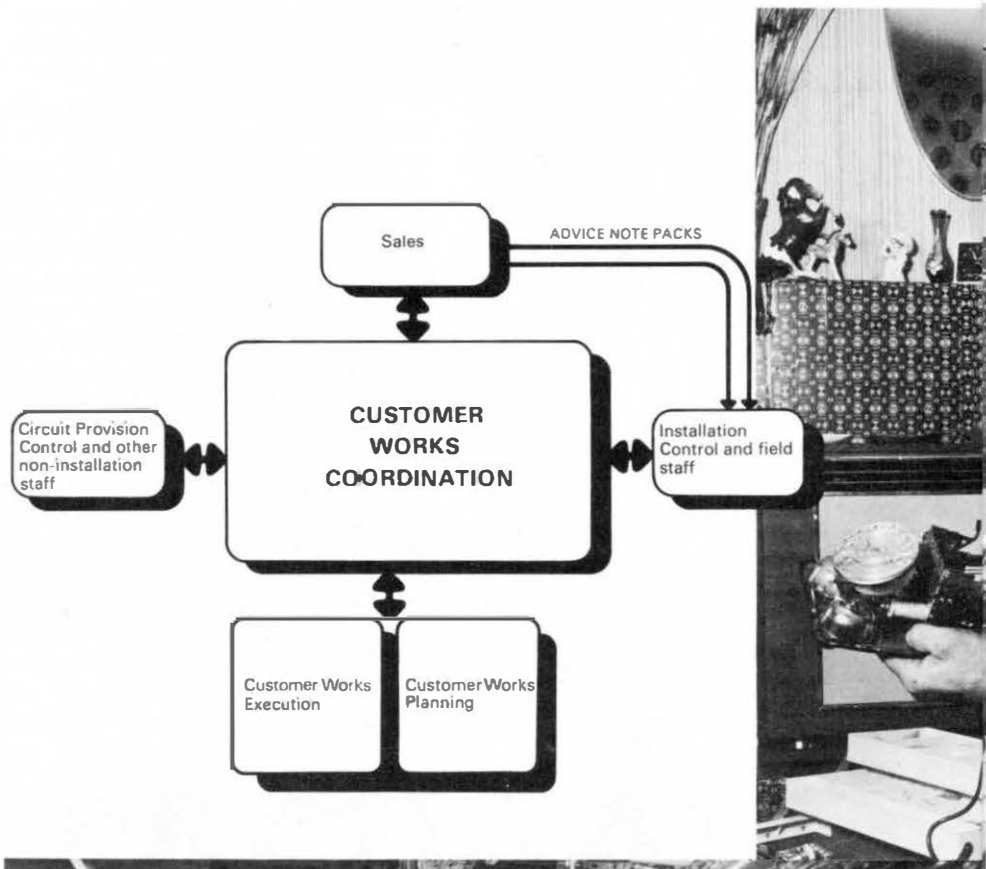
It is a situation which has been creating problems for Telephone Area Installation Divisions. Until a few years ago they could do the bulk of the work themselves, but now more and more of it has to be done by other groups because Installation Divisions do not carry the wide range of skills for the more complex installations. These are increasing to such an extent – PABXs by 23 per cent over the last two years for example – that now a total of four million manhours is contracted out annually by Installation Divisions throughout the country. This means that 13 per cent of all installation work is now being done by non-installation groups such as Internal Construction and Maintenance.

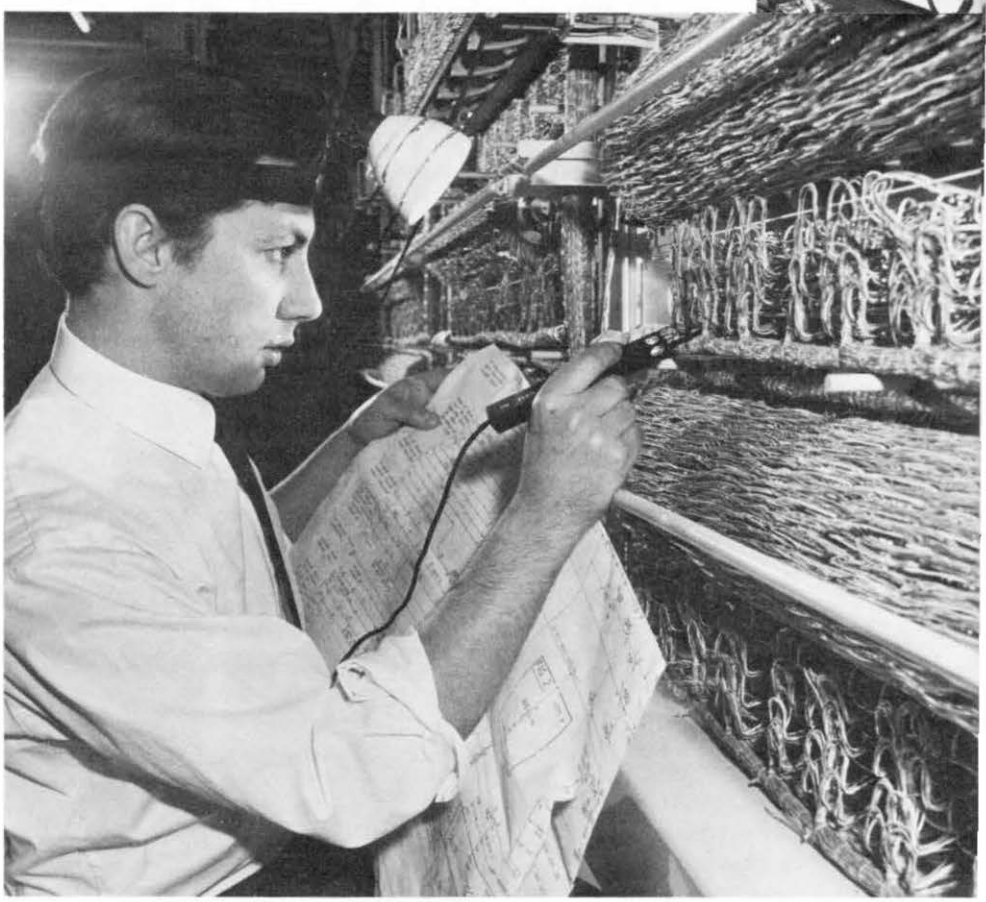
To make it possible for just one group to carry through all the complex work now required in customers' premises Installation Divisions are being reorganised. While existing Installation staff will continue to install straightforward exchange lines, extension plans, local private circuits and small switchboards etc, a new group is to be added to the organisation. To be known as the Customer Works Group, its staff will be responsible for the provision of the more complicated PMBXs, PABXs, Telex, private junction and main circuits for telephone and teleprinter services, circuits for Out-of-Area exchange lines and the larger of those simpler installations which require a greater degree of co-ordination.

The work content of the Customer Works Group was determined as the result of two originally separate investigations, one into PABX provision and the other into the problems involved in providing private circuits. The latter had in fact been organised and executed largely by Circuit Provision Controls. In both cases it seemed that groups whose skills and techniques had been set up for other specific purposes were being required to involve more and more of their staff with work in customer premises.

The organisation needed to resolve this problem evolved following the study of various Regional trials on the provision of private circuits – notably one in Midlands Region which was later studied by a national working party – and another in South Eastern Region for PABX provision.

In the end the solution to both





W R West and F E Wright

Above, left: The diagram shows how the Co-ordination section within a Customer Works Group will be the focus of installation activities. It will co-ordinate the work of the Planning and Execution sections which make up the Group, and is also responsible for bringing together all the numerous parties and activities involved in some installation work, for example private wire provision.

Above: The simple job – an installer wires up a telephone for a customer in a housing estate. This is unaffected by the new organisation.

Left: One of the more involved jobs which the Installation Divisions can now carry out without outside help. A Technical Officer commissions automatic exchange equipment at the new headquarters which Tesco supermarkets are building at Cheshunt.

problems was seen to be similar – firstly, the careful co-ordination of all the various activities involved so that the customer is finally provided with service within a programmed time; secondly, the provision of staff in Installation Division with the skills to complete any aspect of the work within the customers' premises. Both aspects have been built in to the Customer Works Group.

