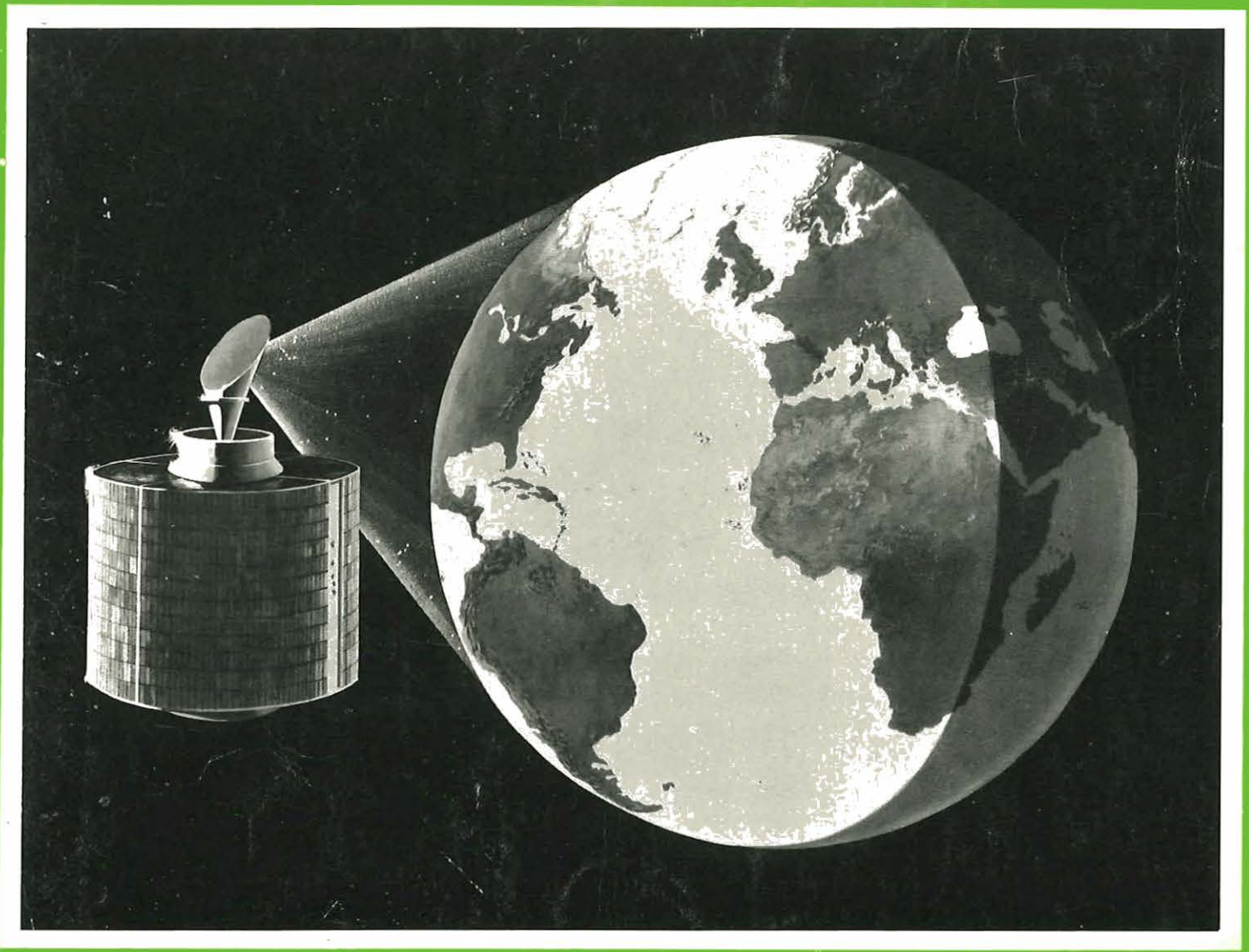
Post Office telecommunications journal

One shilling and sixpence

Spring 1969 Vol. 21. No. 1



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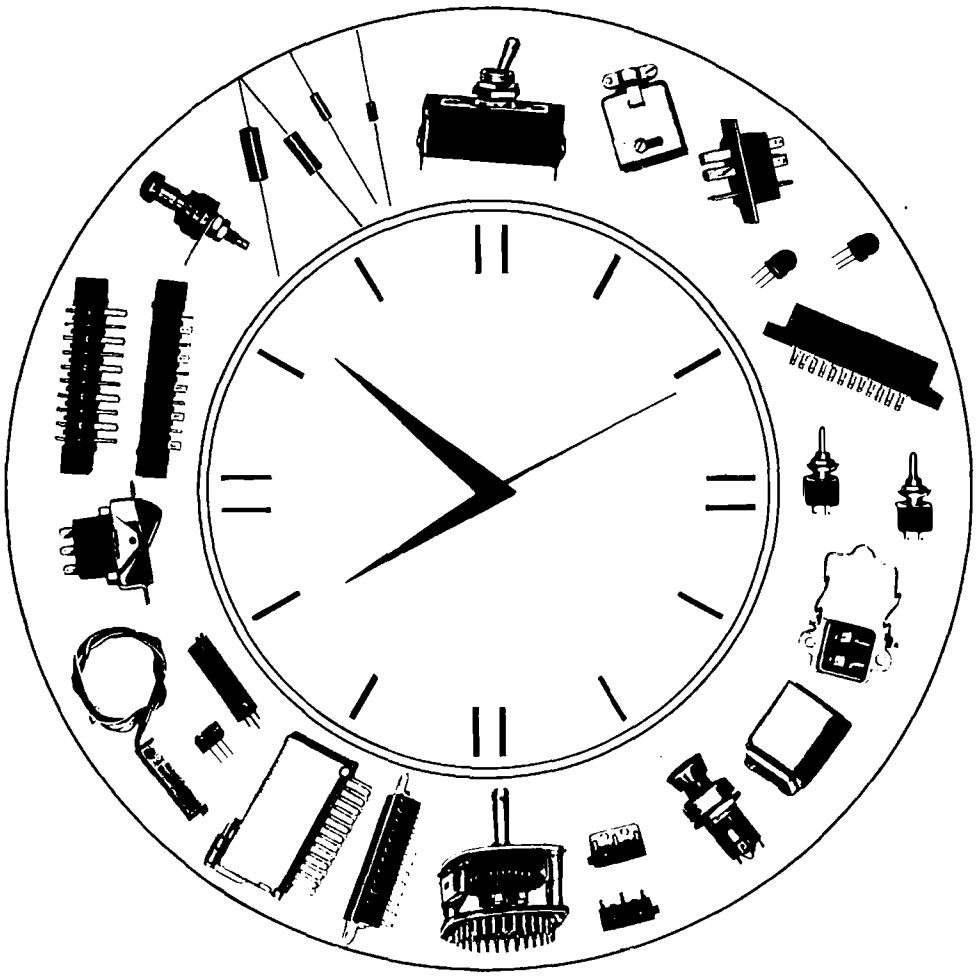

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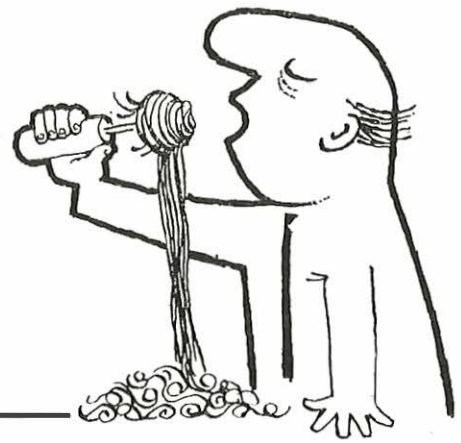

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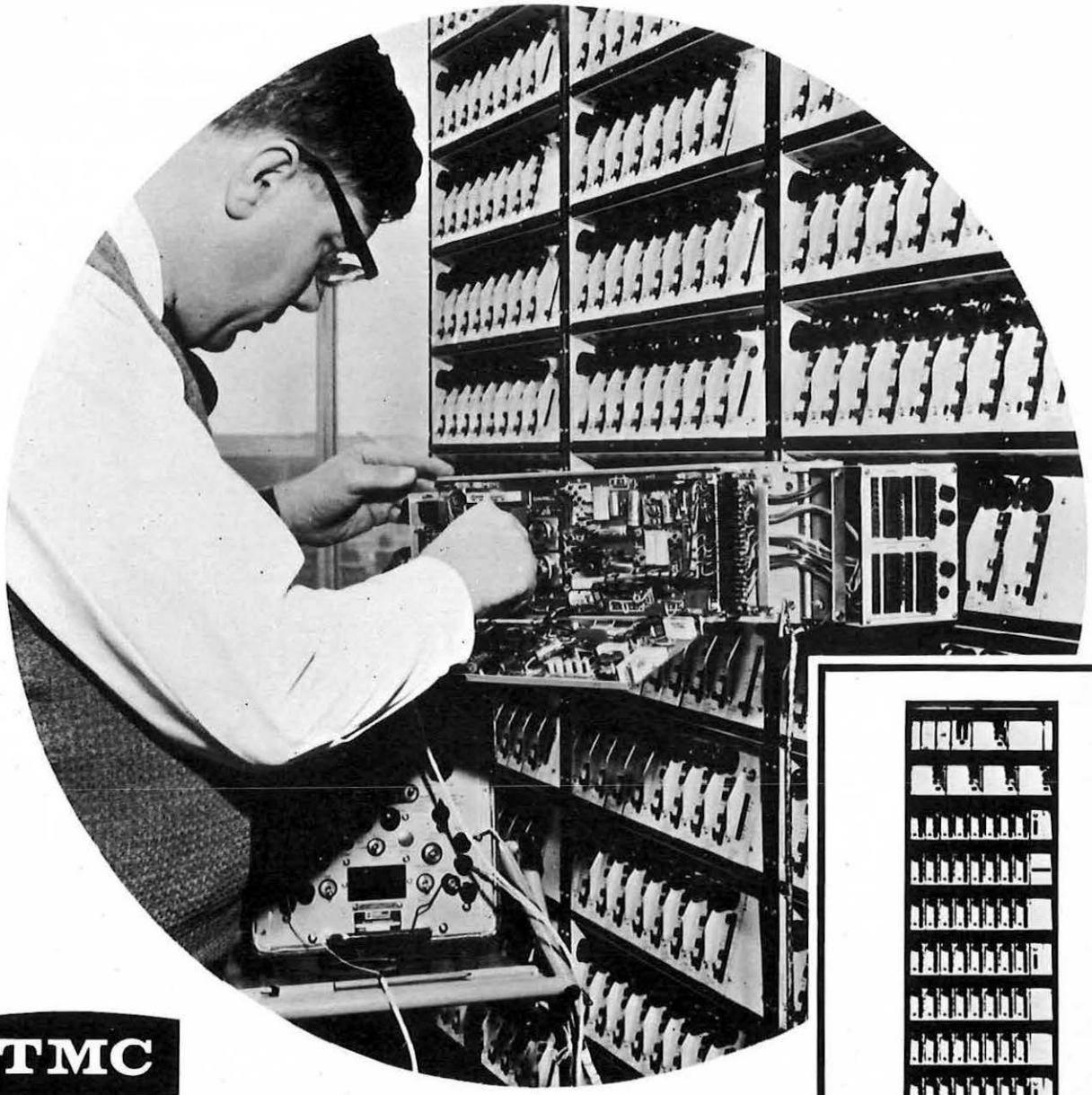

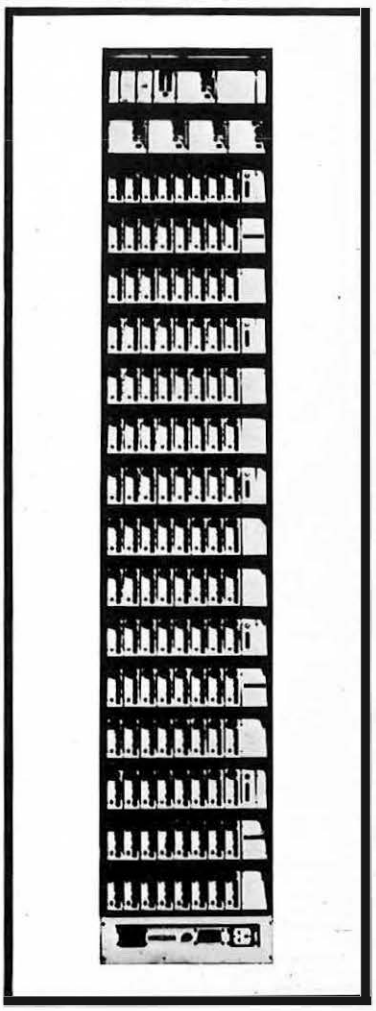

TMC

VOICE FREQUENCY T24P

The G.P.O. International Telegraph Transmission Centre at St. Botolph's, London supplies a vital communications service by providing direct teleprinter links to all parts of the world. Current T.M.C. installation contracts provide 4,000 much needed duplex channels and the total will exceed 6,000 by 1971. This is but one of many G.P.O. stations in towns and cities throughout the U.K. where steadily increasing numbersof T.M.C. 24 Channel VF Telegraph equipments are being installed. The use of only one stage of modulation permits high and low speed telegraph circuits on one system: channel cards of 50/85 and 100/110 bauds being available.

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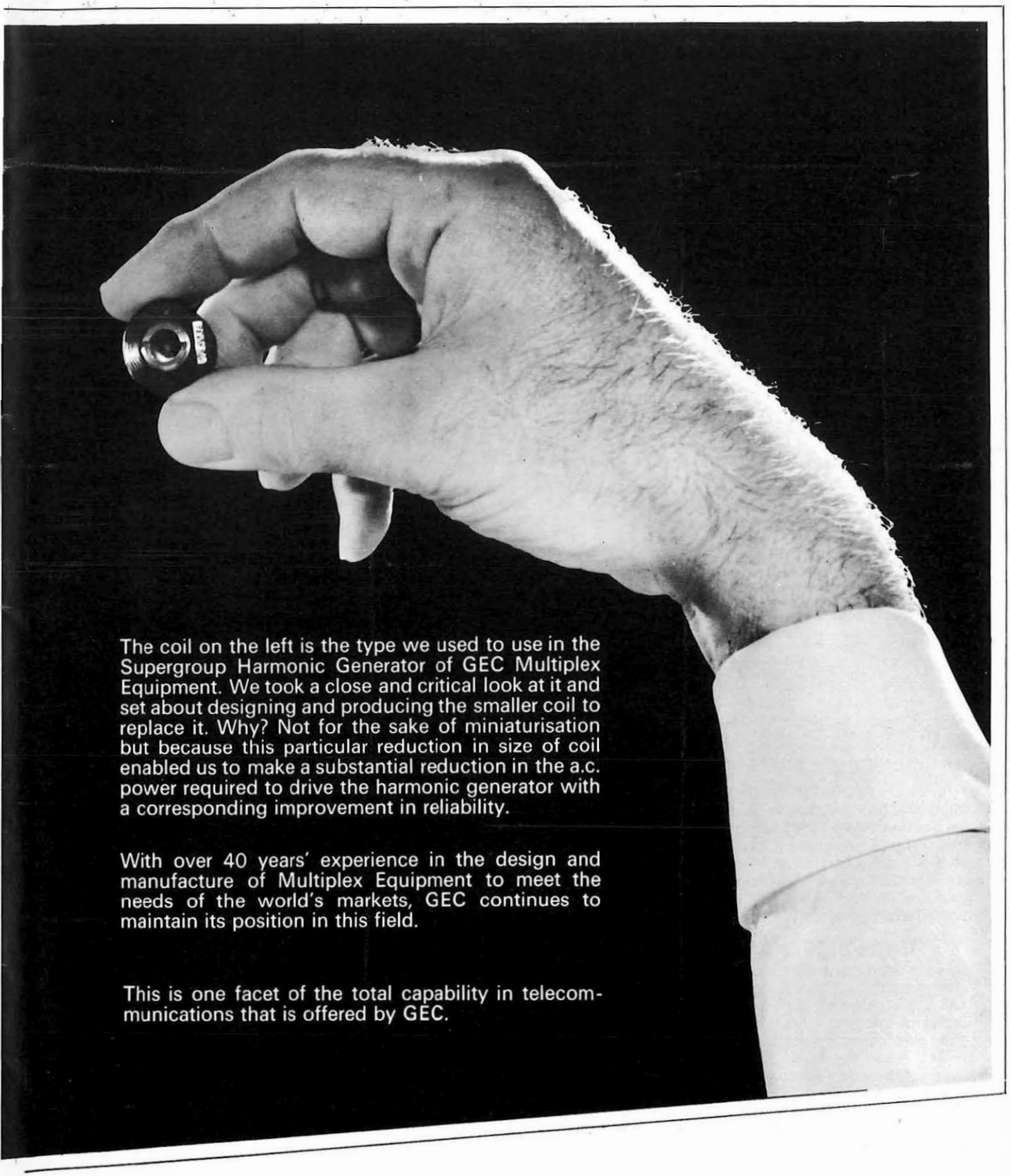

The coil on the left is the type we used to use in the Supergroup Harmonic Generator of GEC Multiplex Equipment. We took a close and critical look at it and set about designing and producing the smaller coil to replace it. Why? Not for the sake of miniaturisation but because this particular reduction in size of coil enabled us to make a substantial reduction in the a.c. power required to drive the harmonic generator with a corresponding improvement in reliability.

With over 40 years' experience in the design and manufacture of Multiplex Equipment to meet the needs of the world's markets, GEC continues to maintain its position in this field.

This is one facet of the total capability in telecommunications that is offered by GEC.

Takes telecommunications into tomorrow

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STC Telecommunications

And that's the best place, of course, for submarine cables, repeaters and equalisers. We reckon they should stay down there for at least 25 years without attention. Which is why we make them to incredibly high standards of reliability, with nothing left to chance.

And the shore terminal equipment too, generally duplicated with automatic changeover to ensure utmost reliability, is made to compatibly high standards.

In collaboration with the British Post Office we've been in the forefront of submarine systems developments since the early 1950's. And have unsurpassed practical experience – STC engineers have participated in 34 major projects worth £137 million.

First with deep-water systems of 160 and 360 circuits, STC will also be first with a 640 circuit deep-water system.

STC innovations include the master-slave power feeding system, and a special test lead which makes equaliser laying that much easier.

STC cable, too – simultaneously carrying intelligence and feeding power to the repeaters – is of optimum performance/cost design and cannot be bettered anywhere in the world. For the very first system to use the new $1\frac{1}{2}$-inch diameter lightweight cable STC was selected to provide all of the cable.

We don't stop at manufacturing the equipment for submarine cable systems. Add an overall capability for systems planning, project management installation of complete systems including civil engineering works and services – and you have a unique organisation able to meet any requirement, anywhere – on time!

All this, just to drop things in the sea.

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Everyone wants the Pentaconta* system

Pentaconta* is the world's most advanced Crossbar automatic telephone switching system. So naturally the whole world wants it, and systems are already installed in over 76 countries.

We're increasing manufacturing capacity to put in a lot more. And that's not all.

Pentaconta* is under continuous development and improvement. We're always trying to make it smaller, faster, cheaper and more reliable. And succeeding.

Standard Telephones and Cables Limited, Telephone Switching Division, Oakleigh Road, New Southgate, London, N.11, England.

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STC makes girls light-headed

STC makes headsets that are so light and comfortable some telephonists forget they're wearing them. They can nod, shake, shrug or frug and the headset stays put.

The exclusive STC 'Rocking Armature' principle improves sensitivity and frequency response. So STC headsets work better (and so do telephonists). All told, STC headsets make telephonists happier, and more efficient.

Made of nylon plastic and virtually unbreakable, the headsets are available in black and grey (colours approved by the GPO) and ivory.

Write, phone or telex for leaflet D/104 to: Standard Telephones and Cables Limited, Telephone Switching Group, Oakleigh Road, New Southgate, London, N.11. Tel: 01-368 1234 Telex: 21612.

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the clever part is how you use it!

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Two laps of steel tapes followed by two laps of paper tape—and the tube is made and protected with a speed and precision hitherto unobtainable. Each tube is then subjected to searching electrical and mechanical examinations.

Air . . . plus care. These are the ingredients that give TCL co-axial cables their renowned performance standards.

TCL—the largest company in Europe exclusively concerned with the manufacture of telecommunications cable—makes *all* types of dry core and plastic cables and as well as being the major supplier to the British Post Office also exports to over 70 countries throughout the world.
A world-wide technical advisory service is provided.

TCL
put **more** into telephone cables

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The organisation with 135 years' experience.

Post Office telecommunications journal

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

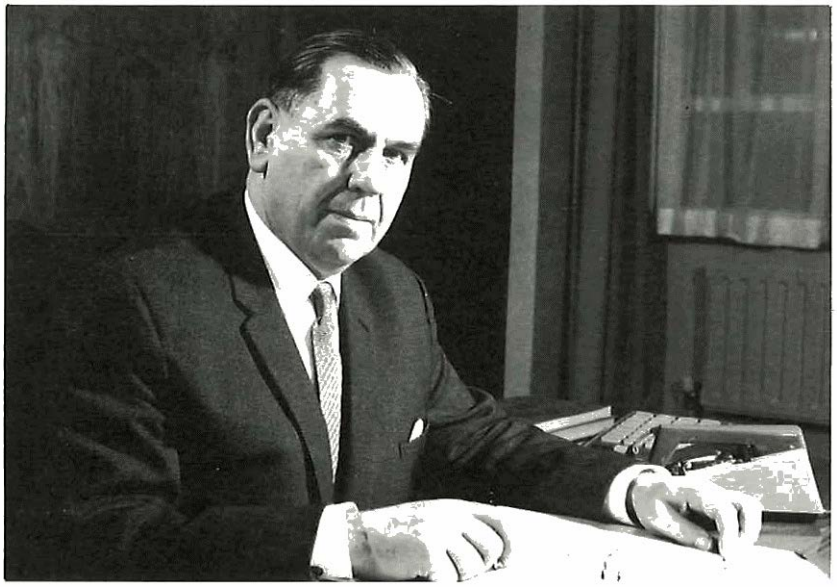
Vol. 21 Spring 1969 No. 1

IN THIS ISSUE

OUR COVER PICTURE

This artist's conception shows the first of a series of four INTELSAT III commercial communications satellites in synchronous equatorial orbit over the Atlantic Ocean, just east of the coast of Brazil. The light area on the earth's surface shows the satellite coverage. Earth stations in this area could transmit and receive television, voice, data, teletype and other communications traffic between distant points.

