Post Office telecommunications journal

Summer 1976 Vol. 28 No. 2 Price 18p

MINI-COMPUTER SYSTEMS AND PERIPHERALS

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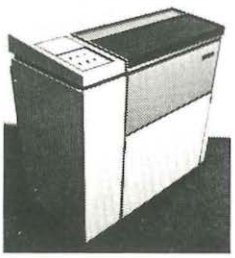

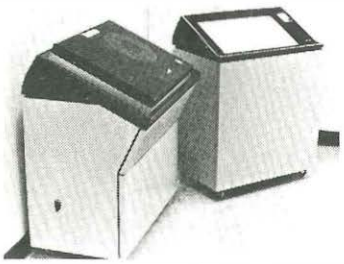

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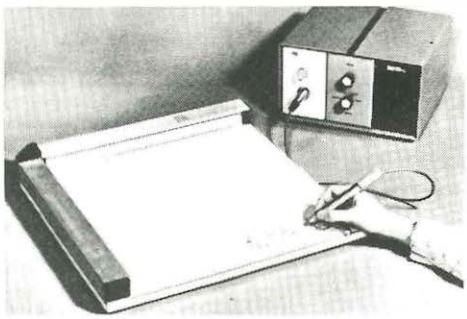

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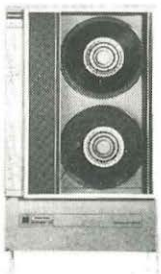

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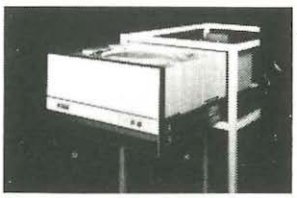

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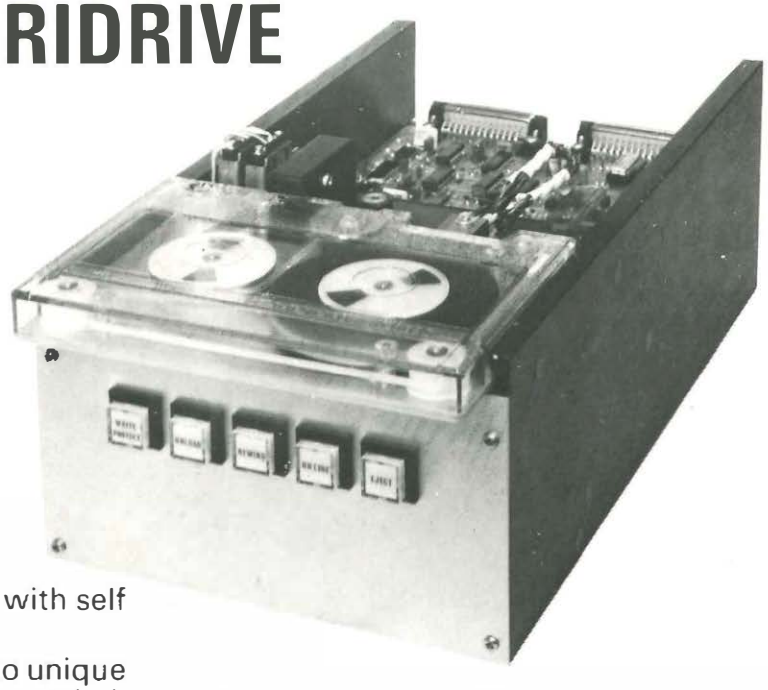

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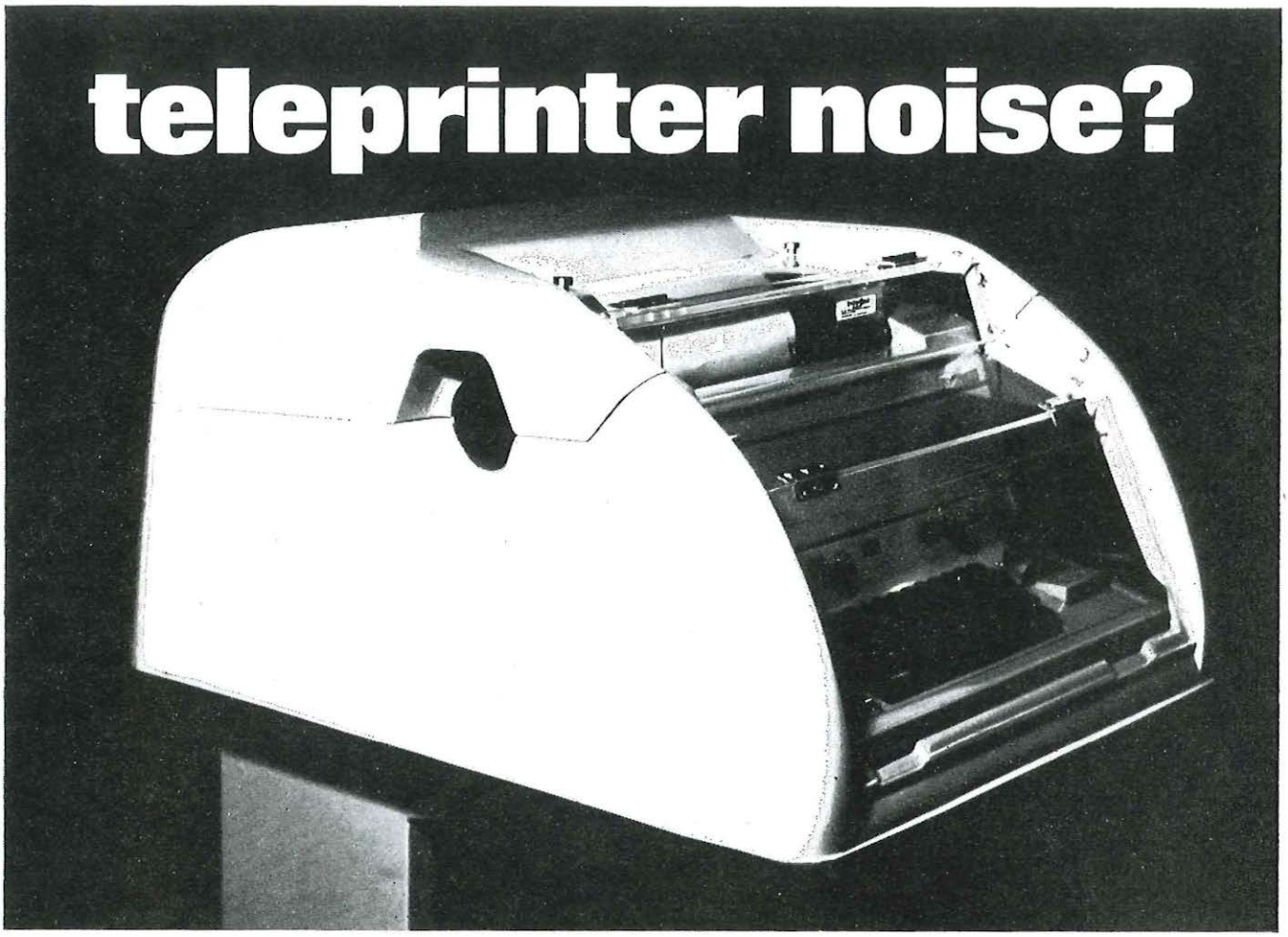

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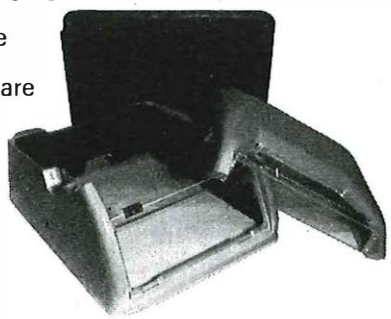

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POTJ/3/76

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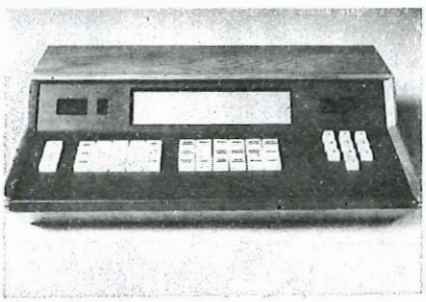

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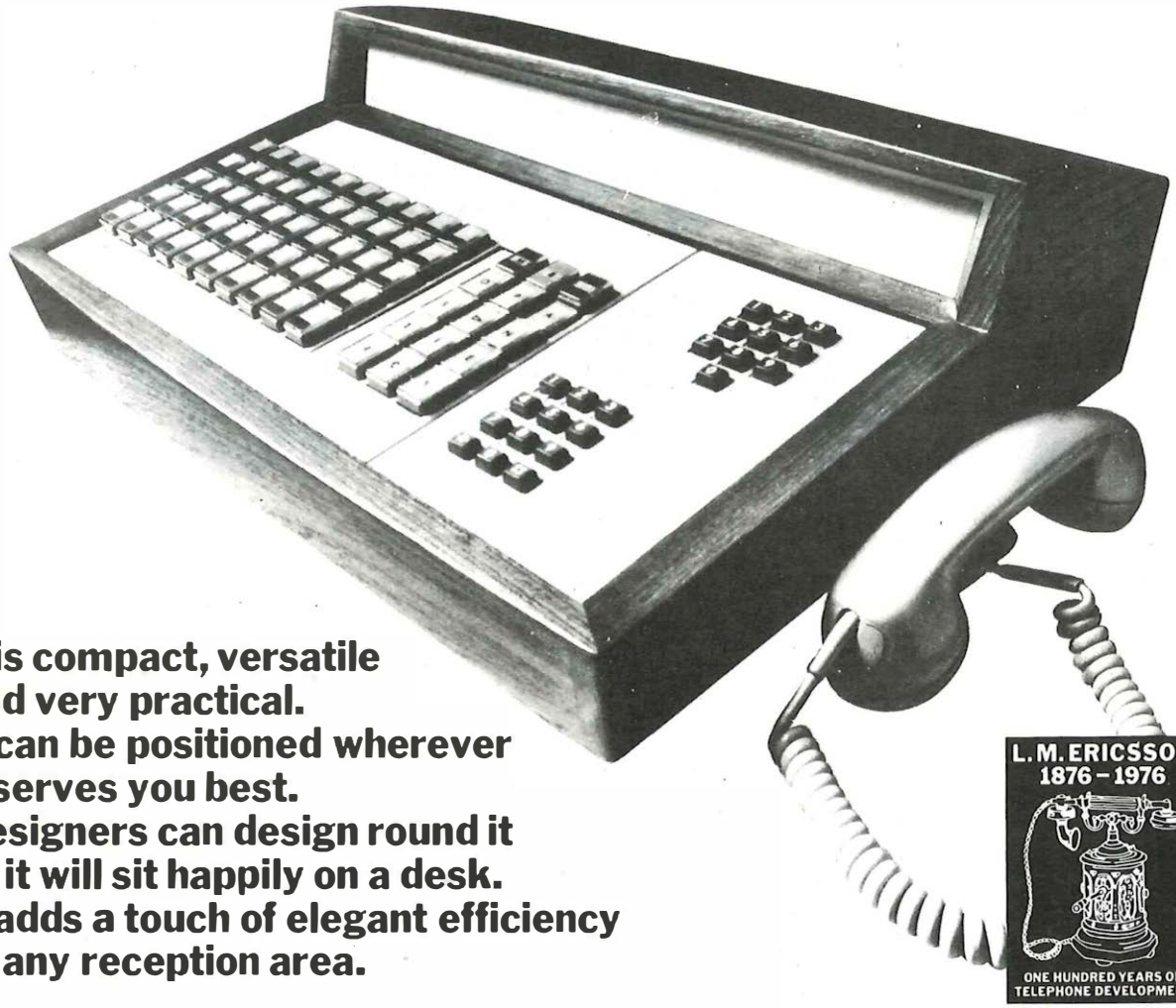

It is compact, versatile and very practical.
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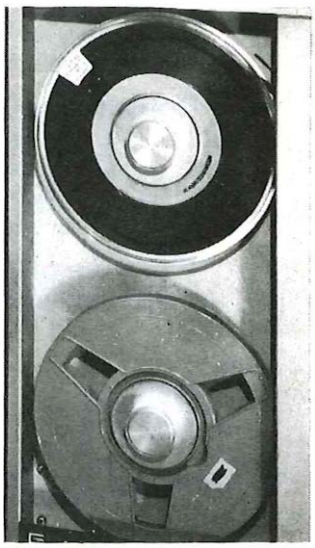

Both LAMA and CAMA toll ticketing systems can be installed as part of a No. 1 EAX system. The LAMA unit will handle up to 45,000 lines and store up to 1,000 completed calls on just nine feet of tape.

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And, LAMA records trunk number, called number, calling number, start and completion time, date, rate, and class of call for automatic billing systems.

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You can add lines just by adding modules to the existing system.

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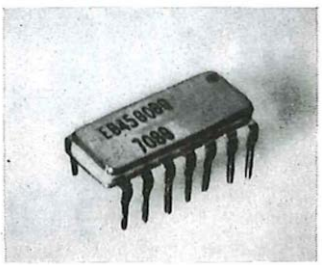
No. 1 EAX is only part of GTE's family of electronic telephone equipment. A family that is designed to meet the needs of every size exchange.



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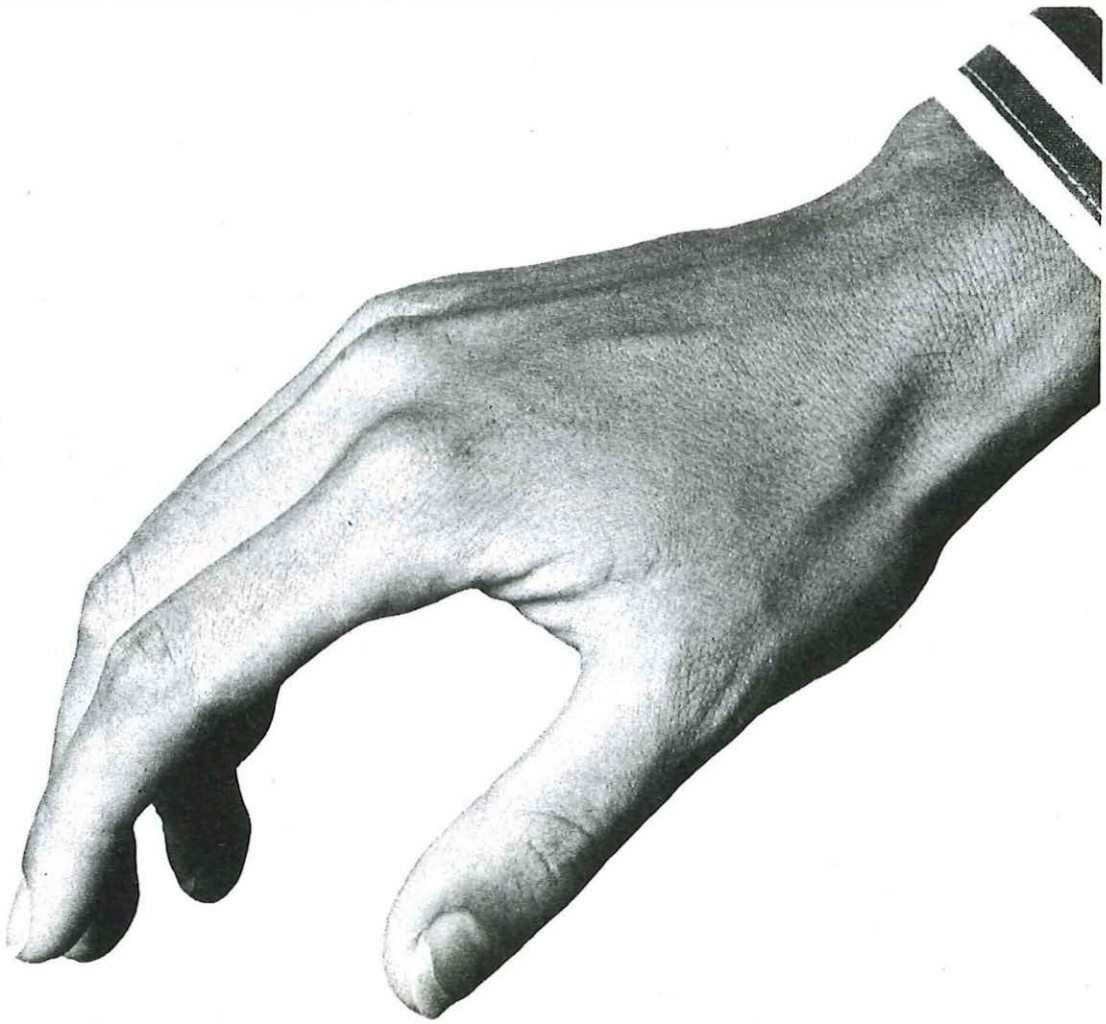

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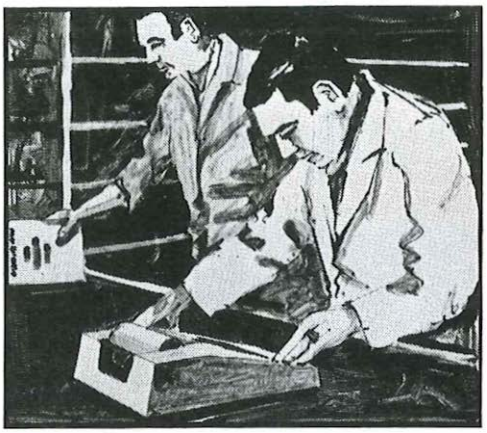

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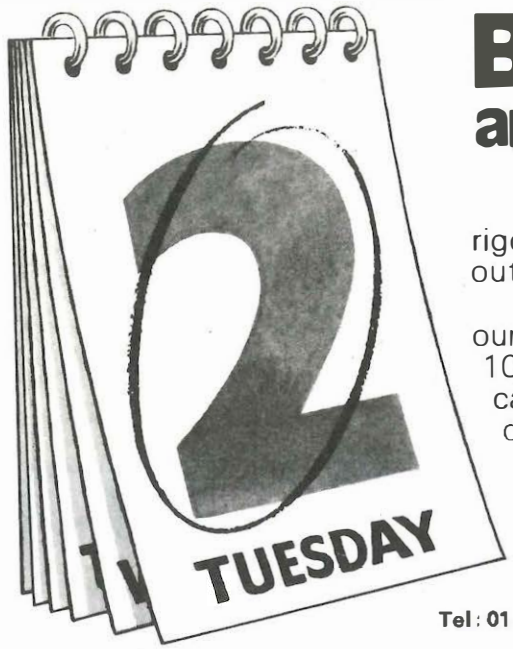

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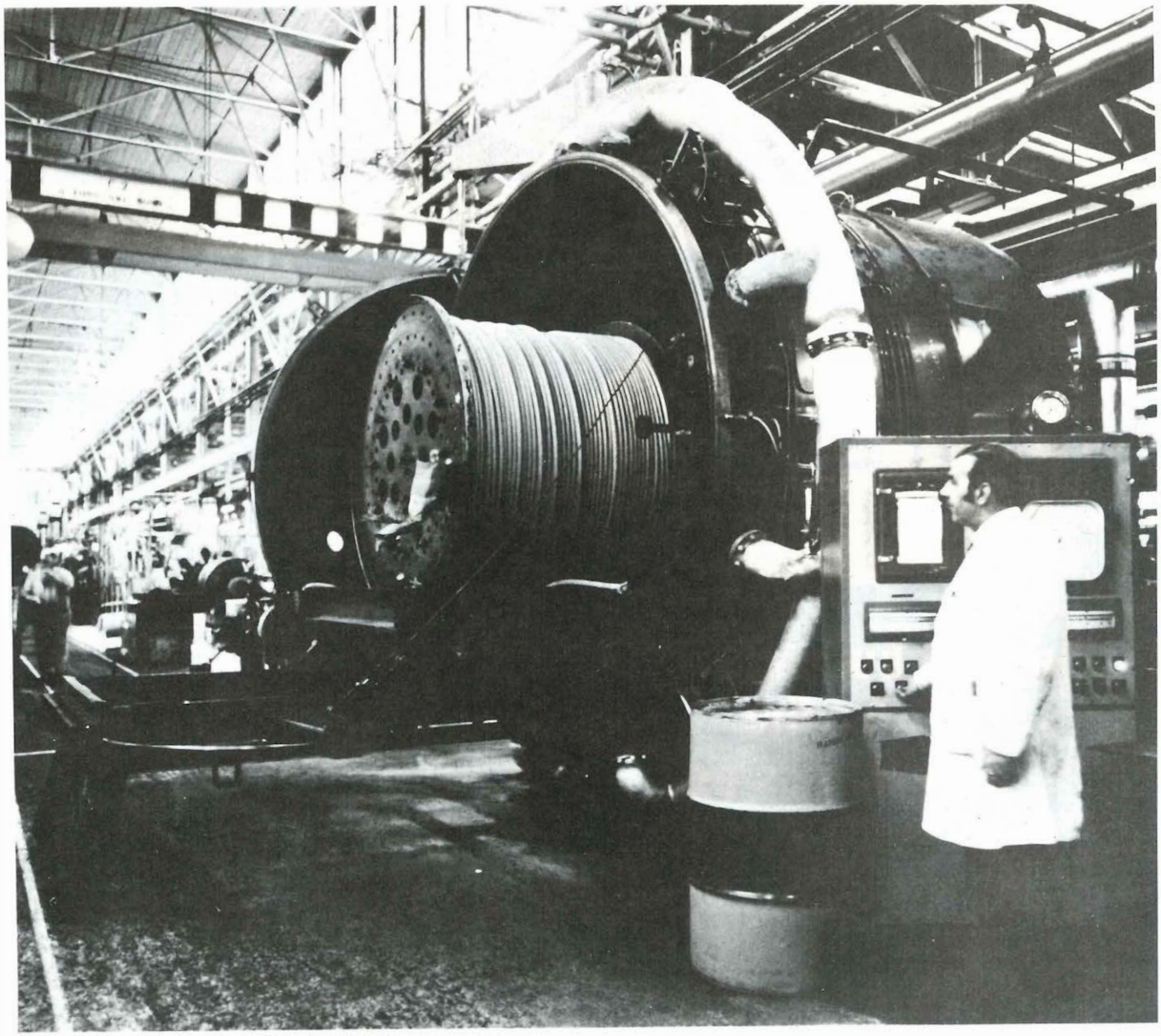


A TOTAL APPROACH- THE CHAIRMAN'S VIEW

UNLIKE some other successful telecommunications administrations, Britain does not have a continuous process from invention, through manufacture and supply to customer service. Yet knowledge of production is important to the Post Office in its decision taking, and knowledge of the operating side is fundamental to the manufacturing industry for considered and responsible approaches to problems, and especially to meaningful exporting.