Each Group will combine three functions – Customer Works Co-ordination (CWC), Customer Works Planning (CWP) and Customer Works Execution (CWE). When a Telephone Area is of sufficient size to justify it these functions will normally be accomplished by setting up within a Group a separate unit for each; alternatively, in the smaller Areas, they will be combined.

The Co-ordination duty is a new one and will be responsible for the co-ordination of the engineering effort required to provide a customer service right from the first enquiry to Sales until final completion of the work. It involves constructing a programme of the various jobs, taking into consideration every separate aspect of the work, agreeing with Sales and the customer the dates determined and progress chasing the work to see that the completion dates are met. Because meeting of completion dates is of the greatest importance if the customer is to be satisfied with Post Office service, the duty must be prepared to act quickly in case of difficulty and must seek effective solutions for problems that arise.

The Planning section will deal with the detailed planning for the range of work carried out in customers' premises. Its staff will also agree accommodation with the customer and plan the equipment installation, including the extension telephones and block wiring. In the past this task was accomplished by engineers on Internal and External Planning duties.

Customer Works Execution will be responsible for completing the work programmed by the Co-ordination section. Its staff will include a group of Technical Officers – for the first time in Installation Division – and Technicians, under the control of an Assistant Executive Engineer. The Technicians will put together and wire-up the equipment although the installing of extension telephones and providing of block wiring will continue to be done as in the past by the Installation Division's field staff. The Technical Officer will test and commission PABXs and carry out any other work in customers' premises that requires his skills.

The reorganisation will see changes in the methods for providing local private circuits, which form the bulk of the orders, and for those others which can be extremely complicated to design and provide. Instructions will now show clearly defined responsibilities for providing the separate sections of the total service, will emphasise the need for an effective handover to the customer, and will have a measurement of results that shows not so much how fast the service was provided but whether the customer got the service he wanted when he wanted it.

The new Customer Works Groups will be responsible for co-ordinating the overall provision of private circuit work from the first enquiry to final completion. They will act as the central engineering information point and will be responsible for controlling the work in the customer's premises and in the local network. The design of the circuits, provision of the line, its line-up and correct working will remain the responsibility of Circuit Provision Control and the Customer Works Groups will connect the line to the customer's equipment and finally hand over the complete service to the customer. The Co-ordination duty's task is to arrange for this to happen with the maximum efficiency.

An Installation Division organisation proper to present-day needs has now been set up. Having got that organisation off the ground, however, two further aspects require further study if it is to be fully effective. The first is for a more detailed planning and control procedure; the second is for a system that allows sales staff to quote customer completion dates for bigger commercial installations at the first enquiry.

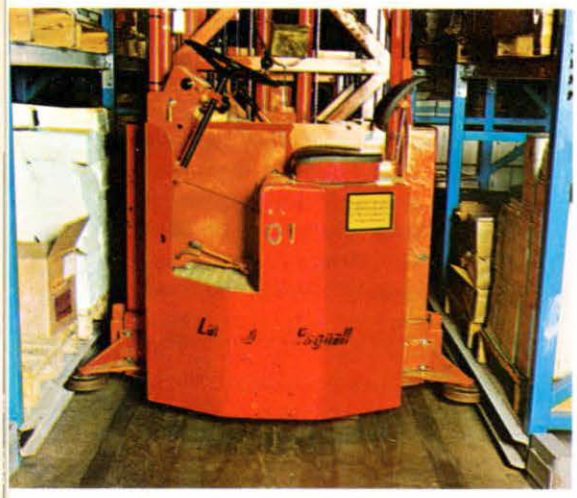
Both these aspects are now being examined. The new organisation has been designed so that they may be added with little or no change when they are ready. When that happens the Customer Works Group will have achieved its own main objective – that of improving service to the customer.

Mr W. R. West is the Senior Executive Engineer in charge of new projects for engineering installation matters. He ran Installation Job Conferences at the College of Engineering Studies, Horwood House, before joining Marketing Department.

Mr F. E. Wright, an Executive Engineer in the same group, has been involved with the design and implementation of Customer Works Groups and Private Service provision procedures from the trial stage onwards.

Handling forms by the ton

K R Foskett



Stacker trucks like these will operate in narrow gangways at Swindon. They run along metal rails between gangways (see smaller picture) and do not have to be steered. They can rotate loads to left or right and slide a pallet out on to the racks.

IN A YEAR the Post Office spends over £7 million on forms, books, telephone directories and teleprinter and other stationery. Over £2 million is also spent on uniforms and protective clothing to say nothing of several smaller groups of items such as twine, lead seals and hand-stamps.

The storage and distribution of all these stores for both the businesses is the responsibility of the Supplies Division of Purchasing and Supplies Department. A depot in Edinburgh serves Northern Ireland, Scotland and a few English offices just south of the border; the rest of England, and all Wales, is served at present by a group of six depots in and around London, helped out by two depots, at Bridgewater and Hereford, which are predominantly engineering stores depots.

The London buildings are mostly old-fashioned and not suited to present-day methods of materials handling, nor is it economic to have the work scattered over eight locations. This year the vast majority of the London depots will be concentrated in a new, purpose-built, depot on a 35-acre site on the outskirts of Swindon. The first phase of buildings will include an office block, three warehouse areas each 400 feet by 300 feet and two covered roadways 76 feet by 400 feet. Altogether 420,000 square feet of storage space is being provided with wide bays between the roof-supporting stanchions.

The move will enable Supplies Division to take on jobs which are now done locally but which could be completed more economically by a central organisation. For example, the Scottish depot has been issuing stationery on a trial basis, direct to sub-post offices rather than delivering in bulk to head offices where a further issues operation has to be carried out. When Swindon depot opens this scheme will be extended to

the rest of the United Kingdom. The depot will also take on the storage and issue of all forms for the Department for National Savings.

For some time a plan for operations in the warehouse at Swindon has been emerging. Taking into account the work now done in the existing depots and the new commitments to be taken on, it shows a depot different in many respects from other Supplies Division establishments. The most striking feature is the very large number of small consignments which will be despatched: altogether, over 20,000 parcels, packets and envelopes every day. Supplies Division have enlisted the aid of South Western Postal Region in handling this load. They are co-operating in setting up a despatch office on the premises, with a conveyor system designed by postal engineers to take the parcels straight to it from the point of issue.

A computer analysis of requisitions has shown that about 1,000 of the 6,000 stationery items are "fast moving" – meaning that the issuer will have to visit each of these stock positions very frequently, in some cases 100 or more times a day. To employ conventional issuing procedures, with people walking up and down between long rows of stock bins wheeling trolleys, would cause terrible congestion and produce a high risk of traffic accidents. For the fast movers, therefore, a small quantity of each item will be held in live storage racking. Each issuer will have a small number of items to look after. Empty, or partially filled, cartons will come to him along a conveyor with a requisition enclosed, he will select the items required from his group, put them into the carton and pass it on to the next person. To support the issuing positions bulk supplies will be held and about 200,000 square feet of storage space will be devoted to this.

Live storage racking consists of lines of roller track sloping towards the front face – probably four high. Each track is labelled to contain one item in trays which are fed in at the back face and travel on the rollers down towards the front. The issuer, working along the front, thus has a compact picking face to work from. There will be no trolleys in the live store section, and no climbing of steps to reach out-of-the-way items. The whole idea is to speed up the issuing process without congestion.

As they become full the despatch cartons will be labelled and slid onto the main conveyor, which will take them via a strapping machine into the despatch office. Various types of strapping machine – which whip a nylon or polypropylene strap around a carton faster than the eye can follow – are being tried out in Scotland, and first reports show that a 20 lb fibreboard carton, with straps, will travel well by post.

Most issues of telephone directories, in response to orders from subscribers, will be in ones and twos and a different type of packaging – heat-shrink wrapping – is contemplated at Swindon. It is envisaged that the directories will be placed on a conveyor, with the address label on top and taken to a machine which will wrap them in transparent polythene film and seal round the edges. The packets will then travel through a tunnel in which streams of hot air will shrink the polythene tightly round the directories with the label showing through. They will then go on by conveyor, cooling as they go, to the despatch office. There will be a lot of experimenting with different gauges of polythene film and different temperatures, but the result should be a good sound package produced far more cheaply than by conventional methods.

