POST OFFICE

telecommunications

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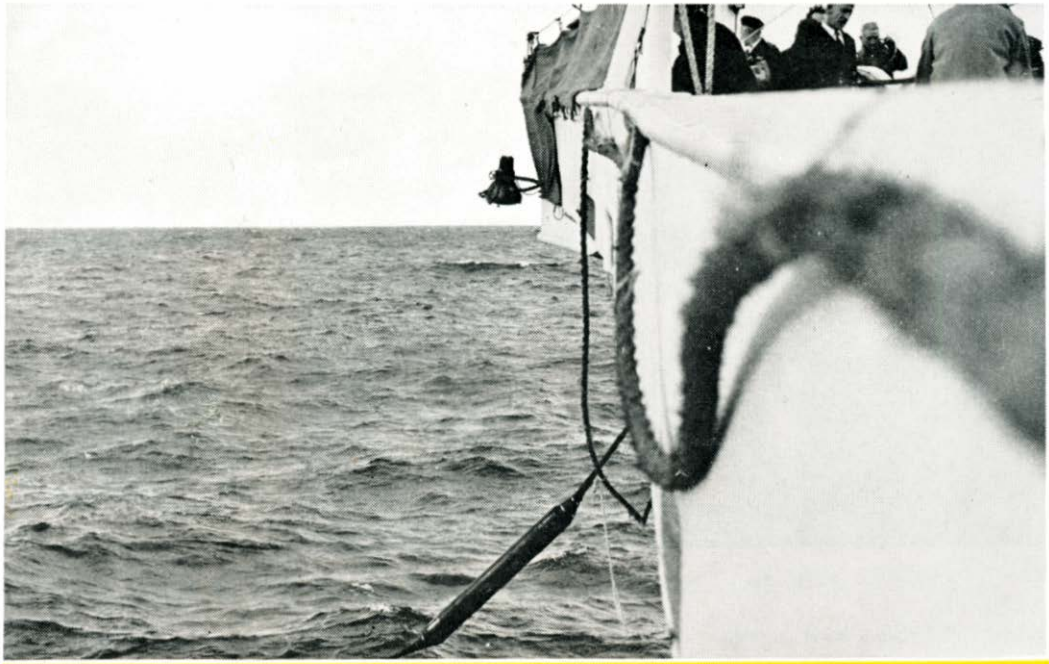
WINTER 1966

STC TELECOMMUNICATIONS REVIEW

DECEMBER, 1966



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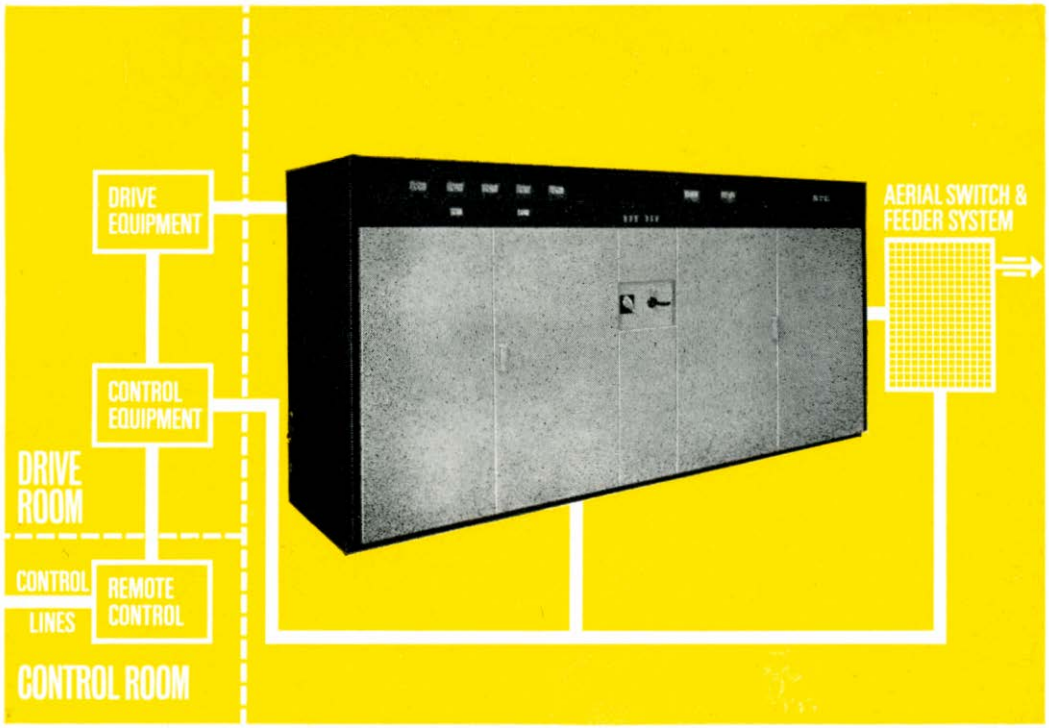

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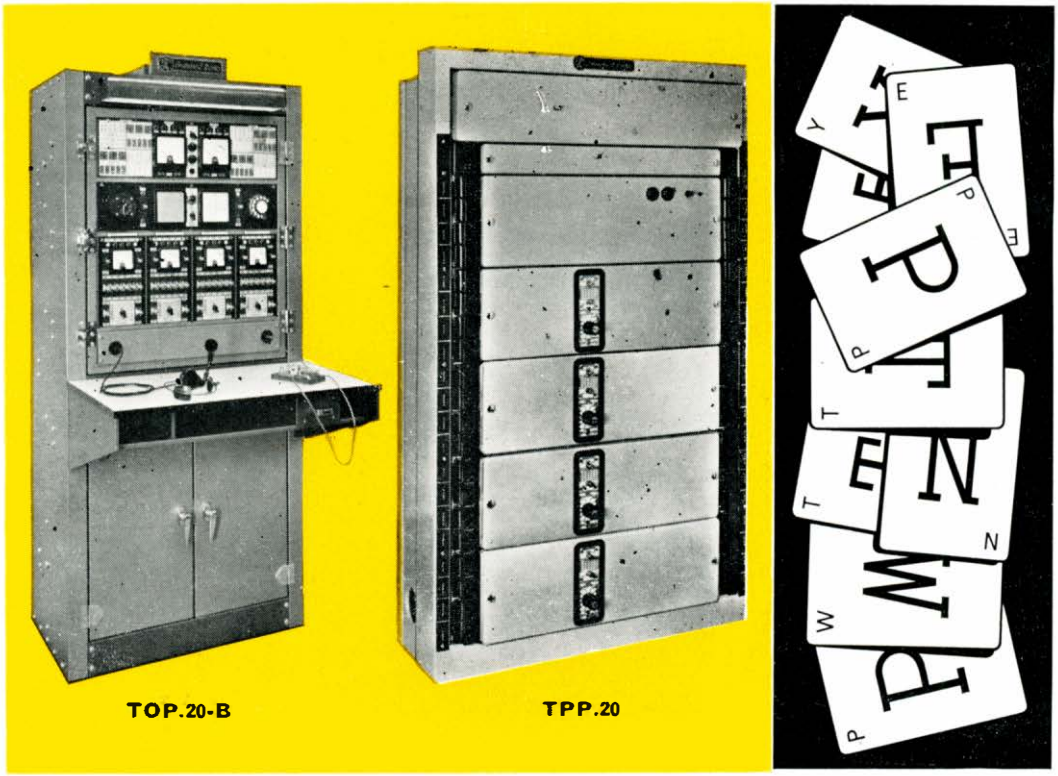

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Post Office Telecommunications Journal

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CONTENTS

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Vol. 18 Winter 1966 No. 4

A THREE-FOLD CHALLENGE

A national campaign has been launched which is of vital concern to everyone in the country.

The campaign—Quality and Reliability Year—has a simple but challenging aim: to help organisations to review their methods for obtaining improved quality and reliability and to make quality and reliability the business of everyone—from boardroom to shop floor.

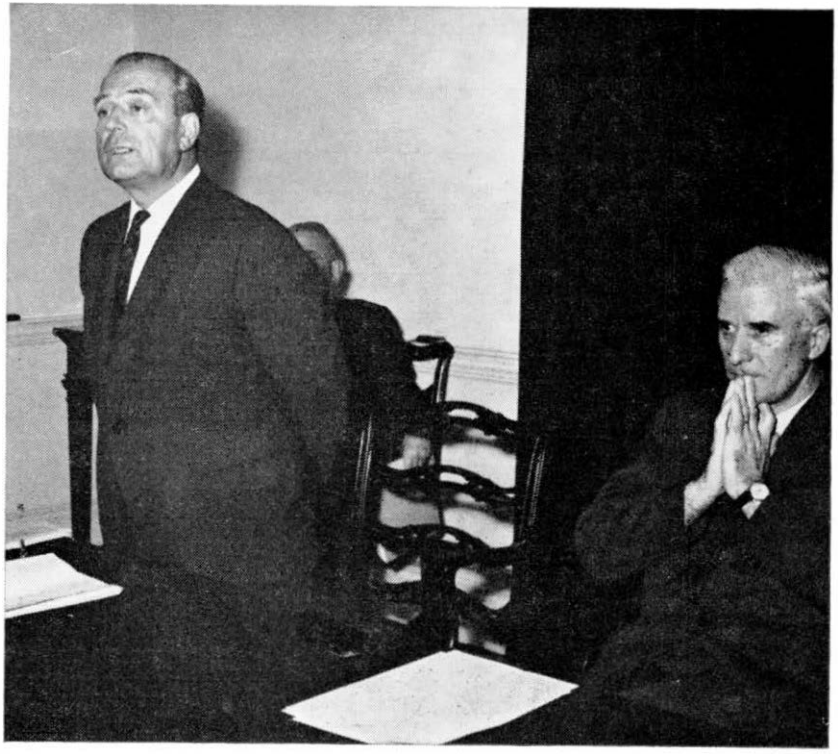
Quality and Reliability Year has a special significance for the Post Office. The nation's industry and commerce depend for their efficiency—indeed, for their very existence—on the availability and efficiency of the services the Post Office provides. Communications are the main arteries through which the lifeblood of the nation's economy courses. If those arteries become blocked the blood will cease to flow and industry and commerce wither and die.

The challenge of Quality and Reliability Year to the Post Office is three-fold. First, to continue to improve the quality and reliability of its services. Much has been achieved but services everywhere are not as good as they should be. The quality testing of new equipment and new maintenance procedures will contribute to service improvement but congestion due to shortage of plant will continue to cause difficulty for some time. Although practices and procedures have been streamlined to reduce the time needed to get new equipment into service, provision of additional equipment has not yet caught up with the high rate of growth in calls and in demand for new telephones.

Second, the Post Office must help industry and commerce to make better use of the services we provide. The Post Office aims to do this by increased publicity and is studying how best to encourage telephone subscribers to take full advantage of all the facilities we offer and to use the telephone and other telecommunications services more efficiently.

The third challenge is to every member of the staff. "The aim of Quality and Reliability Year is to restore the excellence of British goods and services in the eyes of the world," says the Postmaster General in a recent message to the staff. "The Post Office exists to provide these services and everyone is equally responsible for them . . . a telephone operator who does not answer quickly enough, someone at headquarters who delays a decision, all are making Britain less efficient. But everyone who takes a pride in doing a quick, error-free job is helping to restore our good name in the world."

NEW MAN AT THE TOP



Mr. John Wall, the new Deputy Chairman, addresses the Press Conference at which his appointment was announced by the Postmaster General (right).

A LEADING industrialist and specialist in telecommunications has been appointed to help plan the transformation of the Post Office from a Government Department to a public corporation.

He is Mr. John Wall, a former Under Secretary at the Ministry of Food and, since 1960, managing director of Electrical and Musical Industries. He took up his duties on 1 November as Deputy Chairman of the Post Office Board, a new post created on the retirement of Sir Ronald German, Director General of the Post Office since June, 1960.

Mr. Wall, described by the Postmaster General (the Rt. Hon. Edward Short) as "tailor-made for the job", has been seconded from EMI for two years, during which time he will carry out the day-to-day duties of his new office and assist in planning the re-organisation of the Post Office.

Introducing Mr. Wall at a Press Conference recently, the Postmaster General said that the outlines of the new Corporation would be published in a White Paper in the Spring of 1967. Consultations with the staff associations had begun; he had established a Department of Re-organisation; and with senior officials he was now examining the management structure of the Post Office.

In recent years the Post Office had developed into a complex of vast business enterprises. Apart from the postal and telecommunications services, it ran a Savings Bank with 23 million active accounts through which the public transacted some £6,000 million of business every year. It operated the links by cable and by microwaves which carried radio and television programmes to and from all parts of the country. Recently, the Post Office had also added to its responsibilities a Giro system.

A selection of the newspaper headlines which greeted Mr. Wall's appointment.

In the context of the future change in status there was great advantage in now having at the head of the Post Office, under the Postmaster General, someone from outside the Civil Service. Mr. Wall had been appointed with the agreement of the Prime Minister. He would direct the current affairs of the Post Office and assist in planning the changes in status.

"Mr. Wall brings to this very exacting task great experience both in the Civil Service and in industry," said the Postmaster General. "He rose to the rank of Under Secretary in the Civil Service before entering industry and in only 13 years he has risen to the top of the business world. He has considerable knowledge of the electronics industry, a great advantage for anyone at the head of a science-based industry in which electronics play an increasingly important part.

"I feel sure that Mr. Wall will not only make a great contribution to the solution of the problems of expansion, modernisation and reorganisation which face the Post Office, but that he will also ensure that both now and in the future it will continue to strive to give the public the best possible service at reasonable cost and bear in mind its responsibility for the maintenance of comprehensive national services available to all citizens in all parts of the country."

In answer to questions, the Postmaster General said that when the Post Office became a public corporation it would have much more independence. "There will not be the present system of accountability to the Government nor the same day-to-day control by the Government of Post Office business. We shall be changing the managerial structure to separate the postal and telecommunications more widely and this will allow each side to develop more freely."

Legislation would be needed before these changes could take place. There will be a White Paper published early in the Spring of 1967 setting out the plan in outline. The new corporation should be able to "get off the ground" by the end of 1968 or the beginning of 1969.

The question of the appointment of the Chairman of the new corporation was still open, said the Postmaster General. "At the end of Mr. Wall's two-year secondment we shall see how we have got along. We have the highest regard for Mr. Wall's ability and integrity, his knowledge and experience."

No name had yet been decided upon for the new corporation and whatever name was eventually chosen, the Postmaster General thought the man in the street would still refer to it as the Post Office. What was wanted was a name which included a reference to both the postal and telecommunications services and he would be glad to receive any ideas.

On the question of staff, the Postmaster General said that under the new status they would cease to be Civil Servants but they would lose none of their present privileges and their rights would be safeguarded. "We are keeping very closely in touch with the staff associations and hope that they will go along with us. We have first-rate staff associations in the Post Office and our associations with them are excellent. We are now beginning to discuss all relative matters with them."

OVER

Mr. Wall said that one of the attractions which appealed to him on taking over his new post was that the Post Ollice was a greatly expanding organisation. "All the excitement of modern telecommunications lies ahead and this should give us a new sense of purpose.

"I know no more about the Post Office at present than most people do and I should think it will take about six months before I have anything to contribute. One thing which is wanted and which I think I can provide is a fresh approach. Large organisations often benefit from people joining them from outside at various levels."

Asked why he had accepted the post, Mr. Wall said it was very important for Britain to have first-class communications and he felt he could contribute something to finding out the root of the troubles at present affecting the Post Ollice. The very big staff—some 400,000—which the Post Ollice employed was a key to the way the job would be tackled. The change over to a public corporation would give the staff a new sense of purpose and they would take part in setting new standards which would create a personal feeling of responsibility.

Mr. John Woll, OBE, wos born in 1913 and educated at Wandsworth School and the London School of Economics. He joined the Ministry of Food in 1939 and become an Under Secretory in 1948. In 1952 he left the Civil Service to take over as deputy head of the Finance Deportment of Unilever Ltd. He was head of Unilever's Organisation Division from 1956-58 when he joined Electrical and Musical Industries as o director, becoming managing director in 1960. Since 1964, Mr. Wall hos also been o port-time member of the Sugar Boord.

Mr. Wall, who is married and has two sons and o daughter, lives at Kingston-upon-Thames.

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"We Owe Him A Very Great Debt"

Sir Ronald German, KCB, CMG, Director General of the Post Office for the past six-and-a-half years, had a lifetime's experience of Post Office affairs, having worked his way up from an Assistant Traffic Superintendent in Manchester to the top administrative post in the organisation.

Born in 1905, Sir Ronald began work at the age of 14 as an apprentice at Devonport Dockyard before joining the Post Office in 1925. In 1934 he was promoted to Assistant Surveyor, 2nd Class, in South Wales, and three years later to Assistant Principal at Headquarters. He became Assistant Private Secretary to the Postmaster General in 1939 and a Principal in the Postal Services Department in 1941. He then went to the Treasury where he served for only a short time before being appointed Assistant Director of Posts and Telegraphs in the Sudan, a post he held until 1945 when he returned to Britain to become a Principal in the Personnel Department and subsequently Principal Private Secretary to the Postmaster General and Secretary to the Post Office Board.

In 1947 Sir Ronald was appointed Assistant Secretary in the Personnel Department and in 1950 went abroad again, this time as Postmaster General of East Africa, a position he held until 1958 when he returned to Britain to become Deputy Director General.

Sir Ronald German. He led the Post Office for more than six years.

Sir Ronald, who has retired to Eastbourne, was awarded the CMG in 1953. He was knighted in 1959 and awarded the KCB in 1965.

Speaking at a recent Press Conference, the Postmaster General paid tribute to Sir Ronald's work. "Much of the accelerated expansion of the Post Office has taken place under Sir Ronald German's guidance during the past six years," said Mr. Short.

"This period has seen the change from direct control by the Treasury to independent operation through a statutory Trading Fund, the very rapid development of the telephone service, both in size and techniques, big developments in the use of computers, the decision to start the Giro and preparations for the mechanisation of the postal service. The Post Office owes a very great debt to Sir Ronald."

BIG CHANGES IN ORGANISATION

Mr. K. H. Cadbury, MC.

Mr. F. E. Jones.

Mr. J. H. Merriman

Mr. N. C. C. de Jong.

THREE important changes in the organisation of Post Office Headquarters which vitally affect the telecommunications services were announced recently.

The first is the creation of a new Directorate of Re-organisation whose task is to plan for the change in status of the Post Office from a Government Department to a nationalised industry. Mr. Maurice Tinniswood, formerly Director of Establishments and Organisation, becomes the new Director of Re-organisation. The new Director of Establishments and Organisation is Mr. R. Martin, formerly Assistant Secretary in charge of the Marketing Branch of the Inland Telecommunications Department.

The second change is the appointment of a second Director of Inland Telecommunications. Mr. K. H. Cadbury, MC, the present Director, becomes DIT (Planning) and the new post—DIT (Operations)—is taken over by Mr. F. E. Jones, formerly Assistant Secretary in charge of ITD planning. Mr. Cadbury will retain control of the planning and marketing branches of ITD while Mr. Jones will take charge of those branches concerned with operations, tariffs, legislation, organisation and efficiency.

