POST OFFICE

tele*communications*

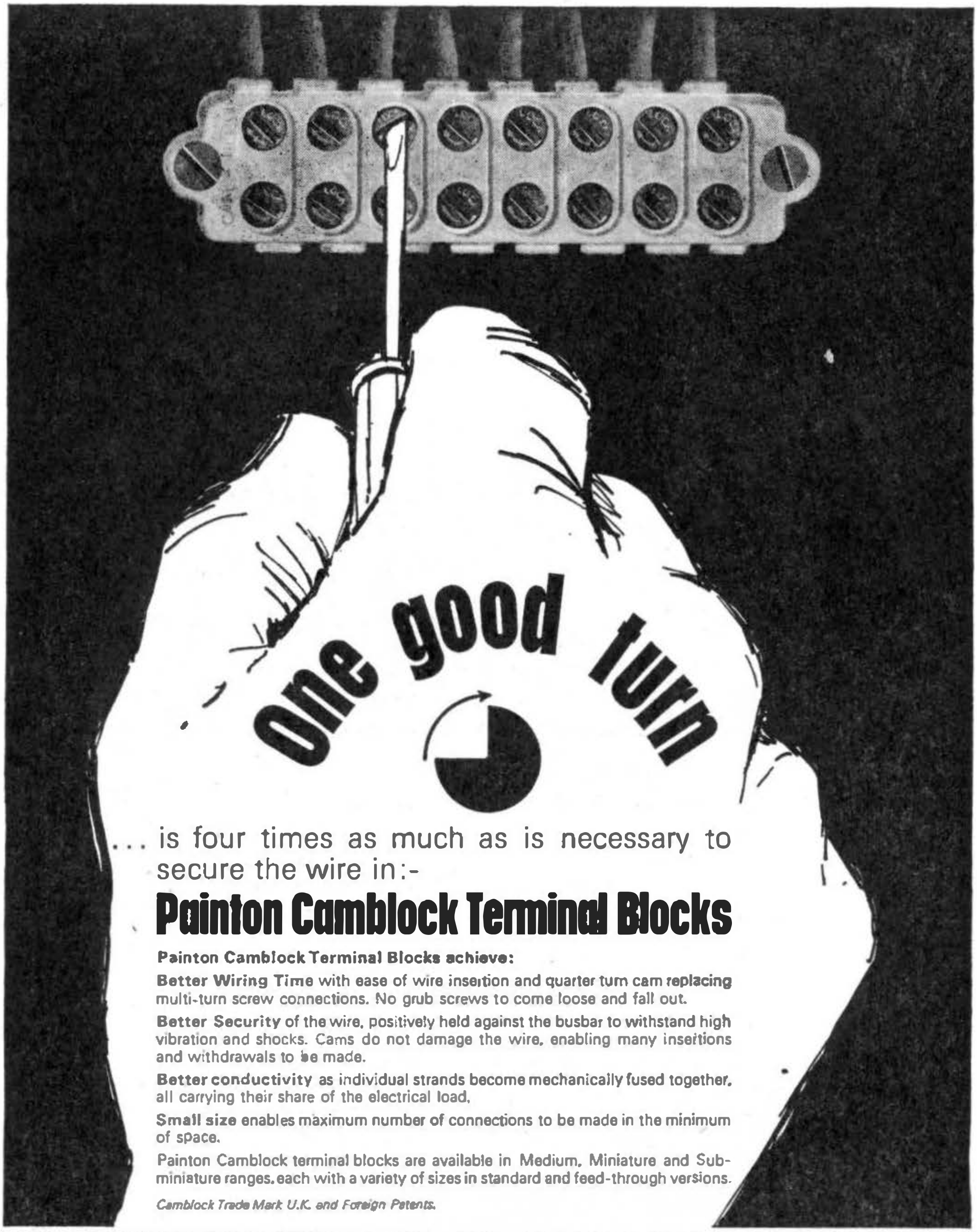
JOURNAL

ONE SHILLING

AND

SIXPENCE

AUTUMN 1966


one good turn
... is four times as much as is necessary to secure the wire in:-
Painton Camblock Terminal Blocks
Painton Camblock Terminal Blocks achieve:
Better Wiring Time with ease of wire insertion and quarter turn cam replacing multi-turn screw connections. No grub screws to come loose and fall out.
Better Security of the wire, positively held against the busbar to withstand high vibration and shocks. Cams do not damage the wire, enabling many insertions and withdrawals to be made.
Better conductivity as individual strands become mechanically fused together, all carrying their share of the electrical load.
Small size enables maximum number of connections to be made in the minimum of space.
Painton Camblock terminal blocks are available in Medium, Miniature and Sub-miniature ranges, each with a variety of sizes in standard and feed-through versions.
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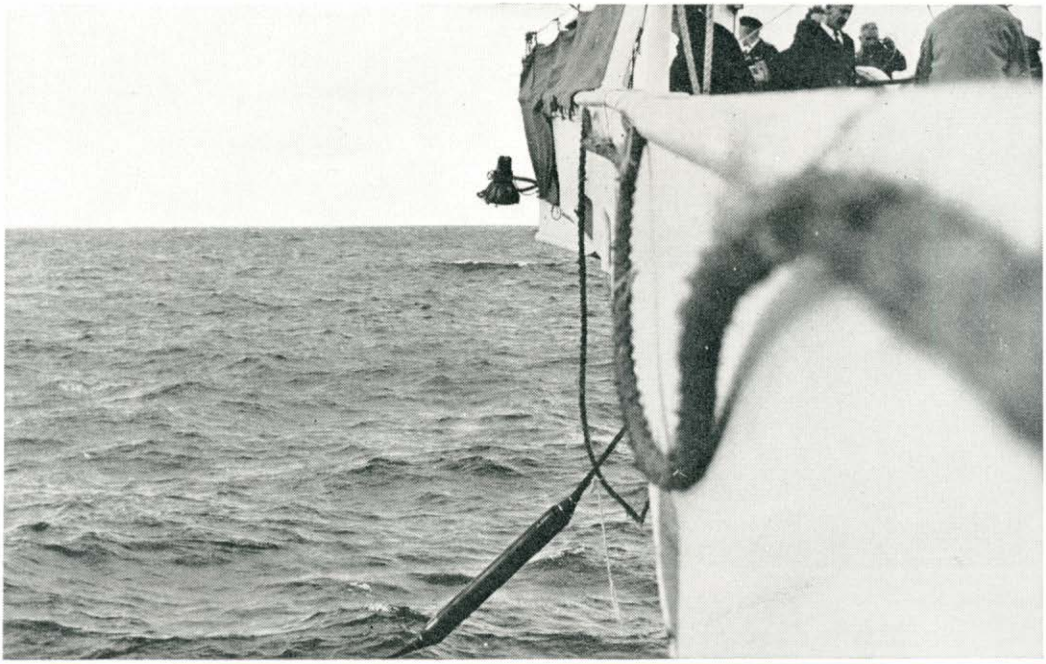
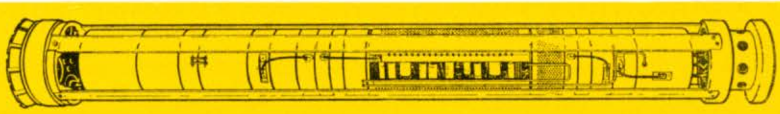
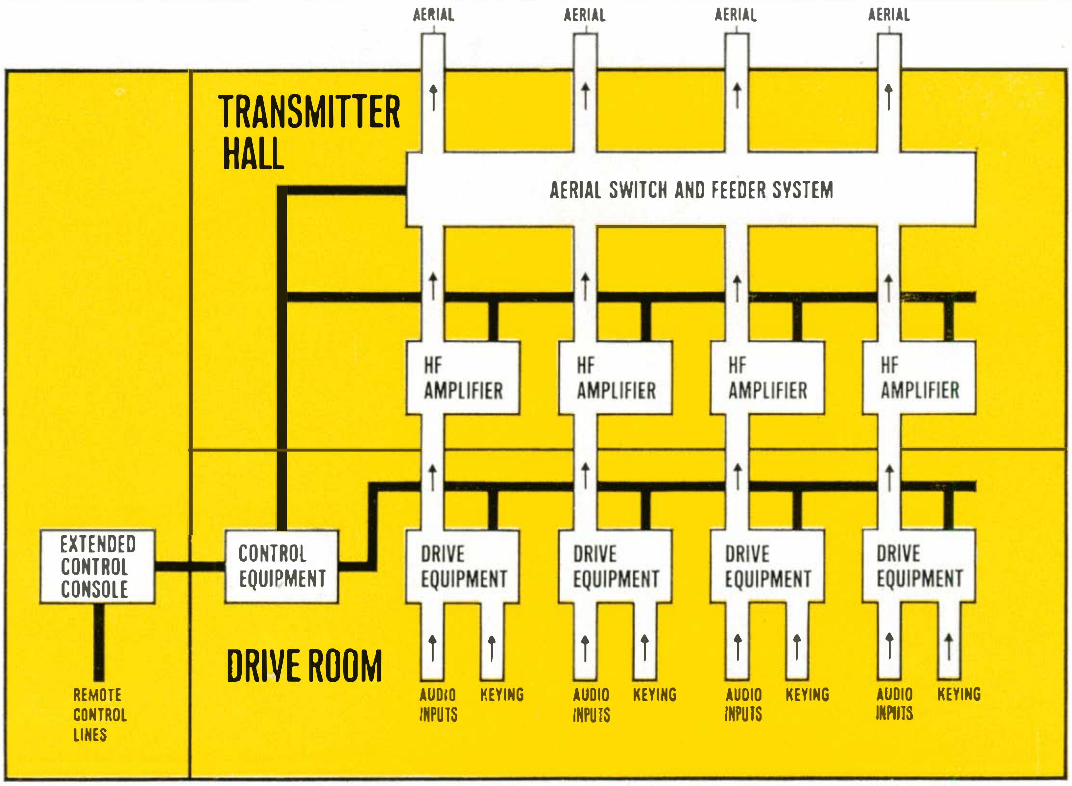
STC TELECOMMUNICATIONS REVIEW

AUGUST, 1966







STANFAST HF Transmitter System

Economic considerations in the operation of modern transmitter stations call for a large degree of high-speed automation. The STC STANFAST design philosophy greatly decreases the cost of communications by reducing attendant personnel to as low as one man for station control in a fully automated system. Further cost reductions are effected by minimum lost time during frequency changes, improved equipment utilization and system flexibility.

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The STANFAST system is the culmination of two decades of STC experience in automatic HF communication techniques. Progressing from single unit equipments to complex multi-block systems STANFAST provides for complete transmitter stations from line input to aerial output. It embodies comprehensive monitoring, automatic fault location and rapid restoration of service in the event of a failure. Tuning and loading are carried out in less than 25 seconds.

For further details, phone or telex Standard Telephones and Cables Limited, Radio Division, Oakleigh Road, New Southgate, London, N.11. Telephone: ENTerprise 1234. Telex: 261912.

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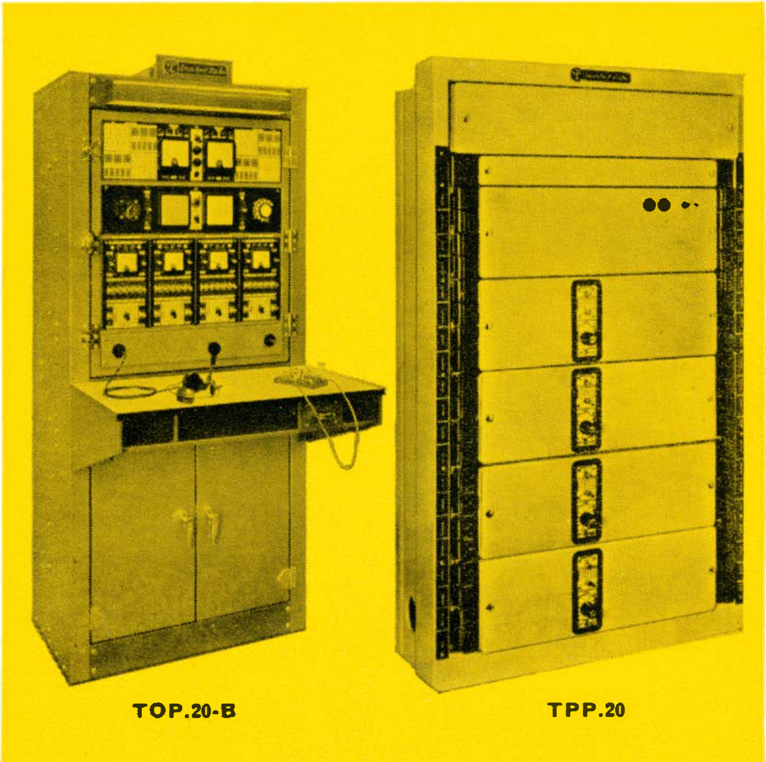

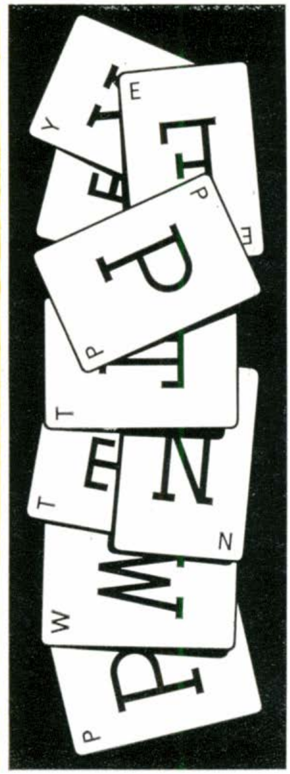

Privacy in radio telephony

Whether it's a matter of discussing an important business deal or just saying hello to Mother, most international administrations operating into radio links consider privacy to be essential. STC provides this facility through the TPP.20 four-wire fully transistorized five-band speech scrambler equipment.

This advanced equipment is designed to operate with h.f. radio link control terminals such as the STC TOP.20-B.

Both the TPP.20 and TOP.20-B handle four speech channels: both are extremely compact and embody modern techniques of transistorization and module construction.

Five Band Speech Scrambler Type TPP.20

■ Four speech channels ■ Fully transistorized ■ 4-wire system (separate send and receive paths) ■ Remote selection of combinations ■ Compact yet extremely accessible ■ Cabinet 36 inches (91,4cm) high x $20\frac{1}{2}$ in (52cm) wide x $8\frac{3}{4}$ in (22cm) deep.

Radio Link Control Terminal Type TOP.20B

■ Four speech channels ■ Fully automatic ■ Relay type VODAS switching ■ Built-in shifter and inverter for each circuit ■ Automatic station identification for each circuit ■ Console 75 in (190,5cm) high x 33 in (83,8cm) wide x 19 in (48,3cm) deep.

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MADE
TO MEASURE
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Post Office Telecommunications Journal

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

CONTENTS

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Vol. 18 Autumn 1966 No. 3

A New And Bigger Challenge

AS part of the Government's latest economic measures, the Post Office has to cut back its capital investment programme for 1967-68 by £13 m.

Of this amount, about £1½ million will be found by postponing some postal and telecommunications buildings. The rest—£11½ million will come from the inland telephone service which forms the largest part of the future investment programme.

This news, especially since it comes at a time when the Post Office is making unprecedented efforts to expand and improve the telephone service, is disappointing. But it is not as bad as it sounds.

The revised programme for 1967-68 still allows for an increase of about £20 million above that for 1966-67 and is significantly bigger than the amount spent in 1965-66. Nor is the Post Office being called upon to shoulder a disproportionately heavier burden than are the other nationalised industries. In any event, the investment programme has always been subject to over-riding national considerations and the Post Office cannot flourish if the national economy is not healthy.

The cuts in the inland telephone service will not affect the priority objectives of improving the quality of the service and pushing ahead with modernisation and automatisation. There will, however, be some slowing down of the greatly-expanded equipment programme for 1967-68.

Priority will also continue to be given to the supply of business connections over residential connections. The main impact of the reductions, therefore, will be in the supply of residential connections, although even here the effect will be cushioned to some extent by the easing of demand expected to result from the decision to require a year's rental in advance from new and removing subscribers. Some engineering overtime will have to be reduced, recruitment and deployment may have to be adjusted and clerical and sales work will also be affected.

