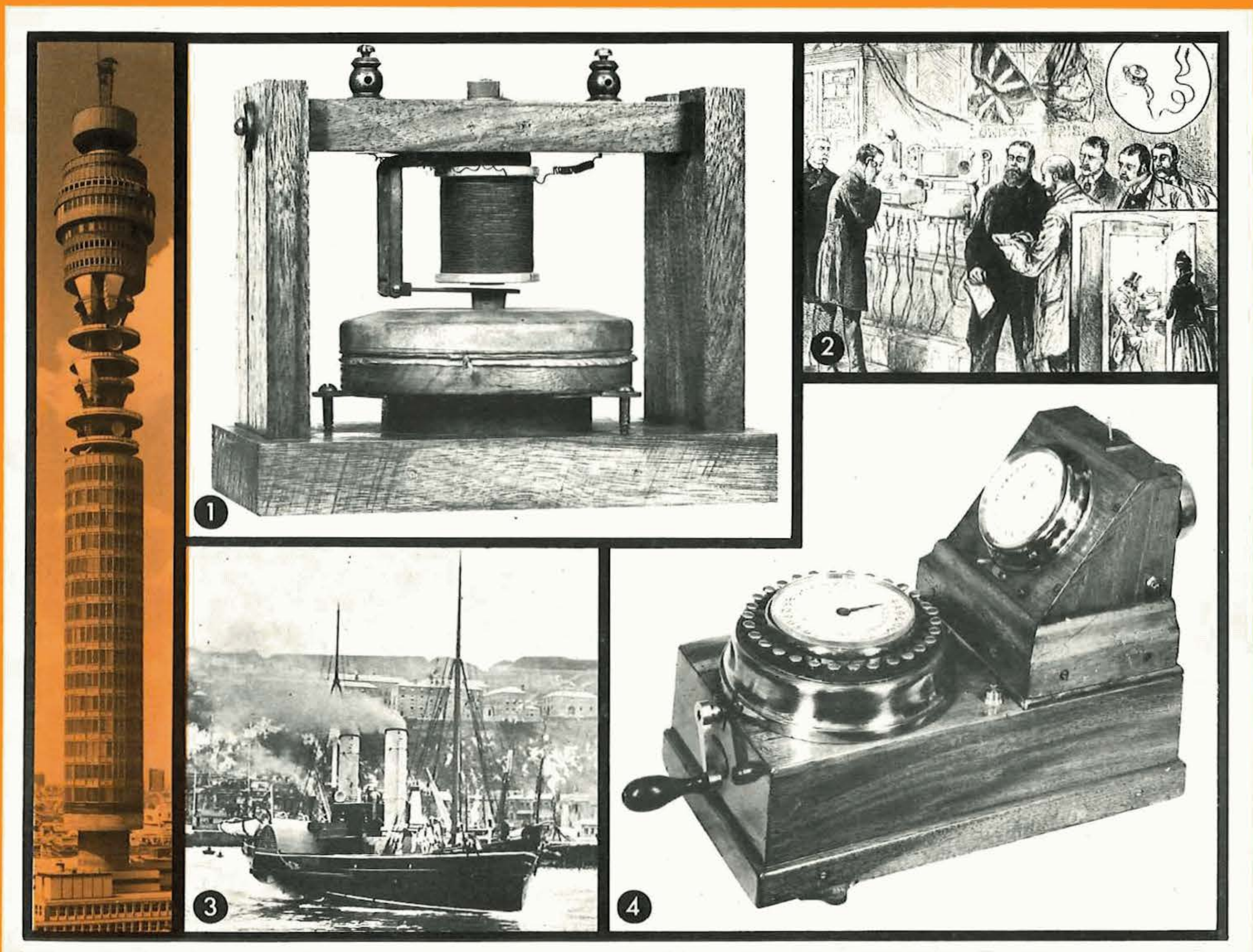
Post Office telecommunications journal

One shilling and sixpence

Autumn 1969 Vol. 21. No. 3



OCTOBER 1, 1969 - THE NEW POST OFFICE

The Dash Mounted Westminster has created a lot of talk

(the reasons are simple)

This front mounted solid-state radiotelephone operates in the VHF band from 25–174 MHz. Both AM and FM versions are available.

The transmitter power output of the series ranges from 5–15 watts (AM 5–8 watts; FM 12–15 watts) with 1–10 channels. Various other features include anti-flutter squelch, and an illuminated channel indicator.

The units have been designed as a 'family' and much of the circuitary is common to both base stations and mobiles.

The equipment meets all relevant specifications, including P.O. specification W6770, and is in use in many P.O. radiotelephone systems throughout the U.K. Rugged all-weatherproof universal versions are also available.

The W30AM

The W30AM is an extension of the Westminster range and being one of the most powerful VHF radiotelephones available in this country it will overcome problems of reception from vehicles in weak signal areas. 10-channel capability with solid-state switching.

rely on PYE the vital contact

THE QUEEN'S AWARD TO INDUSTRY 1966

Pye Telecommunications Ltd Newmarket Road, Cambridge Tel: Cambridge (0223) 61222 Telex: 81166

IN THE FIELD OF MODERN COMMUNICATIONS

THE PACIFIC

SUPER LIGHTWEIGHT HEADSET MICROPHONE

Pacific have made history in providing a vital link in communications between moon and earth.
S G Brown manufacture under licence, a number of units from the Pacific series of equipment used in the Apollo, Gemini and Mercury space probes.
The 1oz. Pacific Headset is extremely robust in construction, efficient in operation and provides unparalleled speech reproduction for astronauts, air crews, air traffic controllers and telephonists.
The Pacific Headset can be clipped to sun visor, spectacle frames or ultra-lightweight adjustable headband.

Send now for full specification leaflet to:

HAWKER SIDDELEY

COMMUNICATIONS

S. G. BROWN LTD., KING GEORGE'S AVENUE, WATFORD, HERTFORDSHIRE
TEL: WATFORD 23301 TELEX 23412 TELEGRAMS RADIOLINK WATFORD

Hawker Siddeley Group supplies mechanical, electrical and aerospace equipment with world-wide sales and service.

STC Telecommunications

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

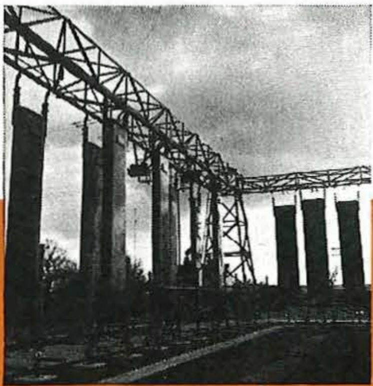
Here's how

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

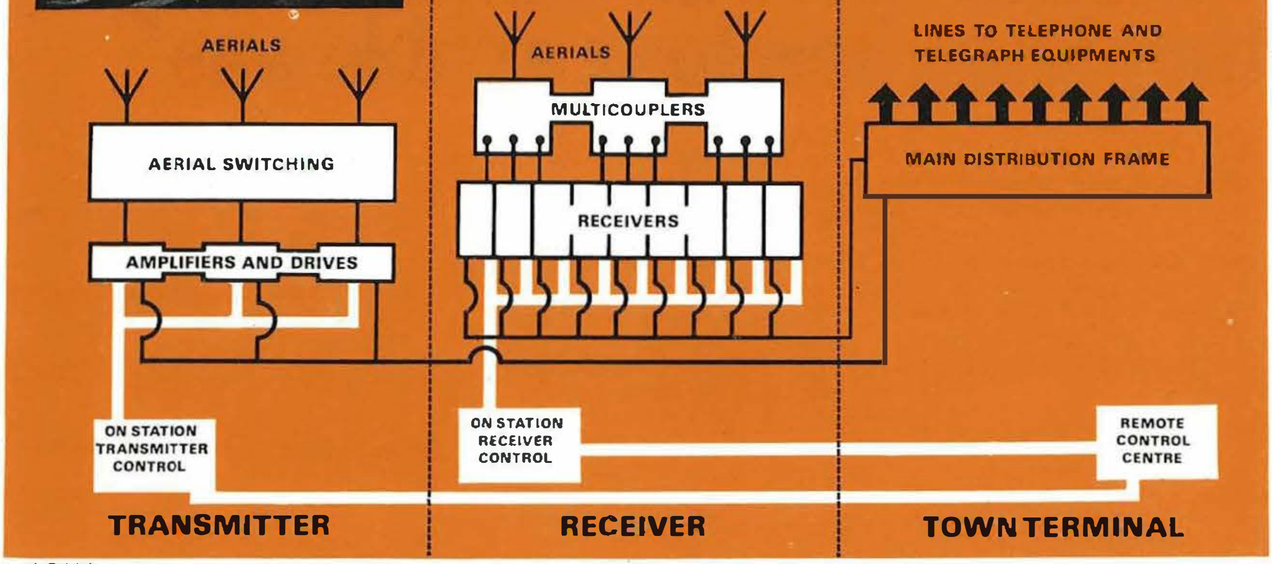
STANFAST Systems provide high speed frequency changing, automatic performance monitoring and rapid fault location affording optimum traffic handling capability and maximum revenue.

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

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



STANFAST MATCHING UNITS (BALUNS) TYPE A.1004-A & B
Used for coupling an aerial to a transmitter when the feeder is balanced on the aerial side and unbalanced on the transmitter side.
Suitable for transmitter r.m.s. output powers of up to 20kW (A.1004-A) and 30kW (A.1004-B).



A British associate of

ITT

Standard Telephones and Cables Limited

Hello darling. Where in the world are you now?

And a voice answers. Loud and clear. From two or two thousand miles away – or more.
STC helped to make it possible.
However the call was transmitted. Over a land link. Through the air via satellite. Under the sea. Via cable, microwave or radio. Whether the call came through a simple village switchboard. Or a giant automatic exchange in a big city.

Across the world STC has installed over 5 million lines of Step by Step equipment, and is now producing the internationally accepted Pentaconta* crossbar system.
As a member of the British Joint Electronic Research Committee STC is a leading developer of the revolutionary TXE4 electronic exchange. STC – backed by the international know-how of ITT.
Always researching new ways. Faster ways. To link peoples of the world.

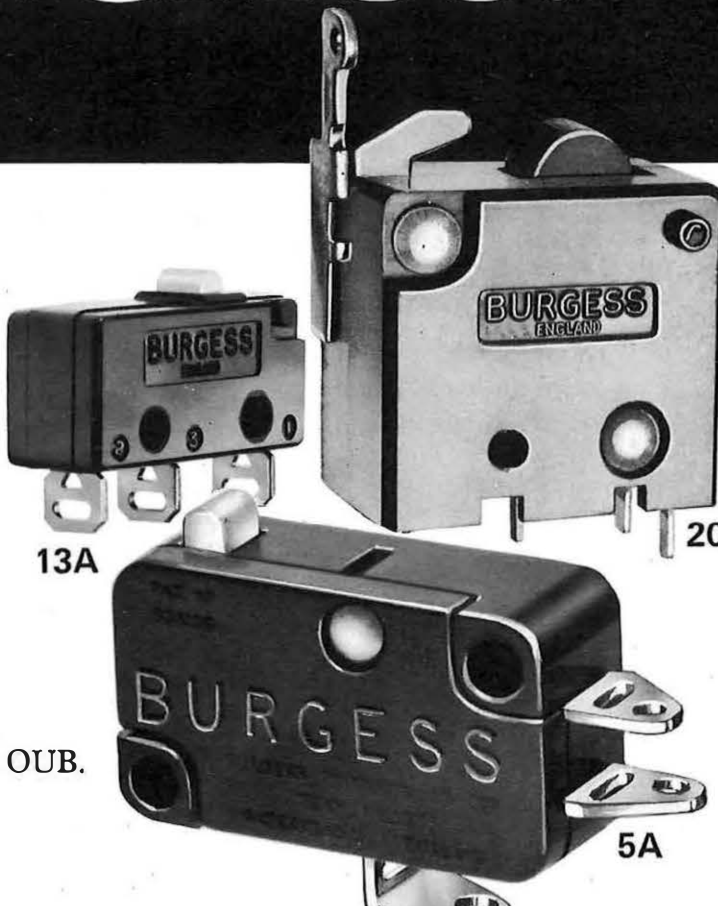
Standard Telephones and Cables Limited,
Telephone Switching Group,
Oakleigh Road, New Southgate,
London, N.11, England.
Telephone: 01-368 1234 Telex: 21917

**Registered trade mark of the ITT System*

A British associate of
ITT

world-wide telecommunications and electronics **STC**

Burgess reliable micro switches.



Approved Burgess Micro Switches and Micro Switch assemblies include P O ref 5A, 5A-3, 5A-4, 13A, 13A-2, 16A, 16A-1, 19A, 19A-1, Gravity Switches 20A, 20B, 20C.

BURGESS

Burgess Micro Switch Company Limited,
Dukes Way, Team Valley, Gateshead NE11 OUB.
Telephone 0632—877171. Telex 53229.
London Office: Eastbury House,
Albert Embankment, SE1.
Telephone 01 735 7871. Telex 25553.

the clever part is how you use it!

Making co-axial cable calls for advance production and engineering techniques. In an automatic process, TCL takes copper wire, moulds plastic discs at critical distances along its length, wraps it with plastic foil, and applies a copper strip longitudinally to form a tube.
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

Telephone Cables Limited Dagenham, Essex. Tel: 01-592 6611. Cables: Drycore Dagenham. Telex: 896216

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 Autumn 1969 No. 3

THE NEW POST OFFICE

A NEW ERA BEGINS

THE day has arrived for the Post Office to take its final step towards independent commercial management. We are all now part of a corporation which overall is the biggest, and also one of the most advanced, enterprises in the country. Why has this change to corporation status been made? Is there more to it than a change in title?

Successive Governments have realised that trading operations on the scale carried out by the Post Office need to be managed on commercial lines if they are to be efficient. Over the years many changes in status and structure have been made to our organisation. But, constitutionally, the Post Office has remained a Government Department with a Minister at its head who answered to Parliament for its day-to-day operations. It was also recognised that the organisational pattern of a central Government Department—its practices and procedures—was not appropriate for the successful management of a large service industry like the Post Office.

It was for these reasons that the present Government introduced the measure which received Royal Assent in July—the Post Office Act, 1969. Now the final close ties with the Civil Service and detailed Parliamentary control are broken.

No-one need expect sudden or dramatic changes; after all the Post Office has carried out its functions with some credit for 300 years and there is a wealth of tradition to be drawn upon. However, one major step was necessary to make the Post Office a sound commercial organisation: this was the separation of the Post Office into two clearly defined businesses, Telecommunications and Posts, necessary because each business was so large and was developing at a different rate, and each had widely differing operating characteristics and problems.

Within the framework of the new corporation each business can now move forward to meet the objectives laid down in the Post Office Act. The new Post Office is charged to develop efficient services at low cost; it must meet the social, industrial and commercial needs of the country; it must keep abreast with technological change; it must carry out its responsibilities to its staff.

Are these objectives very different from the objectives of the old Post Office as a Government Department? Perhaps not. But the corporation now has the power and the structure it needs to meet these objectives with the maximum efficiency and commercial adaptability. At the same time we in the new Post Office can build upon our traditional loyalties and sense of public service learned over the years in the old Post Office.

A MESSAGE FROM THE CHAIRMAN

THE creation of the Post Office corporation gives us a chance to show our customers just what we can do in business on our own account. Telecommunications is massive capital investment in any language—and it is expansive.

The future is bright.

But industry is not just finance and equipment; it is essentially people. It is on personal relationships we judge our working conditions and upon these many of our customers judge us.

Every one of us has a vital role to play in this and I rely on all in Telecommunications to help make the corporation a resounding success.

Hall

IN THIS ISSUE

OUR COVER PICTURE takes a look at the old and the new as the Post Office enters a new era as a public corporation. The Post Office Tower, a symbol of all that is modern in telecommunications, and some historical pictures 1. Alexander Graham Bell's first telephone; 2. The first telephone call to Paris in 1891 being made by Mr. Raikes, the then PMG; 3. HMTS Alert leaving Dover Harbour in 1900; 4. The ABC Telegraph Instrument of 1840.

THE NEW POST OFFICE

The Post Office Bill is a mammoth and complex document. This article, in the short space available, explains in brief what the Bill does and asks. . . . .

What will it mean for the Telecomms Services?

By M. O. TINNISWOOD

WHEN the Reorganisation Department was set up in Headquarters in August, 1966, one of its biggest tasks was to work out what legal framework was needed for the new Post Office.

The Post Office Bill was introduced in the House of Commons on October 31, 1968—the earliest date possible in the Session. After many hours of debate and discussion, during which more than 500 amendments were considered, it became law on July 25, this year, on the day Parliament rose for the summer recess, as the Post Office Act, 1969. An Act of some 260 pages, with 142 Clauses and 11 Schedules, amending about 900 other Acts of Parliament dating back to 1702, has become part of the law of the land.

A layman may be impressed by its size and complexity. But what does it mean for the running of the Post Office, and in particular for the telecommunications services?

The most important feature of the whole exercise is what made it unique from the beginning. When nationalised industries have been set up in the past, the purpose has been to bring an industry more closely under public control, without sacrificing commercial efficiency. The aim of the Post Office change has been to enable the Post Office to achieve greater commercial efficiency by making it less dependent on detailed Parliamentary control and bound by civil service practices and procedures, while at the same time making sure that it continues to serve the public interest.

The Act therefore does three things:—

It separates the commercial activities of the existing Post Office from the other functions of the Postmaster General as Minister of the Crown.

It sets out the legal status and powers of the new commercial Post Office.

It sets out the framework which will make sure that the commercial Post Office continues to act in the public interest.

The Act distributes the functions of the existing Post Office between three new bodies. The new Ministry of Posts and Telecommunications will take over the Postmaster General's administrative responsibilities for radio frequency control and broadcasting policy, and will become the sponsoring Ministry for the Post Office in the same way as the Ministry of Power sponsors the fuel industries. The Department for National Savings will remain part of the Civil Service and will be responsible to Treasury Ministers. The vast bulk of the existing Post Office's work—its postal, telecommunications, giro, remittance, and data processing services, and new services which may be developed within these fields—become the responsibility of the new Post Office, which will also continue to provide 'agency' services for Government departments. The new arrangements come into operation on October 1, 1969.

The new Post Office is a public corporation with a Board consisting of a Chairman and up to twelve other members. The Act sets out the corporation's powers in detail. These are intended to enable it to do everything necessary to run its services efficiently, now and in the future, as technology develops. It will have a telecommunications monopoly which covers broadly the same ground as the Postmaster General's old telegraph monopoly, but in modernised form.

The Post Office will have power to manufacture things it needs for its business. It will be able to fix charges and conditions of service by publishing them in the form of 'schemes' in the London, Edinburgh and Belfast Gazettes. These will be similar to the existing Regulations but will not need to be laid before Parliament as Regulations must be, or approved by the Minister. (The new Post Office will, of course, continue to be subject to any Government legislation on prices and incomes.)

The Act also contains safeguards to make sure that the Post Office uses these wide powers responsibly. The Post Office has a statutory duty to exercise its powers to meet the social, industrial and commercial needs of the country, and in doing so it must have regard to efficiency and economy and keep abreast of technological developments.

The Minister will have no power to control the day-to-day running of the Post Office, but he will have some general powers of control. He will appoint the Board, and will be able to give it directions in certain areas where the national interest is directly involved—for example, where national security or international relations are affected. He must approve its capital investment programme. He will also be able to call for information. The importance of the customer's opinion is emphasised by the setting up of a statutory Users' National Council which the Post Office will be obliged to consult about important proposals affecting the public. There will also be statutory Users' Councils for Scotland, Wales and Monmouthshire, and Northern Ireland.

The Act also emphasises the Post Office's responsibilities to its staff. The Post Office is given powers to promote training and welfare activities and to help its staff in other ways, and has a statutory duty to consult staff associations about the setting up of machinery for consultation on pay and conditions, training and welfare.

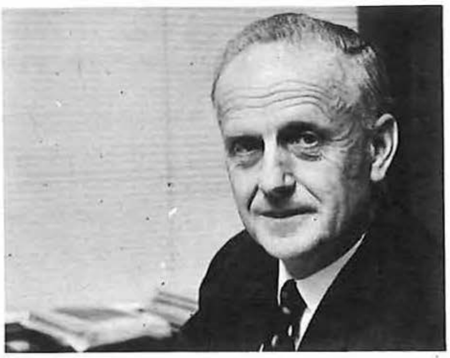
What the Act does not do is to lay down how the Post Office should be organised, or how it should run its business. All it does—and all it is intended to do—is to provide the legal framework. It has set the Post Office free from detailed control by the Government. It has given the Post Office the powers it needs to run its services. The rest is up to the Post Office's management and staff.

THE AUTHOR

Mr. M. O. Tinniswood *has recently been appointed Secretary to the new Post Office Board. He was formerly Director of the Reorganisation Department.*

THE NEW POST OFFICE

FURTHER APPOINTMENTS TO THE POST OFFICE BOARD



Mr. Geoffrey H. Vieler

Professor James H. H. Merriman

Mr. F. J. M. Laver

Sir Richard Hayward

IN a further series of appointments to the Board of the Post Office Corporation, Professor J. H. H. Merriman has been named as the Member for Technology. Professor Merriman was formerly Senior Director, Development.

Other appointments to the Board were:

Mr Geoffrey Vieler—Managing Director (Posts and Giro)

Sir Richard Hayward—Member for Industrial Relations

Mr F. J. M. Laver—Member for National Data Processing Service

Mr. Alan Wolstencroft, former Managing Director of Posts and Giro, has been appointed Adviser to the Chairman on special projects.

The Board appointments are for a period of four years and the salaries of Board Members are within the range £7,700—£10,450. Earlier this year the appointments were announced of the Chairman of the Board (Viscount Hall of Cynon Valley); Joint Deputy Chairman and Chief Executive (Mr. A. W. C. Ryland); Joint Deputy Chairman, half-time, (Mr. Whitney Willard Straight); Managing Director Telecomms (Mr. Edward Fennessy).

Professor James H. H. Merriman, CB, OBE, M.Sc., A.Inst.P., C.Eng., FIEE was born at Pembroke, West Wales, in 1915. He joined the Post Office at the Research Station, Dollis Hill, in 1936 after graduating in Honours Physics and following post-graduate research at the University of London. He went on to serve principally in engineering research, development and management of national and international telecommunications.

He was seconded to the Treasury from 1955 to 1959 as Deputy Director, Organisation Methods. In 1963 he became Assistant Engineer-in-Chief and in 1965 Deputy Engineer-in-Chief. On retirement of the former Engineer-in-Chief the title of that post was changed to Senior Director of Engineering and to this position Prof. Merriman was promoted in March, 1967. In August, 1967 he became Senior Director: Development.