The reason for the appointment of a second Director of Inland Telecommunications is the urgent need to cope with the increasing problems associated with the growth of the telephone service and at the same time to plan the expansion and development of the service. "Keeping pace with long-term problems has become a full-time task," says Mr. Cadbury. "No less important are the day-to-day problems which also merit the full-time attention of a Director."

The third important change is the creation of a second post of Deputy Engineer-in-Chief to which Mr. N. C. C. de Jong, formerly Assistant Engineer-in-Chief, has been appointed. Mr. de Jong will be responsible for management services, Engineering programmes, performance and service and postal engineering. Mr. J. H. H. Merriman, the other Deputy Engineer-in-Chief, will be responsible for longe-range systems engineering, telecommunications development, radio (including broadcasting) and staff.

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TWO REGIONS FROM ONE

BECAUSE of the rapid rise in population in the counties bordering London and with it the increase in responsibilities and services, the Home Counties Region, the biggest geographically in England, has been reorganised into two new regions: South Eastern and Eastern.

The dividing line between the two new regions corresponds roughly with the course of the River Thames. Both regions have six Telephone Areas: Eastern Region contains the Oxford, Bedford, Cambridge, Norwich, Colchester and Southend Areas, with a total of 465,000 exchange connections; and South Eastern Region the Reading, Guildford, Portsmouth, Brighton, Tunbridge Wells and Canterbury Areas (625,000 exchange connections).

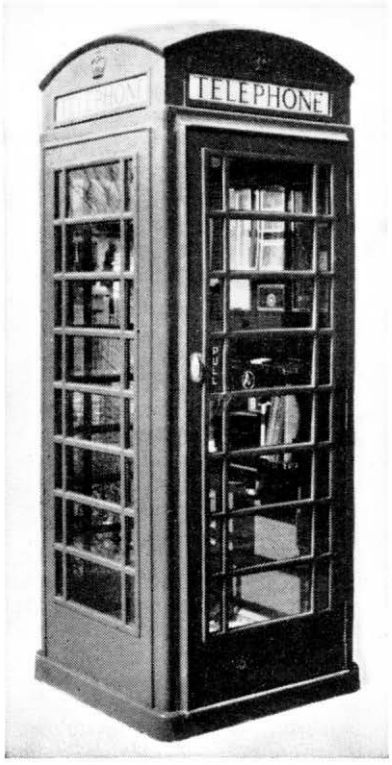
The Director of the new Eastern Region is Mr. Leonard Hill (formerly Director, Home Counties); the Deputy Director, Mr. A. F. James; the Telecommunications Controller, Mr. G. C. Goodman; and the Chief Regional Engineer, Mr. A. Leckenby.

Mr. F. G. Fielder (formerly Deputy Director, London Postal Region) is the Director of the new South Eastern Region. Deputy Director is Mr. L. J. Glanfield (formerly Deputy Director, Home Counties); Telecommunications Controller, Mr. J. V. R. Birchall; and Chief Regional Engineer, Mr. A. H. C. Knox.

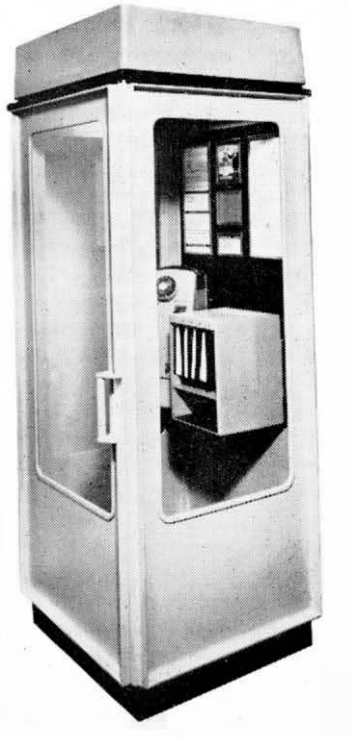
Public coin boxes are being converted to the pay-on-answer type as quickly as possible, new designs are now becoming available and steps are being taken to prevent vandalism. But there are still many problems to be solved as the author discusses in this article

Coin Boxes and Their Problems

By Miss E. A. KNIGHT, BSc. (Eng.)



Left: The present day kiosk which was designed in 1935 by Sir Giles Gilbert Scott. It is made of cast-iron. Right: The new Kiosk No. 8, designed by Mr Bruce Martin, is also in cast-iron, but has three very large single panes of toughened glass and a fibre glass roof which glows red at night when the fluorescent lighting inside is switched on. The new kiosk has only 50 component parts compared with the 400 or more of the present kiosk. The new kiosk will make its appearance in 1968.



THE pay-on-answer type coin box, introduced in 1959 following the advent of STD, is now installed in most large towns. Conversion from the old pre-payment type is proceeding steadily and some 60 per cent of the 200,000 coin boxes in use in the country are now of the pay-on-answer type.

This does not mean, however, that coin box design has reached a period of stability and that when the remaining 40 per cent have been converted to pay-on-answer working we can regard coin boxes as settled for the next decade or so. Far from it.

The public call office service is unprofitable and steps must be taken to improve the situation. The proposed introduction of a decimal system of currency means a major change to our coin boxes. In addition, the Post Office is about to make a new design of coin box available to customers who wish to rent them. It is also devising a stronger public coin box to resist the attacks of vandals and experimenting with different forms of coin box housings which

may ultimately lead to a different form of coin box.

The prepayment type of coin box was introduced in 1925 and for some 25 years its design remained unchanged. Two pence was the minimum fee necessary to make a local call and 6d. and 1s. slots were available for other calls.

The pay-on-answer box is clearly not going to have such a long life without change. After only seven years of use and well before it is available everywhere it is about to be modified to accept only sixpences and shillings—a comparatively simple modification involving no more than clipping a peg into the 3d. slot. The actual operation of the box will not be changed and users will get double the time they would have got for 3d.

The use of a peg was the quickest and cheapest change to make but boxes with a coin slot plate which have apertures for only 6d. and 1s. will soon be available. Both these changes are, however, regarded as expedients since a much more fundamental change will be necessary if the Government proceeds with its plans to adopt decimal currency.

Decimal Currency Problems

The introduction of a decimal currency has been debated for well over a century but more recently interest in the subject has quickened. In 1961 the Government appointed a Committee of Inquiry under the chairmanship of the Earl of Halsbury to advise on the most convenient and practical system. The Commitee published its report in 1963. It made an exhaustive study of the subject, reviewing no fewer than 25 systems, four of them in detail, but finally decided that the choice lay between a system based on the 10s. as the major unit or a system based on the £. The majority recommendation was for a system in which the £ would be the major unit divided into 100 minor units which the Committee termed cents.

Some six months ago the Government announced its decision to adopt the £-cent-½ system in 1971. How will this affect coin boxes? Clearly the fundamental question is what coins in the " minor " unit will be available. There has been no decision about this as yet but the Halsbury Committee recommended the following:

½c.	1c.	2c.	5c.	10c.	20c.
(1.2d.)	(2.4d.)	(4.8d.)	(1s.)	(2s.)	(4s.)

It suggested that the 5c and 10c coins should be interchangeable with the shilling and florin as regards size and weight but that the other coins should be new.

In considering this range of values anyone familiar with coin boxes will immediately question the absence of a coin equivalent to 6d. (that is, 2½c). Pay-on-answer coin boxes work on 3d., 6d. and 1s.; they will shortly work on 6d. and 1s. and they could be made to work on 6d., 1s. and 2s. If there were to be a 2½ cent coin the conversion would be simple since the box could operate on 2½, 5 and 10 cents exactly as it does now. But in the light of the Halsbury Committee's views on inclusion of fractions in a decimal system it looks as though the sixpence will disappear.

How then can we adapt our boxes? A fundamental feature of the pay-on-answer design is that it operates on a coin value ratio of 1:2:4, the 3d. being converted to one electrical pulse, the 6d. to two and the 1s. to four. If we had had a box working on 6d., 1s. and 2s. this ratio could have been maintained. But all this fails with coins in a ratio of 1:2:5 or 2:5:10 and we only get back to the 1:2:4 ratio when we want to charge a minimum of 5 cents (1s.) for a call —and such a high charge is not likely for many years if, indeed, it is ever needed in the life of the equipment.

A means of modifying the box to work on a coin value ratio of 1:2:5 has been found and current production models now have facilities which permit the box to operate either on value ratios of 1:2:4 or 1:2:5. In present circumstances we need a minimum fee from coin boxes of about 6d. so we shall probably have to use a 2c piece (4.8d.) as the minimum fee at the beginning. But even this is a rather lower value than we would wish. Use of 5c and 10c pieces to make up higher charges has obvious attractions but 5 is not a multiple of 2 and obviously if a 5c piece were inserted the equipment could not translate this into 2½ electrical pulses! Unless we design a new box working on quite different principles or adopt some system so that the amount of time available for each of the various coins inserted is not in an exact ratio, we may be faced with coin boxes working on 2c and 10c when decimal currency arrives.

OVER

Changes will also be unavoidable with pre-payment boxes but by 1971 the majority of these will have been converted to the pay-on-answer type.

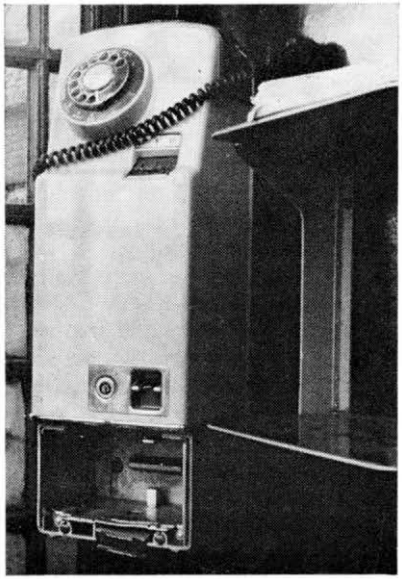
Problems involving the actual conversion will be formidable. The Post Office will clearly have to work closely with those concerned with the issue of the new currency to ensure that coin boxes can be operated with the currency which potential users are likely to have in their pockets. It will not be practicable to modify any one box so that either the new or the old currency can be accepted.

Renters' Coin Box

Public telephone coin boxes are fair game for the irresponsible and the Post Office is also under constant pressure to provide more public telephones. One method of easing both problems is to encourage more people to rent coin boxes, particularly in shops, garages, hotel foyers and so on where they are readily accessible to the public but also under supervision.

To this end the Post Office has been considering a different design of the renter's type pay-on-answer coin box. In view of the impending change to decimal currency the designing of a completely new box has been deferred until we can be certain of the coins we shall need to use, but as an interim measure a cut-down version of the public call office type coin box has been produced in two tones of red. These are now becoming available and will be tried out experimentally in one Region. Customers' reaction to the new model will be useful when it comes to designing a table-type decimal pay-on-answer coin box.

Some countries produce coin boxes for customers use which operate on a single coin. This has the attraction of simplicity and consequently of cheapness but it has limitations in a fully automatised service when call charges vary with distance and duration. The Post Office will, nevertheless, be considering whether the provision of boxes of this type would offer any advantages when the position with decimal currency has clarified.



Vandalism costs the Post Office about half a million pounds a year. Left: An Engineer shows some of the sad remnants of public telephone kiosks damaged in the Colchester area. Above: An almost new pay-on-answer coin box with its cash compartment ripped out and the telephone directories stolen. New measures are being taken to defeat the vandals.

Vandalism

Although providing coin boxes in renters' premises reduces the risk of vandalism there is still a need to make public telephones more vandal-proof. Vandalism to public telephones is costing the Post Office about £500,000 a year. On average every kiosk in the country is damaged twice a year—some coin boxes in kiosks are so frequently damaged that it has proved impossible to keep them in full working order.

The damage takes three main forms—to the coin box mechanism, to the handset and/or cord, and to the kiosk structure. The last type of damage is usually hooliganism. The first two are usually due to theft of cash or apparatus and generally result in the coin box being left unusable.

There is a constant flow of suggestions to remedy the trouble, ranging from kiosk doors which lock when the apparatus is interferred with, so imprisoning the culprit, to burying the cash compartment in a manhole in the floor. Some of the suggestions are impracticable, others would give rise to more difficulties than they would cure (it is easy, for example, to visualise the trouble resulting from an innocent member of the public—especially a child—being imprisoned in a kiosk until the police arrived because the automatic door-locking device developed a fault). However, every suggestion is carefully considered and the Post Office has been impressed with the ingenuity of some correspondents and the generally helpful attitude taken by the public.

A "walk-up, drive-up" mounted public telephone recently introduced in the United States. The British Post Office is considering an experiment with a similar type of telephone.

Some ideas for strengthening the apparatus which have been tried out have merely resulted in greater damage by the determined criminal but a remote alarm system introduced some six months ago has proved very useful in catching offenders. Modifications suggested by two engineers—one in Glasgow and the other in Liverpool—have been adopted in some Regions and both men have been rewarded under the Awards Scheme. One experiment which seems particularly promising is the use of a three-eighths inch steel cash compartment. Pay-on-answer coin boxes may also in future be fitted square-on to the back of the kiosk, instead of at an angle of 30 degrees, to strengthen the fixing. Stronger cords and handsets are being developed and experiments with the use of perspex instead of glass in kiosk panels are in hand.

Coin Box Housings

No review of coin box development would be complete without mention of public coin box housings. The present kiosk was designed in 1935 by Sir Giles Gilbert Scott and while it has stood the test of time it possibly has a somewhat dated appearance and a new design of kiosk is now being manufactured.

This new kiosk—No. 8 in the series—will be manufactured, as are present kiosks, in cast iron. Its most distinguishing features are its clean lines, large panes of glass and a fibre glass roof through which the interior lighting will glow at night. It was designed by Mr. Bruce Martin, an industrial designer, and should make its appearance towards the end of 1968.

The Post Office has also been trying to find a much cheaper form of coin box housing and various forms of boothette have been considered. Possibly the most successful of these is likely to be a transparent perspex dome but no form of boothette gives full protection to either the user or the equipment in bad weather—an

OVER

This is the new table model of a renters' pay-on-answer coin box which has been produced in two tones of red. The designing of a completely new box has been deferred until it is known which coins will be used under the decimal currency system.

important consideration for public telephones in this country. An experiment with the type of walk-up, drive-up telephone which has recently been introduced in America may be held later. With this coin box telephone the equipment is protected but the user must keep up his umbrella!

In remote areas of Scotland public telephones without housing or coin box are being tried out. These are available only for emergency calls and for calls for which the user does not have to pay at the time, such as transferred charge and credit card calls. The dial associated with this instrument operates only on 1, 9 and 0. While telephones of this type enable people in remote localities where there are no public telephones to summon assistance, they cannot offer the same facilities as ordinary or coin box telephones; all calls must be connected by operators and special means of identification to the operator must be devised to ensure that the only calls connected are either those for which payment can be made in some special way or genuine emergency calls.

The Future

What of the future? The immediate problems are to get everything in train for a satisfactory conversion to decimal currency; to win the war against vandals and to improve call office finances by getting pay-on-answer coin boxes installed as fast as possible. Because of decimal currency, contractors manufacturing all types of coin vending machines will have a heavy programme of work before them for the next few years and this, together with the present economic situation, may mean that development of some of the Post Office's ideas will have to be deferred for the present.

Public telephones without a housing or coin box, but contained in a weatherproof casing, are now being tried out in Britain. They are designed for making emergency calls or calls which do not have to be paid for at the time. This picture shows one of the new weatherproof telephones at Invernaver, in Scotland. Other weatherproof telephones have been installed at Scadabay, on the Isle of Harris, and on the Catterick by-pass.

THE AUTHOR

MISS E. A. KNIGHT, *one of the few women in the Post Office to hold a degree in engineering, is a Principal in the Tariffs and Legislation Branch of the Inland Telecommunications Department and is concerned with all aspects of Call Service charges, Information services and Public Call Offices. She joined the Post Office in 1936 as a Clerical Officer.*

New Exchanges for the North-West

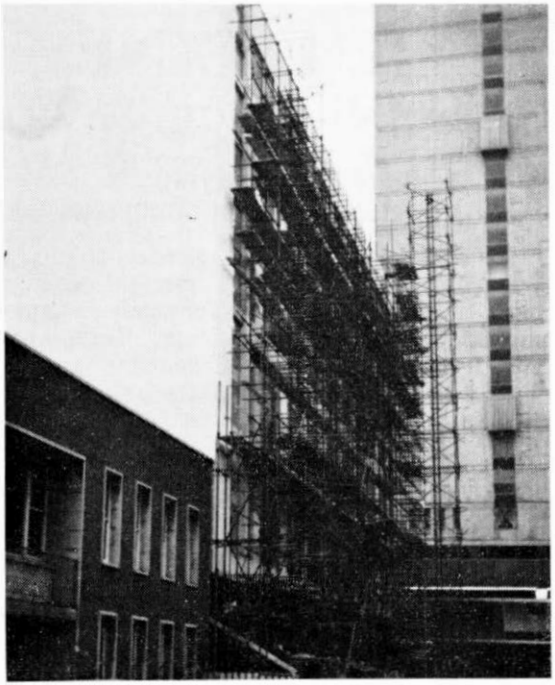
Pressing ahead with the development of the trunk telephone service, the Post Office is building two major automatic trunk telephone exchanges in Manchester and Salford to handle the rapidly rising number of STD calls.

By DAVID NORBURY

At present, the Manchester area's outgoing STD traffic is handled by three register-translator centres—at Dial House, Salford; Edgeley RTC, Stockport and Ashton RTC—and is then routed through trunk switching equipment at Dial House. This equipment also carries incoming trunk calls to the Manchester area.

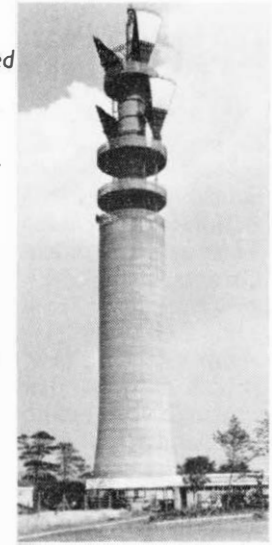
To meet the increasing number of STD calls —telephone users in the Manchester area make ten million trunk calls a quarter, 75 per cent of which are subscriber dialled—the new exchanges are now being built to switch outgoing calls into the national trunk network and to receive incoming calls from other parts of the country.

A £1.4 million contract, the largest of its kind yet placed in the North-West, has been awarded to AEI Telecommunications for trunk switching equipment for the new Salford exchange in St. Stephen's Street. Construction work on the site, which adjoins Salford Town Hall, began in January, 1966. The three storey exchange building will be completed during 1967. The equipment will then be installed to provide initially for 2,700 outgoing trunk circuits and, by the early 1970s for 4,000 trunk circuits.



The new Salford Exchange, to be known as Turret, will receive STD calls from subscribers on 26 exchanges in the Manchester area and switch them into the national trunk network. From Turret, STD calls will be carried either by the underground cable system or on the microwave radio network by way of the communications tower at Heaton Park, Manchester.

Subscriber dialled trunk calls arriving in Manchester from other parts of the country will be handled by Rutherford exchange in George Street, Manchester. The £400,000 exchange building will be completed during 1966 when equipment costing £600,000 will be installed. This equipment, manufactured by the Automatic Telephone & Electric Co. will provide 2,400 incoming trunk circuits when the exchange opens in 1967.