The cuts are a setback but no reason for slowing up the efforts to improve and expand the service. Indeed, the situation now calls for even greater efforts to improve productivity and increase efficiency. We now face a new and greater challenge to make the best possible use of all our resources, skill and invention.

The Queen views London from the 580 ft high platform on the Post Office Tower, hub of the nationwide microwave radio network which is being built up to cater for the growth of telephone and television requirements.

A GOOD YEAR . . . AND A TESTING FUTURE

THE Report and Accounts, 1965-66, presents a picture of a continuously expanding telecommunications service which faces a challenging future.

"High rates of growth in demand and traffic are expected to continue for the remainder of the decade, providing a great stimulus and challenge but also presenting formidable problems", says the Report. "The provision of telephone exchange equipment will be a critical factor. A new programme has been worked out in close consultation with the manufacturers to increase output at the fastest practicable rate."

"There is a limit, however, to the rate at which expansion can be accelerated," warns the Report, "and it will be some time before the extension of existing exchanges and the provision of new ones overtake demand."

The Past Year's Achievements

The main tasks in 1965-66, adds the Report, were to maintain and improve the quality of the telephone service; to meet growth and prepare for further expansion; to continue with modernisation and automatisation; and to increase efficiency.

Record levels of business were handled. Profit fell from £39.7 million in 1964-65 to £39.3 million and the return on capital was slightly lower at 8.2 per cent although still on target. Productivity, as measured by the ratio of income at constant tariffs to costs at constant prices, increased by 4.9 per cent.

How the Business Grew

Demand for new exchange connections in 1965-66 rose by over 21 per cent to a record level of 861,000. The main reasons for this were the relative cheapening of the telephone and the new social attitude towards the telephone, especially among young people.

Supply of new connections (808,000) was also a record. This was 100,000 more than in the previous year.

However, supply did not meet the demand and the waiting list rose by some 46,000 to over 96,000. But this is less than 1.5 per cent of total connections and is noticeably smaller than in many other European countries. There was no waiting list at nearly three-quarters of all exchanges.

A record total of 6,050 million local calls and 841 million trunk calls—increases of about 8 per cent and 14 per cent respectively compared with 1964-65—were handled. Overseas telephone calls rose by 22 per cent to 7,600,000. Telephone traffic had grown twice as fast in Britain as the United States in recent years and faster still in comparison with some European countries.

Meeting Growth and Improving the Service

Many of the recent problems in the telephone service were due to under-capitalisation in the past, says the Report. The present and prospective programme was vastly bigger but it was still not enough—not because of financial limitations but because of severe physical problems.

The critical factor limiting the rate of expansion was the supply of exchange equipment and, although the industry was planning to expand output very rapidly, shortage of equipment would persist for some time. To alleviate the worst effects of the shortage some 200 mobile exchanges and 450 transportable units were in use or on order to provide temporary relief for exhausted exchanges. More small extensions were being carried out by Post Office staff in advance of larger extensions by contractors and procedures and practices were being streamlined to reduce the time needed to get new exchange equipment into service and to spread the available equipment more widely.

More new trunk circuits should be added in the next five years than now exist to cope with the rapid growth in trunk traffic.

The overseas telecommunications services were growing very rapidly, the most notable advances being in satellite communications. The overseas cable network was also being expanded.

Modernisation

During the past year 95 manual exchanges were converted to automatic working, and by the end of March, 1966, automatic local service was available to 94 per cent of subscribers. Automatic trunk service (STD) was extended to a further 750,000 subscribers and was now available to two subscribers out of three. Some 8 million trunk calls were being dialled by subscribers each week. About 70,000 calls a week were dialled by subscribers in Britain direct to subscribers in other European countries.

Operators at work on the new cordless switchboard which is being installed in all new exchanges. The new boards are easier to handle and less noisy.

Experience with electronic equipment for exchanges up to about 2,000 lines had been so satisfactory that all future orders for new exchanges up to that size would be for the new electronic equipment. Trials with production versions for larger electronic exchanges and electronic equipment to extend and replace existing electro-mechanical exchanges were expected to begin in 1966-67. Meanwhile, some orders were also being placed for large crossbar electro-mechanical exchanges.

Field trials with Pulse Code Modulation transmission systems had been successful and a quantity of PCM equipment was being ordered for use on selected routes to improve the service where additional junction lines could not be provided as quickly by other means.

New designs for most subscribers' apparatus were completed and efforts were now being directed towards new facilities—for example, the new Trimphone, press-button telephones, loudspeaking telephones, repertory diallers and a portable coinbox with STD facilities.

OVER

Following successful field trials, pulse code modulation equipment is now being ordered for use on selected routes. Here, an STC engineer tests the terminal equipment for a 24-channel system.

Research and Development

1965-66 was notable for an increasing number of research and development projects sponsored by the Post Office in universities. A wide range of studies was being carried out. There were two primary tasks for the future—to prepare for the rapidly-expanding demands for telecommunications facilites; and to keep down costs to customers.

Data Transmission

The Datel services continued to expand and the number of stations (now about 800) almost doubled. New Datel services were being developed and the possibility of establishing a national data network was being considered.

Telephone Directories

A new structure of directories was being developed to provide more informative books which better meet the needs of users, minimise demands on directory enquires and contain rising costs of providing number information.

Telex and Telegraph Services

Telex again expanded rapidly and by the end of March, 1966, there were more than 17,000 connections. Inland traffic rose by 7 per cent and overseas traffic by 15 per cent.

The number of inland telegrams was some 6 per cent lower than in 1964-65 but traffic in the overseas service increased slightly.

Improved Efficiency

Over the past five years productivity in the telecommunications services had increased by an average of 3¾ per cent a year and efforts were being made to improve this figure in the three main fields—operating, engineering and office procedures. "Telecommunications are well placed to improve their productivity," says the Report, "because they are essentially technical services offering considerable scope for techniques which improve service and reduce costs. The rapid rate of growth offers opportunities for economies of scale."

Future Outlook

"The Post Office is not stimulating demand or traffic, except for telex," the Report adds. "Stimulation is impracticable so long as shortage of exchange equipment persists. Accordingly, the level of demand in the next few years will continue to be governed mainly by factors outside Post Office control, such as the state of the economy, the trends of income and prices, rate of house building and so on.

"In the years ahead the system will grow faster than ever before and there will be a rapidly increasing use of a widening range of facilities. But the backlog of plant deficiences must be made good before the potential of the service can be fully realised. The enlarged capital investment programme should go a long way in this direction, but time is needed for it to bear fruit . . . There is a testing time ahead for the Post Office and the manufacturing industry. There is no lack of desire or determination on the part of either to reach a situation in which all the traffic offered can be carried efficiently and demands for connections met as and where they arise."

On 20 July—the day on which the Report and Accounts was presented to Parliament—the Government announced a series of measures to relieve pressure on the national economy. The effects that these measures will have on the Post Office are discussed in the editorial on page 1.

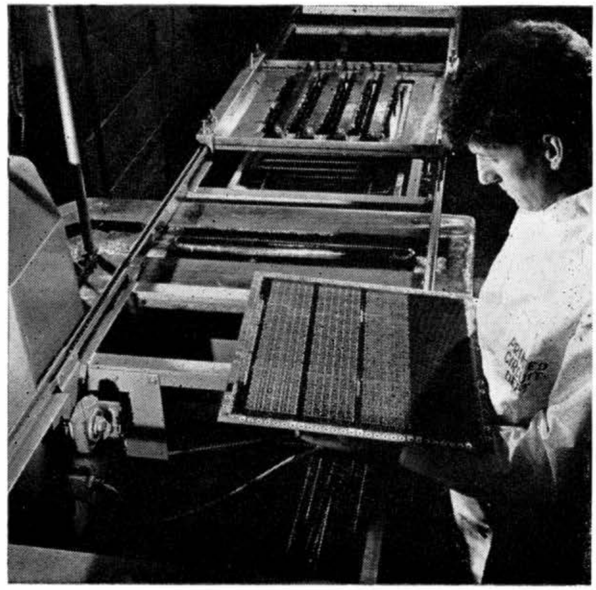
More Computers to Speed Modernisation

The Post Office is placing a contract with English Electric Leo Marconi Ltd for five new computers, together worth £3 million, and is taking an option on another four. The five new machines—to be known as Systems 4/70—are due for delivery between 1968-70.

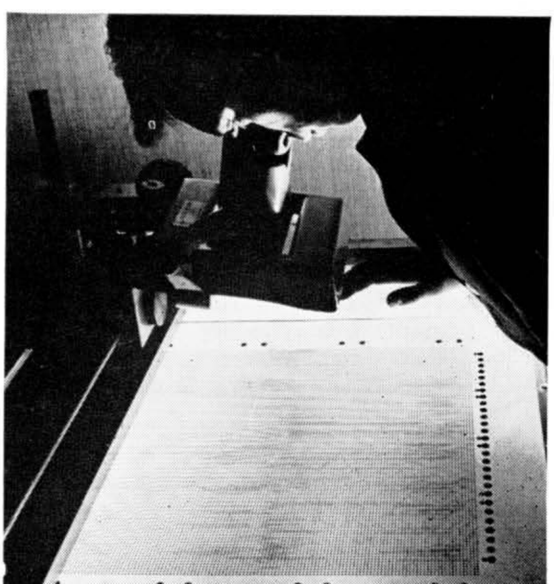
The new computers will play a vital part in helping the Post Office to modernise its techniques. Two of the machines will serve the Giro Office due to be opened at Bootle in 1968; two more will be installed in the new Savings Bank headquarters in Glasgow; and the fifth will be used at an as yet unspecified Regional Centre to handle a growing number of telecommunications and postal projects.

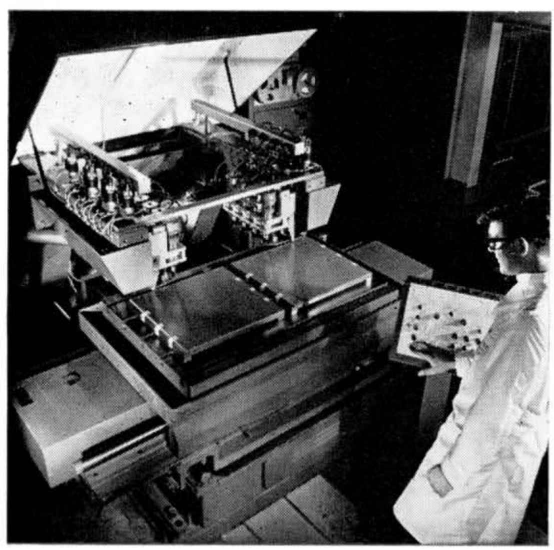
Computers are already being used in London to carry out such tasks as preparing telephone bills. They will be increasingly used for this and a variety of other telecommunications projects. Studies are now taking place, for example, in the use of computers to improve the utilisation of telecommunications line plant.

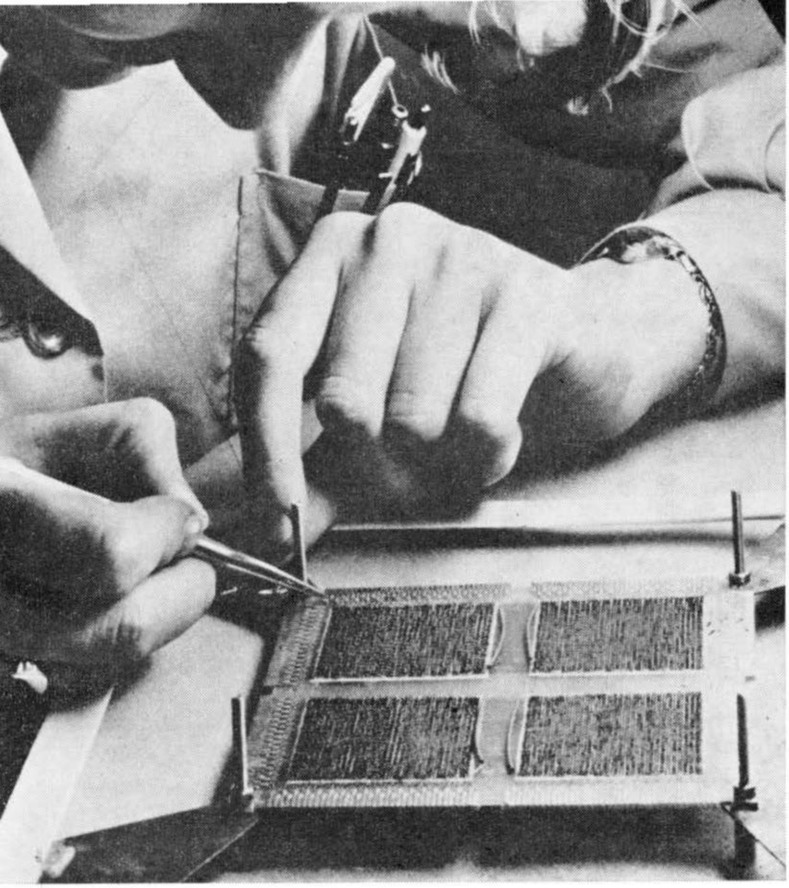
The pictures on this page show System 4 computers being constructed and tested at English Electric Leo Marconi's factory at Kidsgrove, Staffordshire.



The Systems 4 computer uses the most advanced electronic techniques of any computer in the world. A feature is that in the central processors back panel wiring is replaced by six-layer printed wiring panels, called platters, into which up to 120 three-layer printed circuit boards are plugged. Above: An operator examines a platter before passing it over a solder bath to ensure that all connectors are fixed in one operation. Below (left): Inspecting a photographic master of a platter and (right) setting up the machine which puts the holes into the platters.







Part of a ferrite core store being assembled. There are 16,000 cores, each only one-thirtieth of an inch in diameter, in the section of the store shown here.
Picture: Courtesy Plessey Co Ltd.

All computers must have memory stores if they are to provide the answers to the problems they are given. These memory stores vary in size and form and are being continually improved to meet the demand for bigger, better, faster and more versatile computers

MEMORIES FOR COMPUTERS

By D. V. DAVEY

A COMPUTER runs on the fuel in its memory. This fuel is the programme of instructions and also the data which is being used in the problem being solved or processed. The larger and faster the computer, the larger must be its memory. The memory can take several forms and it is now common for two or even three forms of memory to be used in one computer.

The one form of memory which is found in virtually every computer is the ferrite core store which uses small rings of magnetic material called ferrite woven together with wires to form a complex network or matrix. Such stores have been a feature of computers since the early 1950s.

The size of these stores has increased since those early days to the extent that a capacity of a quarter of a million alphabetic or numerical characters is now quite common and much larger stores of up to three million characters are now being built. About six ferrite cores are needed for each character.

At the same time, the operating speed of the stores has been considerably increased. This means that it is now possible to write

A magnetic tape deck being loaded on to the Engineering Department's new computer installation.

information into the stores at a rate of perhaps four million characters a second. These stores are very expensive because they involve a lot of manual assembly work. Up to four wires have to be threaded through each core, the diameter of the hole through the core being as small as 100th of an inch.

From the early days of electronic computers it was realised that core stores were too expensive to provide all the memory capacity required. This problem has been accentuated by the increase in speed of computing and the use of computers for more complex tasks involving the manipulation of very large quantities of data.

An analogy can be drawn here between human memory and computer memory. We can all carry a limited amount of information in our heads and can quickly process it. For example, we can do mental arithmetic and recall telephone numbers and so on. The core store memory is roughly similar to this type of memory since it, too, can store a limited amount of data and provide access to it in a very short time. For human beings there comes a time when we must write things down in order to remember them. Thus we have mathematical tables, telephone directories and so on. The capacity of our memory now becomes very much larger, although the time taken to find a particular piece of information becomes very much longer.

The same situation arises in computer memories. There are alternatives to core stores which are much larger in capacity but have much longer access times measured in tens of milliseconds rather than in microseconds. Whereas the core store, like the human brain, is a static device, these alternative forms of computer memory involve movement and are, therefore, sometimes grouped together under the title of "dynamic storage".

The most common form of dynamic storage utilises magnetic tape. The computer tape transport works on a principle similar to that of a domestic tape recorder, although the standards of performance required are considerably higher. One reel of tape can hold over 20 million characters equivalent, say, to all the words in seven Bibles. Because each reel of tape is removable from the tape transport and can be replaced by another, the memory has now become open ended, that is, there is no limit to the amount of data we can provide for the computer although there is, of course, a definite limit to the amount of data available to the computer at any time.