How, then, might Britain's telecommunications service and the manufacturing industry work more closely together in the future? Sir William Ryland, Chairman of the Post Office, recently gave a personal viewpoint in which he emphasised the need for a common, total approach. Presenting the annual STC lecture in London, he said that the whole sequence from innovation through to customer service needed to be a unitary operation, with arrangements to speed up innovation, to give economies of scale and keen and fair prices.

Referring to the potentially enormous changes in technology that now lay ahead, Sir William said the cost of exploiting them would be immense. But the benefits – in providing more and better customer service at acceptable cost and price – could be commensurate, provided the two sides of the service prepared and organised themselves for the purpose.

After making clear that he was aiming only to suggest and persuade that changes would be needed sooner or later, the Chairman did float one idea. "In these days when our own mixed economy is being diversified by combinations of organisations from the public and private sectors, why shouldn't we consider together voluntarily a mini-mixed economy of our own?

"For example, is it out of the question for the principal manufacturers to separate out their telecommunications entities from the rest of their organisations and, while retaining their interest in them, designate them to enter into a full and free partnership with Post Office telecommunications and with other telecommunications entities?" Such a partnership would be one of the public and private sectors, giving joint direction and joint endeavour to the achievement of joint objectives, sharing success and rewards.

Post Office telecommunications journal

Summer 1976 Vol. 28 No. 2

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

Cover: The Post Office needs 120,000 new wooden telegraph poles every year. Untreated poles are assembled here at a timber yard, ready to be wheeled into creosoting plant. (See page 16.)

Scientific 'hot line' for Europe

PTF Kelly and EJB Lee

A EUROPEAN computer network is being established that will enable data terminals in any of the Common Market countries to gain fast access to scientific and technical information held on computer files at specific locations. The network is sponsored by the European Economic Community and will be set up jointly by the British Post Office and the Postal, Telegraph and Telephone Administrations of the other eight member countries.

Known as EURONET, the network is due to become operational within about two years and will be serving some 700 data terminals at research centres, public bodies and other organisations by the end of the decade. The most important advantages of this network are that it will enable communication to be achieved from any terminal to any one of several previously incompatible documentation systems and, at the same time, reduce duplication of database files in the participating countries.

Although EURONET will be a private network, it could eventually form the basis of a European public data transmission network. Access to the databases by terminals located in non-EEC countries is also envisaged, as well as access by terminals in EEC countries to databases located in non-EEC countries.

Initially the network will be based on four switching centres (NSCs) – in London, Frankfurt, Paris and Rome – with two "host" computer centres in Cologne and Frascati (Southern Italy) providing the database files. By the end of the decade there will be a number of "host" computer centres holding information on such subjects as physics, chemistry, aerospace, energy, nucleonics, metallurgy, medicine, agriculture, economics, statistics and law.

The network will use packet switching techniques by which data is transmitted in discrete "packets" of information, each containing the address to which it is destined. Data terminal access to the network will be either by direct links or via public switched telephone, telex or data network connections to small switching computers, called concentrators. This equipment enables terminals operating in different modes to gain access to an NSC, and vice versa, by the high-speed packet interleaved link that connects a concentrator with an NSC.

Concentrators will be co-located with NSCs to serve terminals in the United Kingdom, the Federal Republic of Germany, France and Italy. Terminals in the Netherlands, Belgium, Denmark and the Irish Republic will gain access to the NSCs through remote concentrators located in Amsterdam, Brussels, Copenhagen and Dublin, respectively. Later a concentrator will also be provided in Luxembourg, the data centre of the EEC Commission.

The EURONET concept was originally published by the Commission in 1971, and in September 1974 its Committee for Information and Documentation on Science and Technology proposed a three-year plan of action to establish the network. Shortly afterwards the Committee's Technical Aspects Group reported on the possible use of existing and planned networks to meet EURONET requirements and prepared a study specification to determine the operational requirements for the computer network.

A contract for the study was subsequently placed with a firm of consultants in the Netherlands who reported in June 1975. However, the EEC considered that the co-operation of the various PTTs was essential in the implementation of the telecommunications elements of EURONET, and formal approaches to them were made in January 1975. The EEC stressed that the network should be implemented as early as possible, the urgency being to discourage several independent information retrieval data networks becoming established in Europe. Avoiding the inefficiencies of a multiplicity of such developments was one of the EEC's prime objectives of the project.

The consultants' report to the EEC proposed that a packet switched network be established to enable, initially, some 100 terminals to gain access to the medical databases at Cologne and those of the space documentation system at Frascati. These terminal and database objectives were adopted by the Commission of the EEC as its initial requirements for EURONET.

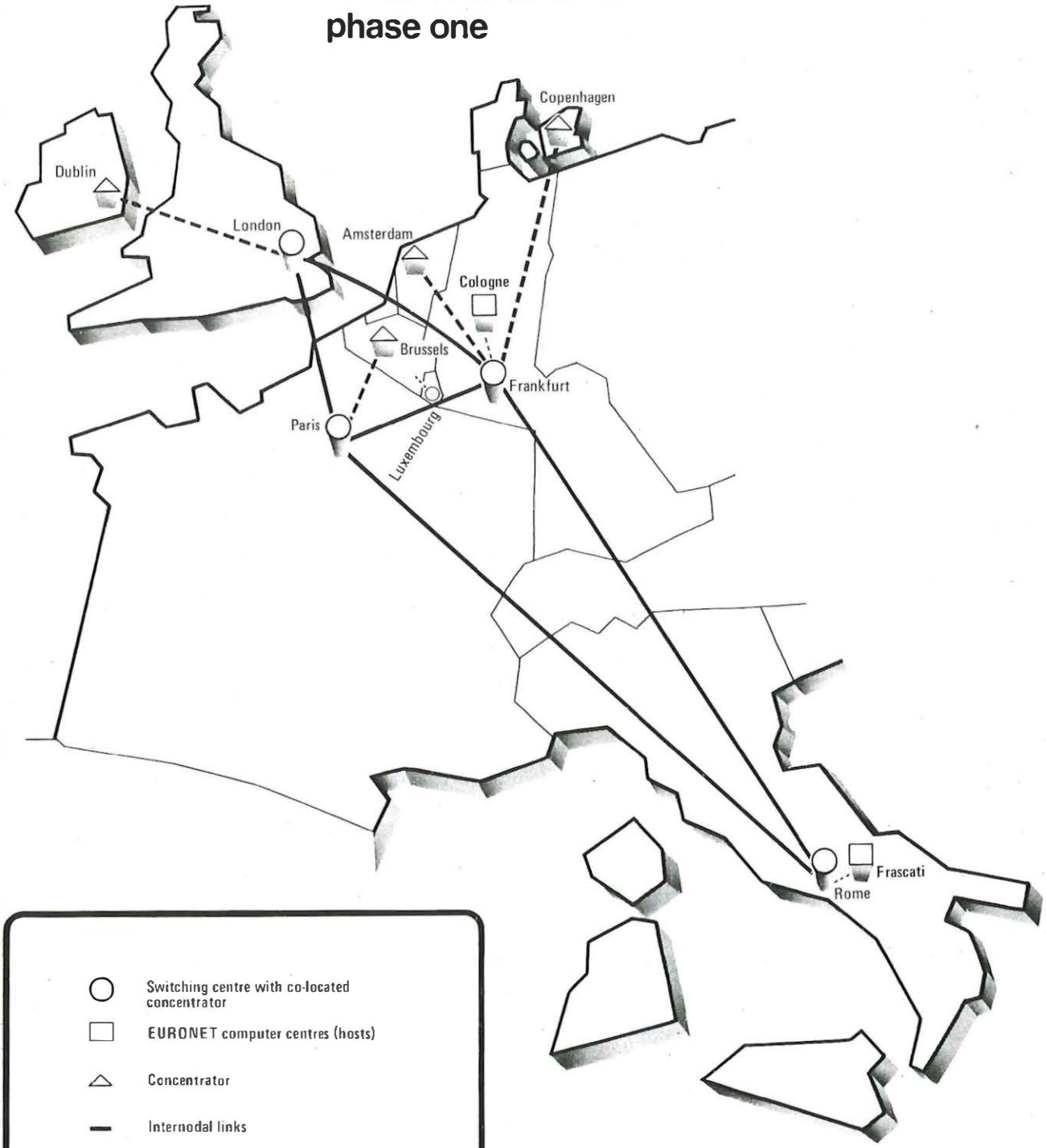
Study of the basic requirements was then undertaken by a specially formed group of the Conference of European Postal and Telecommunications Administrations (CEPT) and led to a single agreed CEPT proposal for the telecommunications element of the network. Examination of the technical implications and the proposals made in the consultants' report resulted in the group favouring a solution basing the core of the network on the packet switching technology of the European Informatics Network (EIN). This network became operational in May this year between research centres in four countries in Europe to enable research into computer resource sharing. CEPT had been closely associated for some years with the EIN project and were already considering plans for its ultimate integration into their respective planned public data networks.

The technical proposals were subsequently endorsed by CEPT's Special Committee for Data Transmission (CSTD) and outlined to representatives of the EEC responsible for scientific and technical information and information management. Conditions proposed by the CSTD were that the network should be implemented in accordance with agreed international standards where applicable and that the design of the network should be such that its reliability could be enhanced to that needed for a public data network. The Committee also specified that access to the network should be through national public data networks where and when they existed and that the design of the network should not preclude the carrying of non-EURONET traffic.

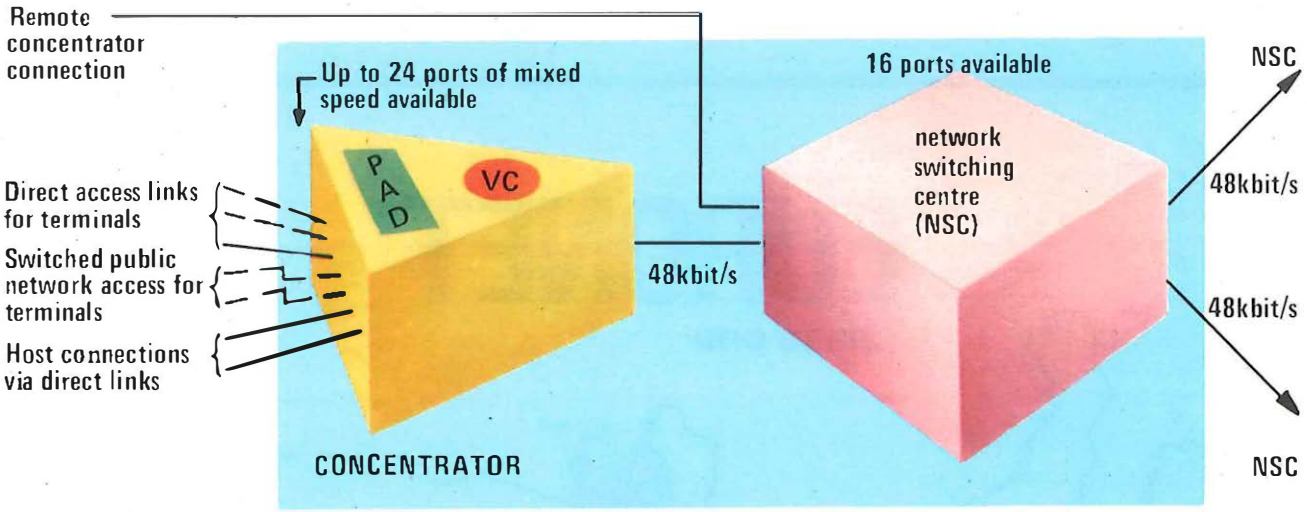
These conditions were accepted by the EEC and last December the French PTT, acting on behalf of all nine national PTT Administrations of the Community, signed a contract with the Commission by which the PTTs would implement and operate for the Commission a network meeting EURONET's needs. A consortium of the member PTTs was established to manage this task. It consists of a management committee, a sub-committee for technical, planning and implementation aspects, and a sub-committee ▶

EURONET

phase one



- Switching centre with co-located concentrator
- EURONET computer centres (hosts)
- Concentrator
- Internodal links
- Remote host connection
- Remote concentrator connection
- Remote access facility, connection point to be decided



Key:

PAD: Packet assembler/disassembler VC: Virtual call process — ⌐ — and — — —: asynchronous and synchronous terminal connections ———: packet mode connections

CONFIGURATION AT EURONET SWITCHING CENTRE

for commercial aspects. Because co-ordination and implementation of the task is significant a full-time project team is being established consisting of experts nominated by the PTTs. In addition, each Administration has set up a small national implementation group to manage the planning and installing of the network and customer connections in its own country.

The configuration of equipment at each of the four switching locations is planned to be as indicated in the diagram (see above). The final design will be the result of further study to define the facilities and configuration required. To meet the short timescale, the NSCs will most probably be identical in hardware and software terms to those used in the EIN.

The EURONET concentrators (additional processors not necessarily of the same type as used for the NSCs) will include packet assembly and disassembly facilities for non-packet mode terminals and, for both packet and non-packet mode terminals, virtual call facilities – the periods of communications between two terminals in which users' data will be transferred in the network in the packet mode of operation. "Host" computer centres will be directly connected to the concentrators and will use the virtual call procedure. The target set by EEC for mean time between failure of the network is about 200 hours, so it is unlikely that the processors will be duplicated solely to meet EURONET needs.

Some network management facilities will be needed to perform functions such as call recording for billing purposes, and remote software reloading in the event of a processor failure. How these facilities are implemented, whether they are held at local sites or in one or more dedicated centres, is under study. Furthermore, if the network reliability is upgraded to that of a public data network and dual or multi-processor configurations are introduced which may not be identical in each country, then national network management centres may need to be established.

The most important progress made since the signing of the contract with the EEC in December last has been the placing of a definition study contract and the development of standards and protocols.

A four-month contract for defining the optimum configuration and facilities of the network has been placed by the French PTT on behalf of the consortium of PTTs with a multi-national software house, the study specification having been written by the PTT's project team and ratified by their technical, implementation and planning sub-committee. The definition of call set-up and clear down procedures for the telecommunications network for EURONET has been undertaken by the CEPT's Working Group on Data Communication.

Interfacing standards for packet mode data terminals which the working group prepared have become the agreed text of a draft International Telegraph and Telephone Consultative Committee (CCITT) recommendation. The interfacing recommendation for packet mode to start-stop character terminals has also been completed. They will be further refined later.

The drafting of recommendations for the connection of synchronous terminals is at present being considered. It is expected that these standards will be adopted by other Administrations and recognised private operating agencies intending to introduce packet switched data services, especially if they become CCITT recommendations.

For those countries intending to provide access for EURONET's telecommunications network by way of their public data networks – whether they are based on packet or circuit switched techniques – agreements on interconnection arrangements will be hastened in much the same way as EURONET is hastening packet mode data terminal equipment interfacing standards.

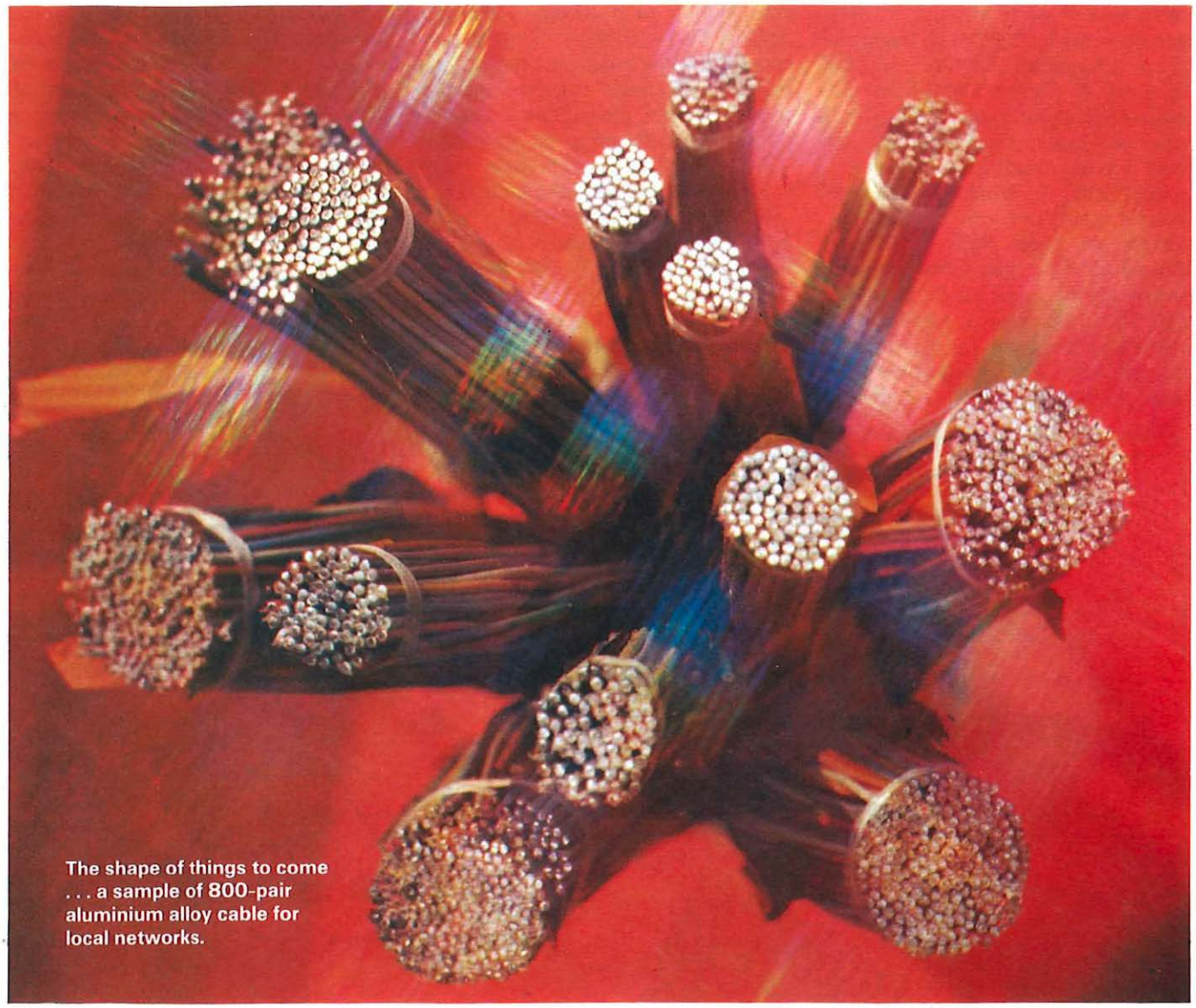
Interest being shown in implementation of the network is considerable and already there are indications that the number of data terminals to be connected to the network will far exceed the initial forecasts. In addition, several major multi-national organisations have shown interest in using the network. It seems clear that the provision of an international data network to recognised international standards will act as a catalyst and will affect considerably the various Administrations' plans for national networks in their own countries.

Mr P. T. F. Kelly is head of the Data Systems Planning Division in Network Planning Department at Telecommunications Headquarters. He is also chairman of the EURONET sub-committee for technical planning and implementation aspects.
Mr E. J. B. Lee is an Executive Engineer in the same Division.

It's a change of conductor

J Pritchett and RC Adcock

Plans for a large-scale switch from copper to aluminium alloy conductors in local telephone network cables will bring considerable cost savings to the Post Office over the next few years.



The shape of things to come . . . a sample of 800-pair aluminium alloy cable for local networks.

COPPER has for many years been accepted as the best conductor material for underground telecommunications cables but its price has always been liable to marked fluctuations. In contrast the price of aluminium, an acceptable alternative as a conductor, has remained comparatively stable – and currently costs half as much as copper.

Not surprisingly, therefore, the Post Office has often considered a change from copper to aluminium on economic grounds, and since the Second World War a number of experimental cables with aluminium conductors have been laid in various parts of the country. The most notable of these is, perhaps, the Dover to Deal junction cable which was installed in 1954.

A major step forward was made in ▶

1968 when the Post Office adopted aluminium as standard for local distribution cables connecting roadside distribution cabinets with customers' premises. These cables range in size from 2–100 pairs of wires and are filled with petroleum jelly for protection against water seepage.

The introduction of these cables resulted in significant savings in capital outlay, despite the need to develop new jointing techniques and provide the necessary jointing tools.

Later on a change was made to aluminium alloy which was found to be more satisfactory than the commercially pure aluminium that was used in the earlier cables.

Now, following agreement between the Post Office and the Telephone Cable Makers Association, plans have been made for a large switch from copper to aluminium alloy in the local networks. At present aluminium alloy cables account for 25 per cent of local cable purchases. Over the next few years this figure is likely to increase to 95 per cent, resulting in savings of about £10 million a year.

Under the latest plans cables with aluminium alloy conductors are being progressively introduced into the local main networks which radiate from telephone exchanges to the distribution cabinets. Cables in these networks range in size from 100–4,800 pairs and are pressurised with dry air. Installation started last year in the South Eastern Telecommunications Region and plans are being made for extension to the North East, Wales and the Marches and Scotland.

The essential mechanical properties of a conductor are tensile strength and ductility – the ability to stretch without fracture. During cable manufacture the wire has to withstand the various processes of insulation, stranding and sheathing before the final drumming and despatch to the working site.