Left: The Rutherford Exchange, still wrapped in scaffolding, will begin carrying STD traffic arriving in Manchester from other parts of the country during 1967. Right: This communications tower at Heaton Park is Manchester's link with the national microwave network. It will handle STD calls from the new Turret exchange and traffic from the rest of the country destined for Rutherford Exchange.

Venezuelan workmen remove a float from the cable after bringing it ashore at Maiquetia. Offshore lies Alert

VENEZUELA ON THE LINE

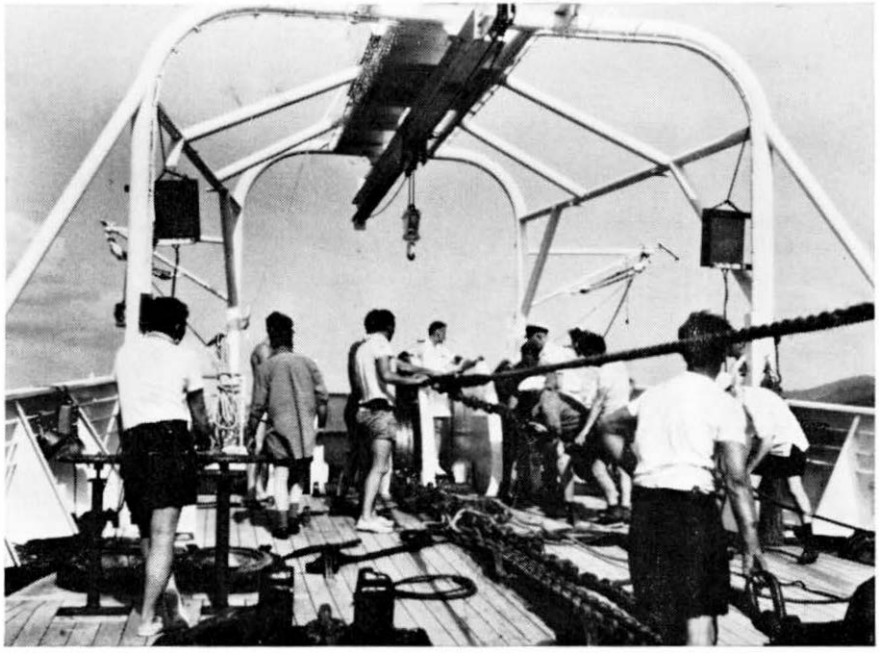
By J. B. HOLT, C.Eng., AMIEE

The British Post Office played a major part in planning and laying the new British-designed submarine telephone cable to link the Americas

At 11 am on 3 August 1966, in a ceremony to mark the opening of the first submarine cable telephone link between the North and South American continents, President Lyndon B. Johnson, speaking from the White House to Venezuela's President Raul Leoni, at La Casona, Caracas, said: *"This new link represents a very important step forward in improving global communication."* It was made possible by the completion of a new submarine cable system of British design and manufacture which extends existing cable facilities from the United States mainland to St. Thomas in the Virgin Islands, across the Caribbean Sea to Venezuela.

Until the opening of this new service, Venezuela depended on a few high-frequency radio circuits for international telecommunication which were insufficient to meet the demands for overseas calls caused by Venezuela's expanding trade with the United States, Europe and the rest of the world. The plan to link Venezuela to the United States by cable was first considered in 1962 and in June, 1964, the American Telephone and Telegraph Co (AT and T) in collaboration with its subsidiary, Transoceanic Communications Inc. (TOC) agreed with the Compania Anonima Nacional Telefonos de Venezuela (CANTV) to provide a suitable cable by August 1966.

The cable system chosen was to be one already well-proven in service as well as one which satisfied the basic requirements of cost



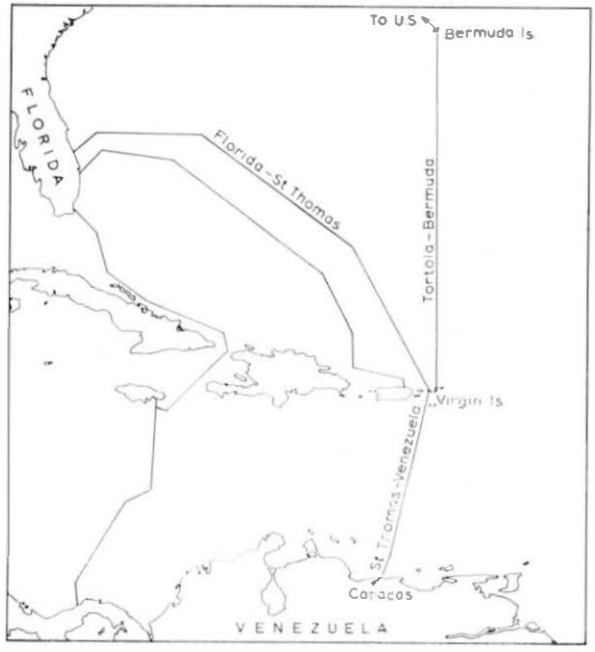
Captain Ruddock keeps a watchful eye over the bows as the crew of HMTS Alert recover the shore-end cable at Magens Bay.

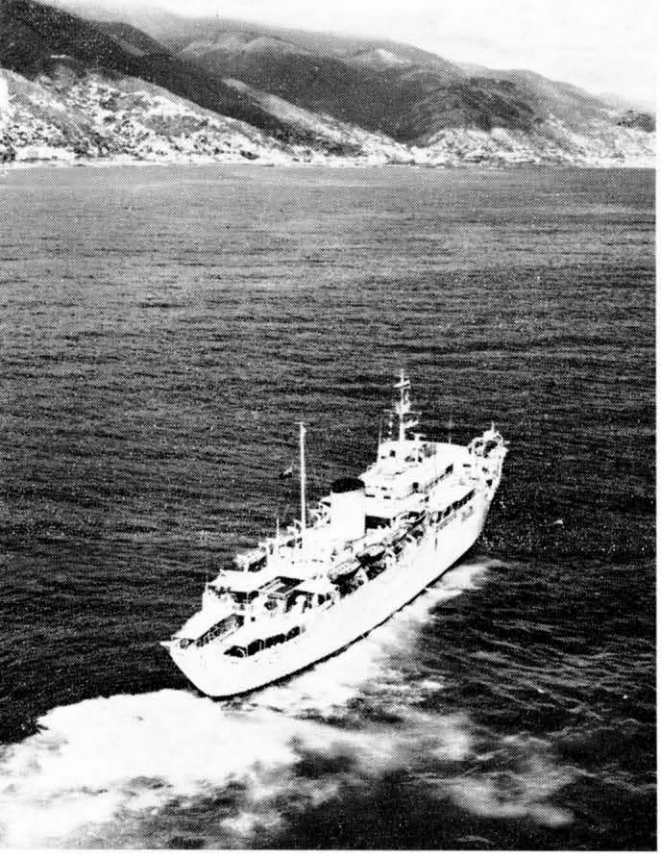
and circuit capacity. Examination of the various systems available led to the conclusion that the British Post Office designed Submarine System No. 2, with a capacity of 80 3kc/s telephone circuits, was the most appropriate.

The British system had been well tried, some 13,000 nautical miles having been installed between the United States and Bermuda and on the CANTAT, COMPAC and SEACOM sections of the Commonwealth Cable. It was also decided that the new cable—about 550 nautical miles long—should be provided from the existing Transoceanic Communications cable station at Magens Bay on the north side of the island of St. Thomas to a new cable terminal to be constructed by CANTV at Maiquetia, some 17 miles from Caracas on the coast of Venezuela. Since an AT and T cable already linked Magens Bay with Florida, the new cable would extend facilities from the United States mainland to Venezuela.

In the autumn of 1963, the Long Lines Department of AT and T and CANTV began to prepare the technical specifications of the submarine cable, its associated submerged repeaters and equipment installations at the terminal stations. Time was of paramount importance if the target

This map shows how the new cable from the Virgin Islands to Venezuela links with the cable from Florida to St. Thomas to join North and South America by submarine cable for the first time.





HMTS Alert *manoeuvres off the Venezuelan coast after completing the main lay.*

date was to be met and technical advice was obtained from the British Post Office Engineering Department which had past experience of this type of system. From these contacts a co-operation developed which lasted throughout the project.

Specifications were ready by the end of 1964. Tenders were invited from British telecommunications contractors and a contract was placed in May, 1965 with Standard Telephone and Cables Ltd., for the manufacture of 490 nautical miles of British Post Office Mark 1 lightweight, deep water cable; 67 nautical miles of armoured, lightweight, simulator, shallow water cable; 22 type-N submerged repeaters; one submerged equaliser; and all the submarine system terminal equipment from the cableheads to the group distribution frames. In addition, the repeater energising direct current power equipment, repeater test and monitoring equipments and (for Maiquetia only) the carrier supply generating equipment, were to be supplied

The contract also covered installing this equipment and certain other items to be supplied by AT and T and CANTV. It stipulated that all materials and production should satisfy the Tests & Inspection Branch of the British Post Office Engineering Department. The ready for service date was specified as 1 August, 1966.

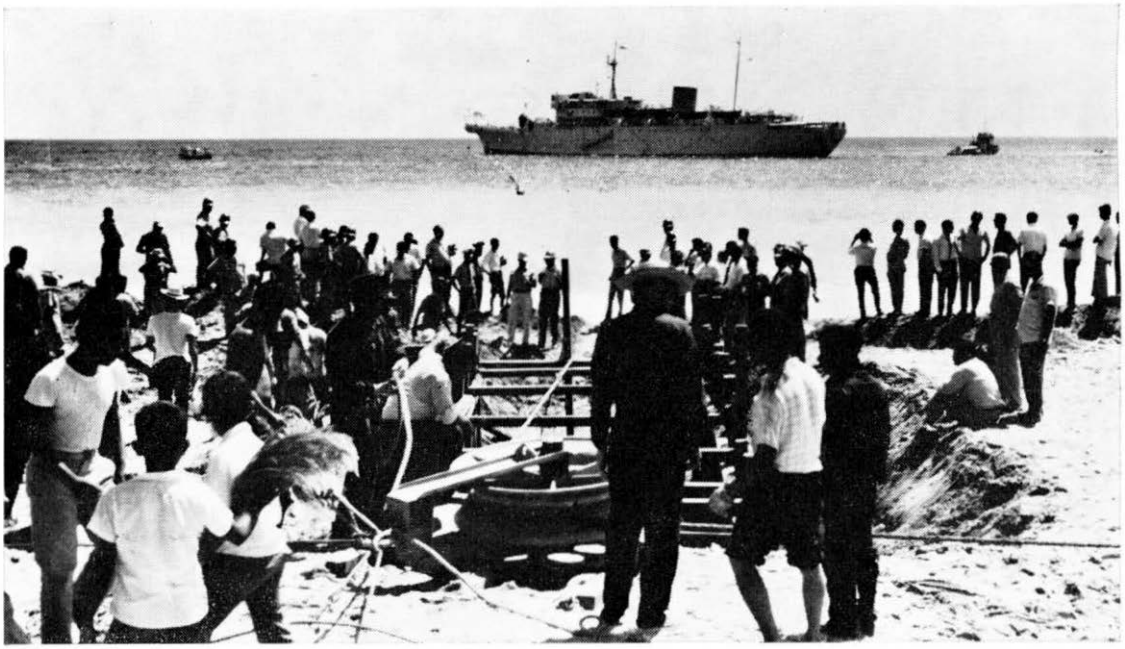
Further Post Office participation followed early in 1965 when the cable-ship HMTS *Alert* was chartered to lay the cable and a small team from the Main Lines Development Branch of the Post Office Engineering Department was chosen to exercise, on behalf of the sponsoring organisations, responsibility for the transmission testing and adjustment of the cable system during the laying and commissioning and its final technical performance.

Loading the cable and repeaters on to *Alert* at Southampton began on 9 June, 1966, and was completed in time for her to sail on 19 June for St. Thomas. There and at Maiquetia, the installation work had advanced to the stage where all essential equipment was ready and composite teams of AT and T, CANTV, Standard Telephone & Cables Ltd. and Post Office engineers were making the final preparations for the laying operation.

When *Alert* reached St. Thomas and berthed in Charlotte Amalie harbour on 30 June, even those often-frustrating formalities had been settled, largely by the efforts of the manager of the Transoceanic terminal station. Within a few hours specialised test equipment brought out on the ship had been moved into the terminal at Magens Bay and set-up ready for use.

The following day, with senior officials and

The trans-oceanic communications terminal at Magens Bay on the north side of St. Thomas.



Part of the crowd of Venezuelans who watched the new cable being hauled ashore at Punta Mulatos.

engineers of AT and T and CANTV on board as observers and other AT and T engineers working with the Post Office testing team. *Alert* sailed round to Magens Bay, picked up and made the first splice on to the shore-end section which had been laid during a previous operation. Initial testing was carried on during the night and at first light on 2 July *Alert* began paying-out the cable towards Venezuela.

A cable pay-out speed of 130 nautical miles a day was averaged and just after dawn on 6 July the Venezuelan coastline was sighted—9,000-ft. high mountains forming a dramatic backcloth to the coastal strip containing the port of La Guaira and the adjoining townships of Maiquetia and Punta Mulatos.

As *Alert* approached the coast, a formation of Venezuelan air force planes and a convoy of small private craft came out to welcome her and large crowds gathered in the cable landing area. The cable was quickly buoyed off and *Alert* entered the port of La Guaira, escorted by fire floats, sending curtains of water into the air, and to a chorus of siren blasts from naval and merchant vessels in the harbour.

The following morning, with the sun burning down on the beach, the shore-end was floated ashore at Punta Mulatos and, watched by another large crowd, the buoyed end was recovered and *Alert* made her final splice. *Alert's* task, carried out smoothly and efficiently under the command of Captain J. P. Ruddock, OBE, was completed. A few hours later the cable end she had landed was jointed to a land section extending it to Maiquetia and the work of commissioning the cable began.

The objective was to have circuits in operation by 25 July so that AT and T and CANTV could set up the special circuits required between Washington and Caracas for the Presidential opening ceremony on 3 August, and to have the system in public service the same day. Both these aims were achieved.

The operation was fittingly summed up by President Leoni of Venezuela. It brought his country, he said, into the vast communication network which linked people close together.

The project itself confirmed this sentiment for it brought together many men of differing interests and organisations who worked harmoniously at all times towards the realisation of a common objective.

THE AUTHOR

Mr. J. B. HOLT *is a Senior Executive Engineer in Main Lines Development and Maintenance Branch, of Post Office Engineering Department.*

A NEW CABLE TO NORWAY

The new submarine cable to be laid between England and Norway next year will mark a big step forward in overseas communications

By J. B. SEWTER
and B. K. MOONEY

ANOTHER landmark in the development and growth of submarine cable systems will be made in 1967 when a 480-circuit system is to be laid and brought into service between Britain and Norway.

The new system, developed and manufactured by Submarine Cables Ltd, will be the longest very-large-capacity system in the world and the first to use a large number of transistor repeaters.

In 1961, the North Sea Conference recommended that the existing cable between the two countries—laid in 1955 and providing 36 telephone circuits—should be supplemented by a new 120-circuit system to be brought into service in 1966/67. By the time the system was planned in detail, however, traffic requirements to Scandinavia had grown faster than had been expected and major advances had been made by the British Post Office in developing and manufacturing reliable transistors suitable for use in wide-band submerged repeaters. It became desirable and possible, therefore, to increase the capacity of the new system fourfold.

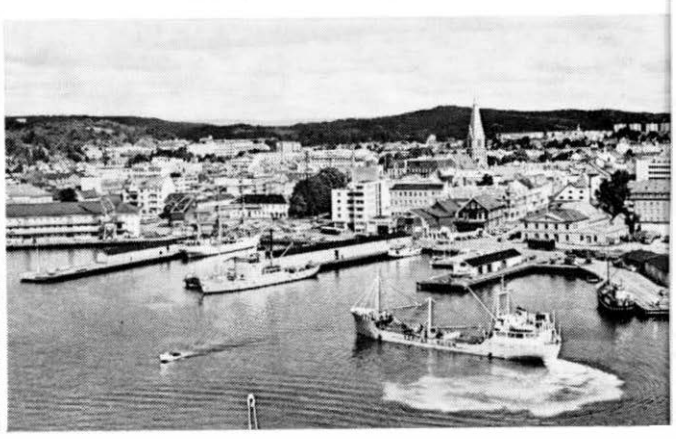
The 480 4 Kc/s telephone circuits, which are being provided between Scarborough and Kristiansand, require a submarine cable system with a bandwidth of 5 Mc/s. Fifty-three transistor repeaters, each spaced about seven-and-a-half nautical miles apart on the seabed, will be connected in about 390 nautical miles of 0.935-inch armoured coaxial cable. The direct current to energise the transistors in the repeaters will be fed along the cable and will be 150 milliamps. The total system voltage will be about 1,100 volts.

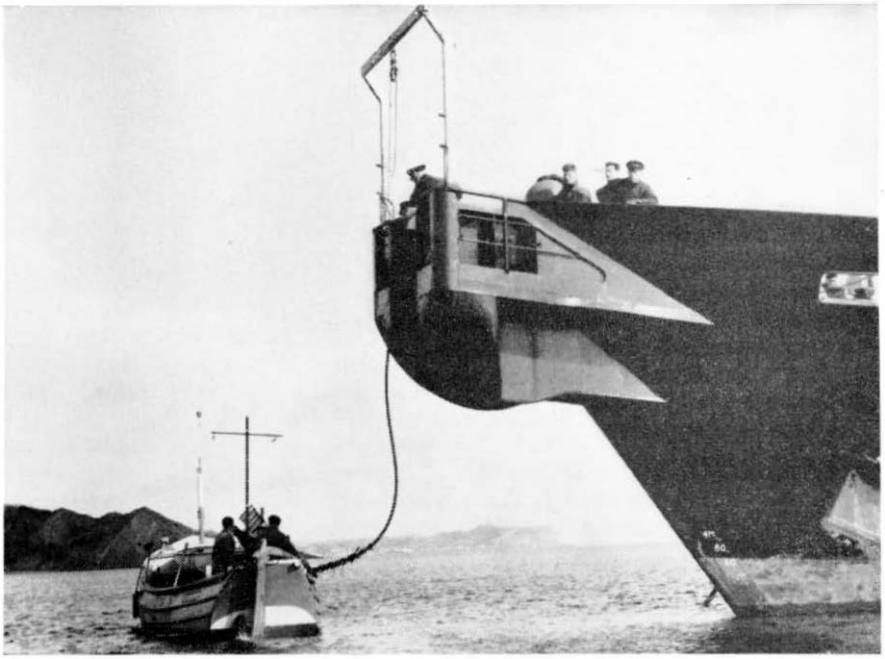
To achieve satisfactory transmission, the gain of the repeaters should match the cable loss over the entire frequency range. To compensate for the small differences in repeaters and cable during manufacture (on a long system of 53 repeaters these can build up to appreciable amounts) four submerged equalisers will be inserted at various points along the cable. These equalisers will be factory sealed, but can be switched before laying to give the necessary correction between repeater gain and cable loss.

The terminal equipments installed at Scarborough and Kristiansand will include equip-

Continued on page 18

The 480-circuit cable will run from Scarborough (left) to Kristiansand (right), a distance of 390 nautical miles.





A local fishing boat takes the cable end from the Danish cable ship Peter Faber.