Another form of memory which has been used in computers since the early days is the magnetic drum. This consists of a metal cylinder coated with some magnetic material. Around the outside of the cylinder are arranged the recording heads which write and read the data on the magnetic surface of the drum as it revolves at high speed.

It is from the magnetic drum that one of the latest forms of dynamic storage has been evolved. This is the magnetic disc store which comprises a number of discs of aluminium or magnesium alloys, the flat surfaces of which are covered with a magnetic material similar to that used on magnetic drums. A number of these discs, which may vary in diameter between 14 and 48 inches, are arranged on a spindle driven by a motor in the same wav as the magnetic drum. The recording heads float on a very thin layer of air above the rotating discs and are carried on a number of arms which form a comb, the teeth of which fit be-

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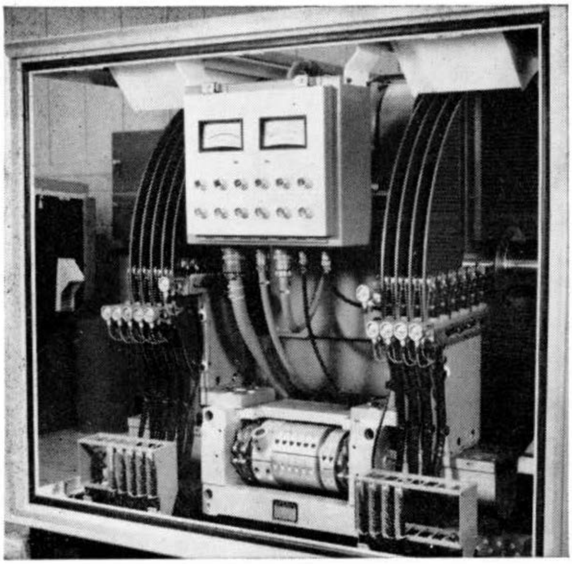
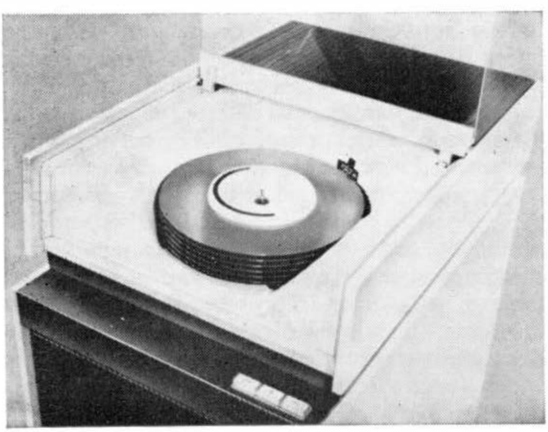


tween the discs. This comb is driven to and fro by means of an hydraulic or electromechanical mechanism and the movement can be controlled so that the recording heads are accurately positioned over any one of up to several hundred tracks on each disc surface. These tracks are, of course, concentric circles and the disc store may be considered as a large number of concentric magnetic drums. It therefore follows that the capacity of a disc store can be much larger than a magnetic drum. Some of the smaller disc stores are made so that the pack of discs can easily be removed by the operator and replaced by another disc



A large disc store. These discs are 39 inches in diameter and cannot be removed by the operator.
Picture: Courtesy Bryant Computer Products.

pack. Thus the store can be made open ended in the same way as a magnetic tape system.

There is a further type of dynamic storage device which can provide even larger capacity memories. This is the magnetic card machine—a sort of cross between the magnetic tape transport, the magnetic drum and a juke box. The cards are, in fact, thin sheets of plastic, typically 12 inches long and three inches wide, coated with a magnetic oxide similar to that used on magnetic tape. They are arranged in packs of, say, 256 which may be removed by the operator and replaced by another pack so that again the memory is open ended.

One magnetic card machine may accommodate several packs of cards. The mechanism of the machine is to arrange to select and pick out one of the cards, place it on a track where it is gripped by rollers or belts and conveyed to a small rotating drum. The card is automatically wrapped round the drum and held there by vacuum. Adjacent to the drum are a number of recording heads which can be arranged to write or read data on any selected tracks on the card. When a command is given by the computer the card is automatically released from the drum and returned by means of further rollers or belts to the pack. This type of machine provides the largest storage capacity (currently over 500 million characters in one machine) at the lowest relative cost. The mechanism is not as fast as that used in disc stores but even so it is possible to find any record in even the largest capacity card machine in less than one second.

The ferrite core store is found in every computer as a fast access memory, although other forms of static storage are being developed which may in time replace it. The form of dynamic storage which may be used as a slow access memory will depend on the requirements of the particular computer system. Magnetic tape storage systems are very common since they provide a cheap method of storing large quantities of data. The data is inherently

An exchangeable disc store. The pack of six discs can be replaced by the operator. The discs are 14 inches across and the pack weighs 10 lb.
Picture: Courtesy International Computers and Tabulators.

A magnetic card machine being loaded. This machine accepts a single pack of 256 cards.
Picture: Courtesy National Cash Register Ltd.

arranged sequentially and tape systems are, therefore, best suited for applications such as payroll where it is usual to process each record in a logical sequence.

There are many applications, however, where it is desirable to be able to go directly to any record in the memory in such a way that the time taken to find that record is more or less independent of the location of the record.

It is for these applications that the choice is made between the magnetic drum, the magnetic disc stores and the magnetic card machines. Magnetic drums give the fastest access time to any record but have the smallest storage capacity. On the other hand, magnetic card machines provide the largest possible storage capacity but at the expense of a slower access time. Disc stores come between drums and card machines both in terms of access time and storage capacity. The smaller disc store using the exchangeable disc pack is becoming very popular and to some extent is replacing magnetic tape transports.

The possible applications of these devices are too numerous to list here but the following are typical. British Railways use a magnetic drum installation to keep records of the whereabouts of some 90,000 trucks in use in their Western Region. At any time the computer can be asked to report the precise position of any particular truck, whether it is empty or loaded and so on.

Many large organisations use disc stores or card machines to keep records of their stocks of spare parts, components and so on. The records are continually updated as stores are issued or taken into stock and at any time the computer can provide details of the stock position, rate of consumption and so on, and can be programmed automatically to initiate stock replenishment procedures.

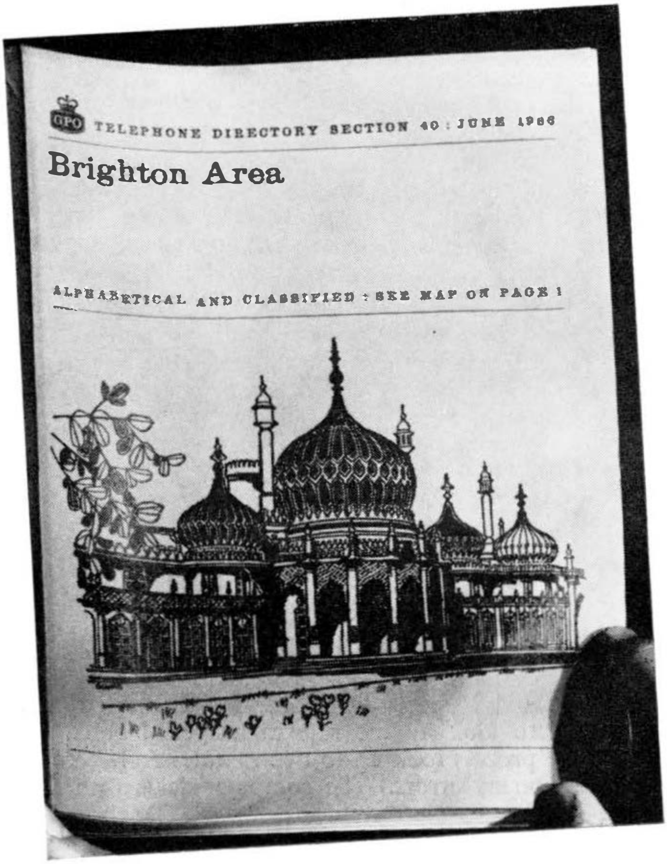
The North Western Bell Telephone Co. uses a computer fitted with a magnetic drum to store details of the charges for telephone calls from any one of the 3,000 exchanges in its area to any one of 30,000 exchanges in the United States and Canada. A novel feature of this installation is that the computer has a voice, also recorded on the magnetic drum. When the telephone operator makes an enquiry to the computer by dialling, the computer "voice" announces the cost of the call within one-tenth of a second. Previously, the operator had to dial a special rate operator whose job it was to look up the rate in a special book. This process took up to two minutes and there were many errors. The computer deals with 50,000 inquiries a day.

It is unlikely that we shall see this latter type of application in the British Post Office, although a similar process could perhaps be applied to the Directory Inquiry Service. At present the use of a computer with a large disc memory is being considered for the planning and control of the trunk telephone network.

All the forms of computer memory described in this article are continually being improved to meet the demand for bigger, better, faster and more versatile computers. In addition, other forms of memory are being developed and in some instances these are in limited use. Some of these do not rely on magnetic phenomena. For the time being, however, magnetic storage remains supreme for all types of computer memories.

THE AUTHOR

Mr. D. V. DAVEY, AIMEE., AMIMechE *is a Senior Executive Engineer in the Technical Support Unit. He started his engineering career as an apprentice in Devonport Dockyard and joined the Post Office as Assistant Engineer in 1953. Until 1964, when he joined the TSU, he was in the Power Branch of the Engineering Department.*



A NEW LOOK FOR DIRECTORIES

The cover of the new Brighton Directory

Public reaction to the introduction of a new combined telephone directory in the Brighton Area is keenly awaited. The issue of the new directory is the first step in a scheme to help telephone users and to reduce production costs and demands on Directory Enquiries

THE publication this Summer of a combined alphabetical/classified directory for the Brighton Area, introduces a completely new look to telephone directories.

Combined directories have been previously published experimentally for a number of years in Northern Ireland, Stoke-on-Trent and Reading and, although they have been well received, the Brighton directory has many new and brighter innovations specially designed to stimulate intelligent interest and promote greater use of directories. If its aims are achieved this new-look directory will be progressively introduced throughout the country.

The number of directories issued to subscribers is increasing with the rapid expansion of the telephone system and the Post Office now supplies more than 13 million telephone directories and answers 100 million directory enquiries each year. The cost of production of directories amounts to about £3 million a year and directory enquiries cost a further £4½ million a year.

The application of computers and new printing techniques to directory publication is being planned and studies are being pressed forward into the future organisation and operation of directory enquiries to contain the mounting cost of providing number information.

Despite all these developments the fundamental problem will remain of ensuring that our customers make the most effective use of their directories and, because this is the most economical way of tracing numbers, mini-

Staff of Thomson Directories Ltd at Farnborough compiling lists for the new classified directories

mise their demands on the directory enquiry service. The average cost of each of the 100 million calls which are made annually to the directory enquiry service is 11d. Almost half of those calls are for numbers the caller could find in the directory supplied to him. For this reason, ways are constantly being sought to improve directories and encourage their use.

In July, 1965, a 10-year contract for the right to sell advertising space in telephone directories published from 1966 onwards, and for the compilation of classified directories, was awarded by the Post Office to Thomson Directories Ltd., a subsidiary of the Thomson Organisation. In placing this contract, the Post Office made it known that they planned to off-set the increasing costs of directory production through the commercial development of directories as an advertising medium and at the same time to make directories as useful and attractive to the public as possible.

A Consultative Committee was set up with Thomson Directories and Her Majesty's Stationery Office to work out how these objectives could be achieved. The first development to which attention was given was the publication of directories containing both alphabetical and classified lists of subscribers, bound together in one cover, for issue to all subscribers. The Committee took as its first task the development of this basic concept both operationally and commercially, choosing Brighton as the first Telephone Area in which to measure the full value of such a directory.

Stretching from Littlehampton to Eastbourne and Crawley to the coast, with large centres of population around Brighton, Worthing and Eastbourne, the Telephone Area, which has been without a classified directory for many years, was considered an ideal area for pioneering such a project. In addition to the prosperous existing population, the area also attracts more than seven million visitors every year and consequently any new service to the public is exposed to a very large percentage of the country's population.

Once it was decided to go ahead with the new venture the closest co-operation between the various interests concerned in the Post Office, H.M. Stationery Office and the contractors had to be established and maintained to meet a publication date which had to be decided eight months in advance.

As an immediate first step to enable the advertising contractors to go ahead as quickly as possible with the preparation of classified lists of subscribers and selling advertising

OVER

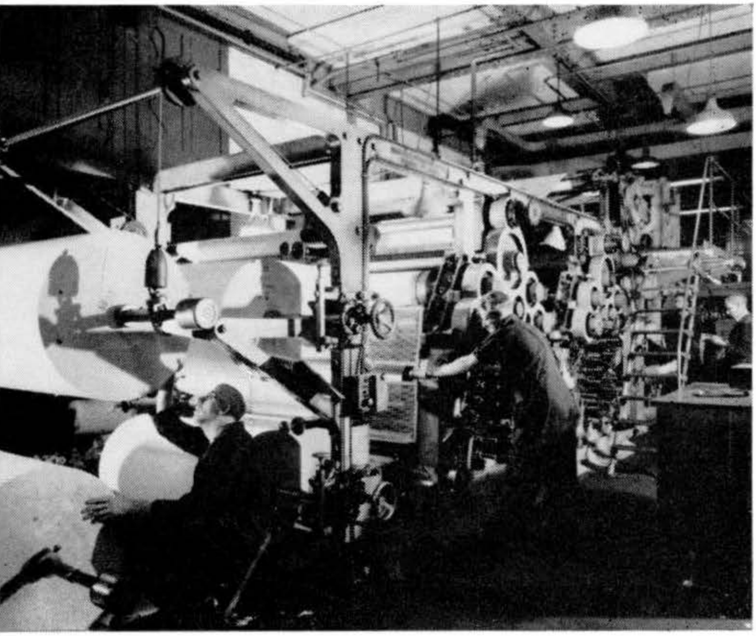
Telephone salesgirls check compilation and canvass for advertisers in the Brighton Directory.

space, the Telephone Manager's Office, besides the usual work of updating the alphabetical directory, prepared a special list of all business subscribers in the Area. These had then to be sorted by the contractors into their appropriate classifications and checked with each subscriber to ensure that the details of his listing were correct. This involved Thomsons in telephoning about 30,000 firms over a period of 13 working days, followed by a three months sales campaign throughout the area with a force of 20 salesmen and 24 telephone salesgirls operating from a temporary headquarters in Brighton. Each member of the sales force, either by personal call or by telephone, first identified himself or herself as a representative of the official contractors to the Post Office and, after verifying the subscribers' free entries, invited them to take advertising space or extra entries in the directory. A computer was employed for this complex operation to handle sales data, sales analysis and invoicing. The sales operation and preparation of the classified pages copy were completed in March.

Her Majesty's Stationery Office assigned a liaison officer at managerial level to maintain the close contact required between all those concerned with compilation and production, with special responsibility for telephone directory production and to provide additional production facilities for the expected increase in advertisements and classified listings. Normal directory production at H.M.S.O. printing press is geared to a very tight timetable to enable the most economical use to be made of plant and staff. Similarly, printing paper is bought in bulk well ahead of requirements. A closely co-ordinated plan from the outset and liaison at all levels between Thomson Directories Ltd., the Post Office and H.M.S.O. was essential to ensure that the work of all those concerned was properly phased.

Various styles of presentation and printing papers were considered for the new directory. An early problem was to find suitable papers in various colours to meet production as well as design needs. The final choice was made from a large selection of papers and cover materials and orders were placed at the beginning of January, 1966.

The re-styled directory incorporates a number of attractive and useful new features. The cover, which has been completely re-designed by Mr. Stuart Rose, Typographical Adviser to the Post Office, is completely free from advertisements and the front is illustrated with a drawing of the Brighton Pavilion. The preface has not only been re-designed typographically to make it easier to read, but has also been expanded to include new information such as advice to subscribers on how to get the best use from the telephone and how to trace numbers. It also includes a list of numbers of such places as local hospitals and London railway termini for which many Directory Enquiry calls are received. The new Brighton directory is also illustrated with attractive sketches of local places of interest. Changes have been made in the order of listing surnames with hyphens and apostrophes to give a more logical sequence of listing and help subscribers to find them more easily. Surnames spelt differently but sounding the same have been boldly cross-referenced. The classified list of subscribers is printed for the first time on a bright yellow paper and is preceded by an



Left: One of the HMSO rotary printing machines on which telephone directories are produced. Below: Completed directories roll off the Sheridan Gatherer and Binder.

index to the classifications printed on pink paper giving cross-references to help customers quickly find the appropriate classification covering their needs.