A Message from the MD:T



Mr. A. W. C. Ryland, C.B.

"I warmly welcome this issue of the new-style *Post Office Telecommunications Journal* on its twenty-first anniversary. It appears at a particularly exciting time for the telecommunications service.

"We are in the middle of a telecommunications revolution. New developments, including electronic exchanges and pulse-code modulation, are coming into service. A new kind of communications—data transmission—is rapidly becoming commonplace. Satellites are part of the established fabric of overseas communications. We have started to sell our services. We are improving them, too, installation by appointment being one example. We have plans for the widespread use of computers. There are many more developments round the corner.

"The *Journal*'s aim is to promote and extend knowledge of the operations and management of telecommunications. It has done this supremely well and will go on doing so. The rate of growth and speed of change in the years ahead will make its task even more important.

"In congratulating the *Journal* on coming of age and its achievements over the past 20 years I commend it in its new form to all who work in the telecommunications business and wish it every success in the future."

TWO DECADES OF PROGRESS

The Post Office Tower in London, hub of the nation's microwave communications system.

The *Telecommunications Journal*'s 21st birthday issue gives an opportunity to look back at the significant steps in the accelerating progress of telecommunications which have been recorded in the past 20 volumes.

It is interesting to note that wideband transmission systems carrying hundreds of telephone channels on microwave radio links as well as on coaxial cables; the adoption of subscriber dialling for all inland calls; and the eventual introduction of all-figure numbering were confidently asserted in our first volume in 1948 although the time scale and the solutions to many problems were then unknown.

On the other hand, the hollow waveguide is still in the research stage while the search for the economic "all-electric" (as distinct from the electro-magnetic) telephone exchange still goes on.

"*Any attempt to forecast future engineering developments is liable to err through the impossibility of taking account of new discoveries and inventions.*" This observation was also made in our first number and soon justified by the announcement of the transistor. The application of transistors to land and submarine cable repeaters and in electronic switching has since been realised; the prototypes of the reed-electronic telephone exchange—TXE 2—were opened in 1965.

Revolutionary developments unforeseen in 1948 were the telecommunications satellites, the rapid growth of electronic computers and the introduction of digital transmission and switching systems. The commercial viability of each of these developments depends upon semiconductor devices.

These developments have changed the course of telecommunications and are shaping for it a different future. Transistor circuits are being incorporated in micro-electronic packages while the computer is rapidly advancing into the telecommunications system, as a service to design and management, in control functions and as a demanding customer for the rapidly-growing data communications (*Datel*) services.

The telephone service has passed several landmarks. Subscriber trunk dialling over the inland network was inaugurated in 1958 and is now available to 80 per cent of subscribers. International subscriber dialling has been introduced for calls to several European countries and the international telephone system is expanding through a complementary network of submarine and land cables, radio-relay and communication satellite links, together with hf radio circuits that have the improved characteristics given by the use of *Lincompex*.

Customers' installations have shared in the progress. The "700" series of telephones has been introduced, supported by the luxury *Trimphone* and loudspeaking telephones and a range of modern equipment including devices to ease the setting-up of calls such as repertory diallers and card-diallers and by experimental versions of the push-button telephone which presage the introduction of a *Keyphone* service.

The *Datel* service, adapting the telephone system for digital data transmission by means of a range of modems, was introduced in July, 1964, and a new teleprinter (No. 15) became available at the end of 1968 for use on private telegraph circuits and on Telex.

The Telex service, in its present form, has evolved over the past two decades. It is essentially an international service and subscriber dialling of international calls opened to Europe in 1961 and to the United States in 1964.

Few of the developments reviewed here are visible to a subscriber, who in general is conscious only of his telephone instrument or his teleprinter. But the growth of microwave and satellite communications has resulted in structures of a most impressive kind, typified by the Post Office Towers in London and Birmingham and by the steerable aerials at Goonhilly, the second of which became operational in January, 1969.

The Queen launches STD by making the inaugural call at Bristol.

M.B.W.

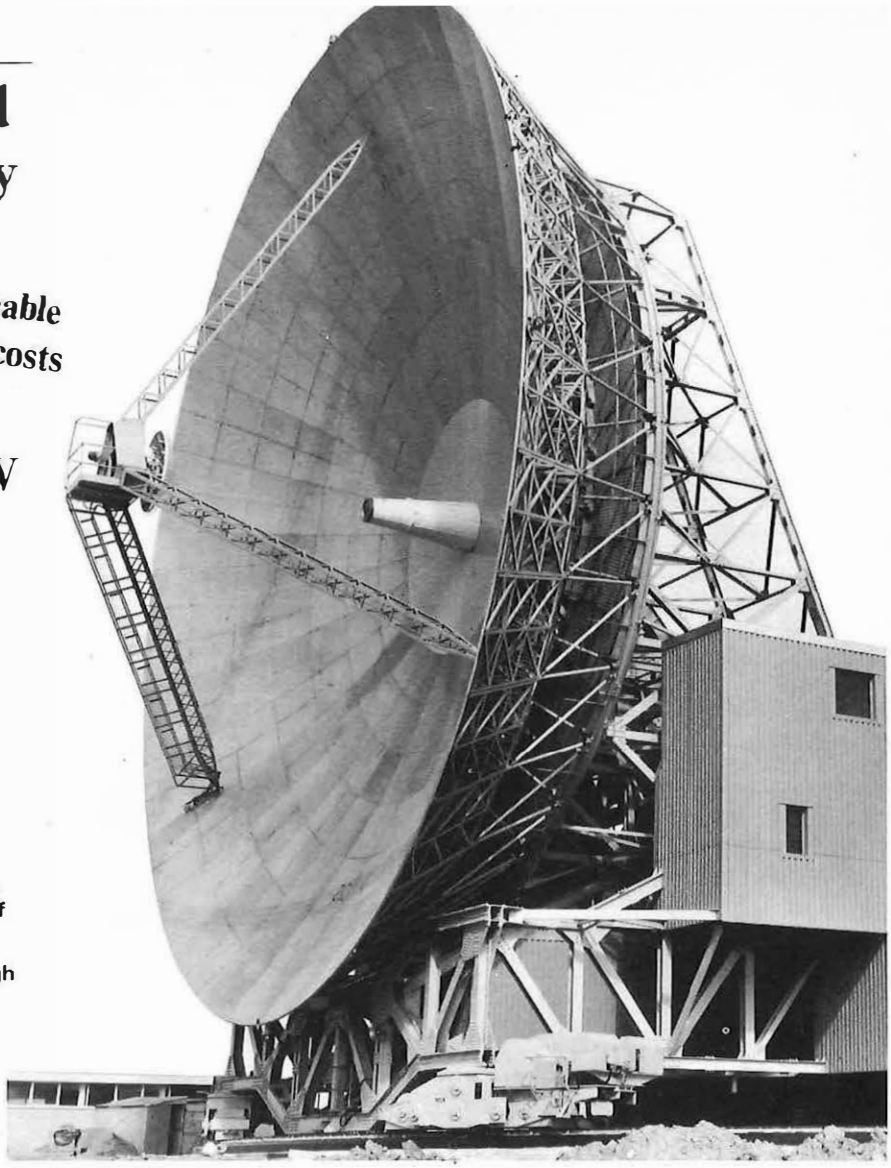
Colour TV and calls galore—by wonder aerial

WONDER OF SCIENCE —PHONE CALLS MAY BE CHEAPER

Goonhilly cuts cable links and PO's costs

'DIAL THE WORLD' SPACE LINK

£2m aerial improves TV



The Goonhilly 2 aerial structure which weighs nearly 1,000 tons. The whole of this assembly is mounted on a central bearing with two massive bogies enabling it to rotate in azimuth through a 210° arc.

GOONHILLY'S WONDERFUL 'EAR'

A second aerial system at the Post Office earth station at Goonhilly, Cornwall, came into service in January. One of the most sophisticated aerials of its kind in the world it is working to the newest of the American space satellites, *Intelsat* III, and takes the United Kingdom into the first stage of a new era of satellite communications which will soon span the globe

THE first stage of a satellite communications system which, by the mid-1970s, will span the globe was completed by the Post Office in January when a new £2 million aerial system at the Goonhilly Earth Station in Cornwall became operational. Called Goonhilly Two, the new aerial and its sophisticated technical equipment—believed to offer the best performance of any of the world's civil earth stations—will carry up to 400 telephone circuits and a television programme simultaneously. It has been designed to allow additional carriers to be provided as and when needed so that ultimate capacity is virtually unlimited.

The historic Goonhilly One—Early Bird link up which took place less than seven years ago provided only a single trans-Atlantic link for not more than 240 telephone conversations or one television programme.

The giant, 90-foot diameter, 1,000-tons space dish, operating through the *Intelsat* III satellite, launched by the Americans in December and now hovering 22,300 miles above the Atlantic Ocean, is already carrying 25 per cent of trans-Atlantic traffic and 20 per cent of European calls. Later this year new services are expected to be opened to Morocco, Nigeria and Iran and by the end of next year Goonhilly Two will be carrying 60 per cent of international traffic. It will have helped to increase the number of countries with direct satellite links with Britain from the present four to 30, a figure which will almost double in the next six years.

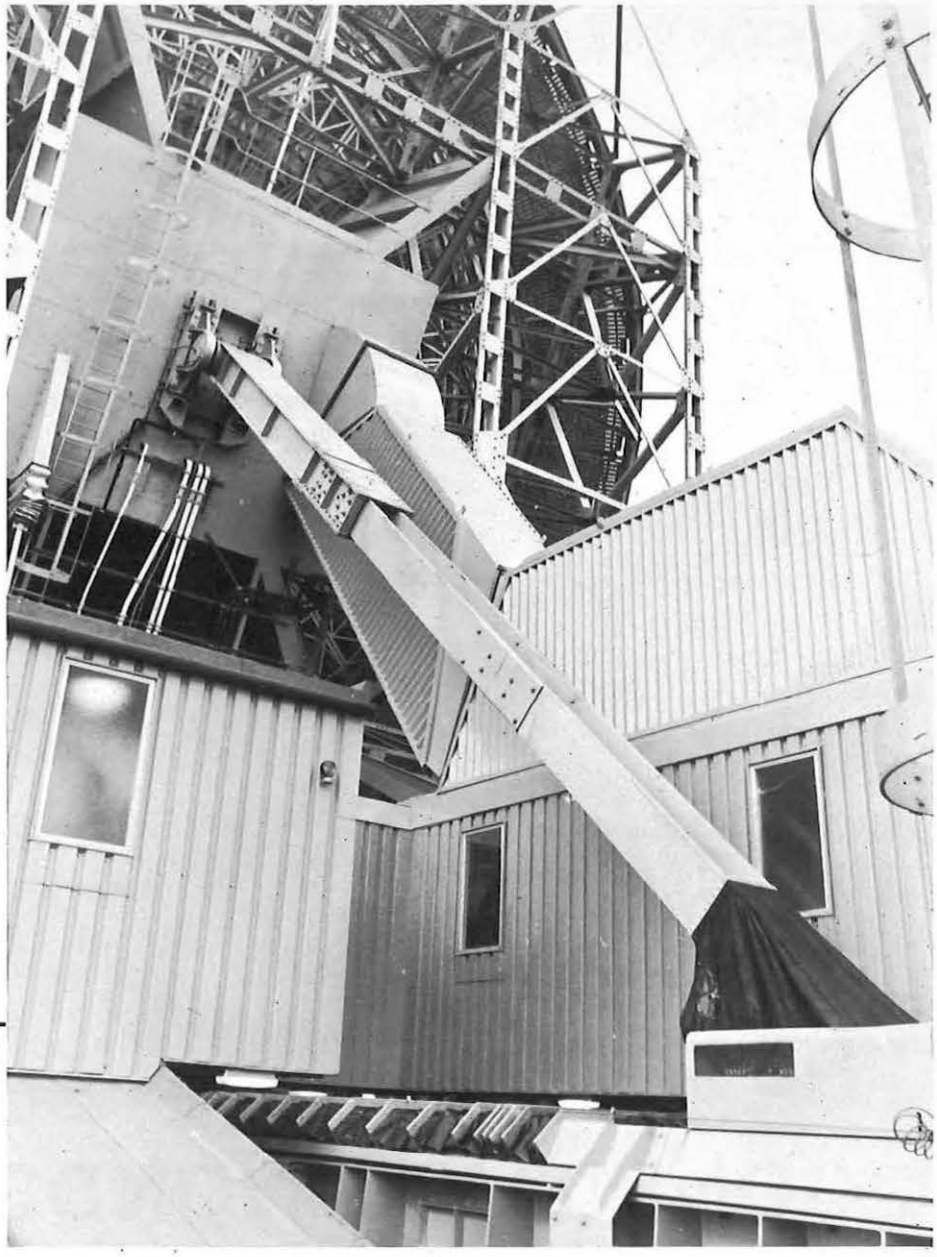
A global communications network will be completed with the launching of other *Intelsat* III satellites over the Pacific and Indian Oceans and another above the Atlantic. To this end Goonhilly One, no longer required for the service to America, is currently being provided with new equipment to enable it to operate with countries to the East of Britain through the satellite over the Indian Ocean.

Goonhilly Two which meets the technical requirements of the International Telecommunications Satellite Consortium (INTELSAT) was built by the Marconi Company to Post Office specifications. Threshold extension demodulators and certain other equipment were supplied and installed by GEC/AEI (Electronics) Ltd. The aerial was designed by Husband & Co., Post Office consultants and one of the world authorities in this field.

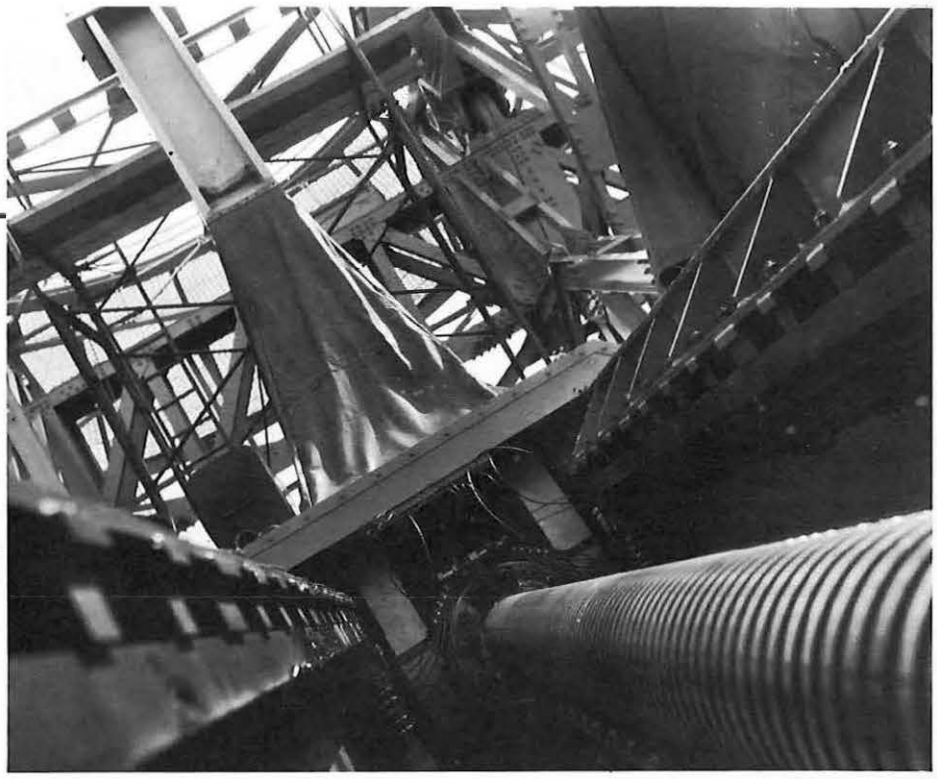
The new aerial follows the pattern established by the first Goonhilly installation of dispensing with a radome, a practice which has been followed by other earth station designers.

A limited steerability model, it covers a 210° arc in azimuth to enable it to work to either the Atlantic or the Indian Ocean satellites. The entire structure is mounted on a central pintle bearing, with two massive bogie units carrying the load at the front of the structure. The bogies, each driven by two silicon controlled rectifier (SCR) fed DC motors generating a total of 60 hp are able to move, with the complete assembly, around a circular track. An auto-track facility enables these to control the complete assembly to a pointing accuracy of better than one minute of arc in winds of 47 mph gusting to 66 mph. Movement in elevation is also controlled by two 15 hp, SCR-controlled motors which drive a 15-foot long horizontal screw in turn driving a cross-head nut which is linked to a connecting rod and moves the dish in elevation to within one minute of arc. The aerial can also be moved from one satellite to another at a maximum speed of 10° per minute in azimuth, and 5° per minute in elevation.

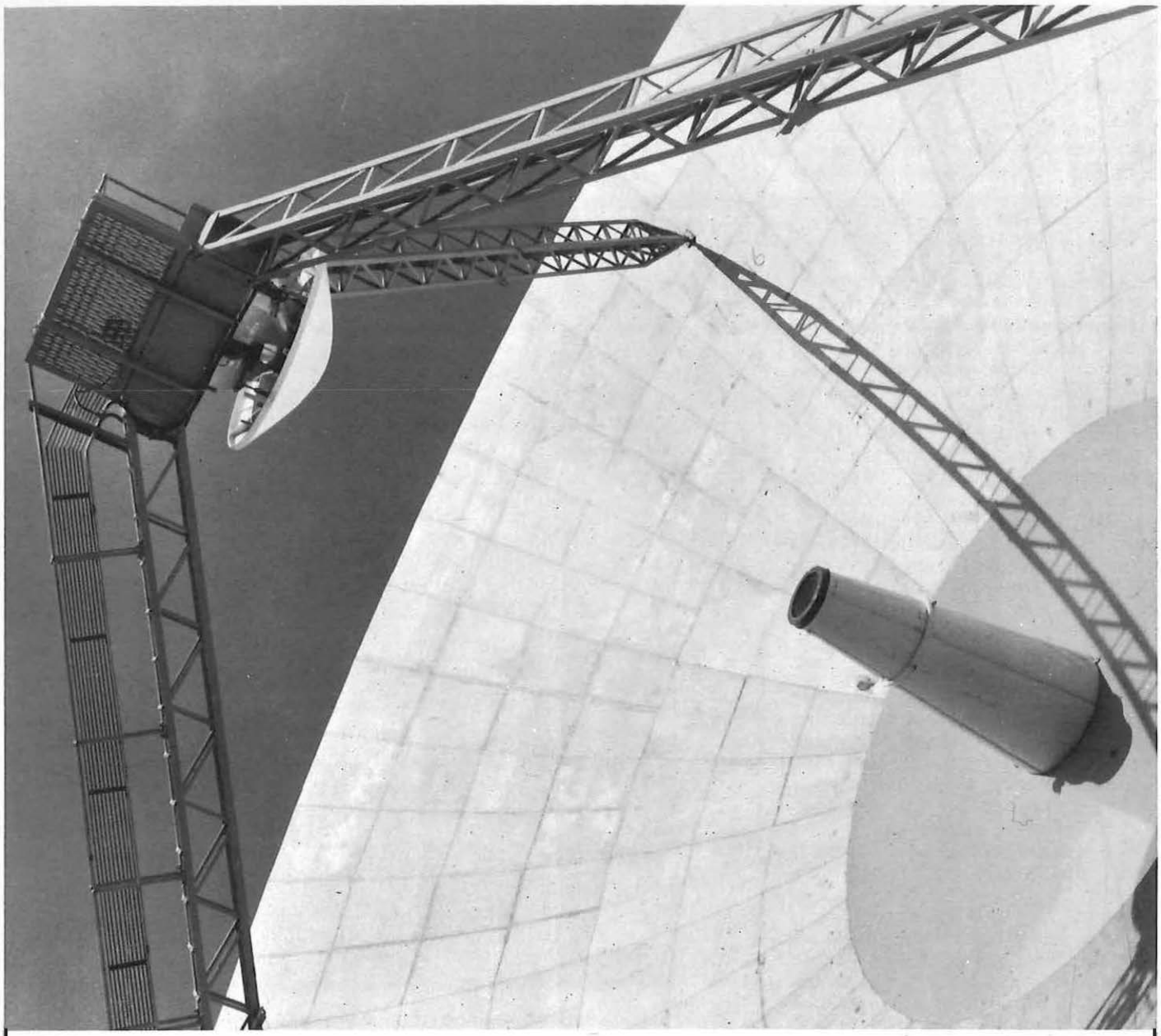
The reflector surface, a 24-foot diameter central section surrounded by two rings of stainless-steel panels, has a surface accuracy of 0.020 inches r.m.s. The panels have been adjusted on the back structure to an r.m.s. setting tolerance of 0.010 inches. The overall surface accuracy of the reflector



The connecting rod which moves the dish aerial in elevation. The upper end is joined to the dish structure at the back of the cabin which contains the parametric receiver stages. The telescopic stairway leading to the cabin can be seen behind the connecting rod.



The huge drive screw which controls the elevation of the dish aerial. As the screw turns it moves the cross-head nut in the centre of the picture which is linked in turn through the connecting rod running out of the top left hand corner of the photo.



The Cassegrain feed system is seen here with the aluminium sub-reflector which is seven feet in diameter. Small deflections of the aerial beam can be made by moving this sub-reflector using a hydraulic servo system the pipes for which can be seen running up the support leg from the bottom of the picture.

dish in any elevation attitude in still air and inclusive of gravitational deflections is 0.040 inches r.m.s. Maximum distortion in a wind speed of 70 mph will be 0.200 inches.

The dish profile is quasi-paraboloidal and is Cassegrain-fed by a one-piece quasi-hyperboloidal aluminium sub-reflector, seven feet in diameter and machined to an accuracy of 0.005 inches r.m.s. The width of the main radio beam between 3d points is approximately 10.5 minutes of arc at 4,000 MHz in the receiver band, and 7.5 minutes at 6,000 MHz in the transmit band. Beam deflection for small satellite movements and wind deflection compensation is provided by moving the sub-reflector about two axes by a hydraulic servo system which gives a maximum beam deflection of $\pm\frac{1}{2}°$. Up to ± 10 minutes of this is used during auto-track operation to remove errors fed from the outputs of the tracking receiver. As soon as the sub-reflector servo drive achieves a measurable "off-set" from its centre position, the main axis steering system drives the dish towards the satellite.