The shore-end cable being laid at Cayton Bay, Scarborough.

ment which will monitor the performance of the submerged repeaters in normal service and will be used to locate any cable or repeater faults.

The landing points for the submarine cable are at Cayton Bay, just south of Scarborough, and near Kristiansand, in Norway. The land cables between the terminal repeater stations and the landing points were completed in April, 1966, and the submarine shore-ends (transmission and earth cables) were laid by the Danish cable ship *Peter Faber* at Scarborough and Kristiansand in April and May, 1966.

The main section of cable with repeaters and equalisers is scheduled to be laid by the British Post Office Cable ship HMTS *Monarch* in the autumn of 1967. On this operation *Monarch* will load 390 nautical miles of cable with 53 repeaters and four equalisers jointed in and sail for the Scarborough shore-end which she will pick up and joint to the system loaded in the ship. During the laying, continuous testing will be carried out between the ship and the Scarborough terminal through the cable and repeaters. Based on the results of these tests, which will be affected during laying by the temperature of the sea bottom and by laying effects on the cable, decisions will be made on the correct settings of the equalisers as the lay progresses.

On arrival at Kristiansand, *Monarch* will pick up the shore-end which will have been buoyed off in readiness, cut off the remaining stock cable in her tanks and joint the system to the shore-end. This operation—known as making the final splice—completes the laying of the system which will then be tested between Scarborough and Kristiansand. The cable should be carrying traffic by early December, 1967.

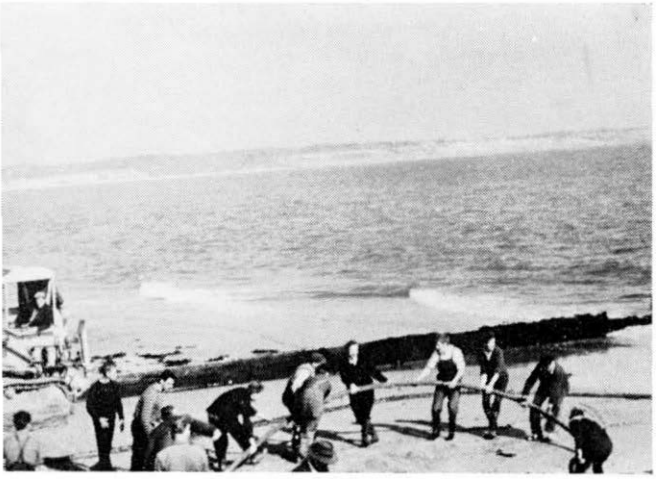
The new cable, in conjunction with submarine cable systems between Kristiansand and Denmark and overland systems between Kristiansand and Oslo and beyond to Sweden, will provide the additional telephone capacity required now and for some years between the United Kingdom and Scandinavia.

★

. . . AND A NEW CABLE TO JERSEY

WORK has begun on the laying of a new submarine cable which, within the next few years, will treble the number of telephone circuits now provided to the Channel Islands.

The new cable—which will run between Christchurch, in Hampshire, and St. Helier, in Jersey—will have four times the capacity of any other cable system of its size at present in use in the world. The system will be of the most advanced design and have 18 transistorised submerged repeaters, each placed eight-and-a-half miles apart, to boost the 480 simultaneous conversations which it will ultimately carry.



Preparing to dig in the shore-end cable after it has been hauled ashore near Hengistbury Head.

The terminal stations will be in the Post Office repeater stations at Tuckton Bridge, Bournemouth and at St. Helier.

The laying of the shore-end cables, which was recently carried out in bad weather by the Dutch cable ship *Poolster*, presented some difficult problems. At the southern England end the most suitable landing site was an area between Hengistbury Head and Christchurch Harbour. Here, since the sea approach is indirect and over a rocky bottom, the shore-end cable had to be double-protected with the heaviest armoured wires yet used in Britain.

In addition, because of the fairly shallow

The Dutch cable ship Poolster *lies off St. Helier as the shore-end cable is landed and work begins to link it to the repeater station.*

water and the great weight of the shore-end cable, neither the smallest of the Post Office cable ships nor local small vessels could be used. For this reason, the British Post Office had to call on the Dutch *Poolster*, which is particularly suitable for this type of work, to operate with the Post Office ship HMTS *Iris*.

Poolster was also employed to lay the shore-end cable at St. Helier where large sandy beaches are surrounded by extensive areas of rock.

The laying of the main cable—about 130 miles long—will be completed in 1968 and laid by the British Post Office's HMTS *Monarch*.

★ ★ ★

DIAL-A-DISH FOR LONDON

PEOPLE living in London can now dial a number—246 8071—and listen to a recorded announcement giving a recipe for the main course of a mid-day or evening meal.

The new London Recipe Service was opened on 6 October by Baroness Phillips who said it should appeal not only to housewives but also to the many thousands of single men and women who live in flats and bed-sitters and cook their own meals.

The recipe service was introduced in Birmingham in 1961 since when it has spread to Bristol, Liverpool, Manchester, Belfast, Edinburgh and Glasgow. The number of calls to the service has risen from about 350,000 in 1963-64 to nearly 900,000 in 1966. By the end of 1967, when the Post Office plans to extend the service to a large number of other places—including Leeds, Sheffield, Gloucester, Cheltenham, Bradford, Huddersfield, Southend, Chelmsford, Derby and Plymouth—the number of calls is expected to increase to well over one million.

Baroness Phillips, who is the Post Office spokesman in the House of Lords, emphasised that existing resources are used to provide the recipe service. It is made available as part of the normal exchange development in those places where there is good reason to believe that it will be both profitable and meet a public demand.

* *A new weather forecast service for the Thames Valley was opened on 30 September.*

★

NEW DIRECTOR FOR NORTHERN IRELAND

THE new Director of the Post Office in Northern Ireland is Mr. G. H. Coates, M.B.E., who takes over from Colonel M. G. Holmes when he retires in the New Year.

Mr. Coates, whose father and grandfather also served in the Post Office, began his career in 1929 as an Inspector in the Radio Branch of the Engineer-in-Chief's Office and was closely associated in his early years with world-wide radio telephony. In 1948 he was transferred to administrative work at Headquarters on buildings and establishment and in 1954 became Staff Controller and subsequently Deputy Director of the External Telecommunications Executive. Until recently Mr. Coates was an Assistant Secretary in the Personnel Department.

Colonel Holmes joined the Post Office in the Engineering Department in 1927, later serving as Telephone Manager, North-West Area, London, at Post Office Headquarters, as Telecommunications Controller, and subsequently Deputy Director, Scotland from 1957 until his appointment as Director, Northern Ireland in 1962.

★

AUTOMATIC

Only 305 of Britain's 6,034 telephone exchanges were still being operated manually at the end of July, 1966, when automatic service was available to 95 per cent of the country's 6.69 million exchange connections. In the 12 months ending July, 94 manual exchanges were converted to automatic working.

THE TALE of the REPERTORY DIALLERS

Two new devices which remember telephone numbers and dial them for the caller are going on trial. The author traces the history of repertory diallers since the director automatic system was introduced in London more than 30 years ago

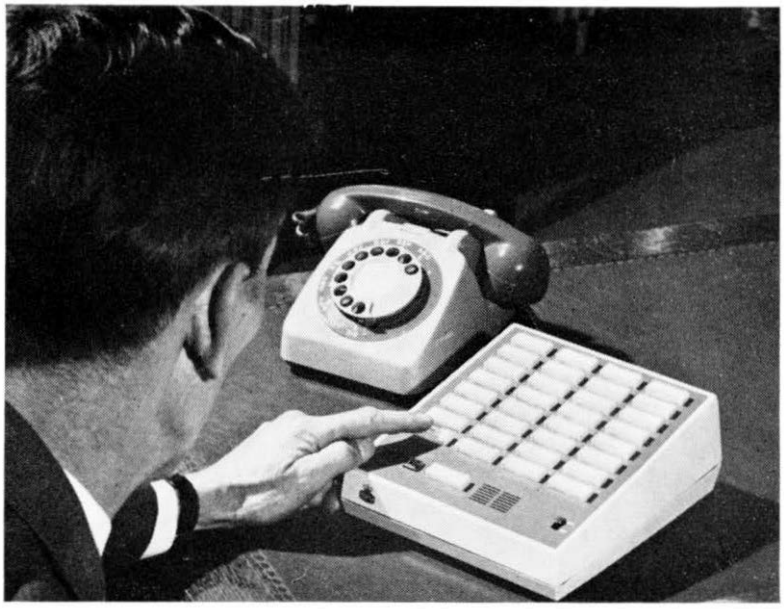
by J. d'A. COLLINGS

The Tape Callmaker stores telephone numbers on a magnetic tape in the unit shown on the left in this picture. The dial-in unit is plugged into the tape unit when numbers are inserted into the store.

TWO new repertory diallers—to be known as the *Tape Callmaker* and the *Key Callmaker*—are about to go on trial in London. If the trials are successful one or both of these new instruments may eventually become generally available to subscribers.

The story of repertory diallers — devices which remember the telephone numbers you call frequently and dial them for you—began as far back as 1931. In that year, soon after the director automatic system, with its seven-digit numbers, was introduced in London, it became apparent that a device for pulsing out a limited number of pre-determined telephone numbers automatically would be a great time saver and lead to fewer wrong numbers. Development was put in hand and in 1933 the Post Office launched the *Autodial*.

There were two models of the *Autodial*—one with a capacity of 25 and the other of 50 num-



The Key Callmaker provides 32 telephone numbers which are selected by individual press buttons. A small loudspeaker is also incorporated in this design for monitoring the progress of the call.

bers. Each number was made up of up to seven digits and was selected by sliding a pointer over an index at the top of the case and depressing a lever on the front to tension a spring-motor to operate the device on release of the lever. The digits were pulsed out by contacts operated by the notched edge of revolving brass discs, one for each number stored. Changing a number meant that a maintenance engineer had to fit a fresh disc.

The *Autodial* was discontinued shortly after World War Two and for some years there were no further developments.

Requirements today are more sophisticated than in the 1930s. International Subscriber Dialling means that telephone numbers can consist of 16 digits and storage requirements can range from around 30 numbers for business executives to several hundred for wholesalers who employ full-time staff to telephone their retail outlets. The cost and scarcity of engineering manpower demand that changing a number in the store should be a simple operation which the subscriber can carry out himself.

Various designs have been developed abroad in recent years and study of these, together with market research trials of purchased models, has assisted in setting out a policy on the form of repertory diallers for use in the British Post Office system.

Further trials are now taking place with a new repertory dialler made under licence from an American company (the DASA Corporation). This model—to be called the *Tape Callmaker*—consists of a compact magnetic tape storage unit connected to line and a separate detachable dial-in unit for use when inserting numbers in the store. A magnetic tape, eight feet long and three inches wide, stores up to 400 telephone numbers, each up to 18 digits of 10 pulses and recorded across the width of the tape.

The magnetic tape unit is contained in a black plastic case which has a clear perspex window behind which the magnetic tape passes. To record a number, the dial-in unit is plugged in to the back of the tape unit and a flap under the window is opened to expose the magnetic tape. The correspondent's identification is written in pencil directly on to the magnetic tape which has a white coating on the front for this purpose. The tape is then moved until the entry is between the guide lines in the window (indicating that this portion of the tape is over the record/playback head) and the appropriate digits, including the STD and ISD codes, are dialled in. The digits are recorded in the form of blips corresponding to each dial pulse. A "wait" lamp is provided so that each digit is

OVER

completely recorded before the next is dialled. When used on a PABX a stop occurs after the exchange access digit to allow a wait for second dial tone. Sending is re-started by pressing a special button.

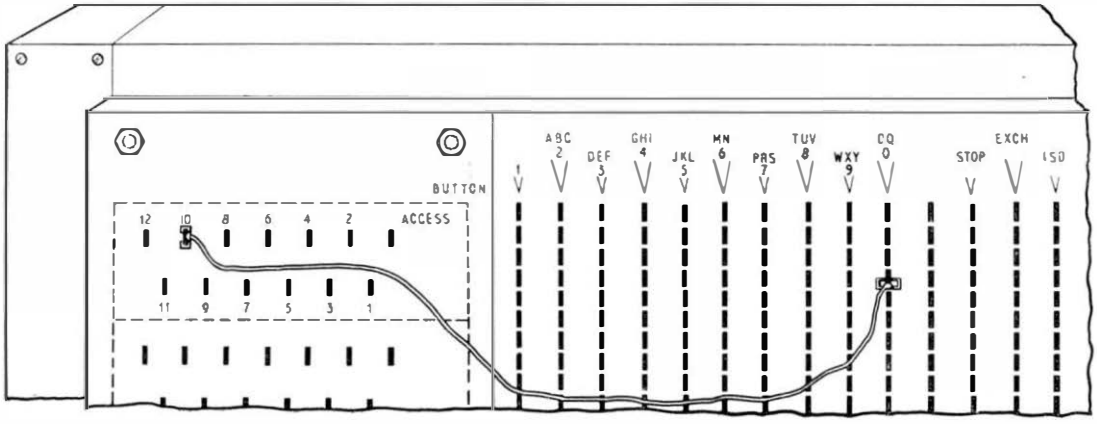
To make a call on the *Tape Callmaker*, the approximate position on the tape of the wanted number can be quickly reached by a forward and reverse motor-drive controlled by a two-way key on the front of the unit. Final adjustment is then made by a manual selector knob. Under motor drive the tape moves too rapidly to be legible so a red line is printed diagonally along the length of the white side of the tape and an alphabet is inscribed across the bottom of the window. As the tape moves, this line appears to traverse the alphabet and so provides an index to the tape. With the wanted name between the guide lines in the window, the receiver is lifted and, when the dialling tone is received, the call button is pressed. The play-back of the recorded blips causes a reed relay to pulse out the wanted digit trains.

If an inter-digit pause has been included, the dialler stops at this point until the special button is depressed on receipt of the second dial tone. Pencil entries can be erased from the tape with a very soft rubber and magnetic entries are automatically deleted when new numbers are recorded over them.

The *Key Callmaker*, the second repertory dialler on which trials are also being carried out, operates on a different principle. The subscriber is provided with a tablet of 32 press

With the Key Callmaker *the telephone numbers are set up on a separate wall unit shown here.*

Diagram of the translation field of the Key Callmaker, *showing how digits are selected by small leads.*



About 40 Tape Callmaker and Key Callmaker repertory diallers are being tried out by a number of selected subscribers in London and the trials may continue until the Summer of 1967. About 200 of the new instruments will then be put on market trials in the City area.

buttons beside his telephone and depressing any button initiates the dialling of the number with which it is associated.

The action of the *Key Callmaker* is basically electronic. The digit pulses are not pre-stored but generated when required by a transistor multivibrator. The multivibrator, counters and a jumper field are mounted in a separate wall unit remote from the telephone. Clusters of 13 tags—one cluster for each press button on the tablet— are provided down the sides of the wall unit and there are 14 vertical bus bars in the centre which control the counting circuits. To set up a number, the required digits are selected one by one by connecting the appropriate tags to the bus bars for the counters with small jumper leads of PVC-covered flex, six inches long with spring clips at each end. One jumper is used for each digit in the number. This arrangement is similar to the plug-board used

The numbers in the 1933 Autodial were stored as serrations on the edge of brass discs cut by an engineer. To make a call a pointer was slid to the appropriate name on the index and the lever at the front of the unit was depressed.

to control mechanical punched-card processing equipment.

STD or ISD codes can be included in the *Key Callmaker* system which also provides for the access digit on a PABX. To make a call the appropriate button is pressed and pulsing begins. To avoid the need to lift the handset before the distant correspondent answers, a small amplifier and loudspeaker are incorporated in the desk tablet, thus enabling the progress of a call to be monitored after a button has been pressed. If the handset is not lifted within 60 seconds after the call matures a "time-out" device operates to disconnect the line. A cancel button is also provided so that a call can be abandoned at any stage.

Yet another form of repertory dialler—one which stores numbers on punched or marked cards—is also to be developed. It will be known as the *Card Callmaker* and has two advantages over any other type. First, there is no limit to the number of telephone numbers that can be stored and, second, the cards can be pre-sorted for sequence calling if required. In addition, the same cards can also be used in more than one instrument.

To call a number the caller selects the appropriate card and inserts it in a slot in the dialler. When action starts, the card is read row by row, sending "dial" pulses to set up the call.

Considerable interest has been shown in the development of repertory diallers, particularly by business customers, and they are likely to become an increasingly useful telephone aid as STD and ISD expand.

THE AUTHOR

MR. J. d'A. COLLINGS, *is a Senior Sales Superintendent in the Subscribers Apparatus Division of Inland Telecommunications Department Marketing Branch. He joined the Post Office in 1948 as a Technician at Criggion Radio and in 1950 became a Sales Representative in the Bedford Telephone Area. He moved to GPO Headquarters, as an Assistant Sales Investigation Officer in 1958, and took up his present post after three years secondment to Central Organisations and Methods Branch.*

Introducing . . .

THE NEW PABX 4

By P. A. MARCHANT, AMIEE

A standard system has been introduced for the PABX 4 to overcome the problems created by the need to deal with a number of variants

The AEI PABX 4 has a display panel built on the turret principle and is mounted on a metal frame.

SIX types of Private Automatic Branch Exchange are at present in use by the Post Office. They are the PABX 1 (with a cordless switchboard and automatic equipment for a maximum of 49 extensions); the PABX 2 (a similar equipment but with a cord switchboard); the PABX 3 (automatic equipment with a cord manual board for large installations); the PABX 4 (a cordless type also for large installations); and the PABX 5 and 6 (small, fully-automatic systems catering for a maximum of 20 extensions and which need no switchboard operator).

All these PABXs are of standard design except the PABX 4 which, in the past, has been supplied by using manufacturers' own proprietary designs. Although design approval by the Post Office has ensured that acceptable equipment and operational practices have been used, inevitably differences exist between them. To overcome the problems arising from the need to deal with five or more variants, a standard system has now been introduced. It will be known as the PABX 4, the previous models being distinguished by the manufacturers' prefix—for example PABX STC 4.

To provide the facilities required of a modern PABX, the switching system of the PABX 4 is necessarily complex and can be only briefly described here.

The design follows conventional step-by-step switching principles but some novel features have been included. The equipment is extensible from the basic unit of 50 extensions to a total of some 7,000 extensions, with no limitations on the number of manual positions, exchange lines and private circuits which can be provided.

The basic design covers all the facilities normally required by a PABX customer. In addition, special facilities can be provided although these are not all as yet covered by the standard design and will continue to be supplied in a proprietary form for the time being. Equipment practice also follows the conventional pattern.

Satellite PABXs can give considerable line economy and they have been catered for in the new design, full facilities for satellite extensions being achieved mainly by the addition of small registers at the satellite. This, with other design features, ensures that an extension connected to a satellite now enjoys the same facilities as

it would if connected to the main PABX. In addition, there is no need for special routing codes to and from the satellite or for different operating instructions.

Although the objective of a cordless system is to reduce operator control of calls to a minimum, the switchboard still retains a position of importance in the system. Telephonically it is the shop window of the PABX. From a design aspect, cordless switchboards have the advantage that functional requirements are no longer the major consideration. Operators are not now required to sit closely in line facing a formidable array of multiple jacks. Instead, they can sit at attractive desk-type cordless positions with simple press-button controls with an illuminated display of operating information presented automatically as required.