In December last year he was appointed by the University of Strathclyde, Glasgow, as Visiting Professor in the Department of Electronic Science and Telecommunications. He is Vice-President of the Institution of Electrical Engineers and past Chairman of its Electronics Divisional Board.

Prof. Merriman is married, with a daughter and twin sons, and lives at Wimbledon. He is a keen amateur organist and his interests also include painting, rough hill walking and active church work.

Mr. Geoffrey H. Vieler was born at Bexhill-on-Sea, Sussex, in 1910. He was articled to a chartered accountant in Reading in 1927 and qualified as a chartered accountant (with honours) in 1932.

Mr. Vieler joined the Army in 1941 (Royal Army Ordnance Corps) and served in Britain and in India. Early in 1945 he was in charge of the jungle depot of Panagar, 100 miles from Calcutta, responsible for supply routes to troops engaged in the Burma campaign. On demobilisation, in 1946, Mr. Vieler joined Binder, Hamlyn and Co., and became a partner with Binder, Hamlyn in 1959.

Mr. Vieler lives in Reading and is married, with one daughter (Maggie Vieler, the actress).

Sir Richard Hayward, CBE, was born in Catford, London, in 1919 and joined the Post Office as a boy messenger at the age of 14. He later became a counter clerk and then from 1940 to 1946 served as a wireless operator at a Post Office Radio Station.

He became Assistant Secretary of the Union of Post Office Workers in 1947 and Deputy General Secretary in 1951. He served as Secretary to the General Civil Service National Whitley Council (Staff Side) from 1955 to 1966. Since 1966 he has been chairman of the Supplementary Benefits Commission.

He has been President of the Civil Service Cricket Association since 1965 and last year became chairman of the Civil Service Sports Council.

Mr. F. J. M. Laver, BSc., CEng., FIEE, FBCS was born in 1915 at Plymouth, Devon. Educated at Plymouth College and Medway Technical College, Gillingham, he later took a London external degree by private study in mathematics and logic. He joined the Post Office in the Engineering Department in 1935 and worked at the Research Station, Dollis Hill, until he moved to Radio Planning Branch in 1951.

He began the engineering appraisal of commercial computer systems in 1956; trained Post Office engineers in programming; and helped to launch the use of computers in the Engineering Department. In 1963 he transferred to the Treasury as Assistant Secretary of the Organisation and Methods Division. In 1965 he moved to the Ministry of Technology to set up its Computer Advisory Service.

In 1968 he was appointed Director of the National Data Processing Service. He was appointed to the Post Office Board in March this year.

Mr. Laver is a member of the Council of the Institution of Electrical Engineers and of its Electronics Divisional Board. Married, with three children, he lives at Loughton, Essex.

100 YEARS

ALMOST 100 years ago the inland telegraph service of the United Kingdom was transferred to State ownership. Now comes the new legislation which unties the knot between State and telecommunications. Below we give an outline of how the Post Office entered the field of telecommunications, and some of the historical milestones of the last century.

Telegraphs

The practicability of electric telegraphs for the sending of messages was demonstrated in 1837 by the successful working of Wheatstone and Cooke's 5-needle electric telegraph on the London and Birmingham Railway, between Euston and Camden Town. In 1846 Wheatstone and Cooke formed the Electric Telegraph Company, the first of a number of such companies. As they grew in number, the telegraph began to be recognised as essential to the commercial life of the nation, and desirable as a social service. Yet, by 1866, only a quarter of the towns in the British Isles with a population of over 2,000 had a telegraph office. The case for public control grew, resulting in the Telegraph Act of 1868. This empowered the Postmaster General to acquire the inland telegraphs of the United Kingdom and, two years later, in 1870, these were transferred to State ownership.

At the transfer, most of the technical staff of the telegraph companies went over to the Post Office to form the nucleus of the Engineering Department. Its first job was to extend the telegraph lines, hitherto terminated at railway stations usually some distance from the towns, to post offices within the towns. New routes were laid, and badly constructed lines improved.

Telephones

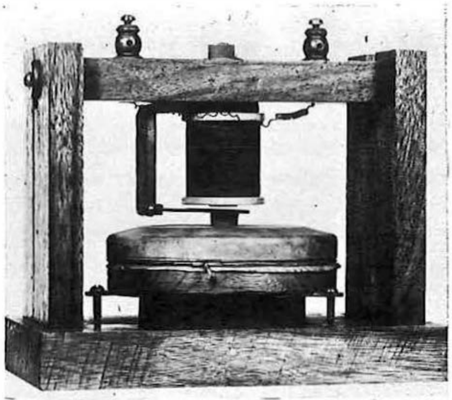
Speech was first heard over a telephone circuit in Boston in March 1876, and Graham Bell's telephone was soon in practical use in the United States. During the next few years private firms and companies opened telephone exchanges in London and a number of provincial towns, the first of which was the exchange opened by The Telephone Company Ltd. in Coleman Street, London, in 1879, with a handful of subscribers.

It soon became clear that the development of telephones by private enterprise would have a large effect on the telegraph service, and it was considered that these activities were an infringement of the monopoly conferred upon the Postmaster General by the Telegraph Act of 1869. The High Court of Justice ruled in 1880 that the telephone was a telegraph within the meaning of the Telegraph Acts. The Postmaster General, however, decided to grant licences to approved companies to develop telephone services, all licences to expire at the end of 1911. It was also announced that the Post Office, to a limited extent, would carry out telephone development as well. Its first exchange opened at Swansea in 1881.

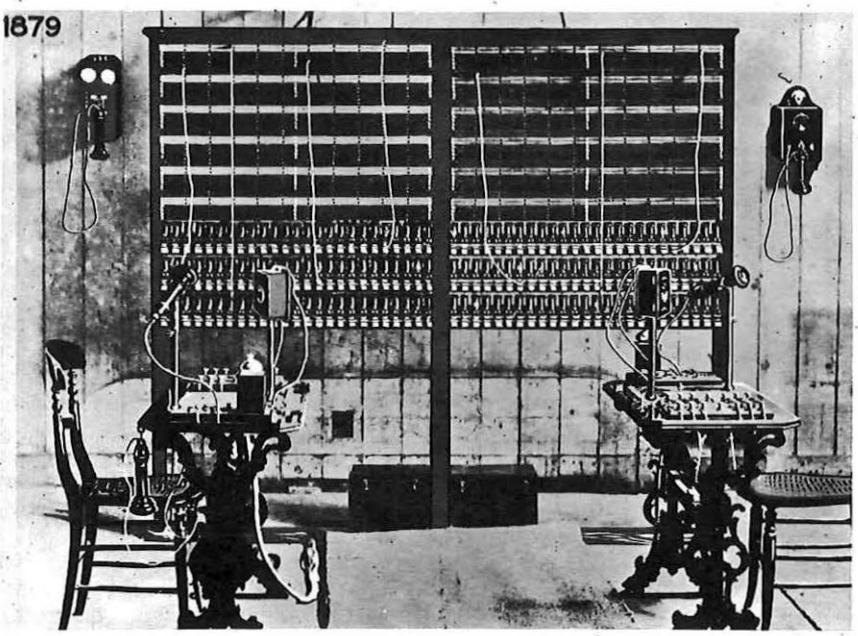
Later, the Post Office arranged to erect and rent to the companies trunk wires to link towns. Public dissatisfaction with the service of the companies and alarm at the uncontrolled monopoly gradually being created by the merger of companies resulted in the Post Office being directed in 1892, to take over all trunk systems, its engineers being given the job of erecting trunk wires on a large scale.

Wireless telegraphy

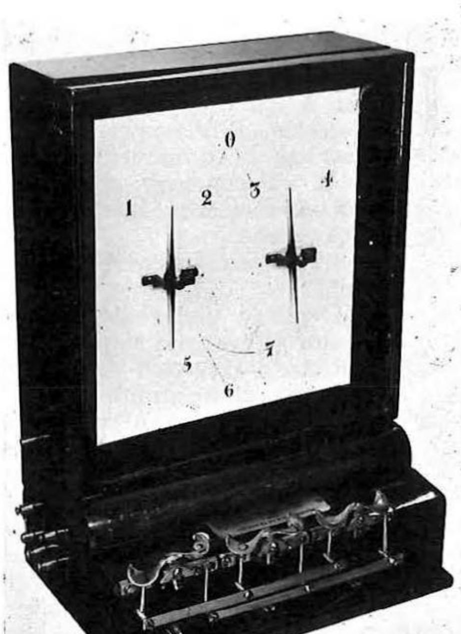
In 1896 the young Guglielmo Marconi called upon the Engineer-in-Chief of the British Post Office to demonstrate his new system of "telegraphy without wires." Immediately all the resources of the Post Office were utilised to help Marconi with further experiments. The formation of Marconi's Wireless Telegraph Company in 1897 gave great impetus to Radio, and this soon demonstrated



Alexander Graham Bell's first telephone made in 1876.



Britain's first telephone switchboard (2 panel) installed at Coleman Street, London in 1879.

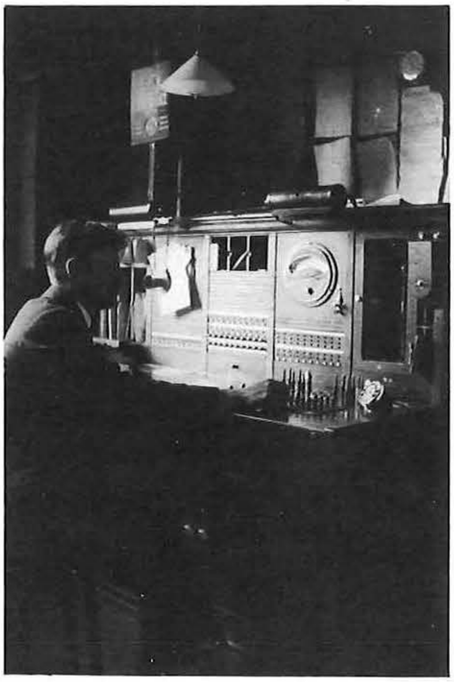


Cooke's portable two-needle telegraph.

Wheatstone's ABC Telegraphic Instrument invented in 1840.

OF HISTORY

Test desk of the first automatic telephone exchange.



the potential of wireless telegraphy as a service of inestimable value to shipping and to international communications. In 1908 the Post Office opened its first ship-to-shore radio station, at Bolt Head, Devon, and in the following year it assumed control of the main shore stations of this country.

GROWTH AND DEVELOPMENT

1868 Telegraph Act empowering Her Majesty's Postmaster-General to acquire the inland telegraphs of the United Kingdom.
1870 Inland telegraph system transferred to state ownership. Continental telegraph station set up in Little Bell Alley, Moorgate—afterwards renamed "Telegraph Street" (T.S.)
1879 First telephone exchange in England opened at 36, Coleman Street, London, by the Telephone Company Ltd.
1881 First Post Office telephone exchange opened at Swansea.
1891 Telephone service opened with France. Continental telegraph "Cable Room" transferred to Central Telegraph Office.
1896 National Telephone Company's trunk service taken over by the Post Office.
1908 First Post Office ship-to-shore radio station opened at Bolt Head, Devon.
1909 Marconi coast stations transferred to the Post Office.
1912 All National Telephone Company exchanges taken over by the Post Office. First automatic exchange (non-director) opened at Epsom.
1915 Archangel submarine telegraph cable laid.
1920 Long distance wireless-telegraph service to ships opened. Private automatic branch exchanges introduced.
1921 London toll system opened.
1922 First "Relay" system non-director exchange with remote manual board opened at Fleetwood. First teleprinter trials.
1925 Prepayment coin-collecting boxes introduced.
1926 Voice-frequency telegraph working over inland telephone lines introduced experimentally. Rugby long-wave telegraph transmitter, with world-wide range, brought into service.
1927 London-New York radio-telephone service commenced. First director exchange opened at Holborn, London.
1928 All Post Office extra-European telegraph services transferred to Cable and Wireless, Limited. Post Office standard non-director system introduced.
1929 First 100-line unit (rural) automatic exchange (No. 5) opened. Hand micro-telephone introduced (combined transmitter and receiver in one hand-set).
1930 Automatic metering up to 3d. introduced on director exchanges.
1931 First 200-line unit automatic exchange (No. 6) opened. Engineering complaint and repair service made directly available to director subscribers by dialling.
1932 "Telex", "Printergram" and private telegraph services introduced, using teleprinters "7B". Sleeve-control switchboards introduced. First "Strowger" type non-director exchange with remote manual board opened at Horsforth.
1933 Telephone service opened with India, Northern and Southern Rhodesia, and Turkey.
1934 Short-range radio-telephone service with coastal ships opened via Seaforth Radio coast station. First ultra-short wave subscriber's circuit installed. First 800-line unit automatic exchange (No. 7) opened.
1935 Telephone service opened with Japan.
1936 First telephone 4-channel carrier system established over existing underground cables. "Country satellite" exchanges introduced. Two-frequency trunk telephone signalling and dialling trials. Anglo-Continental telex service introduced.
1937 First submarine coaxial telephone cable opened to Holland carrying 16 channels. First 12-channel carrier telephone system on special carrier cable opened between Bristol and Plymouth. "999" service introduced in London. London trunk director exchange opened.
1938 London-Birmingham coaxial cable brought into use, carrying 40 circuits initially with wide bank working.
1939 "Two-frequency" inland trunk signalling and dialling introduced. First mobile unattended automatic exchange put into service.
1940 Private manual branch exchange switchboard "1A" introduced.
1941 Telephone 12-channel carrier system standardised.
1942 Shared service introduced on automatic exchanges. First V.H.F. radio multi-channel telephone link converted to frequency modulation.
1943 First submerged repeater (suitable for depths to 200 fathoms) laid in the Irish Sea.
1945 Direct Anglo-German polythene coaxial submarine cable laid.
1946 Gradual re-opening of continental and overseas telephone services.
1948 Most of pre-war overseas telephone services reinstated. International teleprinter alphabet No. 2 adopted for the inland telegraph service.
1949 London-Birmingham television radio relay link opened.
1950 Control of Cable and Wireless Ltd.'s overseas telegraph services from the United Kingdom transferred to the Post Office. Private automatic branch exchanges Nos. 1 and 2 introduced. London-Birmingham television coaxial cable brought into use. Field trials of pressurisation of trunk and junction cables radiating from Leatherhead.
1951 Telephone Act passed, enabling the Postmaster-General to fix rental charges, etc., by Statutory Regulation. Experimental key sending of trunk calls introduced between Continental Exchange, London and Oslo.
1953 Pressurisation of trunk and junction cables introduced.
1954 The new Inland Telex Service established with a separate network and integrated with the International Telex Service.
1955 First cordless switchboard opened at Thanet exchange.
1956 Opening of the Transatlantic Telephone Cable.
1958 Introduction of Group Charging of telephone calls. First Subscriber Trunk Dialling (STD) installation opened at Bristol. First automatic telex exchanges opened.
1959 First Pay-on-Answer Coin Box (STD) introduced at Bristol. Public radiophone service for vehicle users opened in South Lancashire.
1960 First STD exchange in London Telecommunications Region opened (Watford). Conversion of inland telex service to automatic working completed.
1961 Post Office Act, 1961—to separate the finances of the Post Office from the Exchequer. First direct telex subscribers' dialling to foreign countries (Fed. Germany).
1962 First telecommunications satellite (Telstar) launched; reception via Goonhilly Downs satellite communications ground station. Experimental electronic exchange opened at Highgate Wood.
1963 Opening of COMPAC submarine cable between Canada and Australia. International Subscriber Dialling (ISD) introduced, from London director exchanges with STD facilities to Paris automatic exchanges. New cordless International telex switchboard opened in Fleet exchange, London.
1964 Datel services introduced, enabling data to be sent over private telegraph circuits and the telex network. Trial pulse-code modulation (PCM) systems introduced on junction cables. First Crossbar exchange opened to public service at Broughton. First Small Automatic exchange (SAX) opened.
1965 London Post Office Tower opened for service.
1966 Change to all-figure telephone numbers commenced in the director areas (London, Birmingham, Edinburgh, Glasgow, Liverpool and Manchester). First production electronic telephone exchange opened at Ambergate.
1967 Opening of final section of South East Asia Commonwealth (SEACOM) cable. Inauguration of Birmingham Radio Tower. Overseas Telegraph Services new automatic relay centre opened. 'Lincompex' a new type of radio telephony terminal equipment introduced on several overseas routes.
1968 Inauguration of first pulse code modulation (PCM) switching centre.
1969 Post Office becomes a corporation.

... HUNDREDS OF MILES APART

Conference

CONFERENCES between large groups hundreds of miles apart will soon be possible over the public telephone network. New equipment for this purpose which has recently undergone a series of experimental transmissions will shortly be marketed by the Post Office under the name of Confraphone.

Confraphone can be used in two ways. One person using a normal telephone and one line may address a group of up to 30 people gathered at the Confraphone termination. Two units connected together by two lines enables two groups of up to 30 people to participate.

The equipment consists of a control box which houses the line and system controls. A loudspeaker unit with integral receive amplifier has an audio output of approximately two watts—equivalent to a normal commercial radio receiver. If required a second loudspeaker may be provided. At present, an omnidirectional microphone is provided and for reliable transmission this should be placed about two feet from the speaker. The equipment is powered by a small wall mounted mains operated power unit.

The amplifiers are manually switched by means of a "press to speak" key incorporated in the microphone unit. The equipment may be connected to any exchange line, PBX extension or private circuit by means of interception jacks installed between the line and the telephone termination. All the peripheral equipment is connected to the control unit by means of plug ended flexible cords enabling the customer to dismantle the equipment when necessary. The telephones which are used to set up conference calls may be used for normal purposes when the Confraphone is not in use.

In April, 1968, a series of lectures and seminars were exchanged between the Royal Observatory, Edinburgh, and Cambridge University. To augment the exchange of speech provided by Confraphone, Modern Telephones Ltd., installed their electrowriter equipment associated with overhead projectors as a visual aid for this experiment. This equipment allowed simple drawings or diagrams to be transmitted during the lecture. The lecturer drew the diagram on a small plate on his desk. The diagram then appeared on a large screen simultaneously at each terminal. Up to 30 students were present at some of the lectures and a total of 186 students took part in the series.

In July, 1968, four members of the Council for Educational Technology assembled in London addressed the annual general meeting of the University Film Council being held in Edinburgh. This experiment highlighted the savings in travelling time and expense achieved by the use of Confraphone.

In September, 1968, J. Sainsbury Ltd. used the equipment between their Head Office Conference Room in London and their Distribution Depot in Basingstoke. The speed with which a conference could be set up proved valuable in this commercial application.

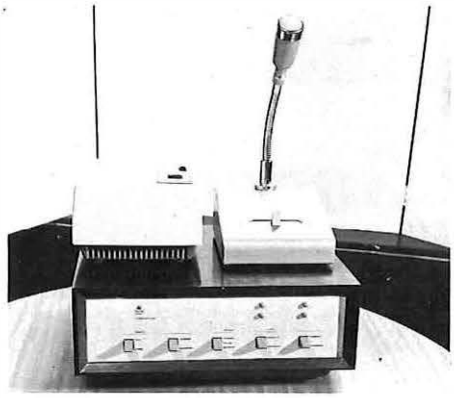
In all the experiments the telephone calls were set up over the public telephone network using normal STD or operator assisted calls. No special engineering work was necessary. Reproduction of speech by the Confraphone was generally judged to be of satisfactory quality in spite of the restricted frequency range imposed by the commercial telephony channels used. Articulation could be improved

A test conference call is set up between Market Research Division's offices in London and Edinburgh TMO.

by asking the speakers to address the microphone from within two feet or so and speak distinctly. Acoustic environment is, of course, extremely important in speech reproduction and small, softly furnished rooms were found to give the best results. Large, highly-reverberant rooms should be avoided.

The experiments showed that the manually switched mode of operation presented no insuperable practical difficulties. Good switching discipline is needed to ensure a smooth flow of conversation between the two groups but the technique was apparently quickly learned in both formal and informal discussions. Voice switching was ruled out at the design stage as presenting too many hazards for large conferences, for example, coughing by one of the listeners could cut off the distant speaker's voice.

A small quantity of Confraphone equipment is now being manufactured and initial supplies will be used for further trials with commercial customers prior to limited marketing later this year.



The microphone, loudspeaker and control units which make up the Confraphone.

THE AUTHOR

Mr. R. J. Beale *is a Senior Sales Superintendent in the Marketing Department of THQ responsible for conducting trials of new customers' apparatus. He joined the Post Office as a Youth in Training at Torquay in 1945 and moved to London North West Telephone Area as a Sales Representative in 1964.*

by telephone

... IN THE SAME OFFICE

THE Post Office is introducing a modern version of its House Telephone System. It will be known as the Internal Telephone System and will be available in three sizes of six, 11 and 16 station maximum capacity.

The design, with its two-tone grey modern telephones available for either desk or wall mounting, is much more attractive than its predecessor which has remained unchanged since its introduction in the pre-war years.

The telephones are, in fact, similar to the Post Office's 706 series except that the dial has been replaced by a five, 10 or 15 way elephant-grey push-button unit which gives direct and fast inter-communication between all stations.

Technically, the new system's major advantage over the old units is that conference calls can be set up between any number of stations.

The whole system must be installed at one address and it will not be possible to provide external extensions or any plan extension arrangements. As it is not feasible to associate an exchange line with the system, it will have no connection with the public network.

The normal calling signal is a buzzer within the telephone case but extension bells or buzzers may be associated with any station. The system is designed to allow any number of separate calls to be conducted simultaneously but there is no secrecy against intrusion into an established call.

Power is supplied by a small wall-mounted mains driven power unit which should be fitted at a convenient point near the centre of the system where the customer must provide a suitable three-pin earthed socket outlet of at least five amp. capacity. The system is inoperative under mains failure conditions.

To originate a call the user selects the appropriate button for the station required. Each button has three positions—normal, speak and call. For identification purposes the ivory buttons carry bold, black numerals beneath transparent plastic covers which may be removed to allow insertion of designation labels to suit a customer's particular requirement.

After lifting the handset, full depression of the selected button will operate the buzzer at the called station unless it is already engaged on a call when conversation will be heard. Release of pressure allows the button to move to the speak position and silences the distant buzzer. If there is no reply further full depression of the button will reoperate the buzzer at the called station.

An interlocking mechanism associated with the press button unit will release any operated button on depression of another. Any button not in the normal position is released when the handset is replaced.

The conference call can be set up by the originator calling each station involved in turn and requesting them to call him back. The quality of transmission is virtually unaffected by the number of stations taking part in a conference.