The publication of the new directory is being backed by a concerted publicity campaign to encourage subscribers thoroughly to understand the directory and to use it as often as possible, particularly the classified section. The continued interest of advertisers who have taken space in the directory will depend on the general public's use of it and is essential if the full commercial potential is to be realised. The publicity campaign has included sending letters to everyone of the 145,000 private and business subscribers in the area, placing advertisements in local weekly and evening papers and putting posters on mail vans, buses and hoardings. The Post Office is measuring the effect of the new directory on the level of Directory Enquiries and Thomsons are verifying its commercial impact.

All those involved in this new project keenly await the reaction of the public both as users and advertisers. The indications are that the venture will be a success. The effects on Directory Enquiries and public opinion remain to be confirmed but plans for similar new style directories to be introduced in other parts of the country are already being made.

A new Post Office-designed equipment is being introduced in the near future which will increase the capacity of telegraph systems on ocean cable routes and meet increased demand for some years to come

TDM WILL SOLVE THE PROBLEM

By C. S. HUNT

THE continuous expansion of intercontinental traffic, largely due to the demand for international telex circuits, has posed a problem for the Post Office. How could the capacity of these overseas routes be increased?

Time-division synchronous multiplex (t.d.m.) equipment which provides additional voice frequency telegraph circuits on ocean submarine cable routes without having to take telephone circuits out of use now solves this problem.

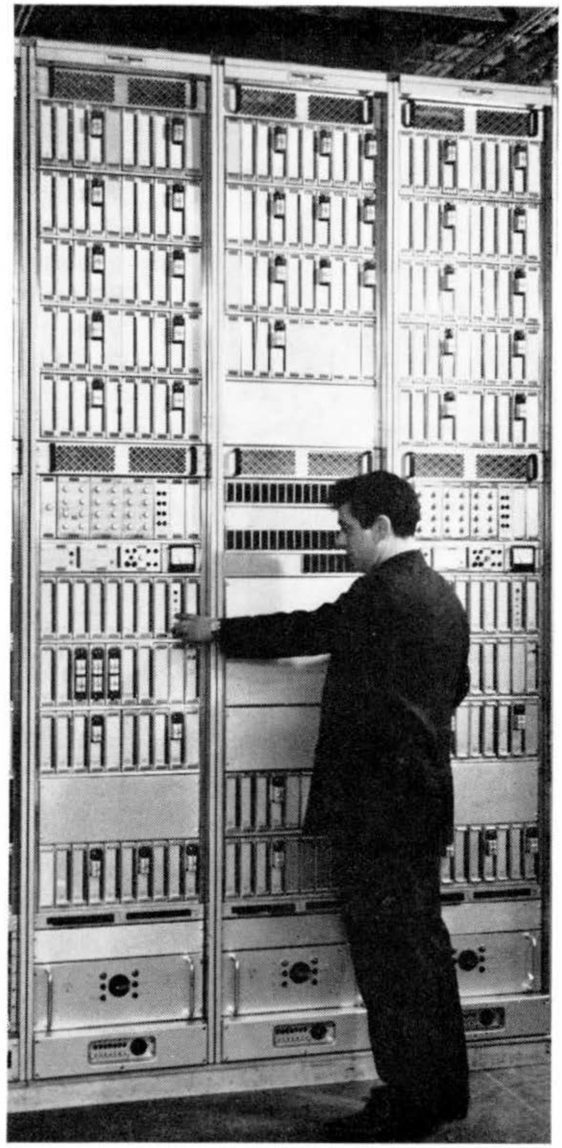
The equipment, designed to Post Office specifications, will be introduced shortly.

In the normal way, long-distance telegraph circuits are provided by a number of tones of different frequencies, each tone carrying a single telegraph message. A group of tones is carried by one telephone circuit and is called a multi-channel voice frequency telegraph (m.c.v.f.t.) system. When additional circuits are required it is not always possible to add more m.c.v.f.t. systems, since there may be no telephone circuits available. There comes a point where it becomes necessary to provide another submarine cable, which is an expensive solution, or, alternatively to make existing m.c.v.f.t. systems carry more circuits—and this is what a time-division multiplex system is designed to do.

Ordinarily, when one teleprinter message is sent without the intervention of a synchronous multiplex system, each character transmitted from the teleprinter is composed of a start element which starts the receiving cycle of the distant teleprinter. This is followed by five code elements which comprise the character being sent, and finishes with a stop signal which brings the receiving teleprinter to rest. Thus, the action of the start and the stop signals maintains synchronism between the two teleprinters for each character, despite small speed differences between the machines.

Assistant Executive Engineer P. T. Hercus checks the performance of one of the plug-in units of the new tdm equipment by means of a cathode-ray oscilloscope connected to a printed circuit.

When the v.f.t. circuit, which in the normal way carries the teleprinter message, has time-division multiplexing equipment connected at each end, additional teleprinter characters can be conveyed by the circuit in the time normally taken for one character. This is achieved by sending at a higher signalling rate. In the t.d.m. equipment either two or three teleprinter circuits use the v.f.t. circuit in rotation, thus one or two additional circuits are obtained. Exact timing is maintained by operating the multiplex equipment from a high-stability frequency-source, enabling the start and the stop signals of each teleprinter character to be dispensed with on the multiplex circuit. This has the effect of reducing the increase in signalling rate necessary to obtain the additional circuits,



A group of six multiplex systems being put into service. The left-hand rack provides for up to 14 full-rate circuits and the adjoining rack for additional circuits and inter-connections.

thus assisting in problems which arise in the transmission of higher signalling rates. Even so, it is necessary to add additional equipment to the v.f.t. circuits to enable the higher of the two signalling rates to be used.

At the receiving end of the multiplex system each character is routed to its appropriate channel output unit where the start and stop elements are added to the five code elements and the reconstituted character is sent to the receiving teleprinter.

Time-division multiplex equipment provides more full character rate circuits, hence assisting in the rapid expansion of the overseas international telex service and requirements for additional leased circuits.

A useful facility, termed channel subdivision or part-character rate working, is incorporated in the multiplex equipment. This provides for circuits to be operated at either one half or, one quarter of the normal rate of transmission, which is 400 characters a minute. This facility of quarter or half character rate working finds favour with renters who, having insufficient traffic to keep a full-time, full-character rate circuit efficiently loaded, require a circuit which is always available even though traffic cannot be passed at the highest character rate.

Time-division multiplex equipments are designed as groups of six multiplex systems, each system operating over one voice frequency telegraph circuit, and each providing either two or three full-character rate teleprinter circuits. Thus the voice frequency telegraph systems can be progressively loaded with extra circuits without increasing the load on the submarine cable system since no more voice frequency tones are added.

The additional cost of this equipment has, of course, to be taken into account when judging whether the method is to be applied, but where long ocean cable routes are concerned it is usually economical over the long distances involved. In fact, t.d.m. telegraph equipment should be able to assist in meeting the demand for expanding the existing telegraph systems operating on ocean cable routes for some time to come.

THE AUTHOR

MR. C. S. HUNT *is a Senior Executive Engineer in the Telegraph and Data Systems Branch, Engineering Department. He joined the Post Office in 1925 as a Youth-in-Training in the London South-East Area and was transferred to the Engineer-in-Chief's Office in 1938 where he has chiefly been concerned with developments in overseas telegraph communications.*

COLOUR TELEVISION COMES

Next year BBC 2 viewers will be able to see colour television programmes when Britain becomes one of the first European countries to have such a service. This article describes the PAL system which has been accepted, the alternatives which were considered and how the Post Office is preparing to meet both the BBC and public demands

These are copies of some of the colour transparencies most commonly used for testing colour television systems. Colour slides are limited in their colour ranges but they enable many of the relative performance differences to be judged. Some, for example the picture at bottom left, have large areas of uniform colour, while others contain sharp vertical and horizontal lines.

WHEN the PAL (German) colour television system is regularly used on BBC2 towards the end of 1967, Britain will be one of the first countries in Europe to have an operational colour television service.

The Post Office is in the happy position of having prepared for some time to meet the demands of such a service. For many years now, inter-city television links have been provided to a standard to make them suitable to carry any of the other contesting colour television systems—American, French, Russian. But there will be a number of the shorter links to studios and transmitters which will need to be replaced.

In addition, the Post Office Television Switching Centres will have to provide monitoring and special test equipment to examine the quality of colour pictures being passed through these stations to ensure that the links meet the required standard.

For the ordinary viewing public, colour television will mean some additional outlay. A special licence will be issued by the Post Office and a sum of about £250 will be needed to provide a special colour receiver, or, alter-

TO BRITAIN By C. E. CLINCH BSc. (Eng.), C. Eng., AMIEE

natively, a set may be rented at an estimated charge of 30 shillings a week.

Programmes will not all be in colour in the early stages of the service and black and white transmissions will therefore be received on colour receivers in monochrome. In addition, viewers with monochrome receivers, who are content to see the colour transmissions in black and white, will be able to do so without modifications to their receivers. Also, an aerial suitable for BBC2 reception need not be changed for colour reception.

A main consideration has been to secure an acceptable quality of colour reception for viewers with colour receivers and, at the same time, to ensure that the quality of the monochrome picture received by those with black and white receivers would also be acceptable. A further consideration has been the cost to the viewer to equip himself to receive colour transmissions. Finally, to ease as far as possible the exchange of colour programmes with other European countries and to facilitate exports of components and capital equipment, the Television Advisory Committee and its Technical Sub-Committee have had constantly to keep in mind the choice of colour systems other countries might make. These problems have been under study since 1954.

One of the problems of colour television is the need to have a form of signal that can be displayed both as a monochrome picture and a colour picture on different receivers at the same time. In 1802, Thomas Young suggested that colour pictures are seen by virtue of three types of receptors in the eyes separately sensitive to red, green and blue. While this is not strictly true, it is known that we can construct the complete range of colours from three main primaries. If subtractive colours are used, that is, white light minus some colour, the colour filters have to be red, green and blue. This same principle applies to ordinary photographic colour transparencies. The black and white picture can be formed from colour primaries by mixing one third red, almost two thirds green and just over one tenth blue. Mixed well, these give a range of greys depending, of course, on the intensity of the colours. In television, the signal carrying this black and white picture information is called luminance signal and is given the symbol Y.

If the Y signal is transmitted then it is not necessary also to transmit separately the red (R), green (G) and blue (B) signals. It is found convenient to transmit Y, (R-Y) and (B-Y). The colour receiver calculates from these three signals the R, G and B components. This is done in all colour systems—the luminance (Y) signal is transmitted to permit a monochrome picture to be seen in the normal way and the (R-Y) and (B-Y) are transmitted for use with the Y signal in the colour receivers.

To prevent these colour signals from causing interference to users of adjacent broadcast channels the colour signals must be sent within the same bandwidth as the original monochrome service. Because of the way a television picture is built up, line by line, the energy in the signal, if analysed, is found to be distributed in packets spaced at a frequency equal to the line scanning rate. The colour information can be carried by a separate

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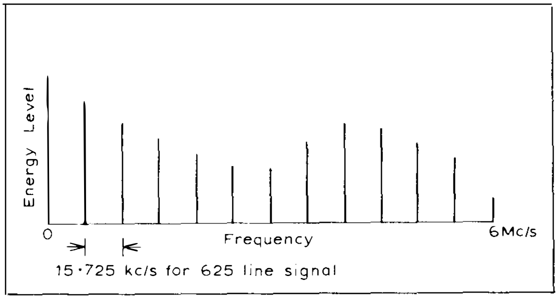

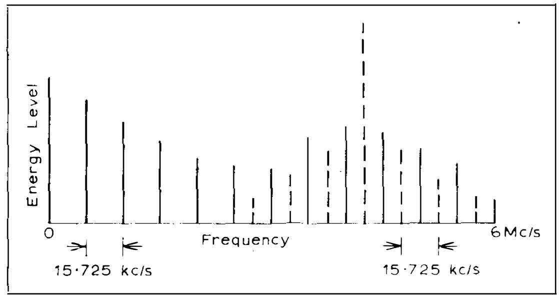

These two diagrams illustrate (left) how the energy of the luminance signal is distributed throughout the frequency band and (right) how the luminance and colour information is distributed to minimise mutual interference.

carrier frequency. If the colour carrier is chosen correctly, the carrier is also modulated by a television type signal which will cause energy to occur in packets also spaced at line frequency apart, and the energy can be interleaved between the luminance energy spectrum.

In 1953 the National Television Standards Committee (NTSC) proposed the colour television system used in America (see Autumn 1959, issue of the *Journal*). In this system the colour carrier is modulated in both amplitude and phase. In the NTSC system any false change in the phase (the timing) of the colour carrier changes the hue of the displayed colour. Imagine colours of the rainbow arranged in a circle and see the errors caused by a false change of, say, 40° clockwise—red becomes magenta and blue becomes cyan (i.e. a bluey green).

Equipment can cause such changes in 'phase' of the colour carrier and so, too, can reflections from buildings or mountains. While equipment design can be improved to overcome this defect, echoes in the transmission path from the broadcast transmitter to the home aerial are not easily overcome. This was one reason why those countries in Europe with mountainous terrain were not happy about the American NTSC colour television system. It was this difficulty which also prompted the remark that the initials NTSC could stand for **N**ever **T**wice the **S**ame **C**olour.

The French studied the problems of colour television and in 1960, a paper was written describing a system invented by Henri de France, to overcome the (NTSC) Never Twice the Same Colour problem. They pointed out that the definition or sharpness of a colour picture is satisfactory if the luminance component is sharp but the colour information relatively blurred. Hence it was possible to accept a 625-line luminance picture plus a 312-line chrominance picture. They proposed to send the (B-Y) signal on one line and the (R-Y) signal on the next line. In the receiver a "delay-line" stores one line of information. The two sets of signals are processed to obtain the R, G and B signals for display on both lines of the picture. Having only one piece of colour information to transmit at any one time, this could be done either by amplitude modulation or frequency modulation, either of which were not sensitive to phase errors. They called this new system SECAM (sequential with memory).

After investigating the possibilities of amplitude modulation they changed to frequency modulation. However, with frequency modulation the energy no longer falls in packets between the luminance signal; and the black and white picture displays additional black dot patterns resulting from the interference from the colour signals. The carrier level can be reduced to improve the compatibility but the result is an increased susceptibility to noise interference. By introducing variations, with the titles of SECAM 1, 2, 3, 3A and 3B, continued attempts were made to improve the overall system but so far these have failed to match the original NTSC performance and, in addition, they have lost half the colour vertical definition for ever.

An alternative solution to the NTSC problem of phase errors was introduced in 1963 by Dr. Bruch of Telefunken, and this new approach from Germany was called PAL—

The author tunes a colour television receiver. On the screen is a typical colour test picture containing toy trains which have proved very useful for examining colour distortions.

meaning Phase Alternate Line. In this system one line is the same as NTSC, but the next line has the phase of one of the colour signals reversed. This 'phase' reversed has the effect of turning the colour circle upside down for every other line. The receiver unscrambles these reversals and can either display the signals exactly as for NTSC or, can be provided with a circuit to average the colour of two adjacent lines before displaying them.

The effect of this reversal process on phase errors can be seen by considering the same rainbow colour circle. As before, a 40° clockwise change on line one changes red towards magenta, but on line two red will change towards yellow. If these lines are displayed directly, providing the error is relatively small, the eye will average the two and the correct colour will be experienced. If the two colours are electrically averaged then the correct colour results. Since lines arrive sequentially in time, to do the averaging it is necessary to delay one line until the other arrives. The cost of the PAL receiver with this delay equipment and the switch to uncross the alternate lines, is expected to be about 3 per cent. more than the NTSC receiver.