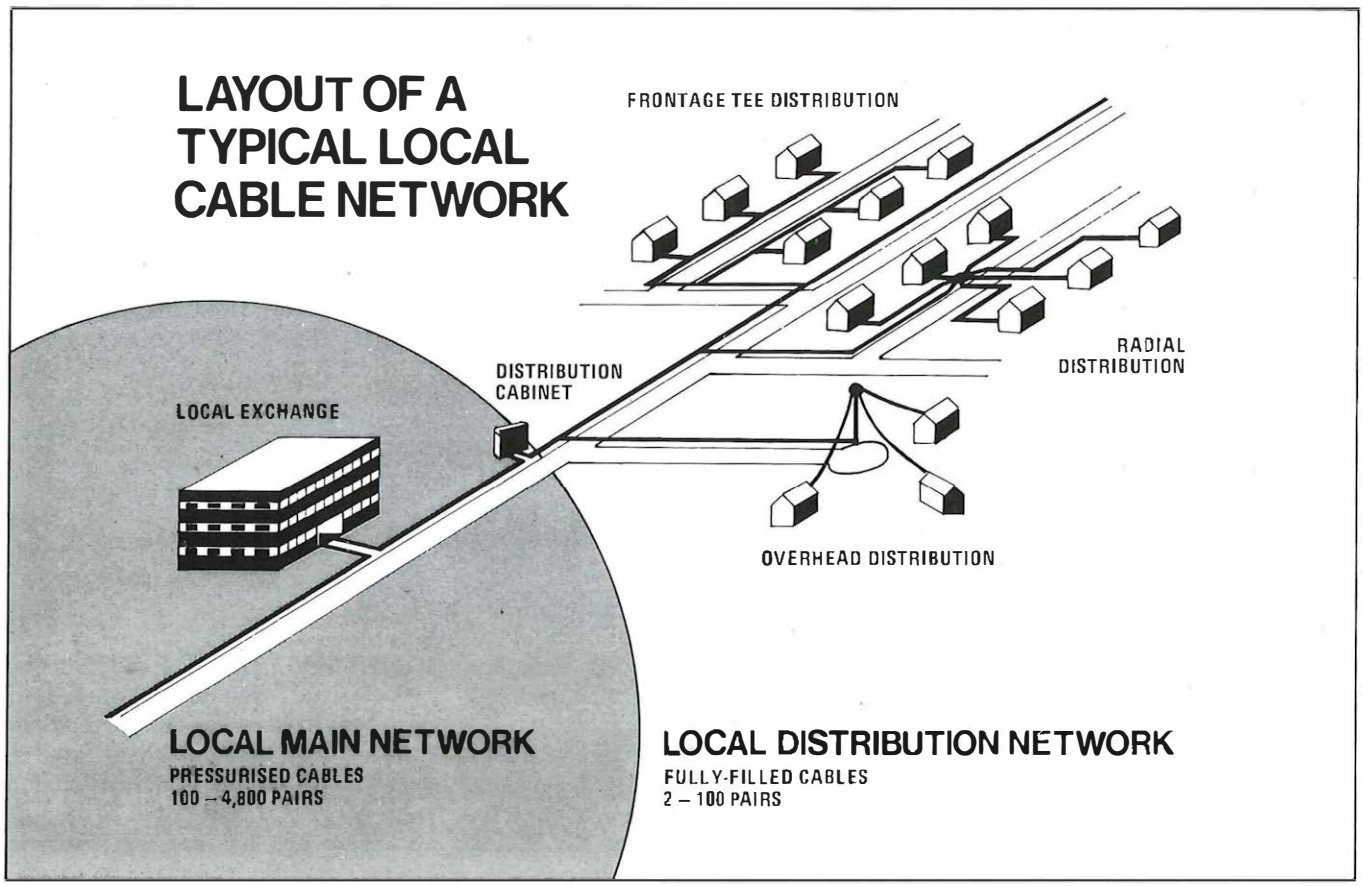
At the installation stage the conductors have to be strong enough to allow the cable to be pulled into a standard length of duct without breaking. All the conductors would make an equal contribution in a straight duct but, because ducts generally follow the line of a footpath or roadway, they contain bends which tend to cause a disproportionate part of the pulling tension to pass to a small group of conductors. This is why ductility is of such practical importance in a cable conductor.

Although the tensile strength of the pure (three-quarter-hard) aluminium wires used in the early cables was adequate, problems arose because their handling characteristics were inferior to those of the soft (fully annealed) copper they replaced. As a result, occasional breakages occurred when the wires were bent sharply at joints and distribution cabinets. Consideration was therefore given to the adoption of aluminium alloys, many of which were known to combine the high tensile strength of three-quarter-hard aluminium with an ability to stretch before breaking which was much more like that of the copper.

The relative merits of various alloys were assessed in the laboratories of the External Plant Development Division at Carlton House, Wembley, and the results were compared with those for soft copper and three-quarter-hard aluminium. Meanwhile, Post Office cable suppliers took on the task of procuring suitable alloys and developing manufacturing methods for aluminium alloy cables.

Aluminium alloys require only partial annealing, and close control of this important process is essential for wire fabrication and cable manufacture. This meant that new manufacturing plant had to be installed by the suppliers before the switch to alloys was made three years ago. The mechanical characteristics of aluminium alloys now in production are far superior to those of three-quarter-hard aluminium. They are also sufficiently close to those of copper to give adequate tensile strength for cable fabrication, while at the same time meeting the minimum stretching specification

Layout of a typical local cable telephone network.



which has been shown by experience to be adequate for field use.

Because aluminium is not as good an electrical conductor as copper, the wire is made with a slightly larger diameter to obtain a comparable overall resistance. Cables in the current range using 0.5 mm diameter aluminium alloy wire replace those with 0.4 mm copper wire. However, it has been possible to reduce the thickness of the cellular polyethylene insulation used, so that the change of conductor material involves no appreciable increase in the overall cable diameter.

Weight for weight, aluminium is cheaper than copper and the consequent saving is enhanced because one tonne of metal yields twice as much 0.5 mm aluminium wire as 0.4 mm copper wire. Furthermore, because aluminium alloy cables are lighter in weight than their copper equivalents, transport and installation is easier.

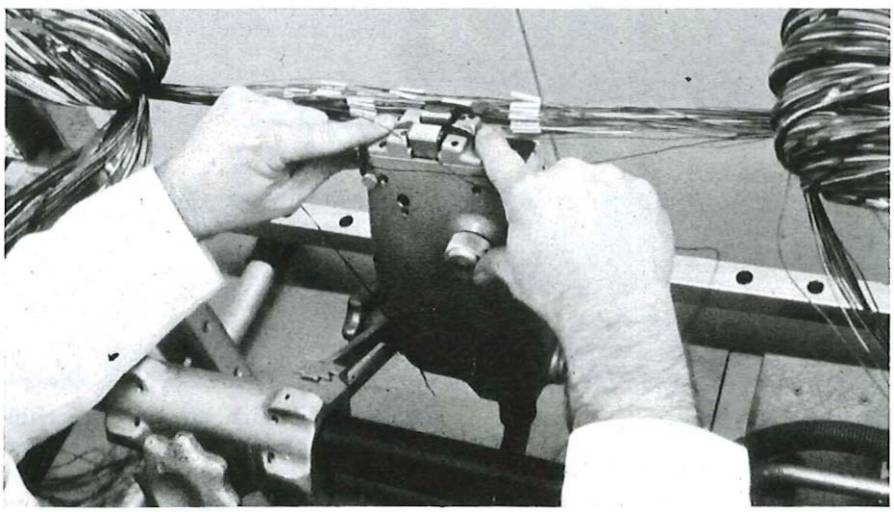
The new cables have been received very favourably by Post Office field forces, the weight saving being particularly clear to cabling staff. Jointers, too, have found that handleability – an all-embracing term which includes, for example, the various processes of folding back bunches of conductors for selection of pairs, and bending conductors during jointing – is not noticeably different from that of copper, but far superior to that of the three-quarter-hard aluminium originally used.

Jointing problems have also been overcome. The method of connecting copper cables by stripping the insulation and twisting the bared wires together was not possible with aluminium because it oxidises rapidly, the oxide film preventing good electrical continuity. The solution has been found by providing crimping devices which compress the conductors inside an insulated phosphor-bronze connector. There is no need to remove the conductor insulation because sharp projections inside the connector penetrate it with ease.

For the jelly-filled cables of the local distribution networks an easily operated jointing jig to crimp the wire joints has been developed, together with a readily accessible cap-ended closure to house the jointed wires (see Telecommunications Journal, Winter 1973/74). For the pressurised local main network cable a conventional in-line joint can be made using an hydraulically operated device, the Jointing Machine No. 4 (see Telecommunications Journal, Spring 1969). Other types of joint using methods similar to those already adopted for the local distribution cables are being developed.

Above: This specially developed jig simplifies jointing of local distribution network cables. A cap-ended closure provides easy access to the jointed wires.

Below: A conventional in-line joint is made on a local main network cable using the hydraulically operated Jointing Machine No. 4.



The possibility of extending use of aluminium alloys to the cables of the junction network is being investigated and various cable designs are under consideration. There are no plans, however, to abandon copper for the coaxial cables of the main network. Each pair of coaxial tubes carries a large number of circuits and the metal content is so very small in relation to traffic handled that a change to aluminium alloy could hardly be justified.

The introduction of aluminium conductors and the subsequent change to aluminium alloy has been achieved with due regard to the availability of the new materials and the rate at which manufacturers could adapt their plant. The success of the venture to date illustrates the close technical liaison between manufacturer and user, which has allowed the changing needs of the field to take full advantage of the progressive development in processing techniques following the introduction of new materials.

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Mr R. C. Adcock is an Executive Engineer in the same Division, in a group responsible for local cable development.

Call for better protection

EN Harcourt

To avoid damage to underground telephone cables, specially trained Post Office engineers give on-site guidance to contractors and public utilities engaged in excavation work. Now, to provide even greater protection, trials are planned of a scheme in which a Freefone call to a special reception centre by one undertaking will result in work site information supplied or requested being passed to all other participating interests.

With the aid of special track locating equipment, Plant Protection Officer Malcolm Larnach and technician Ted Hall trace and mark the route of a telephone cable at a roadworks.

A CARELESSLY operated mechanical digger or simply a spade plunged thoughtlessly into the ground . . . The result could not only be an expensive repair bill for damaged Post Office cables but it could mean frustrating, even disastrous breakdowns in business, private and emergency communications. Every year more than 1,000 major long distance and junction cables are put out of action in digging accidents as they are crushed, ripped, spiked, flooded and sliced in a nationwide trail of damage. And yet it need never happen.

A code of practice among public utilities to prevent damage to each others' plant has long been in operation and under it, notice of any proposed works is required to be given to all interested parties. The Post Office, however, has gone one step further and four years ago set up a special "dial-before-you-dig" scheme and appointed Plant Protection Officers to give site guidance.

Under this scheme a free telephone service is provided by the Post Office and contractors doing excavation work are urged to dial before they begin digging to discover the exact location of underground cables. Calls are put through to one of the 68 external plant maintenance centres (EPMCS) which have information on the routing of underground cables.

As soon as a call is received it is the duty of the Plant Protection Officer (PPO), usually armed with plant records and special track locating equipment, to establish on-site liaison with the authority or contractor concerned. Once the precise nature of the excavation has been determined he

will locate the Post Office plant and mark its position, usually with distinctive yellow posts, along the route of the cable and then advise the officer in charge of the EPMC if any further attention or supervision by the Post Office is necessary.

Now a new scheme, which is due to begin field trials later this year, is aimed at further improving co-operation between all utilities. The plan is to set up a Joint Utilities Location and Information for Excavators (JULIE) service in Blackburn Telephone Area as an extension to the existing Freefone service.

Information given to or requested from the Centre by a contractor will be passed on to all the other utilities participating in the scheme. The idea was developed because a contractor faced with having to telephone the individual numbers of all utilities involved may not, for various reasons, contact them all.

The need for co-operation between the various authorities and undertakers including the Post Office is, of course, obvious and depending upon the size and nature of the proposed works, notices received by the Post Office are either dealt with, and a reply sent by the EPMC, or passed to the External Planning Group or Drawing Office for attention. If maps are submitted with the notice these are returned to the promoting authority or undertaking marked to show the areas where Post Office plant is liable to be situated.

The plans are also stamped with a warning that the Post Office plant may be up to three metres from the centre of the marked area and point out that arrangements can be made for the position of this plant to be accurately marked on site. For this the promoter is urged to call Freefone One-Double-One via the operator who will extend the call to the EPMC without charge.

Although the procedure for advising of proposed works, and if necessary the on site marking of plant positions, is operating successfully it does not completely eliminate all mechanical damage. The incidence of damage caused by non Post Office operations to trunk and junction telephone cables alone is considerable and in the local cable network, where many of the smaller cables on housing estates are buried without the protection of an encasing duct, the incidence of damage is much greater. It is true to say, however, that much of this damage occurs during the early life of the estate while building operations and surfacing work are still very much in evidence.

At the External Plant Maintenance Control in London's North West Telephone Area, technician Frank Noah receives cable damage reports from repair service controls. The wallchart shows details of cables for which the Area has maintenance responsibility.

Damage to underground cables causes a variety of problems to the telecommunications service. In the case of small local cables, only a few customers may be affected but when large local, or trunk or junction cables are damaged the interruption is far more widespread. The speedy repair of damage obviously reduces the extent of an interruption but it uses engineering labour which could otherwise be employed on more productive work. The time spent on the repair of damaged Post Office plant is currently equivalent to the full time employment of about 300 staff. Although the Post Office does, in many cases, get re-imbursement of the cost of the repair, the disruption to the normal programme of work and the reduction of revenue due to the interruption of service, are losses which the business suffers alone.

When buried plant is damaged the PPO is one of the first Post Office men on the scene. The liaison established between him and the contractor's work force is usually such that when plant is damaged it is directly reported to the EPMC. Although jointing staff are normally required to make a repair when a cable has been damaged it is often a PPO who is first sent to the site to assess the amount of the damage, determine the size and composition of the repair force needed, and to prepare, or help prepare a damage report. Obviously he also takes what steps he can to prevent further damage.

Although the PPOs' main function is to prevent damage to underground ▸

Plans of a proposed roadworks scheme by a local authority are checked against a map showing the position of Post Office plant by Sid Crook, a senior technician at the North West Area EPMC.

plant they normally visit a work site only when requested. At other times they are employed on other essential work such as locating the position and route of existing Post Office plant for the benefit of other Post Office staff not equipped with suitable track locating equipment.

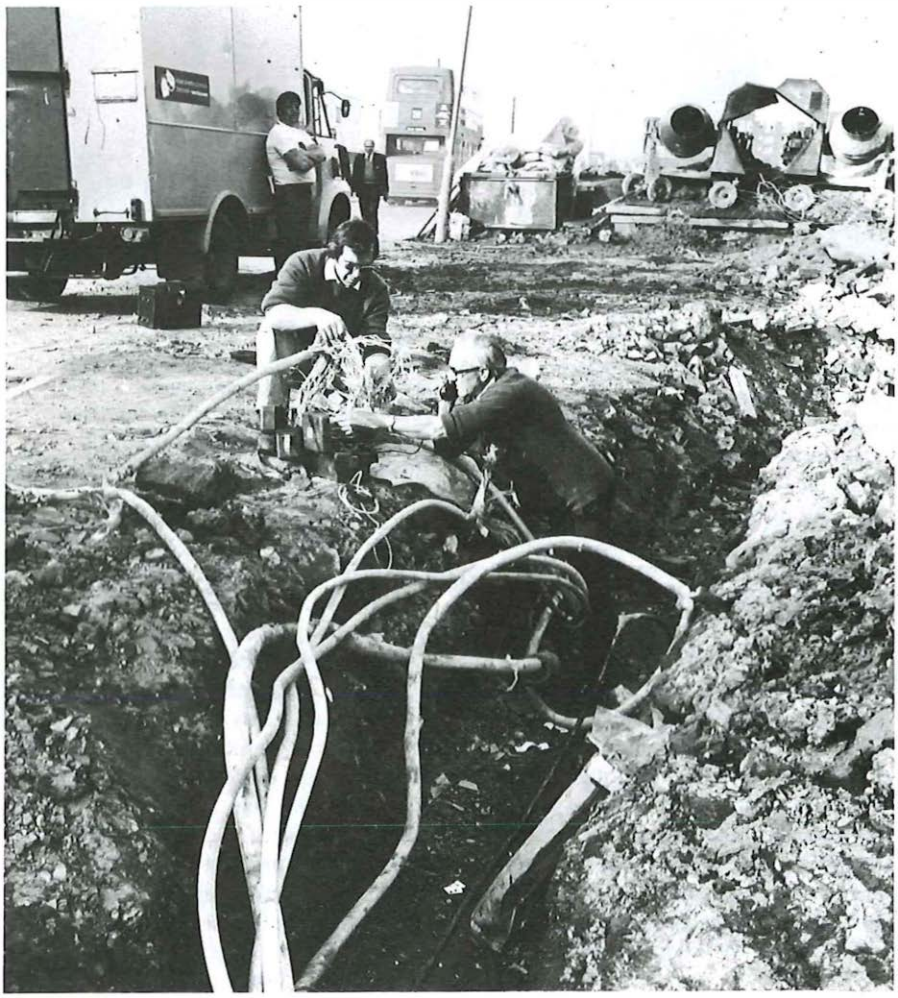
As well as this, there is also the subsequent checking of new overhead electricity lines and services which cross or are close to Post Office overhead wires and cables to ensure that the necessary separations have been maintained.

As is well known the Post Office underground plant shares the available space below roads and footways with other undertakers plant which is also liable to be damaged. The way in which other owning undertakers deal with notices of intention to carry out excavation work varies considerably but several undertakers have shown considerable interest in the Post Office method and the proposed trial in the North-West is a result of this situation.

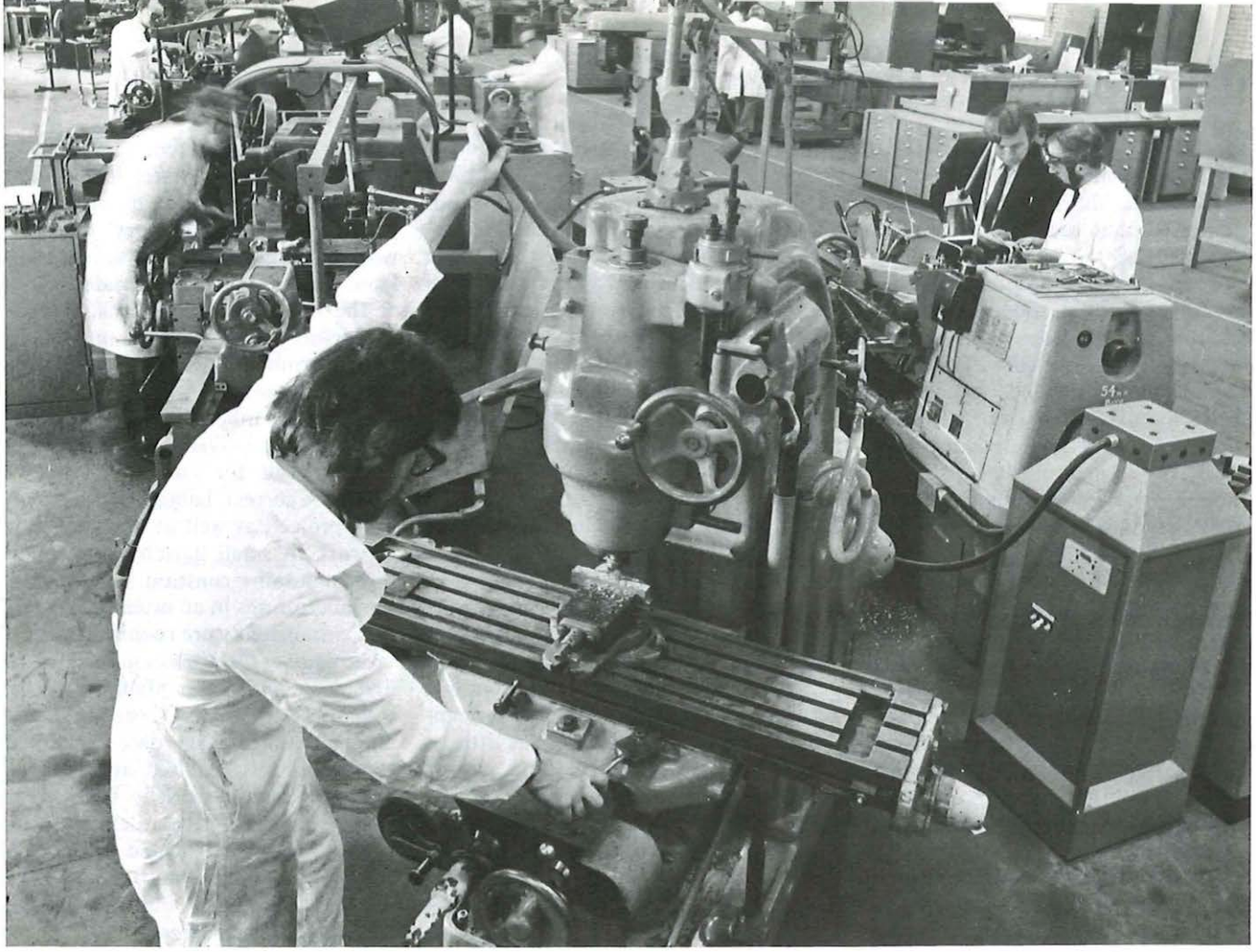
The Post Office firmly believes that prevention is better than cure and it is concerned to encourage those responsible for excavation work – be it the planner or the operative on the work site – to advise of all proposed activities. To back up this policy there have been several national, Regional and Area campaigns including advertisements in telephone directories and trade journals, the distribution of thousands of information cards, and discussions with other authorities and undertakings and their contractors. In one Region, wide distribution of an eye-catching "girlie" calendar proved a particularly appropriate way of getting the message over at site offices and workmen's huts.

Ideas and schemes like this, together with the liaison established by the PPOS, has helped create a greater awareness of the vulnerability of Post Office plant to mechanical damage and the consequent breaks in service.

Below: Post Office engineers examine the damage caused to telephone cables unearthed during excavation work at a building site.



Mr E. N. Harcourt is head of a group in Service Department at Telecommunications Headquarters responsible for maintenance of the trunk and junction cable network and the organisation of EPMCs.



The backroom boys

TE Chalklen and DJ Joyce

WORKSHOP skills such as toolmaking, carpentry and sheet metalworking are not readily associated with the exploratory environment of research. Yet much dedicated "behind-the-scenes" activity of this kind is essential if the possibilities for change and improvement emerging from the laboratory are to be transformed into proven substance.

For projects undertaken at the Post Office Research Centre, Martlesham Heath, comprehensive support services are provided by a large workshop which is equipped and staffed to meet most modern precision engineering needs. Here the main task of 70 highly skilled technicians is to turn the ideas of Post Office scientists and engineers into practical reality – ideas that may be presented to them as complete sets of detailed drawings, as rough sketches, or as verbal instructions.

The work of Research Department (RESD) involves many disciplines and this is reflected in the workshop's facilities which combine conventional processes, such as toolmaking, instrument making and general fitting and machining, with a variety of more specialised services. For example, the expertise of numerically controlled machining and sheet metalworking have been put to good use in the production of special ovens for screening and testing long-life transistors.

Normal carpentry needs are met in the woodworking shop, and here the main demand is for pattern making and model making skills. This has proved invaluable in the past for the design and development of such projects as the Goonhilly aerial No. 1 and the linear cable engine concept to speed the laying of submarine cables.

Typical of the special facilities which have been developed as a result of new requirements are electroforming and plastics processing. Briefly, electroforming is a process for producing a highly accurate copper tube, the shape of which is determined by a mandrel made of aluminium or stainless steel. The mandrel is immersed in a solution containing copper sulphate, sulphuric acid and distilled water, and pure copper is deposited on it to form the required shape.