The successful completion of the product trial has allowed us to make the new product nationally available to meet spontaneous demand. An unrestricted market trial is now in progress in SWTR. As soon as the results show the likely size of stimulated demand we shall arrange sufficient supplies to extend selling across the country. This will mark a break away from the previous policy of offering this type of internal system only when the customer asks for it to a new policy of active sales promotion.

Using the push-button telephone a conference call is set up in a London office building which could involve up to 16 people none of whom would have to leave his desk.

The Super Communications of the Queen Elizabeth II

The telecommunications techniques employed on the QE2 are the most sophisticated in the maritime service. They point the way to the future pattern for serving large seagoing vessels.

By W. M. DAVIES

A PASSENGER luxuriating in the comforts of the giant Cunarder Queen Elizabeth II awakes each morning to find his daily paper available on request. It is that morning's edition, "hot" from the presses of the Daily Telegraph hundreds of miles away in London's Fleet Street, transmitted over Post Office circuits to the ship every night.

The service is one of a number provided for QE2 passengers by the most modern and comprehensive communications facilities ever set up on board a liner.

In addition to providing a picture service and two bearer channels for the daily transmission of the newspaper, the Post Office also provides the ship with telephone and telegraph services including telex. The liner also uses Lincompex, a Post Office development which almost eliminates the effects of radio interference and makes maximum use of transmitter power. As a result, high quality radiotelephone circuits are available to connect passengers with telephone subscribers on both sides of the Atlantic.

The newspaper, a condensed version of the "Telegraph", involves the transmission of approximately 8,000 words of copy plus the technical instructions necessary for setting up the type. A Varitype type setting machine is used in the "Telegraph's" London office with a similar machine in the print room of the ship. Transmission of the information from one machine to the other requires more characters than is normally available from the five-unit teleprinter alphabet (it gives 31 active combinations plus an "all space" combination that is not used on the telex system) so a six-unit code is used.

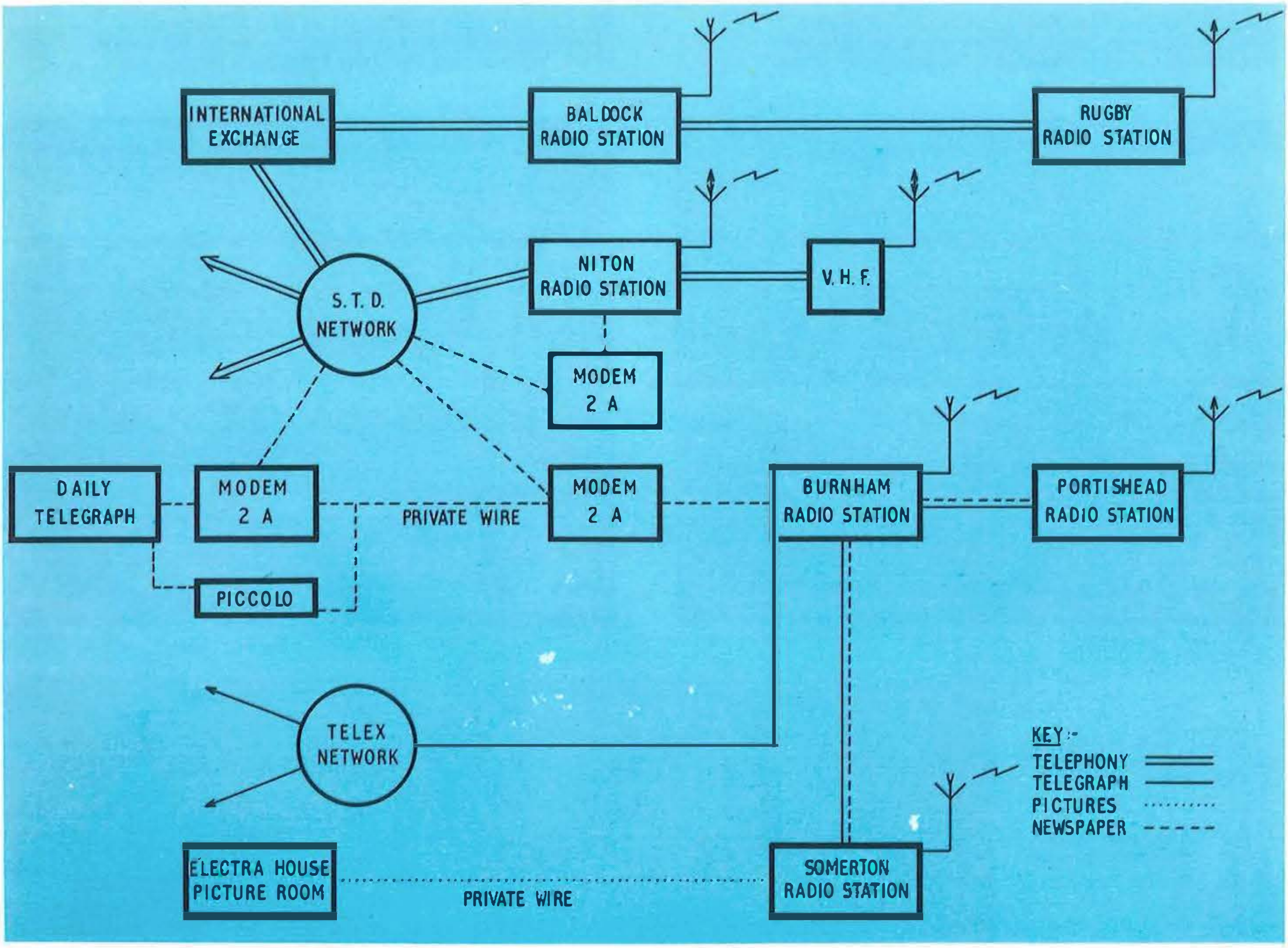
Two independent transmission systems are available between Fleet Street and the liner. With the "Piccolo" system each of the 32 characters on the telegraph alphabet is represented by an audio frequency in the range 330-640 Hz (A equalling 330Hz, B equalling 340 Hz and so on). The signalling speed is 10 characters a second, each being represented by an 80 millisecond burst of tone, which energises one of the 32 filter/detectors at the receiving terminal. The output from the equipment is in the form of five-unit punched tape but, in the case of the Daily Telegraph transmission, this tape must be converted to a six-unit form before it is suitable for feeding into the Varitype machine. Transmission of the audio tones from the newspaper's office in London is over a private wire by way of Burnham Radio to the transmitter at Portishead. As this system requires extreme frequency accuracy (an overall error of five cycles will completely invalidate transmission) the transmitting equipment at Portishead is operated from synthesisers locked to a special master oscillator.

In the second system the signals from the Varitype are connected to an error-correcting data transmission system specially modified for 100 baud working. This equipment generates a 10-bit error-detecting telegraph code by the addition of "parity" bits. It operates on the same ARQ principle (Automatic Request for repeat) as is used on the main point-to-point telegraph channels. If an incorrect 10-bit character combination is received, the receiving terminal returns a special request signal to the transmitting terminal which then repeats the preceding six characters. If these are repeated error-free the system carries on until another incorrect combination is received.

This system is of the "duplex" type which allows transmission in both directions, shore to ship and ship to shore. The output is in the form of polar d.c. and this is applied to a standard Post Office Modem 2A which produces an audio frequency-modulated output corresponding to the polar d.c. input. The audio signals are fed over the private wire to a complementary Modem 2A at Burnham Radio the output of which is used to control a keyer unit of the type used for the radio telex service.

On the ship, the output from the dual diversity synthesised receivers as used for the telex service is demodulated by a special unit developed by the Post Office and the resulting polar d.c. signals are applied to the data terminal. This produces a punched tape immediately suitable for the Varitype machine. The shore receiving station for the return path is Somerton Radio which receives the ship's transmission using a dual-diversity receiver and aerials beamed on the ship. The polar d.c. output from the receiver is conveyed to the Burnham control station by means of a voice frequency telegraph channel and from there to London over the return channel of the Modem 2A. As an emergency alternative to the private wire, switching facilities have been provided to allow the system to be routed over the inland STD network.

Since the Portishead-Burnham-Somerton complex operates in the



high frequency radio bands 4-22 MHz it cannot always provide a good service when the ship is within a few hundred miles of the British coast. To cover this contingency parallel arrangements have been made to allow the data transmission system to operate by way of Niton Coast Station which operates in the medium frequency 1.6 to 3.8 MHz band. The signals, in this case, are conveyed from the Daily Telegraph to Niton by another Modem 2A system and the inland STD network.

Radio Telex is operated through the long range Burnham-Portishead stations on radio frequencies in the HF (4-22 MHz) maritime bands according to the position of the ship and the prevailing propagation conditions.

In the radio transmission system used, the start-stop 50 baud teleprinter signals coming into Burnham Radio Station from the national or international telex networks are converted to a synchronous 10 bit error-correcting telegraph code by the addition of "parity" bits. The code used enables the receiving equipment to recognise and print correctly all characters containing one incorrect bit out of the ten and will also correctly print some characters containing two or three incorrect bits. When an uncorrectable character is detected a special error symbol is printed. By these means the results achieved approach the standards of a land connection.

The system operates in binary form over the radio path at a modulation rate of 68.5 bauds, one condition of the code being transmitted as one radio frequency and the other condition by altering the frequency by precisely 170 hertz (frequency shift operation). To ensure stability of operation, the radio frequencies employed in the transmission are generated by frequency synthesis techniques from a highly stable and precise oscillator having a frequency accuracy of a few hundredths of a hertz. Reception of the return signals from the ship is at Somerton Radio Station where dual diversity receivers and large directional rhombic aerials are used to ensure the best possible performance. The d.c. signal output from the receiver is used to modulate a voice-frequency channel to Burnham Radio for connection to the error-correction terminal equipment the output of which is used to produce a five-unit tape for automatic transmission into the telex network.

Radio Telephone working in the 4-22 MHz band uses Lincompex and operates through Baldock (receiving and control) and Rugby (transmitting) in conjunction with the London International Exchange. The two radio channels, fitted with Lincompex, carry the bulk of the telephone traffic and give a circuit quality equivalent to that of an international cable. A requirement of Lincompex is very low end-to-end frequency

Above: A block schematic diagram of the telecommunications complex serving the QE2.

Below: Post Office equipment used on board the ship. From the left—dual diversity radio receivers and error correcting telegraph equipment and a Teleprinter No. 15 A, the latest development in teleprinters, used for the first time on board a ship, with its associated control box.

Aboard the Cunarder Radio Officer Mr. Stewart Lund of Burnham Radio Station prepares tape for transmission during the ship's "shakedown" trials.

Mr. Les Lott (extreme right) an AEE in Network Planning Department of THQ on a visit to the ship's Print Room where the Daily Telegraph is "run off".

A section of the ship's busy radio room.

error in the transmission system and this has been achieved on the QE2 by using frequency-synthesised receivers and accurate transmitters. The Rugby transmitters are also equipped with frequency synthesised drive equipment while the receivers at Baldock have conventional crystal-oscillators and automatic frequency control.

Radio telephone channels of the conventional type in the 1.6 to 3.8 MHz and VHF bands are operated through Niton and Lands End coast stations. These stations handle the ship's telephone traffic when she is within a few hundred miles range in the case of multi-frequency channels and within a few tens of miles for the VHF system. Calls are extended from the coast station to the shore-end subscriber over the inland STD network.

Picture and facsimile transmissions from the ship to shore are catered for by the normal commercial service which operates in the HF band 4 to 22 MHz by way of Somerton and Electra House. This system employs a frequency modulated sub-carrier varied over the range 1,500 Hz (white) to 2,300 Hz (black). If advance warning is given the transmission can be extended directly to the newspaper office concerned. Each picture is transmitted line by line, in the same way as television, except that the picture is built up on photo sensitive paper wrapped round a rotating cylinder instead of appearing directly on a flat screen, and takes about 15 minutes.

For morse telegraphy, main and emergency transmitters capable of being hand-keyed are fitted on the ship and can be operated on any of the maritime frequencies from 500 KHz upwards. Complementary transmitting and receiving facilities are provided at the 11 United Kingdom coast stations and at the long range transmitting and receiving stations at Burnham and Portishead.

The Post Office has put considerable effort into ensuring that communications with the liner are as reliable as possible. In fact, on the early voyages, traffic and engineering staff sailed with the ship to make sure that everything went to plan. They not only helped to clear the huge amount of traffic—telegraph messages reached an all-time record of more than 20,000 words a day and telephone calls more than 600 paid minutes a day—but also gave valuable advice on technical matters as well as operating procedures to ship's staff.

THE AUTHOR

Mr. W. M. Davies, C.Eng., MIEE *is a SEE in the Network Planning Department of THQ with responsibilities for systems evaluation, prototype testing of HF radio equipment and International Radio Consultative Committee support studies.*

Network Co-ordination Centres have been set up throughout the country and play a major part in controlling and co-ordinating the restoration of service under major breakdown conditions. The organisation is also concerned with the use of protection channels and takes steps to ensure that any works affecting service are planned to limit the extent of service interruptions. The Centres have resulted in a big step forward. . . .

Towards a better service

by K. R. HOWSE

THE AUTHOR

Mr. K. R. Howse *is an Executive Engineer in the Network Planning Department of Telecommunications Headquarters. He joined the Bristol Telephone Area in 1941 as a Youth in Training and was later employed as a Demonstrator and Lecturer at the South Western Regional Training School. In 1956 he moved to the Engineering Department and was engaged as an Assistant Executive Engineer on Exchange Tester design and then controlled a Special Investigation Team until 1964. Promoted to Executive Engineer in 1965 he was concerned with Test Desk design and the design and production of the new public exchange Cordless Switchboard until joining the National Network Co-ordination Centre in January 1968.*

Staff at work at the National NCC in London.

THE automation and rapid expansion of an already complex telecommunications network increases the importance of its effective control by management and the need for close co-ordination of maintenance activity and of any work on the network affecting service. To meet these requirements, with the general objective of effecting an improvement in the service given to both public and private circuit users of the network, the Post Office have established 11 Network Co-ordination Centres (NCCs) throughout the country. These centres are staffed by engineers with clerical support and operate Monday to Friday during normal working hours. The National NCC, in THQ London, together with centres in the Midland and North Western Regions commenced operation in January, 1968; centres in all other Regions were opened by September of the same year.

All breakdowns on the main network that give rise to major service failures are reported by wideband link controlling stations and by circuit control centres to the Regional NCCs. The reports are made by telephone and are followed by reports of the action being taken and of the final clearance of the fault condition. The Regional NCC receiving a fault report passes the information immediately to all other NCCs who, in turn, advise the main circuit control centres affected and the Regional and National management and specialist groups. When it is clear that the breakdown will be a long one, consideration is given to the possibility of by-passing the faulty plant by re-routing the traffic on spare or service protection plant. On clearance of the fault the NCCs ensure that the circuits are quickly brought into service by reporting the clearance to the main circuit controls concerned.

By these means the NCCs, although not part of the first-line maintenance organisation and therefore not responsible for day-to-day maintenance of service, play a major part in controlling and co-ordinating the restoration of service under major breakdown conditions.

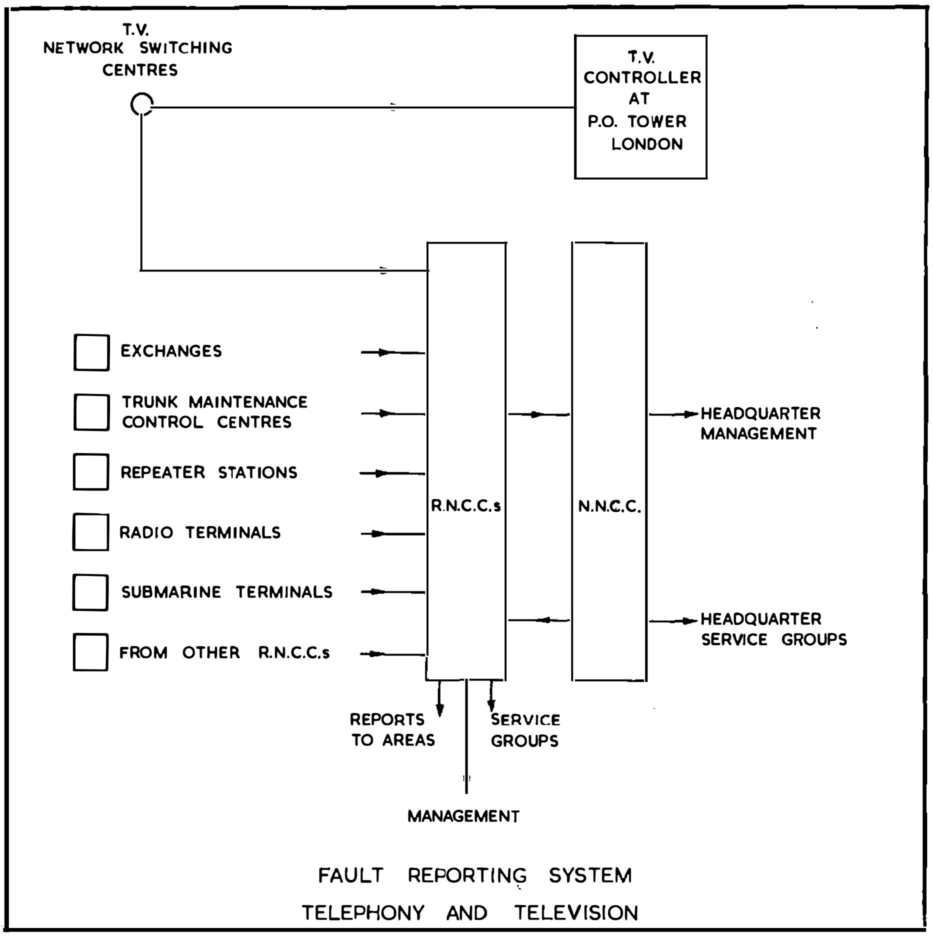
Reportable major events are defined as:

(1) failure of a coaxial cable link or radio link for a period in excess of 30 seconds.
(2) failure of more than 50 main network or junction circuits on any one traffic route for a period in excess of 15 minutes.
(3) isolation of any telephone or telex exchange.
(4) any loss of service affecting more than 500 subscribers lines.
(5) failure of a television link for more than 30 seconds.
(6) failure of a submarine cable system.
(7) damage caused by storms, floods, fire or gas explosions.

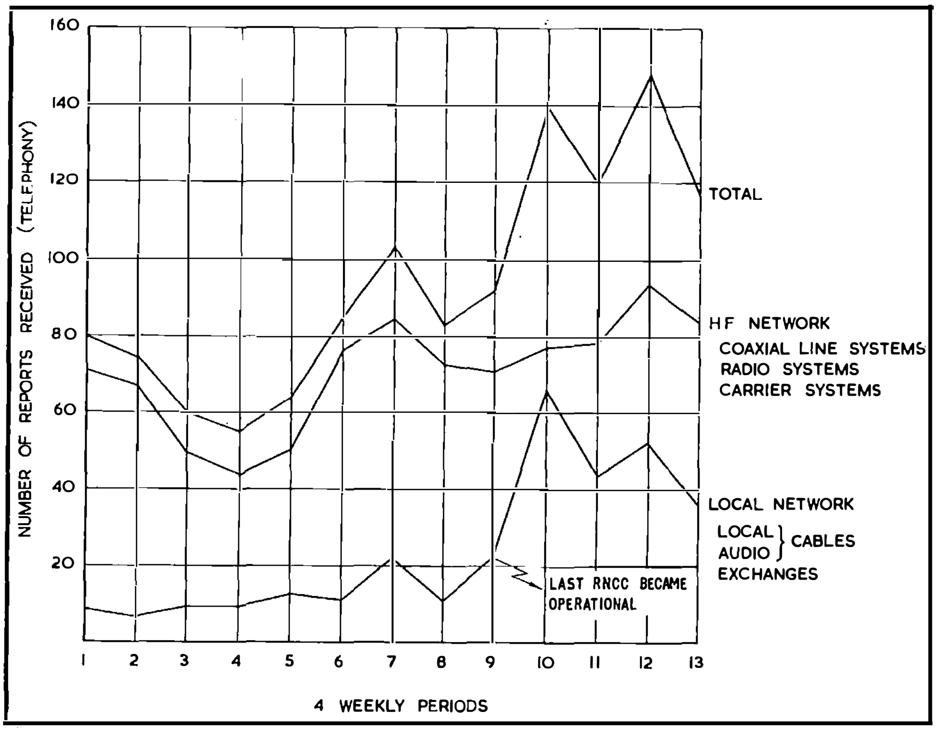
To ensure the rapid reporting of all major service failures, swift and efficient communication facilities are essential. A specially designed loudspeaker circuit links all centres and enables immediate inter-communication between them. Information may, therefore, be rapidly disseminated to all Regions and via these centres to Trunk Maintenance Control Centres (TMCCs) and to coaxial and radio link control stations, thereby achieving rapid co-ordinated action throughout the entire network. To ensure that each centre can be readily contacted via the public switched network PBX telephone facilities are also provided.

Information concerning major service failures is displayed on wall charts in each NCC to indicate the performance and availability of both telephony and television main links.

During 1968 on the telephony



The fault reporting system for telephony and television.



This chart shows the rate of fault reporting to the national NCC in 1968.

network there were 1,250 reports, of which 74 per cent concerned the transmission media and 26 per cent concerned exchanges. This year, with all Centres fully operational, the current level of reports is at the rate of nearly 2,000 per year. The number of reports concerning television failures is about 2,900 a year of which 700 are events lasting for more than 30 seconds.

The NCC organisation is also responsible for the day-to-dav use of the Service Protection Network. This network, which is in the course of provision and will consist of both 4 MHz and 12 MHz coaxial cable links, will enable alternative routings to be set up rapidly by means of patch connections in repeater stations to restore service disrupted by fault conditions. For each of the existing line links several alternative restoration plans are being prepared in advance to cater for conditions of failure on this link. At present, much use is made of the existing protection channels that form part of microwave systems. Arrangements have been made to extend these from the radio terminal stations to suitable switching centres.

So far as planned works (A60 procedure) are concerned, those likely to cause reduced serviceability of public and private circuits within the network have now to be examined by the Regional NCC concerned to ensure that each operation is suitably planned so as to limit the number and the extent of service interruptions likely to be incurred. Co-ordination of the work nationally is also undertaken to prevent coincident operations giving rise to serious disruptions of service.

NCCs are vested with the right of inquiry, direct to field staff, on matters concerning major service failures and exercise the right when determining the true cause of each failure. Details are recorded on dockets, copies of which are distributed to management and the appropriate specialist groups, within a short time of the full facts becoming available. In addition, a summary of the major failures is prepared each day for submission to top management. Other summaries and analyses are widely circulated and show the causes of service failures, including those due to plant defects, contractors working parties and Post Office working parties. They also illustrate general trends in equipment performance.