Switchboard presentation is important and variety in design, which allows customers a choice, is a distinct advantage. This has been achieved in the PABX 4 by giving the manufacturer freedom in design while providing the essential operational and engineering requirements of the Post Office. All the switchboards have been approved by the Council of Industrial Design and constitute the standard range offered by the manufacturers. Other designs which may be offered to suit special requirements are not excluded.

The functional part of a cordless position is little more than an assembly of keys and lamps used to control and supervise the automatic equipment. The switchboard provides no through connection for any call. Controls are routed from the automatic equipment to the switchboard as and when the operator calls for them. The presentation of calls to the operator, the routing of calls from the operator and the final clear down of connections are all performed automatically. This simplification of operator control and supervision is achieved by adding automatic equipment to perform the functions previously completed manually.

The cost of this additional equipment can be offset if the facilities provided by the cordless system are fully used to allow savings in switchboard equipment and operating staff.

The two main components of the switchboard are the display screen and the control keyboard. By means of an illuminated display, the former tells the operator of calls awaiting

The GEC PABX 4 follows the conventional cordless switchboard design and is made in light teak to blend with modern office furnishings.

answer, the class of call, route information, line identification, supervision of calls in progress and provides other miscellaneous information. This information is displayed by lamps mounted at the rear of a non-reflective glass screen, with a suitably marked negative film interposed between lamps and screen.

All keys on the keyboard are of the press-button type. Located centrally are the connecting circuits on which calls are held while being progressed by the operator. Normally six are provided, the maximum being eight. On the left of the keyboard are call selection and miscellaneous control keys and on the right a key-sender for use on both internal and external calls. The dial is for emergency use only and is normally hidden from view.

Incoming calls to the PABX 4 may be operator-connected or dialled-in directly to the extensions. Normally, all incoming exchange calls are operator-connected as are inter-PBX calls if they cannot be given dialling facilities. Where dialling is provided the arrangements follow standard PABX practice.

When an incoming call arrives for connection by an operator a signal is given on all cordless positions. In all circumstances an indication must be given of the class of call, that is,

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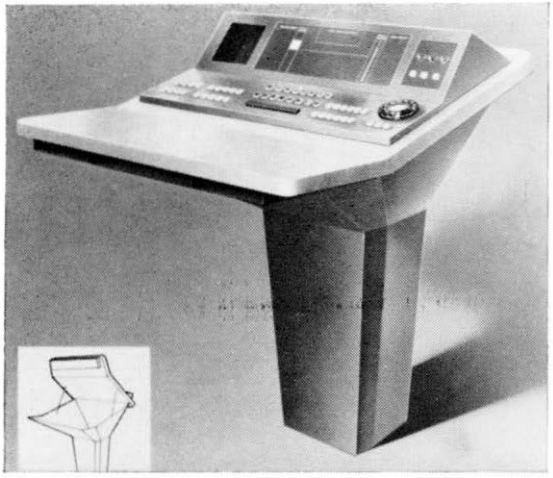


Above: The column type PABX 4 designed by the Plessey Telecommunication Group (ATE) is mainly in metal and very much in keeping with the design trends of the 1960s. Below: Another of the Plessey Group's designs, the Ericsson PABX 4. It is similar in keyboard design but rather more conservative.

whether it is an exchange, inter-PBX or an assistance call. Common answering may be provided which means that the next call waiting, whatever its class, is accepted by the operator. Alternatively, the operator can select the class of call to be answered. The operator accepts incoming exchange calls by depressing an answer bar or key and selecting a free connecting circuit. She then routes the caller automatically to the extension required, by using the keysender.

When the call is established all switchboard contact is automatically released from the connection. Up to this point full supervision is given to the operator. If for any reason the call has to be supervised the hold key of the connecting circuit concerned may be operated to prevent automatic release from the switchboard. If a called extension is engaged and the caller decides to wait, the call remains connected under operator supervision until the extension becomes free when it is automatically rung and connected.

With minor exceptions, outgoing calls from the PABX can be made automatically by the extensions. This is the ideal arrangement if maximum advantage is to be obtained from a PABX and particularly so with cordless working. Unfortunately this ideal is not always obtained in practice mainly because freedom of access to the outside network for all extensions does not always suit the customer.

Where outgoing traffic is dealt with automatically the arrangements follow normal PABX practice. The extension dials the appropriate routing digit or digits to obtain connection to the outside lines. If a call is to be connected by way of the manual position "0" is dialled. The operator accepts the demand and connection is made by reversing the call to the extension concerned. When established, the connection is identical to that for an incoming call.

Apart from extension-to-extension connections, all established calls can be held while an enquiry is made of another extension or transferred to another extension under the control of the extension user. This is a common feature of cordless systems where a high degree of extension control of calls without operator intervention is desirable. The operator may, however, be called in if desired and there is a

built-in safeguard which ensures that in the event of misoperation by the user an outside caller is not left unconnected but is switched automatically to the operator.

Another important facility which can be readily applied to large cordless systems and which has been designed into the PABX 4, is direct dialling into PABX extensions from the main exchange network (DDI). This is achieved by allocating exchange numbers to the extensions, so that a call is routed from the main exchange through the PABX equipment directly to the required extension without the intervention of the PABX operator. This facility will undoubtedly become popular when exchange multiple numbers become more readily available. When fully used it could remove the only remaining essential switching junction of the cordless switchboard operator and thereby reduce the operating responsibilities to assistance and enquiry only.

With STD in mind, the PABX 4 provides an operational facility for metering calls at the switchboard on a common exchange line basis, or at the extension point. The switchboard provides for meters at the right of the display panel which the operator can associate with any outgoing call set up by way of the switchboard. Association of the meter is automatic. STD codes may be barred to individual extensions and, as with all PABXs, access to the exchange network can be barred completely.

Tandem switching for private circuit networks, either manually or automatically operated, can be provided and among the many other facilities are full night-service arrangements, access to dictation systems, supervisors and enquiry desks. A standard system of key-calling, which gives immediate access between an executive and a selected group of extensions and can incorporate loud-speaking telephones, will be available shortly.

The optional features which have been provided for a number of cordless installations in the past will continue to be available, although the frequency of demand may not in every instance warrant the development of standard arrangements. The optional features include conference facilities set up by the operator or controlled from selected extensions; emergency call arrangements resembling an internal 999 Service; manual extensions giving immediate access to the operator; short-code dialling (obtaining frequently called numbers by dialling or keying a code of two or three digits); night watchman's patrol systems; staff location systems; internal queueing systems for enquiry bureaux; calling line identification to the operator; special facilities for hotels and the provision of automatic accounting of calls; and press-button telephone working.

The STC PABX 4 is a happy combination of wood and metal, at home in any setting.

This list is by no means exhaustive. The new PABX is expected to be closely integrated with the needs of industry and commerce and not necessarily confined to precise telephone communication. No doubt the future will call for even more elastic treatment but the PABX 4 equipment should be able to cope.

THE AUTHOR

MR. P. A. MARCHANT, AMIEE, *is a Senior Executive Engineer in the Subscribers' Apparatus and Services Branch of the Engineering Department. He has been intimately concerned with all aspects of PABXs since the introduction of Post Office standard designs in 1950. He is at present in charge of a group responsible for electro-mechanical PABX design.*

DOLLIS HILL GOES ON SHOW

The Post Office Research Station invites scientists and technologists to see some of the work which is being carried out in the field of telecommunications

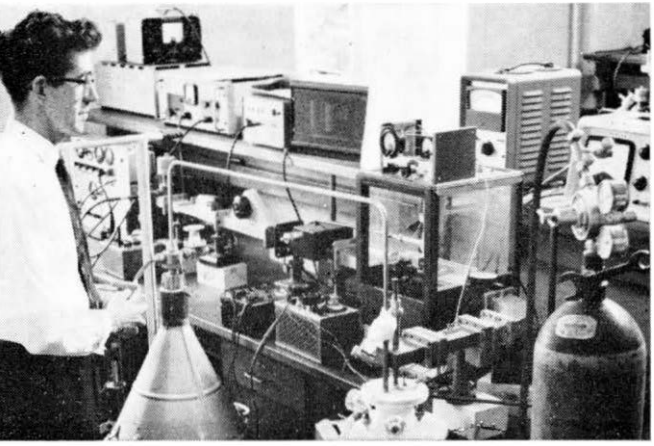
THE curtain which normally hides the work carried out at the Post Office Engineering Research Station at Dollis Hill was drawn aside recently to show scientists and technologists from industry and universities some of the remarkable inventions and advances which are being made in the telecommunications field.

Among the 68 exhibits was experimental equipment designed to expand and improve the message-carrying capacity of the microwave links now being set up throughout the country.

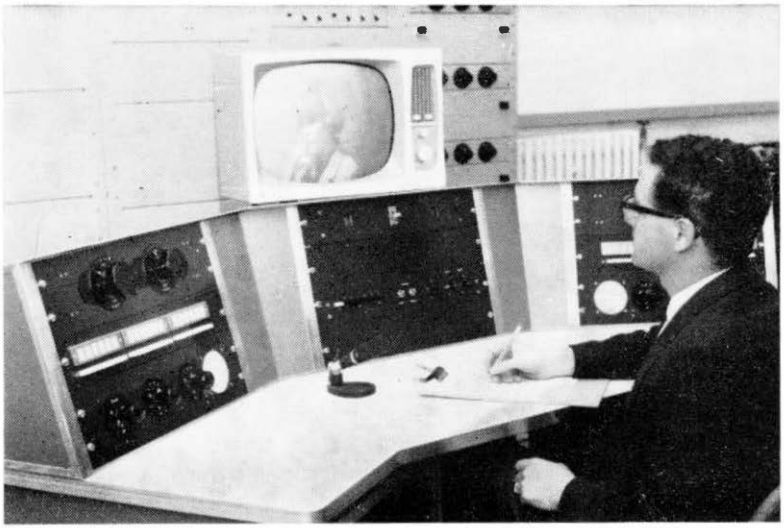
The microwave system is growing rapidly and existing radio links using high-frequency bands around 2, 4 and 6 Gc/s (million-million cycles per second) are being filled more quickly than was originally thought. It will soon be necessary, therefore, for other high-frequency bands to be used.

The number of channels a link can carry is directly related to the frequency of the carrier wave and experts at Dollis Hill are now experimenting to determine the upper practical limit of the frequency bands. To help discover the answer an experimental radio path has been set up between Cranfield and Everton, in Bedfordshire, which already suggests that microwave links with a frequency of 11 Gc/s are practicable over a distance of at least 15 miles. One problem is that the higher the microwave frequency the more it is affected by weather conditions (for example, microwave energy is absorbed by large rain drops). Fortunately, since the Cranfield to Everton link passes over the meteorological station at Cardington, it has been possible for local weather and the quality of reception to be accurately related.

Also on display were a number of lasers with which Dollis Hill is experimenting to find out, among other things, how they could be used to speed and expand telecommunications facilities.



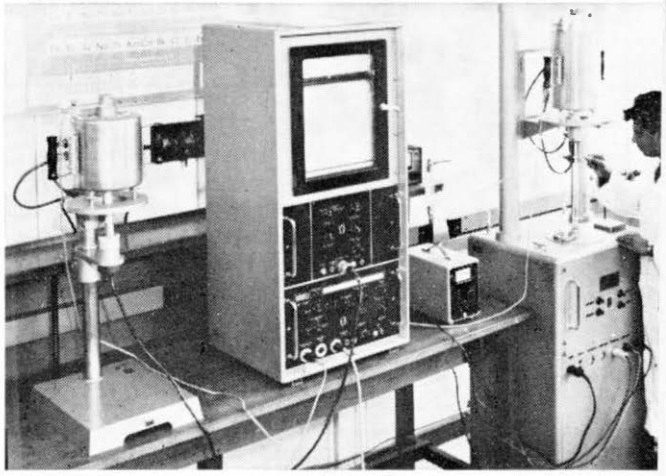
Very low noise parametric amplifiers are being developed for use at satellite communication earth stations. Here, AEE Mr. Bob Oakley determines the characteristics of a diode at liquid helium temperature—an essential step in the development of the new amplifiers.



Closed-circuit television cameras are used to study the way the handset is held in relation to the user's mouth when new telephone sets are given subjective tests. Far left: Miss Lorraine Leishman, a Clerical Officer, tries out a new STC handset while (left) Mr. Peter Boucherat, Assistant Executive Engineer, studies the results of the test on the television screen.

It may be possible, for example, to use lasers for producing beams of pure light contained in a copper tube, or "light pipe", along which many thousands of telephone messages, radio and television programmes could be carried all over Britain. One problem, on which Post Office scientists are now working, is that while signals can travel perfectly along the light in a straight line they become distorted when the light pipe has to go round a bend. To overcome this difficulty Dollis Hill is now experimenting with the use of very fine filaments of glass which would transmit the light round sharp radius bends. In such a system, messages would be superimposed on the light beams in the form of a modulation which could be made at a very high speed by applying an electric current to the special crystals through which the beams would be made to pass.

Visitors to Dollis Hill's Open Day also saw the latest pulse code modulation equipment which is being introduced into the telecommunications network as rapidly as possible to increase the number of circuits between exchanges. Pulse code modulation, invented by an Englishman, Mr. A. H. Reeves, in 1937, is a system of telephone transmission involving the time-sharing of pairs of wires between 24 simultaneous conversations by sampling each in turn and sending coded signals which are decoded at the end of the circuit.



Mr. Harold Baccus, a Scientific Officer, inserts a material into the thermogravimetric analysis apparatus which is used to find out the thermal stability of a new material and its compatability with various ambients. The recorder is seen on the left of the picture.

The speech waveform is sampled 8,000 times a second and each sample value is sent in telegraph code to the receiving equipment. The coded signal consists of "on-off" pulses which can be recognised despite distortion and interference, regenerated into perfect shape at intervals along a route and finally decoded to yield the original wave substantially without

OVER

Operators in the special Clean Room carry out the final assembly of No. 4A transistors which are used in submarine cable repeaters. These transistors need to have a minimum life span of 20 years so that extra special care is required to avoid contamination and imperfections from dust particles.

University to Test Waveguide

The Post Office recently placed a research contract with the Electrical Engineering Department of University College, London, to construct and test a one-mile length of low-loss circular waveguide for carrying telephone, television and sound radio signals. The system will be installed at Martlesham, near Ipswich, on the site to which the Post Office Research Station at Dollis Hill will move in 1969-70.

Professor H. E. M. Barlow and his associates at London University have been carrying out experiments with waveguides for many years and in 1965 gave public demonstrations with a 280-ft. long system which they had built around the roof of one of the College buildings.

Post Office staff will collaborate closely with Professor Barlow and his team at all stages of the experiment at Martlesham which, if successful, may open the way towards the introduction of operational waveguide systems for long-distance trunk transmission.

error. Samples from several talkers can be interleaved in time so that two pairs of wires can carry, typically, 24 conversations.

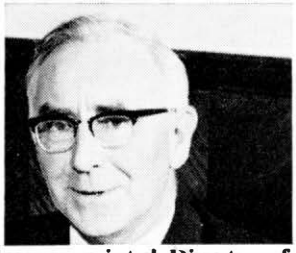
An order for £1 million worth of pulse code modulation equipment to be installed at junctions between exchanges has already been placed by the Post Office with telecommunications equipment manufacturers. If, as seems likely, pulse code modulation is used extensively in the junction network, it would be attractive to keep signals in digital coded form where junctions are connected in tandem as, for example, in most cross-London calls, and so save intermediate coding and decoding. This would halve the minimum economic junction length for the application of the system and conserve transmission quality. The tandem exchange in the pulse code modulation form should also be smaller and cheaper. Integrated pulse code modulation switching and transmission systems are being studied at Dollis Hill and a model tandem exchange is being built to test the feasibility of incorporating them in the existing network.

Also on show were reed relays with hermetically sealed contacts which will be used in the next generation of telephone exchanges—electronic exchanges. Since electronic exchanges will need a very large number of reed

relays and their long-term reliability is vital, a small production unit, equipped with laboratories, has been set up to carry out exhaustive studies into reed relays so that design techniques and failure mechanisms can be perfected.

Among other exhibits were a new machine which can joint wires on street cables much more quickly than any previous method; a new type of transistorised submerged repeater for submarine cables which can be used in the 12 Mc/s frequency range; push-button telephones; and test equipment for investigating data transmission over the public telephone network. ★

A NEW DIRECTOR OF RESEARCH



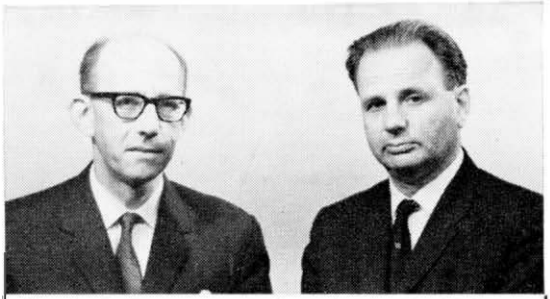
Mr. W. J. Bray

Mr. W. J. Bray has been appointed Director of Research in succession to Dr. G. H. Metson who retired in August.

The new Director, who joined the Post Office Engineering Department in 1934 as an Assistant Engineer in the Radio Experimental Laboratories at Dollis Hill, is one of Britain's leading authorities on radio communications and it was mainly due to him that the CCIR and the United Kingdom adopted common values for the essential characteristics for radio-relay systems. In 1961 he was selected to lead the newly-formed Space Communication Systems Branch of the Engineering Department and since 1963 had been head of a Dollis Hill team working on research into communication satellites and lasers. He became Deputy Director of Research in March, 1965.

Dr. Metson had a distinguished career in the Post Office which he joined in 1925 as a Youth-in-Training. In 1946 he became head of the Thermionics Group set up to study the causes of valve failure and which later designed and manufactured the very long-life valves on which the success of such projects as the CANTAT and COMPAC submarine cable systems depend. In 1962 he received the Institution Premium, the highest award which can be made by the Institution of Electrical Engineers. He was appointed Deputy Director of Research in the same year and Director in 1964.

DOLLIS HILL STAFF REWARDED



Mr. D. L. Richards (left) and Mr. W. T. Duerdoth.

Two Post Office engineers have become the first engineers in Government service to receive special merit promotions in recognition of their personal abilities. They are Mr. D. L. Richards, C.Eng., BSc (Eng.), AMIEE, FSS, and Mr. W. T. Duerdoth, C.Eng., BSc (Eng.), MIEE, who have been promoted to Staff Engineers by the Treasury Special Promotions Sub-Committee as a result of their work at the Post Office Research Station, Dollis Hill.

Mr. Richards has for many years been studying subjective rating of telephone systems and their interaction with the user and is internationally known for his work in this sphere. Mainly as a result of his efforts, design objectives in communications systems, including pulse code modulation and satellites, have been placed on a sound footing.

Mr. Duerdoth has a wide experience of transmission systems and has contributed a great deal towards negative feedback amplifier design and its application to repeaters for multi-channel telephony and television. He has been a member of the team which has pioneered electronic telephone exchanges and in the past few years has been involved in the study of integrated switching and transmission systems for digital telephony, using pulse code modulation.

★

165,171 UP

The number of calls made to the Test Match Information Service during the 1966 series against the West Indies totalled 8,362,991—the biggest for any series since the service began in 1956. The previous highest was 8,197,820 in 1964 durng the series against Australia.