Electroforming lends itself to batch production, especially if the mandrel can be extracted. It has, for instance, been used in the production of a number of high-precision waveguide components needed in current research on future higher-capacity communications satellite systems using the six-metre diameter steerable aerial at Martlesham.

The plastics processing unit has grown considerably since the first requests for this type of work were made to RESD workshop staff in the late 1960s. Today the available techniques include extrusion, injection moulding, vacuum forming and PTFE spraying. Extrusion work is, in fact, playing an important part in the research at Martlesham on optical transmission systems which use a pure glass or silica composite thread of about the same diameter as a hair.

To protect the fragile optical fibres when they are handled, stored and eventually pulled into ducts, the plastics unit has developed an extrusion line which forms a polypropylene tube around the fibre in a continuous process as it is drawn from its crucible. The tube is a few hundredths of a millimetre larger in diameter than the fibre, and the molecular structure of the polypropylene is "orientated" so ▸

that the longitudinal strength of the tube is considerably increased. This enables the finished product to be pulled without breaking the fibre inside the tube.

Vacuum forming and moulding techniques have been used in the workshops to produce experimental keypads for the Viewdata information service being developed by RESD (see Telecommunications Journal, Winter 1975/76). They include a variety of cases, key shapes and layouts for evaluation to assess the most appealing and ergonomically suitable keypad.

Heavier engineering work is carried out by a group known in the workshop as "millwrights". Typical of this work is a hold-and-cut grapnel weighing in excess of two tons which is currently in an advanced stage of development for the submarine cable group.

Apart from the many support activities for RESD, the workshop's expertise is also called upon by other Departments at Telecommunications Headquarters. Current work, for example, includes a new feed unit for a 30-ft diameter dish aerial now in operation at Goonhilly Downs earth station which has involved machining large plates to very precise dimensions and assembling the finished items, again to a high degree of accuracy. The workshop technicians are therefore good all-round craftsmen rather than specialists, the main staff consisting of two groups of Technical Officers, each under the control of an Assistant Executive Engineer.

Most of these men will initially have served an indentured apprenticeship as a toolmaker, instrument maker or similar pupilage prior to joining the Post Office, although there are a small number of apprentices progressing through the workshop. Many of the younger element are employed in an engineering group which backs up the main workshop, and former apprentices are also situated in this group so that they can put into practice the skills acquired during their training.

A technician is usually responsible for making a complete item of work, contributing ideas, deciding on methods of manufacture and giving it a final polish. The time taken to complete each job can vary from as little as a few hours to several months, and if a particular project does require substantial effort a team is formed for the duration of the work. The more repetitive tasks which would be too expensive if dealt with in this way are usually placed under contract with local engineering firms on a competitive basis.

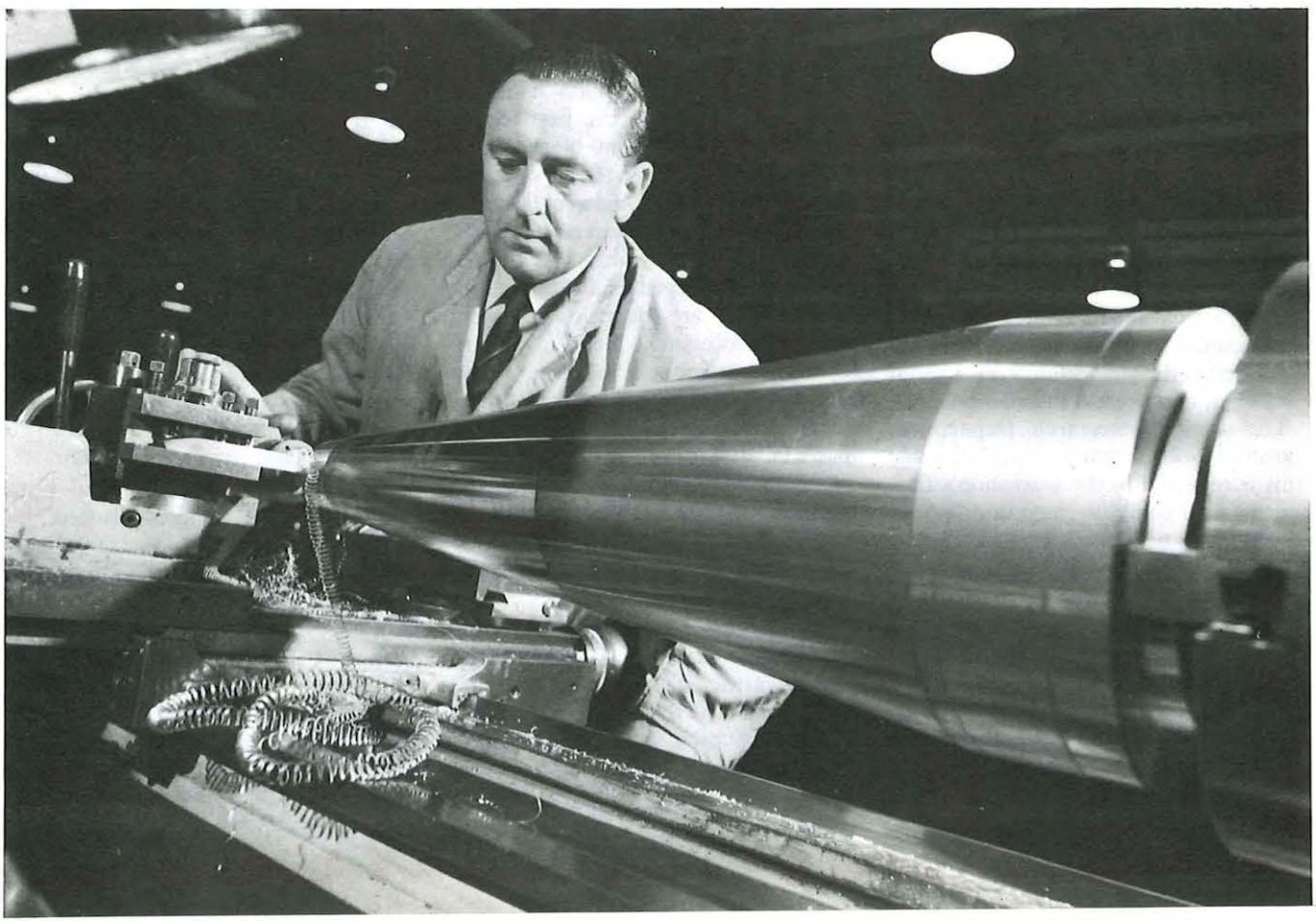
In private industry men in a similar environment to that of the workshop staff work either on a bench or a few selected machines, but experience has shown that the system employed at Martlesham gives greater job satisfaction and eventually builds a team experienced in almost every aspect of working technology. This assists them later if they show an aptitude for one of the more specialised jobs, such as numerically controlled machining, electroforming or work in the plastics processing unit.

Clearly the inherent flexibility of the system and the diverse demands placed upon it call for careful control to ensure a correct balance of effort on each project, as well as a smooth flow of work. A small liaison group therefore maintains constant contact with the laboratories in an attempt to gauge and anticipate future requirements.

All requests for workshop services are first dealt with by a planning group. When the work has been estimated and a planned start date scheduled, the customer is advised and he gives authority for the work to begin. During this time tentative orders are being placed for materials and bought-out parts. Once work is started the job is monitored regularly and the customer is advised of its progress.

During manufacture further ideas or improvements to design may emerge at the suggestion of either the workshop staff or the customer. There is, therefore, a need to vary the original terms of reference of any job while, at the same time, maintaining close control on time and money being expended. This can, of course, upset plans for

An aluminium alloy mandrel takes shape on a lathe in the Martlesham workshop. The mandrel will be used in an electroforming process to produce a horn of pure copper for experiments in satellite communications.



Above: A copper transducer is produced by the electroforming process in which an electric current is passed through the bath of copper sulphate, sulphuric acid and distilled water. Copper forms on the slowly revolving mandrel at a rate of about one-thousandth of an inch per hour to produce the required shape.
Left: The holes in an aluminium alloy plate are checked after drilling to extreme accuracy by numerically controlled machining. The plate, called a padplacer, will be used in the manufacturing of printed circuits board masters.

future work, but staff accept that in a research environment changes will be required on some projects. Experience has also shown that it is easier to alter requirements within the workshop than if the customer had placed a contract with an outside contractor.

In Post Office research most projects seem to follow a general pattern, starting from fundamental research to experimental work and, finally, a demonstration of practical feasibility. Much of the demand for workshop services occurs at discrete intervals during the life of a project, and coping with these peaks in demand requires a very flexible workforce. In brief, the workshop together with other "backroom" general services play a vital role in the overall objectives of developing better service for the public, reductions in the cost of services, and a wider range of facilities.

Mr T. E. Chalklen is head of a group at the Post Office Research Centre, Martlesham Heath, responsible for workshop services.
Mr D. J. Joyce is an Executive Engineer in the same group, in charge of the workshop.

Brighter outlook in exchange forecasting

MC Jones

A new computerised system coming into operation this autumn will improve the accuracy of forecasting equipment orders needed to meet future growth in Britain's telephone exchanges.

ABOUT £200 million is being invested this year by the Post Office in the purchase of contract telephone exchange equipment. Clearly such investment requires careful management and control, both in the context of overall planning strategy and in the placing of contracts for individual exchange equipment orders. The Exchange Equipment Review (EER) exists to fulfil these requirements.

Primarily, the Review is designed to determine exchange exhaustion dates and calculate order sizes for additional equipment, and so provide staff in Telecommunications Regions and Telephone Areas with the essential basic information for planning and programming new exchanges and extensions. The Review embraces five forward ordering years and apart from identifying future requirements also acts as a progressing vehicle for orders already placed and in the manufacturers' pipeline.

Additionally, a forward programme of orders is compiled which is used to inform equipment manufacturers of planned ordering levels. The EER also provides an important data base for the calculation of forward forecasts of expenditure, essential to the Telecommunications Business for investment planning purposes.

The requirements of the EER were to a large extent satisfied by the introduction of a computerised system in 1969. Since that time, however, the accelerating effects of the exchange equipment modernisation strategy have called for more sophisticated calculation processes to meet the needs of crossbar and electronic exchanges.

Furthermore, the existing system was not able to cope with the complexities of multi-unit exchanges, nor could it handle exchange traffic capacities or calculate order costs. Consequently, a decision was made in 1973 to transfer the system from an obsolescent LEO 326 computer to an ICL System 4, and by building on the experience gained from the existing system, to improve and enhance the EER to meet the changing needs of the switching network.

The new system with its enhanced data base will considerably improve the accuracy of forecasts of exchange equipment forward ordering requirements. It will examine the current and forecast situation for each exchange in terms of both connections and traffic capacities, apply national planning rules and costing formulae, accommodate local influences and constraints, and compile an ordering programme for Area and Regional planners in respect of each exchange.

The more detailed information extracted from the new system will also provide a valuable range of statistics to assist the Business to formulate policy on the provision of exchange equipment so that the requirements of modernisation and system growth can be matched to national resources in the most practical and economic way.

Primary information in the form of Area data and Regional parameters are input to the system when any item on the computer's data file requires amendment or when a new item of information is required. Following each input the data file is updated by a discrete updated suite of programs and data vet reports are produced. Data conversion from input document to the computer is effected by process control keying (PCK), an on-line system which obviates the need for punch cards and allows the application of certain data vet checks.

National parameters in the form of exchange order lead times (EOLTS), overall adjustment periods (OAPS), design periods and costing formulae are held on a parameters file which can be updated when necessary by the application of a parameter file update suite of programs.

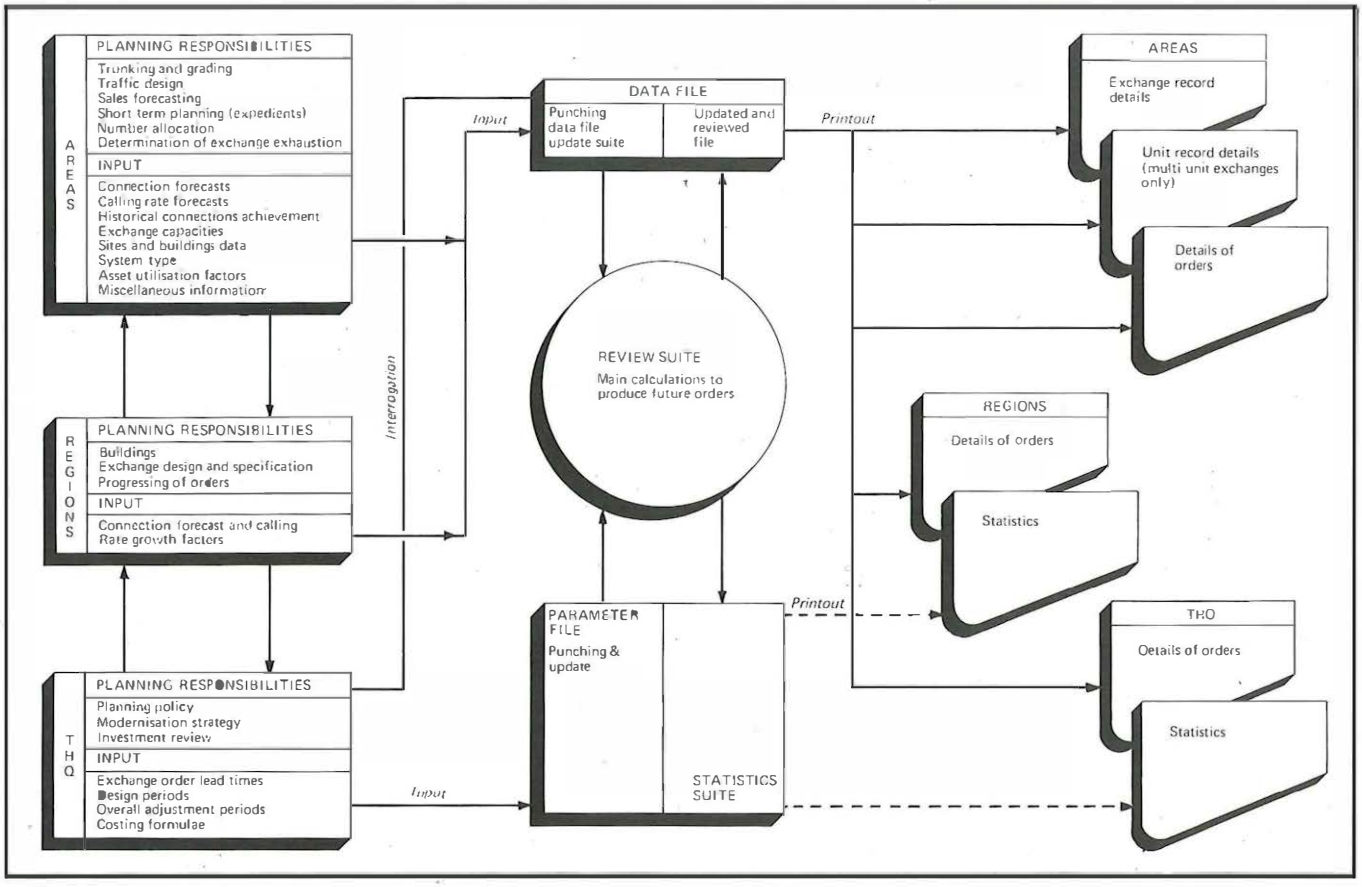
The data and parameter files are used in conjunction with the complex review suite of programs to carry out a review run. Following each review, the updated data file is carried forward and Area and Regional printouts produced. Finally a special statistics suite of programs is used to extract, edit, and print summary statistics on a National, Regional and exchange system basis.

The principal advantages of this modular arrangement are that the individual processes can be run separately and the data file updated frequently. This allows an accurate data base for statistics extraction when required, while the review suite can be run on a less frequent basis.

An important feature of the system is the ability to test the implications of tentative changes in policy by running under simulated conditions. A copy of the data file and an experimental parameter file can be processed and reviewed to produce statistics without disrupting the normal operational activity. Interrogation facilities will allow the extraction of special or infrequently required information not included in the regular statistics.

Structuring of the individual programs within each program suite is also on a modular basis which will enable existing routines to be enhanced or new processes added without affecting other links in the processing chain.

During a review run the computer compares individual exchange capacities in terms of connections and traffic against forecast demand and estab-



This diagram shows how primary information in the form of Area data and Regional parameters are input to the EER system when any item on the computer's data file needs amendment or when new information is required.

lishes exhaustion dates. Overall adjustment periods held on the parameters file are then applied to determine the required brought into service (BIS) date for the equipment. Using the later of the BIS and exhaustion dates of the existing equipment, the design date of the job can be determined by the application of standard design periods.

Once these critical dates have been derived the size of an order can be determined by subtracting capacities in terms of connections and traffic prior to the introduction of the order from the design date requirements. Order size details, in terms of connections and traffic are used to calculate costs which, combined with the unit type, exhaustion date and system type, determine the relevant exchange order lead time and hence the Regional contract order (RCO) date.

The computer reviews all orders which have RCO dates in the "review" period (broadly the following five years). The resultant order profile will thus extend to cover equipment needs up to nine or ten years ahead.

Although the basic procedure is relatively straightforward, allowance must be made for the everyday practical problems encountered in equipment planning. Many orders include an element for equipment replacement as well as for future growth, while others may have a main network or a switchboard component. Similarly, the computer processes must be capable of recognising such formidable problems as building constraints.

Consequently, in ensuring that the computer processing is as complete and as comprehensive as possible and yet flexible enough to accept special input information where non-standard situations predominate, computer routines have necessarily become complex. This is particularly so in the case of a multi-unit exchange where an order can relate to equipment capacity for more than one unit although the connection forecast is only provided for the exchange as a whole and must be broken down and distributed by the computer among the various growing and non-growing parts of the exchange.

Computer systems sometimes attract criticism because they offer solutions only to straightforward situations and tend not to be sensitive to the practical problems which invariably confront the Area planners. To enable Areas to overcome such difficulties most computer derived information on the new EER will be capable of direct or indirect manual over-ride.

As it is impossible to cover these various eventualities within the framework of the automated routines, the system has been designed to allow correction or adjustment by the input of very little additional information. An added advantage of this type of flexibility is that the need for manual amendment to computer printout – a very significant problem on the existing system – will be largely overcome. Apart from the obvious advantage to the user this will also help enhance the quality and accuracy of the file held data base and hence the statistics extracted.

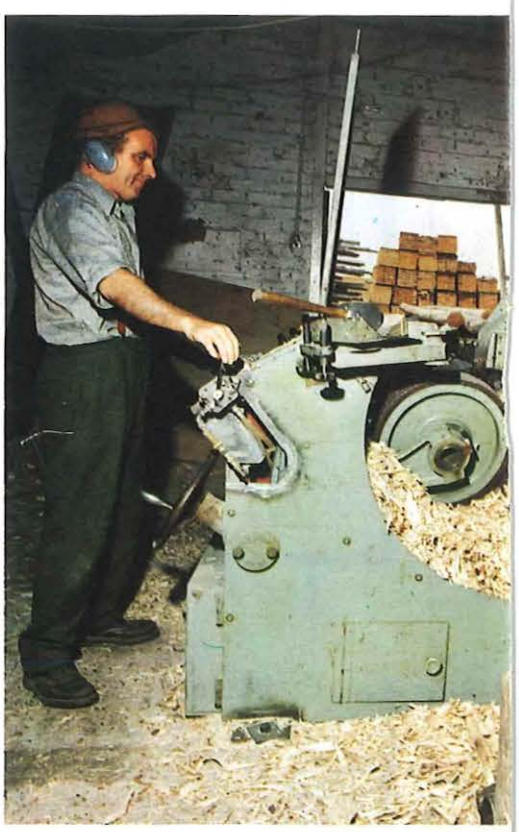
Programming of the new system is now nearing completion and implementation is planned for the autumn following a phased file conversion period and exhaustive system testing. Already, development work has begun on future stages of the system. These stages will embrace the mechanisation of the Main Network Equipment Review, an extension of the output statistics covering expenditure outfall, integration with other computer systems, and processing of direct labour orders, but each will first be subject to a full feasibility study.

Mr M. C. Jones is a Senior Telecommunications Superintendent in a group of the Operational Programming Department at Telecommunications Headquarters, responsible for development of the new Exchange Equipment Review project.

Wooden poles are worth their salt

EH Wheddon

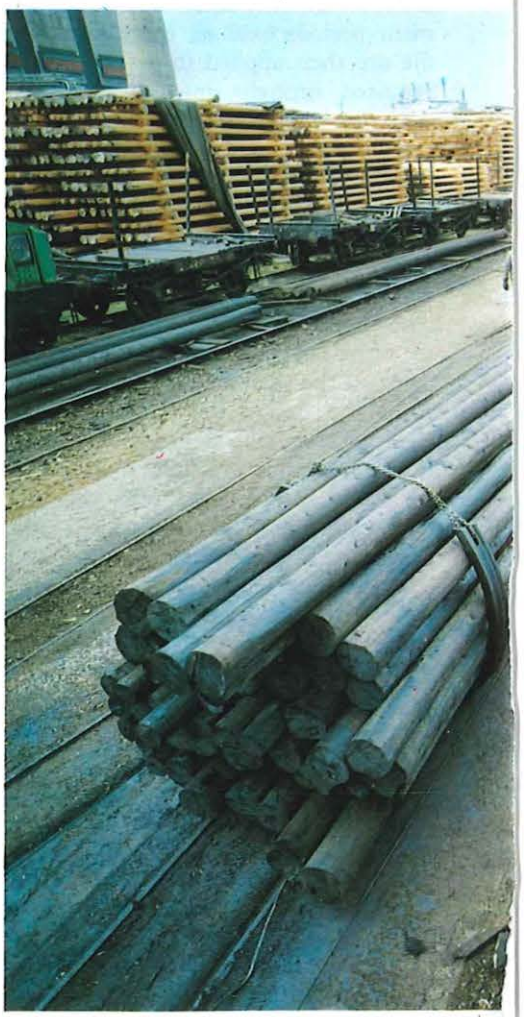
Plastic and steel telegraph poles are being tested by the Post Office, but the traditional wooden types remain a vital part of the telephone network. Many processes for preserving wooden poles have been tried, and 15,000 salt treated poles are currently under examination.