The functions of the NCC organisation are continuing to expand in response to Regional requirements as well as those from Telecommunications Headquarters. In fact, the NCCs are now increasingly being regarded as major reporting centres and the chief source of factual information on the day-to-day performance of the telecommunications network.

The men who put safety first

By L. H. CATT

A survey over a period of 12 months revealed that 10,500 accidents were suffered by members of the 100,000-strong minor engineering grades in the Post Office. Roughly one in three of these accidents involved injuries of a serious nature. Other areas of the Post Office also produce disturbing accident statistics and to combat this serious problem the Post Office began in 1964 a phased plan of action which has resulted in the establishment of a co-ordinated accident prevention organisation—and a progressive reduction in the accident rate. This article deals in particular with the work of the Engineering Safety Officer.

Strapped securely to a stretcher, an injured man can be brought down safely from the dizzy heights of a Radio Station mast.

THERE are more hazards in the field of engineering works than in most other areas of staff activity in the Post Office. Great efforts are made to take steps which will reduce the number of accidents, or the severity of any that do occur.

A Safety Officer of Assistant Staff Engineer rank is attached to Telecomms Headquarters to act as adviser on safety in engineering practices, operations and design matters, to any part of THQ and the engineering staff in the Planning and Mechanisation Department of Postal HQ. His staff includes the Safety Officer for inland radio stations who deals with safety practices and equipment for radio masts and towers. The Engineering Safety Officer's work is of an advisory nature. While he can suggest means of reducing the hazards to engineering staff, the responsibility for actual design and method remains with the Safety Services Division of Central Headquarters who deal with safety of members of all parts of the Post Office. Having identified a hazard which does, or may, cause accidents the Engineering Safety Officer brings it to the attention of the HQ group controlling that aspect of work.

The great aim of the Engineering

Safety Organisation is the reduction in the number of accidents and in their severity. For any accident, it is entirely fortuitous how long an injured man may be on sick leave. If he falls from a pole, he may fall 20 feet on to a concrete road or ten feet into a hedge. The severity of the injuries is considerably different, hence conclusions based only on sick leave incurred can be misleading. The important fact is that a man has fallen from a pole and this is the fact that must be investigated. This investigation is carried out locally and if possible the reason found.

The Engineering Safety Officer, from observation of numbers of accidents, selects types which are the most numerous and by examining individual reports and visiting sites endeavours to initiate action which will prevent or minimise such accidents and reduce their severity. This last point highlights an important feature of safety work, in that there are two distinct but complementary lines of action; that necessary to prevent accidents happening and that

POST OFFICE WINS TOP RoSPA TROPHY

THE POST OFFICE has won the Sir George Earle Trophy presented each year by the Royal Society for the Prevention of Accidents.

It is given to the organisation judged by RoSPA to have made the outstanding contribution of the year to the prevention of accidents at work.

This year was the first time the Post Office had entered for the award.

required to prevent injury if an accident does happen. For instance, safety shoes may prevent a foot injury if a joint box cover falls on the foot but to prevent the accident there are standard methods whereby the cover can be removed without the foot ever being under it. The first is injury prevention the second, accident prevention.

From records within the Post Office and in other engineering works it is a regrettable fact that at least 80 per cent of accidents are due to human errors or failings. The victim is not necessarily the person who does the incorrect or thoughtless act or omits or neglects to replace or make something "safe". Working methods must therefore be devised to minimise as far as possible the results of human error. The number of cases where tools or plant design cause accidents is less than ten per cent of the total and, therefore, most of the effort in safety work aims at inducing skilled and competent men to observe the standard "disciplines" of the work methods laid down and not to take short cuts or use incorrect or faulty tools. To assist in this a quarterly newspaper *Engineering Safety* is produced for

This staged sequence is based on an actual mishap. A man prises open the lid of a box, throws the lid behind him and then steps back on to a nail. Eighty per cent of engineers grades accidents are due to human errors.

the Engineering Safety Officer by PRD, in an attractive colour format, giving details of cases, suggestions for safe working, and drawing attention to items which are available to reduce working hazards. This is a "high impact" publication and leaves the long term record of safety regulations to the established EI's etc. Of 120,000 copies printed well over 1,000 are purchased by telephone administrations overseas and other departments with similar interests.

The accident rate index used by the Post Office is that used internationally and is the number of accidents involving sick leave per 100,000 man hours worked—a figure considered to be an approximation of a man's working life. Thus the index could roughly be said to be a number of sick leave accidents a man may expect to have during his working life. The rate for the March quarter, 1969, for all engineering minor staff was 1.66 but this rate tends to fluctuate due to factors such as weather conditions and amount of overtime worked and therefore another index, the "Quarterly Cumulative Rate", is more useful to observe the trend in accident rate. This is obtained by taking the average of the rates for the current quarter and the three immediately preceding quarters. The method of recording was improved in 1965 and rates recorded before that date are not strictly comparable. The general trend has happily been downwards and must reflect the effects of the increasing provision of mechanical aids as well as the efforts of the safety staffs in increasing the awareness of staff to the benefits, both personal and financial, of following safe practices.

The number of minor engineering staff is nearly 100,000. Of these about 30,000 are employed on external works. Some other men have duties involving both external and internal work such as subscribers installation staff. The majority of the injuries are sustained by external staffs due no doubt to the heavier nature of their work and the added hazards of weather conditions.

A high proportion of their accidents involve back injuries, which is a reflection of the nature of their work. It also spotlights the need for continuous vigilance on the part of all first line supervisors to ensure that the correct techniques for lifting and handling, which are taught to all external staffs, are used continuously, since men can easily revert to the dangerous practices of lifting without ensuring a good foothold, good grip and proper stance with back "locked", chin well in.

Another field in which hazards are ever present, is in the use of ladders. Both internal and external staffs use them and it is an unfortunate fact that familiarity with this universally used item can result in serious injury and, in some cases, permanent partial disablement or even more serious results. In this field a sub-committee has been set up to investigate the hazards involved in all types of climbing or access to high places and to investigate methods of reducing these hazards. Here, the Engineering Safety Officer and his staff have a definite field of activity. Data is obtained from accident cases in which falls have occurred. From these, those areas in which possible re-design of plant or equipment, or additional aids could reduce the hazards are identified and the equipment design groups appraised of the way in which the commonest accidents happen. At present there are two or three lines of approach being pursued. For instance, it is a surprising fact that about half of the ladder accidents occur indoors. Modern floor coverings accentuate the risk of ladder slips if the stability angle of a spread of a quarter the vertical height is departed from to any significant extent. To overcome this, it is proposed to introduce some new light weight step ladders using modern designs of platform tops with steady rails, for access up to about 12 feet. Above this it is proposed to investigate the use of portable stagings which can be easily and quickly erected and dismantled. Lockable castor type wheels enable them to be moved easily along the floor of say, a factory or other site where cable runs are required above 12 feet from the floor. Both the steps and the stagings are on field trials to assess their usefulness and the ability of men to handle them. There will be occasions of work inside buildings when ladders will still need to be used and in these cases, it is proposed that the ladder must always be "footed". This should reduce the hazard considerably. For the external staffs, the steps and stagings will also be available together with an increased provision of vehicles fitted with Simon hydraulic platforms to enable safe access where the vehicle can safely get on to firm ground within reach of the job. For climbing to the steps of poles, a modified ladder designed to hold the top of the ladder away from the pole and with a flat "platform" step at the top, together with a rapid acting securing device for the top lashing rope, is also on field trial.

Other fields in telecommunications engineering which the Engineering Safety Officer is exploring are the handling of PABX units, Datel modems etc. into and out of subscribers premises; the handling of apparatus racks from the transport truck to the final erection and placing in position. This type of task is hazardous because of the weights involved, often over half a ton, and the restricted spaces in which they have to be handled. It involves the design of mechanical devices which reduce or eliminate the need to lift or manhandle these awkward and heavy items. Hazards under review are often found to be due to bad methods of working and these are highlighted in the publication *Engineering Safety* with practical suggestions or reminders of safer standard methods, the relative Engineering Instructions being amended when necessary. As mentioned earlier, the case of radio aerial masts and towers receives special attention owing to the nature of this work. Here much more elaborate safety precautions are taken and the riggers are conscientious in their safety drills. They can easily suffer from tiredness when climbing and must therefore always be secured by one means or another to the main structure when working away from the platforms or staircases. Inclement weather conditions can also lead to the loss of handhold on structural parts and the safety harnesses, inertia blocks etc. are used with these points in mind. Under the guidance of the Radio Safety Officer, all riggers are trained in rescue operations to get injured men down from any height, since, although an ambulance team will attend at the station, few ambulance men will venture 100 or 200 feet up a lattice mast.

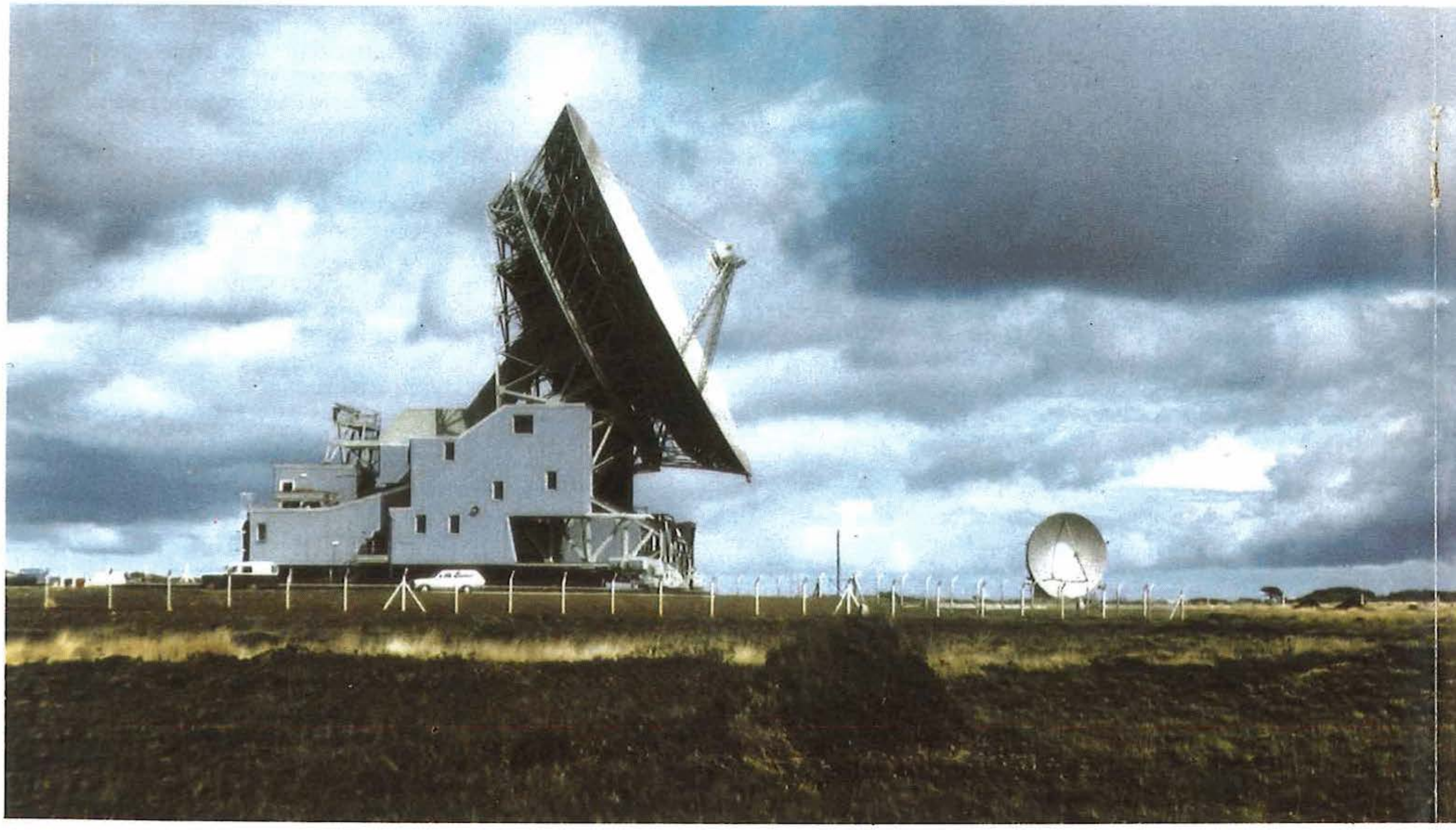
From the foregoing it will be seen that although a recent definition of a "Safety Expert" is one who has just witnessed an accident, there is always a steady process of recognising hazards and drawing the attention of the persons most able to reduce or eliminate the hazards.

The top of a ladder with an experimental "stand off" fitting. The picture illustrates how the climber's foot can be placed firmly, with complete safety, on the very top of the ladder.

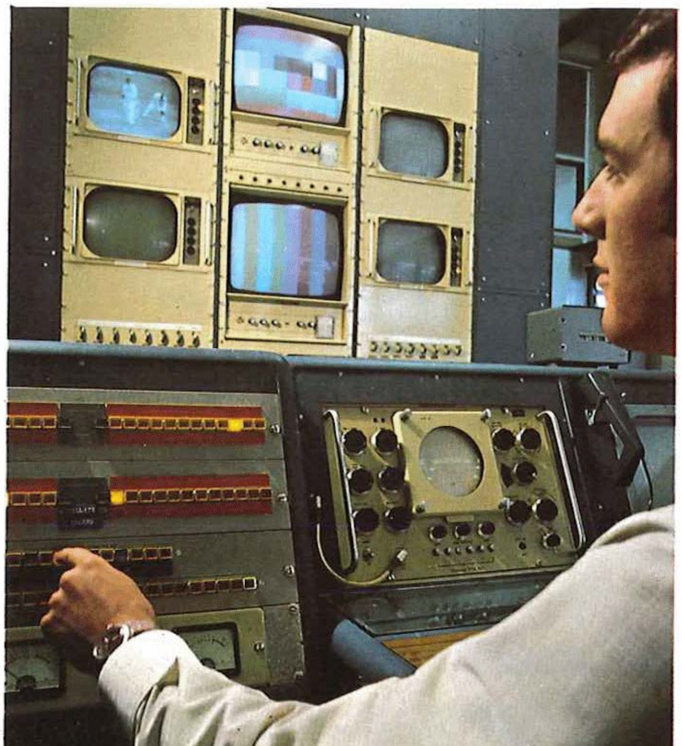
THE AUTHOR

Mr. L. H. Catt, C.Eng., F.I.E.E. *entered Post Office Engineering Department as a Youth in Training, Brighton area, in 1927. Instructor at Training School, Dollis Hill, until transferred to ENCO as Inspector in 1936. Since then he has been concerned with telecommunications power plants except for a wartime period when he was involved in emergency restoration of exchanges and exchange maintenance procedures. He was appointed Engineering Department Safety Officer in March, 1967.*

24 HOURS AROUND THE CLOCK . . .



. . . and 23,000 MILES AROUND THE WO



BRITAIN'S satellite communications links now gird the globe. The round-the-clock and round-the-world tie-up came in August when the No. 1 aerial at the Post Office's Goonhilly Satellite Communication Earth Station in Cornwall, "locked on" to an Intelsat III satellite over the Indian Ocean, became officially operational.

With Goonhilly's No. 2 aerial working to a similar satellite over the Atlantic Ocean, the Earth Station now has its two giant dish aerials operating to satellites in both the eastern and western hemispheres. The global link is completed by a third satellite over the Pacific Ocean.

Aerial No. 1 originally provided the Britain-Europe-North America link but was released from service with the introduction of Aerial No. 2 since when it has been refurbished and modernised for its role in the Indian Ocean. Initially, it is providing direct links with Japan, Bahrain, Indonesia and Kuwait with two outgoing 132-channel, multi-destination unidirectional carriers—one to serve Japan and Bahrain, the other to service Indonesia and Kuwait: and

RLD

also for the reception of four separate 60-channel carriers, one from each of these countries.

The system is soon to be expanded to provide direct service to Australia, India and Malaysia. Outgoing transmissions will be included on the existing carriers but reception of three additional incoming carriers will be necessary—one of 132-channel capacity and two of 60-channel capacity.

In following months further expansion will provide direct service to Ceylon, East Africa, Hong Kong, Singapore and East and West Pakistan. Since each of these services will require the reception of a separate incoming carrier, the immediate capacity of the No. 1 Aerial system will be two 132-channel transmit carriers and 13 receive carriers of varying capacities (24, 60 or 132-channel). By the end of 1970 the traffic load is expected to reach nearly 175 circuits with possible expansion to follow. The addition of a third transmit carrier is expected by 1971.

Details of the No. 2 Aerial were provided in the Spring, 1969, issue of Telecommunications Journal.

For the financially minded, Goonhilly has an earning potential of £100 a minute much of which is foreign currency earned for Britain.

Goonhilly staff and Post Office engineers have been praised for their work in getting television pictures of the Prince of Wales' Investiture ceremony to the world. At Goonhilly, staff worked round the clock to get the No. 1 Aerial equipped to send the pictures when the satellite over the Atlantic broke down.

A congratulatory message to engineers through the MD:T was sent by the Postmaster General, Mr. John Stonehouse. Praise also came from Australia and from Mr. Reuven Frank of America's NBC.

Top left and right: The two aerials (No. 2 in foreground) by day and night. The night picture is made doubly dramatic with the use of trick photography to obtain a double image of the aerial and lights from windows of its equipment building. *Far left:* The television control and monitoring console at Goonhilly.

Long-life transistors beneath the sea

The Post Office Research Station at Dollis Hill is in the forefront of transistor development, design and production. The reliability achieved is not bettered anywhere in the world, and the work of the Dollis Hill team has reduced dramatically the cost of submarine cables.

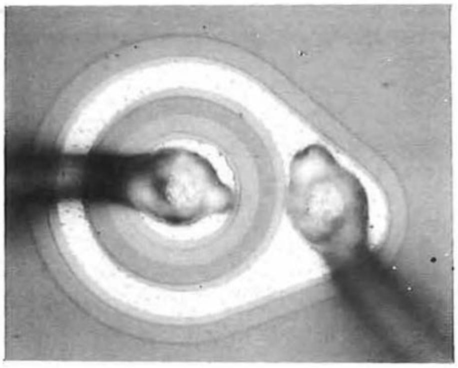
By M. F. HOLMES and D. BAKER

OVER the past twenty-five years steady progress has been achieved in the development of submarine telephone cables. In particular the number of circuits in each cable has risen from five in the Lowestoft-Borkum laid in 1946 to 1,260 (4KZ speech band) in the latest systems which will be commissioned in the early 1970s. This rise in circuit capacity has been due to developments in submarine repeater design and, more specifically, to improvements in the amplifier active elements, formerly thermionic valves, now transistors.

The change to transistors followed the realisation that overall terminal voltage limitations prevented the design of thermionic valves with bandwidth capabilities much in excess of 360 both-way circuits. This limitation was no bar to the design of the transistors needed to handle much greater bandwidths.

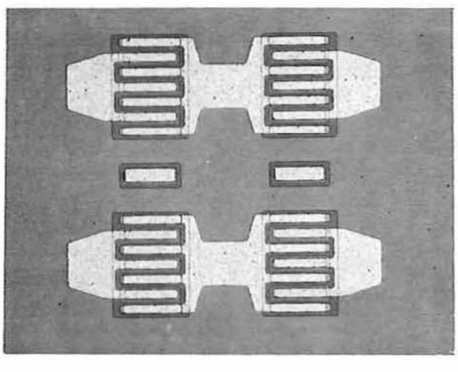
In the early 1960s a technological process for transistor production was introduced which also supported serious consideration of this device as the active element in future submarine systems. This process, known as silicon planar technology, gave promise of very high device reliability, always an important criterion for submarine repeater components. There was, in addition, a further possible advantage associated with the new technology. Failure of silicon planar transistors when it occurs is almost certainly due to the drift of contaminating ions over the surface of the thin layer of silicon dioxide which protects the small silicon chip in which the transistor is fabricated. The achievement of transistors having a predictably long life is practicable because it is possible to forecast the failure point in time by means of a relatively short life test in the laboratory at elevated temperatures. It has never proved possible to accelerate the failure mechanisms of thermionic valves in a controllable fashion and consequently the problem of life prediction was very much more difficult.

There is one major disadvantage associated with the use of transistors. The relative uncertainty of valve life prediction is balanced by the design of the valve amplifier. It was found possible to incorporate redundancy by introducing two separate amplifying paths. This permitted practically any failure to occur in any of the three valves in one path without much affecting the gain of the valves in the other path. It was not found possible to incorporate this redundancy in the transistor amplifier and, in consequence, the failure of a single transistor anywhere in the chain of repeaters lying at regular intervals of about 10 miles on the sea bed will cause loss of all circuits in the cable.



The type 4A2 transistor used in all stages of the amplifiers of the UK-Portugal and Canada-Bermuda systems. The surface of the silicon chip is shown with lead wires one thousandth of an inch in diameter attached to the transistor surface by eyelet bonds.

A view of the surface of a type 10A10 transistor before the bonds are attached. This device will be used in the output stage of the 12 MHz amplifier intended for the 1140 channel submarine systems in the early 1970s.



It was only the very high potential reliability of silicon planar transistors which, in spite of the loss of redundancy, encouraged the Post Office to develop the design of transistors for a new wider bandwidth submarine repeater amplifier. The conversion of the potential reliability to a guaranteed reliability proved to be a long and difficult task which occupied the Research Department from 1962 to 1968 before the first devices suitable for use in deep waters were produced.

A study of the long term performance of commercial silicon planar transistors was started in 1962 and this was based on tests carried out at high temperatures. The reliability study showed that the probable average life of the transistors tested, which were representative of the best devices commercially available at that time, was much greater than the required submarine cable system life of 20 years. However, the results also showed that a small percentage of the transistors would be expected to fail early in the system life, even though the devices had been very carefully tested and selected before the commencement of the tests. On this basis a guarantee could not be given that the devices tested were suitable for use in deep water submarine cable system.

A separate study of the design and manufacturing processes required for the production of silicon planar transistors also commenced in 1962 and this led to the development of an improved method of stabilizing the electrical properties of transistors. For example, one cause of failure was the residual photo-sensitive material used to define the aluminium electrode patterns. Every slice of silicon containing some 400 transistors is now baked in air at 500°C for one hour immediately before the slice is scribed into separate rectangular chips, each containing one transistor. The high temperature bake removes the last traces of this material, and thus stabilizes the current gain and junction leakage currents. Also an improved form of bonding between fine aluminium lead wires and evaporated aluminium electrode patterns has been developed at Dollis Hill and this technique, known as "eyelet bonding", allows very reliable bonds to be made through the thick coating of aluminium oxide produced by the stabilization bake.