The transmitter uses wideband travelling wave tubes (TWTs) to provide a final peak saturation power output of 10 kW. In normal operation this power is limited to about 1 kW to ensure that intermodulation between carriers is virtually eliminated and to avoid overloading the satellite. A TWT was chosen for its overall system performance in a wideband system in preference to klystrons, since each individual carrier would require a complete klystron transmitter whereas the entire 500 MHz satellite band can be covered by a single TWT amplifier. The TWT is also likely to prove more reliable as no mechanical tuning is involved. Two TWT amplifier stages are employed in series to provide a high power output capable of transmitting three separate telephony carriers, giving the capacity for up to 400 telephone channels. The standby transmitter can be used simultaneously to provide a television videocarrier and separate sound channels in addition to the telephony channel on the main transmitter. A single varactor diode up-converter is used to change each of the 70 MHz carriers, which are provided by the modulating equipment, to the output frequency. A solid-state local oscillator source supplies the output frequency reference. These carrier signals are then combined before the first stage of power amplification. Solid-state circuitry is used throughout the transmitting system,

with the exception of the two travelling-wave-tube amplifiers.

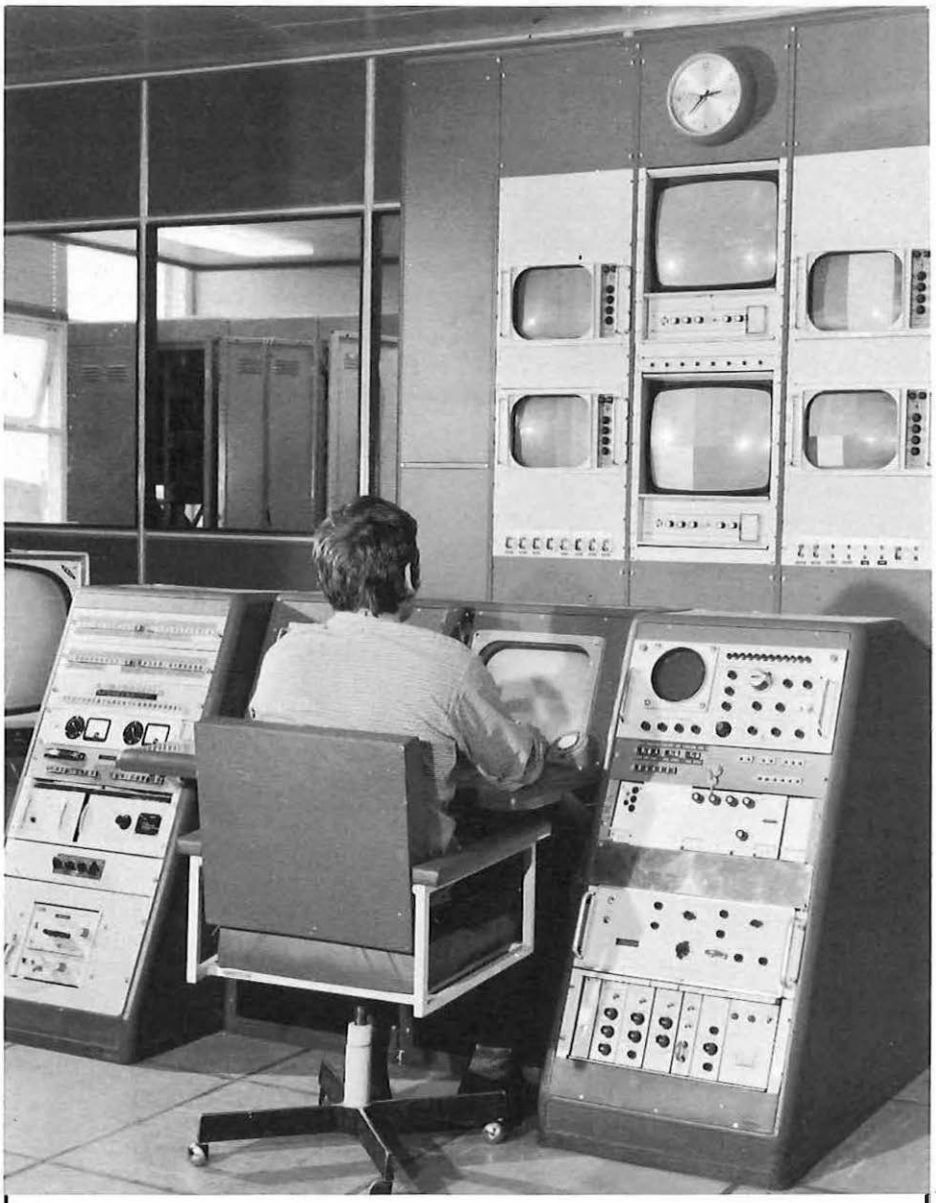
The receiving system uses a low-noise parametric amplifier housed in a cabin on the back of the dish structure, to provide a combination of low-noise performance with a maximum band-width of 500 MHz which is very close to the present-day achievable limit. The closed-cycle cryogenic system—it will operate for 3,000 hours without topping up—uses gaseous helium operating at approximately —257°C close to the liquid helium temperature. The parametric amplifier consists of three identical gallium arsenide varactor diode stages, connected in cascade. Each stage is mounted with the associated circuitry inside the low-temperature enclosure. Each of these three stages is pumped by a klystron source connected through a three-way passive splitter. The klystrons, the only parts of the receiving system which do not use completely solid-state equipment, provide 30 milliwatts of pump power at a frequency of 34 GHz.

The main and standby parametric amplifiers are mounted in separate containers inside the low-noise receiver cabin which has a movable floor and remains horizontal at any aerial attitude and is readily accessible for maintenance. Each container is completely removable for servicing, without affecting the other.

A low-noise tunnel diode amplifier forms the second main amplifying stage in the receiver, and this is also contained in the same cryogenic package as the parametric amplifiers operated from the same low voltage supplies as the tunnel diodes which require no routine maintenance. The receiver covers the complete satellite communications band from 3,700 MHz to 4,200 MHz, including all possible channels from both the *Intelsat* II and III type satellites, as well as from *Intelsat* I (Early Bird). The output of the first receiving stages is then passed into a waveguide branching network, which separates the received channels and passes them to separate frequency down-converters using balanced diode mixers with crystal-controlled oscillators. These signals are passed at the intermediate frequency of 70 MHz through further amplification stages, before leaving the aerial structure by coaxial cable.

The satellite is tracked using a beacon signal which it transmits itself. The signal from this beacon is separated from the communication carrier signals in the waveguide branching network and fed into the tracking receiver. The tracking signal itself is derived from a rotation of the horn feed at the vertex of the dish to produce a conical scanning motion of the beam at the beacon frequency only. This conical motion, only 0.4 minutes of arc off centre, produces a modulation of the received beacon signal which reduces to zero when the beam is pointing directly at the satellite. The depth of this modulation is directly proportional to the magnitude of the aerial pointing error, and is used to control a servo system to drive the aerial into the correct position. The direction of this error is determined by the phase of the error signal. Two voltages are produced by comparison of the received signal with reference signals and these give error voltages for servo corrections in azimuth and elevation.

All equipment in the transmitting and receiving chains is duplicated in standby chains and failure of any part of the active system is covered by the substitution of the appropriate section of the standby system which is divided into sections, with detectors provided at the output of each of them. A loss of output at any of these points will automatically operate the changeover switches to restore the service. The

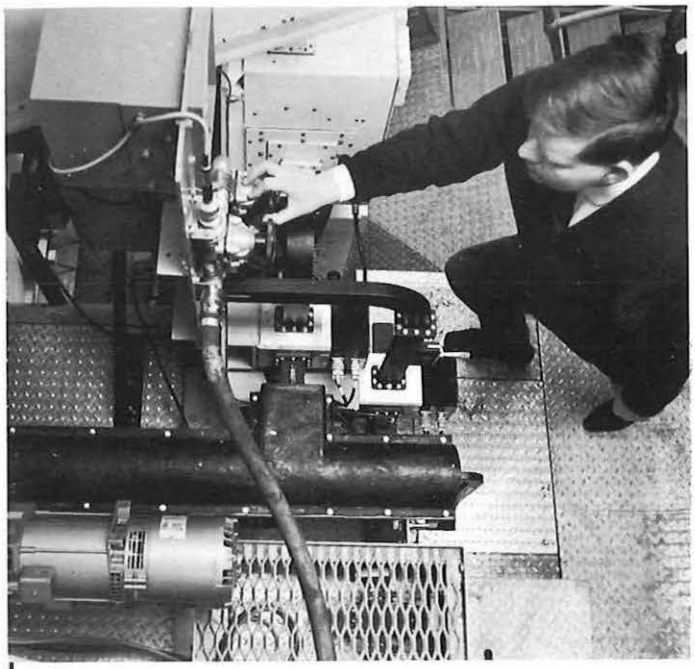


The television control console which provides comprehensive testing and monitoring facilities for both colour and black and white signals.

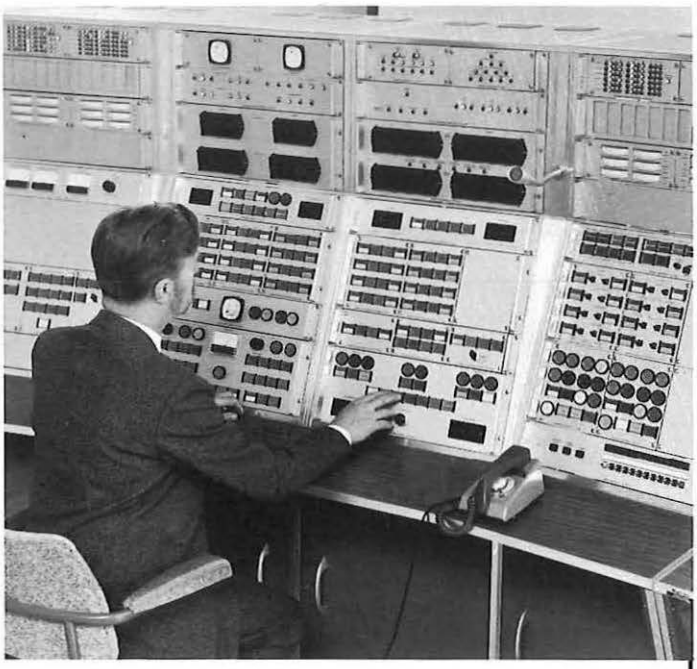
BRITISH industry and the country's exports are also benefiting from the new aerial. Senior Marconi officials have stated that their Post Office contract for the Goonhilly aerial has put them in a position to be able to compete in the very competitive foreign markets now opening up around the world for earth station contracts.

Because the Post Office specifications for Goonhilly 2 covered "a vast amount of the hardware" involved in such jobs, Marconi, among other things, had been able to develop very broadband transmitters in the 6 MHz band capable of carrying a very large number of channels.

As a result Marconi have now secured or have tendered for the building of earth stations in Hong Kong and Bahrain, Kenya, Malasia, Nigeria, Pakistan and New Zealand.



The low noise parametric amplifiers and the two cryogenic enclosures seen as white boxes with a waveguide network leading to them from the aerial horn feed.



The control console in the main Goonhilly station building. Full control of all components of the Goonhilly 2 aerial is given at this remote position.

slowest of these switches—the waveguide changeover in the transmitter chain—operates in fractions of a second to effect a changeover. These provisions will make the station so reliable that it will have less than nine hours out of service each year.

The complete station is controlled from a central control room where all the supervisory and control equipment is located. Displays indicate the state of all parts of the system, showing which chains of equipment are in service and which on standby.

Extensive monitoring, control and test facilities are provided at the operational control console and these, together with the automatic changeover facilities, will ensure the efficient operation of the station. The majority of routine testing and the overall testing facilities will be controlled from this point.

The control engineers can select different chains of equipment as necessary and monitor fault conditions manually or automatically. Full control over all aerial functions will be effected in this central control room, including manual control of tracking functions.

It is also possible when necessary to transfer control to local panels situated near the operational equipment.

Goonhilly Two makes Britain the first country in Europe to bring a second main earth station into operation. The United Kingdom is also the only European country to use big earth stations built entirely from its own design. The new station, therefore, retains for the Post Office its position among the world leaders in space communications.

MOONFLIGHT LEADER THANKS THE ETE

THE part played by the British Post Office in the recent flight by the American astronauts to the moon and back was recognised at the United States Embassy in London when Colonel Frank Borman, the flight commander of Apollo 8, presented Mr. C. J. Gill, Director of the External Telecommunications Executive, with an award on behalf of the National Aeronautics and Space Administration (NASA).

The award—in the form of a framed certificate—expressed NASA's thanks to Mr. Gill and the ETE and said: "the dedication and skill of the leaders and all personnel of those organisations in maintaining reliable communications insured the success of the first manned lunar-orbit mission and made it possible for millions of people around the world to witness man's first venture into extra-terrestrial space."

Through the London Switching Centre in Electra House the ETE provided essential and continuous operation of speech, high-speed data and low-speed teleprinter services during the six-day mission and additional trans-Atlantic telephone circuits to cater for news coverage of the operation. Accepting the award from Colonel Borman, Mr. Gill said he and his staff were proud to have played a part in the magnificent flight to the moon.

The Colonel thanks Mr. Gill.

Colonel Borman also presented a similar award on behalf of NASA to NASA's London switching centre based in Electra House, one of the links between the Houston space flight control and tracking stations throughout the world.

INTELSAT III

By R. M. HINDE and
J. H. PINDER

The largest and newest of the commercial satellites the Intelsat III series will soon provide the world with a global communications network via space.

THE world's newest commercial communications satellite, *Intelsat* III, which has a greater capacity than all the transatlantic cables and its two predecessor satellites, is now operating successfully and carrying public and commercial traffic between North and South America and Europe.

The satellite, hovering high above the Atlantic and serving British interests through the new Goonhilly 2 aerial, can provide communication between several earth stations simultaneously, has a capacity of over four times greater than the earlier satellites and can carry telephone and television traffic at the same time. Like its sister satellites, one was launched over the Pacific on February 6, a second will go up above the Atlantic in April and another over the Indian Ocean in May, *Intelsat* III has been designed for a minimum life in orbit of five years.

At launch the satellite weighed 632 pounds but this was reduced to 322 pounds after the apogee motor fuel had been expended in placing the spacecraft into synchronous orbit.

The body of *Intelsat* III is a cylinder 41 inches tall and 56 inches in diameter. Surmounting the cylinder is the antenna system which gives the spacecraft an overall height of 78 inches.

The combined directional communications-omnidirectional telemetry and command antenna enables the satellite to receive and transmit signals. The antenna is mechanically despun—as the satellite spins clockwise to maintain stability the antenna spins anti-clockwise at precisely the same speed thus keeping the antenna always pointed towards the earth in the correct communications position.

All of the *Intelsat* III satellites are designed to receive transmissions in the 5.930 to 6.420 GHz band and to transmit back to earth in the 3.705 to 4.195 GHz band. Two repeaters (transponders) receive, process and transmit the signals; the effective radiated power from the satellite being more than 22 dbW.

Earth sensors and electronic equipment are used to measure the satellite's attitude and, when required, the control earth station transmits signals to fire small thrusters to keep the satellite properly aligned with the earth.

Over 10,000 solar cells, which cover the outer surface of the satellite, convert sunlight into electrical energy to supply more than 130 watts of electric power for operating the many electrical and electronic components. At synchronous altitude the spacecraft is in sunlight most of the time, but in Spring and Autumn there are 45-day periods during which each satellite will be in and out of the earth's shadow. Then the electrical energy is provided by a battery which is recharged by the solar cells when the satellite re-enters the sunlight.

The new Goonhilly 2 aerial working to *Intelsat* III is now carrying UK telephone traffic to the earth stations at Etam in the United States and Mill Village, Canada. Initially a 132 circuit carrier is provided to Etam and a 60 circuit carrier to the Canadian station. But when the second Atlantic *Intelsat* III is operational Goonhilly 2 will transfer to it and the 60 circuit carrier will be extended in 1970 to cater for services with new earth stations under construction in parts of the Near East and Africa.

The United Kingdom's satellite telephone circuits to the Latin American countries will be routed through the continental European earth stations—Buitrago in Spain, Fucino in Italy and Raisting in West Germany—which will operate to South and Central America by way of the first Atlantic *Intelsat* III. This dual satellite operation in the Atlantic will provide much needed relief to the very busy North Atlantic routes.

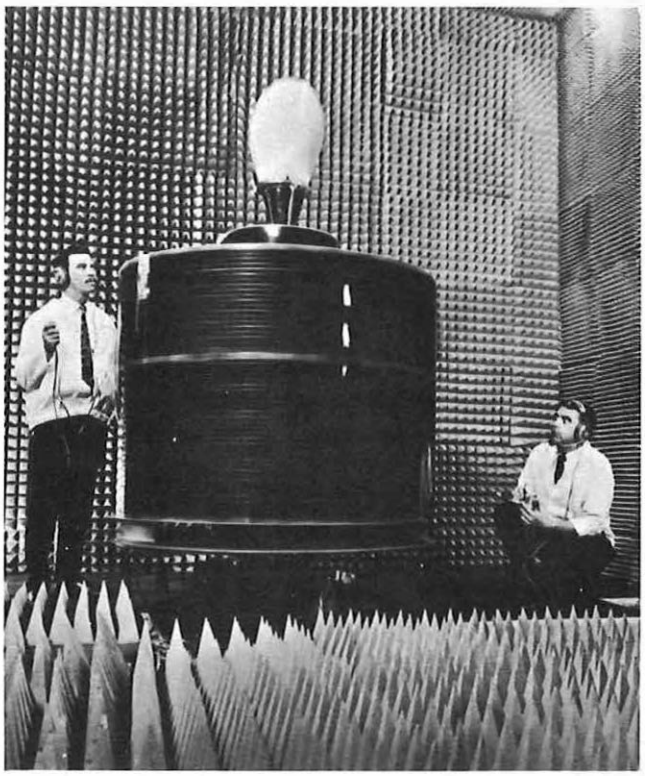
Yet, because of the increasing growth of the international telephone service the capacity of both Atlantic *Intelsat* IIIs will be fully used by the end of 1970. Consequently the International Telecommunications Satellite Consortium, a growing venture in which there are currently 63 member nations, has placed a contract for *Intelsat* IV satellites which will have capacities exceeding 5,000 telephone circuits the first of which is expected to be in service over the Atlantic early in 1971. Something which, yet again, emphasises the truly phenomenal development of satellite communications technology.

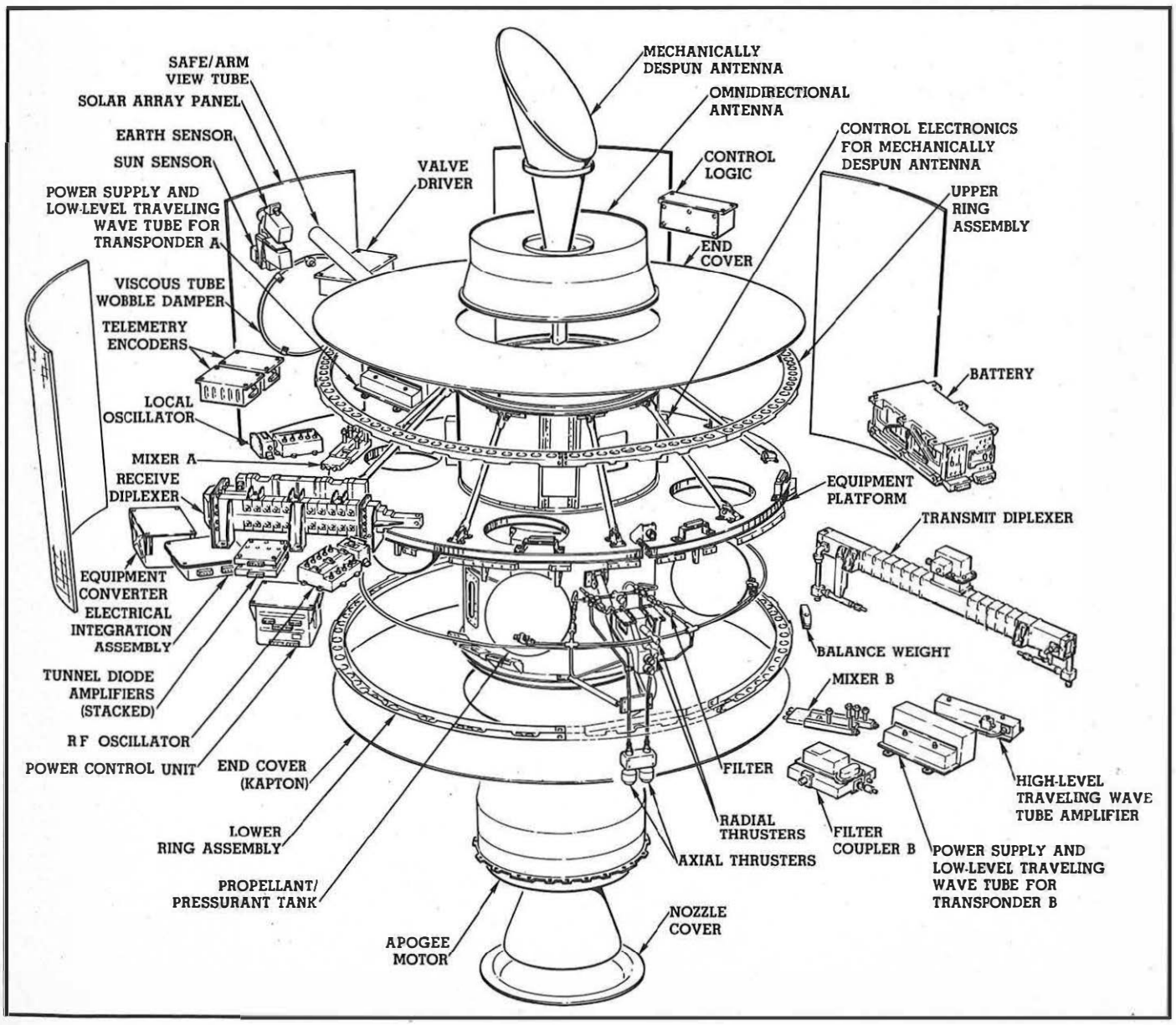
THE AUTHORS

Mr. R. M. Hinde *is a Senior Executive Officer in the Satellite Communications Division of the External Telecommunications Executive and*

Mr. J. H. Pinder *is a Higher Executive Officer in the Overseas Network Planning Division of the E.T.E.*

An Intelsat III satellite under test in America before launching.