THIRTY NATION SEMINAR

The delegates take time off for a picture at the end of one of the lectures. Representatives from 30 countries attended the seminar.

FORTY-FOUR telecommunications engineers and administrators from 30 different countries attended a two-week seminar arranged by the British Post Office to spread knowledge abroad of the latest engineering developments in planning, constructing and maintaining a telephone service.

The seminar was organised as part of a scheme devised by the International Telecommunication Union—of which the British Post Office is a leading member—to reinforce advice and assistance given through the United Nations.

Highlight of the seminar was a demonstration at the Post Office Radio Station, Ongar, Essex, of some of the latest techniques in external plant construction. Among the devices the delegates saw were new types of cabling winches which save manpower and reduce the strain of heavy work, machines which can be used for duct rodding, the new pole erection unit and new apparatus for sealing the joints of underground cable. The students also visited the Research Station at Dollis Hill, the Engineering Department's Telephone Branch Circuit Laboratory, the Post Office Tower in London, the Oxford Telephone Exchange and repeater station and the Slough Exchange and engineering depot.

Much of the seminar was taken up with lectures by British Post Office engineers and discussions on a number of papers prepared by Post Office staff who have served abroad and have first-hand knowledge of the problems facing many of the newly developed countries.

During the seminar, which was opened by Mr. D. A. Barron, the Engineer-in-Chief, the delegates attended a reception at Lancaster House, a party provided by the Telecommunication Engineering and Manufacturing Association at the Café Royal and a farewell party at the Waldorf Hotel when they were addressed by Mr. A. W. C. Ryland, Deputy Director General (Telecommunications).

On the last morning of the seminar a telephone link was set up between London and Melbourne, Australia—where a similar seminar was being held—and delegates at both exchanged greetings and information. Dr. M. B. Sarwate, Secretary General of the International Telecommunication Union, speaking from Geneva, addressed both seminars in a prerecorded message.

Mr. D. A. Barron, Engineer-In-Chief of the British Post Office, enjoys a joke with some of the delegates during the opening ceremony.

Left: This new traffic warning-cum-floodlighting device, which is now being used by the British Post Office, was on display at Ongar. It has three 150 watt lamps and can be packed in a box three feet long, one foot high and one foot wide.

Below: Mr. R. E. Harris, of the Engineering Department's Circuit Laboratory, demonstrates the operating principles of a 5005 Crossbar telephone exchange switch.

Representatives of the following countries attended the seminar: Australia, Bolivia, Burma, Canada, Ceylon, Chile, Colombia, Cuba, Ecuador, Ethiopia, Finland, Ghana, Gibraltar, Greece, Guyana, Iraq, Malaysia, Mauritius, Nepal, New Zealand, Nigeria, Pakistan, Spain, South Korea, Sudan, Sweden, Tanzania, Uganda, United Kingdom and Zambia.

FAREWELL TO MR WILLIAMS

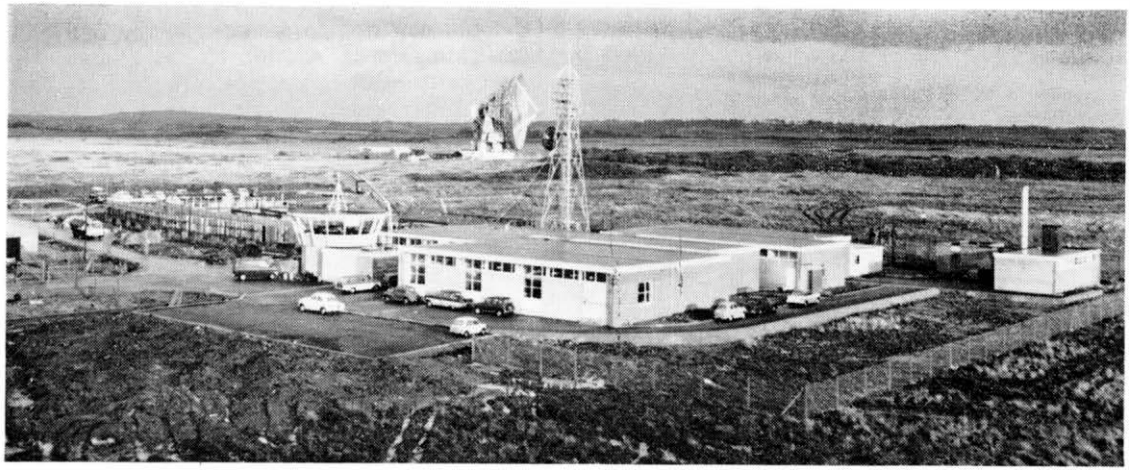
THE *Journal* joins his many friends in the Post Office in wishing a happy and successful retirement to Mr. Harold Williams, Assistant-Engineer-in-Chief since 1958 and the longest serving member on the Editorial Board of the *Telecommunications Journal*.

Mr. Williams, who began work as an apprentice fitter at Portsmouth Dockyard, joined the Post Office in 1926 as a Probationary Assistant Engineer in the Signalling Section at the Research Station, Dollis Hill. He served there for the next 12 years and in 1938 was promoted to Assistant Staff Engineer in the Main Lines Branch of the Engineering Department. In 1947 he was promoted to Staff Engineer in the same Branch and in 1953 returned to Dollis Hill to work on transmission development problems.

As Assistant Engineer-in-Chief for the past eight years, Mr. Williams has been responsible for training, main lines development and planning, telegraphs and submarine cables systems.

Mr. Williams joined the Editorial Board of the *Journal* in 1957. "I am very proud of the *Telecommunications Journal*," says Mr. Williams, "not least because it has been a great help to many people in helping them to obtain promotion."

Mr. Williams' successor as Assistant Engineer-in-Chief is Mr. H. Barker who also takes over from his predecessor as the Engineering Department representative on the *Journal's* Editorial Board. Mr. Barker joined the Post Office as a Probationary Inspector in 1928. He became an Assistant Engineer in 1935, Senior Executive Engineer in 1950, Assistant Staff Engineer in 1951 and Staff Engineer in 1963.



This recent picture of the Goonhilly earth station shows how it is being enlarged and improved.

GOONHILLY—Past, Present and Future

By R. E. G. BACK

Five years ago Goonhilly earth station did not exist. Today it is a focal point in the rapidly expanding world-wide satellite communications system with a future as exciting as its past

ON 1 OCTOBER, 1966, operation and maintenance control of Goonhilly Earth Station passed from the Space Communication Branch of the Engineering Department to the External Telecommunications Executive. Organisationally this brings the Goonhilly station into line with other Post Office stations which take part in overseas communications by radio.

Goonhilly is a splendid example of the speed of technological advance. Early in 1961 Goonhilly Downs was a virtually unknown area of moorland on the Lizard Peninsula, covered with rough grass and with a derelict concrete blockhouse in the centre. Space communications were being talked about by a few scientists and engineers but no proof that they were a commercial proposition existed.

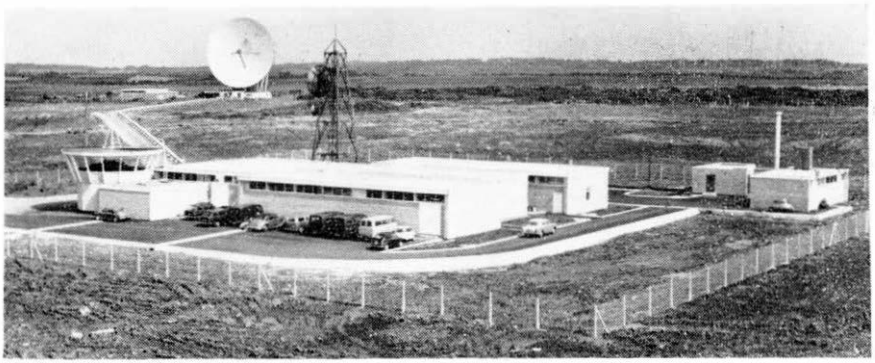
Yet, in the short space of five years satellite communications and the Goonhilly station had so proved themselves by carrying commercial telephone traffic over a long period that Goonhilly Radio Station could be incorporated into the normal operation and maintenance organisation of the Post Office.

This significant milestone in the development of satellite communications in this country gives an opportunity to review what has been achieved and to look forward to the tasks ahead.

The decision that the Post Office should take part in experimental communication by satellite was taken in 1961 and the next 12 months saw frenzied activity both by Post Office staff and a number of British contractors. During this time the site for the Goonhilly station was selected and the complete station provided, including the giant 85-feet diameter aerial which dominates the landscape, the central control building and the radio and line transmission equipment.

In July, 1962, came the historic trans-Atlantic transmissions by way of *Telstar* which showed that both multi-channel telephone and television transmission by satellite were possible and that commercially-acceptable quality was obtainable.

Following the first few, widely televised transmissions via *Telstar* there came a period in which a very extensive programme of tests was carried through to evaluate fully the satellite system and the associated earth station equipment.



Goonhilly, 1962. Note the original aerial which has since been modified to enable it to operate to the new 22,000-mile high satellites.

These tests were followed by similar series with the satellites *Telstar II and Relay I and II*. All these satellites were in relatively low elliptical orbits which meant that the period of mutual visibility between stations on each side of the Atlantic was limited. Thus, if a low altitude system capable of 24-hour operation was required, a large number of satellites would be needed.

The use of these first experimental satellites in low-altitude orbits also affected the design of the aerials at the earth stations. Because of their low height, their angular velocity when viewed from the ground was high and it was necessary to design the aerials to be able to track accurately at relatively fast speeds. This had a significant effect on the design of the aerials and their control equipment.

In April, 1965 the *Early Bird* satellite (now known as *Intelsat I*) was launched into a circular orbit above the equator. By a superb feat of rocketry and control it was placed in an almost exactly equatorial circular orbit 22,300 miles above the surface of the earth at a velocity of 6,800 miles-an-hour. At this height and velocity the satellite has an orbital period around the earth of 24 hours and thus appears to be stationary to an observer on the earth.

To enable Goonhilly to operate to this new satellite extensive modifications had to be made, notably to the aerial (which required a new and more accurate reflector to be mounted inside the old one), to the aerial control equipment and to the radio equipment *(see Telecommunications Journal, Summer, 1965)*.

After the successful launching of *Early Bird* the system was extensively tested to prove its suitability for telephone and television traffic. One of the most important tests was to determine the effect on users of the time delay—just over a quarter of a second in each direction—which is experienced when using a satellite at a height of some 22,000 miles. Although some people experience a little more difficulty in conversing over a circuit with long time delay, customer reaction indicated that it was well worth while to exploit the advantages obtained by operating to near-stationary satellites.

Finally, after a series of tests with live telephone traffic, commercial operation for trans-Atlantic telephony by satellite began on 28 June, 1965. For this service the three earth stations in Europe operate with one station carrying traffic, one on standby and the third released for maintenance or experimental work in a three-week rota. The system at present carries traffic for 12 hours each day, five days a week. Up to the time this article went to press, traffic at the American end had been carried entirely through the earth station at Andover, Maine, USA.

The major factor which has enabled control of the Goonhilly station to be transferred to the ETE so quickly has been the consistently high service reliability which satellite communications have provided since commercial operations started. The satellite itself has given 100 per cent reliability and the overall system reliability has been over 99 per cent. Goonhilly has a high reputation as a reliable earth station which reflects great credit on those who designed and provided the equipment and those who have maintained it.

The immediate future for Goonhilly looks

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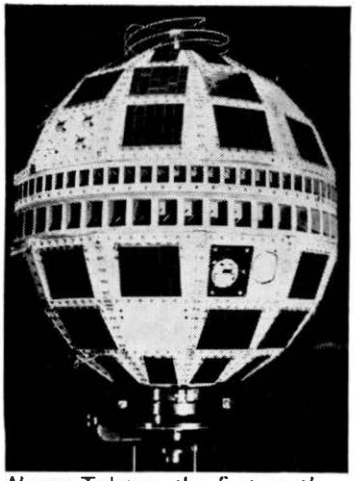
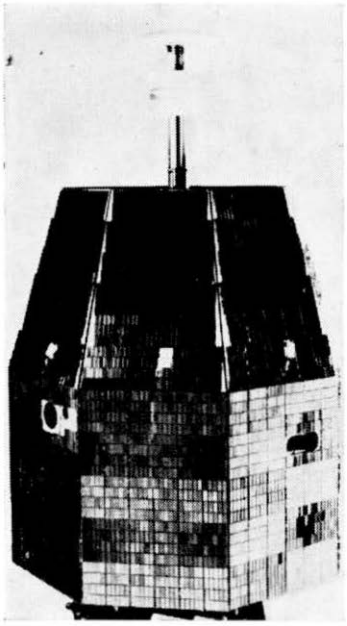


Above: Telstar, *the first earth satellite to which Goonhilly operated. It was launched in 1962.*

Right: Relay, *another low-elliptical satellite, which followed* Telstar.



An Engineer at work on Early Bird, *later renamed* Intelsat I.

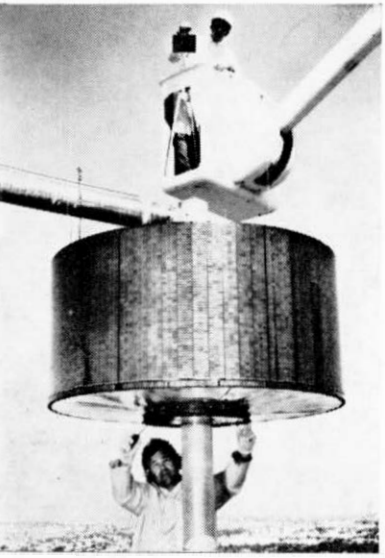
just as exciting as its star-studded past and tenders have already been sought for building a second 85-feet diameter aerial and providing its associated equipment. The central control building is being extended to house this equipment in preparation for the launching in the middle of 1968 of a new generation of satellite, to be known as *Intelsat III*.

The new satellite will be of the *Early Bird* stationary type but will have a capacity of up to 1,200 telephone circuits instead of *Early Bird's* 240 and an estimated life of five years compared with *Early Bird's* predicted 18 months (in October, 1966, *Early Bird* had completed 18 months life entirely satisfactorily).

The equipment in *Early Bird* permits two-way transmission between only two stations at a time but the new satellite will permit multiple access. This means that all countries within the coverage area of the satellite can provide an earth station and obtain circuits to any other country in the coverage area quite independent of whatever other links are established by other countries through the satellite. This facility will, of course, add greatly to the flexibility of the satellite system and should ultimately bring inter-continental communications within the reach of many countries. At a major station like Goonhilly it will mean that much more equipment will be needed to transmit and receive from many destinations instead of the one served at present.

It is proposed that the 500 Mc/s of radio frequency bandwidth available in the new satellite should be allocated to earth stations in blocks for telephony working to various destinations, with a large block, probably at the top end of the available bandwidth, which could technically be made available to any earth station for television transmission. Under such conditions the satellite would thus have a reduced telephone circuit capacity but would be able to transmit, in either direction, a television programme without interruption to the telephony services in other parts of the satellite bandwidth.

It is proposed that three of the new *Intelsat III* satellites should be launched in 1968, one over the Pacific, one over the Atlantic and the other over the Indian Ocean. Goonhilly will be able to 'see' two of these and it is intended to operate via them. The second aerial will be completed to enable it to operate to the *Intelsat III* over the Atlantic to provide service to North and South America and Africa.



This is Intelsat II *which was launched over the Pacific in October, 1966.*

Left: Diagram shows how an Intelsat III *satellite—three of which are due to be launched in 1968—will provide communication between many earth stations simultaneously.*

As soon as the second aerial is in service, the existing aerial will be released and re-equipped to provide service to India, Australia, Japan, Africa, Middle East and so on by way of the new Indian Ocean satellite.

This programme of work will continue through 1968 and should result in the extended station at Goonhilly working to destinations over two-thirds of the world's surface. It will be a worthy successor to the present installation.

After 1968 the crystal ball becomes cloudy. There will be a continuing need to add equipment to the existing installation to cater for expansion on existing routes and to initiate new routes. New and higher capacity communications satellites are already being discussed but these are probably a good way off yet and it is possible that over a heavily used zone such as the Atlantic a second *Intelsat III* will be required.

Operation to two satellites in one coverage area is possible because of the very narrow beams of electrical energy which 85-feet diameter aerials transmit and receive. It is therefore possible to operate to satellites which are relatively close together without interference. This type of operation brings problems, however, in arranging the network for the area so that those countries which wish to communicate with each other work to the same satellite if the need to have two aerials at each earth station is to be avoided.

Satellites for other communication purposes are already under discussion, notably those for air-traffic control which could provide communication and possibly navigational aid to aircraft throughout the whole of the time they are crossing the Atlantic. The need for this service will be high-lighted when supersonic jets come into operation. Studies are also being made of the use of satellites for television distribution.

To what extent and in which parts of the world these proposals will ever become operational is not clear; nor is the role which the Post Office or its successor may play in the development. But, whatever the task, Goonhilly and its staff will be ready to play its appropriate part.

Goonhilly has had its fair share of glamour and hard work. Although further glamour cannot be guaranteed continued hard and interesting work seems assured.

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BETTER LINKS WITH FAR EAST

Telephone operators at the International Exchange in London can now dial direct to numbers in Hong Kong and operators in Hong Kong can dial calls direct to subscribers on most automatic exchanges in Britain.

This improvement in communication with the Far East has been made possible by the completion of a further link in the Commonwealth Cable system—that between Guam and Hong Kong. This new section of the SEACOM cable, which is 2,058 nautical miles long, provides 80 voice channels.

THE CRAYFORD STORY

By H. A. JENKINSON

A vast new depot has been set up at Crayford to store and distribute items for the telecommunications services in London and the Eastern and South-Eastern Regions. The new system will speed and improve distribution

The new Crayford Depot has more than five miles of internal roadway, part of which is shown in this picture of incoming stores being unloaded.

A BRIEF notice that went out from Supplies Department Headquarters towards the end of 1965 marked the end of an era. It announced the closing down on Friday, 31 December, 1965, after 50 years' service to Post Office telecommunications, of the London Engineering Stores Depot at Studd Street, Islington.

A new era was born three days later, on Monday, 3 January, 1966, when the vast new depot at Crayford, on the south-east outskirts of Greater London, opened its doors for business.

To make the best use of modern storage and handling techniques a single-storey depot was essential. Inner London had nothing to offer so search was made to find either a site or existing buildings which could be readily adapted. The answer was found in a modern engineering works at Crayford, 28½ acres in extent and providing about half-a-million square feet of indoor accommodation on one

level, to heights varying beween 15 and 30 feet.

The greater part of the new Crayford depot has now been converted to meet the Supplies Department's requirements and brought into use. Thus, for the first time for many years, all the Department's main operations involving the storage and issue of engineering stores in London are concentrated in one place.

Although development is not yet complete, many of the benefits of concentration are already evident, in particular the advantage of replacing by unified operational areas the many receipt, packing and despatch sections within the old Studd Street group.