Following these developments the British Post Office type 4A2 transistor has been successfully produced to meet the requirements of both electrical performance and long term reliability for submerged repeater system with up to 640 circuits. A transistor production unit has been established at Dollis Hill in which transistors are manufactured under super-clean conditions and with very careful inspection at all stages of production and testing. During 1966 and 1967 type-4A2 transistors were produced in this unit for use in various shallow water systems. In the next year a total of 1,260 transistors of the same type were produced in the same unit to deep-water standards for submarine systems which included the U.K.-Portugal and Canada-Bermuda cables. Before supplying the devices to repeater manufacturers all were tested for a period equivalent to two years normal operating life. An additional 2,000 transistors were manufactured during 1968 for a comprehensive programme of destructive overstress and mechanical testing which showed that less than one transistor in a total of 500 devices is expected to fail during the required system life of 20 years.

The need of system designers for transistors suitable for even wider bandwidth cables led to the development of a new family of highly reliable transistors, known as the 10A-types, with a typical cut-off frequency of 1,000 MHz and able to operate at power dissipations of up to 1.5 watts. The requirement for both higher frequency and higher power dissipation introduced many new problems in both design and production technology. The increase in frequency demanded that the overall size of the transistor should be reduced to lower the capacitance compared with the type-4A transistor which has a cut-off frequency of 500 MHz and a maximum power dissipation of 600 mW. The increased power required for a 10A-type output stage resulted in a much higher power density with consequent problems of current and temperature distribution over the active area of the transistor. Satisfactory solutions to these problems have now been established and the production of type-10A transistors for use in 12 MHz, 1,260 channel submarine systems has now commenced at Dollis Hill. Submarine cables whose repeaters need type-10A devices will be laid for the first time in the early 1970s between the United Kingdom and the Continent.

It should be recorded that the Post Office has worked closely in parallel with industry in the development and production of transistors for submarine repeaters.

Looking forward, it is possible to foresee that devices of even greater bandwidth capabilities than the type-10A may be needed for submarine cable systems in the future. Similar devices will, however, be required for high capacity overland systems and new development of higher frequency transistors will therefore be planned on a broader basis to serve the needs of both land and sea systems. Many problems will demand solution in the technology of design, passivation, interconnections and encapsulation when cut-off frequencies reach beyond 3 GHz and few of the solutions achieved for the types-4A and -10A will be relevant at these higher frequencies. Nevertheless, considerable experience has already been gained in improving the reliability of devices intended for use in submarine repeaters and this experience can be applied throughout the broader field of overland systems.

It must, however, be remembered that reliability derived from statistical analysis of large scale overstress and mechanical tests is costly. This reliability taken in conjunction with the relatively small production runs required for submarine systems has made the type-4A and type-10A devices very expensive, but this is more than compensated for by the increase in cable capacity. For an overland system, using devices made by the same technology but having lower imposed standards of statistical assurance and larger production runs, the price may well be reduced.

Staff wearing special caps and clothing assemble the transistors in the super-clean laboratory at Dollis Hill.

THE AUTHORS

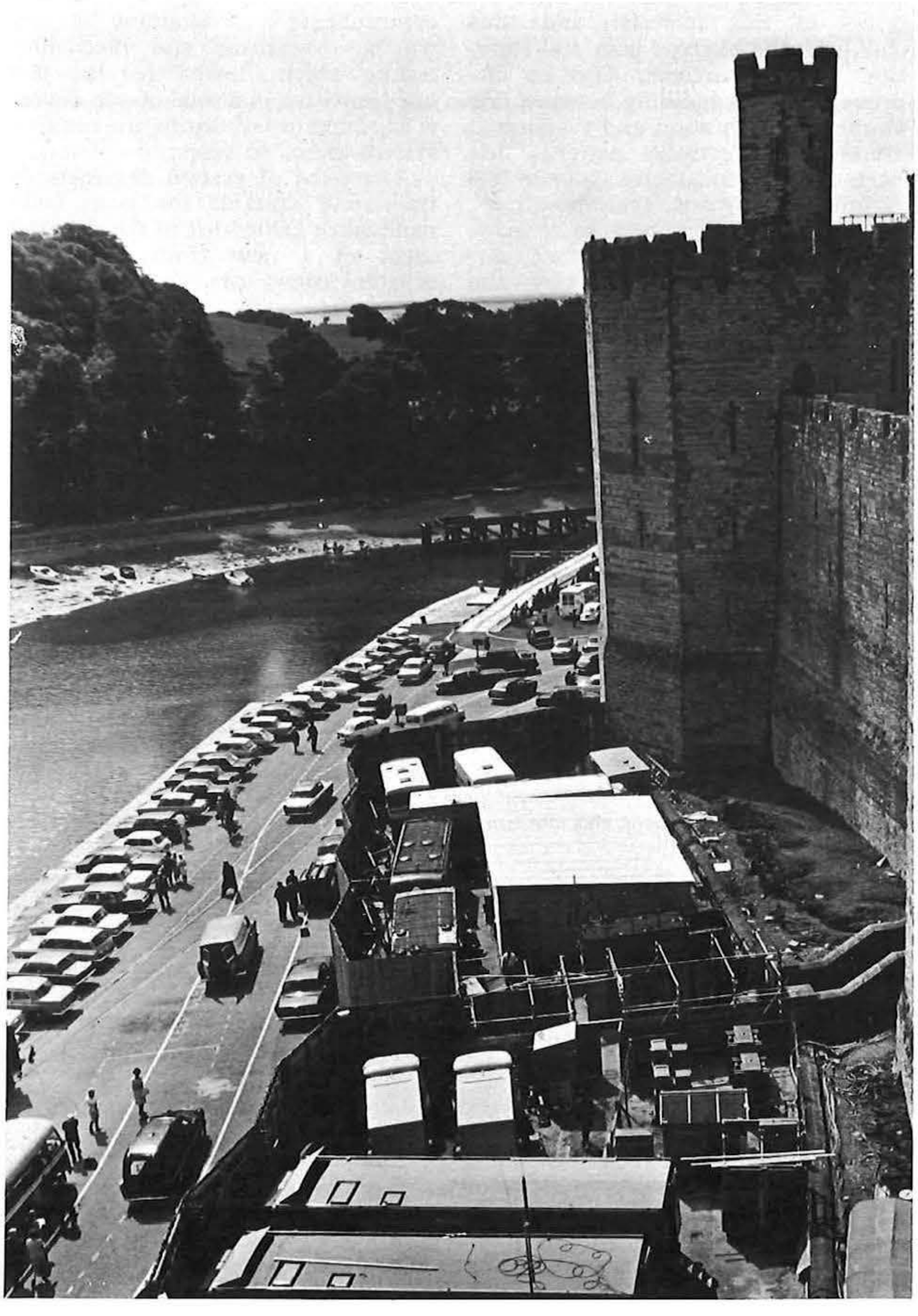
Mr. M. F. Holmes *is a Senior Principal Scientific Officer looking after the devices and micro circuits branch of the Post Office Research Station at Dollis Hill. He is currently engaged on the development of transistors and high frequency semi-conductor devices.*

Mr. D. Baker *is a Principal Scientific Officer in the same department at Dollis Hill involved in the development and production of devices for submarine repeaters.*

The Investiture of the Prince of Wales at historic Caernarvon Castle was a great state occasion and it provided major problems in meeting the large telecommunications needs. The world-wide television audience was the biggest ever to watch an event staged in this country. It was the biggest colour TV operation in the United Kingdom and one of the largest outside broadcasting events, in terms of deployment of equipment and resources, ever undertaken. This article tells of the work that went on behind the scenes to make it all possible.

CAERNARVON'S COMMUNICATIONS

By E. DICKSON and A. R. POWELL



The BBC and ITA compounds just outside the Castle walls which housed their main control centres.

OVER 500 million television viewers around the world saw the Investiture of the Prince of Wales at Caernarvon. Millions more read about it in their newspapers. It was a massive exercise in telecommunications made possible by nearly two years of planning and field work by staff in Wales and Border Counties Region of the Post Office.

It involved the provision of new lines and equipment to meet the requirements of the Investiture authorities, BBC and ITA, the Press, the public service needs of the large influx of visitors as well as miscellaneous requirements to meet the special demands of the Police and Ministry of Defence.

The Region had their work on the 1958 Commonwealth Games in Cardiff as some basis for initial planning. Even so, the requirements presented many new problems. Television in 1958, for example, was solely 405-line monochrome. For Caernarvon, a 625-line colour service was required.

But it was the choice of rural Caernarvon as the venue that presented probably the greatest challenge. While facilities in this part of North Wales were adequate for normal requirements they were quite inadequate for an event of this size. Existing facilities included a 1,800 multiple non-director exchange which also acts as a Group Switching Centre. The exchange was dependent on audio cables for its outlet to the national network and has junction routes to Bangor and Colwyn Bay. When detailed planning started in January, 1968, there were only 90 spare pairs existing between Caernarvon and Bangor—the cable route which would have to carry the main requirements. Estimates of the needs for this route showed that more than 450 additional circuits would be necessary.

Fortunately, a coaxial system from Colwyn Bay through Bangor to Portmadoc became available shortly after planning started. A 124 pair audio cable already existing was routed from Portmadoc through Caernarvon to Bangor. A first step to clearing the bottleneck between Caernarvon and Bangor was to transfer all existing circuits to the new coaxial system. In addition, spare tubes in the coaxial cable were intercepted at Caernarvon and equipped with a 60 circuit HF link to Bangor. This still left provision short and a temporary 100 pair cable was laid in a fortnight along a disused railway track between the two places.

The event started with the Royal Procession driving two-and-a-half miles from the outskirts of Caernarvon to the Castle for the ceremony. The BBC were able to deploy their own equipment to cover the Castle and its approaches but asked the Post Office to lay duct to take their camera and coaxial cables where concealment was necessary. This included laying cable across the River Saiont. For the processional route the BBC used three Mobile Control Rooms and asked for two outside broadcast type video circuits, suitable for 625-line colour service, from each to their main control in the Castle compound.

To relay the programme to the Post Office Tower in London, the BBC set up a temporary microwave radio station with alternative routes to the Post Office permanent vision network terminals at Manchester and Cardiff. Three vision circuits were provided to connect this radio station to the main control at the Castle. A local network of audio and control circuits was provided to inter-connect the Mobile Control Rooms with the main control together with 58 Caernarvon-London circuits for use as music, control and overseas commentary circuits.

For the ITA companies, outside broadcast facilities similar to those for BBC were provided, except that they required 625-line monochrome service only. They used five Mobile Control Rooms on the processional route, four with single video circuits and the other with a standby in addition to the main circuit. Duct was laid to take ITV camera cables and two video circuits provided from their main control to the radio station. Over 20 miles of cable was laid to facilitate the television broadcasts. Considerable assistance was given by teams from London, Midland and North West Telecomms Regions in manning the various outside broadcast points.

To meet Press requirements—200 reporters and photographers covered the event—a 100 pair cable was laid from the special Press Centre to the ATE enabling 23 Bangor trunk subscriber lines to be installed, 4-wire circuits provided for 12 picture call circuits and 12 coin boxes on either Bangor or Portmadoc trunk subscriber lines for outgoing calls only—used mainly with credit cards or transferred charged calls by reporters whose papers had not ordered lines. Six call offices for overseas calls were set up and a further 35 trunk subscribers lines, 16 picture call circuits and four private circuits to London or Manchester provided in rooms all over the town from which individual newspapers also operated.

A special Telex Centre was established for overseas traffic in a rented garage and housed 11 Teleprinters No. 15 provided on lines to Chester Telex Exchange. Outside the Centre were five No. 8 kiosks for the general use of the Press.

The Telex Centre from where thousands of words of reporters' copy went out to newspapers all over the world.

In the Castle itself a 10 plus 50 switchboard with two Bangor trunk subscribers lines and 34 extensions was installed. To keep in touch with the various Service units on duty, the Ministry of Defence was also provided with numerous exchange and Bangor trunk subscribers lines, private circuits and external extensions. Extensive telephone and telex facilities were also made available at the television authorities' administration centres.

To control the huge operation as Investiture Day approached, the Post Office set up an operations room in Caernarvon Exchange under a specially appointed Communications Controller. From this nerve-centre, requests for circuits were processed and provided within the hour and all traffic problems dealt with on the spot.

A maintenance control was also set up in Caernarvon ATE to which all Investiture lines and emergency organisations, such as Police, Fire, Hospitals and Ambulance, were asked to report all faults. In the event only three faults were reported and these were cases of minor damage to telephone instruments.

The projects outlined were the main ones concerned primarily with the Investiture itself. Of course, a great deal of planning and work by many people also went into augmenting the telephone trunk and telex systems, including large temporary routes from Bangor to Manchester and London.

TV outside broadcast vehicles made Post Office history. Lettering on the outside of the vans was in Welsh, the first time in any language other than English.

THE AUTHORS

Mr. E. Dickson *joined the Post Office as an Assistant Engineer at the Dollis Hill Research Station in 1930. He was appointed Area Engineer, Cardiff, in 1939. In 1953 he joined Wales & Border Counties Regional office as SEE in charge of transmission planning and provision.*

Mr. A. R. Powell *is an Executive Engineer on maintenance in Chester Telephone Area and was given a special appointment of Temporary SEE to act as Communications Controller for the Investiture.*

The plough blade in the prepared pit with the PVC duct connected to the expanding moles.

By J. W. YOUNG and D. G. ROSSITER

A new generation of high circuit-capacity inter-city coaxial cables is being planned by the Post Office to help meet ever increasing demand for telephones. To find out whether moleploughing of duct could cheapen and speed provision, and reduce cable damage, a field trial of new equipment has been held in the Midlands.

ON TRIAL—NEW HEAVY MOLEPLOUGH

LAYING of duct at around 1,000 yards a day may now be possible following field trials of a new moleplough in the Midlands Telecomms Region. This is five times faster than the traditional method of digging trenches for multiple ducts and filling in later and it is likely that the plough will be suited for the laying of the new generation of high circuit-capacity inter-city coaxial cable, now being planned.

To contend with the large forecast of circuit requirements the new 0.375 cables are likely to have 18 tubes equipped with 60 MHz coaxial line systems to give a total capacity of over 90,000 circuits in one cable sheath. Obviously, with such cables the Post Office has had to consider ways of preventing cable damage with its implication of severe service interruption.

Among the ideas being considered are the laying of new inter-city cables in duct tracts segregated from ducts carrying other cables, laying duct at extra depth and the possibility of laying across country. But these ideas have to be tested and assessed to see whether they would be cheaper and speedier than conventional methods. The rapid growth of the main and junction network involves a large amount of external duct construction which takes much of the time required to provide new cables, and at a cost of about £11 million in 1968/69.

It was early last year that Telecommunications Headquarters decided, after seeing a demonstration of the new heavy moleplough, that it should be put on trial on a typical duct route.

Planning was already in progress for the provision of a main circuit coaxial cable between Stoke and Wolverhampton which required about 10 miles of new 4-way duct between Stafford and Stoke. This section was selected for the trial because, although it had above average grass verge width, it was generally representative of country duct-laying conditions. Yates Badger (Pipelines) Ltd. agreed to develop attachments to enable four pipes of 3½ inch PVC duct No. 54 to be ploughed simultaneously.

The plough, called a Badger Minor, is a track driven vehicle capable of ploughing to a depth of over five feet, the blade being hydraulically controlled. Considerable force is required to pull the blade through the ground and it is important that the pull should be smooth with no jerking. When used on its own, the Minor's tracks incorporate spikes which could cause damage to verges and roadways. For these reasons the contractor used another tractor type machine, a Tugmaster, developed in conjunction with the Minor to provide it with extra pulling power. The Tugmaster is held stationary by a ground anchor and coupled to the Minor by a steel hawser. A winch on the Tugmaster winds in the hawser and pulls the plough towards it, the plough's own diesel engine being engaged in drive to "take its own weight". An operator walking beside the plough blade adjusts the depth of lay by means of a remote control box. With the Tugmaster providing the pulling power damage to the ground over which the Minor is operating is much reduced.

A detailed survey of the proposed route was carried out by the external planning staff of Stoke Telephone Area. Apart from a few sections of built-up areas containing too many services to allow moleploughing, the main difficulties were found to be a water main which was present over the majority of the route and a considerable number of lateral pipes from road drains. Nevertheless, the feasibility of moleploughing several miles of duct was established. The route was planned with jointing points (extra-depth JRF 10s) located at 250 yard intervals and R5 manholes at 2,000 yard spacing for loading of a proposed junction cable.

Yates Badger were given a contract for the whole of the duct work and moleploughing started in February this year. The PVC duct, which is manufactured in 20 feet lengths, was stuck together with Post Office adhesive and filler compound to make up sections of the required length of 250 yards. It was necessary to leave the duct joints for at least 24 hours for hardening of the compound. A small mechanical digger was used to excavate a pit at the start of the length to be ploughed. The four ducts were attached to expanding moles on the plough blade, the blade positioned in the prepared pit and ploughing began.

Some parting of duct joints was experienced in the early stages of ploughing due to adhesive failure, but this could have been caused by the wet and cold weather. Certainly, the difficulty was largely overcome with an improvement in the weather and with extra care taken in the cleaning and jointing of duct, but the true reasons for the early failures are not known and will be further investigated.

To assist jointing arrangements, it was planned to lay the majority of duct in a vertical formation. There was also a trial of horizontal formation but this was soon abandoned as the plough blade design was unsuitable. At the planning stage it had also been thought that there might be difficulty in filling in the voids between the ducts if a quad formation was used. In fact this problem did not materialise and a considerable yardage of duct was laid in this way.

Techniques were improvised for passing duct under drains and other services, exposed by pilot holes, by disconnecting the expanding mole from the plough blade, repositioning the blade on the other side of the obstruction and reconnecting to the blade by the use of a chain. Offset ploughing was satisfactorily undertaken with the machine on the carriageway when the grass verge was too narrow to take the machine. Several lengths of duct were successfully laid at depths in excess of four feet.

This shows the plough blade linkage designed to isolate the blade from tractor pitching movements. The man nearest the machine is operating the plough by remote control.

Just over three miles of duct was laid by ploughing whereas at the planning stage it was estimated that five miles should be possible. Given suitable conditions it was expected that up to 1,000 yards a day could be ploughed, but the best achievement was 600 yards

General introduction of the machine would mean changes in Post Office procedure and some new problems. For example the planning survey must be performed in greater detail than would normally be necessary for country duct laying. Other Authorities' plant must be thoroughly investigated, a very necessary step since it is obviously inefficient to stop the machine working while problems are resolved.

A total of 70,000 yards of duct was required for the scheme and, with a theoretical planned maximum usage rate of 20,000 yards a week, it was necessary to make special arrangements for delivery and storage. With the requirement of pre-jointing lengths of duct, consideration must also be given to access to properties on the route. The number of pilot holes required is considerable when compared with a conventional scheme and the speed of laying, up to one mile an hour, produces prolems in recording duct line and depth.

The machinery caused little damage to the grass verge, but kerb stones are vulnerable to damage and must be protected when subjected to the weight of the machinery. The Tugmaster ground anchor caused a good deal of turf surface damage and the many pilot holes and pits needed careful reinstatement. Nevertheless, the overall condition of the verge after ploughing is fairly good and the system has the advantages of retaining the top soil in position and there is a reduction in traffic delay due to the speed of operation.

The cost of the ploughing operation was estimated to be slightly less than duct laying by conventional means, but it is worth noting that there is virtually no change in cost when the depth of cover is increased from two feet to four feet. No serious problems were encountered apart from the adhesive failure, but the time taken to iron out operational problems which could only be encountered and solved on site prevented full utilisation of the method. Further discussions will be held with the contractor with a view to refining the operations.

Given the right conditions, properly surveyed, a laying performance of 1,000 yards a day – even up to 2,000 yards a day on smaller operations – could be achieved on future schemes at an economical price.

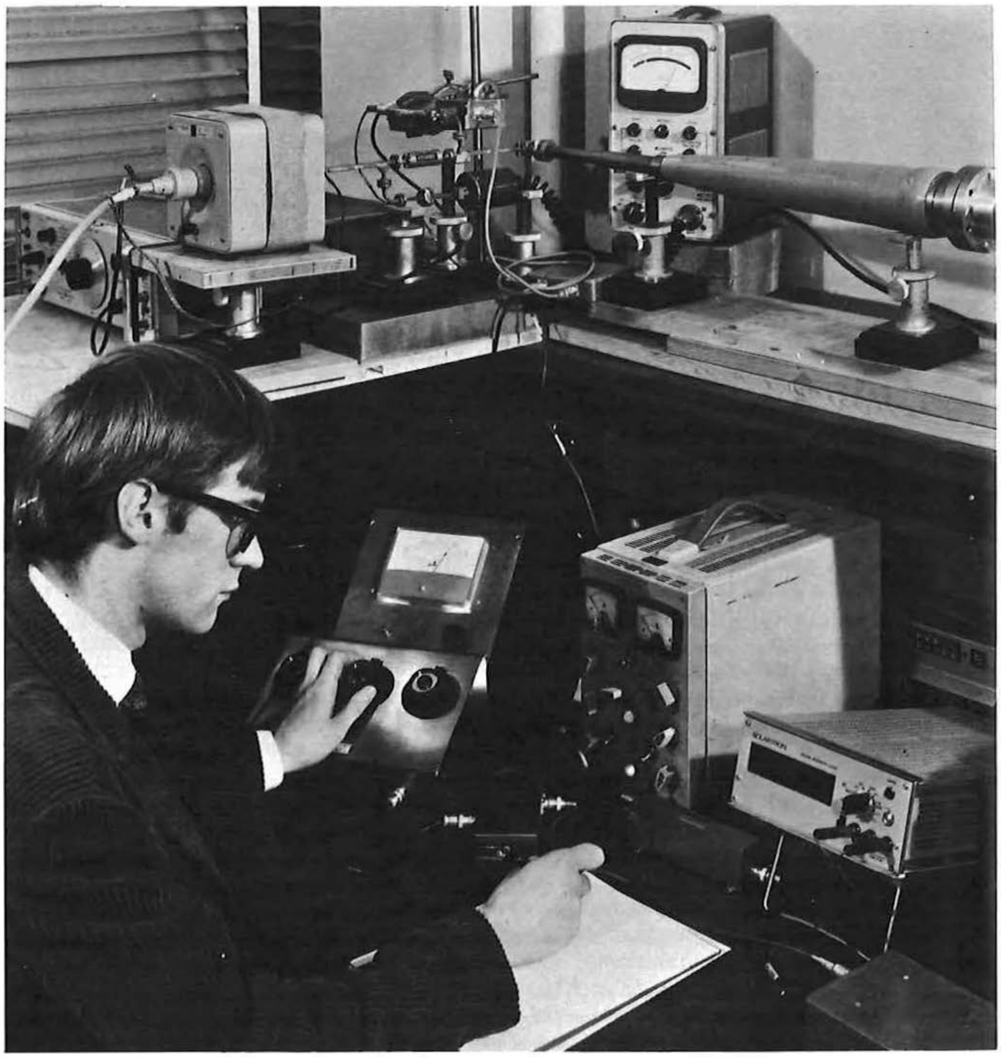
THE AUTHORS

Mr. J. W. Young BSc (ENG) *is an SEE in Midland Telecomms Region HQ Network Group, with responsibility for cable and transmission planning.*

Mr. D. G. Rossiter *is an EE in Midland Telecomms Regional HQ on trunk and junction cable planning duties.*

Business continued to expand and efficiency and productivity also increased says the annual report for 1968-69. While future prospects are bright a lot of hard work lies ahead to solve the problems which still exist.