THERE'S MORE THAN TO DIRECTORIES

The rapid and progressive expansion of the telecommunications business has produced its own problems for the Post Office. Among these is the problem of maintaining the highest standard of directory service. This article discusses the wide ranging but integrated development planned for directories and the problems that must be overcome

by K. C. GROVER

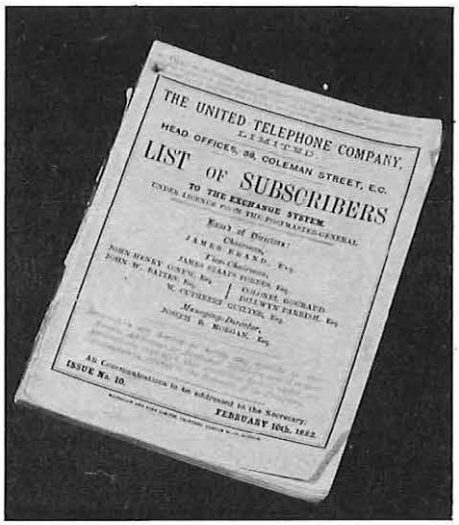
PUBLIC interest in telephone directories was stimulated last year by the announcement of proposals for changing the pattern of the London telephone directory. The plans for London are only one facet of a wide ranging but integrated development aimed at maintaining the highest standards of directory service properly in keeping with the needs of a progressive and rapidly expanding telecommunications business.

Telephone directories serve the customer by meeting his needs for number information, minimising costs, and satisfying other social and business needs. The simple concept of a book containing lists of telephone numbers conceals a complex interrelationship of conflicting requirements. Numbers should be easy to trace but there is pressure to include a variety of other information in entries to meet needs unconnected with the use of the telephone. A telephone directory can be developed as an advertising medium to become a valuable additional source of revenue but its prime function as a source of telephone numbers must not be jeopardised.

The development of telephone directories ranges from changes aimed at making the books more informative to radical changes in their design and production. Any change can indirectly affect other aspects of the overall process of publication. For example a change in the quality and design of the cover may lead to a need for greater protection of the books during distribution and delivery. A more attractive cover, however, may also enhance the attraction of the books as an advertising medium and increase their commercial potential. This article outlines two particular projects —changes in the pattern of directories and the commercial development of the books.

About 11 per cent of telephone calls are preceded by a reference to a directory and about 2 per cent by a directory enquiry. The two sources of number information are complementary and it is the task of a telephone business to achieve the optimum balance in the use of the two services by its customers. The relative costs are critical. A directory enquiry costs a shilling to deal with compared with an average cost of less than a penny for each number obtained from a directory. The more directories are used and the less the enquiry service, the greater the indirect benefit to the customer in minimising the costs of his service.

Whatever the balance, however, it is of paramount importance that users must be able to get the numbers they need quickly and telephoning made as easy as possible for them. The problem is to decide which numbers to include in the user's directory and by selection avoid making it difficult for him to find the numbers he requires from among the mass in which he has no interest. About 50 per cent of the numbers which Directory Enquiries are asked for could be found easily in the directory issued to the caller. Directory size, the number of pages and long lists of common surnames to search through are some of the disincentives to a full use of the books.


THE UNITED TELEPHONE COMPANY,
HEAD OFFICES, 26, COLEMAN STREET, E.C.
LIST OF SUBSCRIBERS
TO THE EXCHANGE SYSTEM
ISSUE No. 10.
FEBRUARY 10th, 1882.

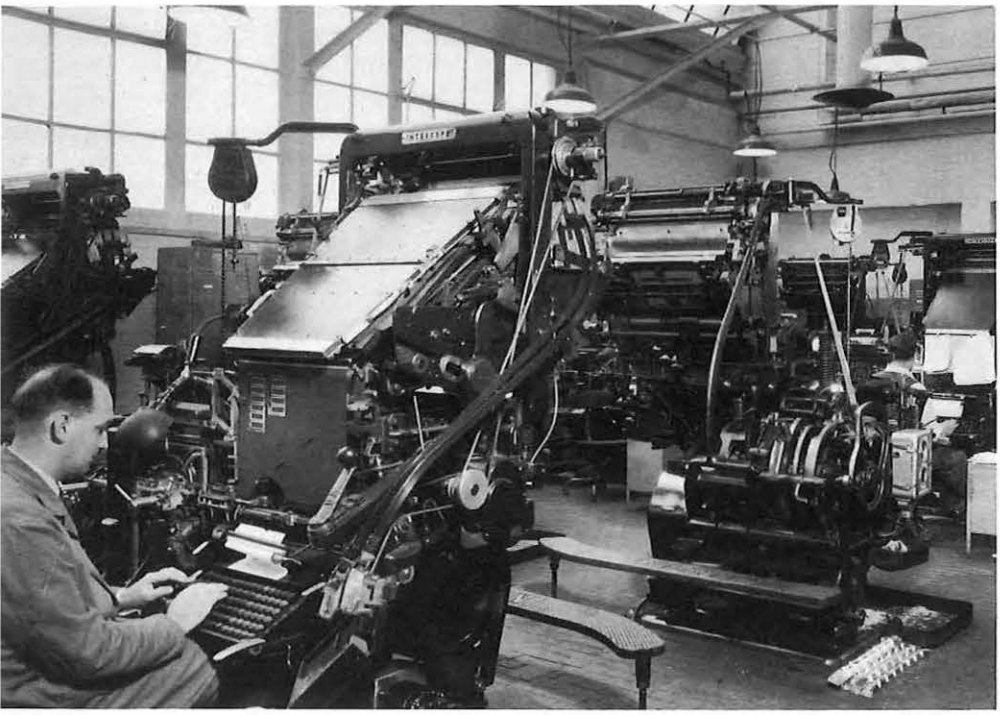
One of Britain's oldest telephone directories. Produced by the old United Telephone Company it dates back to February, 1882.

The first directories listed every subscriber—often arranged in street and numerical order as well as in alphabetical order of surnames—and every subscriber had a copy. With the rapid growth of the system it soon became impossible to list every number in a single book and some form of subdivision was inevitable. Traditionally the solution has been to subdivide geographically and to provide subscribers with books listing only the numbers of other subscribers in the same geographical segment of the system. Directory boundaries have been drawn to avoid wherever possible cutting through communities, but with telephone growth and wider social and commercial interests, this is becoming increasingly difficult and changes will be necessary. The need is growing most acute in London where nine books with a total of nearly 6,000 pages listing over 1.5 million entries are now required to cover the conurbation.

A fundamental weakness of the traditional approach to directory pattern is that although users' needs for number information fall away gradually with distance, directory coverage stops abruptly at a line on the map. If numbers just beyond the boundary of the user's own directory are required, he must normally either call directory enquiries or be supplied with the directory for the whole of the adjoining area. A subscriber in Harrow for example is supplied with the 700 page directory for West Middlesex containing about 200,000 entries, but if he also needs a directory listing numbers in Wembley a mile or so away he must have the four books for the whole of the London Postal Area containing nearly 3,000 pages and over 750,000 entries.

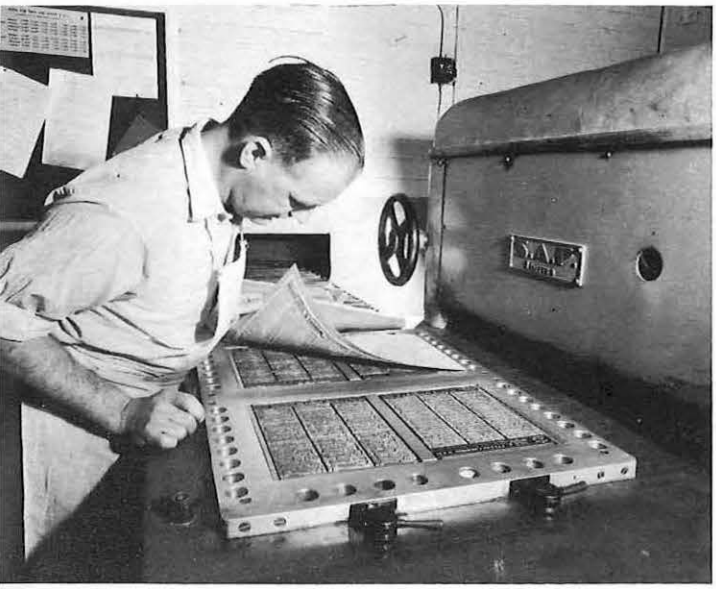
continued on page 12

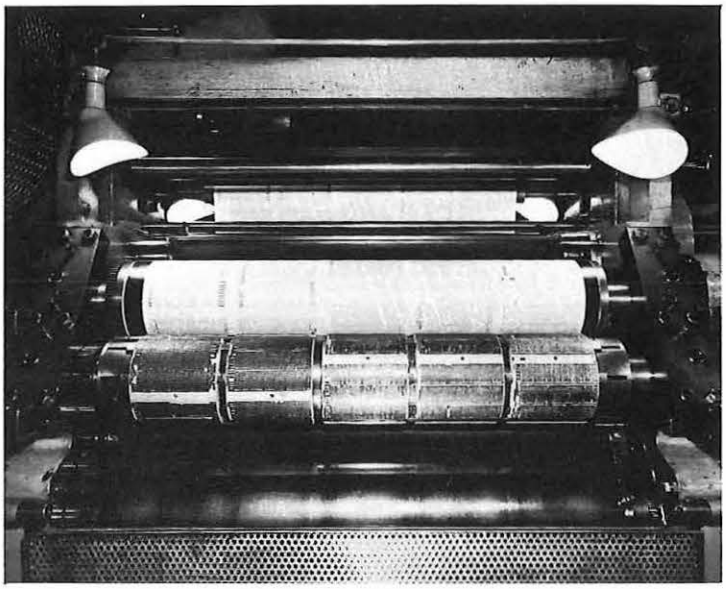
NUMBERS



The printing works division of HM Stationery Office comprises eight printing presses and five binderies. The annual value of printed matter is over £2 million. Harrow Press is the largest works, employing about 1000 people and produces principally Telephone Directories and other security printing. Our photographs show the sequence of printing of telephone directories. These are now set on an Intertype machine in Bell Gothic, a type specially designed for legibility and economy of space.

Left: An Intertype machine operator sets in metal a page of a telephone directory.

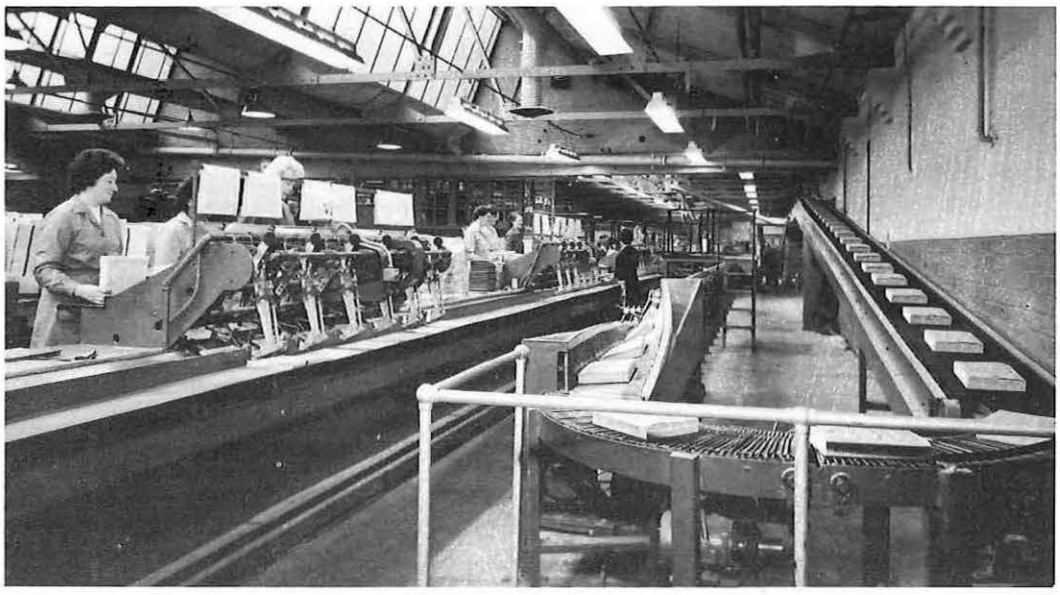




Above: Directory pages ready for moulding. The mould is used for producing a papier mache replica of the type.

Above, right: A rotary press containing 20 pages of directory plates on each of two cylinders. It delivers a 40 page folded section.

Right: Bound books travelling round the conveyor while the glue dries before being trimmed.



THE AUTHOR

Mr. K. C. Grover, BSc (Econ), *is Principal in charge of Service Literature and Information Services. He joined the Post Office as a Youth-in-training in 1941, served in Traffic grades and for a period in ETE. He was appointed a Principal four years ago.*

These considerations have led to a new concept of directory which will be tried in the new London Borough of Hillingdon early in 1970 and if successful will be introduced throughout Outer London. Each of the new directories will list not only the numbers of the subscribers who receive it, but also the numbers of subscribers in a wide surrounding area. In addition it will include a further 3,000 numbers throughout the conurbation which are commonly required e.g. hospitals, railway enquiry bureaux, theatres and cinemas. The aim is to compile selectively a variety of abridged editions from which the users will find the majority of the numbers they need and which excludes the mass of numbers which they seldom if ever call.

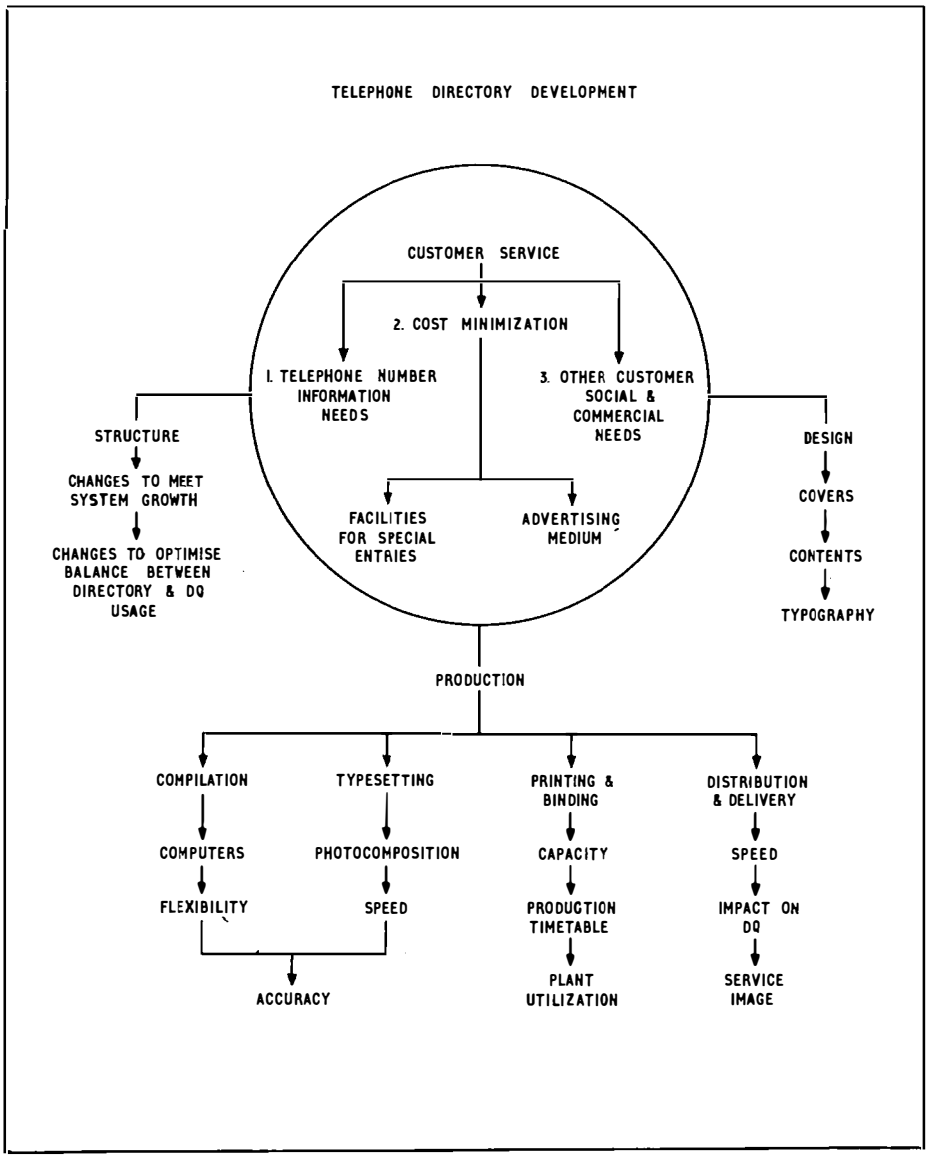
The Hillingdon directory will be issued to some 48,000 subscribers, but will list a total of 210,000 numbers. The effectiveness of this pilot book will be carefully evaluated and customer opinions sought on its merits compared with their existing directory. If this concept of overlapping directories compiled essentially on a basis of user need and not segmentation is proved sound, the existing Outer London books will be progressively replaced by a further eighteen of the new directories for other Outer London communities during the following two years. The existing four books covering the London Postal Area will also become unwieldy with growth and will have to be further subdivided, but a decision on this will be unnecessary until well into the 1970s. The implementation of the scheme depends on the availability of computer facilities and the latest printing techniques; work has been proceeding on such a system for more than a year and it will be brought into operation in the late Autumn of 1969.

It is recognised that some users, and particularly business subscribers, require more extensive information than they could obtain from their new community directory. A major step was taken in meeting the special needs of industry and commerce in London in 1967 with the publication of the Greater London Business directory. This is issued to all businesses in Greater London, but lists firms with 2 exchange lines or more in an area of 30 miles around Charing Cross. In addition any London subscriber will be able to have free, on request, any other or all of the new community directories as they are introduced. For further specialised needs a complete alphabetically integrated list of all subscribers in Outer London will be made available ultimately in some form.

Classified directories in which subscribers are listed by trade or profession were introduced at an early stage in the development of directories. The user with a particular need to satisfy can find a list of local firms in a classified directory who may be able to supply the goods or service required. Until recent years such directories have been issued only to business subscribers in those parts of the country where the revenue from the advertising they contained adequately covered their costs of production.

Since 1966 the Post Office with its contractors Thomson Yellow Pages Ltd has directed considerable effort to the development of classified directories as an important additional service for all of its customers. By the end of 1969 virtually every telephone user in the country will have a Yellow Pages classified directory bound with his normal alphabetical book or issued separately. The new directories will ensure that users can not only look up the telephone number when they know *WHO* they want, but also have a selection of numbers to ring when they only know *WHAT* they want. Experience in the United States, Australia and other countries suggests that, given reasonable time for the value of the new books to register with the public, they will become an important factor in the stimulation of telephone usage. Yellow Pages also provide firms with a means of ensuring that they will be brought to a potential customer's attention at the time he is looking for a supplier of particular goods or services. In contrast with most other media,advertisements in Yellow Pages are aimed at satisfying a need which already exists rather than creating one. Their value as an advertising medium is rapidly being recognised by industry and commerce and their potential as an additional source of revenue to offset the costs of the telephone service is already being realised to an encouraging degree.

The projects outlined are only two of a number directed to the progressive development of directories. It is planned within the next two years to automate completely the production of the books, to improve their covers, layout and typography, to achieve better standards of distribution and delivery, and—more important—to use directories more effectively as a source of information about the many other services and facilities available to telephone users.



They were strawberry pink 50 years ago

By A. M. R. HARDIE

KEEP a thing for seven years and you'll find a use for it says an old Scots proverb. But keep it for longer and it can become a fascinating relic of the past.

These thoughts crossed my mind recently when I dug out a real treasure from the archives of the basement store of the Telephone Manager's Office in Edinburgh. It was an early copy of Edinburgh's telephone directory issued 50 years ago.

Gaily dressed in a strawberry-pink cover, an inch or two shorter and narrower and considerably thinner than its modern counterpart, the 1919 directory throws some interesting sidelights on the telephone service of those days.

Half a century ago the Post Office appears to have been fairly autocratic in its attitude to its customers, laying down on page *iv* of the preface that "subscribers at the unlimited service rates must not allow other people to use their telephone". What happened, one wonders, if a neighbour without a telephone wanted to make a life-or-death call on a subscriber's telephone?

In those days, too, the rental became due on the day the installation was completed and was payable annually in advance (last year's decision by the Post Office to require an annual rental from new subscribers—now rescinded—was not then after all a new and unfair imposition as the newspapers claimed).

Subscribers, too, could obtain lists of subscribers for any other district only so long as they made "reasonable use of the trunk circuits concerned".

Charges for trunk calls (all of which had to be connected by the operator) were extremely expensive compared with today's prices, taking into account the fall in the value of money over the past 50 years. A three-minute trunk call up to 25 miles cost 4d. by day or night. A call up to 50 miles cost 8d., day or night; up to 75 miles, 1s. by day and 8d. by night, and up to 100 miles 1s. 4d. by day and 8d. by night. There were no information services and no free emergency calls. Extra directory entries, too, were expensive by today's standards.

All the main exchanges gave a

Part of a page from the 1919 Directory.

continuous service every day of the week but a number of the smaller exchanges were open for service only between 8 a.m. and 8 p.m. on weekdays and only for one hour, between 8 and 9 a.m., on Sundays.

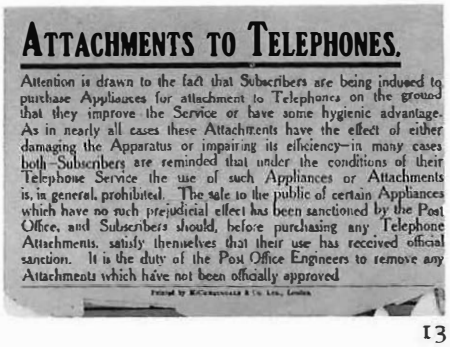
In those days, too, subscribers were told they were not entitled to use the trunk service continuously for more than six minutes. If they had not completed their business during that time they had to book a fresh call and start again.

They were also advised to insure their telephones for the sum of at least £5 against destruction by fire and requested not to have cosy chats with the operator—just to give the number they wanted.

The 1919 Edinburgh Directory cost the subscriber 1s. and contained 76 pages (compared with 476 pages plus a classified list of 184 pages in 1968 for 5s.), inside a cover which contained six advertisements, four of them from Edinburgh firms which appear, at the same addresses, in the local directory today. There were 13,000 separate entries (132,000 in 1968), sub-divided into eight districts, and the telephone numbers appeared before the names and addresses, the reverse of today's arrangement. One entry, which no doubt infuriated the literary purists, and all Scots, described the Scottish Education Department as the *Scotch* Education Department.