Issues of clothing will generally be packed, as now, in multi-wall paper sacks, and these, too, will find their way into the South West Postal Regions despatch system – but by trolley loads, collected from the despatch point by motor vehicle. In addition to this mail traffic, there will be a number of issues too big for postal despatch – the quarterly stationery requirements of Telephone Area Offices for example may run into tons of stores. These will travel by road or rail container.

Pallets and fork lift trucks will be the basis of bulk stock handling at Swindon. In the bulk stationery store, however, a recently evolved adaptation of the fork lift truck – the narrow aisle stacker truck – will be introduced. This is very like a fork truck, and lifts pallets of stores on forks. It can, however, rotate its load 90° to right or left of the forward facing position and slide the pallet out sideways on to racking. The truck itself is guided along the gangways between the racks by side-wheels running along metal strips, and the operator, who does not have to steer whilst in the gangways, can lift the load at the press of a button to exactly the height required. Narrow aisle stacker trucks are faster in operation than conventional fork trucks, and save valuable space by working in very narrow gangways.

The loading and unloading of road vehicles will take place in the covered roadways. Loading banks were thought to be too restrictive in relation to future developments on the site. Elevating platforms will be provided to allow pallet trucks to be lifted into vehicles and portable powered conveyors will be used in unloading small packages; and, of course, the ubiquitous fork lift truck will handle palletized loads.

In a depot like Swindon, providing a service to over 20,000 "customers" in the Post Office, a lot of mechanical gadgets are needed to allow smooth and speedy working. However, for all the mechanisation, no depot is better than its people. The satisfaction of its customers, who will be sending Swindon 1¾ million requisitions every year, depends on careful provisioning to see that stock levels are just right; on stock controllers who know just where to find any one of over 22,000 items; on issuers selecting the right quantity of the right item; on skilful drivers of fork lift trucks and other mechanical aids; on maintenance men; on supervisors with an eye for staff well-being and safety as well as determination to get the job done; on lively union representatives. It depends on good lighting, heating and ventilation and so many other things.

Meanwhile the plans go forward; the critical path bends a little but does not break, and Opening Day rushes nearer.

Mr K. R. Foskett is Head of Warehouse Methods Branch in Supplies Division of Purchasing and Supplies Department. He is responsible for the planning of warehouse procedures at Swindon.

A section of a "live" storage area of the type being introduced at Swindon. The issuer slides the carton in front of him along the static rollers to the next filling point. When a carton is filled it is pushed on to the central row of powered rollers which whisk it off for parcelling and dispatch.

The four-wire call sender

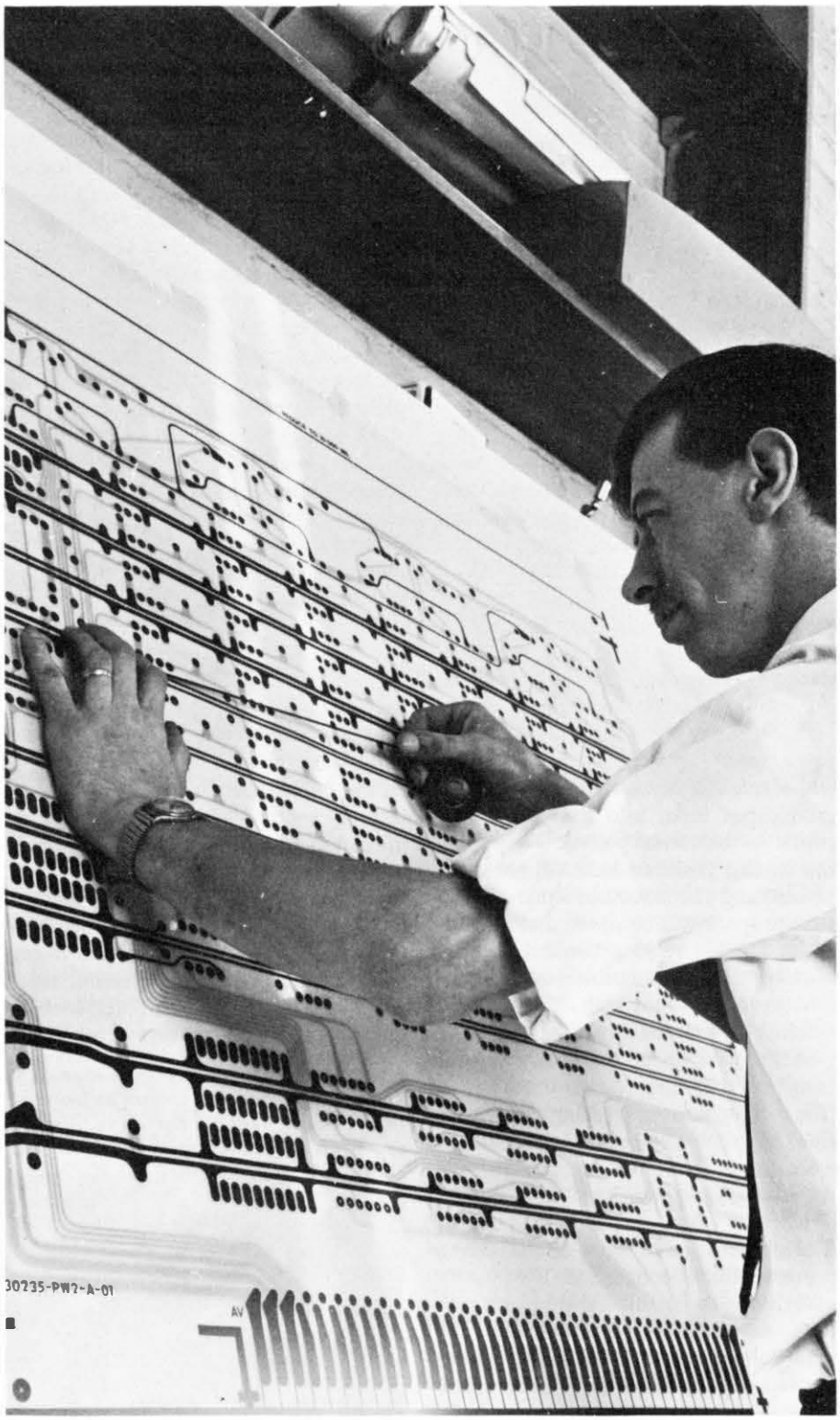
J B Millar

WHEN THE Post Office buys a new telephone exchange it is necessary to ensure before it is brought into use that it will provide the required quality of service. There are established practices through which the Purchasing and Supply Department of the Telecommunications Business ensures that the various items of exchange plant delivered by a contractor are up to specification. It is also the contractor's responsibility to install the equipment in an exchange and to provide the interconnecting wiring, and consequently further checks have to be made on site before final acceptance of the exchange by the Post Office. These include making test calls through the exchange and noting its performance. A disadvantage in involving other parts of the telecommunications network in such calls is that there is a possibility of calls failing because of faults in equipment outside the exchange which is under test. Ideally the exchange should be tested in isolation, using "call-sending" equipment.

The advent of crossbar and electronic exchanges has brought an additional problem. With these types of exchanges it is impossible to predict precisely the items of equipment which will be in circuit for a specific connection through the exchange. To ensure that traffic is spread fairly evenly across the exchange equipment modern test equipment has to be capable of "flooding" the exchange with calls.

For the last five years or so call-senders have been available which can generate more than 3,000 calls an hour and evaluate the performance of the exchange being tested while analysing and recording call failures. Now a need has arisen for the development of a special design of call-sender to be used in the final acceptance testing of the new London Sector Switching Centres (SSCs). It is needed because the SSCs will respond to a variety of signalling systems when calls are being set up, and the call sender has to be capable of generating the whole range of possible signals.

Sector Switching Centres are crossbar



Plastic tape is laid down in the original layout of a printed circuit board which will form part of the call-sender. The finished board, after reduction, measures 12 in by 8 in.

exchanges each comprising an incoming, an outgoing and a tandem unit. The incoming unit receives traffic direct from provincial Group Switching Centres and also traffic from the Trunk Transit Network.* This traffic is switched by the SSC to local exchanges within the Sector. The outgoing unit performs the complementary function of switching trunk traffic originating in the Sector to distant Group Switching Centres. The tandem unit carries some indirectly routed traffic between exchanges within the Director Area. To avoid delaying the installation programme each unit will be acceptance tested as soon as it is completed. Thus the ability to test units in isolation becomes a prime requirement.