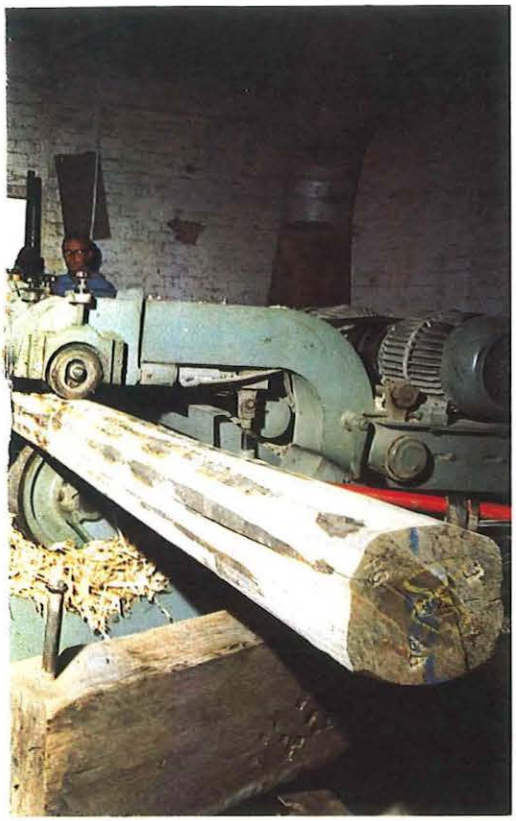


Above: Before being creosoted, wooden poles pa which cuts away about 6 mm of bark, removing lu

Below: Trolley loads of wooden poles emerge fro treat about 165 poles at a time.

Post Office pole inspector Peter Gerrard measures the moisture content of an untreated wooden pole at a contractor's depot. If the timber is too wet, creosote will be unable to penetrate it sufficiently to give the required protection against decay.





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ASK MOST people to describe a telegraph pole and they will probably talk about a creosote covered column of wood with wires attached to the top. And, of course, they would be right. But wooden telegraph poles – for so long a familiar sight on the landscape – could, in the future, gradually disappear and be replaced by poles made from galvanised steel or reinforced plastic.

At present a variety of steel and plastic poles are undergoing trials at the Post Office's special testing ground at Smallford in Hertfordshire. As well as being tested to see how they fare in the vagaries of the English climate, the poles are being used to study possible new methods of holding aerial cables and fittings. The fact that some of them are hollow, for instance, allows the wiring to be run down the length of the pole so that repairs and maintenance can be carried out at ground level. This technique, also, has obvious safety benefits.

And, of course, there is the economic situation to consider. No fewer than 120,000 poles are needed annually and the price of wood has more than doubled in the last couple of years.

But non-wooden poles are by no means new to the Post Office. Various iron and steel poles were tried more than 100 years ago and tubular iron poles in ornate cast iron bases proved particularly popular with the Victorians. Use of this type of pole suffered a severe setback in 1903, however, when a line of 11 poles collapsed at Worthing – the spread of trouble being halted at the first wooden pole!

In 1889 iron-reinforced concrete poles were first used but various designs proved unsatisfactory, mainly due to flaking of the concrete and consequent exposure of the iron. Most unusual of all, however, were the glass poles invented in 1903 by a German architect. It was claimed they had the advantage of easy maintenance due to being hollow like the steel poles currently being tested, but costs proved high and the project was turned down. Rubber and plastics of various types have also been considered but the normally higher cost of maintenance has precluded full development.

At present there are about 4.5 million telegraph poles in Britain and about 85 per cent of these are of Scots Pine. Of the 120,000 new poles needed annually about 30,000 are home grown – mainly in Scotland where the climate produces sturdier trees. A small number of trees from the Queen's estates at Windsor, Balmoral,

A galvanised steel pole undergoes tests alongside a more familiar wooden type at the Post Office's Smallford Test Centre in Hertfordshire.

and Sandringham are also used. The 90,000 imported poles come mainly from Scandinavia, with Finland supplying the majority.

Trees normally take up to 50 years from planting to be mature enough for telegraph poles and their average life span is 30 years. Some, however are still giving satisfactory service after 100 years! But why are telegraph poles still needed anyway, when so much cable goes underground? Basically it's simply a question of cost and convenience.

In the outlying districts of large towns it would not be practicable to tear up the pavements every time an installation was required and poles are still the easiest and least costly means of distribution. In remote thinly populated rural areas it is far easier and cheaper to erect and maintain poles than it is to lay cable underground.

The earliest traceable mention of telegraph poles is reference to a few poles of untreated larch in 1844 and this being the case the telegraph pole can rightly claim to be the most senior of all items of telecommunications stores.

Until 1870, private telegraph companies worked in competition with the Post Office, who played only a minor role in this field, but in January of that ▶

year the State acquired control of all telegraph companies. As part of the take-over the Post Office acquired 60,108 miles of line, on a total of 14,950 poles.

The Post Office has, of course, always been in the vanguard on research, and to this end many pole designs have been examined and used experimentally. Some 50 species of timber have been tried ranging from the earlier despised red fir to eucalyptus and wallaba; but most had serious shortcomings. Present specifications allow only the use of Scots Pine from abroad, and Larch and Douglas Fir from home grown sources. The latter are, however, not in plentiful supply and account for only 15 per cent home grown production.

Seven Pole Depots are situated in private contractor's yards at Belvedere, Kent; Newport, Gwent; Boston, Lincolnshire; Fleetwood, Lancashire; Blyth, Northumberland; Leven, Fife; and Grangemouth, Stirlingshire. They are staffed by contractor's men, who work under the supervision of Post Office pole inspectors. All inspectors are highly trained in detecting faults in timber from bacteria or fungi infection, to damage by squirrel bite or wood wasp or any other of the countless enemies of timber. They also determine when treatment shall start.

For many years poles were used untreated against decay. Larch was preferred because the small quantities required were easily obtained from home grown sources, and the timber being moderately durable, had an expected life of 10 years. The importing of timber for poles was strongly resisted by home growers, and many questions were raised in the House of Commons, aimed at forcing the Post Office to accept only home grown supplies, however unshapely or unsuitable they might be.

Scandinavian Scots Pine was denigrated as having a shorter (untreated) life than Larch. It was also said to have less strength, and would promote unfair competition because supplies could be obtained more cheaply as shipping costs were lower than inland transport costs either by horse and cart or railway. By the early 1880s, however, as the telegraph system grew, demand for timber began to outstrip supply, and urgent attempts to find a cheap method of preservation were sought.

Primitive methods such as charring were employed, and in some cases pitch was used. Ineffective chemical methods were also tried in quick succession, with zinc chloride in various strengths being used. When this failed to produce the desired effect, copper sulphate in various forms and by many methods became a favoured form of treatment.

Although Bethel, a German chemist, had developed his effective system of pressure antiseptic treatment using creosote in 1838, no plant was installed in the United Kingdom until 1868. This process was adopted by the Post Office in 1869 and was used exclusively until 1912 when a process of impregnating creosote by pressure and merely coating the walls of the cells of the timber with antiseptic was introduced for the first time.

It is difficult to assess exactly how many forms of antiseptic treatment have been used in attempts to give ever-lasting life to poles. Records are held of some 79 processes – many akin to witchcraft! – which have been tried or examined. More recently specifications have been introduced for the use of copper, chrome and arsenic salts under various trade names, and these are the Post Office's latest venture into the field of experiment. Some 15,000 salt treated poles have been issued to the field and now await the lengthy process of life tests.

All antiseptic treatment, whether with oil or salts is monitored at every stage, thus ensuring strict quality control. Since there are many poles throughout the country still giving satisfactory service after standing more than 100 years, the Post Office may congratulate itself on attaining such a reliable and inexpensive item. Any development of glass fibre, plastic or any other man-made pole, will have to be very good indeed to equal this remarkable record.

More than 70 years old and still going strong . . . the 1904 pole being examined here by Bryan Hambly, an inspector of major works in Bedford Telephone Area, carries lines at a local timber yard.

Post Office technicians Stan Andrews and Charlie MacLean erect a new pole alongside a decayed one, which will later be removed. On top of their vehicle is a pole which was replaced after giving nearly 80 years' service.

Mr E. H. Wheddon is a Higher Executive Officer in Post Office Purchasing and Supply Department responsible for the provision of telegraph poles and associated equipment.

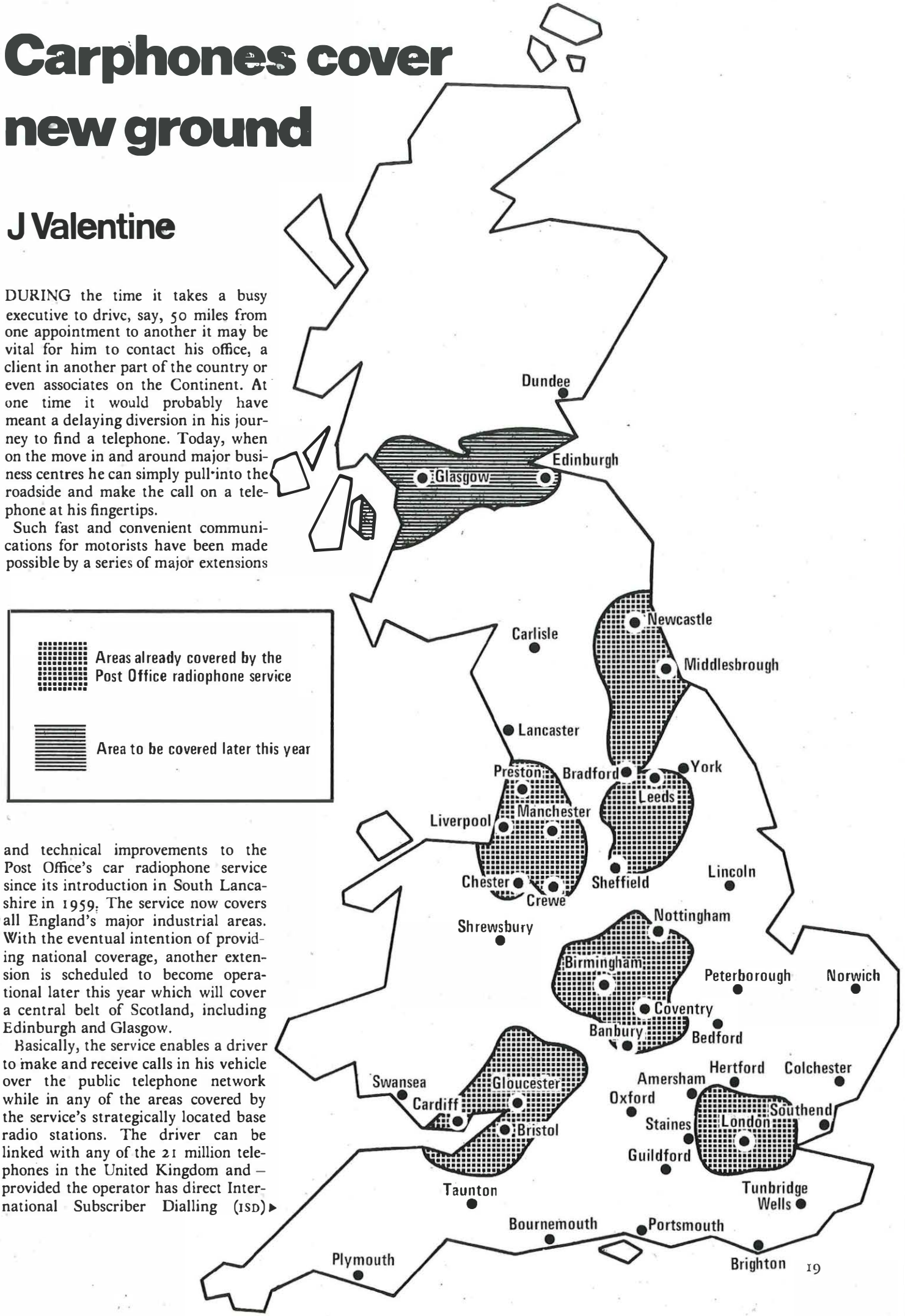
Carphones cover new ground

J Valentine

DURING the time it takes a busy executive to drive, say, 50 miles from one appointment to another it may be vital for him to contact his office, a client in another part of the country or even associates on the Continent. At one time it would probably have meant a delaying diversion in his journey to find a telephone. Today, when on the move in and around major business centres he can simply pull into the roadside and make the call on a telephone at his fingertips.

Such fast and convenient communications for motorists have been made possible by a series of major extensions and technical improvements to the Post Office's car radiophone service since its introduction in South Lancashire in 1959. The service now covers all England's major industrial areas. With the eventual intention of providing national coverage, another extension is scheduled to become operational later this year which will cover a central belt of Scotland, including Edinburgh and Glasgow.

Basically, the service enables a driver to make and receive calls in his vehicle over the public telephone network while in any of the areas covered by the service's strategically located base radio stations. The driver can be linked with any of the 21 million telephones in the United Kingdom and – provided the operator has direct International Subscriber Dialling (ISD) ▸



Opposite top: Using the radiophone at his fingertips a driver makes an urgent telephone call from the roadside.

Opposite bottom: The radiophone service enables this businessman to keep in touch with his office while taking a trip on the river.

access – to most countries in Western Europe, Canada, the United States of America, Australia, New Zealand, South Africa, Hong Kong, Israel, Singapore, Cyprus and Finland as well as main towns in the Irish Republic.

From its introduction in South Lancashire, the Post Office radiophone service has been expanded to cover areas in London, the Midlands and, last year, the industrial area of the East Pennines. The latest extensions, completed in April this year, take in 3,000 square miles of Severnside and South East Wales and an area of 2,000 square miles in the North East.

Although all Britain's major industrial areas will soon be covered by the radiophone service there is still much work to be done in extending the capacity of the system even further and in examining the marketing aspects. The Post Office hopes to organise meetings with approved equipment manufacturers with a view to staging and taking part in exhibitions to promote the service, and there might also be selective advertising and postal sales promotion to prospective customers.

The mobile equipment consists of a handset and control unit which may be fitted under the vehicle dashboard, a special aerial and a transmitter and receiver unit which is usually housed in the car boot. Recently a self-contained, portable set has become available which can be removed from the vehicle and carried over the shoulder.

Most present mobile units operate on any of 10 radio channels which have 25 kHz channel separation. One channel is for control and is used by the operator at the radiophone exchange to signal to mobiles, while the remaining nine channels are available for transmitting calls.

The nine traffic channels are allocated to different sectors into which a service area is divided. A channel selector switch enables the user to select a suitable free channel, and he then presses a call button to contact the operator. Ringing tone indicates that the call has reached the radiophone switchboard. Incoming calls to a mobile unit are indicated by a call lamp and a short buzzing tone. The user then contacts the operator using the procedure as for making a call.

A positive step to help cater for increasing demand, particularly in the London area, is the introduction of new 55-channel mobile equipment. This will gradually replace the existing 10-channel equipment, giving customers a much greater choice of channels and, in turn, affording an increase in user capacity of several hundred sets. Further increases would depend on achieving improvements in operating procedures to avoid any degradation in service.

A current problem is that the radiophone frequency spectrum allocated to the Post Office is being used to capacity and the Home Office may not be able to release further frequencies before the 1979 World Administrative Radio Conference. It is essential, therefore, to make more efficient use of the bandwidth currently available.

One way of doing this would be to switch from 25 kHz channel spacing to 12.5 kHz. Tests are being carried out to see whether this could be done without disrupting or modifying the existing system. If modification is necessary the high cost would need to be balanced against the fact that the capacity of the system would be doubled. And if this step was combined with a change to an automatic system – currently all calls are connected by operators – less channel time would be used setting up each call. As a result, capacity could be further increased.

Even so, maximum use would still not be made of each channel. Pauses would remain while calls were set up and during breaks in conversation, but to utilise this time would require sophisticated electronic monitoring and switching equipment at all points in the system. At present this would be neither economic nor practical, but as both the size and cost of large-scale integrated circuitry reduces it does become a more realistic proposition.

Technical developments to date have already provided considerable advances in user capacity and improved service. The first system in South Lancashire had a maximum capacity of only 300 users, and while the second, opened in London six years ago, had a similar capacity it was based on an improved service, known as System 1. This provided the major advantage of selective calling, by which individual customers could be called exclusively. Previously a customer had to listen in to all calls, only "switching off" when he knew the calls were not for him.

The first two systems quickly became used to capacity and in London a waiting list built up. To allow for early expansion in London and other conurbations a new system was designed around standard, commercially available radio equipment which required minimal modification. Known as System 3, it was introduced in London in 1972 and today is the basis of all services now in operation.

Although the new system was similar to its forerunner in some respects, there were some major changes. The use of 25 kHz spaced VHF channels instead of 50 kHz allowed a more efficient use of the frequency spectrum, contributing greatly to increased capacity. Its initial capacity of some 700 customers was, in fact, more than twice that of the old system and was later developed to serve up to 3,000.

Perhaps the most important advance in System 3 however, was the introduction of very much faster selective calling, call-connection times between the radiophone switchboards and customers being reduced from up to 30 seconds to less than two seconds. Another significant innovation was that customers could use their radiophones in any of the available service areas, regardless of their "home" area.

Before System 3, operators had no indication that a call had been received by a mobile unit until the customer lifted his handset and announced his identity. It could be many minutes before a driver found it possible to stop and answer, so operators often had to dial the same number several times. Under the new system the car set automatically acknowledges a call without the customer having to lift his handset, and operators are given a lamp signal to confirm that the call has been picked up by the vehicle. Lamps also provide positive clear down signals to indicate that a call has been completed.

Currently there are about 2,500 Post Office radiophone customers throughout the country and there are clear indications that this number will continue to increase. In London alone applications are still being received at the rate of 50 a month, and demand for this service by 1980 has been estimated at 6,000. The Post Office is anxious to meet the challenge, and the next long-term major step could well be a switch to an automatic system.

Mr J. Valentine is product manager of new services in the Sales and Installation Division of Telecommunications Marketing Department.

PO Telecommunications Journal, Summer 1976

A new bill is on the way

AG Martin

THE computerised system of billing Britain's 12½ million telephone customers has, over the years, become the biggest single operation of its kind in the country – and one of the most complex. Every year more than 50 million quarterly bills drop through letterboxes throughout the country at the rate of about 200,000 every working day – equivalent to one for every inhabitant of a city approximately the size of Portsmouth.

The computerised billing system which makes this massive operation possible was first introduced by the Post Office in 1967 and it is now based on 11 LEO 326 computers at six computer centres in different parts of the country. Over the years the original system has undergone modifications to cope not only with an 80 per cent increase in customers but also with the introduction of decimal currency, Value Added Tax, frequent tariff revisions and a wide range of changing requirements within the Telecommunications Business.

It was clear, however, that a new system would eventually be needed, and a feasibility study was undertaken in 1972. Following this a vast amount of design work was undertaken and the result is that a new billing system (NBS) using modern and more powerful ICL 2970 computers and carefully designed to incorporate flexibility, job satisfaction and management control, should be ready for national implementation to begin in May next year.

Because of the greater capacity of the ICL 2970s, it is expected that the whole of NBS can be accommodated at the Post Office's Edinburgh, Derby and Bristol computer centres. The Edinburgh centre will take on the initial load, followed by the other two centres as Areas progressively change to the new system at the rate of about three Areas a month. The whole implementation should be completed by the end of 1978 and the whole system has been planned to meet the needs of the Business through the next decade.

Exhaustive system trials of NBS are already being undertaken, and pilot runs producing bills for Middlesbrough Telephone Area should begin in December. London's West Telephone Area will join in the pilot runs a month later. The aim is to prove the system under operational conditions and rectify any shortcomings.

The need for a completely new system has been created mainly because all the modifications which had to be made to the original system resulted, in the main computer billing programs growing large and cumbersome. The point was reached where further additional facilities could only be provided, if at all, by lengthy and often highly complicated and expensive rearrangements of the machine processes – sometimes with detrimental effects on existing facilities.

Also, as the billing system developed, other major linked computer systems designed to supply charging data to it were being developed and implemented. These included Customer Rental Records (CRR) which provides rental charging information and the Input System for Operator Controlled Calls (ISOCC), which supplies ticketed call charge data. It was found that the maximum benefits from these new systems could not be realised with the existing billing system.

With an expected useful life of about 10 years, the LEO 326 computers – by now obsolescent – were due to be replaced over the period 1976 to 1978 by more modern machines. This could not be delayed because as the machines grew older their maintenance and that of an efficient billing service was likely to become progressively more difficult. In any case, there would be insufficient LEO 326 computer capacity beyond 1978 to cope with the ever growing load of telephone bills.

Accordingly, the Telecommunications Business and the Post Office Data Processing Service (DPS) jointly undertook the feasibility study. The aim was to design a system which would, at acceptable cost, not only provide better facilities for customers and for billing staff in Area Offices, but also exploit the capabilities of the new generation of computers which were becoming available. In addition to achieving closer integrated working between CRR, ISOCC and billing the main aims were to achieve flexibility, job satisfaction and better management control.

Specialist teams were set up in Telecommunications Finance Department (TFD) and the DPS to design, test and eventually implement the new system. The teams have operated under a Computer Billing Steering Group, chaired by TFD. Membership of the Steering Group and the various subsidiary working parties has included Regional and Area representatives to ensure that field interests are not overlooked. In addition, of course, there has been close consultation with the trade union interests involved as system design has developed.

The ability to accommodate changes to meet fresh statutory or business policy requirements as they arise was of prime importance and there had to be sufficient in-built flexibility to enable such changes to be made quickly, effectively and with the minimum of cost and overall disturbance. It was also felt important that the new system should provide maximum involvement by Area billing and revenue collection staff in its control and operation. It should also provide Area billing staff with more comprehensive and convenient bill information, to help them deal with customer queries.

As far as management was concerned the new system should provide a wider range of control statistics to enable Area management to monitor continously the efficiency of the billing and revenue collection operations under their control. And finally one more important aspect was to ensure that unbilled revenue should be reduced to the absolute minimum.

So how, exactly will NBS meet these aims? For a start the many suites of computer programs involved have been carefully designed, using the latest programming techniques, to provide the necessary inbult flexibility to cope with change. In particular, program construction has been based on the modular principal, whereby each program is made up of self-contained "packages", which makes for easier maintenance – a close parallel to the way modern electronic exchanges are constructed.