In the 1919 directory there were 116 Browns, 137 Smiths and 593 Mcs or Macs. Today, Edinburgh's directory lists 1300 Browns, 1490 Smiths and 8430 Mcs or Macs.

A 1919 warning to subscribers.


ATTACHMENTS TO TELEPHONES.

Attention is drawn to the fact that Subscribers are being induced to purchase Appliances for attachment to Telephones on the ground that they improve the Service or have some hygienic advantage. As in nearly all cases these Attachments have the effect of either damaging the Apparatus or impairing its efficiency—in many cases both—Subscribers are reminded that under the conditions of their Telephone Service the use of such Appliances or Attachments is, in general, prohibited. The sale to the public of certain Appliances which have no such prejudicial effect has been sanctioned by the Post Office, and Subscribers should, before purchasing any Telephone Attachments, satisfy themselves that their use has received official sanction. It is the duty of the Post Office Engineers to remove any Attachments which have not been officially approved

The Selling Plan:
A NEW EMPHASIS

By JOHN D. BEAN

A new Selling Plan for the Telecommunications Service is being launched which aims to make better use of Post Office resources. Its main objective is to develop the system in both the residential and businesses sectors and to give our customers the kind of service they want

THE 1968/69 Selling Plan for the Telecommunications Service which has failed to reach its objectives, is to be succeeded by a new Selling Plan for 1969/70 based firmly on available resources.

The 68/69 Plan—the first comprehensive selling campaign for Telecommunications—came into action with the introduction of the new tariffs on 1 October, 1968. It symbolised the developing role of marketing in the Post Office and mirrored the establishment of the Marketing Department.

The basic premise of the Plan is that in a competitive society the telephone service, like any other provider of consumer durables, needs to adopt a more positive, customer-orientated selling role than has been possible in the past.

All our customers, whether residential subscribers or business organisations, are under constant pressure to spend their funds on the latest labour saving devices that will make life easier or their operations more efficient.

Among these must be included improved communications. But, in the clamour of advertising and salesmanship, the role of communications will be lost unless we in the telephone service take deliberate and positive steps to go out and meet the customer, actively promoting our range of products. We have substantial barriers to scale, based on past years of restrictive opportunity and the sheer weight of ignorance about what we can provide and what the terms and extra costs will be.

Few people either inside or outside the Post Office would disagree with the principle of the new approach but of course there is a lot of weight behind the opinion that we should get the service to existing customers right before we start our canvassing. In Marketing Department there is an equal eagerness to see that the service should be all the customer has a right to expect. It makes the selling operation so much smoother if the after sales service has a firm reputation.

The question of adopting the new policy of active selling resolves itself then into a question of timing. The Selling Plan 68/69 showed that we have decided that the time is now ripe for us to change and to start the long haul of re-educating our public and re-orientating our own organisation to take account of the new selling concept. We are aiming to anticipate the working out of the measures to improve the service and thus to obtain a flying start as we move out of the Government service into a new Corporation. The decision that now is the time to move ahead in selling was underlined by the report of the National Board for Prices and Incomes which specifically took us to task for our long-standing, traditionally cautious approach which considered the existence of a waiting list as a permanent deterrent to selling the service.

The underlying principle of the Plans is the basic principle of all Marketing—that opportunities exist for meeting increased consumer needs and that any organisation that is not moribund must identify those needs which it can meet at a profit and then organise its resources to tap that market.

We have, however, had to interpret the principle in the light of the opportunities open to us within a comparatively short time span. So we looked for resources which we thought would be under-utilised once the tariffs of October 1968 had taken effect and planned to make a concerted effort to bring them into profitable use—profitable at once to us and to our customers. The justification of our plans was multiple: there were extra profits to be had from the extra sales; there was increased productivity to be obtained from keeping the engineering force steadily engaged; there was the chance to demonstrate that publicly-owned enterprise could be enterprising and there was an opportunity to demonstrate to our own staff that our organisation, so often on the defensive, could be as forward looking in its marketing as it is technologically.

We have, of course, a great deal to learn about what is involved when the customer is actively canvassed. We are experimenting with the use of mass media for promotional purposes; we have recruited a new advertising agency to provide us with material with an emphasis on promotion rather than information. Areas up and down the country have been mounting their own local experiments to test out a range of selling methods from stands at exhibitions to direct mail "shots". In some areas we are experimenting with selling by installation engineers. To prepare for this new emphasis we have introduced quick programmed learning courses for the staff of the Sales offices and we have set up a course for managers on the control of promotional campaigns. The evidence so far suggests that we have plenty of talent in the areas just waiting to have the full support to tap the markets.

A clerical officer deals with an order from a residential subscriber.

Support resources—supplies and manpower—are, of course, the keystones of an active selling operation. The ideal towards which we are working is that degree of pre-planning that is available to the marketing man in outside industry. We should and shall aim to identify the market and then set up the machinery and acquire the resources to develop it to the limit of its potential.

At the moment, however, we have to recognise that there are many

other demands on the resources and on the money that lies behind them so that the Plans for 68/69 and the forthcoming Plan for 69/70 have been inevitably constricted by the investment decisions of the past and the supplies and manpower that are available at present. We cannot hope for extra resources but we are aiming to make the best and fullest use of those that we do have.

The limitation of resources was the basic reason for the progressive scaling down of the 68/69 Plan. Our expected spare resources of manpower were in fact absorbed by buoyant demand—we expect to achieve what we planned but we shall not need to sell to get there. The resources of stores which we had planned did not become available in time, for a variety of reasons, so that again an expected opportunity did not materialise. It is because of these experiences that the 69/70 Plan proposals were geared very firmly to the resources that will be available—especially the stores.

In addition we have recognised that we shall have little spare manpower so that there will be no great opportunity to sell exchange line service although we will be prepared against the eventuality of a turn down in demand. It is, of course, a disappointment to be held back from an attractive and profitable market but it is important that, to keep faith with our own staff and with our customers, we steer clear of false optimism.

The existence of a plan which can be scaled up if necessary, however, does give us a valuable insurance against economic fluctuation and should enable us to keep all our staff steadily employed.

A detailed description of the Plan for 69/70 would be out of place here but, in brief, we consider we can divide the market broadly in two. The simplest segment is the residential sector where we are aiming to improve the penetration of extensions at the fastest possible rate consistent with our engineering resources and the number of selling opportunities we shall have. We are also aiming to sell the Trimphone widely into this market, again basing our target on the number of contacts we expect to have with potential customers. This contact will almost entirely be with the clerical duties in the Sales Office, on the telephone or by mail, and their selling efforts will be supported by press campaigns. In some very local areas where we have spare plant we shall also be aiming to carry out further small-scale experiments in selling exchange lines. These will be delicate operations to avoid overspill into less favoured areas.

The business sector will be the province of the Sales representatives who will now be encouraged to plan ahead the sales they hope to achieve, covering the range of products that are available. Good planning will be a pre-requisite of this operation to keep the sales effort in step with the manpower and supplies situations locally.

Our overall objectives are to increase the number of extensions in service and to encourage our customers to rent larger and, for preference, automatic systems. The long standing Telex campaign will continue with the added attraction of the new Teleprinter 15 and with the specific impetus of specialised campaigns to widely scattered bodies, such as libraries, which have a common pattern of need. As in 68/69 there will also be national press campaigns run from THQ to encourage consumers to increase their use of the services. We shall be aiming particularly to increase the calls dialled in the off-peak period and the calls made to the Information Services.

The coming financial year will hold out the major challenge of the change to Corporation status one of the fundamental assumptions of which is that the Telecomms Service will find wider opportunities outside the restrictions of a Government Department. The Selling Plan is one of the opportunities we have to demonstrate that we can accept the implicit challenge and that we understand that to be properly commercial minded is to face the need to fight for our customers in the competitive market place.

Points are made quite clear on the equipment in the demonstration room.

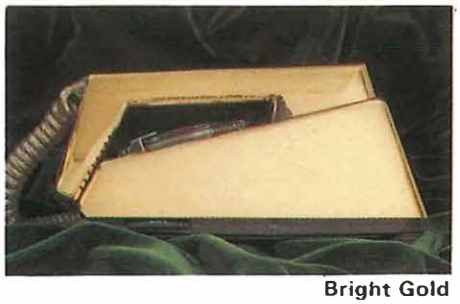
A sales representative explains features of a switchboard installation to a potential customer.

THE AUTHOR

Mr. John D. Bean, M.A., M.Sc (Econ.) *joined the Post Office over seven years ago direct from Oxford University. He was for a short time private secretary to the last Director General and was then appointed an Assistant Principal. After two years at the London Business School where he took his M.Sc. degree he joined the new Marketing Department at THQ where he is now head of sales promotion.*

Satin Chrome

Tangerine



Bright Gold

Two Tone Blue

Satin Gold

Tangerine

Concord Blue

Transparent

Are these the colours for the 'seventies?

Britain's telephones of the 1970s may be dressed in a rainbow of new colours to match the sparkling decor which will make the country's homes and offices over the next decade brighter and better places to live and work in.

For the past six months the colours featured on these pages, and a few others not reproduced here, have been tried out on the public in a series of displays in the bigger city stores, at exhibitions and in Telephone Managers' offices, Telephone Exchange buildings and Head Postmasters' offices in every Post Office region.

In Gamages in London more than 3,000 visitors filled in questionnaires indicating their colour preference.

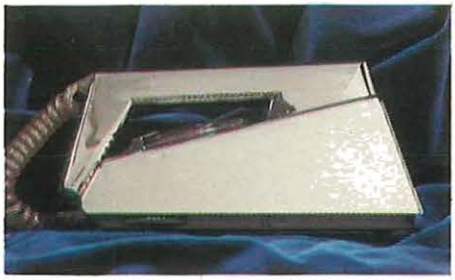
There are 19 new colours in all, ten for the Trimphone, including black in which it has never been available before, and nine for the modern telephone—the 706 and 746 series. Also included in the new range are transparent "see through" modern telephones and trimphones.

A market research display unit used during the survey.

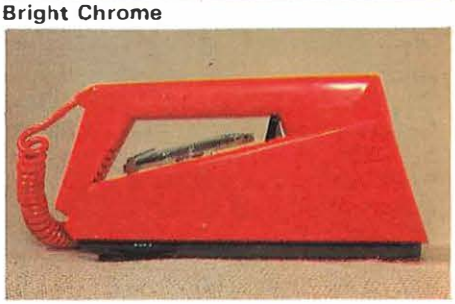
To speed up results of the survey, questionnaires from the regions are being processed by computer at NDPS in London and then will be evaluated by staff at Market Research Division at Telecomms Headquarters.

Main purpose of the exercise is to measure public reaction to the suggested new colours. Results of the market research may also influence the colour ranges of future telephones.

If any of the new experimental colours are introduced they will be the first change in telephone colours in ten years.



Bright Chrome



Red

White

Red

Two Tone Green

Two Tone Grey

Topaz Yellow

Light Ivory

ALUMINIUM CABLES ARE THE ANSWER

By E. E. L. WINTERBORN

The British Post Office has gone a long way towards solving the many problems involved in using aluminium for telephone cables. Trials are nearing completion which, if successful, will eliminate the need for expensive copper conductors and bring other advantages to the telephone system

THE Post Office is leading the world in the use of aluminium as a telephone cable conductor. Through persistence with field trials which have been going on periodically since 1954, and the collaboration of the wire-drawing and cable manufacturing industries, the intrinsic problems of the metal's susceptibility to corrosion and difficulty in jointing wires made from it have now been overcome.

Because of price increases in copper, the Post Office first became interested in the possible use of aluminium as a conductor in the early 1950s. Trials began in 1954 and by 1959 about 1,500 pair miles of cable—including the Dover-Deal experiment—had been laid.

These trials, subsequently dropped because of the stabilising of copper prices, at least established that such cables could be manufactured and installed, although several problems including the difficulty of jointing and terminating the conductor had still to be solved.

But four years ago when protracted strikes in the Chilean copper fields pushed the price of the metal up again, and when the Rhodesian problems threatened to cut off the supplies of Zambian copper, there was reason enough for the Post Office to turn once again to aluminium.

The world's copper deposits are in fact restricted, in some cases difficult to obtain, and not all in countries under western influence.

The copper ore has also of necessity to be smelted in the mining areas which results in the purchasing country being unable to exercise any control of production costs.

Deposits of bauxite, the ore from which aluminium is obtained, are on the other hand, found throughout the world, are less vulnerable to strategic and political influences, are more stable in price and with the ore shipped to the smelter there is more control over production costs.

The Government's recent decision to erect aluminium smelting plants in Scotland, North Wales and Durham, should also add to the economic attractiveness of aluminium over copper.

There were technical considerations too. The specific resistance of aluminium is 2.7 compared with 1.6 for copper so that for equivalent resistance an aluminium wire must be 1.3 times the diameter of the copper wire it replaces.

On the other hand the specific gravity of aluminium is only 2.7 compared with 8.9 for copper. For a given resistance, the weight of aluminium wire is therefore only half that of copper. Cables with aluminium conductors are increased in diameter by 1/3rd but are reduced in weight by something like 25 per cent. They are not half the weight because the increased conductor size means that larger quantities of insulating and sheathing material are required than with copper conductor cables.

Mr. R. A. Hoare a Tech 2A using "B" wire connectors and crimping tool.

The Post Office decided to hold extended trials of aluminium conductor cable on the distribution part of the exchange area network, where the increased cable diameter would be least likely to cause duct congestion and where much of the cable is buried directly in the ground.

All the cables in this section are polythene insulated and sheathed, so this set the basic design of the proposed new cables.

Early in 1966 experiments were started to determine the most suitable grade of aluminium. Unlike copper, which is used in the fully annealed condition as a result of heat treatment after wire drawing, aluminium must be in a partly work-hardened state, otherwise it is too weak to handle.

It is drawn down to an intermediate size, annealed and further drawn down to the actual size required—an additional process which slightly offsets the economic advantage of using aluminium.

Still, the 1966 reappraisement confirmed the 1954-59 trials, that a wire having a tensile strength in the range 18,000 to 24,000 lbs/sq. in. was the most suitable. In view of the national policy to go metric it was decided that the new conductors should be specified in millimetre sizes, 0.6 and 0.8 being chosen.

Sixty sheath miles of cable in various sizes up to 100 pairs were manufactured and installed; an exercise which established that cable using this class of conductor was capable of being manufactured and laid by the normal means.

Jointing problems were also overcome. The unsoldered dry twist connection used on the copper cables was not possible with aluminium because it oxidises rapidly, the oxide film preventing electrical continuity unless the joined conductors are welded or soldered together. But even these methods, tried during the earlier trials, were not acceptable for general field use.

The answer came with the hand operated crimping tool which compresses the conductors inside an insulated phosphor-bronze connector.

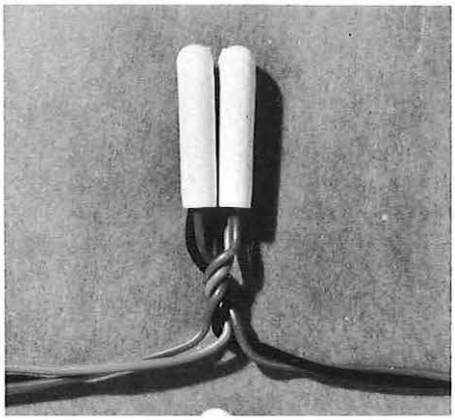
To prevent the corrosion which occurs when two dissimilar metals are in intimate contact in the presence of water, it was essential that condensation of water vapour in the joint should be prevented.

Calculations and laboratory experiments on the stability of crimped joints, completed in mid-1967, showed that the insertion of packets of silica gel would probably ensure freedom from corrosion failures for a cable life of at least fifty years.

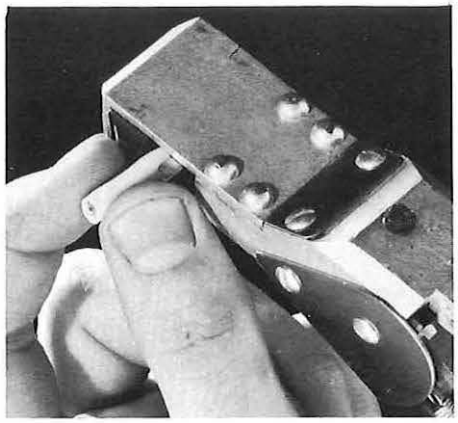
Only one big problem now remains to be solved—that of terminating aluminium conductors on fuse mountings and terminal blocks. This again is a question of overcoming the metal's susceptibility to corrosion and the formation of oxide film. Standardisation of cable design demands that an answer shall be found eventually. Meanwhile, aluminium cables can be connected to copper cable "tails" which are terminated by normal methods.

Bulk production in one factory in late 1967 and early this year has also shown that it is possible to manufacture aluminium cable economically. Contracts have now been placed with all the Supplies Department's suppliers at prices which give a saving around ten per cent on copper conductor cable when copper costs £450 per ton.

Engineers have also taken another look at the economics of cable design. Each yard of cable inserted into a customer's circuit introduces unavoidable transmission loss. The cable specification sets a limit to this in terms of the cable capacitance and resistance both of which affect the loss; one property can be exchanged for the other.



The insulated wire connectors which are used for jointing aluminium to cable.



Insulated wire connectors being inserted into Pliers Crimping No. 2.

Tech 1 Mr. S. R. Hoverd jointing the aluminium cable to a copper tail.

When copper conductor cable is used, it is customary to have a small conductor with relatively thick insulation. This means that with aluminium the resistance can be made low by using a relatively large diameter conductor, while the capacitance is permitted to rise by using a thin insulation.

The strict application of this principle to aluminium conductor cables indicates that a 0.5 mm conductor could be used for 90 per cent of underground plant in the exchange area network. This is smaller than the "equivalent resistance" conductors used on the field trials and which are being purchased at the present time.

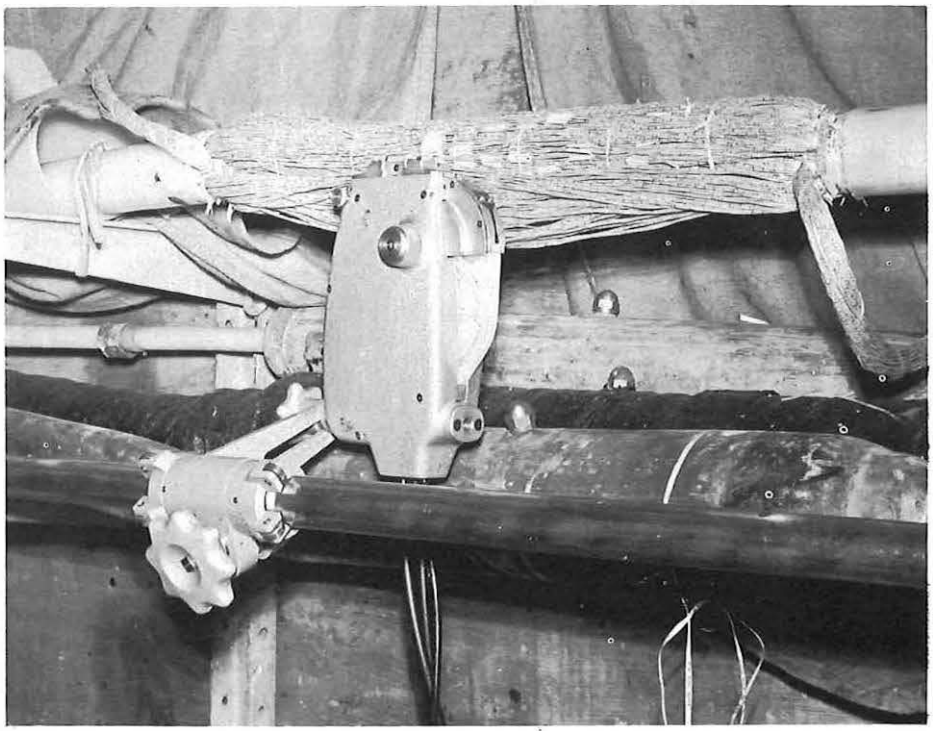
It is therefore anticipated that even cheaper aluminium conductor cables may be practicable and points the way to the extension of the metal's use to the larger cables between the telephone exchange and the distribution cabinet. And in this section, corrosion problems are not expected to arise since the cables are always protected by duct and are pressurised to give early indication of fault conditions.

THE AUTHOR

Mr. E. E. L. Winterborn *is a Senior Executive Engineer in the Civil and Mechanical Engineering Branch of THO's Development Department and is responsible for Post Office purchasing specifications for cable and wire.*

THIS MACHINE JOINTS TEN TIMES FASTER

Hand twisted joints are on the way out. A new machine is being introduced which does the job more efficiently and in only a tenth of the time



THE hand twist used by Post Office jointers for more than 50 years may become a thing of the past and a new technique of machine jointing take its place.

The old method of stripping the insulation, twisting the bared wires together and enclosing the joint in a small paper tube is likely to be superseded by a new mechanical device, the Jointing Machine No. 4.

An order for 60 machines has been placed. The first batch is now undergoing strenuous tests to ensure reliability in service when released for field use.

The Jointing Machine No. 4 will enable jointing to be carried out ten times faster than at present. By the hand twist method it took a man 25 seconds to make a single wire joint. The new machine will do it in two-and-a-half seconds with more consistent results and with less fatigue to the man on the job, giving him more time to concentrate on other aspects such as wire selection. It will obviously ease the jointers' task which is often carried out in difficult and arduous conditions.

The development of the new machine has been carried out by the Post Office Research Department at Dollis Hill and the Plessey Company. It looks like being a winner in this country and its export potential is promising.

Mechanical jointing, particularly for the new large cables, has always been a desirable development specifically to save time and give more consistent results electrically.

The equipment consists of two parts: a jointing head mounted at the cable joint and a hydraulic power unit operating from a 110v generator set. The connectors are supplied in cassettes containing reels of about 52. These are fed into position in the machine automatically as jointing proceeds.