Although the transmission paths through the SSC are 2-wire, the circuits to distant trunk exchanges may be either 2-wire or 4-wire. Because some of the signalling systems used require connections to be made to the 4-wire side of the terminal equipment it is necessary that the call-sender should have a 4-wire capability if a comprehensive test of the installation is to be achieved. As a consequence the equipment being developed is now referred to as the 4-wire call-sender.

Existing call-senders are designed to assess the quality of service by checking whether or not a connection has been established through an exchange in accordance with the digits fed in. By connecting special circuits to the test numbers to which the call is directed it is an easy matter to return a signal to the call-sender on successful receipt of the call. However, when a call is routed through a SSC, routing digits will be passed forward to control subsequent switching stages in other exchanges, and a call can be said to be successfully routed through a SSC only if it switches to a free outlet in the correct junction/trunk group and if in addition the routing digits subsequently passed forward are correct.

Because of the diversity of modern signalling systems this latter task is a difficult one and is beyond the capacity of the test number circuitry used in conjunction with the existing call-senders. New circuitry has had to be developed which is capable of examining the routing digits forwarded on a call to check whether or not they are error-free. Sufficient circuits to cater for 128 outlets are housed in a unit known as the Automatic Response Unit (ARU) and this is connected by flexible cords to the switching unit under test.

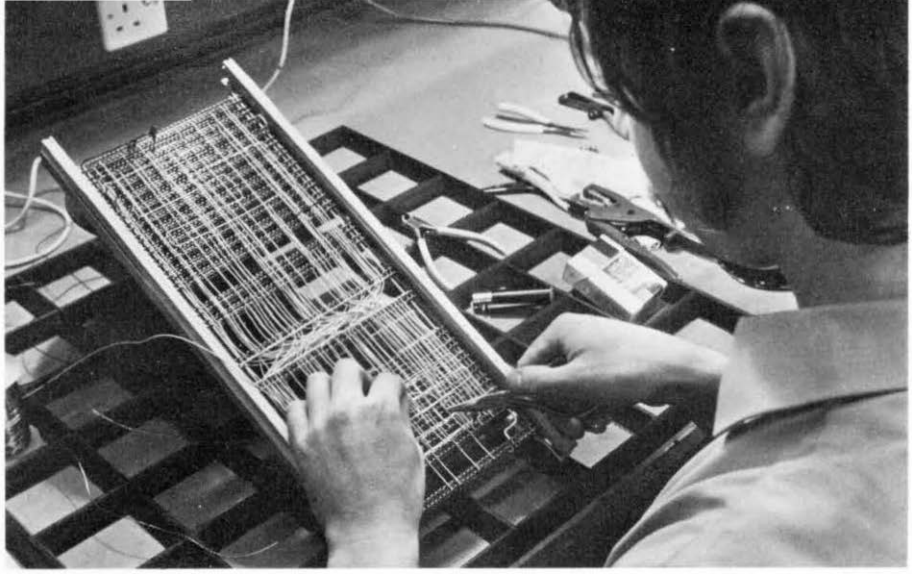
To avoid a proliferation of call-sender and answering-unit types, the equipment will be designed so that it can be used for testing either the incoming, outgoing or tandem units of the SSCs. In addition it will have an application in the final acceptance testing of exchanges in the transit network.

The call-sender and ARU have to be designed as transportable units while the performance of their constituent circuits must be to at least the same standard as the circuits they simulate. Solid-state electronic techniques offer both small size and inherent reliability and have consequently been widely used in the design.

The call-sender will be capable of storing up to 128 test calls of up to 20 digits each. The storage medium consists of two 8192-bit ferrite-core stores and the equipment can be programmed to send each call one, two or three times. Up to 20 calls will be in progress at the same time, entering the exchange at up to 40 inlets and being routed to the ARU from up to 128 outlets.

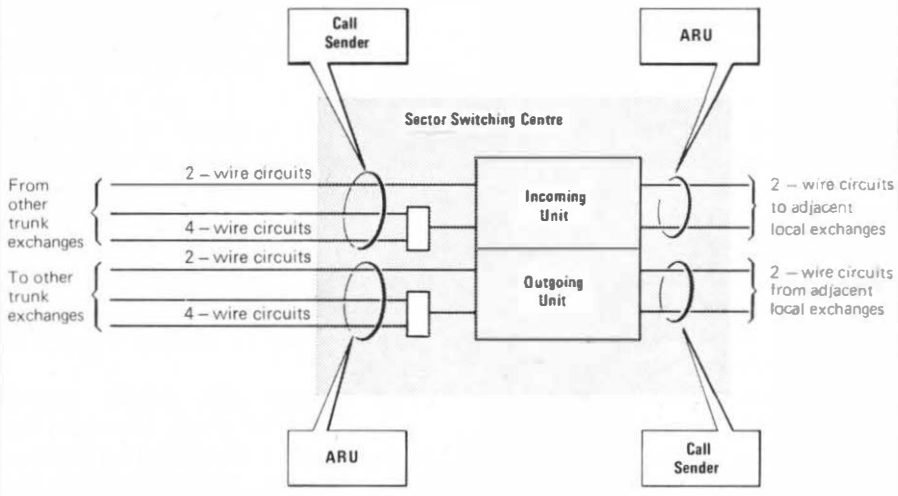
From each of the 40 inlets calls may be directed to all of the 128 outlets. If each call were sent three times a total of 15,360 (40 × 128 × 3) calls would result. It will be possible to programme the call-sender to execute such a test pattern. The complete cycle would occupy some eight hours, though in certain circumstances a test call-sending rate in excess of 3,000 calls per hour will be possible. During the test cycle fault details will be fed to an adjacent teleprinter.

Development of the equipment is now well-advanced and its debut is planned for the latter half of 1973 when the first of the Sector Switching Centres will be nearing completion.



A shelf assembly for plug-in printed circuit boards is wired at Cescom Electronics Ltd, London, which has been involved in the development of the call sender.

Mr J. B. Millar is head of a section in Telecommunications Development Department concerned with switching systems and associated equipment.



The diagram shows how call sender equipment is connected to Sector Switching Centre units.

* *Sector Switching Centres were described in the Spring 1971 Journal, and there is an article on the transit network in this issue.*

WARMER WINTER AT SEA

Above: Seaspray turns to ice as the cableship *Alert* meets 42 degrees of frost during a winter cable protection patrol off Newfoundland. The ice must be cleared to prevent the ship becoming top-heavy and capsizing.

Right: The heated waistcoat, with its battery.

CREWS OF the Post Office's three cableships have been supplied with electrically heated waistcoats to keep them warm while working at sea this winter. They are among the first British seamen to be issued with the new clothing.

Cableship crews experience some of the world's worst weather while maintaining their winter vigil over undersea telephone cable links. Sometimes they have to work in conditions so cold that a man standing still for more than a few minutes can be frozen to the deck by his boots.

The new waistcoat, a British invention, has a conductive material on the inner lining which is heated by lightweight rechargeable batteries to a maximum 112 degrees F, providing a comfortable body temperature. Even if they become soaking wet they will not harm the wearer. Worn under heavy outer clothing the waistcoats will enable crews to work comfortably in even the coldest conditions.

The batteries will provide warmth continuously for about two-and-a-half hours without recharging, or up to five-and-a-half hours with intermittent use.

The largest of the Post Office's cableships, CS *Alert* with a crew of 111, has been on a winter cable-protection patrol of the Grand Banks fishing grounds off Newfoundland.

Several transatlantic telephone cables cross the shallow waters of the Grand Banks and are particularly vulnerable to damage by fishing trawlers. The *Alert* shares with American and French cableships the year-round task of patrolling these cable routes to keep the trawlers off – and carrying out repairs in the event of cable damage.

The Post Office's other ships, CS *Ariel* and *Iris*, each with a crew of 63, are responsible for cable maintenance around the shores of Britain, across the North Sea and into Arctic waters.

THE MACHINERY OF INVESTMENT PLANNING

J D Cartwright

IN THE FIRST part of this article (published in the Autumn 1972 issue) it was suggested that telecommunications capital investment is characterised by:

its sheer size, amounting to more than £500 million spent in 1971/2;

the vast number of schemes involved;

the long lead time associated with many items because of the need to plan developments long before they are required;

the complex interrelationship between schemes in the overall telecommunications network.