Another successful year but prob



THE drive towards greater efficiency and improved productivity continued successfully throughout the Telecommunications Service in 1968-69.

By increased effort at managerial level and through the co-operation of Staff Associations, with whom joint committees have been set up to discuss productivity projects, both objectives are being achieved.

This is revealed in the *Post Office Report and Accounts* for the year ended March 31, 1969.

There are several revealing statements in the Report which spotlight the success of the efforts made. For example, although the number of telephones increased by 6.6 per cent and calls by 8.6 per cent during the year, the total staff increase was only 2.3 per cent.

Productivity increased in all fields of engineering—16,000 more cable pairs were installed with 9 per cent fewer staff; and despite the additional work of tariff revision and computerization of billing, increases in clerical staff were lower than in the previous year. The number of telephonists in the inland service was reduced by 3,300, due mainly to the mechanisation of the system, although the number of trunk and local calls increased substantially.

Here, in brief, are some of the achievements of the Telecommunications services during 1968-69:

GROWTH OF BUSINESS

New exchange connections provided for subscribers was the highest ever achieved at 821,000. Total connections increased from 7.4 million to 7.9 million, a rise of 6.5 per cent. While demand for new exchange connections was 1.1 per cent less than in the previous year and residential demand fell by 4.9 per cent, business demand increased by 7.5 per cent. At the end of March, 1969, plant was available to meet 85 per cent of new orders on demand. An improvement in exchange equipment availability enabled the waiting list to be reduced by 50,000 to 87,500.

Customers made many more calls too than in the previous 12 months. Local calls were up by 8 per cent, trunk calls by 12.5 per cent, Continental calls by 20 per cent and Intercontinental calls by 22 per cent.

PROVIDING FOR GROWTH

The extension to the Telephone Exchange Equipment Bulk Supply Agreement, the last of its kind, ended on September 30 and exchange equipment will now be obtained by competitive tender.

During the year 291 buildings were completed, including 275 telephone exchanges—an increase of 60 per cent over the previous year. A further 342 buildings and extensions were started, including 318 telephone exchanges.

The trunk network was increased by some 10,000 long-distance circuits, a growth of 15 per cent. In addition, 47,500 shorter-distance circuits were provided, an increase of 8 per cent. More than 915,000 additional lines were added to the local lines network which connects subscribers' premises to telephone exchanges—an increase in lines of 8 per cent. The installation of 600 new exchanges and extensions to existing exchanges was completed—double the number in each of the previous two years but still substantially less than had been hoped for.

For overseas services, additional high-capacity telephone cables linking Britain with the Netherlands and

LEFT: The Prime Minister and Postmaster General study a computer print-out at the opening of National Giro.

BELOW: A submarine cable is towed ashore. In the foreground, two plastic floats used to support the cable.

lems still remain

An engineer at the Post Office's Dollis Hill Research Station working with shuttle pulse equipment for circular waveguide attenuation measurement.

Norway came into service; connection-on-demand for straight-forward telephone calls to the United States and Canada was introduced; HF radio-telephony circuits to a number of places abroad were replaced by submarine cable and satellite links; the Lincompex system, which improves the quality of HF radio circuits, was extended to further routes and there was a general expansion in satellite communications through the Earth Station at Goonhilly.

IMPROVING THE SERVICE

Improving the service to existing customers remained a priority objective, and to good effect, says the Report. The operator service showed a reduction in times-to-answer for the fourth successive year; orders dealt with by appointment jumped from 40 to 50 per cent by the end of March, 1969—most of which were completed within two weeks—and over 60 per cent of the remainder within four weeks. There were also reductions in the proportion of automatic calls failing due to faulty plant. STD facilities were extended to a further 434 exchanges serving 800,000 subscribers and by the end of March, 1969, STD was available to nearly 6.5 million subscribers—82 per cent of the total.

TELEX-DATA TRANSMISSION

There was a 15.5 per cent expansion in the telex service to almost 26,000 subscribers. Calls to overseas countries, 93 per cent of which were dialled direct, increased by 18 per cent and represented nearly 40 per cent of all calls made. Inland calls jumped by 7 per cent.

By March, 1969, there were 4,500 data transmission terminals in Britain, more than double the number at March, 1968. The Datel 2400 service was introduced, affording transmission at a rate of 2,400 bits per second on leased telephone circuits and a wide range of optional facilities. New data modems to provide for data transmission at up to 48 kilobits per second on wideband channels are being developed and the international Datel 100 service was extended to ten European countries.

NEW DEVELOPMENTS

Trials were completed of a new telephone operator's headset weighing only one ounce. It incorporates several novel features, has an insert type earpiece and can be clipped to the frame of spectacles.

Orders were placed for magnetic-tape-operated repertory diallers which will store 400 recorded telephone numbers. After selecting the name of the person or firm to whom he wishes to speak, the customer can get the number by pushing a button.

A new machine was developed which automatically clears a way through an underground duct and then pulls a cable through the duct as the rod is withdrawn.

The first all-transistor 12 MHz (2,700 circuits) coaxial cable systems in the country were brought into use during the year.

RESEARCH & DEVELOPMENT

There have been successful laboratory demonstrations using waveguides for the transmission of microwaves which offer exciting possibilities for the economic handling of large volumes of telecommunications traffic. For example, a 5cm-diameter waveguide could carry about 330,000 telephone circuits or 300 two-way colour or black and white television channels.

Advances have been made in developing electronic equipment, based on computer-like principles, to replace existing electro-mechanical equipment used for switching control in large-city telephone networks.

A submarine cable system, with capacity for up to 1,500 telephone circuits and using high quality transistors, has been developed and will reduce the cost per speech circuit by a third compared with earlier smaller-capacity systems.

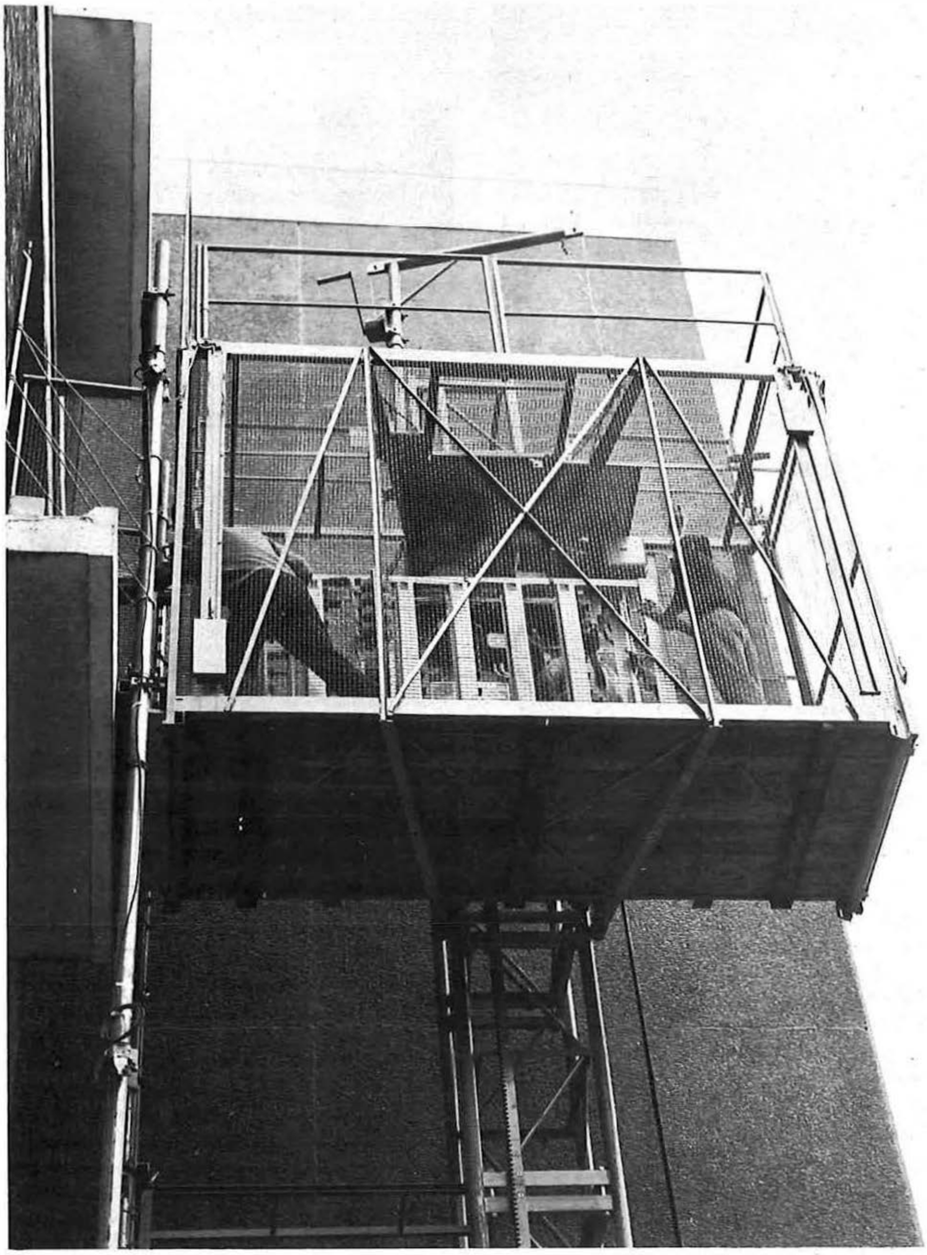
While the year had been one of further expansion and progress, says the Report, the picture was naturally not wholly bright. There were faults as well as virtues.

The Report concludes: ". . . the problems are known and we are trying to solve them. The progress made in 1968–69 gives us confidence that these problems will be tackled successfully. The scene is set for the new corporation to maintain the postal service as the best in the world, to carry the telecommunications service forward until it can justly earn the same reputation and to build up the new services, Giro and NDPS."

THIS HOIST WILL RAISE THE WORK RATE

A new type of transportable hoist may soon mean a speedier and safer way of installing telephone exchange apparatus racks. This article reports the findings of a trial of the new hoist carried out in London Telecomms Region

By D. G. PETERS



Racks being unloaded from the hoist on an upper floor of South Kensington ATE.

LONDON Telecommunications Region is experimenting with a mobile hoist to raise apparatus racks from the ground to rooms on the upper floors of telephone exchange buildings.

The object is to speed the installation of new equipment, raise productivity of construction staff and contractors and provide a safer method of working.

The facility normally provided for lifting equipment racks is a steel beam which overhangs the roof of the building and to which an electric or manually driven tackle is hooked. Each rack is raised by the tackle, usually from a lorry parked below, to a sill outside special equipment-height doors in the apparatus room. Staff on the ground floor steady the equipment by guide ropes and others waiting at the door haul the equipment into the building. With this method there is always the danger that men at the open doors might fall and equipment is also exposed to risk of damage by collision with the building.

The lifting operation can take many minutes if manual tackle is used; only one rack of equipment can be raised at a time; and at least six men are required for the operation.

The portable lift, called the *Alimak,* in use in LTR is of sectional construction for easy erection and transportation. It is estimated that to dismantle, transport and re-erect the hoist between sites within the Region to and from a height of 40 feet would take about three days.

The *Alimak* is powered by two electric motors in the lift carriage. Pinions on the outside of the cage engage a rack mounted on five-foot demountable tubular sections to provide the drive. There is an overspeed braking device in the cage and all gates are electrically and mechanically interlocked.

The cage, which is 11 feet long and carries a ton, has a gate at each end. The base unit gives stability and carries the two ground level landing gates. The upper gates are mounted on tubular sections rising from the base unit.

For heights up to 40 feet the hoist tower is safe when free-standing, but above this height the base unit must be bolted down and the upper sections braced to the building. The equipment racks are transported horizontally on wheeled skates. At the ground floor, unless the hoist base is recessed into the ground, the cage stops six inches above the ground and a ramp is used to enable the racks to be wheeled into the carriage. A flap, hinged to the cage floor, bridges the cage/landing gap.

Apart from the speed at which an *Alimak* hoist can be erected and dismantled, it has the advantage over other passenger carrying hoists that it can be rapidly extended vertically simply by adding further rack and landing gate sections. The erection is carried out from the cage roof without the use of scaffolding or mechanical aids.

The hoist was first tried out at South Kensington automatic telephone exchange during an equipment extension. Access to the upper floors was by way of the normal apparatus height doors.

Considerable saving in equipment handling time has already been achieved. Now, the hoist is to be modified so that it can be made to stop at lorry tail-board height and so permit direct off-loading of racks from lorry to hoist. With this improvement it is estimated that a time saving of 80 to 90 per cent can be achieved in raising one rack.

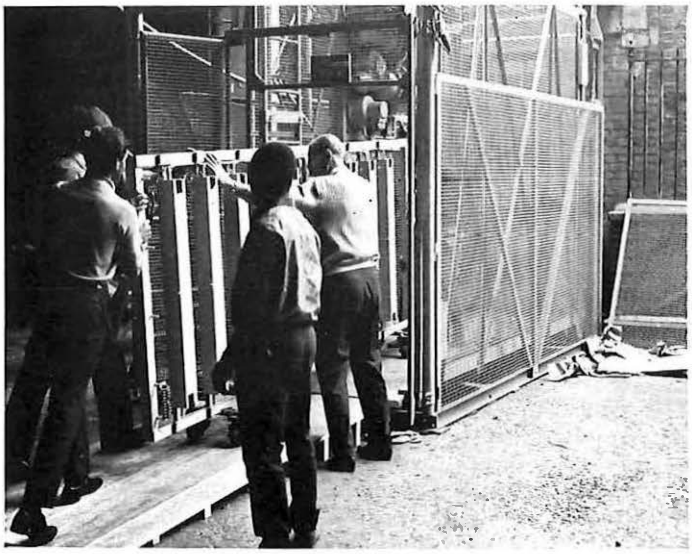
Tower blocks for telephone exchanges are being erected in London to meet the pressing demands for telecommunications equipment. Apparatus will be installed on the lower floors while the builder is completing the upper floors. A permanent apparatus lift cannot be installed in such buildings until the upper floors are completed but the new-style hoist could be used to equip the lower floors until the permanent lift can be brought into service at all levels.

THE AUTHOR

Mr. D. G. Peters *joined the Post Office in 1948 as a Youth-in-Training in the Canterbury Area. He transferred to LTR in 1958 on promotion to Assistant Engineer and is now an Executive Engineer in LTR Works Branch, Power Section, where his duties include the planning and installation of lifts and lifting equipment.*

A general view of the hoist installed at South Kensington ATE.

This photograph, taken at Albert Dock ATE, illustrates all aspects of the conventional method of raising racks. A ratchet type of tackle fixed to an anchorage at the ground floor is in use. For buildings of medium height the length of the lifting rope and the length and acute angle of the guide ropes prevent absolute control of the rack.



A rack entering the hoist at South Kensington ATE. A ground floor car park under the building enabled loading to take place on the building side of the hoist. On most sites 'through' loading would be used. About 14ft is required in front of the hoist at the loading floor to facilitate manoeuvring the racks into the cage.

Miscellany

BRITAIN WAS FIRST

Sir,

An item in your issue of Summer, 1969, describes the evolution of a waterproof cable by Bell Telephone Laboratories. This development represents a big step forward in American telephone practice and it is to be commended. However, it is unfortunate that their work should be reported without any reference to earlier British achievements in the same field.

The concept of a waterproof telephone cable was proposed by G. A. Dodd of British Insulated Callender's Cables Ltd. and described at the I.E.E. Conference on Transmission Aspects of Communications Networks in February, 1964. Since that time the manufacturing process has been perfected and extensive and rigorous field trials have been made. The fully-filled cable was accepted by the British Post Office as a standard for its telephone distribution network in 1966. Petroleum jelly is used as the filler and the cable is completely waterproof.

Use of the fully-filled technique has enabled us to introduce aluminium in place of copper as a conductor—thus saving on the capital cost of new work—and by 1970 all our new distribution cables will be in aluminium.

These British developments were described at the 17th International Wire and Cable Symposium in Atlantic City, New Jersey, in December, 1968, and it was quite apparent to all that we were far ahead of the rest of the world in:

(a) adopting fully-filled and waterproof cables for our distribution network and,

(b) changing the conductor from copper to aluminium to reduce capital cost.

The Post Office Telecommunications Journal is widely read throughout the world and for this reason it is important that all new British developments should be recorded.

In Cable Development Unit we have a particular interest in encouraging the use of new techniques by the British cable makers with a view to improving our network and reducing costs. They, for their part, are keen to lead the world because this means export business which is vital to the nation as a whole—**J. Pritchett, Cable Development Unit, Civil and Mechanical Engineering Branch (TD8).**

Editor: We are very grateful to Mr. Pritchett for putting the record straight about these British achievements. The fully-filled cable was described in the Journal's Autumn, 1967, issue and the change to aluminium was described in Spring, 1969.

* * * * *

THE first European conference to deal comprehensively with the subject of microwaves was held in London in early September. The conference included papers on microwave circuits, design and measurement, microwave antennae, elements and associated devices and solid state microwave devices and applications.

NDPS LEADS THE WORLD WITH AIR CARGO COMPUTER

BRITAIN is to be the first nation in the world to clear incoming air cargo by computer. The Post Office National Data Processing Service (NDPS) have placed a £3 million contract with International Computers Ltd. (ICL) to set up a round-the-clock real-time system at Heathrow Airport to speed air cargo by accelerating control and documentation. Known as LACES (London Airport Cargo Electronic-data-processing Scheme) the system will be ready for service in 1971. It will be operated by NDPS on behalf of the airlines, shipping and forwarding agents, and HM Customs. It is capable of extension to other air and seaports and is expected to be extended later to handle exports. Other countries are planning similar systems and it is hoped that the Heathrow scheme will be the basis for an international airfreight data-processing network.

LACES will drastically reduce paper work and virtually eliminate manual calculation of complex sums. It will make goods available to customers faster, reducing the need for storage space. All users will have instant information on the stages reached by every consignment passing through and it will be easier to deal with discrepancies at once.

In terms of value landed Heathrow is the world's largest international air terminal. Cargo arrivals are expected to rise by 12 per cent annually, to reach a million tons a year by 1973. To cope with the growth of trade, a new 160-acre cargo area has been developed at Heathrow at a cost of £23 million. The LACES real-time computer system is being introduced to make the most efficient use of the new cargo terminal facilities by transforming documentation and control of the swelling tide of cargo. It will keep a constant check on imports, calculate Customs duty and other taxes, select documents and goods for inspection and provide daily accounts and updated statistics for all its users.

The LACES computers—on duty day and night seven days a week—will be housed in a new building near the airport. To communicate with them, there will be over 200 cathode-ray-tube sets with keyboards, giving visual display on television-type screens in agents', airlines' and Customs offices and cargo sheds. By 1978 there will be twice as many.

From airline offices, information about consignments expected will be keyed into the computer. And airlines will be able to link their own communication and computer networks to LACES and transmit information direct from their oversea stations. As consignments arrive an operator in the cargo terminal will key-in details and any differences between goods expected and goods received will be printed-out by the computer.

For Customs Entry the agent or airline will key-in details of a consignment; the computer will calculate duty and purchase tax and flash the result on display screens within seconds. It will be programmed to show whether the consignment needs to be examined by Customs.

In addition to serving Heathrow the new LACES building will be a centre for other NDPS activities in West London.

HONOURS

PROFESSOR James Merriman was appointed C.B. (Companion of the Bath) by the Queen in the honours list announced to mark the Investiture of the Prince of Wales.

It is one of a number of milestones in the Professor's career in recent months. Formerly Senior Director of Development, he has just been appointed to the Post Office Board with responsibility for technology. His Professorship came earlier this year when he was given the Chair of Electronic Science and Telecommunications at the University of Strathclyde, Glasgow. He was again honoured recently when named to give the 1969-70 Faraday Lecture on advances in electrical science.

Five other telecomms people are named in the Honours list. The BEM goes to—Mr. J. A. Sheldon, a technical officer at Alveston TEC, Derby, and a local branch secretary of the POEU; Mr. John Lutener, a technical officer who leads the cryogenics maintenance team at the Goonhilly Earth Station in Cornwall; Mr. Charles Marooth, a technical officer in external planning at Liverpool TMO, who has been a committee member of the POEU since joining the Post Office in 1938.

The MBE goes to—Mr. C. Macpherson, Telecomms HQ Scotland, who already holds the BEM and is an expert on microwave radio links; Mr. H. Cheetham, a SEE in the Service Division at North West Telecomms HQ and a pioneer of television outside broadcasts.

NEW INFORMATION SERVICE

A NEW addition has been made to the Post Office's Telephone Information Service. It provides callers anywhere in Britain, and from overseas, with the latest Financial Times Industrial Ordinary Share Index figures. The recorded message is updated four times a day, Monday to Friday, to give the Index based on London Stock Exchange prices in mid-morning, at lunchtime and in mid and late-afternoon. A caller on 01-246 8026 gets the Index and notification of any change.

In London this will be charged as a local call: elsewhere, where customers can dial direct, it will be at STD rates. Customers not on STD and overseas investors can get the Index at normal operator rates. From countries with subscriber-dialling links with Britain calls will be at the cheaper ISD rates.

It is possible that the new service will attract around one million calls a year. In the year ending March 31, there was an increase in both the number of centres at which telephone information services are available and in the number of calls made to them.

Weather: More than 11,175,000 calls were made—up over three million. The number of centres offering the service jumped from 37 to 44.

Motoring: This all-year-round service, giving details of road traffic and weather conditions, was introduced in May, 1968, and was offered in 34 centres by the end of March this year. It replaced the old Road Weather Service. Calls were over 1,124,000—50 per cent more than the previous year.

Teletourist: Nearly 200,000 calls were made to the London service and the year's total was over 891,000. The service is now available in English, French, German, Italian and Spanish.

Recipe: A 200,000 increase in calls taking the year's total to 2,259,000. The number of centres with the service increased from 36 to 42.

Dial-a-Disc: More than 15 million calls were made, nearly double the previous year's total. The service was available in 23 centres, seven more than the previous year.