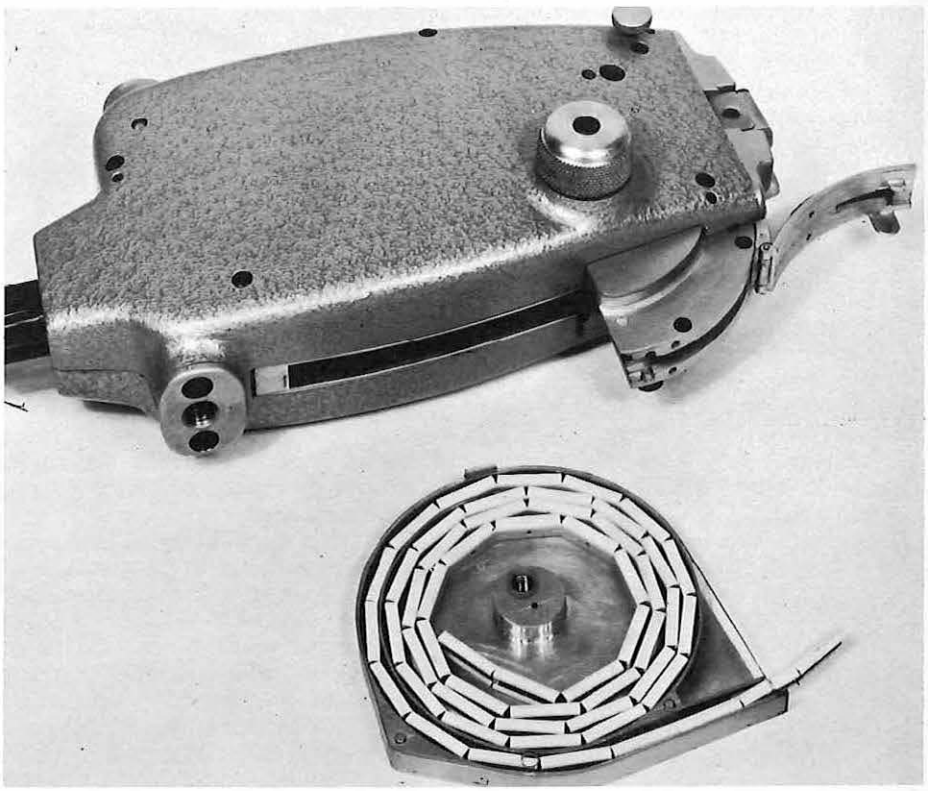
The connectors are five-eighths of an inch long, U-shaped and made of phosphor bronze. They are externally insulated with PVC and contain internally-piercing tangs.

The wires to be jointed—no stripping of the insulation is required—are held down firmly in the slots at the top of the jointing head, when the start switch is pressed, the ram in the machine rises, shears the required connector from the reel and closes it round the wires. Simultaneously, knives fitted to the beaks cut off the unwanted ends of wire. The tangs in the connectors pierce the insulation and make electrical contact with the copper wire.

The bugbear of all crimping is the danger that the fold may relax and cause a bad joint electrically. This danger is avoided in the machine No. 4 by the inclusion of several devices in the design of the connector and the manner of its closing whereby the wires are finally held by a spring action within the connector.

Above: The new jointing machine in operation during reliability tests. It will make a single wire joint in only two and a half seconds.

Below: The jointing machine ready for loading with the plastic cassette.



The Data Explosion

As the *Journal* went to press, arrangements were being made by Telecommunications Headquarters to introduce a scheme to encourage industry to use the public telephone for transmitting computer data between midnight and 6 a.m. when the load on the network is light.

Announcing this and a number of other important developments in data transmission at a recent London Press Conference, the Postmaster General, Mr. John Stonehouse, said that advances in data communication were going ahead at an "explosive pace".

"Data communication is a new and exciting offspring of the telephone which is increasingly touching the lives of us all," said Mr. Stonehouse. "We in the Post Office have no doubt about the magnitude of the ultimate stature of this infant and nor do we have any doubts about our parental duty to see that we meet the demands made upon it."

Although the number of data terminals in use in Britain—about 3,000—seemed small in relation to other telecommunications business and trifling to what they must become, added the Postmaster General, Britain already had the most comprehensive range of data transmission services outside the United States and offered better facilities than any other European country. The rapidly-growing time-sharing computer bureaux were making extensive use of the Datel 200 service and the major joint-stock banks were large and vigorous customers for the extensive networks and facilities needed to link their branches throughout the country to their advanced computer systems.

"A countrywide network of 1,500 data terminals is typical of the kind of system we are now engaged in providing for the banking world," said the PMG. "In 1967 we were installing 20 data terminals a week; in 1968 the average was 120 a week; in 1969 the number will be increased to 200 a week or more."

To meet increasing demand for higher transmission rates the Datel 2400 Service was introduced at the end of 1968. This service afforded transmission rates of 2,400 bits a second on leased telephone circuits using a Post Office Telecommunications modem now being manufactured in quantity. This modem also transmits at 600 or 1,200 bits a second so that it can also be used on the public telephone network.

The Post Office was also considering a reduction in rentals for Datel 200 and 600 modems, said Mr. Stonehouse, and in the near future small users of Datel services whose business is insufficent to justify the cost of a Datel modem of their own would be able to share the use of data terminals at normal tariffs plus a nominal registration fee. Shared use of private circuits to a single destination will also be allowed and the Post Office will be prepared to provide "tail circuits" to give partners access to a shared link.

In addition to all these facilities, a bulk tariff will be introduced in October for groups of telegraph circuits rented between the same pair of customer premises far enough apart—about 20 miles—to justify the use of voice frequency systems. This will offer substantial savings compared with the rentals of an equivalent number of separate lines—for example, 12 100-mile, 100 baud circuits will cost about one third the price of 12 individual circuits.

"There are immense problems ahead," said Mr. Stonehouse. "Because technological advances in data communication are surging forward so rapidly it is almost impossible to foresee the facilities which will be developed.

"The growth potential is such that thorough systematic investigation and planning will inevitably have to go hand-in-hand with risk-taking speculative development where this bids fair to meet a possible need or catalyse the formation of demand. This is indeed, an essential ingredient of the new business approach of Telecommunications generally.

"The main task now is to foresee needs as accurately as possible, perhaps even before the prospective users can envisage them. A massive market research operation on data transmission is now under way to help identify the plans, hopes and aspirations of computer manufacturers and users alike.

"But this is only the first part of a three-stage operation. The next stage will be to analyse these needs, hopes and aspirations and conceive possible facilities to meet them. The third stage will be to go back to the market and measure need for what seems feasible. All this will give us valuable material for future planning."

Mr. Stonehouse also announced that an experimental 48,000 bits per second switched Datel network which customers can use in much the same way as they use the public telephone system will be set up by the end of 1969 to link London, Birmingham and Manchester. Research is being carried out into the desirable technical characteristics of such a network which will provide users, computer manufacturers and the Post Office with essential information on the traffic and switching requirements for future automatically-switched systems which will eventually spread far beyond the confines of the three cities chosen for the experiment.

"Already we see the need to be able to provide for communication between user and remote machines by television screen presentation of paragraphs, shapes and even three-dimensional representations of designs. To capture, in such creative work as computer-aided design, the fleeting moment of inspiration and involvement, data transmission must be several orders faster than that we now provide.

"The essential problem is to decide the rôles of store-and-forward and ultra-fast real time switching technologies in a network which will most effectively and economically serve the nation's future needs.

"We have been making intensive studies of developments in other countries—particularly the United States and Europe—and taking every opportunity for discussion with informed opinion in universities and industry. These studies have been made in close collaboration with the National Physical Laboratory and we have jointly identified areas for technical examination in depth.

"As a result, contracts have been placed for two studies of new data communication networks with industrial research organisations with special experience in their technical fields. Both studies will have a common specification objective but one organisation—Standard Telecommunications Laboratories Ltd—will assume the use of store-and-forward concepts while the other—British Telecommunications Research Ltd—will assume ultra-fast circuit switching.

"The results of these studies should provide a unified solution leading to a fully-costed plan to permit tariffs to be devised and plans for implementation of the network to be formulated by the Spring of 1970.

"A third technical study has been commissioned from International Computers Ltd to analyse requirements for new formats and procedures needed to work with new types of networks," the Postmaster General added.

"In all these studies," he went on, "attention will be paid to new telecommunications techniques which will be introduced in the next decade including increasing use of pulse code modulation and the introduction of computers for controlling the system."

Engineering expertise allied to superb planning and co-ordination between Headquarters, Regional and Area staff has helped the Post Office to provide one of the country's biggest closed circuit TV systems bang on target

New Era for Plymouth's Students

By K. J. TRUSSLER and N. J. TOLCHER

THANKS largely to the Post Office, thousands of school-children in 116 of Plymouth's schools now have a comprehensive television service that enables them to span new worlds every day.

This new closed circuit television service has been made possible by a new Post Office coaxial distribution system installed in the Spring and Summer of last year, enabling up to nine 625-line monochrome or colour programmes to be transmitted simultaneously. A similar network has been installed in London for the Inner London Education Authority.*

Send terminal equipment provided by the Post Office enables separate video and sound signals from the studio to be assembled in the 40–140 MHz VHF band for transmission over the network. A complex of single-tube coaxial cables, totalling some 44 miles radiates from the studio in a series of main and spur paths, the signals to the schools being "tapped-off" from strategically placed repeaters, which are mounted in jointing boxes or manholes. Power for the repeaters is fed over the cables from exchange batteries. These repeaters, together with similar repeaters in telephone exchanges and school buildings, equalise and amplify the VHF signals to correct for the attenuation-frequency distortion of the cable. A 140 MHz pilot signal provides both continuity monitoring throughout the system and controls the automatic temperature correction circuits in the exchange repeaters.

Following the local authority's request for the network, Headquarters, Regional and Area staff met in early March, 1966, to discuss the system and to plan a programme of operations leading to the ready-for-service date in September, 1968. These operations were phased in with the estimated delivery dates for cable and equipment.

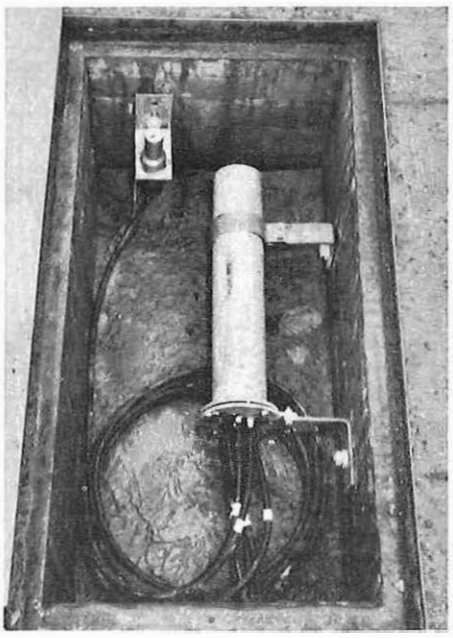
The next stage was a period of intensive network design, resulting in the production of the network diagrams showing repeater section lengths, coding of equipment, supervisory sources, power-feed sections and estimated VHF signal levels at various points. Field survey work then began with a two-stage duct survey, stage one covering the school lead-in ducts, stage two covering the additional duct and jointing points required to accommodate the cable and equipment in the local line network.

To assess the suitability of the new coaxial cable for long-length cabling techniques, a test length was requested from Headquarters and drawn in over a 750 yard section containing various types of jointing point. Results proved satisfactory and it was decided to use this method where possible. Photographs of the school exteriors were produced, the external cable run and the terminating point of the lead-in duct superimposed, and then passed to the cabling party and the duct contract works supervisor. Finally each school was surveyed and a design produced for the internal wiring installation. This last survey took three months to complete, the final estimate being completed on Christmas Eve, 1967.

Speed of installation was essential to meet the service date and it was decided to functionalise the external work as far as possible. Two rodding parties were set up, one to carry out rodding of the entire network as a continuous operation, the second follow-up party to deal with obstructions, buried jointing points, etc. As a result, rodding was completed just prior to delivery of the first cable consignment and the cabling party were then able to perform a continuous cabling operation right up to the final commissioning period.

Close liaison between planning and works groups was required. Repeater section lengths were recorded to an accuracy of two or three yards—before the repeaters were installed—and a record kept of drum numbers and manufacturer's test figures. A continuous flow of this information was forwarded to the Headquarters commissioning team so that repeaters could be pre-aligned on information received from the Area. A line-up centre had been set up in south east London to cover both the London and Plymouth schemes and Plymouth staff made several visits to this centre

Mr. N. J. Tolcher checks the signal level at a joint box repeater while Mr. K. J. Trussler looks on.



A repeater mounted in a subsidiary joint box. The repeater joints are located in a manhole immediately adjacent to the box.

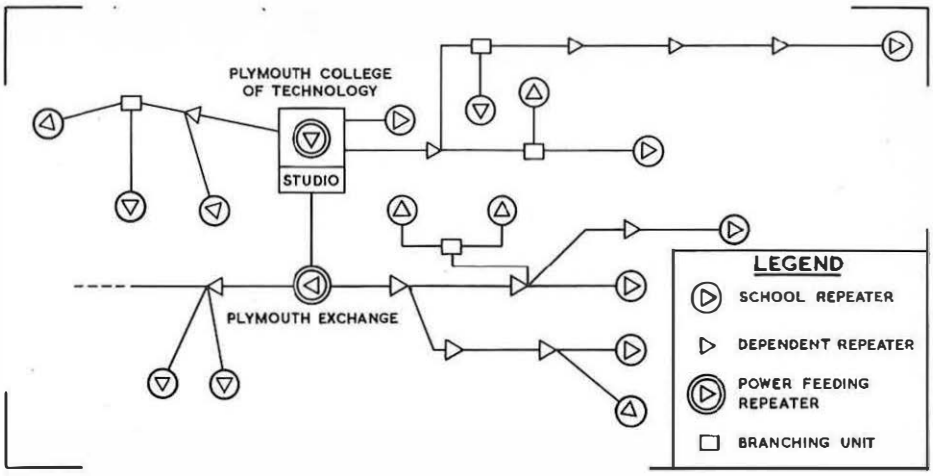
* Detailed articles covering the Post Office nine channel VHF system are published in the January and April 1969 issues of the I.P.O.E.E. Journal.

to prepare the equipment for installation in the field.

As soon as a steady flow of equipment to the Area began, the repeaters to be located in jointing points were installed by a jointing team using specially developed techniques. At the same time internal staff installed both the exchange repeaters and the studio terminal equipment. In spite of an initial shortage of stores, installation staff made a start on the school wiring and also fitted and connected the school repeaters. By the late Spring of last year provision of the system had progressed far enough for commissioning to begin.

It was decided that continuity of each completed part of the network would be checked by recording signal levels at the repeaters located in jointing points. This led to the discovery of one or two faulty joints. The cause of failure was found and a minor change made in the method of jointing. Since only a small proportion of the joints had been completed the modified procedure was established in time to prevent repetition of the trouble. Continuity checking continued and a second party was set up to cover testing of the school wiring installations. At each school the insertion loss between the school repeater and each classroom socket was measured, together with the level of any interference signals present.

With the completion of further sections of the network, a third party was established to line up the system from the exchange repeaters to the schools, an operation involving measurement of the gain-frequency response, level of harmonic content and a check for interference signals.



A section of the distribution network.

This line-up was performed by Regional Headquarter's staff, drawn in to augment the commissioning effort. With three commissioning teams in the field, and the arrival of a further team from Headquarters to check alignment of the studio terminal equipment, Plymouth was subjected to a minor invasion of technical experts, each performing his own mystical transmission rites.

Residual equalisation at the exchange repeaters was delayed for a time pending investigation of voltage surge troubles on a section of the main-path. Subsequently, Headquarters decided to include gas discharge tubes in the power feeding circuits of these repeaters, a modification that was completed at each exchange before the service date.

Finally, a test transmission was arranged to enable Headquarters staff to assess the performance of the completed system. The quality of the received transmission was entirely satisfactory—a tribute to the close co-operation that existed between Headquarters, Regional and Area staff throughout the whole of the project.

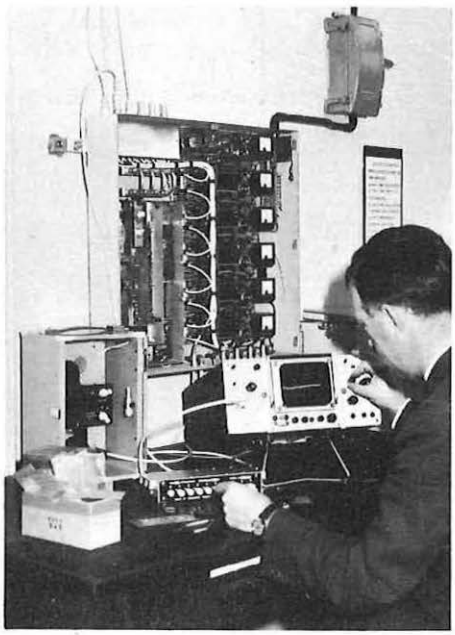
The network was handed over to the local authority in September last year—completed on schedule.

THE AUTHORS

Mr. K. J. Trussler:
Began as Youth in Training at Barnstaple, Devon, in 1940 then progressed to a Technical Officer on UAX maintenance, and in 1960 became an AEE on Local Line planning.

Mr. N. J. Tolcher:
Began as a Youth in Training in 1941, then progressed as a Technical Officer to Transmission and TV link maintenance before becoming an AEE on the Transmission Acceptance Testing Duty in 1968.

Col. G. K. Hall, Area Engineer, Plymouth, discusses temperature control of the injection moulding process with Mr. J. L. Piper, one of the jointing team



Mr. Tolcher carries out "mop up" equalisation at one of the exchange repeaters.

The Studio Control Room at the Plymouth College of Technology nerve centre of the system.

The New Cordless Switchboard

By F. A. WYETH and C. G. DICKINSON

Significant developments have been made in cordless switchboards since their introduction to this country at Margate thirteen years ago. As a result the new Cordless Switchboard System No. 1 will soon be in use at Croydon and orders have been placed for more than 1,100 other positions. For thousands of Britain's telephonists a new way of working will have to be learned. This article looks in detail at the various operational aspects of the new system. The engineering advances embodied in the new switchboards will be dealt with in another article in our Summer issue

THE first of the new Cordless Switchboard System No. 1 (CSS No. 1) installations which are now standard for new auto-manual centres will open at Croydon this Spring. Three cordless exchanges are already working in the United Kingdom—Margate (Kent) came into service in 1956 followed by Middlesbrough in 1959 and Stafford in 1961. The experience gained with these installations has led to the development of the new system.

The CS1 has been designed for all purpose working so that one standard position can handle all types of call. At even the smallest exchange, however, it is necessary to segregate certain groups of traffic such as changed number interception (CNI). But at larger exchanges there are advantages in segregating directory enquiry (DQ) or enquiry calls (EQ), service PBX, personal call operator, fault telephonist, etc. and directing these to positions at which the necessary records are available. The provision of subsidiary queues for this purpose is perhaps the most significant development from the earlier cordless switchboards.

The new system has no answering or outgoing multiple, weighs much less than a conventional switchboard, making it unnecessary for the positions to be arranged in long suites in a room having an apparatus strength floor. This enables normal office type accommodation to be used, the positions being arranged in small groups of two, four or six positions across the width of the room. A switchroom unit can have a maximum of 96 positions.

The ergonomic design of the early cordless positions was considered satisfactory and remains basically unchanged. Each group of positions is manufactured as a complete unit with two end sections and intermediate sections between adjacent positions. Each intermediate section is supported by either an intermediate support or intermediate bookcase. Each end and intermediate section carries a visible index file, a pilot lamp strip and a ticket chute to the back of the position for completed tickets.

The position can be considered as three main parts; the writing surface, the keyshelf and the display panel. At the rear of the writing surface and below the front edge of the keyshelf are a number of spring loaded ball bearings which act as ticket clips.

The subsidiary queue keys and the keys in the group marked Note 2 are the new push-button 2000 type which can be either locking or non-locking, and may carry a lamp which can be used as a calling or supervisory signal. The common position circuit and connecting circuit keys are of the 1000 type—a modern version of the standard switchboard lever key. The keysender, which replaces the dial, has the normal push-button type.

The supervisory signals in the display panel are illuminated from behind. At the right hand side of the panel two thermometer type waiting calls indicators show, by comparison of the length of coloured display, which main queue has most calls for answer; SENDER TAKEN and SEND ANSWER supervisory displays are associated with the Keysender. Each connect circuit has triangular shaped answering and calling supervisory signals, together with a circular timing supervisory; above these signals are

The cordless switchroom at Stafford Exchange where the earlier cordless boards were installed in 1961.

CB and ORD displays which show the electrical setting of the call timer. At the left hand side of the display panel are supervisory signals associated with miscellaneous circuits and an ACCEPT signal which is illuminated when no calls are waiting in the main queues and the position has been "preset" to receive the first call to arrive.

Each switchboard position has seven connecting circuits and is able to take calls from two main queues, or from two main queues plus one or two subsidiary queues. Four connecting circuits are used to answer calls from one main queue and three to answer calls from the other but any connecting circuit can be used to take a call from a subsidiary queue. The allocation of connecting circuits to positions is staggered so that, overall, each queue is served by the same number of connecting circuits—with a maximum of 168 per main queue at a 96 position exchange.

Route and Rate records, subscribers' multiple records and a selection of directories can be accommodated in a pedestal bookcase which can be fitted between each pair of positions.

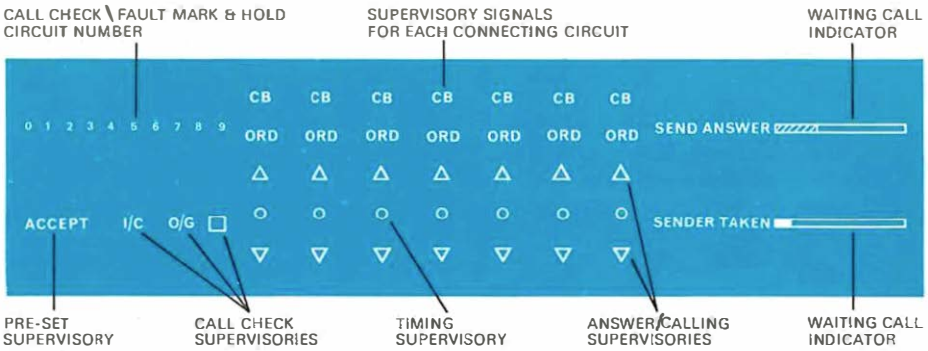
A pedestal bookcase cannot hold a full set of directories and where DQ traffic is handled at the switchboard a complete set of directories is held in an end position bookcase—a maximum of six being available in any one switchroom unit.