For the reasons given above, the capital programme has to be considered and processed as an entity. This is done at Telecommunications Headquarters by means of the Investment Plan and Four-monthly Business Planning and Financial Reviews.

The Investment Plan is prepared annually; it represents a rolling programme covering the current and five subsequent years, and is in all important respects consistent with the current approved 10-year Business Plan. The Investment Plan has two main aims. Firstly, it is a statement of the Business's capital investment plans, together with proposals as to how these will be financed, which is submitted to the Government early in each calendar year. In this respect it serves as a kind of "prospectus" for our "bankers." Secondly, it also represents, within the Post Office, the Business's overall plans for the short and medium term. There are four principal stages in its preparation:

In Stage 1 a Guidance Letter is issued to Regions and THQ Departments. This sets out the growth and other assumptions on which preparation of capital expenditure forecasts for the Investment Plan are to be based.

In Stage 2 forecasts of capital expenditure are submitted to THQ/Business Planning Division (BPD) and are considered by BPD and operational THQ Departments and then by the Business Planning Committee (BPC), which submits definitive expenditure and related financing proposals to the Managing Director's Committee (MDCT). The financing proposals show how the money needed for capital investments will be raised and, in particular, how much will need to be borrowed from government or other sources; in recent years, roughly 50 per cent of requirements has been borrowed.

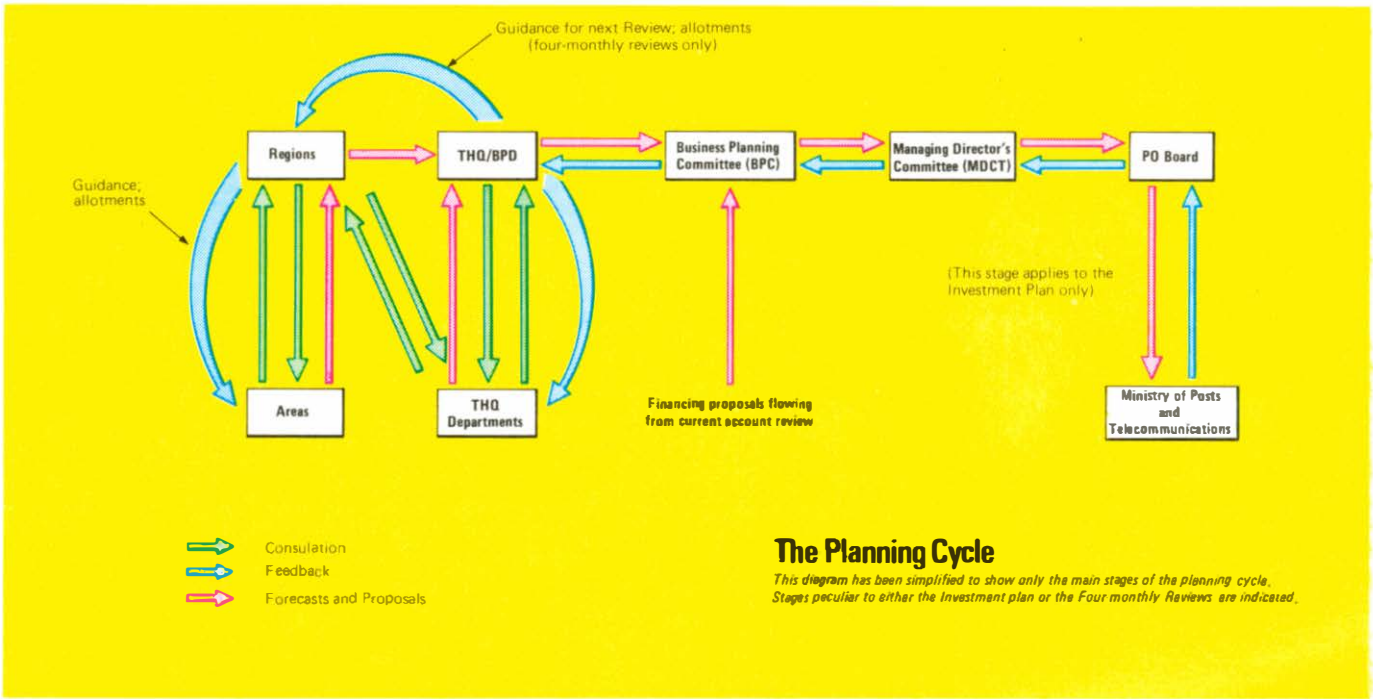
In Stage 3 the Business's proposals as approved by MDCT are submitted to the Post Office Board for approval.

Finally, the approved proposals are sent by the Board to the Ministry of Posts and Telecommunications with other parts of the government machine. Approval of the proposals, with or without modification, is notified to the Board by the Ministry in due course.

The above process normally takes rather more than a year overall, starting in the summer of each year.

Four-monthly Business Planning and

● *Continued on page 31*



The Planning Cycle

This diagram has been simplified to show only the main stages of the planning cycle. Stages peculiar to either the Investment plan or the Four monthly Reviews are indicated.

COMPLETE DIGITAL SYSTEM CAPABILITY

- BULK DATA STORAGE
- COMMUNICATIONS
- SWITCHING SYSTEMS
- CONTROL COMPUTATION
- SYSTEMS MANAGEMENT

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SPERRY GYROSCOPE DIVISION
BRACKNELL BERKSHIRE ENGLAND

● *Continued from page 29*

Financial Reviews, by contrast, cover only the short term (normally the current and two subsequent financial years) and are internal to the Post Office. They are called the March, July and November Reviews and, *inter alia*, monitor the capital programme against the programme approved by the Post Office Board in the Investment Plan and authorise capital expenditure allotments for those parts of the programme under direct Regional or local control.

The main stages in the process are the same as for the Investment Plan. Guidelines are produced by THQ on which Regions and THQ Departments base forecasts which are then considered in turn by the Business Planning Committee, MDCT and the Board. When the proposals have been approved, capital expenditure allotments are issued to Regions.

All the Reviews follow the same pattern, but at the same time as the July Review a *stewardship review* of the previous year's outturn is also carried out in which the Business considers how well it has performed in the light of previous forecasts, especially the approved March Review of the previous year, which represents the capital budget for the year under review. This appraisal of performance represents a vital management tool because it emphasises the accountability of the various parts of the Business for the investment for which they are responsible and assists in the learning process.

The Investment Plan and Four-monthly Reviews are sometimes confused with one another, possibly because capital forecasts for the Investment Plan and one of the Four-monthly Reviews (the November Review) are submitted to THQ/BPD at virtually the same time. The distinguishing points to bear in mind are that:

The Investment Plan is medium term (current year + five); is produced for the benefit of Government as well as the Post Office; serves also as the Five Year Plan for the Business; represents approved expenditure levels in bulk or programme terms.

The Four-monthly Reviews are short term; monitor achievement and revised forecasts against the Investment Review as approved by the Board; also specifically authorise and monitor capital expenditure which is under direct Regional control.

The main stages of the two types of Review are illustrated. It will be noticed that both have one important feature in common, namely that they are built upwards from the bottom of the organisational pyramid, thus ensuring that the resultant capital programmes are broadly consistent with the proposals of Areas and Regions and so enjoy their commitment.

Finally, it may be helpful to include a word of explanation about the Business Planning Committee (BPC) to which reference has already been made. This Committee was created early in 1972 to take over the capital programming responsibilities of the former Standing Telecommunications Advisory Committee (STAC) and also to exercise a wider Business Planning role. It is chaired by the Senior Director, Planning and Purchasing (SDPP) and comprises Heads of THQ Departments and Divisions with important financial, planning or service responsibilities.

Its chief functions are:

1. *to prepare Business Plans, Investment Plans and Four-monthly Planning Reviews for MDCT;*

2. *to ensure that the Business takes an integrated view of prospects and prepares proposals for action accordingly;*

3. *generally, to advise MDCT on all matters concerning Business Planning.*

BPC is supported by an independent Business Planning Division under the Head of Business Planning (HBP) who reports to SDPP. There is no formal subordinate Committee structure, but two informal bodies play a useful supporting role. The first is the Business Planning Liaison Group (BPLG), whose permanent members are the Head of Business Planning and the Heads of key Divisions in TFD and TMSD; secondly, there is a capital working party comprising representatives of BPD and other THQ Divisions which considers Regional expenditure forecasts in detail and makes recommendations to HBP, who then presents the proposed capital investment programme to the Business Planning Committee. The significance of BPC is that, having wider terms of reference than the old STAC, it is able to approach Business Planning from a corporate viewpoint. The Telecommunications capital investment programme is too important to be considered in isolation. In particular it needs to be related to the Business's longer term financing capability and to changes in the national economic environment.