The transfer of operations from Studd Street and its satellite depots to Crayford has been by far the largest operation of its kind ever undertaken by the Supplies Department. As well as the preparation of the depot, it has involved moving thousands of tons of stores, the re-arranging of hundreds of contracts, and the re-location of a sizeable motor transport fleet together with its workshop facilities. Nearly three miles of two-level binning and three-quarters of a mile of pallet-racking have been erected. The layout includes more than five miles of roadways, some capable of accommodating the largest and heaviest road haulage vehicles, others just wide enough for the 35 fork-lift and pallet trucks which deal with internal movement. To ensure that the programme of work went to schedule and in the right order, critical path planning was used and regular progressing meetings were held.

A move from a number of long-established locations to a single new one some distance away cannot be achieved without considerable staff upheaval, presenting many personal problems which can be solved only with the utmost goodwill on all sides. The ready co-operation of the various staff associations involved has been a noteworthy feature throughout; without it, the task would certainly have proved much more difficult. Numerous staff transfers have been necessary to replace and resettle those who were unwilling or unable to move. To help many of those who did move, a large-scale rehousing programme was undertaken in collaboration with the local authority and the Greater London Council. Extensive local re-

Outgoing stores are prepared for despatch. From Crayford go many thousands of items to supply about 40 per cent of the country's needs.

cruitment has been necessary, and fortunately, the run-down of Woolwich Arsenal has provided a steady flow of recruits of high quality.

To make the best use of Crayford Depot's excellent facilities and to prepare it to keep pace with the unprecedented growth of the telecommunications network expected in the years to come, some fundamentally changed thinking about storage methods has been needed. The aims throughout have been to use space as intensively as possible and to speed up movement. To do this, the time-honoured practice of dividing up a store by "Rate Book Sections", under which, for example, all subscribers' apparatus irrespective of size, shape, weight and frequency of issue was stored in the same part of the warehouse, has had to be abandoned, since it enabled neither space nor mechanical aids to be used to the best advantage. The place within the depot in which an item is stocked is now determined by its physical characteristics and rate of turnover. At one end of the scale are tiny items of which a stock sufficient to last for six months will go into a small drawer. At the other, are such items as 700-type telephones, a huge stack of which, occupying hundreds of square feet of

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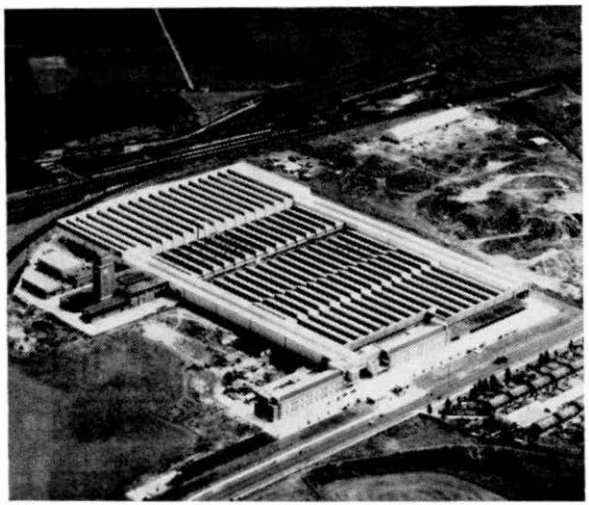
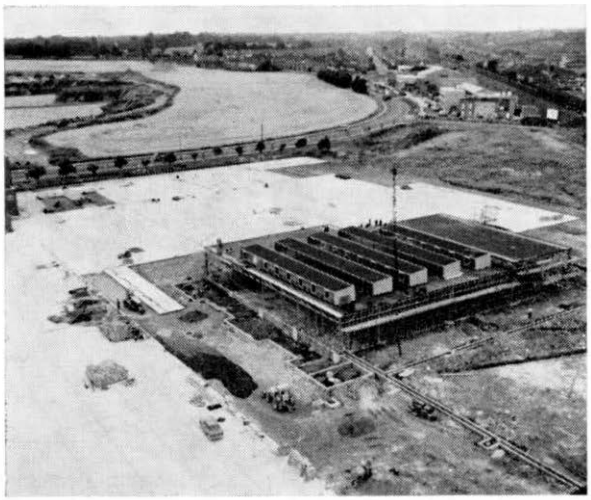


Aerial view of the Crayford works before it was taken over and converted into the Supplies Depot.



A recent view, showing the cable yard and measuring shed under construction.

floor space and reaching almost to the roof, will last for only a few weeks. The storage space in Crayford and other modern depots is thus now divided broadly into areas for binned items, areas of palletised stock in racks and areas of fast-turnover, large-quantity items block-stacked on pallets. Within some of these areas a considerable degree of random storage, which helps to conserve space, is already possible. But the real advances will come as more sophisticated, computer-based stock location systems are introduced.

The transfer of the Studd Street depot group's activities to Crayford was accomplished without interrupting service. In the early days however, there were some fairly heavy arrears of work, due mainly to staffing problems, among them the need to train large numbers of people completely new to the work of an engineering stores depot. The move, although a major undertaking, was no more than a step towards Crayford Depot's final rôle in a comprehensive reorganisation of the Supplies Department's distribution system, planned at the same time and now well on the way to completion.

The old distribution system was an amalgam of two systems—one under which a depot served a specified part of the country, the other under which it was a national supplier of certain ranges of items. As pressure on storage space led over the years to the setting up of additional depots, the demarcation lines between service areas became less clearly defined and it became necessary to place separate requisitions on a number of supply points to obtain the stores for one job.

This system also led to delays in supplying stores, since the regular motor transport service to a given Telephone Area normally operated from one depot. This meant that a significant proportion of outgoing stores had to be transhipped at one or more intermediate points, thus causing delays, and, as many consignees were served only by rail their delivery times were even less predictable. A further complication was the system of supplying many items direct from contractors' works, if the demand was for more than a small specified quantity. This saved space and handling in the Supplies Department, but at the cost of almost total loss of control over delivery.

The problem was not, however, entirely one of delay in getting stores from central stocks to the users in the field, it was also the unpredictability of delivery times. The natural tendency was to requisition enough to cover the longest delay and this resulted in the inflation of field stocks when the stores arrived promptly.

The need for reorganisation was clear. The means and the design of a new system were

studied in detail by an inter-Departmental team. The outcome was the territorial distribution system which is now taking shape and in which Crayford Depot, meeting about 40 per cent. of the country's needs, has a major part to play.

The basis of this system is simple. A relatively small number of items account for by far the greater part of the Supplies Department's output, whether measured in terms of value, weight, volume or number of transactions. It was decided that these should be stocked at a number of Territorial Supply Depots (TSD), each located within easy reach of all parts of its service area and to which it would be linked by regular motor transport services. Transhipment, probably the biggest single impediment to a quick and reliable service, would thus be eliminated for the bulk of stores issued.

A TSD service area would generally comprise a single Post Office Region or Directorate, the exceptions being the London Telecommunications and Eastern and South-Eastern Regions (all to be served from Crayford) and the Scottish and Northern Ireland Directorates, (to be served from Scotland). The slower-moving items—many more in number than the TSD items but representing a small fraction of total turnover—would be stocked in a Central Supply Depot and supplied to users by way of the appropriate TSD unless small enough to be posted direct. The issue of stores direct to the field from manufacturers' works would be confined to exchange equipment, external cable and ducts and other heavy, bulky and fragile items, the rest being made available in the TSD or CSD. Requisitions, wherever originating and for whatever item, would go to a single processing point which would quickly give the appropriate depot instructions to meet them.

The territorial distribution system thus provides for stores in regular and frequent use and available in Supplies Department stock, to be delivered within a short and known time of a demand being placed. Stores called for less often can take longer to supply (there are, of course, items which have to be made to order), but delivery times are still predictable and can therefore be allowed for in planning of work. The territorial system, combined with arrange-

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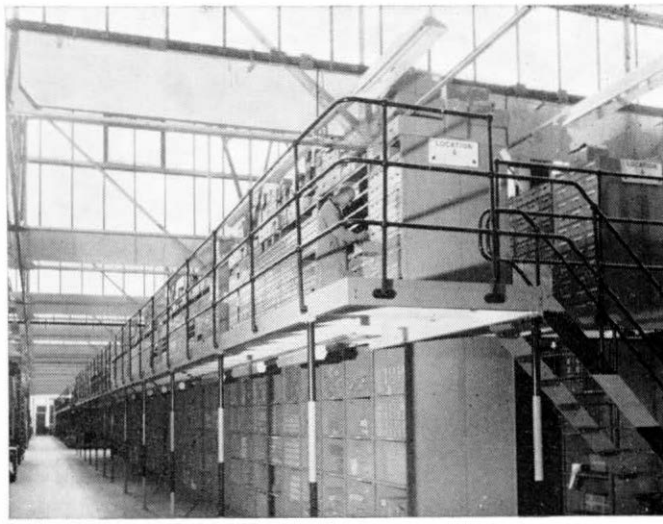

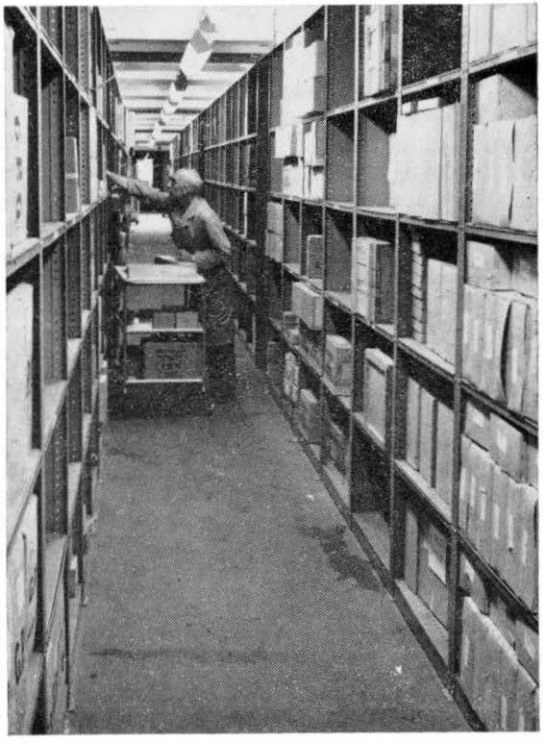

The Crayford Depot has about half a million square feet of storage accommodation. Above: A section of the two-level binning installation, which has frames for storing small items. Below: Stores being issued from the lower deck.

For quick and easy handling electric fork-lift and pallet trucks are used to move heavy and bulky items and those needed in large quantities.

ments made by the Engineering Department for the effective control of local stocks, aims at providing a better supply service from lower overall stocks.

An important feature of the new system is that the TSD Manager becomes the focal point for stores enquiries from his service area, and it is expected that there will be free and regular discussion of supply problems between him and his "customers". There is ample evidence that those Regions served by the first TSDs to be set up are already making good use of this service.

To some extent, the location of existing Supplies Department depots, many of them modern and with years of useful life still ahead of them has dictated, at least for a time, the pattern of depots under the new system. The CSD, for example, instead of being located at a single point as originally proposed, has been split between Crayford (serving London and the Eastern and South-Eastern Regions as it does in its TSD rôle) and two provincial locations sharing the item range and supplying the rest of the country. Existing depots are well placed to act as TSDs for all Post Office Regions except the North-Eastern and North-Western, where new ones are to be built. In the meantime Birmingham and Scotland will share the TSD service to these two Regions. The TSDs at Bridgwater and Hereford, supplying the South-Western Region and Wales and Border Counties respectively, have been operating for some months. The changeover to TSD working at Crayford and Birmingham (where a large additional depot at Saltley has been brought into use) is virtually complete. The Scottish TSD, also well on the way to full operation in its new rôle, will be divided between existing depots at Sighthill (Edinburgh) and Newhouse in Lanarkshire.

The introduction of a new distribution pattern meant a complete reappraisal of the Supplies Department's motor transport system. Efficient transport is vital to the success of the new system and a comprehensive study of the Department's transport needs, with the aid of a firm of consultants, is in progress. Interim arrangements to meet the immediate needs of territorial distribution, largely using the existing fleet, have already been made, but radical changes in types of vehicle and in methods of

control and fleet management are likely. It will be some time before the full benefits of transport reorganisation can be reaped. Replacement of a large number of vehicles, well enough suited to the old distribution system but by no means ideal for the new, is a lengthy process. Ultimately, however, substantial economies in operation, along with a much improved service to the field, should be achieved.

A distribution system can only be as efficient as its back-up supply arrangements will allow. The spread of stocks over a greater number of depots, while shortening the supply lines to users in the field, brings with it stock control and replenishment problems. To ensure that stocks are available in the right places, at the right times and in the right quantities, the Supplies Department's provision system is also being completely overhauled. Sophisticated methods of forecasting supply and demand will be aided by the transfer—now in progress—of stores accounting to one of the Post Office's new English Electric-LEO computers. Ultimately, the central computer is expected to receive requisitions in computer language direct from Regional computers, but from the start it will provide the means of regulating depot stocks more closely in line with demand than is at present possible. The first step—that of centralising receipt of requisitions for processing by the existing punched card machinery—has been taken, and some processes have already been transferred to LEO.

Much has already been done throughout the supply system to bring it into line with the needs of the second half of the 20th Century. Some of the most formidable hurdles—such as the concentration on Crayford of most London issue operations and the change of depots' rôles to provide TSD service elsewhere—have been surmounted. But with two major depots yet to be built and with a new provision system and computer working to be put into action and proved, the task is far from finished. The ultimate measure of success will be the degree of confidence the engineer in the field has in the Supplies Department's ability to meet his needs and the extent to which the biggest expansion in the history of Post Office telecommunications can be supported from the lowest possible stocks.

"This Depot is a very important and effective part of our stores organisation which handles a stores programme costing something like £70 million a year," said the Postmaster General when he visited Crayford recently.

"A large part of this programme is based on fully competitive tendering. Most of the non-competitive purchases are governed by the Bulk Supply Agreements between the Post Office and a limited number of firms for the purchase of exchange equipment and telephone apparatus.

"The Government decided some time ago that there is no justification for the continuation of the Apparatus Agreement. I should be announcing fundamental changes in Post Office procurement policy in the near future."

THE AUTHOR

Mr. H. A. JENKINSON *is a Chief Executive Officer in the Supplies Department which he joined in 1935. As head of the Department's Development and Implementation Group he is closely concerned with the current re-organisation of stores distribution and with the application of computer systems to supply operations.*

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THE AUSTRALIAN DIAL

On page 3 of the Autumn, 1965 issue of your *Journal* you show, among the selection of all-figure dials, an Australian dial which is obsolete. As you will see from the enclosed photograph letters do not now appear on the Australian dial.—**A. H. Kaye, Australian Post Office representative, Office of the High Commissioner for Australia, Australia House, Strand, London, W.C.2.**

The new Australian dial

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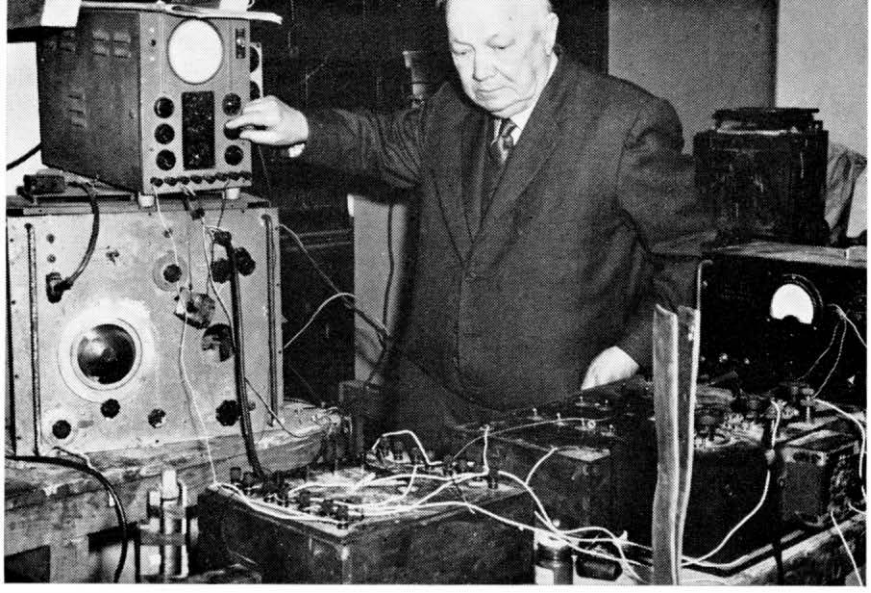
In IPOEE 1965/66 Associate Section Papers Awards, prizes and Institution Certificates were awarded to the following: First Prize, seven guineas, D. A. Spicer, Tunbridge Wells Centre for his paper, "The Pressurisation of the MU and CJ Cable Network". Prizes of four guineas each to H. F. Wood, Lincoln Centre, A. Webster, Aberdeen Centre, J. Fisher, Colchester Centre, E. W. Scott, Darlington Centre. An additional prize of one guinea went to J. T. Pike, Aberdeen Centre as the Local Centre Committee considered his paper worthy of submission for main awards.



Captain Round at work in his private laboratory.

"A Truly Great Engineer"

ONE of the greatest of pioneers in electronics, the "father" of British broadcasting and the man whose network of direction-finding stations enabled the British Fleet to intercept the German Grand Fleet at the Battle of Jutland in World War One, Captain Henry Joseph Round, MC, ARCSc, died recently aged 85.

Captain Round first attracted attention in the electronics world in 1907 when he revealed his discovery several years earlier that the application of an electric potential across silicon carbide could generate light. Later he made one of the first arc radio telephones and so impressed Marconi that the latter appointed him his personal assistant.

In 1912, Captain Round brought off one of his most remarkable feats—re-designing and virtually rebuilding almost single-handed two transmitter stations on the upper reaches of the Amazon so that they were able to operate on 4,000 metres by day and 2,000 metres by night.

On his return to England, Captain Round carried out work on the thermionic valve and was among the first to discover that it could generate continuous wave oscillations. In 1913 he demonstrated valve radio telephony and patented a number of valve improvements, including the indirectly-heated cathode. Within 12 months he had also taken out patents for an auto-heterodyne circuit and a comprehensive transmission system which included the first use of automatic grid bias.

In World War One, when seconded to Military Intelligence, he built a network of valved direction finding stations covering the entire Western Front. These stations pinpointed enemy positions so accurately that Captain Round was recalled to supervise the construction of a second network.

After developing new types of transmitting valves, Captain Round directed the installation in 1919 of a telephony transmitter at Ballybunion, Ireland—the first European station to span the Atlantic with telephony.

He also carried out valuable research into short-wave telephony, inventing the Straight-Eight receiver, a gramophone recording system, a large-audience public address system, the artificial echo system for broadcasting studios, new types of microphone, the screened grid and r.f. pentode valves, gramophone pick-ups, amplifiers, sound recording systems, aerial systems, a new method of recording sound on film and many other devices and circuits.

As recently as the 1950s Captain Round was still carrying out vitally important experimental work in electronics, inventing new magneto-strictive devices for echo sounders, magnetised nickel transducers and the first belt recording system for echo sounders.

"He was a truly great engineer whose contributions to technology helped in no small measure to shape the course of history," said a colleague.

MAKING THE MOST OF MOLEPLOUGHS

By W. T. WILSON

Three new types of moleplough and more efficient ways of using them are being introduced to speed and cut the cost of laying cable and pipes

THE Engineering Department of the Post Office spends large sums of money each year adding to its vast underground network of pipes and cables. The most common ways of laying these networks are with mechanical excavators, excavation by manual labour or by moleploughs which, under suitable conditions, can effect considerable savings in cost and in manpower.