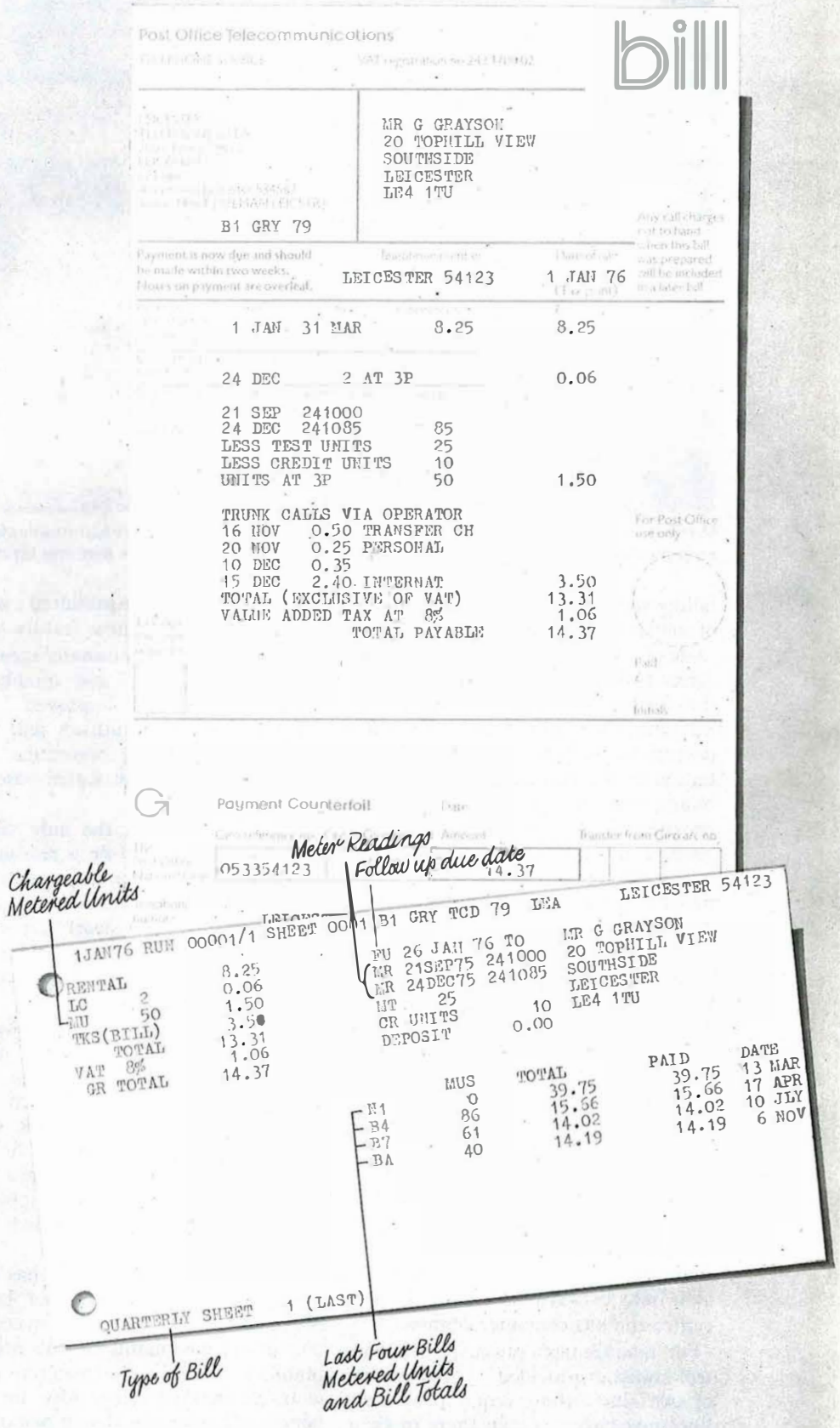
As for Area office staff employed in

billing and revenue collection, several improvements will result. First, and possibly most important, the present unwieldy and inconvenient bill listings – records of the bills sent to customers – on 19-in wide continuous computer stationery will disappear. In their place, individual bill summaries (IBS) will be provided, one for each customer bill produced. These will be on individual sheets, 8 in by 4 in, and held in ring binders available in several different colours to make identification easier. A purpose-built rack has been designed for their storage, which can either stand on the desk top, with a stacking facility or fit in the drawer of a standard desk.

With the comprehensive customer and billing details on the IBS billing clerks will have quick and easy access to the basic information they need to deal with customer bill queries in an efficient, business-like manner. Another NBS improvement for billing staff will come from a re-arrangement of the procedure used for ISOCC in which operator-controlled call charge information is provided to Area billing staff on microfiche – a piece of postcard size microfilm. These fiche contain details of all chargeable trunk and local facility calls made through an operator, listed in telephone number order. A single fiche can show details of up to 4,000 individual calls.

At present fiche are produced each month for use by Area billing staff in dealing with customer enquiries and it may be necessary to reference three separate fiche to clear a customer's enquiry on his quarterly bill. When NBS is introduced the production of fiche will be triggered off as part of the bill production processes, with the result that the call charges brought to account on a quarterly bill will be listed together on a quarterly fiche. This arrangement should reduce search time on specific call charge queries and facilitate the handling of customers' enquiries.

Area control of the billing operation will be significantly strengthened by the use of the Telecommunications On-Line Data System (TOLD) – see Telecommunications Journal, Winter 1975/76. Input of meter readings, payments, amendments and interrogations will be under the direct control of Area staff via the TOLD network, using visual display units (VDUS) located in billing and commercial cash groups. There will be a data retrieval facility through TOLD, giving direct access to the payments data input within the preceding week; this will greatly assist ▸



An example of how the new bill will look to the customer and copy of an individual bill summary for use by Telephone Area office staff.

Marilyn Trudgill an Executive Officer in the new billing group at Telecommunications Headquarters, shows how customer enquiries will be dealt with using the new individual bill summaries and ring binders.

billing staff in applying the later stages of follow-up of unpaid bills.

Use of TOLD for inputting data to NBS direct from the Area Offices will have the further advantage of largely eliminating the existing data conversion delays. This will make a major contribution to the general efficiency of the billing operation. In particular it will produce a significant reduction in the amount of revenue earned but not yet billed, by enabling meters to be read much closer to the billing day than is possible at present.

The existing gap could be narrowed by as much as a week and, at current traffic levels and tariffs, lead to a reduction in unbilled revenue by up to £30 million, improving the Business profit by about £3 million per year through reduced borrowing needs. Rental and operator-controlled call charge data are, of course, not input to billing direct from the Area Offices, but passed to billing via the CRR and ISOCC systems. It is also hoped to speed the flow of this charging information under NBS by providing data transmission links between the CRR and ISOCC centre and NBS computer centres.

For management purposes, the control statistics provided by NBS will be of two kinds: those required by first-line supervisors to help them in their day-to-day control of billing work, and those necessary to provide Area management with a comprehensive picture of work flow and revenue collection efficiency. Computer-produced work flow statistics are a new feature with NBS, providing a continuous measure of the volume, rate and quality of work performed. Improved and expanded revenue statistics will simplify Area balancing procedures and provide a more sophisticated base for revenue forecasting.

For the customer, the only visible change with NBS will be a redesigned bill form with a clearer presentation and an improved standard of computer printing. The most important new feature of the NBS bill design is the method of presenting the metered units information. This entry will show not only the number of chargeable units (as now) but also the opening and closing meter readings, the dates on which they were taken, and the number of test and credit units allowed. Bills for private branch exchange installations will show a bulk entry for chargeable units supported by a separate statement which will give details for each PBX line.

This additional information has been requested by the Post Office Users' National Council to help overcome customers' complaints at the present inability to check the metered units charged on their bills. Also for the benefit of customers, definitions of the terms "metered units", "test units" and "credit units" will be printed in the notes on the back of the bill.

The changeover to NBS is basically transferring records from one type of computer to another, and will require little manual involvement. The situation will, therefore, be very different from that encountered during the original conversion to computer billing in the late 1960s. In order to smooth the way, each Area will take part in a "spring-cleaning" exercise about six months before conversion is due, aimed at removing from the current computer files any "rubbish" which may have accumulated over the years. A small implementation team will be set up in each Region to oversee the conversion and to give training to Telephone Area billing staff in the new procedures.

The detailed system design and programming for NBS has been a massive task. Already more than 250 man-years of effort in TFD and DPS have been devoted to it and by the time NBS is fully tested and operational this will have almost doubled. But, to put things in perspective, NBS will be the prime Post Office Telecommunications revenue collecting vehicle for perhaps the next 10 years, during which – inflation apart – total collections may exceed £30,000 million!

Mr A. G. Martin is head of the Billing Development Section in Telecommunications Finance Department and project co-ordinator for the New Billing System.

Overcoming a bad atmosphere

CF Davidson

SERVICES the Post Office provides for its customers must above all else be reliable, and to this end transmission systems used in the network are designed to specific standards. Good engineering ensures equipment reliability and for line systems – cable, waveguide, optical fibres – transmission is stable although subject to hazards such as civil engineering work.

Microwave radio-relay systems are different. They use the atmosphere as a transmission medium, and the characteristics of the atmosphere are affected by the weather and are therefore variable. It has to be accepted, in fact, that for the frequencies available, satisfactory transmission will not be possible for very short periods during the year.

It is to try to overcome problems like this that the Post Office has been carrying out studies for several decades on the sending and receiving of radio signals through the atmosphere. The latest phase of this propagation work is a comprehensive study of radio transmission along the earth's surface at frequencies above 10 GHz.

This vital work, now being undertaken by staff at the Post Office Research Centre, Martlesham, is enabling the Telecommunications Business to plan its future radio systems and contribute to the International Radio Consultative Committee (CCIR) of the International Telecommunication Union. This organisation recommends the permissible duration of radio-relay system degradations due to poor propagation conditions caused by the weather. (Existing recommendations apply to analogue systems and those for digital systems will be made in the near future.)

And another important aspect of work currently taking place at Martlesham in the propagation field involves measurements of signals from outer space and from experimental satellites. Results of this work will help ensure that future satellite systems provide reliable, high quality circuits.

Consider now how the atmosphere and the weather affect the transmission of terrestrial radio signals. To begin with the atmosphere is not uniform. Normally, moving vertically upwards from the earth's surface, the temperature, pressure and humidity decrease; this means that the refractive index, which determines the bending of the signal path, decreases with height. Using elementary optical theory it is easily shown that a radio wave follows the curved path shown in Fig. 1 (page 27). Distance between the transmitter and receiver can be greater than a straight line would allow.

In bad weather the change in refractive index with height may be less than normal and sub-refraction is said to occur. Under these conditions the curvature of the ray (signal path) is less and obstruction by the earth may occur, greatly increasing signal loss.

Another important condition is super refraction which occurs when, at certain heights, the refractive index decreases with height much more rapidly than normal. This leads to "ducting", the wave being trapped between layers of the atmosphere as shown in Figs. 2 and 3. The result may be enhancement of the signal, its complete loss or its ▶

The refractive index height which determines the bending of the signal path is an important consideration in radio propagation work. Research Department Engineers Graham Packer and Dave Turner prepare to measure its variation using this special equipment here being hoisted up a radio mast.

Meteorological Condition	Attenuation dB/km		
	11 GHz	19 GHz	37 GHz
Clear weather	0.02	0.10	0.14
Light rain 5mm/hr*	0.12	0.50	1.54
Heavy rain 100mm/hr*	4. 4	12. 0	24. 0
*includes gaseous absorption			

distortion owing to there being more than one transmission path. Super-refraction can occur, for example, when warm, dry air passes over a cool sea surface so that, instead of a decrease, an increase in temperature with height occurs.

Let us look now at the absorption and scattering of signals. Again an optical analogy is useful. Anyone who has driven in fog knows that it scatters the light from headlamps and throws it back. Also, in fog the light from the headlamps of oncoming cars is much reduced from that in clear weather – the fog scatters and absorbs the light.

Exactly the same thing occurs with microwave radio signals when they are propagated through mist and rain. Raindrops may be as big as half a centimetre in diameter which is the wavelength of a 60 GHz signal; it is therefore to be expected that the effects of rain will become more serious as this frequency is approached. The table above shows how serious the signal loss due to rain becomes as the frequency and rainfall rate increase.

Other sources of signal loss are water vapour and oxygen in the atmosphere which absorb signals at 22 GHz and 60 GHz respectively. Absorption by water vapour at 22 GHz is not very serious relative to rain loss but absorption by oxygen at 60 GHz is considerable. This means that the latter frequency band can only be used for transmitting signals over distances of a few kilometres, or signal loss becomes excessive.

Clearly all propagation difficulties can be overcome by using short enough paths, but in practice radio-relay systems must use the maximum possible hop lengths – distances between repeaters – consistent with providing a reliable service. This minimises the number of repeater stations and thus reduces system costs.

Systems are designed so that with constraints such as available transmitter power, permissible aerial size and minimum strength of received signal that can be used, there is a large margin to allow for signal fading, often 40 dB. Only when this amount of fading is exceeded does transmission become unsatisfactory. Hop lengths are chosen so that the duration of this excessive fading is acceptable.

There are, however, techniques available for minimising fading effects. Normally radio-relay systems are designed so that there is only one propagation path between transmitter and receiver but under abnormal propagation conditions – for example, when "ducting" occurs – propagation may take place along the secondary paths as indicated in Fig. 4. The signal via the secondary path is delayed compared with that over the main path because it travels further. If the delay is long then serious signal distortion may result even when the signal received over the secondary path is weaker than that over the main path.

But if the delay is small the main effect will be the enhancement or weakening of the main signal, depending on whether the signals over the secondary path or paths are in or out of step with the main signal. One way of combating the latter effect is to use two aerials at different heights so that if the resultant signals are out of step at one aerial they are in step at the second aerial.

The stronger signal is then selected or, alternatively, a combining technique can be used in which the resultant signals from the aerials are brought into step and then added together.

As already described signal loss due to rain becomes increasingly severe at the higher microwave frequencies. To provide a reliable service short hops must be used, typically 5–10 km at 19 GHz. Alternatively, longer hops can be used in which the signals are transmitted along roughly parallel routes but sufficiently separated so that a heavy rain shower does not affect both routes simultaneously; the better signal is then selected. This technique is known as route diversity and is essential for frequencies above about 40 GHz unless extremely short hops – about 2 km – are used.

A technique similar to route diversity will be used for intercontinental communications satellite systems because even now increased traffic is forcing these systems to use higher frequencies. Transmission in the bands at present used – 4 and 6 GHz – is scarcely affected by the earth's atmosphere through which the signals pass quickly, but ultimately 30 GHz and 20 GHz will have to be used for paths to and from satellites, respectively, with consequent serious signal loss when heavy rain showers pass through the paths. Path diversity to avoid the rain, obtained by using separated earth station aerials, will be the only means of obtaining a satisfactory service.

Reference has already been made to the discrete frequency bands available to communications, and it is essential that these bands are used as efficiently as possible to cater for traffic growth and new services. A technique for doubling the traffic carried in a frequency band which is being actively considered by telecommunications engineers throughout the world, including the Post Office, is the transmission of two independent signals at a given frequency, the signals requiring receiving systems set at right angles. Reference to television broadcasting may help explain the principle. The BBC low power Salisbury transmitter for instance needs vertical receiving aerials which discriminate against the high power Oxford transmitter on the same frequency which needs horizontal aerials for reception.

In clear weather good isolation is achieved between such signals but when it is raining heavily the signals received interfere with each other because raindrops are slightly flattened spheres canted by the wind. Statistical data on this effect are currently being collected throughout the world so that systems exploiting the technique can be designed to meet CCIR recommendations.

Much more research into radio propagation techniques still needs to be done and Post Office engineers are well aware of the need to design and plan reliable and economical systems which maximise the use of the radio frequency allocation. But one thing is certain: radio-relay systems are becoming an increasingly valuable asset in communications development.

Mr C. F. Davidson is head of the Microwave Transmission Division in Post Office Research Department, Martlesham Heath, with special responsibility for radio satellite and waveguide systems.

PO Telecommunications Journal, Summer 1976

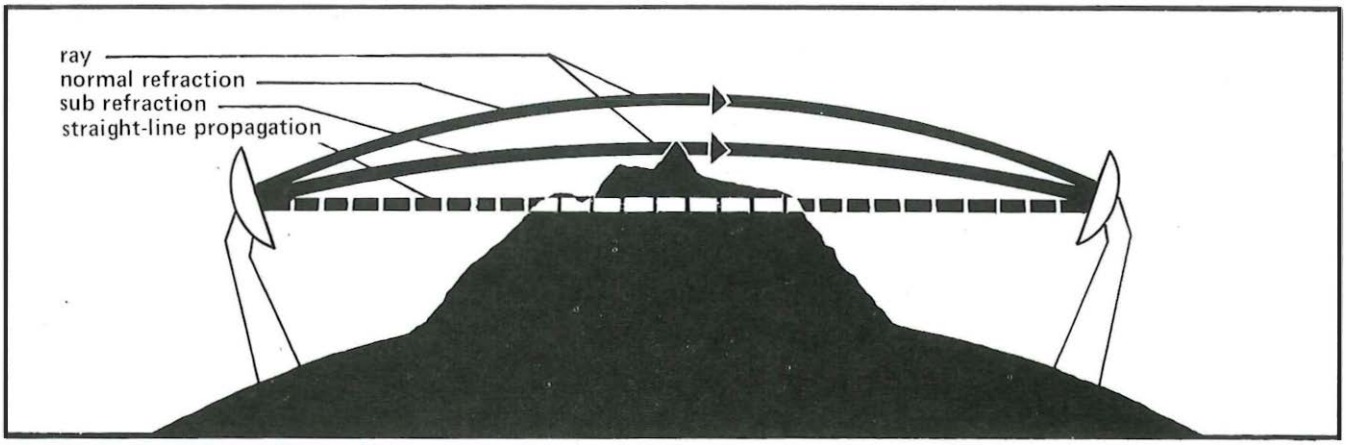


FIG. 1 PROPAGATION THROUGH THE ATMOSPHERE

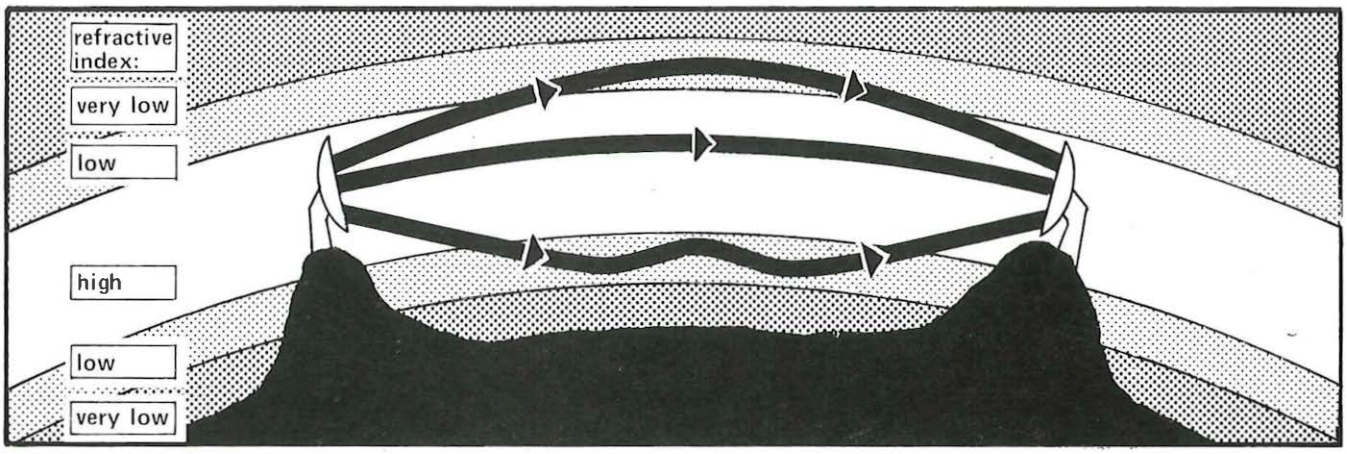


FIG. 2 DUCTING

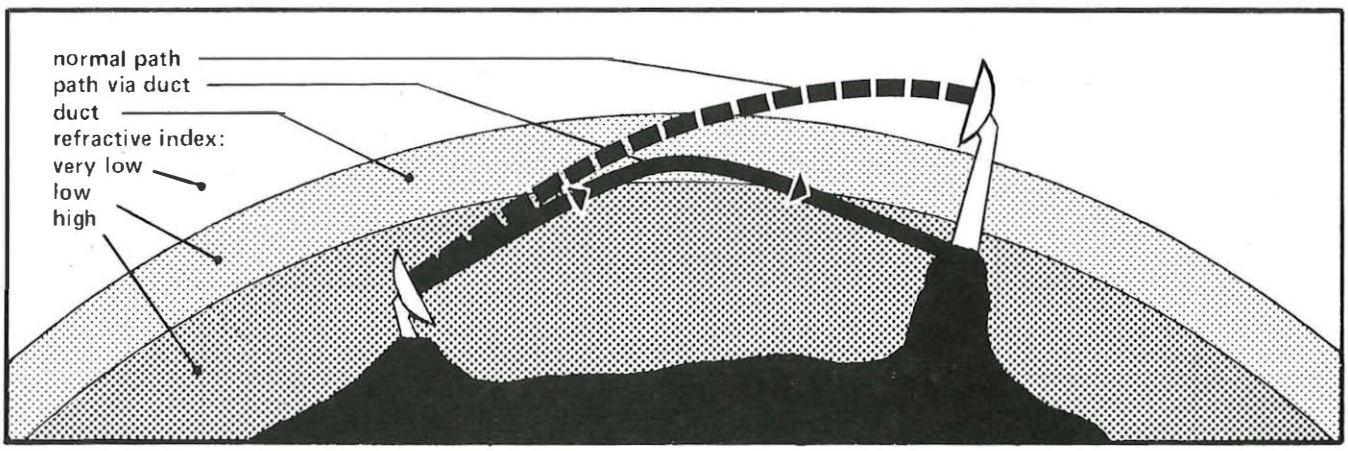


FIG. 3 DUCTING – ANOTHER EXAMPLE

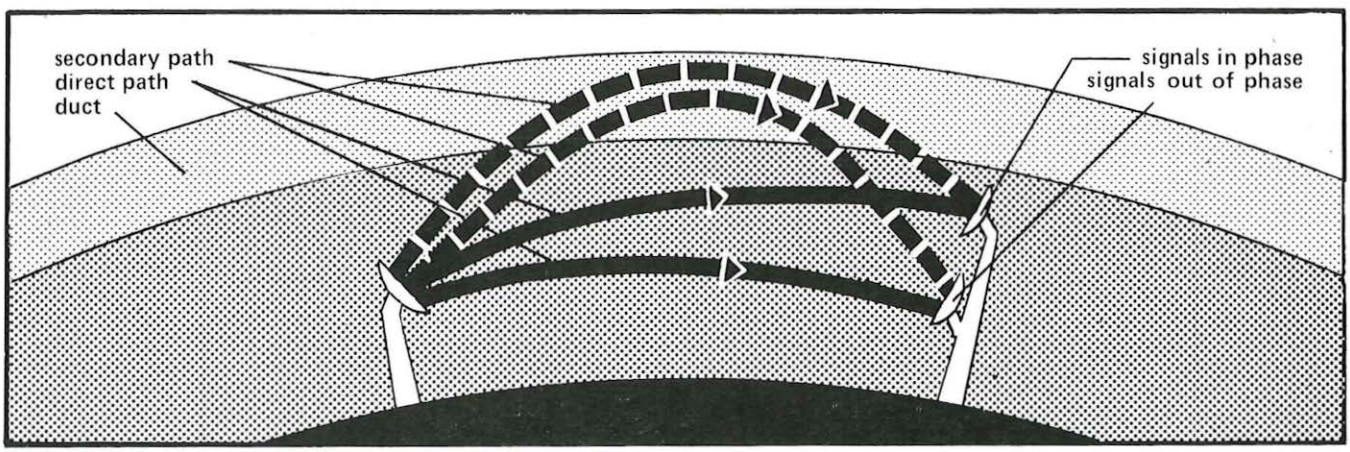
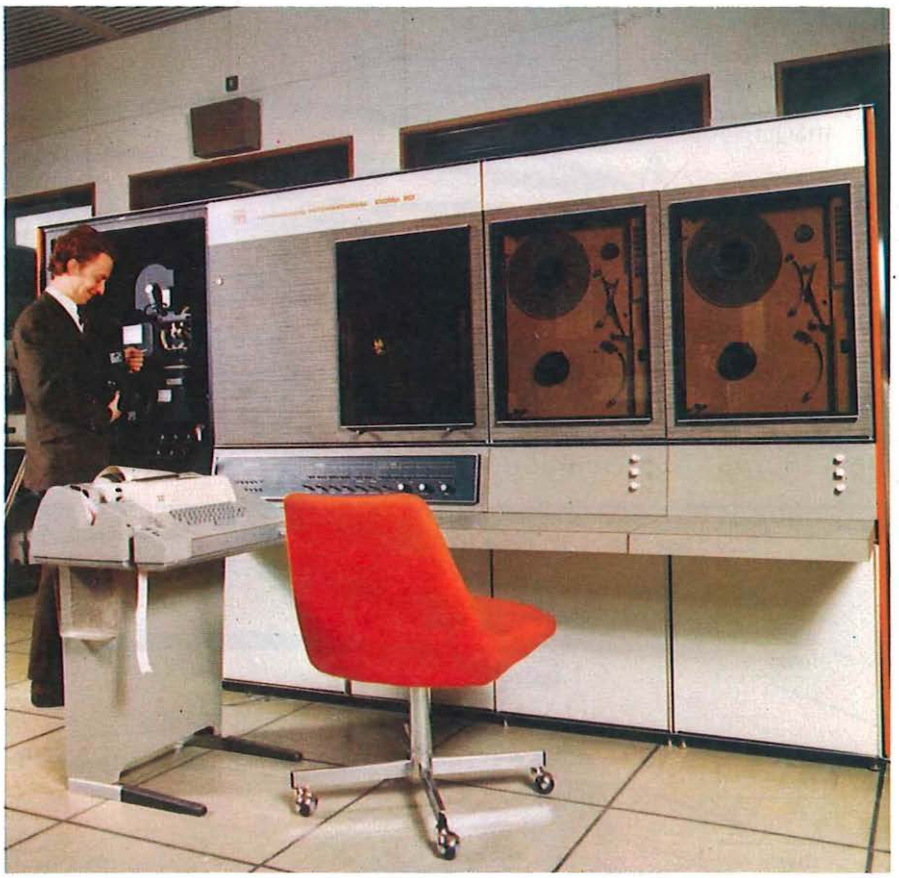