Because BPC represents virtually all major financial, planning and operational interests it can provide a flexible tool for forming Business strategy and tactics during the next decade. Its role will no doubt develop in the light of experience.

MISCELLANY

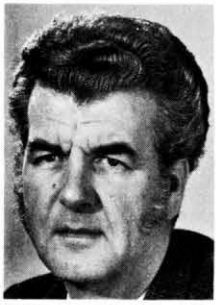
ISD expands

Cardiff became the seventh major population centre in Britain to have International Subscriber Dialling facilities when 78,000 phones in the area were linked to the ISD network in November.

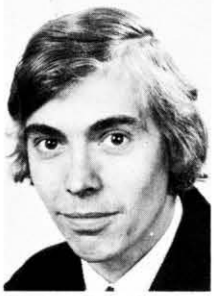
It was the start of a major programme to enable more of the country's telephone users to dial their own international calls. ISD will be extended to 20 centres by the late summer of this year and to a further 30 by 1975.

When the programme is complete ISD will be available from about 5,000,000telephones, compared with about 3,000,000 phones in the original six centres – London, Birmingham, Edinburgh, Glasgow, Liverpool and Manchester.

Research honours



Fred Berry



Terence Evans

John Yeomans

Ron Beaumont

A scientific paper written by Mr Timothy S. Bowles, an experimental psychologist, has won the 1972 Scientific Premium of the Gordon Radley Fund (Christopher Columbus Award). The Fund's awards are made annually to staff of the Post Office Research Department.

Mr Bowles's paper on "The effects of graphical aids on the identification of foreign signal tones" was written when he worked in the Human Factors Branch. It deals with International Subscriber Dialling and the problem of identifying the signal tones of foreign countries – dialling tone, engaged tone, and so on. Mr Bowles devised two types of graphical aid to represent the tones as pictures on a graph.

The Fund's Craftsmanship Premium for 1972 was shared by:

Mr John Yeomans and Mr Fred Berry for their work on a new precision instrument at Dollis Hill for measuring

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electric losses in insulating materials (dielectrics) when subjected to radio waves of microwave frequencies;

Mr Robert Cornwall for intricate machining of a small component made in the alloy Invar;

Mr Terence Evans for designing and making a jig that enables the end wall of a 12 in diameter gas-filled metal cylinder to be drilled, and the gas filling sampled, without gas loss;

Mr Ronald Beaumont for a cut-away section of a screened helical delay line, produced for exhibition display.

In orbit

The latest of the communications satellites, Intelsat IV flight 5 positioned over the Indian Ocean in the summer, is now being used extensively by the Post Office for telephone communications with countries stretching from Kenya to New Zealand. Among the latest countries to get satellite service with the UK is Pakistan through earth stations at Goonhilly, Cornwall, and Karachi. Previously telephone calls between the two countries went by overland link and two high-frequency radio circuits.

Dial Up

A new service for sending computer data over the public telephone network has been introduced by the Post Office. Known as Datel 2400 Dial Up it enables computer users to send data in binary form at 2,400 binary digits per second (bit/s), a faster speed than ever before over the telephone network.

The new service also allows customers to use many different types of data terminal equipment which previously were restricted to use over special private circuits, or at lower operating speeds on the telephone network.

Datel 2400 Dial Up will use a modified version of the Post Office Datel 2400 modem that has already been well proved in service over private circuits. It provides synchronous transmission of serial binary data at 2,400 bit/s in one direction at a time but can also be switched to operate at half or quarter speed where difficulties are experienced at the higher rate.

Milton Keynes

In an article (City of tomorrow) in the Autumn 1972 issue a Post Office engineer was pictured installing electronic equipment which provides broadcast and telephone services to homes in the new city of Milton Keynes. It should have been made clear that the "box-in-the-wall" equipment shown serves a group of about 15 houses.

For oil rigs

Greatly improved ship-to-shore communications are to be provided for exploration platforms and oil drilling rigs operating off the northern and eastern coasts of Scotland.

Extra radiotelephone and teleprinter links will be provided exclusively for the rigs and the vessels servicing them by the Post Office coast radio stations at Stonehaven and Wick. These stations cover the waters from the Firth of Forth round to Cape Wrath on the north-west tip of Scotland. A new communications station will also be provided at Norwick, on the island of Unst in the Shetlands, which will be remotely controlled from Wick radio station 200 miles away on the mainland.

The £160,000 project will also include more radiotelephone facilities on the medium and VHF wavebands for other shipping, especially trawlers, operating off the Scottish coast.

Under the improvement scheme Stonehaven radio station will get 15 teleprinter links of its own.

Navigation aid

The 8,962 tons cableship Mercury is being fitted to Post Office specifications with one of the most accurate navigation systems commercially available.

The Mercury, which belongs to Cable and Wireless Ltd, is to lay the major part of the Cantat 2 undersea telephone cable which will link Britain and Canada next year.

The navigation system, called Hydroplot, was developed for the Royal Navy and uses signals from satellites to pinpoint a ship's position to within 300 feet. It also employs a computer which displays the vital information required by the navigator on a visual display unit.

The system will integrate all Mercury's other navigational aids and some cable-laying information to plot the route of Cantat 2 with great accuracy. Accurate plotting of the cable route is a vital aid to repair operations.

Later the entire navigation system will be transferred to the Post Office cableship Alert which is responsible for maintaining transatlantic cables.

Contracts

Plessey Telecommunications – £1 million for processor controlled equipment to handle billing information for automatic intercontinental telex exchanges. Two automatic ticketing systems controlled by System 250 processors will be installed, one at St Botolph's, the other at Fleet telex exchanges, replacing the existing systems which have paper tape output. The ticketing systems will collect, validate and match the heads and tails of each outgoing call set up by the telex exchange and, after code conversion, output billing details on magnetic tape for later processing at a Post Office data processing centre.

£1 million contract for the supply and installation of frequency division multiplex (FDM), 4 MHz and 12 MHz coaxial line systems.

Standard Telephones and Cables Limited – £50,000 for pilot monitoring equipment. The order is for GTA-14E equipment, specially developed for the Post Office, to be used during the maintenance and installation of coaxial telephone systems.

New Boards

Two new Telecommunications Boards have been set up in Scotland and Northern Ireland. The Board in Northern Ireland will also be responsible for the postal services.

Regional boards are intended to provide a more flexible system of day-to-day management, permitting managers to take into account local circumstances and requirements, while working within national guidelines.

Chairman of the Scottish Telecommunications Board is Mr H. J. Revell, previously Director of Telecommunications, Scotland. The Board will have eight members, including four from outside the Post Office. Outside members appointed so far are:

Mr R. G. Duthie, CA, chairman, Black and Edgington, Greenock; Mr D. G. MacDonald, managing director, John Menzies (Holdings) Ltd, Edinburgh; and Mr Maitland Mackie, convener, Aberdeen County Council.

Chairman of the Northern Ireland Postal and Telecommunications Board is Mr P. J. Manson, previously the Director, Northern Ireland. There are seven members, including three from outside the Post Office:

Mr H. F. Andrews, chairman and general manager of the Northern Ireland board of Gallahers Ltd; Mr J. A. Kennedy, chairman and director of J. B. Kennedy Ltd; and Mr D. H. Templeton, senior partner, Price Waterhouse & Co.

Prizewinners

Prizewinners in the Institution of Post Office Electrical Engineers Associate Section Paper Awards 1971–72 are: G. W. E. Gay, Salisbury Centre, £15; D. McL. Duncan, Aberdeen Centre, £5; R. G. Genge, Southampton Centre, £2. The winners also receive Institution Certificates.

Auto-telex

With the opening of an automatic telex link with Rumania 40,000 telex users in Britain can now dial their own calls to almost anywhere in Europe. Only two countries, Gibralter and Malta, where the inland services are still manually operated, cannot yet accept automatic telex calls.