Moleploughing involves pulling a blade held in a steel frame through the ground to make a slot and simultaneously laying a cable at the bottom of this slot. The cable is normally passed down a tube attached to the rear of the blade—an adaptation of a technique for laying land drains on farms. In fact, one machine used by the Post Office Engineering Department—the Ransome Model CIE—is a modified land-drainer.

Where pipes or cables are to be placed in land already largely occupied by other services, moleploughing is not a suitable method. However, there is plenty of scope for its use along country roads or across fields and it is playing an increasingly important role in laying pipes and cables on housing estates.

The advantages of laying plant by moleplough can be considerable; laying speeds are greater than by other methods and soil disturbance is kept to a minimum. Manual digging or mechanical excavating removes a large amount of soil which must be replaced. When a moleplough is used it is often necessary only to drive a tractor over the route with the wheels on one side passing over the path of the slot to compress the soil. Sometimes even this effort is not required.

Ground conditions limit to some extent the use of moleploughs. They cannot be used, for example, where rock is encountered close to the surface, although the more robust designs will dislodge large stones. In winter, when manual digging is very difficult, the moleplough works extremely well.

At a recent demonstration, engineers show how to lay cable with the new Moleplough No. 2. This machine is particularly suitable for heavy work and is normally pulled by a tractor with a winch.

The Engineering Department is now encouraging the maximum use of moleploughs and three new designs and new methods of using them are being introduced.

The new moleploughs are the No. 2—a roller type, particularly suitable for heavy work, made by Atkins Fulford, of Sudbury, Suffolk; the No. 3—a lighter design more suitable for cabling on housing estates by Bramber Engineering Co. Ltd., Glasgow; and the No. 4—a very light moleplough for drawing in armoured cable on housing estates, made by NV Tools, Ltd., Brentwood.

They all operate in a working path of two feet or less and cover the normal range of work

OVER

Cable laying with the new Moleplough No. 3 which can be pulled by a tractor or by a winch fitted to a Landrover.

required. The Moleplough No. 2 is normally pulled by a tractor with a winch; the Moleplough No. 3 may be pulled by a tractor or a winch fitted to a Landrover; and the No. 4 by a winch fitted to a Landrover. The development of moleploughs which can be pulled by a winch fitted to a Landrover saves transporting a tractor to and from a working site, thus bringing about considerable savings in time and money. Under its own power, a tractor can travel only at a speed of about 15 m.p.h. on roads and for distances over five miles usually requires to be transported on a four-ton trailer towed by a four-ton vehicle. A party using a Landrover can travel to and from the working site at normal speeds.

Specialist moleploughing teams are being organised in the Engineering Department—a heavy party using a tractor to pull the moleplough and a light party using a Landrover. They will be engaged mainly in laying cables and pipes on new housing estates.

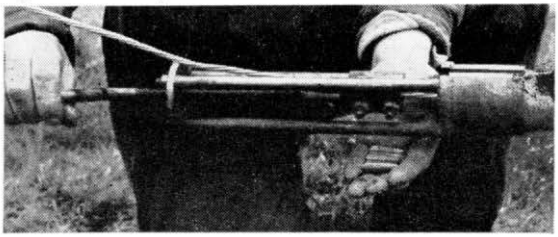
Providing cables on new housing estates has always been a problem since cables are often damaged by other work on the site. Now it is hoped that a solution may be found in serving the estates by armoured cables laid by moleplough before building material arrives on site. Savings made by laying the cable speedily and cheaply should more than offset the cost of armouring the cable.

The laying of pipes by moleplough is a comparatively recent development sparked off by the introduction of plastic pipes which led to an investigation into the possibility of placing them underground by plough to obtain for the laying of pipe the same advantages as in the laying of cable.

Two sizes of PVC pipe are used—a two-inch bore pipe in 10ft. lengths and a three-and-a-half inch bore pipe in 20ft. lengths, both with spigot and socket joints.

The method used is to lay out a number of lengths of pipe along the intended route, fitting them together with a steel wire. The wire is secured into a cap and sleeve at the leading end, placed in a tensioning tool at the rear end and then tensioned to place the total length of pipe under compression. The resultant length of pipe is attached to the bottom of a moleplough blade and the moleplough is drawn forward, the pipe following the bottom of the blade into the ground. Lengths of pipe up to 100yds. have been drawn into the ground in one operation.

Above: Laying two-inch pipe with the Ransome CIE Moleplough. Below: Tensioning the steel wire which holds lengths of pipe together as they are drawn into the ground.



Successive lengths may be jointed in the ground so that any required length may be laid by this method. Pipe and cable may be laid simultaneously by the same moleplough. The cost of laying cable or pipe by moleplough is normally less than half the cost of other methods.

These developments are an extension of the previous methods of moleploughing and still depend upon drawing the moleplough towards a stationary winch. The ultimate aim in moleploughing cable is to have a special vehicle with a built-in or attached blade and carrying its own supply of cable. The vehicle will be able to lay cable while moving forward under its own power so that it could be operated by one man instead of the present moleploughing party which may vary from two to four depending on the type of moleplough and towing equipment used.

Such vehicles are being developed in the United States where site conditions are more suitable than in this country. These are "vibratory" moleploughs, the blade being vibrated vertically and thus reducing the effort required to move it through the ground to within the traction obtained by the vehicle. These units are to be evaluated for use in Britain.

THE AUTHOR

Mr. W. T. WILSON *is an Assistant Executive Engineer in the External Plant and Protection Branch of the Engineering Department. He is concerned with mole-ploughing in general and with the problems in providing service in housing estates in particular.*

Telecommunications Statistics

	Quarter ended 30 June, 1966	Quarter ended 31 March, 1966	Quarter ended 30 June, 1965
Telegraph Service			
Inland telegrams (including Press, Railway Pass, Service and Irish Republic)	**2,594,000**	2,430,000	2,747,000
Greetings telegrams	**603,000**	597,000	619,000
Overseas telegrams:			
Originating U.K. messages	**1,816,000**	1,749,000	1,724,000
Terminating U.K. messages	**1,803,000**	1,764,000	1,679,000
Transit messages	**1,451,000**	1,409,000	1,343,000
Telephone Service			
Inland			
Net demand	**228,000**	264,000	186,000
Connections supplied	**200,000**	233,000	185,000
Total orders in hand	**255,000**	227,000	176,000
Total working connections	**6,658,000**	6,535,000	6,138,000
Shared service connections (Bus./Res.)	**1,324,000**	1,293,000	1,197,000
Effective inland trunk calls	**227,196,000**	218,031,000	199,245,000
Effective cheap rate trunk calls	**51,636,000**	45,635,000	45,108,000
Overseas			
European: Outward	†**1,953,000**	1,860,000	1,611,000
Inward	not available	not available	1,387,000
Transit	†*6,600	*6,302	14,000
Extra European: Outward	†**173,000**	164,000	151,000
Inward	†**233,000**	222,000	189,000
Transit	†**33,000**	31,000	25,000
Telex Service			
Inland			
Total working lines	**18,000**	17,000	15,000
Metered units (including Service and Irish Republic)	**53,093,000**	48,101,000	41,828,000
Manual calls Assistance and Multelex	**24,000**	24,000	18,000
Overseas			
Originating (U.K. and Irish Republic)	**3,009,000**	3,016,000	2,499,000

Figures rounded to nearest thousand.

*Calls for Europe—Europe Services not available. Eastern Europe relations only included under this heading.

†Includes Estimated figures.

INDEX to Volume 18

Spring 1966—Winter 1966

ALPHABETICAL INDEX

GROUP INDEX

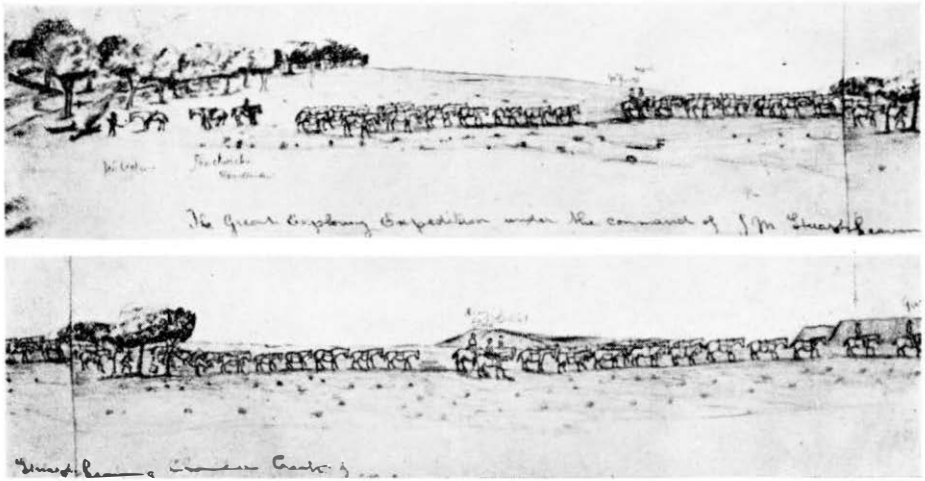
CONTINUED OVERLEAF

GROUP INDEX—*contd.*

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.

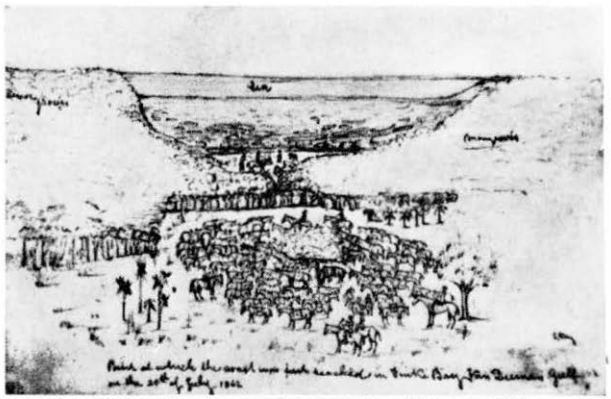
Contributions. The Editorial Board will be glad to consider articles of general interest within the telecommunications field. No guarantee of publication can be given. The ideal length of such articles would be 750, 1,500 or 2,000 words. The views of contributors are not necessarily those of the Board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

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



The expedition, under the command of John McDouall Stuart, leaving Chambers Creek on 8th January 1862.

From originals held in the Archives Department of the Public Library of South Australia.



Point Stuart, where the coast was first reached on 24th July 1862.

£2,000 REWARD

Over 100 years ago, the South Australian government offered £2,000 to the first person to cross to the Northern part of the continent. One of the main reasons for doing so was to bring about the proposed link with the cable and telegraph line to Europe.

The reward was eventually won by John McDouall Stuart, who succeeded in finding a route across the centre of Australia on his sixth and final expedition.

More than a century later, a new £3,200,000 transcontinental microwave communications system, linking eastern and western Australia, is to be supplied by G.E.C. (Telecommunications) Ltd., of Coventry, England. The system, one of the longest civil microwave links in the world, will be in service in 1969. By this date, telephone traffic over the 1500 mile route linking Perth and Adelaide—as far apart as London and Moscow—will amount to about one million calls a year.

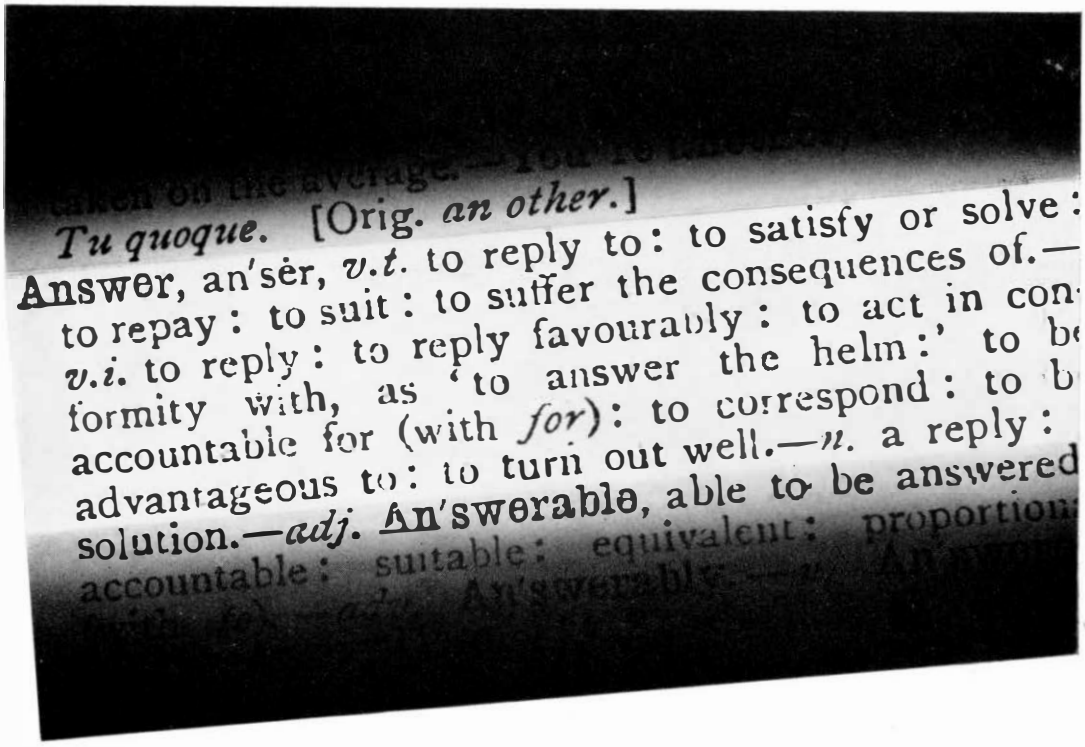
Initially, the system will provide two bothway radio bearer circuits, one main and one standby, with a capacity of 600 telephone circuits. The standby circuit may also be used to provide a television link giving a nationwide T.V. network. In addition a separate T.V. link will be provided between Northam, near Perth, and Kalgoorlie.

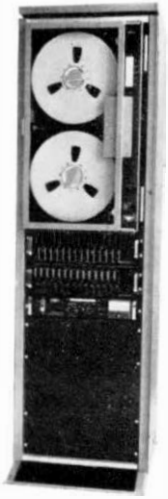
Completely semiconductored equipment, operating in the 2000 Mc/s frequency band, will ensure maximum reliability and minimum maintenance of the equipment throughout the mainly virgin country which it will traverse. Over a hundred years after John McDouall Stuart's achievement, G.E.C. (Telecommunications) Ltd. will forge new links across the continent.

G.E.C.

Takes telecommunications into tomorrow

G.E.C. (Telecommunications) Ltd., of Coventry, England.





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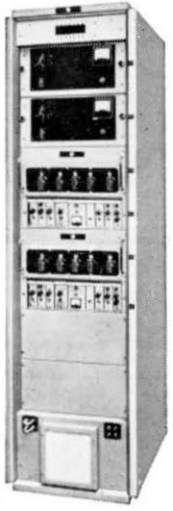
H1601

Comprehensive synthesizer drive assembly for two independent transmitter channels
Inputs: audio frequencies (6 kc/s bandwidth) or d.c
Outputs: modulated signals at radiated frequencies, 2 W p.e.p
Types of modulation: i.s.b with floating carrier, pilot carrier or fully suppressed carrier; d.s.b; c.w 400 bauds; f.s.k 200 bauds or 3500 bauds; frequency shift diplex
Frequency range: 2—27.9999 Mc/s
Frequency selection by decade dials on frequency synthesizers
Stability: determined by 1 Mc/s master frequency

H1605

1 Mc/s master frequency source
Frequency stability: ± 1 part in 10^9



H1601

versatility

Any drive channel can generate any type of modulation. F.S.K and f.s diplex signals are generated by shifting the frequency of 2 kc/s or 4 kc/s tones—thus one transmitter can radiate simultaneously two or more telegraph channels and an s.s.b channel.

Plug-in modules give switch selection of services normally required. Logic circuits prevent selection of two conflicting services. Extra plug-in modules can be supplied for any other types of modulation. A wideband amplifier simplifies frequency selection to a single operation—adjustment of the synthesizer decade dials.

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With the compact MST drive system, self-tuning transmitters and MST control and monitoring equipment, one man can operate an entire transmitting station from a central point.

reliability

All units (except the distributed amplifier) are fully transistorized and use printed wiring. Each unit has a separate power supply. The 1 Mc/s master signal distribution is duplicated, and the master frequency source uses three oscillators to ensure immediate automatic changeover in the event of output failure or excessive frequency drift.

Marconi telecommunications systems

The Marconi Company Limited, Radio Communications Division, Chelmsford, Essex, England LTD/H52

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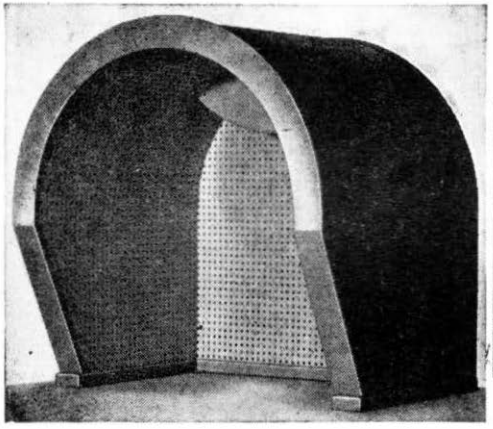
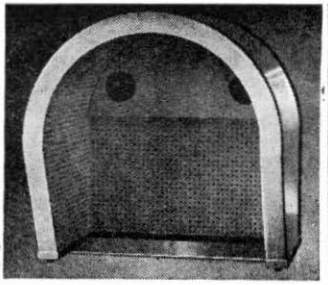
for acoustic hoods

All noisy environments such as factories, workshops, department stores and hotels require the facility of an acoustic hood which permits telephone conversations to be held without the interference of annoying background noises.

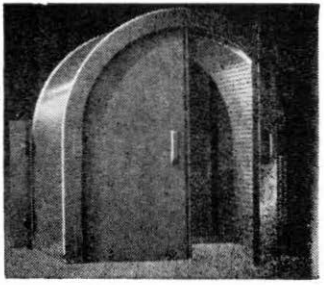
Whiteley acoustic hoods are strongly made from resin bonded ply and finished in a cellulose enamel which makes them suitable for indoor or outdoor use.



Standard Hood dimensions
25" high × 20½" deep × 24½" wide



Fitted with loudspeakers

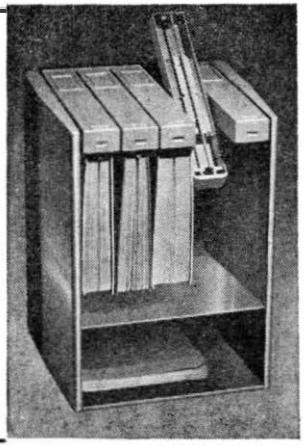


Fitted with doors for outside use

Also available with internal light and/or a storage shelf below hood.

& directory holders

Directory Holder dimensions
17⅛" high ×
13½" wide ×
13⅜" deep



These attractive, and extremely functional, directory holders will hold five directories neatly and securely, in indivdual swivel holders permitting easy identification and reference. The lower shelf provides additional storage space. The units are of cast alloy, finished in an attractive grey epoxy resin enamel and constructed to strict G.P.O. design specifications.

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