It is a tribute to the American NTSC committee that the compromise they selected in the many possible parameters of a television system is such, that it seems impossible to improve the performance in some way without almost unacceptable loss in some other direction. The PAL signal, as with the SECAM signal, is more tolerant of 'phase' errors. The question is, what have we lost by the change? The quality of the monochrome picture derived from a PAL colour signal is slightly worse than NTSC but not as bad as the SECAM compatible picture. It is thought, however, that the public are unlikely to notice the difference in quality on the screen when PAL colour pictures are shown.

The colour picture also suffers in that where there are horizontal colour edges—two adjacent lines in different colours—the receiver interprets this as a phase error and falsely averages the two colours, giving the wrong colour for the first line of a colour change. In practice, this is noticeable primarily on captions, where the horizontal parts of some letters are of different colour.

The PAL system has an additional advantage over the SECAM system in that all the

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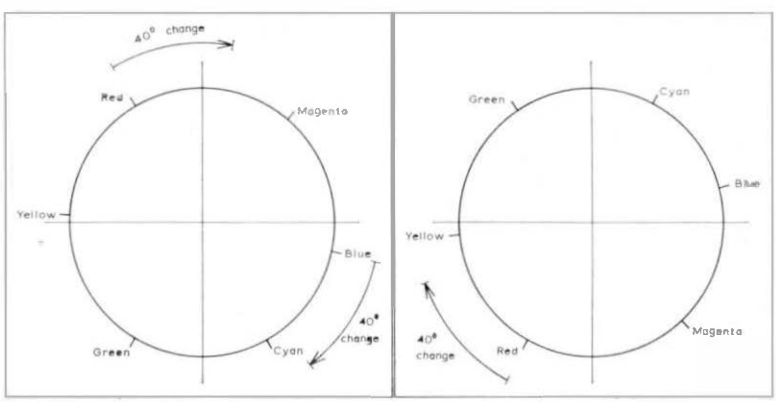

In the NTSC system phase errors cause colour shifts in the same direction, as illustrated in the diagram on the left. The diagram on the right shows how the colour circle is reversed for every alternate line in the PAL system.

colour information in the NTSC signal is still present in the signal. Admittedly, the SECAM system shows that all this information is not required at present, but it is difficult to be sure that, with the future development of display devices, this will always be the case.

During the last year the Russians have suggested to the French that they study a new system called NIIR (equivalent letters of the Russian initials of their National Radio Research Institute). The French have called this system SECAM 4. It is similar to one proposed by a BBC engineer a few years ago and is, in a way, a cross between SECAM and PAL. One line is the same as NTSC and PAL, but, the alternate lines contain only reference signals.

The performance, as far as it has been tested, is also between that of SECAM and PAL. The main advantage of SECAM 4 is that it is completely immune to phase change errors. Its main drawbacks are that, like all the previous SECAMs, it has only half the colour information. It requires a delay line in all receivers (there can be no equivalent to the simple PAL receiver using the eye to do the averaging), and the accuracy of this equipment has to be twice as good as that for the PAL receiver.

The development of colour television systems has not stopped and is never likely to. Development has in some ways been hastened by the preparations for the opening of an operational service by encouraging manufacturers to compete in the design of receivers. Britain has done much of the initial work to get colour television started in Europe and, by being one of the first to start a service, will benefit from the export of colour television sets, components and programmes.

Britain could have used the NTSC system, modified to suit 625-line standard. However, in accepting the PAL system, programme exchange with Europe will be easier and the colour rendering seen by the majority of viewers, particularly those living in the more mountainous areas of Wales, Scotland and the Pennines, will be improved. The majority of Western Europe — Scandinavia, Germany, Austria, Switzerland and Italy have, with Britain, accepted PAL.

THE AUTHOR

Mr. C E. CLINCH, B Sc. (Eng.), C. Eng., AMIEE., FSS., MTS *is Assistant Staff Engineer in Radio Planning and Provision Branch-Inland, and is Secretary of the Technical Sub-Committee of the PMG's Television Advisory Committee. He joined the Post Office as a Youth-in-Training in 1936 in the LTR West Area, was promoted to Inspector in the Main Lines Development Branch in 1944 and as an Executive Engineer and Senior Executive Engineer was responsible for the maintenance organisation for television links when television restarted after World War Two. After a short spell on electronic telephone exchange development he took over his present duties in 1963.*

★

THE NEW POSTMASTER GENERAL

The Rt. Hon. Edward Short, MP. He was formerly Government Chief Whip in the House of Commons.

The new Postmaster General, the Rt. Hon. Edward Watson Short, MP, who was appointed on 3 July, is a former headmaster of a secondary modern school at Blyth, Northumberland.

Born in 1912 and educated at Durham University, Mr. Short served with the Coldstream Guards and later with the Durham Light Infantry, rising to the rank of Captain, during the World War Two. He wrote the regimental history—*The Story of the Durham Light Infantry*—and the War Office training book *The Infantry Instructor*.

Mr. Short, a former leader of the Labour group on the Newcastle City Council, has been Labour MP for Newcastle Central since 1951. As a back bencher he took a special interest in education and in the 1954-55 session of Parliament introduced a Private Member's Bill to empower local authorities to allow free or reduced travel on public vehicles to old age pensioners, the blind and disabled. When the Labour Party was returned to power in 1964, he became Government Chief Whip in the House of Commons and was created a Privy Councillor.

Married, with a son and a daughter, Mr. Short's recreation is painting.

PRESSURISATION and PRODUCTIVITY

By A. F. G. ALLAN, C Eng. AMIEE

This article in the series telling how the Post Office is improving the efficiency and productivity of the telephone service describes how pressurisation of underground cables is reducing both the number of service failures and the overall costs of maintenance

Checking cable pressure with the Post Office standard manometer No. 1B. The column of mercury adjacent to the scale on the right-hand side of the instrument indicates the cable pressure directly in lbs per square inch above. normal atmospheric pressure.

IN FIELDS such as maintenance there are few tangible end products the Post Office can count or measure against the effort involved. Productivity, therefore, is assessed indirectly, by evaluating such aspects as the effect of failures on service to the customer, the cost of repairs and the cost of preventive maintenance.

Generally, maintenance is concerned with two basic factors—achieving adequate serviceability of the plant being maintained and the costs involved (in terms of money or manpower) in providing given levels of serviceability.

The maintenance of underground cable routes differs considerably from that of most other telecommunications equipment in that the main causes of trouble arise from factors outside the direct control of the operating authority. Cables are subject to both natural and unexpected hazards (see Autumn 1965 issue of the *Journal*) among which the most important are corrosion, cracking of sheaths due to vibration, track subsidence, damage by

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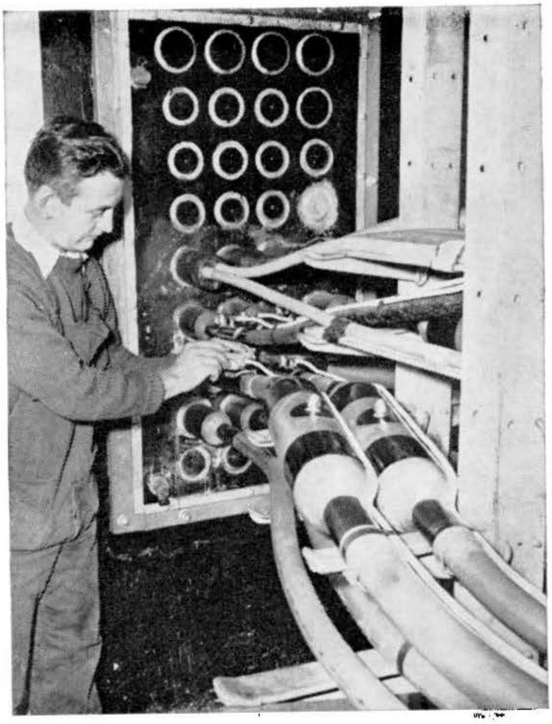


Cables leaving the exchange through the cable chamber duct seal. The small white pipes supply dry air under pressure to the cables. The supply point may be anywhere within the exchange.

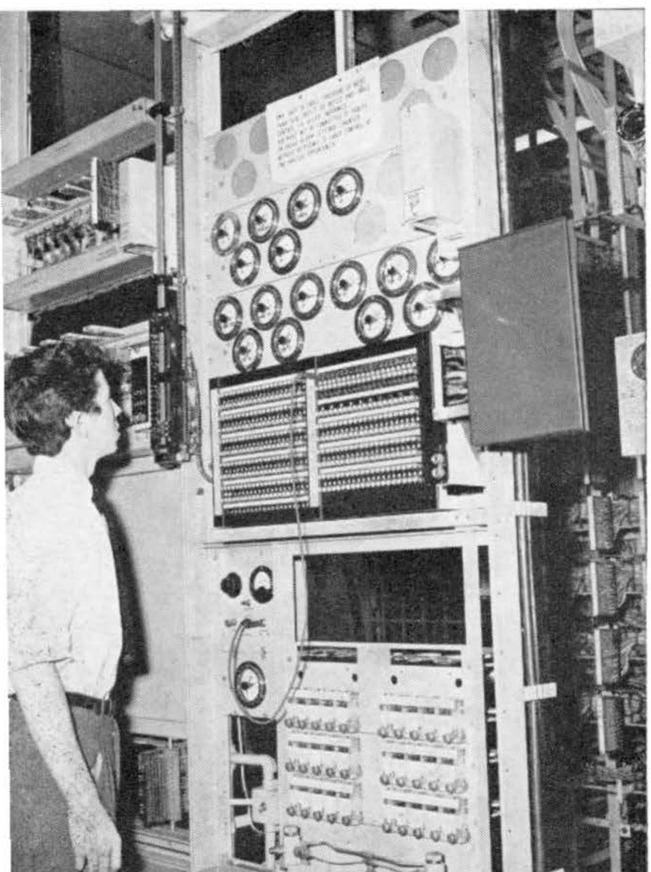
operations in the vicinity of the cable tracks (such as roadworks, gas, electricity, water and sewerage repair work) or accidental damage by gas explosions or burst water mains.

A good maintenance organisation should be able to detect each cable defect, from whatever cause, at an early stage, and endeavour where possible to effect repair well before service is impaired. This is true preventive maintenance but, however excellent the defect detection system, some service failures will occur and the organisation must also be ready to carry out repairs or clear breakdowns quickly and efficiently.

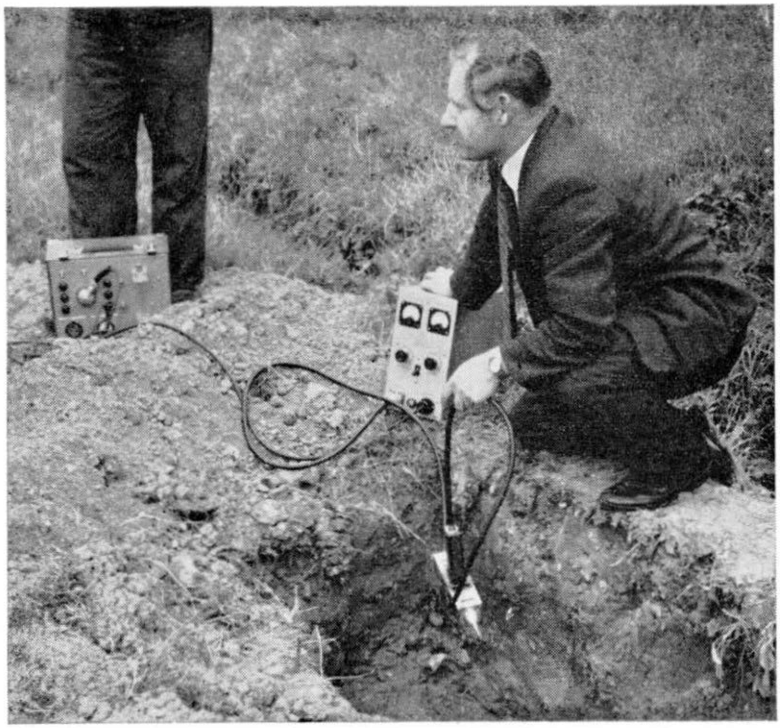
The biggest enemy of the underground cable maintenance engineer is the entry of water into cables once defects in the sheaths have occurred. In the past, by monitoring the insulation resistance of a few selected pairs within each cable, some indication could be given of water seepage. Prompt action was then necessary to locate the point of entry and to deal with the defect before so much water had entered that service became seriously interrupted and cable lengths were ruined.

Prompt action, however, is not always possible. For example, should a defect occur outside working hours cable lengths may be ruined before any effective action can be taken and complete renewal of the faulty lengths has then been the only remedy. Apart from the high cost of the work, the loss of serviceabiliy during the changeover period which, in many instances, takes a number of days to effect, has meant a further loss of revenue and created a poor service image.

In the four years for which necessary data is available, the number of cable defects in each 100 miles has risen from ten to 16 each year but the number of service failures has been held at just over six. It is confidently



A typical cable pressurisation rack in an exchange. The air compressor is usually housed separately in the Power Room. Here, the maintenance officer checks cable pressures on the gauges. There is one gauge for each trunk or junction cable leaving the exchange.



Locating a leak in the middle of a length of cable. By determining the leak exactly a repair may be carried out on the spot and replacement of the cable length avoided.

expected that when pressurisation has been completed by early 1968 service failures on each 100 miles of trunk cable in the country will have fallen to around one or two each year and that these failures will usually be due to serious mechanical damage by other authorities. Pressurisation cannot prevent water entering a cable through large holes caused by digging tools.

Overall maintenance charges for each 100 miles of cable do not yet show a dramatic decline, but it is significant that the rise has been checked. As pressurisation spreads real savings can be forseen. The true effect of the relatively small amount of pressurisation already completed can be illustrated by adjusting the actual cost figures back to 1962-63 price levels. If labour and material charges remained unchanged between 1962-66 the spread of pressurisation in this period would have resulted in a six per cent. decrease in costs.

After 1968, when pressurisation should be nearing completion, it is expected that expenditure on trunk cable maintenance will be considerably less in direct costs each year than at present, even allowing for a continuation of the present rising trends in the costs of labour and materials.

On junction cables it is fairly certain that a similar saving in maintenance costs can be achieved and that there will be an even more impressive reduction of service failures on each 100 miles of cable—from 11.0 (the present figure) to around 1.0 or 2.0, as on the trunk network.

In the exchange cable networks improved serviceability arising from pressurisation has already been demonstrated, but it is a little too early yet to estimate the financial savings which may arise. The present annual direct cost of about £6 million on local underground plant maintenance suggests that there is scope for large savings, although pressurisation is only to be applied to the larger cables between the exchanges and distribution cabinets or pillars.

The application of air pressure to the many small distribution cables between pillars, distribution points and subscribers' premises is not considered practicable or economic because

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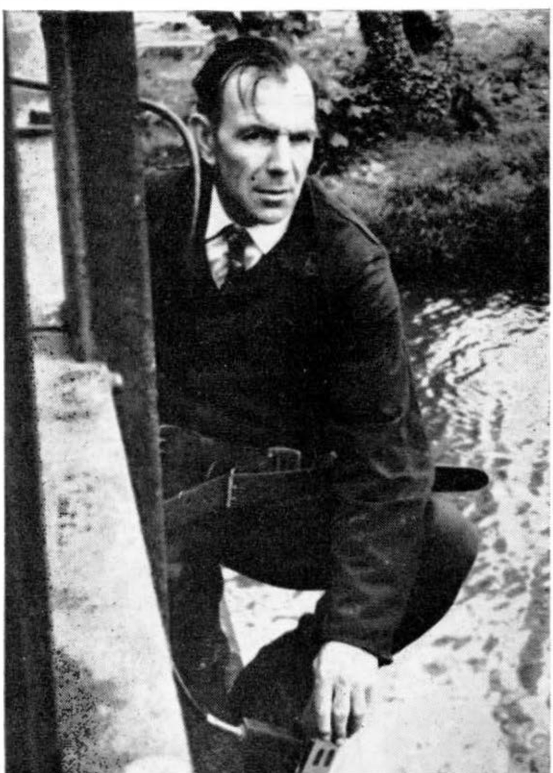
of the large numbers of cable seals that would be required at all the cable terminations, the high pneumatic-resistance due to the small diameter of the cables and difficulties in locating leaks in a cable layout which has a wide variety of cable sizes.