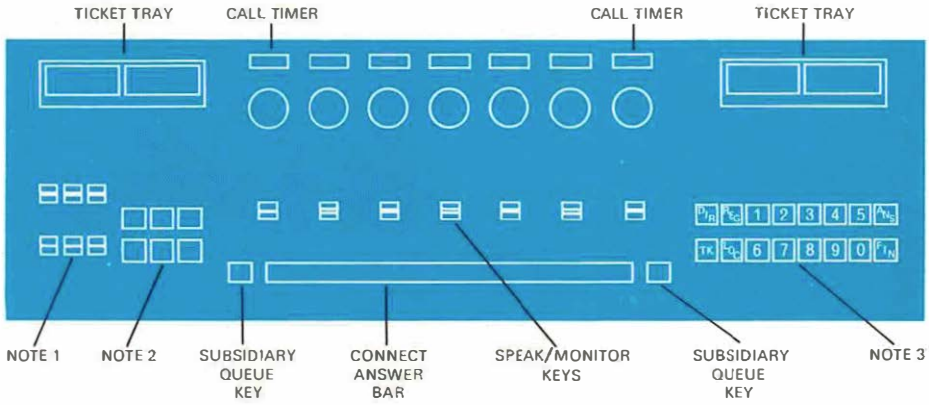
For maintenance purposes the switchboard is hinged at the front of the writing surface and opens forward and main items of equipment such as the key set, call timers and so on, are terminated on plugs and cords and can quickly be removed as complete units.

Calls are connected to operators via groups of distributors which form the queueing equipment and provide access to the switchboard position connecting circuits. In any one switchroom unit there will always be at least two main queues—in case one queue becomes faulty. The provision of additional queues depends upon the load to be carried, but no more than four main queues will be provided at any one unit.

Calls from customers and incoming operator calls are distributed through main queues, calls from operators being identified by a pip of tone. Segregated traffic such as CNI, DQ, etc., is distributed directly to the positions at which the relative records are held by means of subsidiary queues.

Main queue calls arriving at the exchange will be allotted to each distributor group in turn, so that the traffic is evenly distributed over all the queues. Once a call has been allotted to a particular distributor group, it will take its place behind the other calls waiting to be answered in that queue. An operator answering a call from the group can exercise no





NOTE 1

Layout of Position Keys

Ring Ans Ring Call	Call St. Cpl Left	Con Int
Spk Ans Spk Call	Ord Ccb	Rel Ans Rel Call

NOTE 2

Layout of Miscellaneous Keys

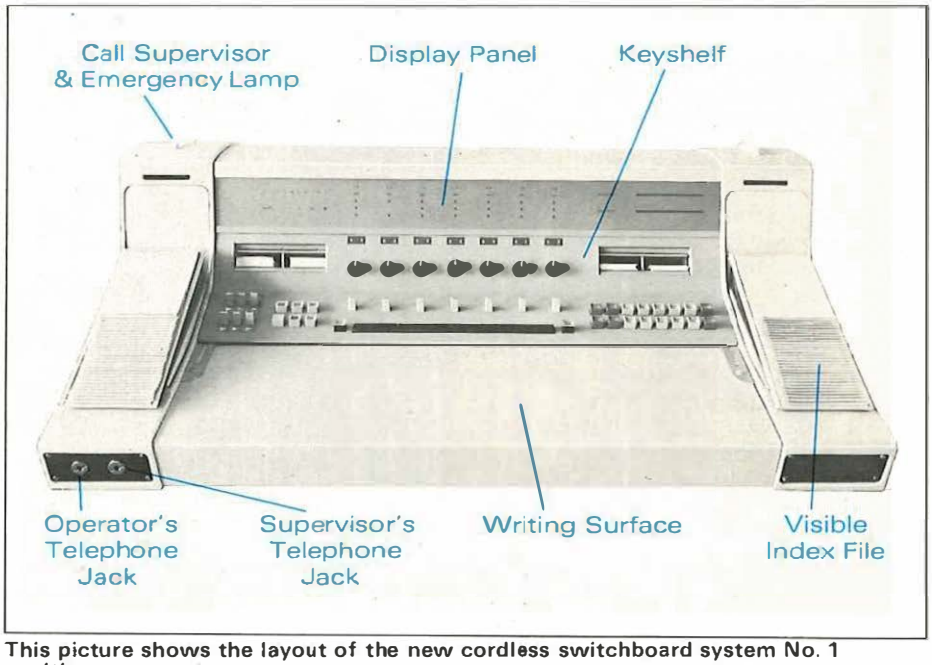
RRO	Tct	Ic Speak
Spare	Call Chk	Ic

NOTE 3

Layout of Keysender
4 route Keys 10 digit Key

Dir	Reg	1	2	3	4	5	Send Ans
Tk	Loc	6	7	8	9	0	Finish

Detailed layout of the keyshelf



This picture shows the layout of the new cordless switchboard system No. 1 position.

choice in call selection and must always take the call which is at the head of the queue, all other calls then moving up one place. A maximum of 20 calls can queue in any one main group at the same time. Once all twenty queue places have been taken up subsequent callers will receive engaged tone. However, as soon as one call is taken from the queue a subsequent caller can join it. The subsidiary queue distribution arrangements are similar to those for the main queue calls but each has only five places. A call arriving when all five queue places are engaged will receive the engaged tone. Any one subsidiary queue will normally call on at least two and on not more than six positions. Each switchroom unit having 20 or more switchboards can have a maximum of 12 subsidiary queues and where there are less than 20 switchboards, no more than six.

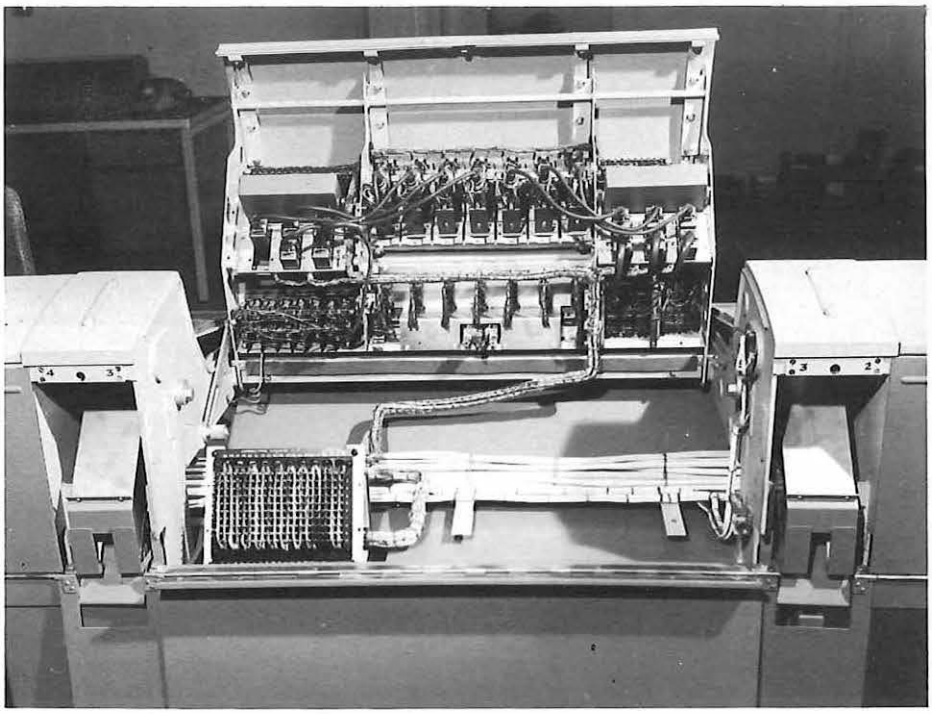
To take a call from a main queue, a free connecting circuit key associated with that queue must be thrown to the speak position and the connect answer bar depressed. It will then be connected to the connecting circuit and the ORD or CB signal will glow on the display panel, to indicate whether the call timer has been automatically set for ordinary or coin box timing conditions. Having obtained details of the required exchange and number the operator then uses the Keysender to set up the outgoing connexion. Normal supervisory signals are given throughout the progress of the call.

The call timer associated with each connecting circuit is set for operation by rotating the knob clockwise as soon as ringing tone is heard. Timing will start automatically as soon as the called number answers.

The switchboard will provide for simultaneous use of the speak and monitor functions. At the time that a connecting circuit key is thrown to the speak position another key can be thrown to the monitor position enabling the operator to listen on one circuit whilst her telephone set is connected to another.

The keysender is normally associated with the calling side of a connecting circuit, but it may also be associated with the answering side of any of the last three connecting circuits. On completion of a call the supervisory lamps will glow in the normal manner. The call may then be released from the position by operating the connecting circuit key to the monitor position and operating the release answer/release call key.

When there are no calls awaiting answer in either of the two main queues to which an operator has access from her position, she will throw a free connecting circuit key to the speak position and depress the connect answer bar. An ACCEPT signal will be given in the display panel, indicating that the position is ready to accept the first call entering the queue associated with the connecting circuit key that has been thrown.



View of position of the new cordless switchboard from the rear.

Emergency calls may be answered from a group of two to six nominated emergency positions, the number depending upon the "traffic" to be handled. A "999" call will cause an audible alarm (a hooter) and a visual indicator to operate in the switchroom. The first operator at a nominated emergency position to throw a free connecting circuit key to the *speak* position and depress the connect answer bar will receive the "999" call. The position on which the call has been answered is indicated by red pilot lamps on either side of the position.

To take a call from a subsidiary queue, any free connecting circuit key is operated to the *speak* position and the appropriate subsidiary queue answer key depressed. The call will then be associated with the connecting circuit and normally the ORD signal will light in the display panel. Whether the call is extended or is merely an enquiry, it must be released on completion, by operating the connecting circuit key to the monitor position and then operating the release answer/release call key as appropriate.

The flexibility which is possible in allocating subsidiary queues to switchboard positions has particular advantages for periods of light staffing in cordless exchanges. At least one

The intermediate and end bookcase.

appearance of all the essential subsidiary queues can be concentrated on to a small number of positions in the exchange forming a concentration area. The appropriate records to allow operators to deal with subsidiary queue calls on the positions, are housed in the intermediate and end position bookcases in the concentration area.

The new exchanges will be provided with facilities for seated supervision. The Assistant Supervisor's position comprises an equipment desk, fitted with a ten-line key and lamp panel and modern telephone. The supervisor will be able to make outgoing exchange line calls, and to make calls over selector circuits, for example, to call on a subsidiary queue. Operators at switchboard positions can call the Assistant Supervisor's desk by keying a local selector code. Another local code will give access to a common circuit calling on all Assistant Supervisors' desks. Each Divisional and Chief Supervisor will be provided with an executive type desk, fitted with a Supervisor's Control Console and modern telephone. Only one console in each switchroom unit will have key control facilities. Additional consoles (for a second Divisional or a Chief Supervisor) will have lamp displays only. The console provides senior supervising staff with details of traffic and staffing conditions which will assist them in controlling the switchroom unit, as follows:—

Positions staffed indicator, showing the number of staffed positions of each type.

Subsidiary queue controls, comprising two lamps and a locking key for each subsidiary queue. One lamp coloured green indicates that there is a call or calls awaiting answer and the other, coloured red, indicates that the call at the head of the queue has waited 20 seconds or more. If a fault develops in the queueing equipment a lamp in the control key flickers; when the key is depressed, the queueing equipment for that queue is taken out of service.

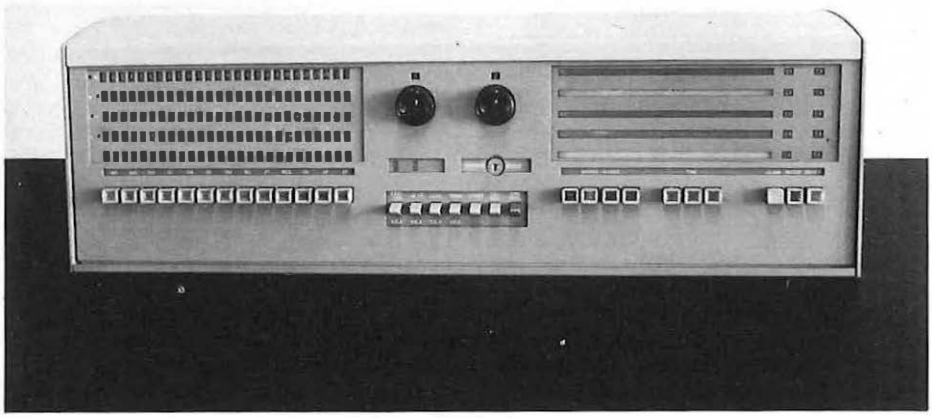
Waiting calls indicators, one for each queue comprising a lamp for each queue place and one to denote that the queue is empty. There are two additional lamps associated with each indicator. The first denotes the queue has been restricted in length and the second that the head of queue alarm has operated for that particular queue.

Queues close keys—four keys are provided, one for each main queue, so that a queue may be closed. If the queueing equipment develops a fault the lamp in the key will flash and when the key is depressed, will glow steadily; the main queue is opened by depressing the key again.

Head of queue alarm—a preset audible and visual alarm is provided which operates when the head of queue call has waited for longer than a preset time. By operating one or more keys the time can be varied between 10 and 70 seconds in 10 second steps.

Queue restrict key—a switch operated by a Yale-type key is provided to restrict all main queues to a predetermined number of queue places.

Outgoing and incoming telephone, remote listening, fire drill, call bell and transmitter cut-off facilities are provided in the normal manner.



The Supervisor's console from which the switchroom is controlled.

The Cordless Switchboard System No. 1 embraces a switchboard unit and associated queueing and distribution equipment. The complete system is normally housed in the same building as the local automatic and trunk automatic exchange.

The ability to outhouse cordless switchboards has significant advantages. At many centres it has been planned that cordless switchboard exchanges in office type accommodation will replace sleeve control automanual exchanges, in order that the vacated AMC switchroom—usually of equipment floor strength, can be used for the extension of subscribers automatic equipment.

There are two ways in which the cordless exchange may be outhoused:—

(1) *Detached working*—where the cordless switchroom is in a different building from that housing the queueing and distribution equipment. Detached switchrooms are usually provided in office accommodation a short distance from an exchange building.

(2) *Remote working*—where the switchboards and associated automatic equipment are in a different building from that housing the local and the trunk automatic exchanges. There are technical considerations which limit the distance between remote or detached exchanges and the automatic exchange or switching equipment. For economic reasons this distance will not usually exceed half a mile.

Comparison of the switchroom layout at conventional cord type exchanges with the office type layout of cordless installations, shows the significant improvements that have been achieved in switchroom working conditions.

Although the first CS1 switchboard has not yet been brought into service, manufacture of equipment for Skelmersdale, Ascot and Basingstoke exchanges has commenced and orders have been placed for a further 1,100 positions.

The development of the CS1 has resulted from close co-operation between the Telecomms. Headquarters Depts. concerned, the Development Contractors (GEC/AEI Ltd.) and the staff side representatives on the Telephone Switchboard Consultative Group.

Because of the need to plan many years ahead and in order to take full account of changes in technology the work of planning a new generation of cordless switchboards has already commenced.

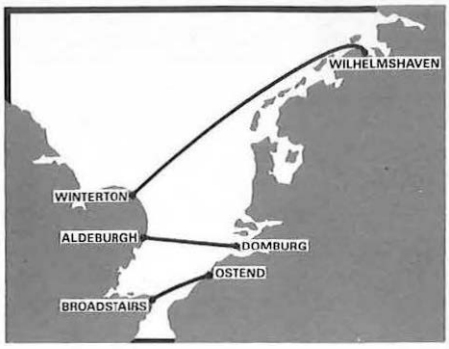
THE AUTHORS

F. A. Wyeth *is a Principal Telecommunications Superintendent in the Service Department of Telecommunications Headquarters. He joined Gloucester Telephone Area as a Youth in Training in 1936 and was later employed in the Engineering Department Training School. In 1947 he became an Assistant Traffic Superintendent at Blackburn and in 1955 moved to Inland Telecommunications Department as Senior Telecommunications Superintendent. He spent 3 years in Nigeria as a Telecommunications Controller and between 1961 and 1966 worked on a number of computer projects. Since 1966 he has been employed on operator services equipment projects.*

C. G. Dickinson *is a Senior Telecommunications Superintendent in the Service Department at Telecommunications Headquarters. He began his career as a Youth in Training at York Area in 1946, where he was promoted to Telecommunications Traffic Superintendent in 1957. In 1965 he transferred to Inland Telecommunications Department on promotion to Senior Telecommunications Superintendent and is now employed in the Service Department of THQ on the operational aspects of cordless switchboards.*

Design innovations and ultra long-life transistors are enabling the Post Office to provide three new cable systems to the Continent which when in service will be the . . . . . .

WORLD'S LARGEST SUBMARINE CABLES



Proposed routes.

CIRCUIT capacity between Britain and the Continent is to be doubled during 1971 and 1972 by the laying of three new submarine cables. They will each provide 1,260 telephone circuits, arranged as 21 CCITT basic supergroups, and at the time they are put into service are expected to be the largest capacity submarine telephone cables in the world.

These new cable systems will serve West Germany, Belgium and the Netherlands and other destinations beyond these countries and will be laid, respectively, from Winterton, in Norfolk, by way of the Friesian island of Spiekeroog to Wilhelmshaven (330 miles), from Broadstairs to Ostend (74 miles) and from Aldeburgh to Domburg (95 miles).

The work will be carried out under the GPO's current £2,000 million 5-year plan for expansion. Contracts for the manufacture of the submarine cable, the submerged repeaters and equalisers and the terminal equipment have been placed with Submarine Cables Limited of Greenwich, London, who are required to do all the testing work and most of the installing. The Post Office will provide the cableship and do the actual laying of the main sea sections. Cableships of the other Administrations are likely to undertake some of the in-shore cable work.

A technician at the Post Office's Dollis Hill Research Station at work in the controlled environment laboratory where the new long-life transistors are produced.

To be known as the SCL 21 Submarine Coaxial Cable Telephone System, the design of this new system follows the well-established principle of a single coaxial cable equipped with submerged repeaters and, if necessary, submerged equalisers, over which the two directions of transmission of the telephone circuits are transmitted in two separate frequency bands. The highest frequency sent over the cable will be just over 12 MHz and to keep the signal losses as low as possible, having due regard to the system cost, the most suitable cable is one having an outer conductor diameter of about 1.5 inches, in this case 1.47 inches. For shallow water applications, such as in the North Sea, a new armoured cable has been developed. It is a "wet" type of cable, that is, one in which the outer conductor is in contact with the sea.

By J. B. HOLT

Assistant Staff Engineer in charge of the Undersea Cables System Branch in THQ

The system design includes two innovations, the repeaters will have separate amplifiers for each direction of transmission instead of the single common amplifier as hitherto and adjustable loss correcting networks which can be controlled from either of the two terminal stations will be connected into the cable when the changes of cable loss due to sea temperature variations are expected to be large.

The "heart" or active components of the repeaters will be transistors. These will be ultra long-life transistors made from a chip of silicon smaller than the head of a pin which are now being manufactured by the Post Office at Dollis Hill in a strictly controlled environment.

Since the loss of service of a submarine cable system could cost more than £250,000 in lost revenue and repair charges, repeater component reliability is vital. To meet this requirement, the transistors have been designed to have a life expectancy of 25 years and are tested during the various stages of manufacture to standards which are aimed at ensuring that not more than one in 500 will fail in this period. As a result, more than 10,000 are made to produce 500 of the required quality.

Such standards have long been a part of Post Office submarine cable design philosophy. Among 3,000 long life thermionic valves made by the Post Office over the years and put into service in transoceanic cable systems, there has been only one failure in 145 million valve hours of service. Transistors promise even greater reliability.

Decisions to lay the new cables followed the seven nations London conference held in May, 1967, on the initiative of the British Post Office and it is anticipated that the new cables will cover traffic expansion up to the late 70's. Annual expansion of telecommunications traffic between Britain and the Continent—including telephone calls, data transmission and telex messages—is around 14 per cent.

Overall cost of the three projects, in the region of £4 million, will be borne pro-rata by the British, Belgian, Dutch and German Administrations. Plans are also well advanced for the installation of a similar cable to Denmark.

A "sneeze hatch" is provided for engineers working in a laboratory at the Post Office research station at Dollis Hill, London.

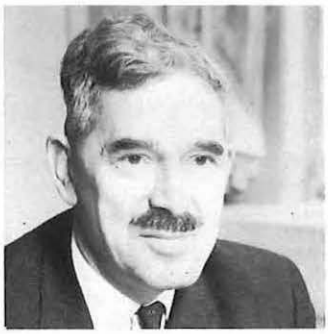
These engineers, who work in rigidly controlled conditions are making tiny, long-life transistors for use in the three new North Sea telephone cables planned for 1971 and 1972. At the laboratory staff wear special clothing and the temperature and humidity are controlled. Filtered air is blown across the work benches to remove any trace of dust. If anyone wants to sneeze, he has to dash to a "sneeze hatch" provided in the laboratory's air exhaust system.

All this is part of meticulous production methods designed to ensure the complete reliability of the transistor destined to spend its entire working life deep under water.

CHANGES AT THE TOP . . .

H. G. Lillicrap

K. H. Cadbury



J. T. Baldry

W.Kirkpatrick

A NUMBER of important new appointments were made recently in Telecommunications Headquarters.

Following the retirement of Mr. A. B. Harnden, CB—the Senior Director of Customer Services—Mr. H. G. Lillicrap, former Senior Director of Planning, takes over Mr. Harnden's post.

Mr. K. H. Cadbury, MC, Director of Purchasing and Supply, is promoted to Senior Director Planning and Purchasing and Mr. W. Kirkpatrick, an Assistant Secretary in the Reorganisation Department at Central Headquarters, becomes Director of Telecommunications Personnel in place of Mr. J. T. Baldry who takes over as Director of Purchasing and Supply.

Mr. Lillicrap who began work in the GEC Research Laboratories, joined the Post Office as a probationary Assistant Engineer in 1936 and spent the next ten years at the Post Office Research Station, Dollis Hill, working on the design of radio transmitters and receivers. After serving in the Radio Branch of the old Engineer-in-Chief's Department for four years from 1947, he became a Principal in ETE, rising to Deputy Director of ETE in 1958. Two years later he was appointed Deputy Director of Finance and in 1964 Director of Radio Services. A keen sportsman, Mr. Lillicrap played Rugby for Kent on several occasions.

Mr. Cadbury joined the Post Office in 1947 and from 1952–55 was seconded to the Cabinet Office. Shortly after returning to the Post Office he became Private Secretary to the Postmaster General, Mr. Ernest Marples, and in 1960 was appointed Deputy Director, Wales and Border Counties of which he became Director in 1962. A year later he was appointed Director of Clerical Mechanisation and Buildings and in 1965 Director of Inland Telecommunications. Mr. Cadbury's main spare time interests include archaeology.