Time: The speaking clock received over 240,850,000 calls, 15 million more than in 1967–68.

TELEX

BRITAIN'S fully automatic telex system has continued to grow by more than 15 per cent over the past year. The number of telex machines in use on May 31 is estimated at 26,350 compared with 22,852 a year earlier. There has been an increase of more than 10,000 since 1965 when the total number of telex machines in use was 15,052.

NEW DATEL SERVICES

NEW Datel services are to be introduced by the Post Office in the next two years . . . a high speed service operating at 48 kilobits per second which should be operational next year . . . and Datel 400 designed for the collection of both digital and analogue data from remote points, due to start sometime in 1971 but possibly even 1970.

The 48 kilobits service will use new modems (modulators/demodulators) designed for very high speed transmission. Representative users are being invited to experiment with the service in its early stages and invitations are going out to a number of computer manufacturers and organisations who have fairly frequent need for high speed data transmission.

Datel 400 will provide telemetry facilities for organisations collecting information from a number of remote points. It could have particular value for measuring liquid levels in reservoirs, rivers and storage tanks or for transmitting recorded weather information. It will transmit digital data at speeds up to 600 bits a second. Sealed cases designed to permit use of modems in any kind of situation or environment will be available.

"Dataplex" services involving multiplexing techniques are also being developed. The first of these will enable bureau operators to rent telephone numbers in towns remote from their processors to which their customers can make cheap, probably "local", telephone calls. Cost of this service will be met by the bureau operator, but as the lines can be used very efficiently the overall effect will be to reduce costs. One Dataplex circuit will carry the equivalent of 12 data channels.

In addition to the direct advantage to customers Dataplex will enable computer bureaux to offer service at standard rates irrespective of the distance of the customer from the processor.

The Post Office will benefit because Dataplex will take some calls from the heavily-loaded telephone trunk network.

WINTER PROGRAMME

THE Postal and Telecommunications Society, formerly the Post Office Telephone and Telegraph Society of London, has arranged a series of lectures for the new Winter session. The programme is: October 14—Sound Entertainment in the Home by Mr. C. K. Beard, Electro Acoustics Department of Phillips Electrical; November 11—Staff Selection Psychology by Mr. J. A. Samual, CHQ/MDD; January 20, 1970—The Mechanised Sorting Office by Mr. L. W. Oatey of London Postal Region; February 17—Long Term Planning of the Trunk Network by Mr. D. Breary, UK T.T.F.; March 17—National Data Processing Service by Mr. C. B. Davis of NDPS. All lectures are held in Fleet Building, London.

YOUNGEST DIRECTOR

MR. J. M. HARPER, Assistant Secretary in the former Reorganisation Department, Central Headquarters, London, has been appointed Regional Director, North East Telecomms Region, in succession to Mr. D. E. Knapman, CBE, who retired on July 31. Mr. Harper, who is 39, is the youngest Post Office Regional Director ever to be appointed. As a Principal in the Inland Telecommunications Department he was associated with planning schemes affecting the North East, including the Leeds trunk mechanisation plan and the replanning of the Newcastle telephone system.

POWERBOAT RACE

SPECIAL telephone links were provided by the Post Office for the recent Round-Britain Powerboat Race. At each of the 10 ports of call a control boat had two telephone lines to the shore—one for ordinary calls over the public network and the other a direct link to the control boat at the next port of call on the route. This was kept permanently open, on a contract basis, on the day the powerboats were travelling between these two ports. There was also a loudspeaker set at each end for easier communication. For radio communication between the control boat and competitors the Post Office assigned a special channel to ensure no interference with any emergency calls on the international distress frequency. The Post Office's 11 coast radio stations, which could have had a vital role to play in any rescue operations, maintained their usual 24-hour watch for distress calls.

TELEXART

MR. RON McGILL, on the sales staff of the Post Office's South Central Area, won the 50-guinea first prize in the International Telexart Award for 1969 with an illustration of the Apollo 8 moon rocket. It consists of 54,000 characters and takes two and a quarter hours to run on the telex. Telexart is the use of teleprinter characters to create striking portraits and designs.

AROUND THE WORLD

JAPAN

The Japanese Broadcasting Corporation has started multiplex audio television broadcasting on an experimental basis. It will enable viewers to select one of two alternative sound channels for the same programme or use two at the same time. When watching a foreign film, for instance, viewers may listen to either the original speech or a lip-synchronised Japanese version. For a musical show sounds would be in stereo. A small adapter will be needed to pick up the extra audio channel but when mass-production begins its cost should be no more than that of a transistor radio receiver.

CANADA

For the first time in Canada airline tickets are being transmitted over the public telephone network. The method, known as "Teleticketing" is operating between Air Canada's offices and Bell Telephone Company's headquarters in Montreal. The equipment at the airline offices consists of an automatic send-receive teletypewriter equipped with an individual business line and a data set. Bell Canada's Service Bureau has a receiving only machine with the same auxiliary equipment. Reservations are made in the usual way by a telephone call. When the Service Bureau has got all the details and confirmed the flight the information is sent to the teletypewriter section where a tape is prepared for transmission at the appropriate time. When the ticket is to be sent Air Canada dials the assigned number which activates the receiving machine. The result is a ticket which is available for the traveller. With clerks previously writing about 80 tickets a day, a great saving in time and labour is achieved. Not only is the writing of tickets eliminated but the chances of error through misinterpretation or transposition of figures is greatly reduced.

MALTA

A new telephone transmission network is to be set up in Malta. It will be equipped with fully semi-conductored 7 GHz microwave radio systems, together with a TIM supervisory system providing local and remote alarm indications and carrier multiplex equipment having an ultimate capacity of 300 speech circuits.

BOLIVIA

A national microwave and switching system, a system of rural telephony, a communication link to the Brazilian frontier and a high frequency radio system to link remote municipalities with the main microwave system is to be set up by the Bolivian Government.

AFRICA-MIDDLE EAST

The Earth Station aerial at Bahrain

The first earth station for satellite communication in the Middle East and Africa has been opened at Bahrain at a cost of over £2 million. Owned and operated by Cable and Wireless Ltd., it will work to the Intelsat III satellite over the Indian Ocean and provide the States of the Arabian Gulf in which Cable and Wireless Ltd. operate with direct links to the worldwide satellite communication system. The Bahrain station followed Britain and Japan in lining up with the Indian Ocean satellite which, in the next 18 months, will be used by Hong Kong, Germany, India, Indonesia, Italy, Kenya, Kuwait, Pakistan, Singapore and Spain.

AUSTRALIA

Ninety-six per cent of the Australian population will have television services available to them when the country's present development programme is completed in 1970. To bring television to some of the remaining four per cent the Australian Government has authorised the expenditure of almost five million Australian dollars for the establishment, over a four-year period, of 38 low-power national stations. Some of these will be established at strategic locations along Post Office broadband telephone routes using the normal television relay channel or, where one is not provided, the "stand-by" bearer which is available for emergency purposes. Others will be established by minimum type microwave links provided specifically for the purpose.

UNITED STATES

A new electronic switching system will provide a more versatile telephone service to Bell System subscribers. Known as the No. 2 ESS it can provide new services to medium size central offices with 1,000 to 15,000 lines. These include "Speed Calling" enabling frequently used local or long distance numbers to be reached by dialling one or two digits instead of the usual seven or ten; "Call Forwarding" which allows a caller to have incoming calls automatically transferred to another telephone in his local area if he plans to be away from his phone; "Three-way Calling" which allows a third party to be brought into a conversation in progress by dialling him; and "Call Waiting" where a subscriber whose line is engaged is notified of an incoming call and can be connected to the new call. The new system uses a ferreed network and incorporates more advanced solid-state technology such as integrated circuits for peripheral system control.

ITALY-GREECE

A fully transistorised 5 MHz submarine cable system about 285 nautical miles long and capable of handling 480 telephone circuits spaced in 4 KHz intervals has been installed between Italy and Greece by Submarine Cables Ltd. The sea-cable was laid by HMTS Alert on charter from the British Post Office. Eighty per cent of the route passes through deep water for which unarmoured lightweight 37mm cable is used with repeaters inserted at approximately 19 kilometre intervals. For the shallow water remainder of the route armoured 24mm cable is used with repeaters at 13 kilometre intervals. The system cost about £1½ million.

SWITZERLAND-ITALY

A 12 MHz coaxial cable which will ultimately permit the exchange of 5,400 telephone calls is to be laid in the Great St. Bernard Tunnel which cuts through the Alps to link Switzerland and Italy. The circuit will link Martigny and Aosta and will ultimately be extended on the Swiss side to Lausanne and Sion and in Italy as far as Turin. When it comes into operation in 1971 the cable will relieve existing lines through Lugano which carry telephone traffic between the two countries and between northern and southern Europe.

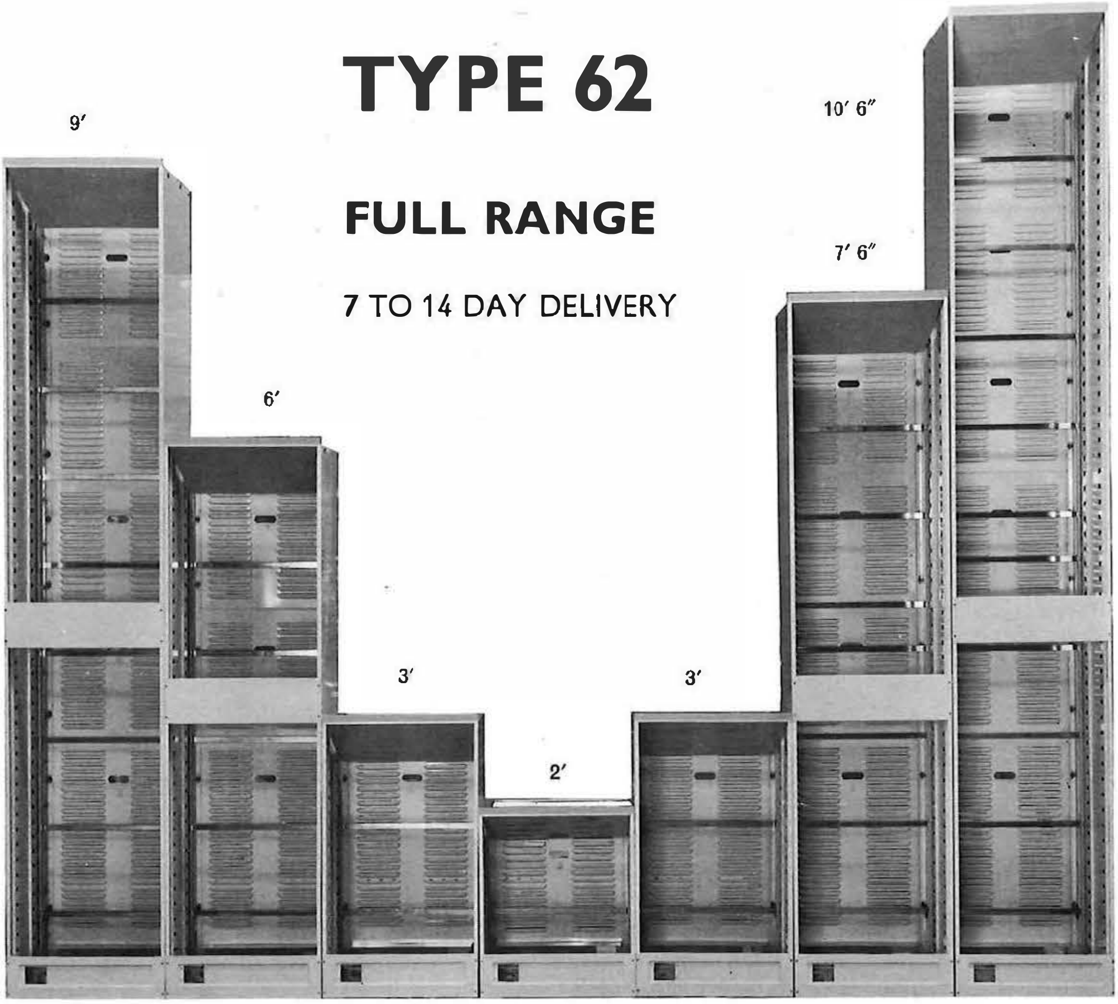
* * *

With the 10,000th subscriber now connected to its national telex network, Switzerland has a density of 1,670 telex connections per million inhabitants. At present, 96 out of 100 international calls leaving Switzerland are set up directly by subscribers themselves.

TYPE 62

FULL RANGE

7 TO 14 DAY DELIVERY



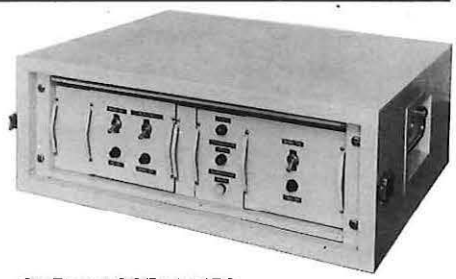
HIGH PRECISION MECHANICS

FOR INSTRUMENT ELECTRONIC AND AUTOMATION INDUSTRIES

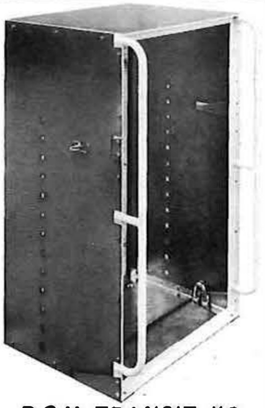
TELECOMMUNICATIONS MECHANICS

P.O. APPROVED

IMMEDIATE QUOTATIONS AND TECHNICAL SERVICE

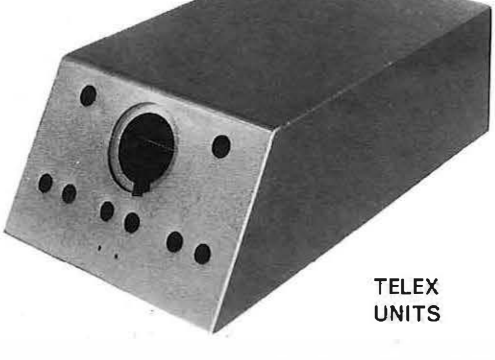


SHELF ASSEMBLIES



P.C.M. TRANSIT JIG

DATA MODEM



TELEX UNITS

CRAY ELECTRONICS LTD

THAMES ROAD, CRAYFORD, KENT
TELEPHONE: CRAYFORD 26526

Telecommunications Statistics

The figures below are for the complete financial year ended 31 March, 1969, compared with those for the previous two years.

	Year ended 31 Mar., 1969	Year ended 31 Mar., 1968	Year ended 31 Mar., 1967
Telephone service at the end of the year			
Total telephones in service	**12,911,800**	12,112,600	11,391,600
Exclusive exchange connections	**6,425,400**	5,990,800	5,576,000
Shared service connections	**1,442,500**	1,396,400	1,355,700
Total exchange connections	**7,867,900**	7,387,200	6,931,500
Call offices	**75,185**	74,856	74,511
Local automatic exchanges	**5,995**	5,919*	5,835*
Local manual exchanges	**141**	192	259
Orders in hand for exchange connections	**223,600**	240,500	220,800
Work completed during the year			
Net increase in telephones	**799,217**	720,922	671,667
Net exchange connections provided	**835,056**	805,702*	757,412*
Net increase in exchange connections	**480,695**	455,693	397,003*
Traffic			
Effective inland telephone trunk calls (incl. SV effective)	**1,198,000,000**	1,064,000,000	930,000,000
Cheap rate inland trunk calls	**273,000,000**	234,000,000	207,000,000
Overseas telephone calls:			
European outward	**11,924,724**	9,906,759	—
Extra European outward	**1,226,820**	954,685	—
†Inland telegrams (incl. Press, Service and Irish Republic)	**8,543,000**	9,305,000	9,968,000
Greetings telegrams	**2,219,900**	2,390,800	2,471,500
Overseas telegrams:			
Originating UK messages	**7,061,302‡**	7,201,608	7,200,743
Terminating UK messages	**6,898,341‡**	7,212,565	7,196,998
Transmit messages	**5,933,616‡**	6,468,389	5,939,821
Inland telex:			
Metered units	**246,000,000**	230,000,000	203,000,000
Manual calls	**124,000**	114,000	112,000
Overseas telex calls (originating UK)	**17,179,849**	14,877,151	12,694,239

*Amended figures. †"Railway Pass" facility abolished Dec. 31, 1967.
‡OTO strike last two weeks in January, 1969.

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

Advertisements. No official responsibility is accepted for any of the private or trade advertisements included in this publication. Communications, advertisement copy, etc., should be addressed to Sawell & Sons Ltd., 4 Ludgate Circus, LONDON, E.C.4. (Telephone: 01-353 4353).

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

Correspondence. Communications should be addressed to the Editor, Post Office Telecommunications Journal, Public Relations Department, Post Office Central Headquarters, 23 Howland St., LONDON, W1P 6HQ. Telephone: 01-631 2191. Remittances should be made payable to "The Post Office" and should be crossed "& Co.".

GET YOUR

Telecommunications Journal *NOW*

Complete the form opposite and send to

TELECOMMUNICATIONS JOURNAL
Public Relations Department,
Post Office Central Headquarters,
23 Howland St., LONDON, W1P 6HQ.

I wish to subscribe to the Post Office Telecommunications Journal and authorise deduction of the subscription at the rate of †Sixpence a month *or* Twopence a week (for 36 consecutive weeks) from my salary or wages.

Name...

Rank or Grade ....Date ....

Signature ....Pay No..................

Office of Employment ....

†delete inapplicable words.

always specified when the requirement is for space saving plugs and sockets providing multiway connections with maximum reliability, now feature

Redesigned mouldings to provide even greater resistance to contact push-out under abnormally abusive conditions

Improved cable clamp for better grip

Modified solder tags to facilitate connections

Available with from 7 to 71 poles, these connectors represent the highest possible quality at the lowest price

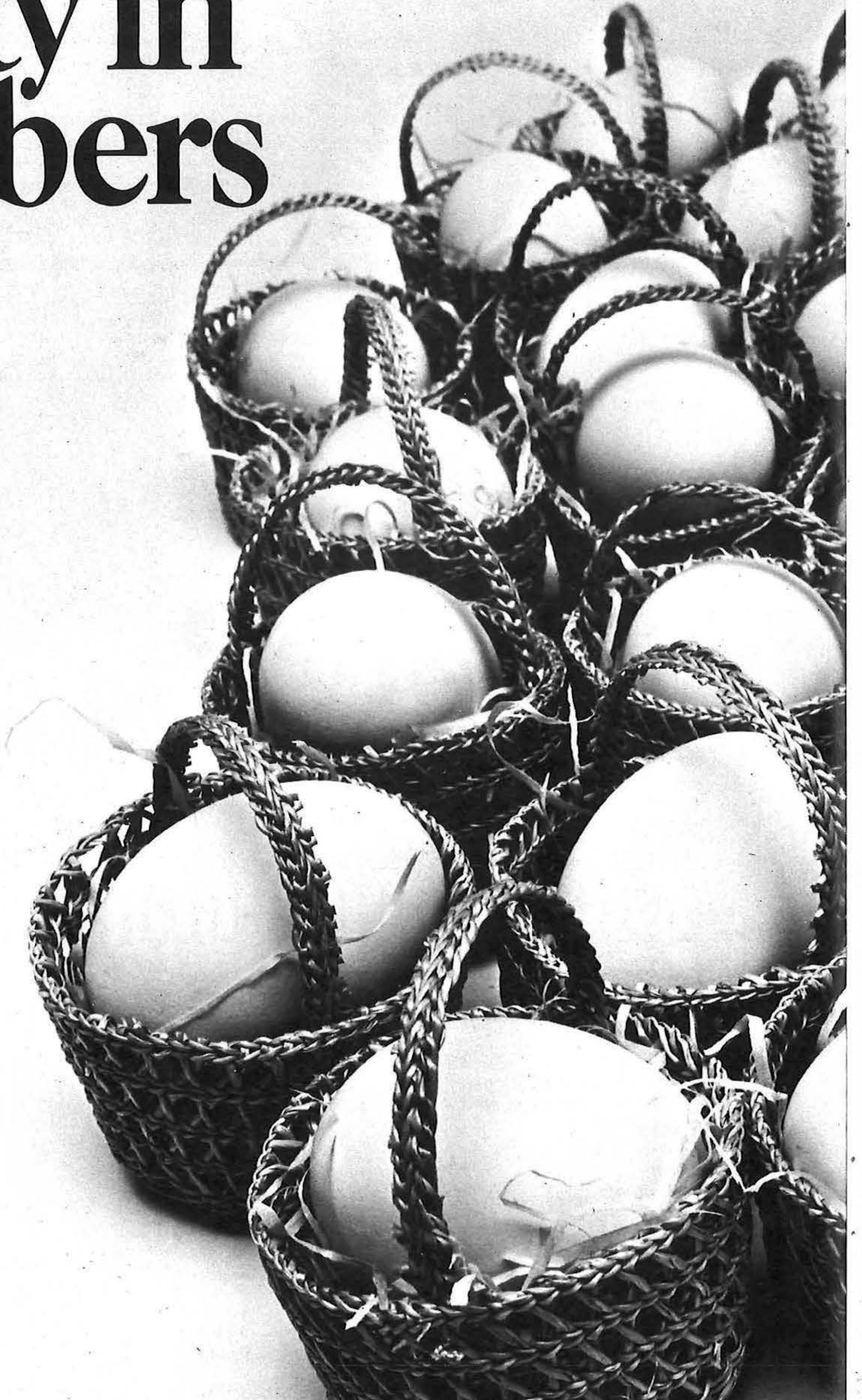
Send for leaflet PS10

PAINTON
ELECTRONIC COMPONENTS

Painton & Co. Limited
KINGSTHORPE · NORTHAMPTON
Tel: 34251 · Telex 31576

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

Safety in numbers



Whichever way you look at it, this 6-digit counter is a good buy

Frequency measurement to 12.5 MHz.
1 μS timing resolution
frequency ratio

TSA 6636

1000D

Whichever one you choose, you get an outstanding 6-digit instrument that has proved its excellence in Britain's leading laboratories and test facilities. For complete details of this counter, ask for Venner leaflet VE3012 today.

Gating times 1 microsec to 10 sec
2MHz oven controlled crystal
Measures time from 1 microsec to 10^8 sec
75 mV input sensitivity.

Other Venner Instruments for P.O. Telecommunication work

Noise Impulse Counter TSA 196—
P.O. Tester type 170A

Interruption Calibrator TSA 209—
P.O. Tester type 171A

Digital Interruption Counter TSA 210—P.O. Tester type 173A

Signalling Distortion Tester TSA 205—P.O. Tester type 156A

VENNER

Venner Electronics Ltd
Kingston By-Pass . New Malden
Surrey (01-942 2442)

See you at Hotel Piccadilly, Manchester, or Hotel Leofric, Coventry.