Direct assessments of changes in efficiency in the cable maintenance field are difficult because of the problems of defining the appropriate units of measurement. But it is certain that with complete pressurisation a very much better service will be provided with a saving of at least 20 per cent. in maintenance costs.

A better way of reducing the number of service interruptions due to cable sheath faults is to seal the cables against leakages at all terminations and then to fill the cable with dry gas at a pressure sufficient to ensure that when sheath damage occurs the presence of the gas inside the cable will usually prevent water from entering.

An unusual stituation. A cable in a steel pipe across a bridge sprang a leak on the bridge. Small holes were drilled in the pipe. Gas was then pumped into the cable and "sniffed" for through the holes. In this way the fault was found and cleared on the spot so that the cable length did not need to be renewed.



Today, most of the underground cables in the Post Office network are being pressurised with dry air, the air inside the cable sheaths being maintained at around nine lb. a square inch above normal atmospheric pressure throughout the trunk and junction cables and between three and nine lb. a square inch on local cables. It is hoped that most pressurisation work will be completed by 1968/69.

The internal pressure is monitored, by pressure gauges and other devices, at regular intervals along the length of each cable and evidence of a sheath defect is indicated by a fall in pressure. Generally, no immediate action is called for. Even if pressure falls as low as one lb. a square inch this is still sufficient to prevent water entering the cable even though it may be lying under two feet of water.

If early attention is inconvenient, a supply of dry air to the cable can be arranged to make up for the leakage until such time as maintenance parties can conveniently be deployed to attend to the defect. It has become possible to plan the operations of the maintenance force as a whole with a minimum of ineffective time. Additionally, since water is prevented from reaching the interior of the cables, the number of ruined cable lengths is reduced and this results in a significant financial saving.

A problem arises in attempting an assessment of the rise in productivity resulting from pressurisation because the traditional systems of managerial control and accounting on cable maintenance have not provided the information required to make direct comparisons with the past.

The efficiency of the cable maintenance organisations have been measured only on the basis of the maintenance manhours expended on individual units of cable, the units themselves being based on the mileage and numbers of individual wires within the cable sheath. Unfortunately, the costs of cable renewals, often as expensive as the preventive maintenance burden, have been segregated and not taken into account in the maintenance performance index. In addition, no records are available of the grade of serviceability given in the past.

With the adoption of pressurisation as a national policy, new approaches have had to be made in determining the units of work involved and measuring efficiency and productivity. The earlier concept—a system of work units based on wire mileages or numbers of circuits—is not satisfactory in the new conditions since the important factor is the cable sheath, irrespective of whether the sheath is large (1,000 wires) or small (50 wires). Since the conductors within the sheaths are no longer affected by water, the costs of repairing defects are generally similar, irrespective of the cable size.

Since the inception of the campaign to provide overall pressurisation to the underground cable networks, records have been maintained for trunk and junction cables of a number of important factors. It has not yet proved practicable to maintain an overall record for the larger local cable networks, but sampling techniques have already shown that the labour required to clear faults on pressurised local cables is about a quarter of that on unpressurised cables. It is also fairly certain that the indicated trends will also apply to the larger cables laid in duct in the local cable networks.

The basic unit which has been adopted for trunk and junction cables is 100 sheath-miles. The total number of defects, and the number of those which develop into actual service failures, is recorded for each Telephone Area. A defect becomes a service failure if one or

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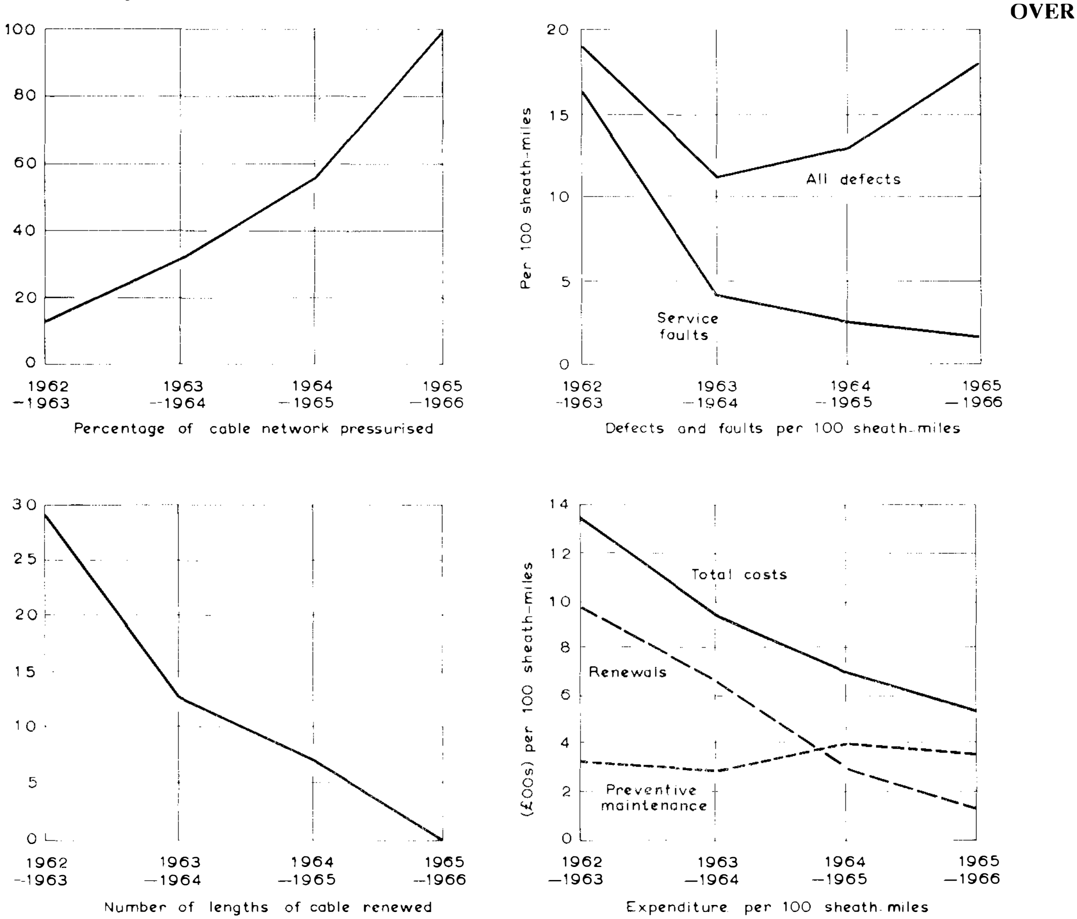
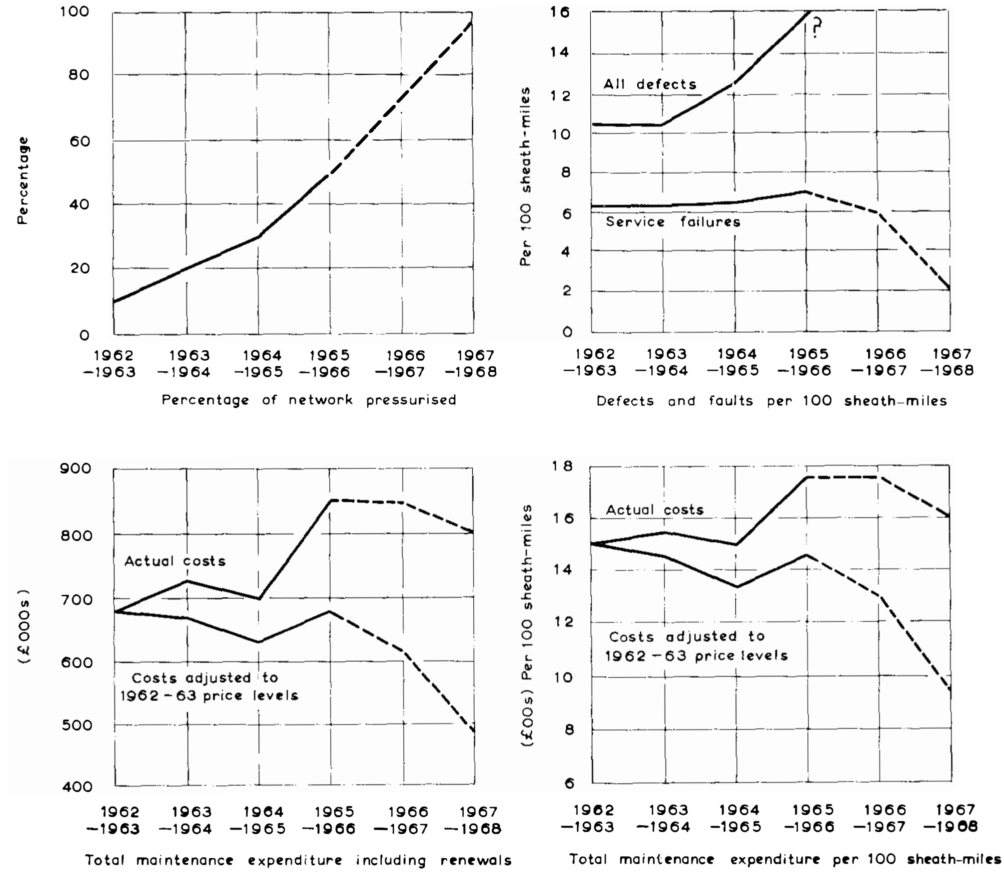


These four diagrams illustrate the very highly satisfactory results achieved when the trunk cable network in the Southend Telephone Area was completely pressurised. Significantly, the service failure rate was reduced from 15.3 to 1.7 a year on each 100 sheath-miles of cable and overall maintenance costs were halved.



These diagrams show the effect of pressurisation on the national trunk cable network between 1962 and mid-1966 when less than half of the system had been pressurised. Big savings are forseen in the future.

more public or private circuits is rendered unserviceable. The maintenance efficiency of each Area organisation is expressed in terms of the percentage of the total number of defects which are prevented from developing to service failure conditions.

Serviceability alone, however, must not be used as the sole criterion of maintenance performance. Obviously, good serviceability can always be obtained with a sufficiently large labour force and a consequent high expenditure, but the aim must be to achieve acceptable serviceability at low cost. It is very necessary that any true performance index should take into account both serviceability and the costs of maintenance and costs must include both preventive and remedial maintenance factors.

The effects of pressurisation are typified by the experience of the Southend Area where, by June, 1966, the entire trunk cable network had been pressurised. The service failure rate has been reduced from 15.3 to 1.7 a year on each 100 sheath-miles of cable, while the overall direct costs of maintenance have been halved. Further, the number of incidents where cabling gangs have been called to carry out unproductive work, such as renewals, has been reduced to a very low order. In fact not one length was renewed in the 1965-66 fault year, although this must be considered somewhat unusual and unlikely to be a general consequence of pressurisation. Similar good results have been achieved in other Areas in which a reasonable amount of pressurisation has been achieved. The effect of pressurisation on the national trunk cable network as a whole cannot yet be clearly demonstrated since by mid-1966, a little less than half of the total mileage had been pressurised. Nevertheless, similar trends can be seen.

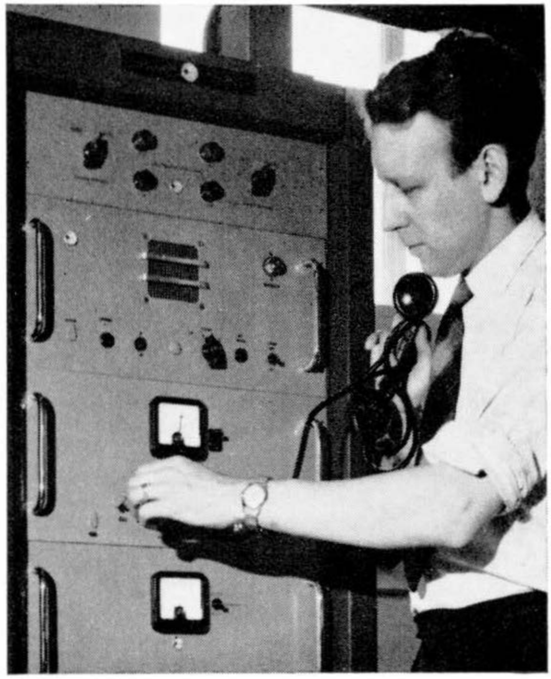
WORLD-WIDE LINK FOR THAMES SHIPPING

THAMES Radio came into operation on 1 May, 1966, to provide an improved Post Office radiotelephone service for all ships using the port of London.

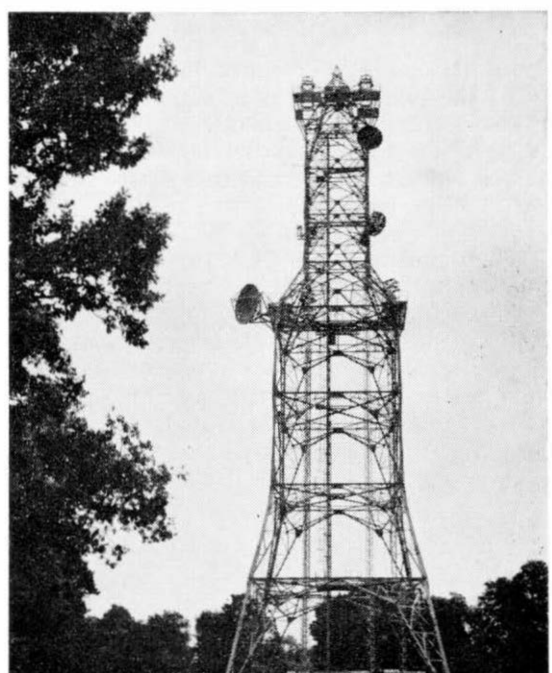
The service is available to all suitably-equipped ships, at anchor, in port, or anywhere in the Thames area from Tower Bridge to beyond Canvey Island, including the Medway. The radiophone calls may be passed to most parts of the world—routed by way of the Continental or International exchanges—including telephone subscribers in Great Britain and the Irish Republic. The new service forms part of the international maritime mobile VHF/FM radiotelephone service in which most of the Post Office's coast radio stations participate and ships are able to use the same radio equipment for public correspondence and port operations purposes.

The Post Office transmitting and receiving equipment is housed in the newly-built microwave relay station at Fairseat, near Sevenoaks, Kent and is controlled by land-line from the coast radio station at North Foreland which also operates a similar service covering a wider area seawards, with transmitting and receiving equipment situated locally. The aerials for the Thames Radio service are mounted on the Fairseat tower at a height of about 820 feet above sea level.

The international common calling frequency—channel 16 (156.8 Mc/s)—is used to establish communication in either direction, after which a change is made to the working channel 27 (ships transmit on 157.35 Mc/s; Thames Radio transmits on 161.95 Mc/s) and the call is then extended to the telephone subscriber. To obtain radiotelephone calls in the direction shore to ship, telephone subscribers ask their local exchange for "Ships Telephone Service—Thanet 21303—Thames Radio" when they are then connected to the coast station, where the call is booked. They are rung back when communication with the ship is established.



Above: Technical Officer Mr. J. Buss adjusts a VHF transmitter at the Fairseat microwave relay station, near Sevenoaks, Kent.



The aerials for the recently-opened Thames Radio Service are mounted on a tower at Fairset which is 820 feet above sea level.

The aerial structure for the new earth station on Ascension Island undergoing tests at Rivenhall, near Witham, Essex. The dish aerial is 42 ft across. The £1 million station on Ascension Island is intended to play a vital part in the United States Apollo project and may relay the first words spoken by man when he lands on the moon.

Picture: Courtesy Cable and Wireless Ltd.

Three More Earth Stations

A SIGNIFICANT move towards meeting the rapidly-increasing demand for more international telephone links has been taken by the Cable and Wireless Ltd. decision to seek tenders for building three earth stations for satellite communications.

The three new earth stations will be established at Hong Kong, in Bahrain, in the Persian Gulf, and at a third place not yet named.

This is not Cable and Wireless Ltd.'s first venture into the world of space communications. Towards the end of 1965 the Company announced that it was setting up an earth station on Ascension Island as a communications link for the United States' synchronous satellite due to be launched over the Atlantic this summer. The British Post Office is giving technical assistance in the building and equipping of this station.

Now, Cable and Wireless Ltd. have decided to enter the space age of telecommunications for public services.