Mr. Baldry joined the Post Office in 1930 as an Assistant Telecommunications Superintendent and became an Assistant Surveyor in 1935. In 1947, after serving for most of World War Two with Royal Air Force Signals, he was appointed Principal and in 1953 an Assistant Secretary. He became Deputy Director, ETE, in 1960 and Director of Personnel in Central Headquarters in 1967. His main interests: tennis, farming and travel.

Mr. Kirkpatrick came to the Post Office as a Principal in Radio Services Department in 1956 after previous service since 1936 with the Ministry of Transport, the Central Land Board and the War Damage Commission. He was appointed an Assistant Secretary in 1963 to take charge of one of the branches in the Establishments and Organisation Department and for the past year has been working in the Reorganisation Department on pay and grading problems. His main interests: music, gardening and travel.

*

The *Journal* joins **Mr. Harnden's** many friends in bidding him farewell after 40 years service.

Mr. Harnden, who joined the Post Office as a Youth-in-Training in 1925, became Deputy Controller of the Post Office Factories Department in 1953. In 1956 he was appointed Director of Home Counties Region and in 1962 Director of London Telecommunications Region. He was appointed Senior Director of Customer Services in 1968.

NEW DESIGN MANAGER

The Telecommunications business is to have its own Design Manager who will be responsible for the design of all types of telecommunications apparatus used by subscribers.

He is Mr. Richard Stevens, B.Sc., FSIA, FIES, who, in 1957, was awarded the Gold Medal of the Eleventh Milan Triennale and in 1959 received three Design Centre Awards. In 1958, Mr. Stevens was appointed Chief Designer of Atlas Lighting Ltd and in 1963 joined Standard Telephones and Cables Ltd as Industrial Design Manager.

Mr. Stevens has been a member of the Council of Industrial Design Index Committee, the Design Centre Award Panel, the Royal Society of Industrial Artists and Designers (SIAD) Engineering Products Group and the SIAD Examining Panel. He is at present a member of the SIAD Examining Board and Professional Practice Board and chairman of the SIAD Salaried Design Committee.

THE RIGHT MEN IN THE RIGHT JOBS

AS the Post Office takes over complete responsibility for recruiting management, engineering and scientific staff in preparation for the change from a Government Department to a public corporation, major changes are taking place in methods for appointing people to new posts and promoting staff.

One important development is the setting up of a training scheme for senior staff in interview techniques. Staff attending these courses are instructed in such matters as how to phrase questions, how to give the person being interviewed scope for expressing himself fully and how to select the right man for the job because of his ability rather than because he fits a familiar image.

The courses are conducted by Mr. J. A. Samuel, the recently-appointed Chief Psychologist to the new Psychological Service Division of the Management Development Department in Central Headquarters. This new unit, which will shortly be strengthened by the appointment of three more psychologists, is developing selection methods for all recruitment grades of Post Office staff and devising and producing suitable aptitude tests. It will also undertake studies into job analysis, morale and staff wastage problems.

One of the first tasks of the new unit will be a job analysis study of a telephonist. This will be carried out nationally in collaboration with Telecommunications Headquarters.

In anticipation of the change to Corporation status, the Post Office has progressively taken over from the Civil Service Commission responsibility for selecting its own management and engineering staff.

Miscellany

LONDON'S LAST MANUAL

AN important milestone in London's telephone history was reached recently when the last remaining manual telephone exchange in the London (01) area—at Wallington—became automatic.

The old Wallington manual exchange, opened in March, 1927 (in the same year as London received its first automatic exchange in Holborn) has been replaced by a new combined Wallington (01–647) and Franklin (01–669) automatic exchange. In its latter years, it was manned by 200 operators and supervisors and handled more than 70,000 calls a day.

The new combined exchange, which completes London's subscriber-to-subscriber dialling system, can initially serve up to 14,000 subscribers. It cost £500,000 to build and equip.

The last manual calls are put through at the Wallington exchange.

Appropriately, a week or so after Wallington manual exchange closed down, its last Chief Supervisor, Miss Valerie Pearson—was awarded the British Empire Medal in the 1969 New Years Honours. Equally appropriately, the Senior Assistant Supervisor, who served at the manual exchange for the past 16 years, was Miss Rose Wallington.

**The last manual exchange in the London Telecommunications Region is at Upminster, Essex. This is due to close by mid-1970.*

By January, 1969, there were only 163 manual exchanges left in the country. These are being converted to automatic working as quickly as possible.

RECORD BREAKING YEAR FOR THE INDUSTRY

THE telecommunications manufacturing industry in Britain broke all records in 1967–68, says the annual report of the Telecommunication Engineering and Manufacturing Association.

The value of telecommunication equipment delivered by Association members in the last six months of 1967 compared with the corresponding period in 1966 showed an increase of more than 20 per cent. Of the 1967 total deliveries of nearly £170 million, £38 million were for export, £102 million for the Post Office and £27 million for other customers in Britain.

At the end of 1967 about 90,000 people were employed in the industry, virtually the same number as employed 12 months previously thus emphasising that the higher level of output had stemmed largely from increased productivity.

The main feature of the year was the spectacular effort made by the industry to satisfy the demands of the Post Office while keeping up with the highly competitive and intense pressures from the export field. The industry was not lagging in its efforts to solve the supply problem which was one of the most important keys in helping to solve the Post Office problems.

The report adds that TEMA, in co-operation with the Ministry of Defence and the Ministry of Technology, have developed a mobile trunk communication system—known as *Bruin*—which is in advance of any other comparable military equipment.

This new system had two basic component parts—a communication centre and a communication head. The centres are sited to meet the tactical situation, thus permitting greater flexibility than has been possible hitherto. They are interconnected by multi-channel radio relay links and each headquarters has a communication head connected to a designated communication centre to provide headquarters staff access into the system.

Voice, telegraph and facsimile facilities and subscriber trunk dialling are incorporated, thus removing the need for up-to-date telephone directories under field conditions. Mobile manual switchboards are provided with each communication centre and communication head as stand-bys to the automatic exchange. "The new system has found considerable favour with the Ministries involved," says the report, "and many orders are anticipated through the NATO organisation."

Member companies of TEMA are playing an important part in the introduction of new techniques and materials for packaging telephone equipment and apparatus and a special working party has been set up to consider how economies can be achieved and improved methods adopted.

"Blister" packing, in which a number of pieces of apparatus can be sealed in one operation—thus saving labour and facilitating storage—appeared to be the most suitable, says the report. More than 30 polythene "blisters" covering the packing of more than 800 items had been designed and approved by the Post Office. Special attention was being given to the packing of units of multiplex equipment and to improved methods of packing for export.

A tribute to telephonists . . .

THE Post Office, probably more than any other organisation, is on the receiving end of criticism and complaint in newspapers' readers columns.

It is pleasant, therefore, to record two recent letters which compliment the Post Office for work well done.

The first, published in *The Observer* of 29 December, 1968 pays tribute to our telephonists and runs as follows:

"For once in praise of, and not in condemnation of, the GPO telephone system.

"Recently I was engaged in work of a most urgent and delicate nature which must, for the time being, not be made public.

"During this period I had to rely almost completely on the services of telephonists in general, especially the personal call operators, directory inquiries (who have been brilliant) and the continental call operators.

"Had it not been for their extraordinary patience, perseverance and humanity, far beyond the call of duty, the life of one person and possibly of others would have been lost.

"To say thank you seems so inadequate, but I hope they will believe in my sincere gratitude."—Elizabeth Williams, Leeds

. . . and engineers

The second, published in The Sun, of 1 January, 1969, said:

"I reported to the GPO that my 'phone was out of order. Within an hour an engineer had made a temporary repair and later in the day two men made a permanent job of it.

"Not only that, but the job was done with remarkable consideration. The top of the ladder used was even wrapped so that it would not mark my newly-painted wall.

"Thanks GPO for service of a sort that has become rare."—C. E. Field, Old Palace Lane, Richmond, Surrey

C.C.I.T.T. Plenary Assembly

THE WHOLE field of telecommunications ranging from multiple-distinction communication satellite transmission channels to preservatives for wooden poles was covered at the fourth plenary assembly of the CCITT in Mar del Plata, Argentina.

Twenty-four chairmen presented reports of the work of 16 study groups, three special study groups and five autonomous working parties.

Among the more important subjects dealt with were proposals for extensively revising the Telephone and Telegraph Regulations, new methods of international accounting for the telephone service and satellite communication transmission channels in the world-wide network.

The previously separate operating instructions for the continental and intercontinental telephone services were combined and brought up to date and an improved automatic circuit-routiner was specified which has a larger repertoire of transmission and signalling tests and is also compatible with speech-concentrators (for example TAS1) and existing CCITT signalling systems.

The 7-unit international alphabet No. 5 was adopted, primarily for data interchange. The No. 5 alphabet enables upper and lower case letters to be used and provides a large number of data control signals.

In addition a 12 MHz line transmission system for standard coaxial pair cables was defined and recommendations made concerning a 60 MHz system.

The assembly also prepared the programme of work for the next study period. Some of the more important items will be the reliability objectives for the design of line and radio transmission systems to be made in conjunction with the CCIR; stored-programme control systems suitable for controlling various types of switched network for example, telephony, data, viewphone and so on; the 60 MHz transmission system, including the study of other than coaxial pair line media for example optical fibre and wave guide; adaptive echo cancelling devices for use on telephone connections with very long propagation times; implications of digital transmission and TDM switching; telephone network management problems; a code-insensitive error control system for data transmission suitable for general use and a universal data collection system employing parallel transmission.

The UK delegation was led by Mr. M. B. Williams, Deputy Director of Engineering. Other members were Mr. J. V. R. Birchall, Deputy Director (Telegraphs) ETE; Mr. J. Rhodes, Staff Engineer THQ Data Systems Development Branch; Mr. W. J. E. Tobin, Staff Engineer THQ Electromechanical Exchange and Telephone Apparatus Development Branch; Mr. A. P. Hawkins, THQ Telephone Policy Section ETE; Mr. S. Munday, ASE THQ Lines & Radio Development Branch; Mr. H. C. Greenwood, CHQ Radio & Broadcasting Department and Miss J. Bleach of the Radio and Broadcasting Department who was secretary to the delegation.

The following members of the United Kingdom Post Office were appointed Study Group chairmen or vice-chairmen for the next working period: Mr. S. R. V. Paramor, Vice-chairman of Study Group I (Telegraph Operation and Tariffs); Mr. J. R. Walters, Chairman of Study Group VI (Protection of cable, sheaths and pole); Mr. J. C. Billen, Chairman of Study Group XVI (Telephone Circuits); Mr. J. Rhodes, Chairman of Special Study Group A (Data Transmission); and Mr. W. G. Simpson, Vice-chairman of CMTT (Joint CCIR/CCITT Study Group for Television Transmission).

The V-th Plenary Assembly of the CCITT is provisionally arranged to be held at Geneva, probably in the first half of 1972.

BOOK REVIEW

"VHF Radio Wave Propagation in the Troposphere" *(Intertext Books, 40s)* by W. G. Burrows, has five chapters with appendices and references and a misleading title.

To those familiar with the subject, VHF means frequencies within the internationally-agreed 30–300 MHz band but the author also uses it to include the UHF and SHF bands.

The book is intended, however, for first-year degree, post-graduate and research students. It is, therefore, disappointing that the subject is not set clearly in the agreed framework of frequency allocation and usage.

The impression given in a number of places in the text is that the author is not completely at home with the background to his subject. For instance, in Chapter 5, we are told that ". . . there are already a number of relatively short range UHF transmission links in actual operation using the troposphere as the essential propagation medium, these and other temporary systems . . .".

Leaving aside the question of UHF television transmissions, one wonders if the author is aware of the very large number of line-of-sight SHF links in operation in the troposphere.

This is not a book to be recommended to a newcomer to the subject.

D.T.

HONOURS

SEVERAL telecommunications people were among the honours in the Queen's New Year Honours list. The highest award was given to Mr. Arthur Harnden, senior director responsible for telecomms customer services, who was made a Commander of the Bath. (For details of Mr. Harnden's career see page 29).

Mr. A. B. Harnden

Also honoured was Mr. A. J. Thompson, LTR's Controller (Works) who was awarded the Imperial Service Order for his "unselfish devotion to work and the needs of the Post Office." Mr. Thompson joined the service as a youth in training in 1926, later became a draughtsman, then an inspector at Cambridge, next an assistant engineer, was promoted SEE in the Engineering Department in 1949 and later became an assistant staff engineer. He joined LTR in 1964 as deputy chief regional engineer and a year later was promoted chief regional engineer. He was closely concerned with the introduction of STD.

Mr. A. J. Thompson

Recipients of the OBE were Mr. Reginald Billington, an inspector of wireless telegraphy; Mr. Stanley Rosser, president of the Post Office Engineering Union. BEMs went to Mr James Mills (Canterbury TA), Miss Valerie Pearson (LTR south area), Miss Evelyn White (Walsall). MBEs to Miss Doris Crane (London TR), Mr. Charles Clarke (Cardiff TMO), Mr. Charles Hale (Southampton), Mr. Arthur Ellenden (South East TR).

AROUND THE WORLD

UNITED STATES

A high-capacity Trans-Atlantic and Mediterranean communications system will be launched in 1970.

The project will involve laying a submarine cable between Rhode Island, in the United States, and San Fernando, near Cadiz, in Spain.

From San Fernando a microwave link will be established to Sesimbra, in Portugal, and to Estapona, Spain, from where another submarine cable will run to Rome. The submarine cable system—to be known as TAT-5—will have a capacity of 720 voice circuits and be the first direct cable link from the USA to southern Europe.

Agreement on the project was reached recently between United States and European communications organisations.

* * *

A new ultrasonic tool which ferrets out underground cable pressure leaks is being used in the United States.

Known as the 18100A Ultrasonic Duct Probe Accessory, the new tool is four times as sensitive as the normal probe and can be operated by one man. It enables him to search 200 feet of cable an hour. A light rubbing of the plastic guide against the cable sheath or duct wall releases sufficient energy to register the full pressure on the detector meter. Leaks are indicated by a fall in pressure.

* * *

"Computer Processing in Communications" is the topic of the 19th international symposia of Brooklyn Polytechnic's Microwave Research Institute being held in early April in New York. The role of computer techniques in data transmission and processing will be stressed, allowing scientists, engineers, mathematicians and specialists in communications and computer processing to review the latest viewpoints and developments. The more prominent features of the three-day programme are Adaptive Systems, Algorithmic Formulation of Communication Problems, Discrete-Time Techniques, Applications and Implementation, Computer Simulation of Communication Systems, Statistical Estimation, Switching and Routing by Computer, Exotic Applications. A panel discussion will focus on the role that computers are expected to play in signal processing systems of the future. Areas of computer processing included in the symposium are adaptive communications systems, data compression techniques, antenna array signal processing, adaptive equalisation for random channels, feedback communication systems and computer simulation of communication systems.

JAMAICA

The first commercial satellite earth station in the Commonwealth Caribbean is to be sited in Jamaica. Owned and operated by Cable and Wireless Ltd. the station—the company's fourth—will provide all forms of public telecommunication services through *Intelsat* III. It will be able to transmit and receive international television. The project which will cost more than £2 million will be operational during 1970. The earth station will relieve the pressure of considerable traffic expansion on the Jamaica-Florida coaxial phone cable. Cable and Wireless Ltd., responsible for the external telecommunication services of 14 territories in the Caribbean, is planning for other earth stations in the area.

EAST AFRICA

The East African External Telecommunications Company has signed a £1.2 million contract with Marconi of Great Britain for the design, construction and installation of a satellite communication earth station. The station will be installed at Mount Margaret in Kenya's Rift Valley 43 miles north-west of Nairobi. It will have a 29.5 m diameter antenna and will incorporate a recently designed pivot assembly. The antenna structure, weighing over 100 tons, will rotate on sliding surfaces made of a synthetic material which is considerably more reliable and resilient than conventional metal ball or roller bearings.

AUSTRALIA, S. AMERICA, AFRICA

Some of the world's most modern cordless telephone switchboards are to be installed in Africa, Australia and South America. The Australian Post Office will install more than 4,000 of the switchboards

An operator at Plessey's Beeston factory wires a modern cordless switchboard which will form part of the £385,000 export orders.

at a cost of £270,000 bringing their total installations of the cordless boards to 5,000.

The East African Post and Telegraph Department also intend installing 700 cordless switchboards in their departments in Kenya, Uganda and Tanzania. In Brazil £30,000 is being spent on installations.

All of the cordless boards are being supplied to the foreign administrations by the UK's Plessey Telecommunications Group. The contracts in total are worth £385,000.

U.S.S.R.

An instrument being tested at the Institute of Defectology in Moscow enables deaf people to make use of the telephone. An ordinary telephone set is fitted with a telegraph key. A vibrator, a minute mechanism the size of a button, serves as a receiver and transforms the aural signals into mechanical vibrations. By lightly touching the vibrator with a finger the person feels these vibrations. A small lamp—a simple table lamp connected to the telephone is sufficient—lights up when there is a telephone call.

NEW ZEALAND

International telecommunications traffic from New Zealand increased in all fields last year. Telephone calls were up by 14.9 per cent, telex calls 26.7 per cent and telegrams 1.6 per cent. New telex connections installed numbered 122 bringing the total number of subscribers to 769. Demand for telephones jumped by 1.6 per cent and TV licences by 8.7 per cent.

CANADA

Bell Canada have applied to the Canadian Transport Commission for approval of higher rates and charges. If granted the new rates would produce an increase of about ten per cent in revenue and in a full year a return of about eight per cent on capital invested in the business. With costs continuing to rise Bell Canada are finding it increasingly difficult to provide on income from present rates the kind of service the Canadian public wants and expects.

ASIA

A work programme is now being carried out on a second planning phase for the detailed traffic and cost survey of plans for the development of national telecommunication facilities in the Asian Region with interconnection at national frontiers. This will ensure proper integration of international requirements with the national links. The programme has been endorsed by the United Nations Economic Commission for Asia and the Far East.

SWITZERLAND

Direct dialling having been introduced in one of Zurich's exchanges, 85,000 subscribers in that city can now set up their own calls directly with other countries. In Geneva, the subscribers of a large part of the town can already use direct dialling for their international calls. Semi-automatic telephone traffic transited by way of New York was introduced for the Mexico Olympic Games. Telephone calls between Switzerland and Chile are now made by way of the satellite link Rome-Santiago de Chile. At the same time there has been a big reduction in rates and a more flexible charging system for calls has been introduced.

Telecommunications Statistics

(Figures rounded to nearest thousand)

	Quarter ended Sept., 1968	Quarter ended June, 1968	Quarter ended Sept., 1967
TELEGRAPH SERVICE			
Inland telegrams (excluding Press, Service, Rail Pass and Irish Republic) ...	2,482,000	2,034,000	2,634,000
Greetings telegrams	683,000	503,000	713,000
Overseas telegrams:			
Originating U.K. messages	1,903,038	1,761,518	1,807,639
Terminating U.K. messages	1,934,093	1,794,875	1,812,207
Transit messages	1,604,086	1,527,816	1,519,811
TELEPHONE SERVICE			
Inland			
Net demand	188,000	174,000	182,000
Connexions supplied...	180,000	181,000	181,000
Outstanding applications	242,000	234,000	219,000
Total working connexions	7,579,000	7,483,000	7,121,000
Shared service connexions (Bus. and Res.)	1,409,000	1,404,000	1,364,000
Total effective inland trunk calls	299,836,000	281,698,000	260,099,000
Cheap rate trunk calls	71,137,000	62,899,000	60,985,000
Overseas			
European: Outward	2,942,711 (part est.)	2,836,335	2,361,357
European: Transit	7,248	7,695	10,366
Extra-European: Outward	266,822	274,874*	228,377
TELEX SERVICE			
Inland			
Total working lines	23,000	23,000	21,000
Metered units (incl. Service)	58,687,000	58,709,000	57,508,000
Manual calls from automatic exchanges (incl. Service and Irish Republic)	28,000	29,000	28,000
Overseas			
Originating (U.K. and Irish Republic)	4,101,732* includes est. for Bulgaria, Rumania, USSR, Gibraltar, and Malta	4,011,180*	3,470,454

*Estimated

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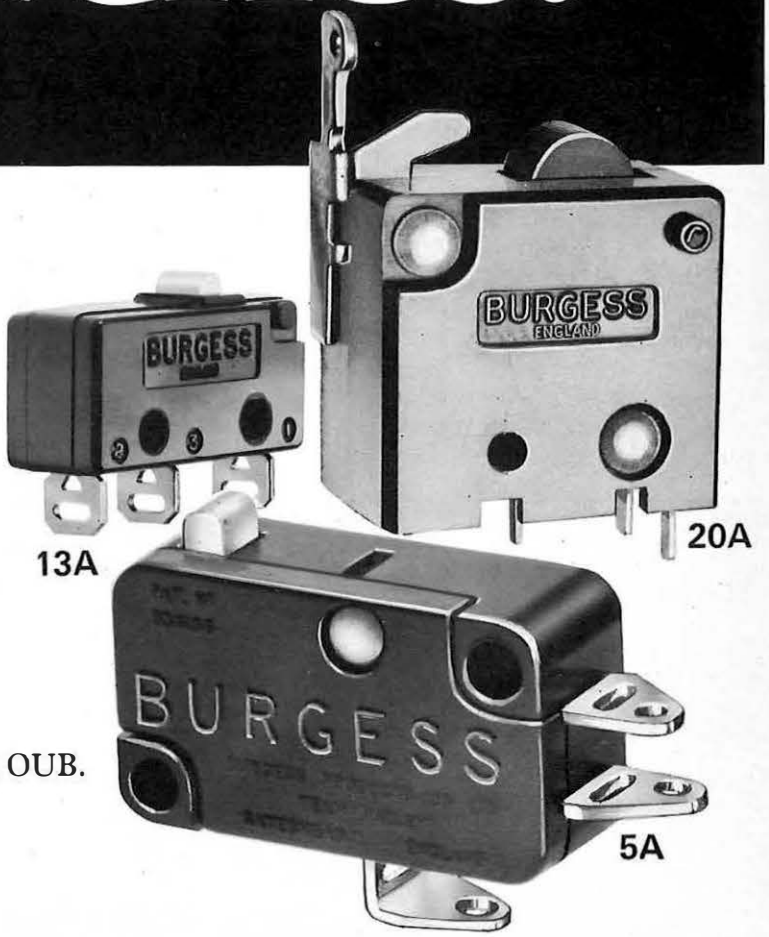

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