Other telex services which have recently switched to automatic working are those to the Pacific islands of Hawaii, Guam and Saipan.

AMP

The telephone number of AMP of Great Britain Ltd is 01-954 2356. An incorrect number appeared in an advertisement in the Autumn issue.

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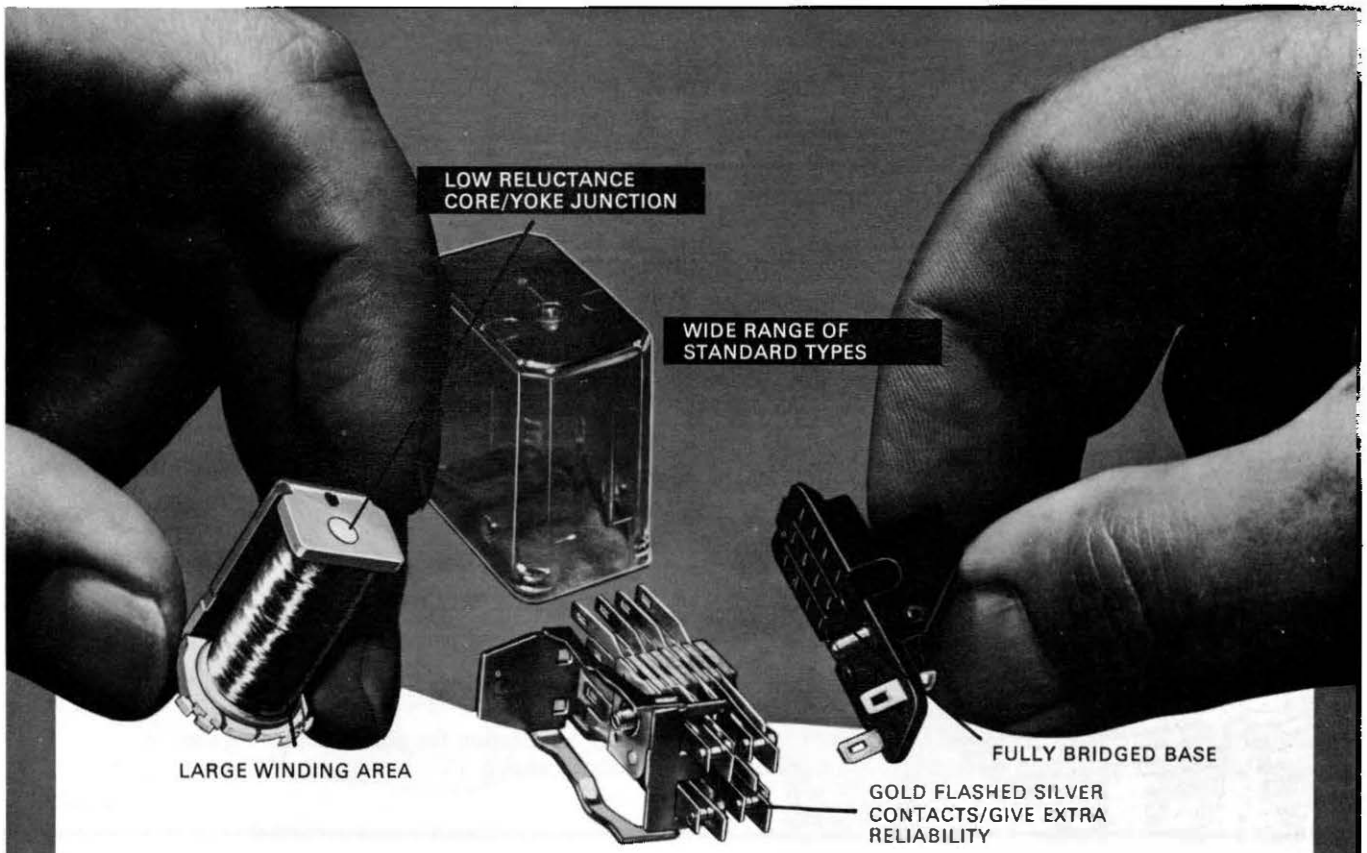

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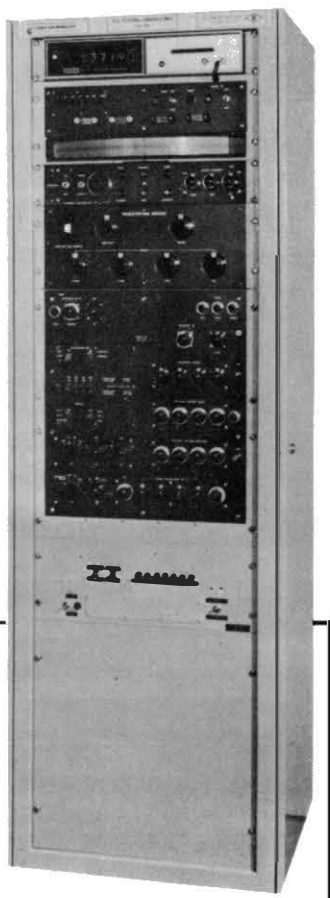

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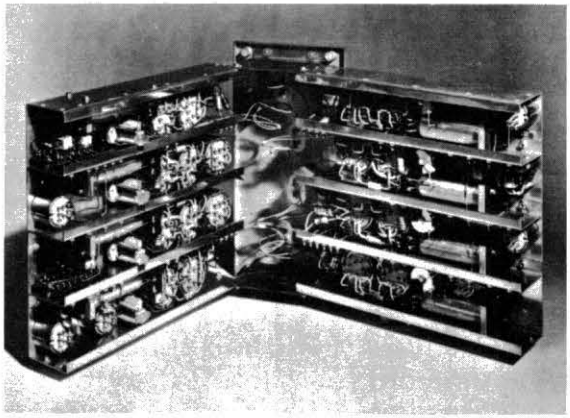

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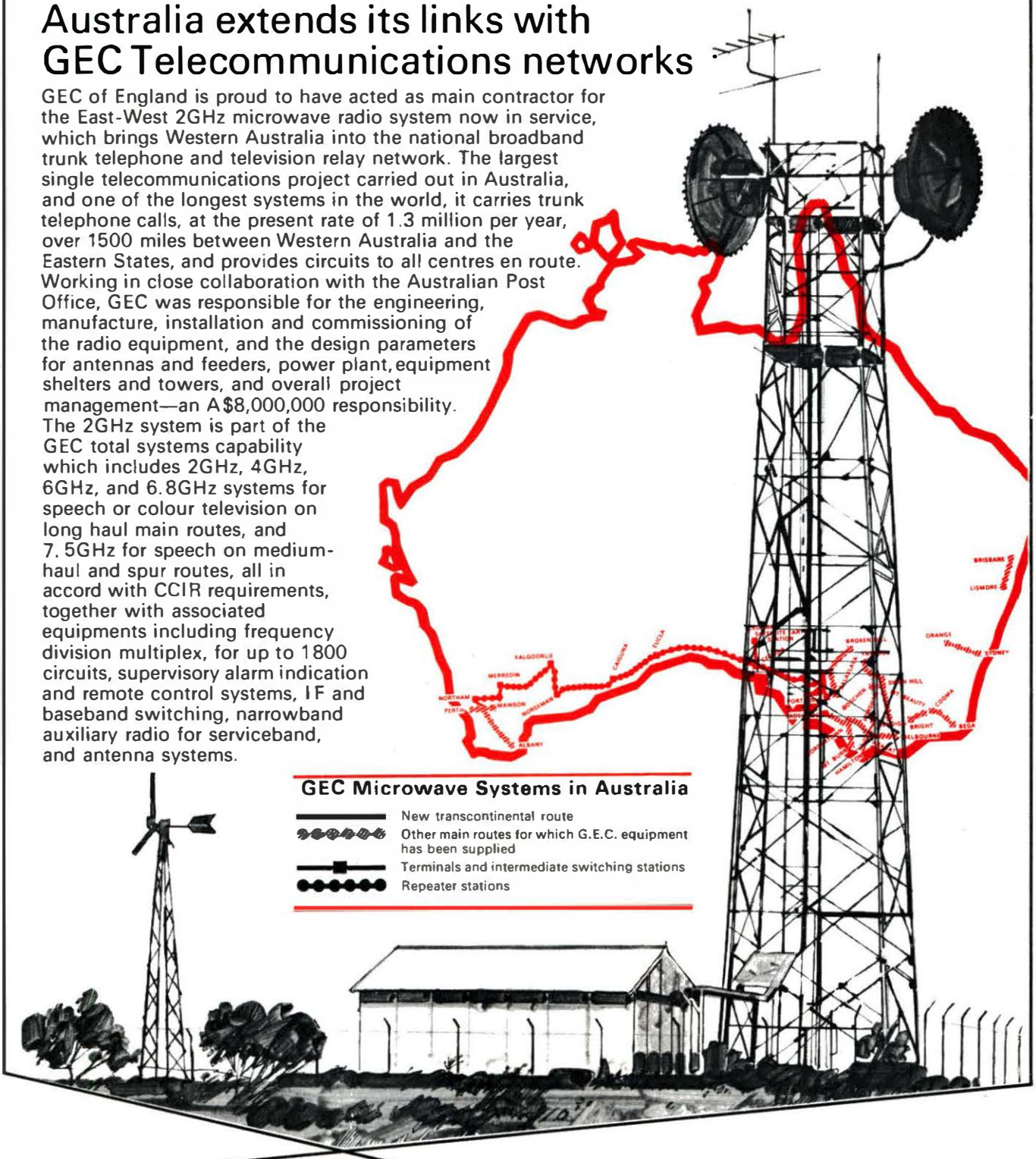