FIG. 4 HEIGHT DIVERSITY

Film improves the image of DQ records

RH Willis



Above: The COMp 80 equipment at the Post Office's Leeds computer centre, which processes telephone directory information and outputs it on microfilm in a form suitable to print updated records for Directory Enquiry operators.

Below: After developing, microfilm output from the COMp 80 equipment is examined to ensure that the images are clear.
Each frame contains two complete pages of a DQ directory.

WITH about a million calls received every working day by the Post Office's Directory Enquiry (DQ) service, the time its operators spend searching for subscribers' numbers is clearly significant from a cost viewpoint. But frequent and extensive changes occur to the directories that operators must have at their fingertips, and the workload associated with producing amended records has been doubling about every five years.

As a result, the Post Office, in common with telecommunications administrations in other countries, has been faced with the increasingly difficult task of providing a quick, efficient and economically acceptable means of updating its DQ records. In a radically new approach to solve the problem a system is now in operation which uses an advanced type of computer output on microfilm (COM) equipment. In this system directory information held on computer tapes is automatically prepared in an easy-to-read form and produced as complete pages on microfilm from which the printing plates are then made for subsequent production of the directories.

As well as greatly simplifying current preparation and printing procedures, the new system may also avoid a longer term need to consider major expansion in paper printing capacity to cope with continued growth in DQ

records. This is made possible by the fact that, in addition to microfilm for printing, the COM equipment is capable of producing output on microfiche – postcard size sheets of film, each of which would contain 200 pages of a directory. Individual pages and entries on a fiche are easily located and read using special viewers which display an enlarged image of the selected page.

Trials recently completed at the London (Bloomsbury), Nottingham and Walsall DQ centres have shown that a microfiche method of working is feasible. This has been accepted by the Telecommunications Business, subject to a successful outcome of consultations with the Council of Post Office Unions.

The COM equipment used in the production of DQ records is the first of its type in Europe. Called COMP 80, it incorporates a small computer under program control, a cathode ray tube and microfilm camera. The equipment is installed at the Leeds computer centre of the Post Office Data Processing Service (DPS) where it makes use of information already stored on magnetic tapes for the production of public telephone directories.

Data on these tapes is first processed by the COMP 80 under complex programming rules to give the required typographical format, such as bold characters, capital and small letters and page headings. Entries are assembled into complete pages which are then sorted into the order required for printing and displayed on the CRT. Using its built-in camera, the equipment photographs the displayed images on 35 mm roll film, with two pages to each frame.

At this stage the films are transferred to automatic developing equipment in which a reversal process – that is, positive to negative – produces the high definition white images on a black background necessary for making the printing plates.

The processed films are checked and then sent to Post Office Reprographic Services units in London and Edinburgh which are responsible for printing the DQ records. There special platemaking equipment is used to produce the printing plates to the correct page size directly from the film images.

The system provides DQ operators with complete new directories every 13 weeks, with a complete set of comprehensively updated supplements each week. Printing of a whole directory takes only five or six days, and the supplements can be provided within 24 hours. Previously, for many years these records were produced by a largely manual method, known as Flexocopy, which involved typing each subscriber's entry on separate strips of paper and inserting them into panels which were then photographed to produce the printing plates.

First introduced for the larger DQ centres in London, the Flexocopy system was later expanded to cater for the whole of the country and by 1971 about two million pages of print were being produced each week. Because the printed records were based on manually produced originals their legibility was poor and design limited. In short, the whole operation had become extremely cumbersome and it was clear that the system would have to be changed to cope with growth.

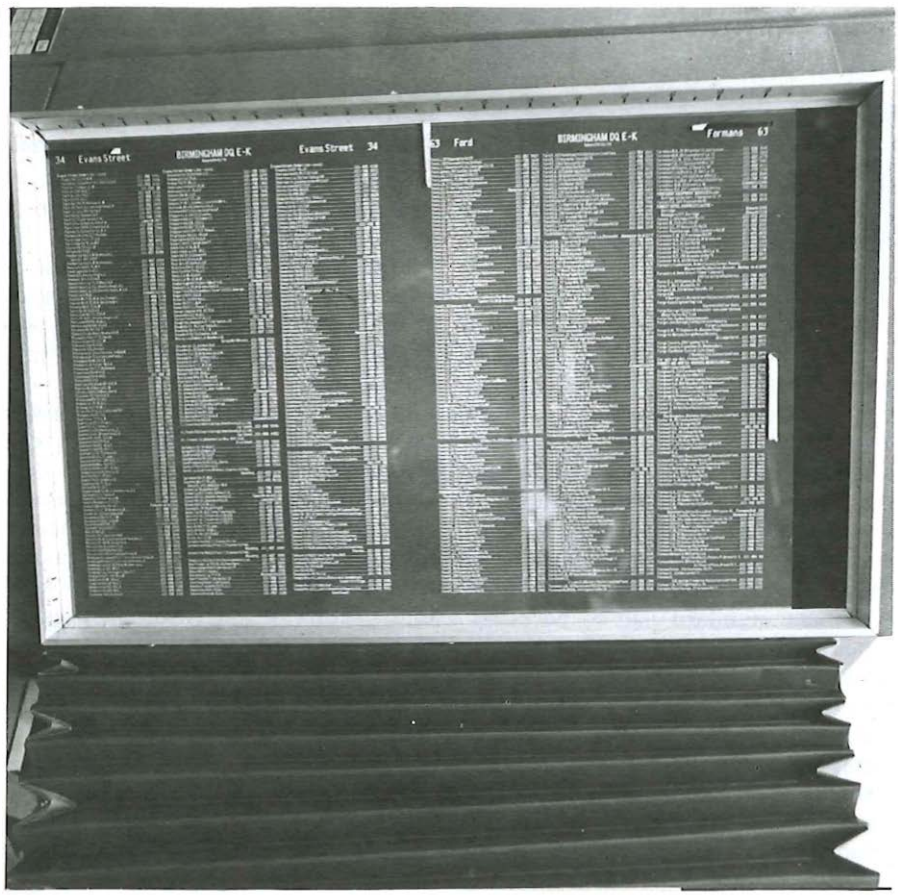
As all the information required for updating the DQ records was contained on a computer file for production of the public telephone directories, consideration was first given to using computer printout as the master record from which copies could be produced. Readability of the output proved unacceptable to the DQ operators, however, and it was doubtful whether a reasonable quality of printing could have been maintained in any case.

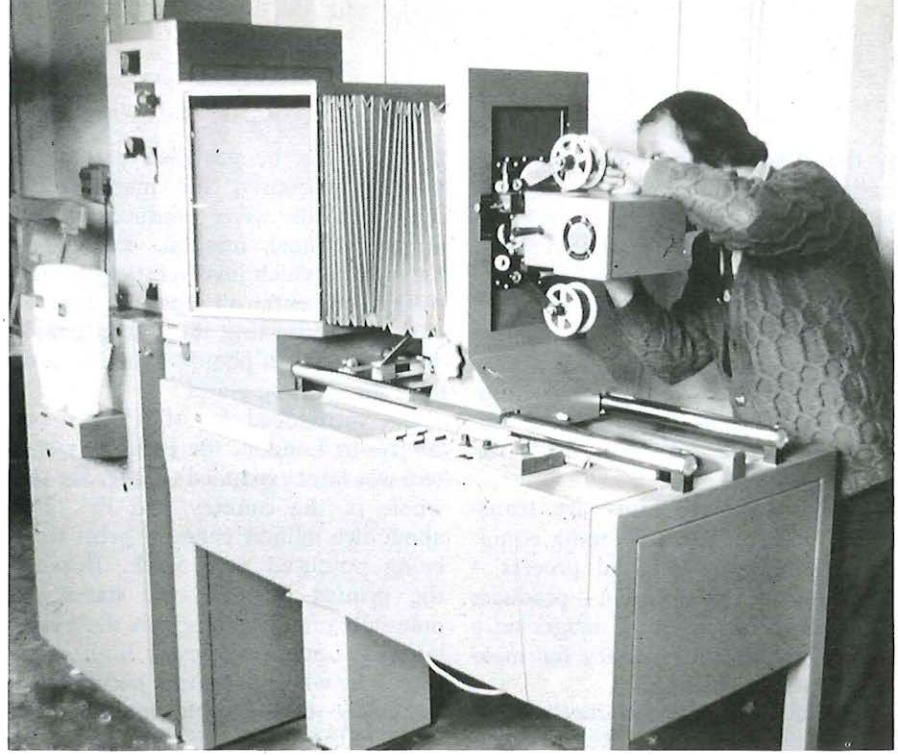
Meanwhile the Office Services Section of Telecommunications Management Services Department (TMSD) had realised that COM equipment could provide the answer if a process with a typographical standard better than that of computer printout could be provided and if a way could be found to print from the film output. Following discussions with manufacturers in the reprographic field, the COMP 80 was found to give the required quality.

A number of problems still had to be resolved and production procedures established. Clearly there was no point in proceeding with the project if the end product did not have good legibility and compactness, and could not be printed to an acceptable timetable. For these reasons it was decided in the early stages to concentrate development on the final printing process rather than the computer processing.

In co-operation with the COMP 80 manufacturers, TMSD had to establish, for example, that the computer programs were capable of manipulating the subscribers' data held on magnetic tape to apply the necessary typographical rules, such as pagination, column length, page turnover and alphabetical sequencing. They also developed a method of producing two ▶

A sideways view of two pages on a frame of microfilm, enlarged on the platemaking equipment to the size in which they will be printed.





At a Post Office Reprographics Service unit, microfilm is loaded on to equipment which makes the plates used in printing the DQ records.

Printed pages of a DQ record, ready for collating into directories.

pages on each frame of the 35 mm film to achieve a correct order of pages for the subsequent printing stage, and were able to redesign certain characters, such as "e" and "a", to lessen the risk of print smudging.

Another important step was to confirm that the polarity of the COMP 80's microfilm output could be reversed at the film processing stage. This output is positive – that is, black characters on a white background – whereas negative images are required to produce the printing plates so that the final printed records are black on white paper. To achieve this the processor partially develops the film, followed by re-exposure to give the reversal before finally developing, fixing, washing and drying the roll of film.

Machinery suitable for production use to convert from 35 mm film to printing plates was not easy to obtain. But following discussions with a manufacturer of special platemaking cameras, TMSD were able to establish that a modification to its equipment would enable rolls of film to be handled. Even so, the feasibility of controlling the quality of printing to an acceptable standard had to be established. This was not simple because, generally, to enlarge an original 35 mm frame of film up to A3 page size and print is not a normally accepted technique.

Much work still remained to be done in proving production programmes, having special computer programs written and in costing the project, but there were no major changes from the original conception. With the co-operation of all Departments at Telecommunications Headquarters involved in the project, as well as DPS and the unions, the COMP 80 system became operational in 1974. Apart from a few teething troubles there has been little difficulty, and considerable cost savings have been made.

While the main reason for buying the COMP 80 unit was to produce DQ records, its excellent programming facilities and capability of producing microfiche output have been successfully adopted for other, comparatively small in-house applications.

The various internal applications include the Post Office Directory Advertisements Control which maintains an updated record of all Yellow Pages entries until a particular book is ready for printing, the Staff Statistics System where basic staff information is held in fiche form, and junction network statistics.

As outlined earlier, the COMP 80 also gives the option of changing DQ records from book form to microfiche if growth of the system or operational needs require it, and to achieve this without any major change in the computer file or computer programs. Such a system would, however, require the production of some 36,000 high-quality fiche copies every working day, and the longest run from any original would be 4,000.

This output would then need sorting and despatching throughout the United Kingdom telephone system, a full record in a DQ centre consisting of about 1,000 fiche. As far as is known this would be the largest job of its kind in Europe.

Beneficial "spin-off" from the development of the COMP 80 system can already be seen in the smaller Post Office applications and in the commercial work of DPS which has a number of customers interested in both microfiche and paper records. And looking to the future, it might well be possible to use the equipment in the digitisation of engineering drawings.

Mr R. H. Willis is Reprographics Manager in Post Office Purchasing and Supply Department, and was responsible for much of the initial development of the COMP 80 project.

Keeping stores under control

AC Anderson

A scheme to improve the control, use and financial accounting of the vast quantities of Post Office Telecommunications stores needed for internal construction work is being introduced nationally, and is also on trial for external works.

ENGINEERING stores in the Post Office are big business by any standards. In the Telecommunications Business alone expenditure on new stores for construction and installation work in Telephone Areas is likely to top £195 million during the 1975/76 financial year and, in the same period, stores valued at about £33 million will be recovered for re-use or scrap, according to need and their condition.

The vast quantities of material represented by these figures clearly require effective control and management to avoid unnecessary expenditure and handling effort. Recognising the importance of these needs, the Post Office has in recent years operated sophisticated computer-based systems of stock control to optimise holdings, both centrally in its Supplies Division (SUPD) and in Telephone Areas.

In Telephone Areas the advantages of a computer-operated system are most readily achieved in section stock holdings. These stocks cater largely for the installation and maintenance of customer services for which stores demands follow a fairly regular pattern. The engineering stores control and pricing system, called ESCAP, operated by the Post Office ensures that section stocks are kept at an adequate level to meet day-to-day requests from users without unnecessarily tying up capital in idle stock.

Within the rules of ESCAP, construction work may be supplied with stores from the range of items held at section stocks, but in practice this work obtains a large proportion of its stores from SUPD central stocks and manufacturers on an individual job basis. The receiving Area then holds the stores until each job is ready to start. In this situation, overall control of holdings is difficult to achieve, and the best approach is to exercise control over stores on an individual job basis.

To cater for changing priorities and to offset delays in deliveries from suppliers, the movement of stores between jobs has become an essential feature of meeting construction objectives. However, this action can lead to confusion unless it is closely governed by a control system which allows flexibility in the movement of stores and provides the ready facility to record action taken. The system employed must also ensure that surplus and recovered stores are accounted for as well as being put to effective use.

Job stores, each individually boxed and indexed, are checked against the storekeeper's copy of the A6310 form at a Works Order store in London's North Telephone Area.

With these points in mind a scheme has been developed in the Telecommunications Business to provide the means of meeting the stores requirements of each job from conception at the planning stage to the final act of "dispensing with the remains" when the job is finished and the paperwork has been closed.

The scheme embodies procedures which enable the movement of stores for a job to be tracked throughout its life so that shortages can be recognised and remedial action taken before installation is due to start. It also identifies unused items, making them quickly available for other tasks or disposal to the benefit of the Business.

To achieve these objectives the existing Stores Summary Sheet prepared for each job has been radically redesigned. Now known as the A6310 form, it is no longer simply a schedule of stores items needed but serves a multi-purpose role, six different versions of the form facilitating better stores control, utilisation and financial accounting. As a valuable spin-off, two versions replace requisitions for stores ▸

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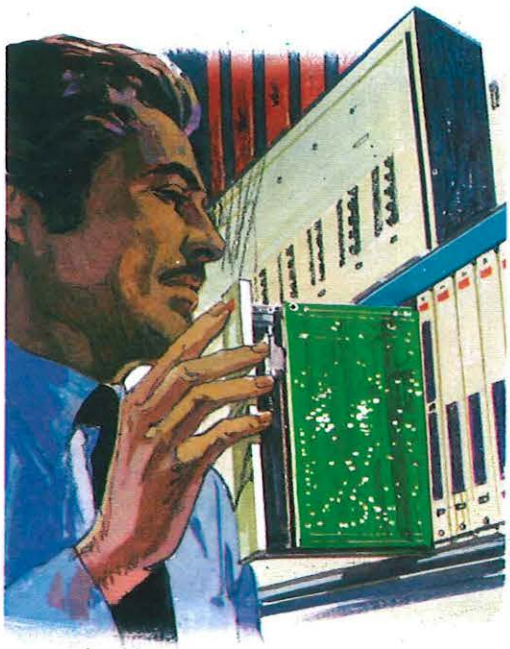

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from both SUPD and Area section stocks.

The new scheme has undergone a successful field trial in the Cambridge, Coventry, Guildford, Lincoln and Liverpool Telephone Areas, where it involved the close co-operation of internal planning and works staffs and Accounts Divisions. In recent months engineers at Regional and Area level have been busy implementing the scheme on a national basis for all internal work, and the trial has now been extended to cover external work in the trial Areas.

In terms of forms and paper alone, the scheme results in useful economies and, by reducing the variety of forms needed, also presents the relevant information more clearly to staff concerned with processing the jobs. Because each form fulfils a number of roles, at least 10 existing forms are replaced, for most of which several copies had to be prepared.

Basic information common to all six versions of the A6310 form – that is, job details and the stores list – are written on a master form prepared in the Area planning office. This information is then duplicated on to as many copies of the various versions as each job requires, ready for subsequent processing.

The principal version, the control and valuation copy, is used by the Works Control to build up a stores history for the job. This copy is also used for pricing the stores and, in presenting both rates and receipt information, it provides the relevant data for valuing stores held for jobs which have still to be completed. In addition it takes the place of undercopies of requisitions, thus saving a considerable amount of paper.

Another version of the A6310 form advises the Works Order storekeeper of the items he will receive, replacing the requisition undercopies used in the old system. The storekeeper uses the form to record receipt of each item, its storage location and subsequent movements. The form is also instrumental in bringing to light stores which have not been drawn or have not even arrived when the job is finished – a situation which, hitherto, has left many thousands of pounds worth of useable stores to gather dust on the shelves of Works Order stores.

Other versions of the form provide the planner with a reference copy of the information he originated, and the engineer who will carry out the work with details of the stores to be used and where they are located. The engineer's copy also enables him to list and report surplus stores items at the end of the job, as well as acting as his authority to draw the stores. Copies listing items to be recovered also indicate subsequent action needed with these recoveries.