The earth station at Hong Kong—which is planned for completion by mid-1968 and is expected to cost about £2.5 million—is planned to operate initially with the United States' Intelsat II satellite (which is soon to be launched over the Pacific) to other earth stations in the Pacific area covering Australia, South East Asia, the Far East and North America. It will be engineered to transmit and receive up to 300 telephone channels or their equivalent in telegraphic, data or facsimile traffic. Alternatively, it will be able to transmit or receive one 625-line television channel.

"Hong Kong is our first priority," the Company announce, "because, with the enormous growth in demand for telephone channels, a serious shortage of capacity is developing in the Pacific area." At one time it was thought that SEACOM—the South East Asia Commonwealth Cable—would provide enough capacity for many years to come, but it had now become clear that capacity would be exhausted within a year or two.

The biggest single item of equipment will be the high-gain aerial system. The aerial—using an 85 ft. diameter dish, or an alternative arrangement of compatible performance—will be mounted on a support capable of pointing the aerial accurately (to within plus or minus 0.04 degrees) in a 50 miles-an-hour wind. It will be specially designed to withstand typhoon conditions. The aerial will serve both for transmitting to and receiving signals from the satellite and the final stages of the transmitting equipment and the first stages of the receiving apparatus will be mounted on the aerial itself to minimise loss.

One of Cable and Wireless Ltd's transmitting stations on the Peak, in Hong Kong.

In planning the Hong Kong earth station allowance is being made for a second (westward looking) 85 ft. diameter dish aerial—with its associated steering equipment, transmitters and receivers—to operate with a second satellite over the Indian Ocean for communication with Britain, the rest of Europe and the United States.

The transmitting equipment will operate in the Gc/s band and be fully duplicated to allow maintenance to be carried out without interfering with the operation of the station.

The power output of the water-cooled klystron amplifiers will be about 5 Kw maximum and remote control will be provided to reduce this to 500 watts. The high gain aerial will direct this power in a narrow beam towards the satellite, resulting in a maximum effective radiated power of 7,000 megawatts. Solid state power supplies will be used.

It is expected that the configuration of the receiving equipment will vary in the tenders, but, say Cable and Wireless Ltd., either maser or parametric pre-amplifiers, cooled by closed-circuit helium cryogenics, will be used before microwave receivers. The receivers will operate on the 3,700 to 4,200 Mc/s band.

Three possible sites for the Hong Kong station are under consideration and a final choice will be made as a result of radio interference tests which are now being carried out.

★

BIRTHDAY HONOURS

Captain O. R. Bates, commander of the Post Office cableship, HMTS Monarch since 1959, and Mr. Harold Francis, Deputy Regional Director, LTR, were awarded the OBE in the Queen's Birthday Honours.

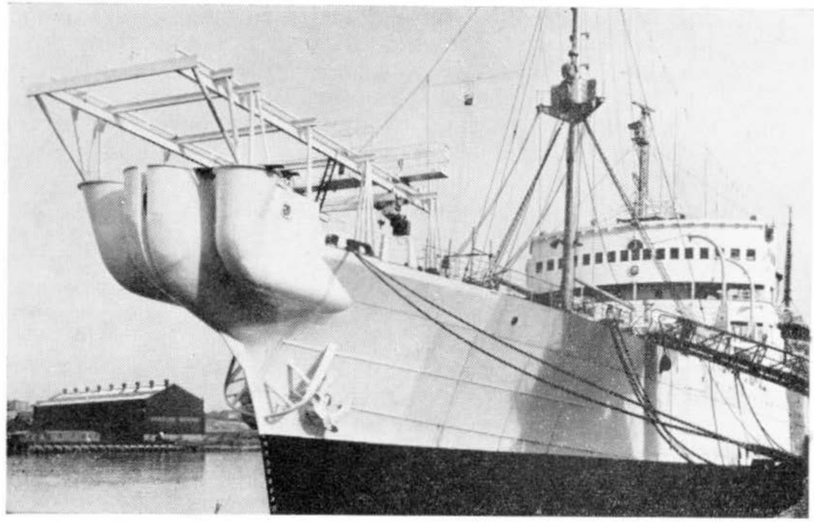
Other awards to members of the telecommunications staffs were as follow:

Imperial Service Order: *Mr. Leonard Perkins, Telephone Manager, Cardiff Area.*

Member of the British Empire: *Mr. George Alton, Assistant Executive Engineer, Belfast Telephone Area; Mr. Edward King, Assistant Executive Engineer, North-Eastern Region Headquarters; Mr. George Thomas, Executive Engineer, LTR; and Mr. Philip White, Assistant Executive Engineer, Post office Research Station, Dollis Hill.*

British Empire Medal: *Mr. Charles Hamley, Technical Officer, Oxford TMO; Miss C. N. Hampton, Senior Chief Supervisor, International Exchange, London; Mr. Edwin Jackson, Technical Officer, Scunthorpe Exchange; Miss Isabella Paterson, Chief Supervisor, Kettering Exchange; Mr. Leslie Rooke, Chief Supervisor, Southampton Central Exchange; and Mr. Gerald Sheridan, Inspector, Maysfields, Belfast Telephone Area.*

New Whiskers For Monarch And Alert



HMTS Monarch *with her new bow whiskers which will reduce the danger of damaging cable.*

By G. HALEY, BSc(Eng), AMIEE
J. KOLANOWSKI, BSc(Eng), AMIMechE
and C. J. CLARKE, AMIMechE

THE development of lightweight submarine cable brought many advantages but also introduced some problems in cable handling. Since lightweight cable has no external armour wires, it is more liable to mechanical damage than conventional armoured cable and the bending radius must be limited to three feet. The main task which faced the Post Office Engineers was to redesign cable guiding plate-work fitted in the bows and stern of a cable ship, and generally known as "whiskers". This has now been successfully achieved.

The whiskers are of considerable importance in controlling the cables. In the past they have been of somewhat limited size and in some instances cable was bent to fairly small arcs before entering the water. The older types of externally armoured cables could stand up to this treatment without damage, but the emergence of lightweight cable, which is less capable of enduring severe bending treatment, meant that it was necessary to redesign the whiskers.

The new whiskers have two main functions. First, to guard against cable slipping off a sheave and to restore it to its original position should this happen; and second, together with the sheave, to change the direction of travel of the cable from that which it follows on board to the line it assumes when passing into the sea.

When cable is being laid, this change of direction is sometimes both vertical and horizontal and the corresponding whisker has to provide support and guidance to the cable along its curved path. The whiskers must also be shaped so that the change in direction of the cable takes place smoothly and the cable is always in a stable condition and has no tendency to slip suddenly across the surface of the whisker.

The two larger Post Office ships—HMTS *Monarch* and HMTS *Alert*—are equipped with one sheave at the stern and three sheaves at the bows. The single stern sheave is used only for laying operations and in this work the cable generally leaves the ship at a fairly low angle of depression from the horizontal. Only for the short time during which a repeater is being laid does it approach an almost vertical descent into the water.

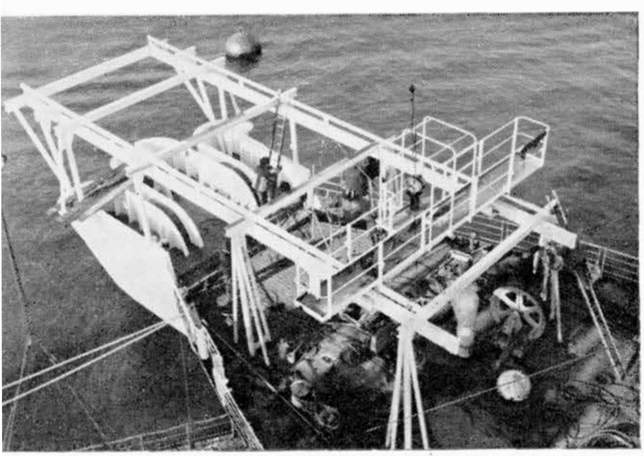
The design of the stern whiskers was established by making models which were carefully studied and tested so that the best shape for ensuring correct handling of the cable and ease of manufacture could be attained. The models were also used to pass the information from the designer to the shipyards responsible for preparing working drawings for the construction and installation of the whiskers. Sea trials and a number of laying operations proved that the modified-style whiskers have considerable advantages over the old design. With the new whiskers, a cable ship can be manoeuvred much more freely while laying cable and this in turn leads to cable economies during difficult operations and to the avoidance of damage to the cable during bad weather.

The design of the bow whiskers was a particularly complex task because of the three sheaves and the functions which they have to perform—these include cable laying, repair and recovery work and "stoppering" a suspended cable (when a man is lowered over the side in a bosun's chair to secure a holding rope to the outside of the cable).

Flat sheaves were provided for the light-weight cable and a V-sheave for handling armoured cable. The width across the whiskers had to be kept to a minimum so as not to affect the performance of the ship and its maximum safe speed in rough weather.

The bow whiskers were modelled on the original construction adopted at the stern of *Monarch*, in which the shape was obtained by marrying a vertical conical section and a horizontal cylindrical section by means of a spherical mating piece. In the bow section the length of cone and cylinder were reduced and they were married together with part of a torus (a ring-shaped solid) instead of a sphere, so providing better support for the cable for any direction of travel and avoiding any areas in which the cable would be unstable.

A seagull's-eye view of the new stern whiskers on HMTS Monarch. *The work of re-designing the whiskers was carried out by Post Office engineers.*



The overall width of less than 22 feet across the whiskers was reduced at lower cross sections by shaping the sides to reduce shock when the bow of the ship plunges into high waves.

To assist in repair and recovery work and other operations at the bows, a new retractable observation platform—a sort of high bridge—has been provided together with a two-ton hoist travelling over the whole working area in the bows. The observation platform is mounted on girders and positioned at the forward end of the overhead beams during cable working. Equipped with engine room telegraph, compass repeater and other navigational aids, it is used by the officer controlling cable work on the deck. The platform can be brought back inboard when not in use to reduce exposure to weather.

On his observation platform, the cable officer is clear of any cable running to the bow sheaves and has a better all round view than hitherto. Special attention has been given to the visibility of the area around and under the whiskers where the cable emerges from the water and accessibility to it. This is of particular importance at the bows since it is here that the most complicated operations of grappling and splicing—which involves two cables simultaneously at the bows—take place.

At present HMTS *Monarch* is equipped with the new bow and stern whiskers and HMTS *Alert* with stern gear only.

THE AUTHORS

Mr. G. HALEY, *is an Assistant Staff Engineer who, since 1965, has been in charge of Research Services, Dollis Hill.*

Mr. J. KOLANOWSKI, *is a Cable and Wireless Engineer attached to the Post Office Research Station, Dollis Hill, and has been engaged on submerged repeater work, including the equipping of cable ships.*

Mr. C. J. CLARKE, *is an Executive Engineer with Submarine Branch (formerly with Research Branch).*

A New Teleprinter Goes On Trial

Miss. J. A. Mountfield of Post Office Headquarters sets up a telex call using the new teleprinter.

FIELD trials are being carried out with a new teleprinter which has a number of important advantages over the present Teleprinter No. 7, not the least of which is that it is likely to prove more reliable and require much less maintenance than the machine it will replace. It will also be able to operate half as fast again as Teleprinter No. 7, that is about a hundred words a minute on suitable circuits.

The Teleprinter No. 7 normally needs maintenance after every 500 hours of operation or once in three months, whichever is the most frequent. The new teleprinter is expected to require maintenance after only every 1,000 hours of operation or once a year.

The new machine—which would become the Teleprinter No. 15—has a 4-row keyboard similar to that of an ordinary typewriter, and each letter, figure, punctuation mark and symbol has its own separate key. Since most teleprinter operators on telex and private circuits are typists, this design is expected to have greater appeal and be easier to operate. Unlike the typewriter and the Teleprinter No. 7, the platen of the new teleprinter remains stationary, while the type basket or cage moves to and fro. As a safeguard against misoperation there is a locking device which prevents the operator sending figures in error for letters and letters in error for figures.

The Teleprinter No. 15, which has an improved clearer type face than the No. 7, will print in two colours—normally in black and red. This facility, which will enable messages to be sent in one colour and received in the other, is expected to be particularly useful to firms which carry on conversations or exchange financial information by means of telex or private teleprinter circuits.

Another great advantage of the Teleprinter No. 15 is that the reperforator and automatic transmitter units can be incorporated into the main body of the machine under the standard cover—a space saving advantage over the present arrangement which requires a special teleprinter with a reperforator attachment and a separate transmitter. When the operator wishes to send a message by way of the automatic transmitter, which operates at

Technical Officer C. D. Sergeant testing the new teleprinter at the Telegraph and Data Systems Laboratory.

a continuous speed of 400 or 600 characters (about 70 or 100 words) a minute, she first types the message in the ordinary way with the reperforator attachment in operation. The message appears on a paper tape in the form of a series of punched holes. The tape is then inserted into the transmitter which automatically sends the message on its way. An incoming message can also be recorded as perforations in the tape.

Changing a paper roll on the new machine, which is fitted with a special quick-release attachment, is also easier and quicker. The new machine is also designed to take paper which is 8.3 inches wide—one of the international standard paper sizes.

The industrial designer, Mr. David Mellor, designed the cover of the new teleprinter as well as the cover of a new signalling unit and a new table to match, and this combined installation has been accepted by the Council of Industrial design. The whole installation is more attractive than the present one and will harmonise more appropriately with modern offices. The teleprinter cover and signalling unit are in French grey with a dark grey base, and the table top is black with a dark grey base and light grey message trays.

The new teleprinter, and the table on which it stands, are smaller than the Teleprinter No. 7 and its table.

During the trials, which are being carried out by the Engineering Department in conjunction with the Inland Telecommunications Department, 50 of the new machines will be tested. Thirty-six of them are being issued to business firms in London, two are being used in the Telex Rooms at Post Office Headquarters and London Telecommunications Headquarters and another is on trial in the City Telephone Manager's Office. The remainder are being subjected to endurance tests in the Engineering Department's telegraph laboratory. It is hoped that the trials will show the machine to be completely satisfactory, in which case a decision will be taken about its adoption by the Post Office. It is unlikely, however, that it could be made available to customers before the Autumn of 1967.

Students at the ETE Training School at Leafield receive instruction in the basics of radio-engineering.

ENGINEERING TRAINING IN ETE

By W. T. WELCH

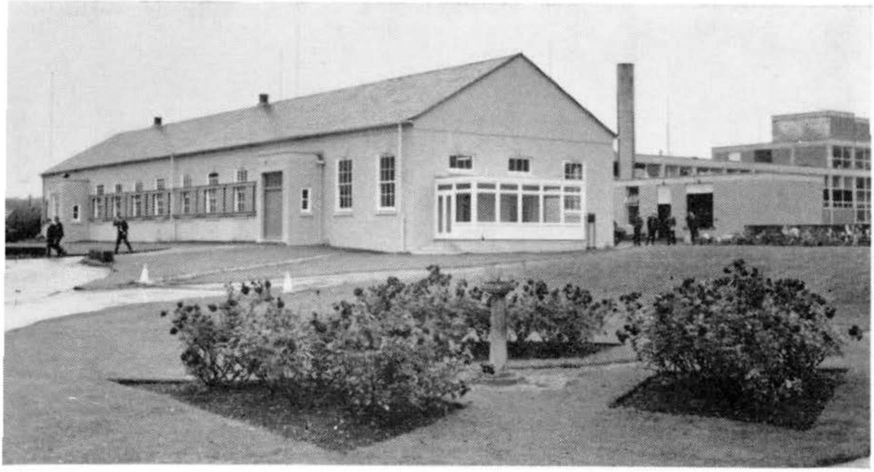
THE External Telecommunications Executive (ETE) holds a unique position in the Post Office organisation having both administrative and executive functions. For the latter, it is in the position of a Region but territorially, it is undefined and includes radio stations in various parts of the country and telephone and telegraph terminals in London.

For administrative purposes, the ETE radio stations and the Radio Telephony Terminal (RTT) at Brent, in London, are divided into four groups with the Telegraph Manager's Office, Electra House, London making a fifth. Each of the radio station groups is under the control of an Area Engineer and directly responsible to him is an Area Training Officer whose duties include the supervision and organisation of field training for Trainee Technician Apprentices (TTAs)—this being the basic grade for recruitment into the service.

Until very recently the ETE had to rely on the Central Training School at Stone, and on the Regional Training Schools to provide training courses for TTAs. The recent opening however, of a new ETE Training School at Leafield, Oxfordshire, will provide co-ordination of vocational and technical training which was not always easy to arrange in the past.