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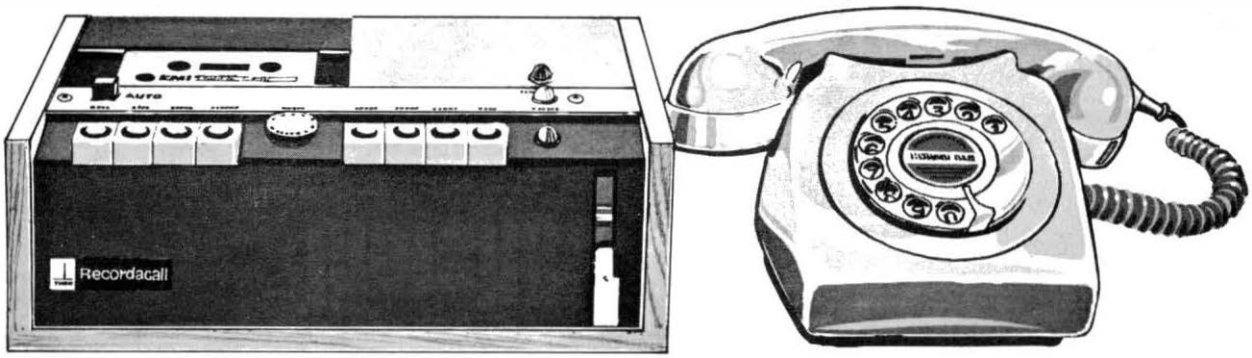

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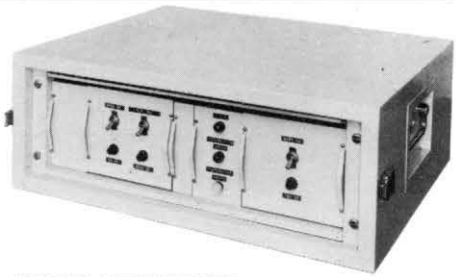

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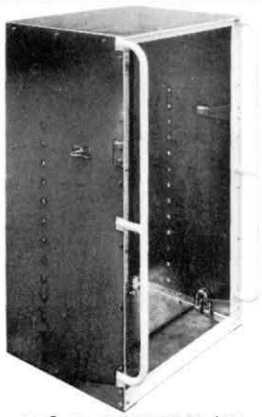

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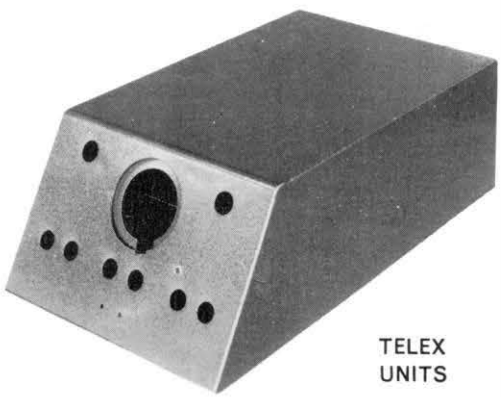

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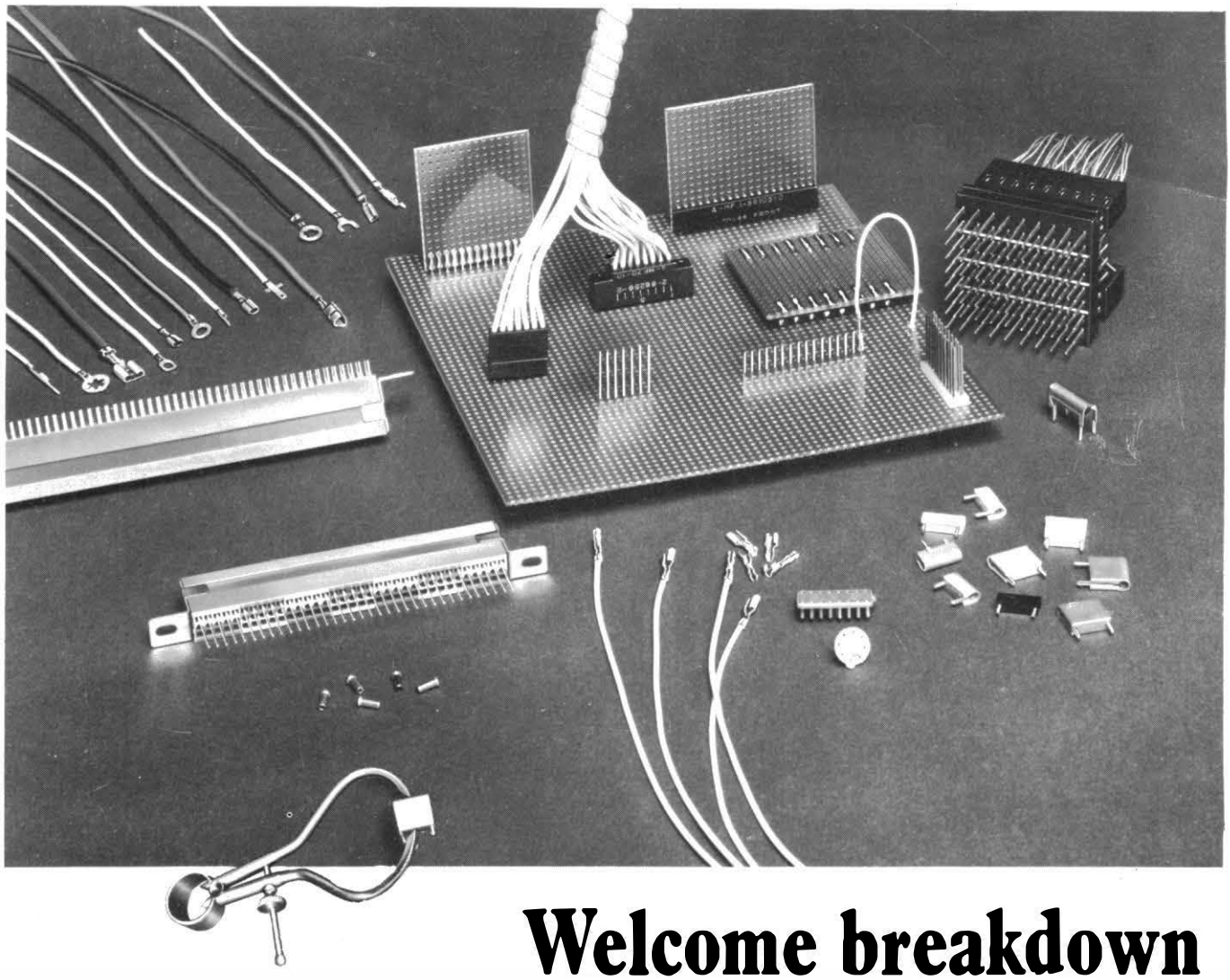

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