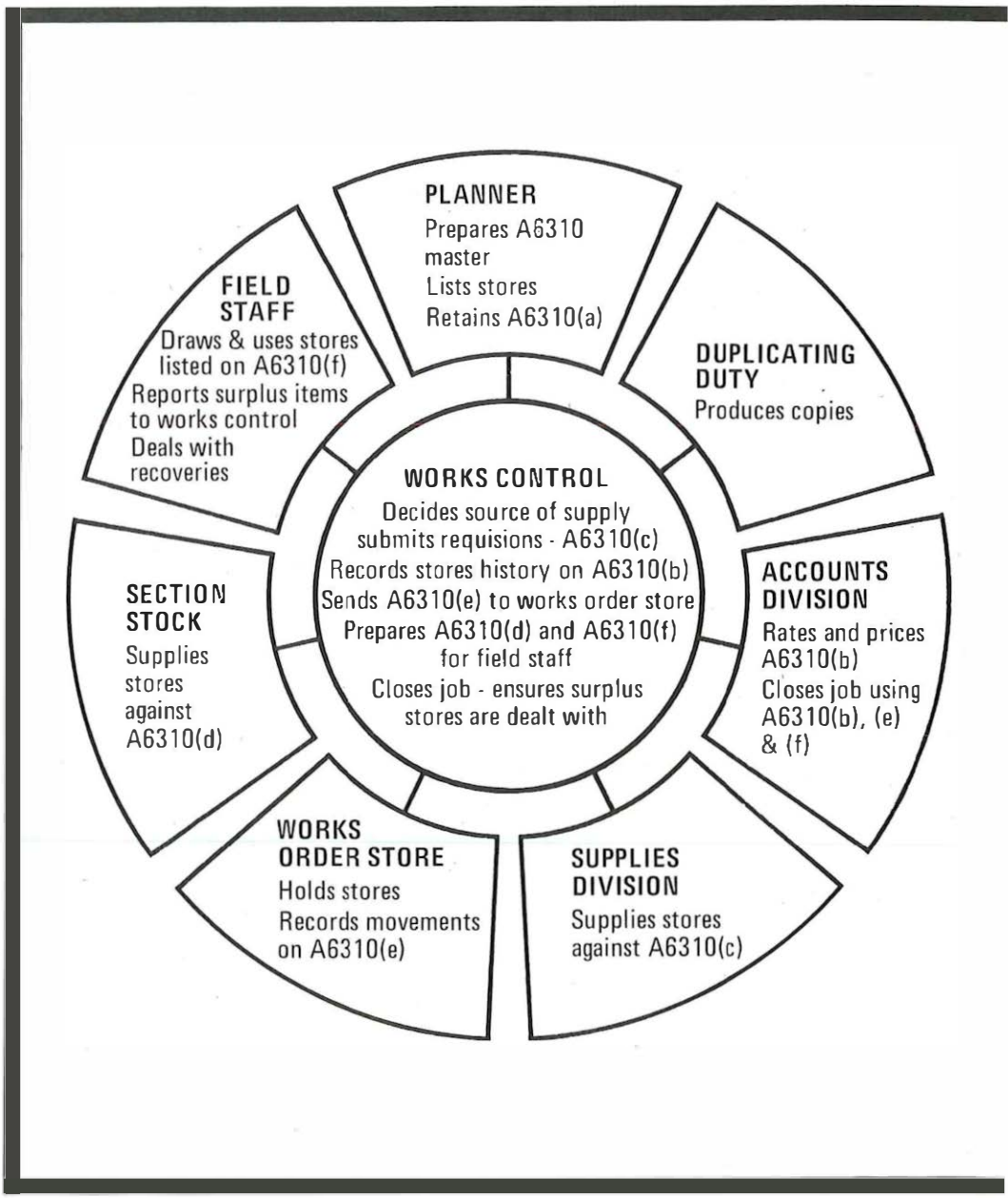
While the main purpose of the A6310 scheme is to improve control and utilisation of stores for construction work, a secondary benefit is that it also helps to reduce clerical effort in the Works Control. For example, advantage has been taken of the case with which forms can be duplicated to incorporate versions which replace requisition forms needed to obtain stores from SUPD, other Telephone Areas and section stocks. All that is necessary in preparing these copies is to insert a requisition number and to delete those items not required.

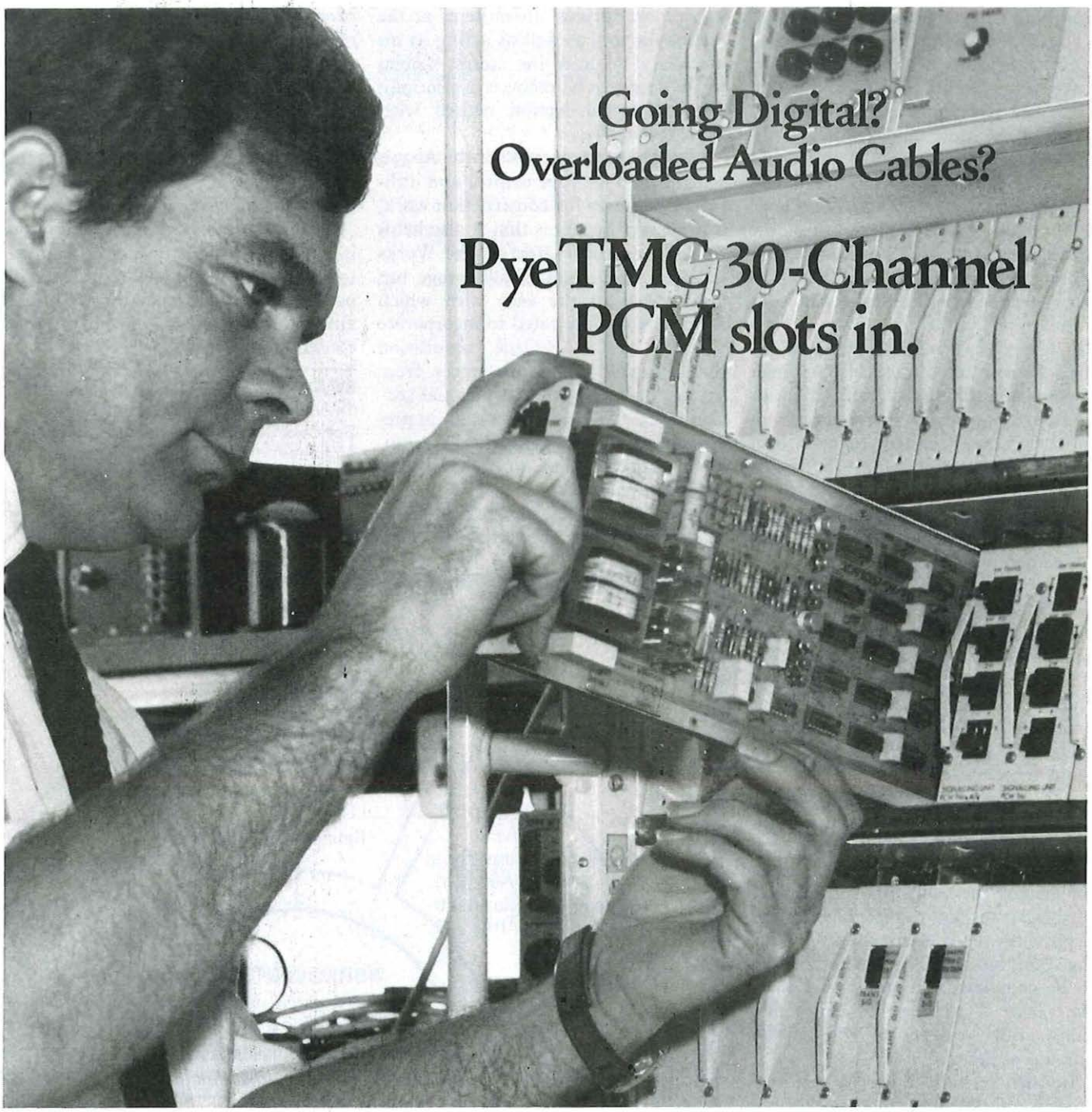
Until stores are installed and, as plant, have the potential to earn revenue or provide a service, they represent idle investment. It is important, therefore, for management to be able to determine how much money is tied up in unused stock. The A6310 scheme provides the building bricks with which the value of stores held for uncompleted works can be easily assessed with acceptable accuracy.

Of course, unless retrospective action is taken on all existing job documentation, a full evaluation exercise will not be possible for some time. But the aim is to value stores held for internal construction works in March 1977.

Mr A. C. Anderson is head of a group in Telecommunications Management Services Department responsible for engineering efficiency assignments concerned with stores and internal construction.

PO Telecommunications Journal, Summer 1976





Typical line regenerator casing

Pye TMC 30-Channel PCM systems will increase the capacity of existing cables and will also interwork directly with most types of exchange.

The line system is suitable for use on cables as small as 0·63 mm diameter and will tolerate losses of up to 37 dB.

The equipment transmits at 2·048 Mbit/s and is designed in accordance with BPO, CEPT and CCITT specifications/recommendations. As such it forms the first stage of the digital hierarchy proposed by the BPO and CCITT.

The audio interface is two or four wire and the twelve types of signalling unit available allow for in-band, E & M or loop disconnect types of signalling, with options for metering, manual hold and trunk offer facilities. The range of signalling interfaces is being extended to provide even greater flexibility of application.

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MISCELLANY

More microelectronics

Over the next four years Post Office use of microelectronic devices will increase from four million to 12 million a year, accounting for 10 per cent of the country's total consumption. These figures were disclosed by Professor J. H. H. Merriman, Post Office Board Member for Technology and Senior Director, Development, Telecommunications Headquarters, at the start of an international conference at Brighton held in conjunction with the Communications 76 exhibition.

The trend indicated the accelerating merging of computing technology with telecommunications technology, Professor Merriman said. Microelectronics were the basis of many new microprocessors which were being increasingly used to control telecommunications operations and to replace bulky electromechanical equipment.

An outstanding feature of microelectronic devices, he said, had been the dramatic reduction in cost in recent years. There had also been a comparable increase in device capacity – it was now possible to produce a large-scale integrated circuit on a single chip with a storage capacity of 100,000 bits.

Examples of the increasing use being made of microelectronics by the Post Office included a push-button system for recording details of calls connected by operators, an electronic method of costing and timing calls from coinboxes and of checking coins inserted by callers, and a method, now on trial, for making calls through the network of exchanges serving Greater London.

Computers were being increasingly used in telephone exchanges as processors in stored program control systems, and they played an essential part in message and packet switching.

Century for ISD . . .

Just 13 years after the first directly dialled international telephone call from Britain was made from London to Paris, the number of centres from which international calls can now be dialled direct has reached 100. Seven exchanges in the Watford area serving 58,000 customers are the latest to get international subscriber dialling (ISD).

Already international calls can be dialled from more than 13 million telephones – more than 60 per cent of the country's total – direct to 260 million telephones in 26 countries. By the end of the year a further 70 centres will have ISD.

. . . and cricket

Cricket-by-phone has reached its century this summer. During the current season, the number of local centres providing the Post Office's popular cricket information service will top 100.

Of all the Post Office's recorded telephone information services, the cricket service has become second only to the Speaking Clock in the extent of its availability by direct dialling throughout the United Kingdom. Last year, 21.9 million calls were made to the cricket service during its 14-week season – an average of more than 1.5 million calls a week.

This year's cricket service programme covers all five Test Matches against the West Indies and will give up-to-the-minute information on the three matches of the Prudential Trophy, on all the matches of the Gillette Cup and on the last three rounds of the Benson and Hedges Cup.

Prizewinners

A prize of £15 was awarded to K. R. Rawlings, an Assistant Executive Engineer at Eastern Telecommunication Region Headquarters, in the Institution of Post Office Electrical Engineers 1975/76 Essay Competition for his essay on the "Planning, Programming and Budgeting System in the Post Office". Executive Engineer V. A. E. Fountain of Telecommunications Headquarters Development Department received £10 for his work on "An Economic Outline of Computer Controlled Telephone Exchanges".

In the section for staff below the level of Inspector, C. D. Rasmussen an Oxford Telephone Area Technical Officer won £18 for his work on "High Wycombe's Mini-tunnel". L. Johnson a TO from Hull received £12 for his essay on "The Search for the Articulating Telephone". Prizes of £10 went to TOs G. R. Rudram of Arundel and D. E. F. Blandford of Southsea.

Contracts

GEC Telecommunications Ltd. – About £6 million-worth of transmission equipment, including microwave-radio, multiplex, and coaxial line systems associated with North Sea Oil operations; international circuits for the new satellite earth station at Madley, near Hereford; and international circuits serving cross-channel links. Other orders cover voice-frequency telegraph, multiplex and line systems for the telex and trunk networks; and more than £1 million-worth of 24-channel pulse code modulation equipment.

The Plessey Company Ltd. – £1½ million for frequency division modulation equipment for expansion of the national trunk telephone network. These follow-up orders comprise channelling and higher order multiplexing for coaxial line systems of up to 2,700 speech channels scheduled to be brought into service in the latter part of 1977.

Pye TMC Ltd – About £1½ million for electronic impulse generators for installation in telephone exchanges throughout

Damaged submarine cables could soon owe the speed of their repair to a helicopter. Recent trials in the Solent have shown that the quickest way to get repeaters and other equipment out to cableships at sea is from the air.

The trials were of helicopter landings on the Post Office cableship "Monarch," pictured here, and they were aimed at giving the crew experience both in handling the landings and calibrating the vessel's glide path indicator which gives a correct approach indication to the pilot.

As well as flying out equipment helicopters would also be able to take out replacement personnel in the event of sickness or leave. They would also be of great value in general emergencies.

"Monarch" and her sister ship "Iris", due to come into service in the autumn, have both been designed with speed of cable repair one of the primary objectives. Both vessels also use pan loading techniques which reduce turn round time at the Post Office's Central Marine Depot, Southampton.

the United Kingdom. The regenerators will replace electromechanical units. The contract provides for the supply of more than 40,000 units over a two-year period. The total number of units ordered from Pye TMC by the Post Office is now more than 80,000.

Export boost

Export of British know-how has been given a £650,000 boost with a contract signed by the Consultancy Service of Post Office Telecommunications and the Libyan Posts and Telecommunications Corporation for a project to provide a new high-capacity telecommunications link between Tripoli and Benghazi.

The contract was signed in Tripoli by Mr Ali Gherwi, Director-General of the Libyan Posts and Telecommunications Corporation, and Mr J. S. Whyte, Director of Purchasing and Supply, Post Office Telecommunications.

The new telecommunications link will consist of a submarine cable with land coaxial cable extensions. It will carry telephone calls, telex messages and television between the two centres.

The Post Office will recommend routes and landing points, and prepare specifications for the systems involved and, after the contract has been let, supervise manufacture and installation of the equipment and commissioning of the systems.

Work on the project will take between two and three years. The Post Office will appoint a manager for the project from among its headquarters engineering staff and other engineers will be assigned to the work as and when necessary.

Focus on Viewdata

Viewdata – the new Post Office system presenting telephoned information on television – could play a part in conserving the world's natural resources and help reduce energy consumption according to Professor J. H. H. Merriman, Post Office Board Member for Technology. He was speaking on the inter-relationship of telecommunications and world resources at an international conference at the Institution of Electrical Engineers where in addition to Professor Merriman, 14 senior Post Office staff presented papers.

Professor Merriman said that significant savings of paper could be made through the use of advanced message services using visual display units and electronic storage in place of typewriters, photocopying machines and paper-based filing systems.

Within the Post Office itself, it might be possible to reduce the number of telephone directories – and directory enquiry calls – by using the Viewdata service to gain access to a national telephone number bank. New telecommunications systems could also replace physical methods of communications, such as travel.

Research into the effectiveness of audio-only and video teleconference systems, compared with that of face-to-face business meetings, suggested that about half of all business meetings which involved travel could be conducted satisfactorily by telecommunications to give substantial savings in the amount of energy used, said Professor Merriman.

Appointments

Mr L. N. Heatherington has been appointed Director of Industrial Relations for the Post Office. A head of division in the Employment Policy Department, he takes over his new job on the retirement of Mr J. E. Sayers, as well as taking over the work of Mr W. Pounder, also retiring, and until now Director of Employment Policy.

Mr J. L. Howells has been appointed Director of Post Office Computing Operations and Development. Formerly head of the Technical Development Division of the Post Office Data Processing Service, he succeeds Mr A. N. James, who is retiring.

Mr A. B. Wherry, Controller of Trunk Planning in the Post Office's London Telecommunications Region, has been appointed Chairman of the North Western Telecommunications Board.

Mr P. A. Long is the new Director of Telecommunications Personnel. Formerly head of Manpower Supply in Telecommunications Personnel Department, he succeeds Mr W. A. Kirkpatrick.

Transatlantic mission

With the aim of winning more customers for its international services, the Post Office recently took part in a major communications exhibition in the USA.

At the International Communications Association Conference and Exposition, held in Washington DC, staff from the External Telecommunications Executive explained how Britain could provide American firms with the telecommunication services they need in Europe and stressed the Post Office's expertise in providing international leased circuits.

The Post Office stand featured the whole range of its international telecommunications services and emphasised the long history of co-operation and friendship between the two countries.

Services on display

More than 14,000 people were visitors to Communications 76, the international communications equipment and systems exhibition held at Brighton recently where the Post Office was one of 160 UK and international manufacturers and users displaying latest developments.

Highlight of the Post Office stand which displayed equipment ranging from the new push-button keyphones to the links used to maintain contact with the North Sea oil and gas platforms, was a demonstration of Viewdata, the new concept for displaying telephoned information on ordinary television screens (see Telecommunications Journal, Winter 1975/76). Visitors to the Post Office stand were able to try the system for themselves.

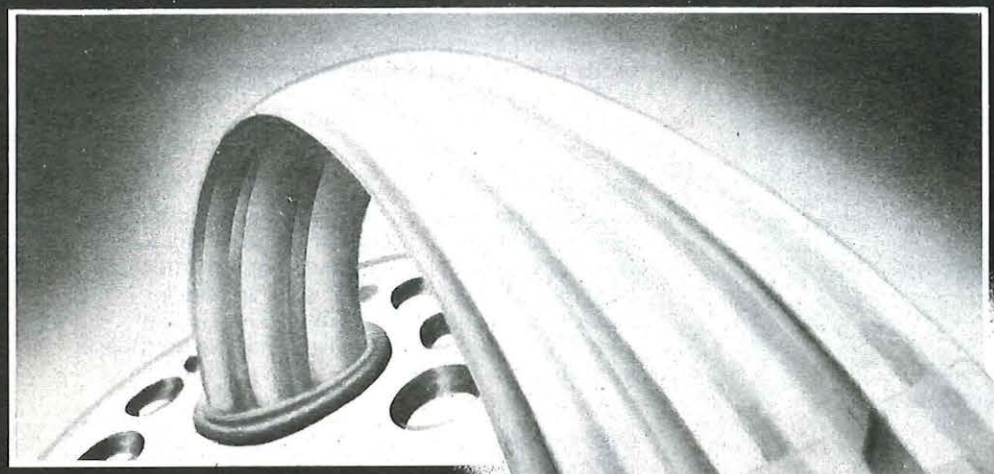
The North Sea communication display was mounted by External Telecommunications Executive staff and illustrated the new trans-horizon microwave radio service for oil rigs and gas platforms. The London radiopaging service, due to be introduced later this year, was also featured.

Also on the stand were staff from Telecommunications Headquarters Consultancy Service which offers impartial advice on all aspects of a company's telecommunications network and Post Office experts to emphasise the advantages of an efficient telephone system.

Show postponed

Following problems with the intended presentation of the West German PTT, the international communications equipment exhibition, Communication '76, originally planned for 7–10 September in Essen, West Germany, has been postponed. The new dates and venue will be announced as soon as possible.

MITEL QUADVERTER



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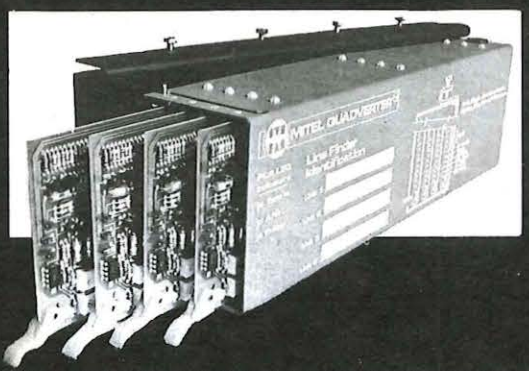

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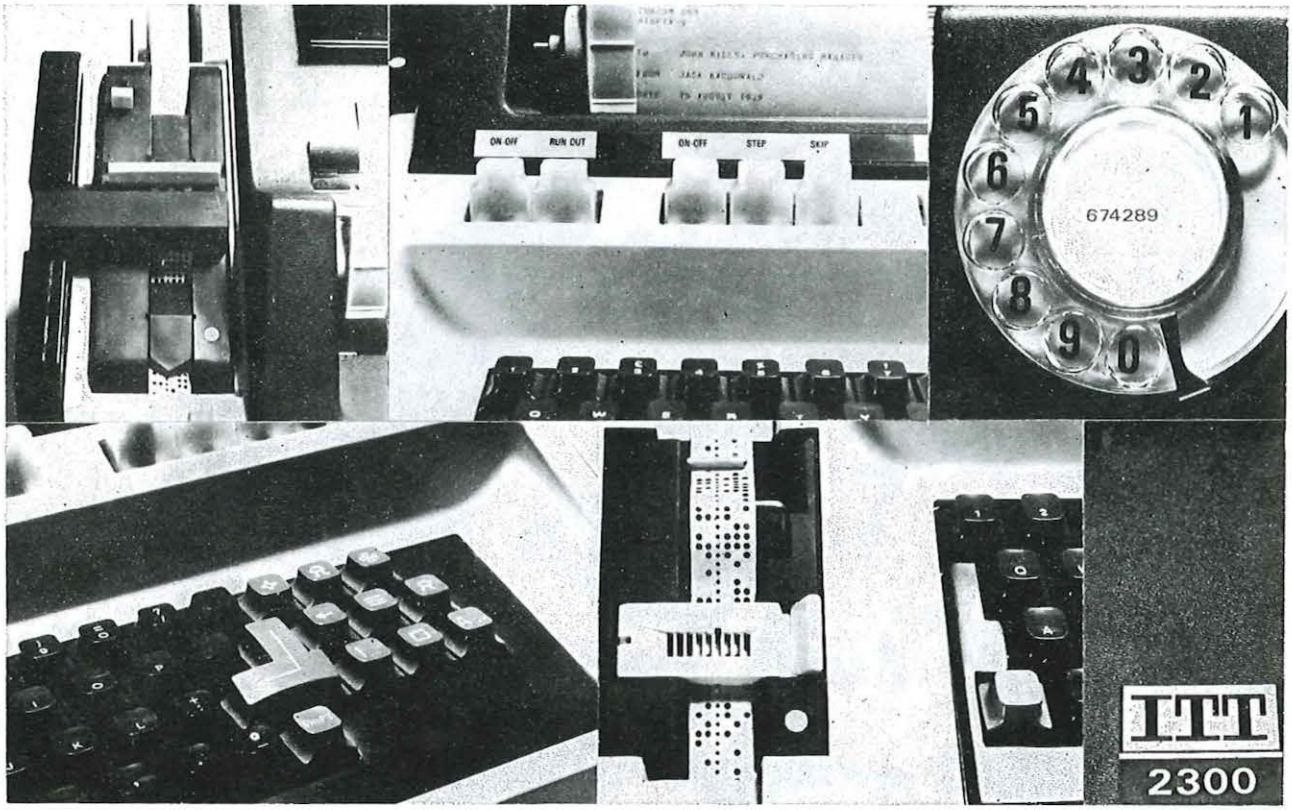

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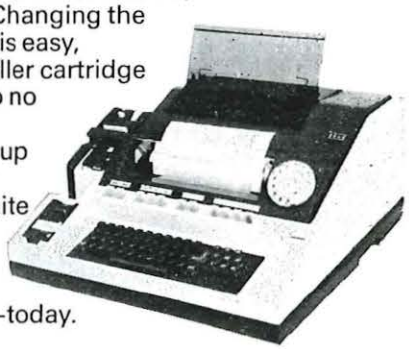

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