AURIEMA

for the best in

MICROWAVE COMPONENTS AND DEVICES

representatives and stockists for

WESTERN MICROWAVE LABORATORIES INC · OMNI SPECTRA INC
UNIFORM TUBES INC · MICRO STATE ELECTRONICS CORP · ALFORD
MANUFACTURING CO · FILMOHM CORP · CUSTOMS MATERIALS

WESTERN MICROWAVE LABORATORIES INC.

Complete range of Isolators and Circulators from VHF upwards. Also available Cryogenic circulators covering a wide frequency range. Write for new Ferrite catalogue.

Omni Spectra

OMI SPECTRA INC.

For all system connector needs from Type N through subminiature. Superior electrical performance DC through K-Band. Large range of components held in stock.

Write for 1967 catalogue

UNIFORM TUBES INC.

Microcoax-miniature solid jacketed coaxial cables.

Available in full range of sizes from .025" to .020" OD. Comprehensive range in stock.

Write for Bulletin 202C.

FILMOHM CORP

Metal film microwave resistors and thin film components.

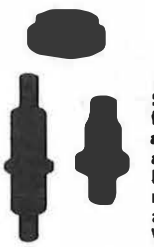
Coaxial Termination resistors. Stripline Resistors. Step attenuators. Crystal resistors. A.T. volt metres coaxial thermal voltmeters.

Write for latest Bulletins.

ELECTRONIZED CHEMICALS CORP.

POLYGUIDE

Polyguide is a low-loss, irradiated polyolefin dielectric for microwave stripline and uhf applications. Polyguide offers highly uniform electrical qualities, high strength, dimensional stability and handling ease. Standard thicknesses are $\frac{1}{32}$", $\frac{1}{16}$" and $\frac{1}{8}$" with a maximum thickness variation of $\pm 0{\cdot}002$. Write for Bulletin.



SEC

MICRO STATE ELECTRONICS CORP

Semi-conductor diodes for Microwave computor and special purpose applications.

Finest quality, proven reliability, highest value at lowest cost.

Write for full details — Bulletin SF-365.

Highly skilled Microwave Sales Engineers are always available to discuss your problems

Sole UK representatives

Auriema Ltd.

23-31 King Street, London, W.3

Telephone 01-992-5388

ALFORD MANUFACTURINGCO.

AMCI

Slotted lines, Hybrids, Precision RF Terminations and Impedance Plotters.

A complete range of slotted lines from 600 MHz to 18 GHz

Write for Bulletin N for complete range.

If talking on the telephone involves you

... in this

... or this

... you need this

The LST4 loudspeaking telephone leaves the busy executive free to make notes and refer to documents as his telephone conversation proceeds. It also enables others present in the office to participate in a conference call, speaking to and hearing the distant party just as if he was in the same room. And when privacy is required, the executive can use the handset provided. Fully semiconductored and tropicalized for operation under damp-heat conditions, the LST4 is made to a rigorous specification by G E C of England and attractively finished to provide a neat and functional aid to effective business communications.

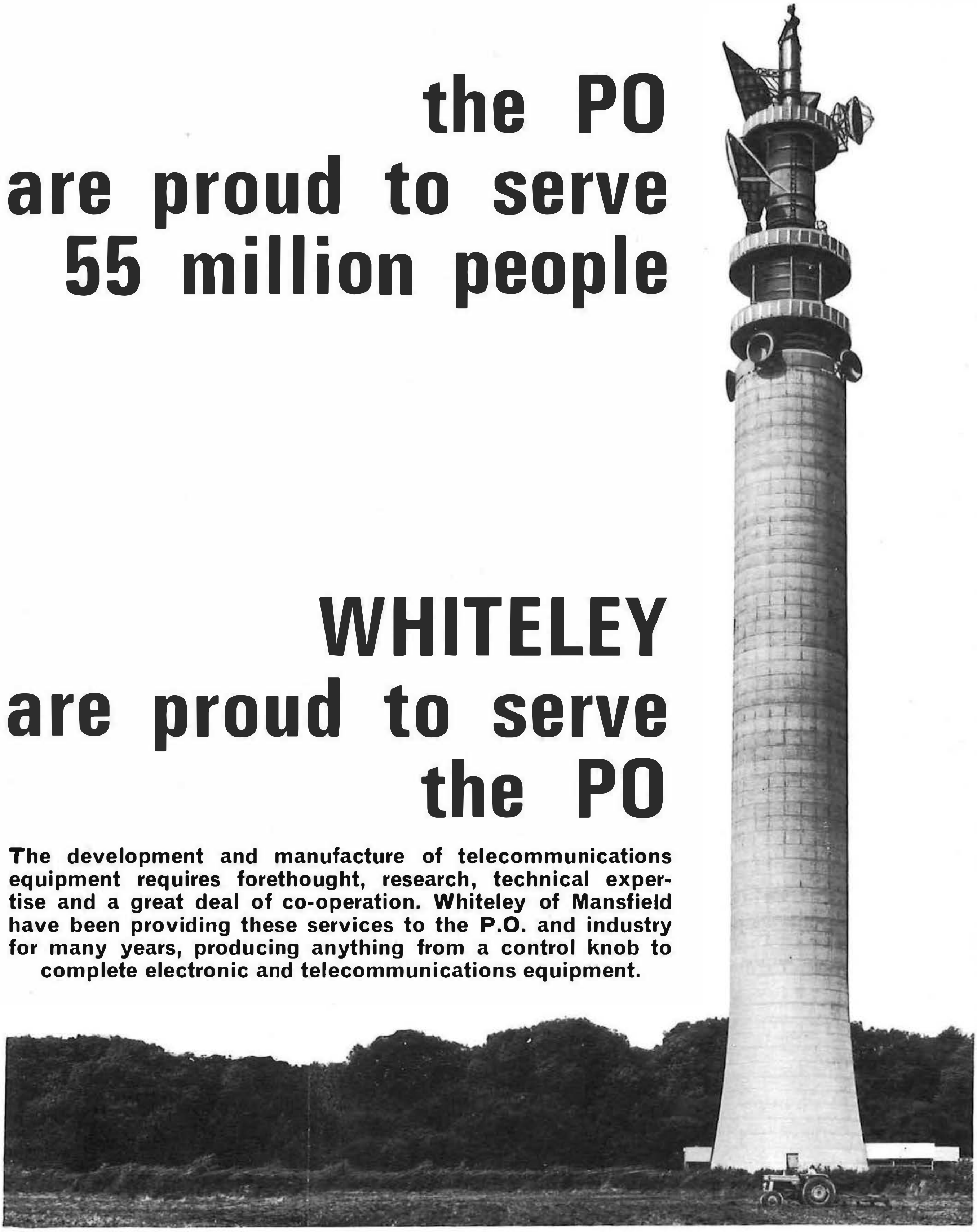
G.E.C.

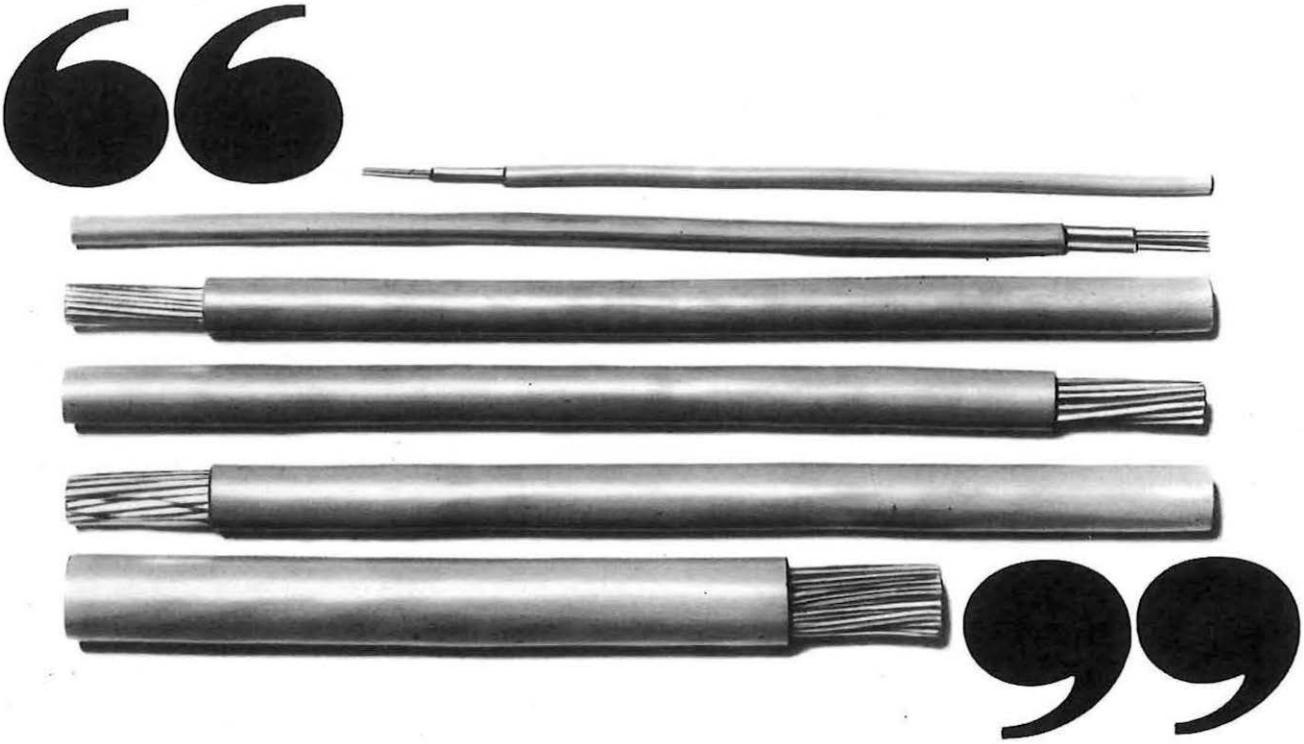
Takes telecommunications into tomorrow

GEC-AEI TELECOMMUNICATIONS LIMITED,
OF COVENTRY, ENGLAND.

A Management Company of The General Electric Co. Ltd. of England.

IB/32





PIRELLI GENERAL

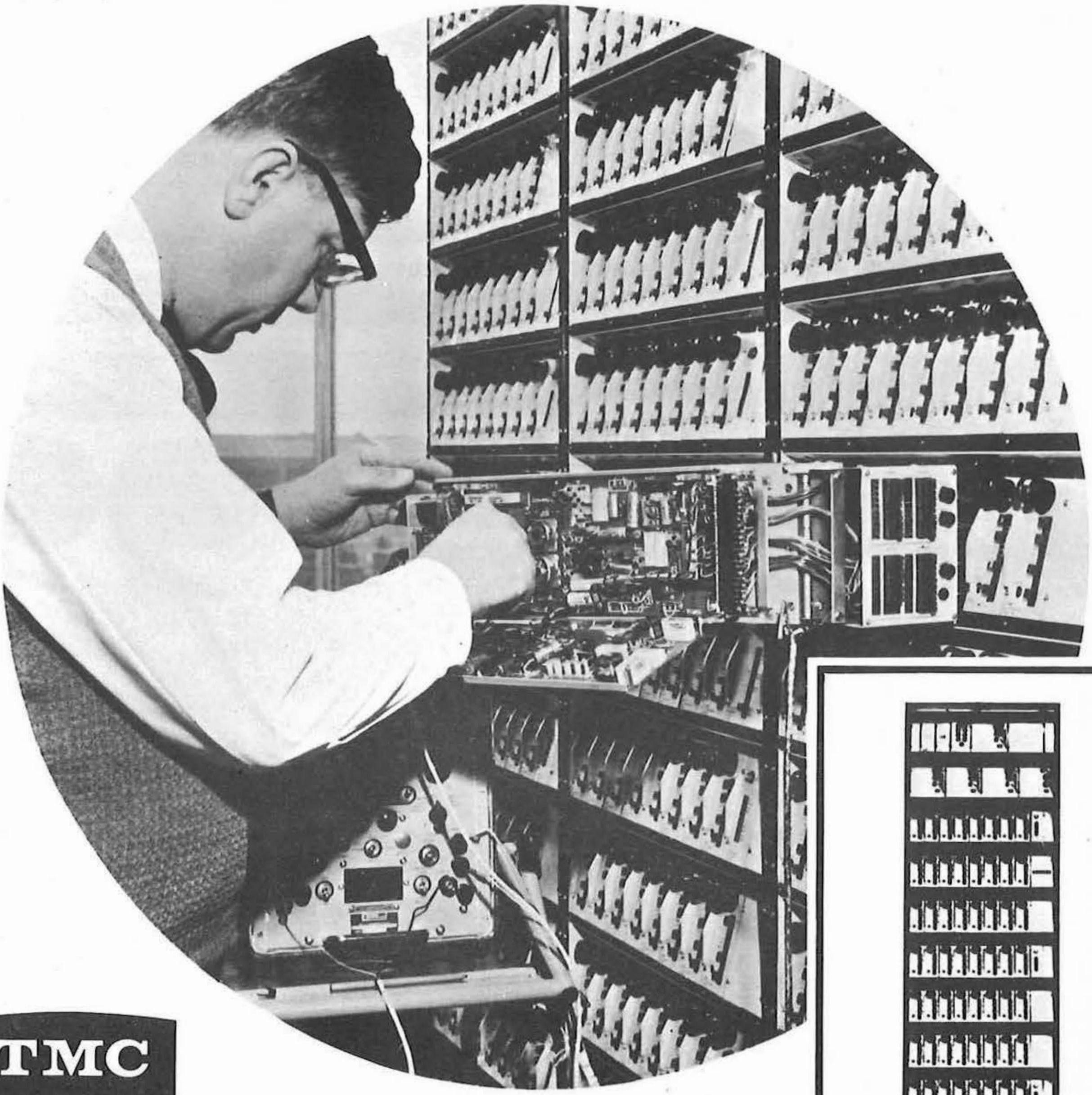
and the power of speech

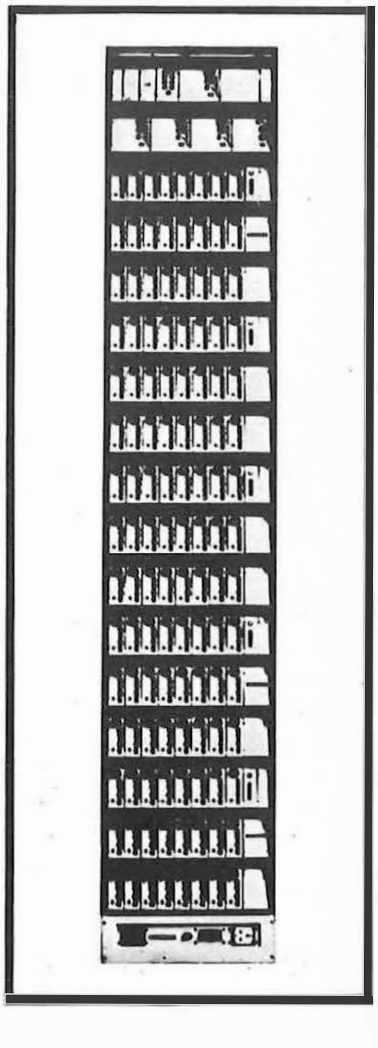
Internal telephone communication systems call for the same degree of reliability as for national networks. Pirelli General manufactures a range of multipair and multi-way internal telephone cables which are stocked for immediate delivery.

To reduce cross-talk in the multipair construction the pairs are twisted and laid-up with varying lays. Each cable has a distinct colour indentification scheme for the cores or pairs which facilitates quick termination, and a Terylene ripper cord assists in quick removal of the PVC sheath. For further details ring Southampton 20381 or ask for Publication RT508.

PIRELLI GENERAL CABLE WORKS LIMITED · SOUTHAMPTON · TELEPHONE: SOUTHAMPTON 20381

P8577





ERSIN

Multicore

5 CORE SOLDER

for quick, easy faultless soldering

Leading electrical and electronic manufacturers use Ersin Multicore Solder for reliability. Made from only the purest tin and lead plus five cores of extra active non-corrosive Ersin flux. Available in over 400 specifications, there is an Ersin Multicore Solder to suit your individual production requirements.

Savbit Alloy

Ersin Multicore Savbit Alloy is specially made to overcome the rapid pitting and wear of soldering iron bits. A precise amount of copper is added to prevent the copper of the soldering iron bit being absorbed into the solder alloy: this eliminates the need for frequent resurfacing of the bit, whose life is prolonged up to ten times. Because the soldering iron bit is kept in good condition soldering speed and efficiency are increased.

Ersin Multicore Solder is shown being used at the Erith factory of Submarine Cables Ltd., in the production of a submersible repeater designed to last for a minimum of 20 years under the sea without attention.

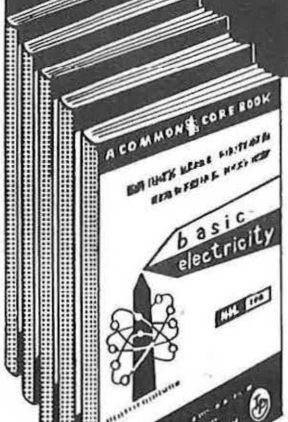
THERE IS AN ERSIN MULTICORE SOLDER FOR EVERY PURPOSE WHERE PRECISION SOLDERING IS REQUIRED

Engineers and technicians are invited to write on their Company's letterheading for "MODERN SOLDERS" containing data on melting points, gauges, alloys, etc.

MULTICORE SOLDERS LTD.
Hemel Hempstead, Herts.
(Hemel Hempstead 3636)

1966

YOURS FREE FOR 7 DAYS



The 'New Picture-Book' way of learning BASIC ELECTRICITY (5 VOLS.) ELECTRONICS (6 VOLS.)

You'll find it easy to learn with this outstandingly successful NEW PICTORIAL METHOD—the essential facts are explained in the simplest language, one at a time, and each is illustrated by an accurate, cartoon-type drawing. The books are based on the latest research into simplified learning techniques. This has proved that the PICTORIAL APPROACH to learning is the quickest and soundest way of gaining mastery over these subjects.

TO TRY IT, IS TO PROVE IT

This carefully planned series of manuals has proved a valuable course in training technicians in Electricity, Electronics, Radio and Telecommunications.

The P.O. needs technicians to advance its expansion programme

"They certainly confirm everything your readers say about them and I am more than delighted with them. They will be of great value to me in my job as Hospital maintenance electrician." A. B., Birmingham.

"I am entirely satisfied with the books, they are everything you claim them to be." S.S., Cardiff.

"I must say they are the best books on the subject as they explain in simple language what other books make hard going of." C. B., Hartlepools.

"They have a wonderful system of imparting the subject to the beginner." H. C. L., Leicester.

"An extremely marvellous set of books." C.B., London.

A TECH-PRESS PUBLICATION

POST NOW FOR THIS OFFER!!

To The SELRAY BOOK CO., 60 HAYES HILL, HAYES, BROMLEY, KENT BR2 7HP

Please send me WITHOUT OBLIGATION TO PURCHASE, one of the above sets on 7 DAYS FREE TRIAL, I will either return set, carriage paid, in good condition within 7 days or send the following amounts. BASIC ELECTRICITY 75/- Cash Price, or Down Payment of 20/- followed by 3 fortnightly payments of 20/- each. BASIC ELECTRONICS 90/- Cash Price, or Down Payment of 15/- followed by 4 fortnightly payments of 20/- each. This offer applies to UNITED KINGDOM ONLY. Overseas customers cash with order, prices as above.

Tick Set required *(Only one set allowed on free trial)*

BASIC ELECTRICITY ☐ BASIC ELECTRONICS ☐

Prices include Postage and Packing.

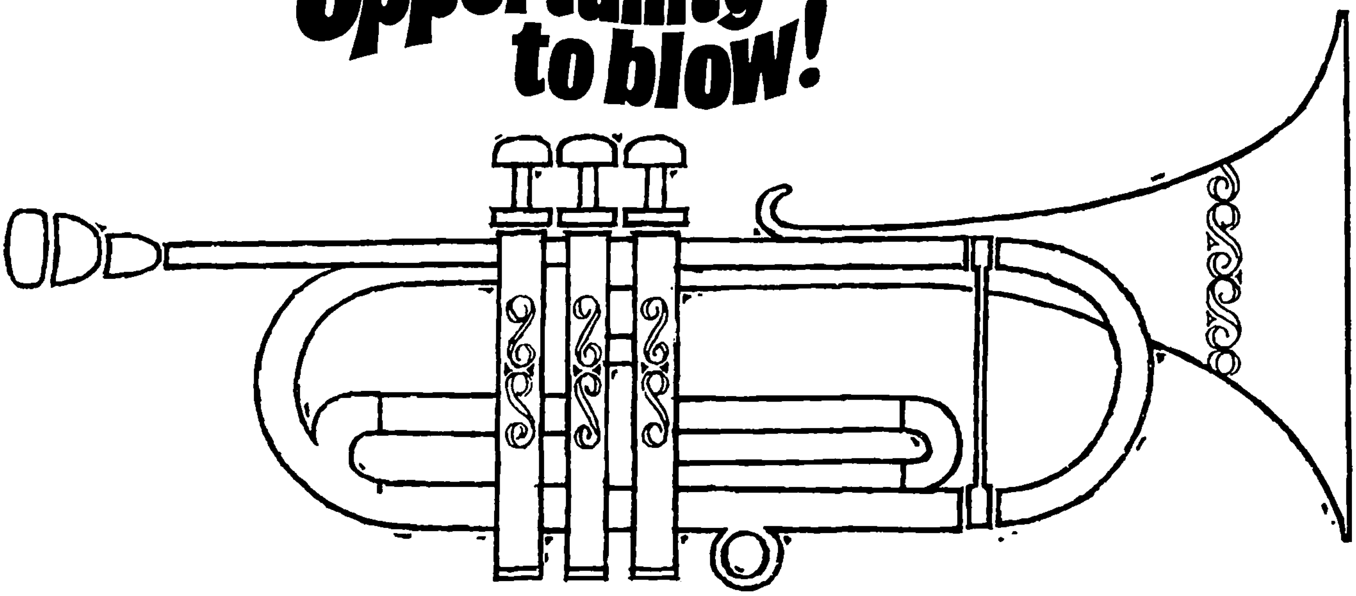
Signature ....
(If under 21 signature required of parent or guardian)

NAME ....
BLOCK LETTERS

FULL POSTAL ADDRESS ....

....

POTJ-S



The Post Office Telecommunications Journal is printed by BKT Printers Ltd., London and Tonbridge, and is published quarterly in December, March, June and September by the Post Office.