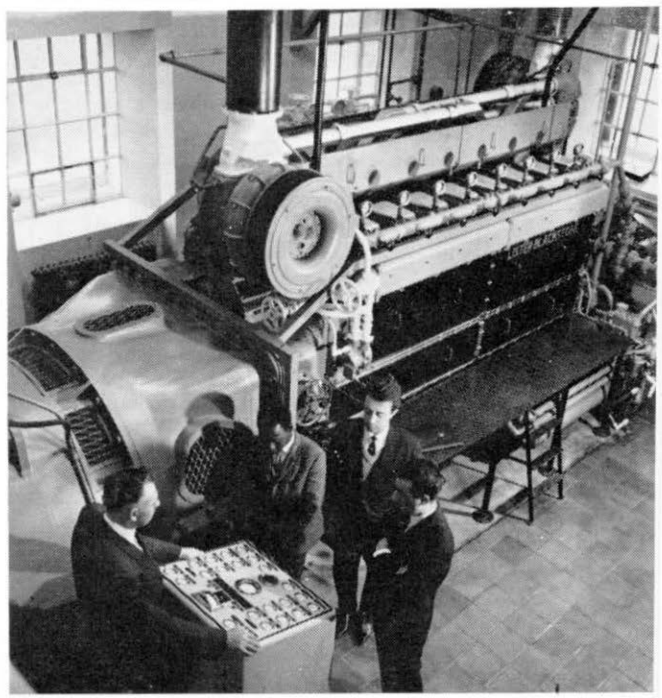
The new school, which opened its doors for the first time on 4 July, 1966, is housed in a large brick building connected by link corridor to Leafield Radio Station. Accommodation consists of two lecture rooms, each seating up to 24 students. There are also two demonstration rooms equipped with work benches and a full range of testing apparatus. In addition there is a shop, lounge, reception office and a cinema/television room. Living accommodation is provided on the site and consists of three comfortable bungalows each divided into five separate bedrooms. There is also a new prefabricated hostel with 40 very comfortable single rooms, equally well equipped. A total of 55 boys can thus be accommodated at any one time. Meals are provided in the station canteen.

Trainee Technician Apprentices are recruited



A view of the new Leafield Training School showing the main entrance (left) and part of the new Leafield Radio Station.

Below: Trainees from overseas receive instruction in the operation of a 1000 KVA Diesel generator at Leafield.



directly from grammar, secondary modern and technical schools, the age range being from 16-17½ years or, exceptionnally, 15½-18 years. On entry, boys are usually required to have three passes at GCE 'O' level in Mathematics, English and one science subject. Skilled or semi-skilled adults are sometimes recruited directly to the grade of technician.

At the new Training School at Leafield, two lecturers, and two demonstrators, under the control of an Executive Engineer, will direct the four basic courses for TTAs, each course lasting six weeks and divided into two periods of three weeks, with an interval between.

Course 'A' introduces students to the fundamental concepts of telecommunications and the rôle the ETE plays. Course 'B', for second year boys, introduces basic theory and a more detailed treatment of the subjects covered in course 'A'. The subsequent courses, 'C' and 'D', deal with the theory and use of more specialised equipment in modern radio stations, including transistors and printed circuit techniques. During these courses visits are paid to other radio stations and to local telephone exchanges and manufacturers works.

Nor has the leisure time of students been overlooked at the new Leafield School. Indoor recreations, include billiards, table tennis with space available for badminton. Also, there is a well stocked bar and it is possible for outdoor games to be organised as there is ample scope in the grounds.

Leafield will also accommodate students attending the West Oxfordshire College of Technology for block release courses. These courses, leading to the Ordinary National Certificate or the City and Guilds Telecommunications Technicians Certificate, last for thirteen weeks and are divided into two periods of six and seven weeks.

Because of the special nature of the work at

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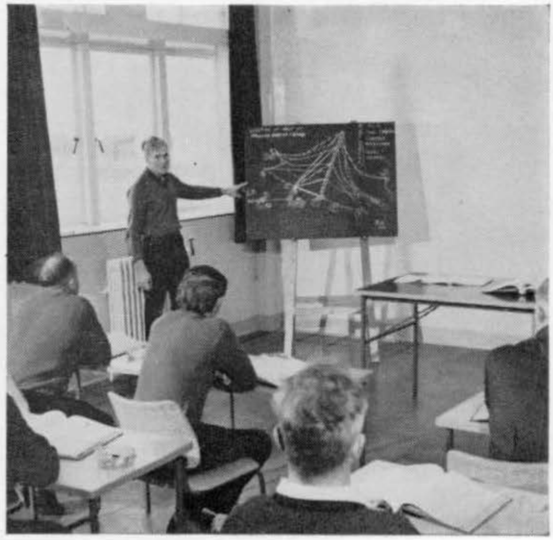
Apprentices from the Telegraph Manager's Office being taught how to operate a lathe in the workshop at Featherstone Street.



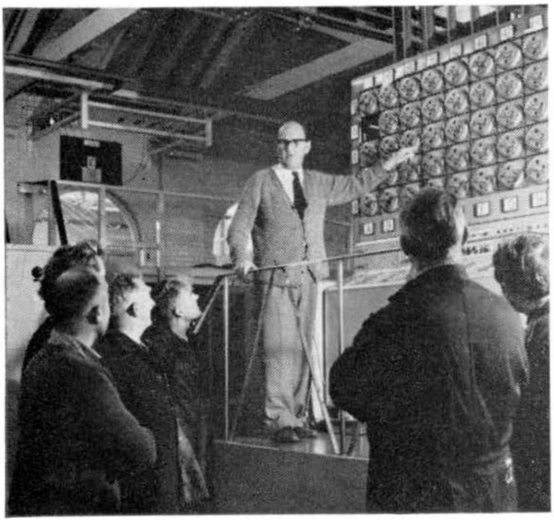
Stages in the erection of a Post office mast are explained to a class at Rugby before the actual work on the site is carried out.

the Telegraph Manager's Office (TGMO) Electra House, London, and because of the large staff employed, the TGMO has its own Training School at Featherstone Street, Finsbury, London, where a lecturing staff of six supervisors give courses for apprentices, special emphasis being given to telegraph machines and systems. The School also trains adult staff engaged in the operation of complex telegraph equipments, particularly error correcting and multiplex systems peculiar to the overseas radio services.

Vocational training in the TGMO follows the same general pattern as that for radio stations except that a greater part of the trainee's time is spent in the London Telecommunications Region where they receive a thorough grounding in the work of an inland telephone area. Towards the end of their training period, apprentices are streamed according to their aptitudes and final training is arranged accordingly.

Another important aspect of training is that

Removing a panel from an aluminium transportable mast at Rugby. This mast, provided exclusively for the School, is used to demonstrate erection and dismantling techniques.



An engineer at Rugby explains to a class of students the operation of a new aerial selection panel in one of the transmitter buildings.

Special attention is paid at Rugby to teaching correct methods of lifting and handling. Here, a class practices lifting a derrick arm.

provided for adult staff who are encouraged to take specialist courses on the more complex procedures and equipment upon which they are engaged. Such courses are available either at the Central Training School or at one or other of the Regional Training Schools.

From time to time advantage is taken of courses provided by the manufacturers of specialised equipment. Quite recently parties have visited Berne, Switzerland, for this purpose.

Special training is given to ETE external staff engaged on the construction and maintenance of aerial systems involving high supporting structures and masts. Emphasis here is very much on safety and on the requirements of the Factory Acts regarding the use of up-to-date methods and equipment. Because of the importance attached to this aspect of training—lives may depend on it—the ETE established its own external construction and maintenance school at Rugby Radio station in 1965 to provide courses for its own and Regional staffs.

The ETE shares in the training of overseas students and during 1964/5 some 50 students received field training at one or other of the radio stations. Students coming to Britain with International Telecommunications Union (ITU) Fellowships, or under the Colombo Plan Agreement usually spend some time with specialist groups in ETE headquarters to obtain detailed information on specific engineering techniques and on the administration of overseas telecommunication services.

With the increasing complexity of modern equipment, and the recruitment of new staff likely to be maintained at its present level, it is important that ETE personnel should receive uniform and up-to-the-minute training in all facets of their work. The emergence of a new training school at Leafield will help to achieve this aim.

THE AUTHOR

Mr. W. T. WELCH, Assc. IEE., *is a Branch Training Officer (Engineering) at ETE Headquarters. He joined the Post Office in 1925 as one of the first Youths-in-Training to Wireless Section. After serving at Devizes and Portishead Radio Stations and the Colney Heath Frequency Measuring station he transferred to Wire Broadcasting Branch of the Engineer-in-Chief's office. After service in the Radio Branch he transferred to the ETE on its inception in 1952.*

Camelford House, the Headquarters of LTR, towers above the Thames on the Albert Embankment.

THE RE-SHAPING OF LTR

By A. B. HARNDEN

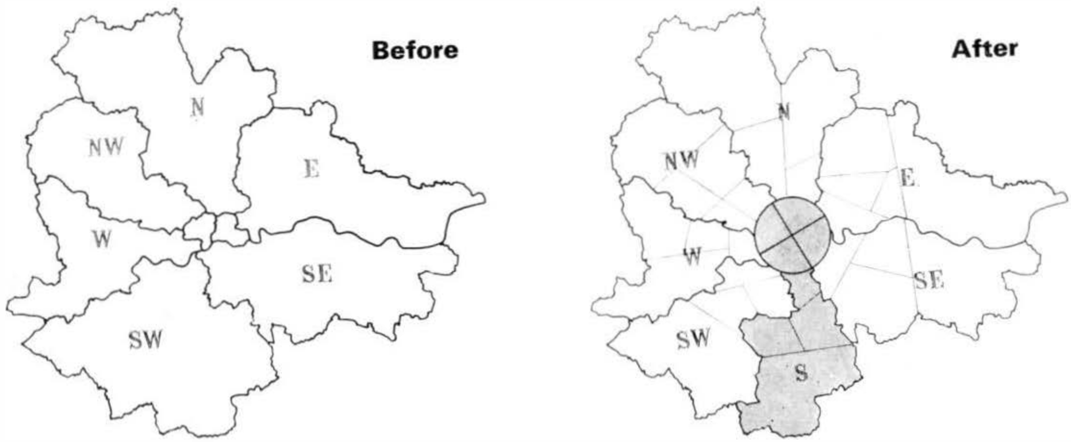
London Telecommunications Region is being re-organised to cater more efficiently with the rapidly-growing demand for services. This article, by the Director of LTR, describes how the Region will be re-shaped

THE present Area organisation of the London Telecommunications Region was little different at the end of 1965 from what it was when the Region was set up 26 years ago. In those 26 years the size of the Region's commitment doubled and it will double again in the next decade.

During the past quarter of a century the organisation has, of course, been adapted in a number of ways to cater for growth and various changes, but, if it is to meet the ever-increasing demands and customers are to be given better service, it must be re-fashioned and improved.

The re-organisation of LTR which is now under way is designed to achieve the main objective of producing an organisation which will be viable for the next 20 years. A secondary, but no less important, objective is to correct some of the damaging effects of excessive specialisation—not only that inherent in the hierarchical divisions but also that within hierarchies which is a common feature in LTR.

These damaging effects are, in the main, twofold. First, a complicated matter may require many specialists to make their contributions in turn—a system which takes up too much time. Second, the sometimes limited interests of a specialist can lead to his making decisions which are too narrowly based and which may, therefore, not be in the best interests of the service as a whole. The new

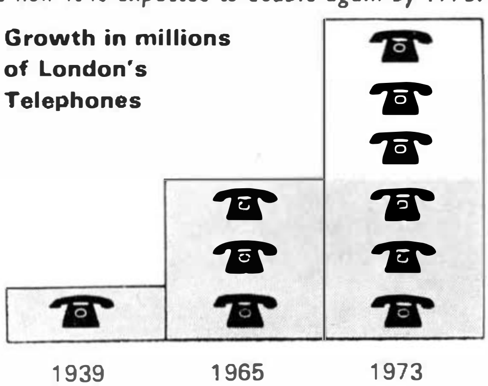


How the London Telecommunications Region is split into areas at present and (right) how it will be split in future.

Area organisation will help to correct all this by a move from functional towards territorial working, wherever this is possible.

The re-organisation plan consists of two basic proposals. First, to extract a new South Area from the present South-West and South-East Areas (this, in fact, became operative on 3 January, 1966) and thus make an outer ring of seven Class Two Areas. Second, to establish in addition four Class One Areas in the centre, initially by re-distributing in four parts the responsibilities of the City, Centre and Long Distance Areas and then augmenting these parts by taking in parts of the outer Areas. The outer boundary of the Class One Areas will be the four-mile inner-London pay circle. In each of the inner Areas, the Telephone Manager will be supported by two Deputy Telephone Managers and in the outer Areas by one.

Diagram illustrates how the number of London's telephones has increased since 1939 and how it is expected to double again by 1973.

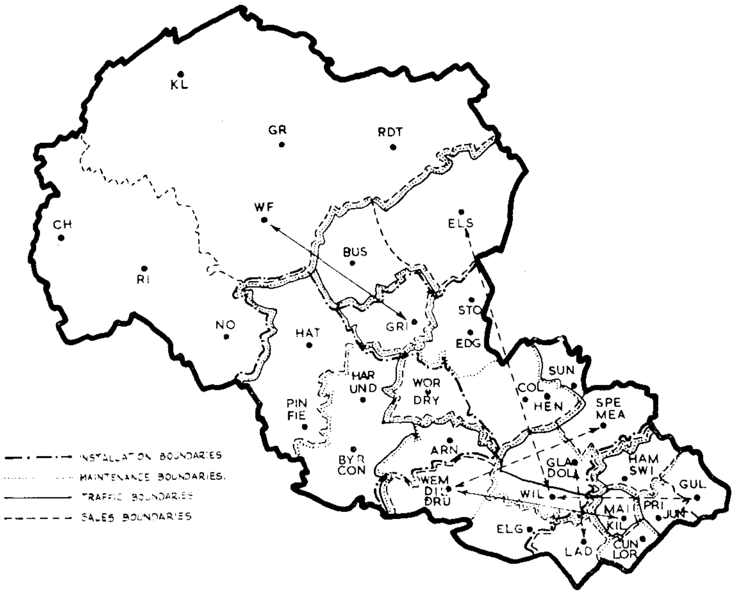


The work of a Telephone Area falls into two main groups according to purpose. The first group is concerned with development (for example, forecasting, planning and construction) and the second with utilisation (for example, commissioning, operation and maintenance and billing). There is also a third group—handling a number of important ancillary tasks such as staff and accounting—which is common to the whole organisation.

This basic division according to purpose is clearly revealed in Area staff trees. Naturally, Areas vary in size and all are increasing rapidly. There are already, therefore, substantial variations of this typical pattern and many more to come. The design of the organisation as a whole is such that splitting groups and re-arranging them should not be too difficult.

A territorial breakdown of each of the utilisation activities is naturally the normal way of spreading the responsibility. But in London it has hitherto been rare for the territorial breakdown of any two activities to be the same. The LTR proposals under the new organisation are no more than a tidying-up of this situation so that a group of installation, maintenance, sales and traffic people will be—and see themselves to be—a team responsible

OVER



BEFORE: Map shows how the grouping in the North-West Area of LTR is arranged at present.

for a group of subscribers. There will be between four and five of these teams in each outer Area. The inner areas, too, will be tidied up but in a somewhat different way because of the very high telephone densities right in the centre.

Billing and exchange operating lend themselves to the same concept but at present they cannot fall completely in line—first, because it is pointless to re-distribute except as part of the computer exercise; and second, because the over-riding present need is to make the best use of available switchboards regardless of boundaries. Such things as Directory Inquiries and trunk traffic cannot sensibly fit the concept in London and they will, therefore, continue to be functional tasks of territorial groups.

The practical application of this concept has some interesting features. In the new Telephone Manager's Office at Croydon for the South Area, for example, the Telephone Manager has allotted half a floor to each of his four groups so that clerical, engineering, sales and traffic staff work in close proximity to each other and can now more easily solve their difficult cases by direct discussion rather than by correspondence.

In effect, the tidying-up process establishes service sections which, at first sight, may seem to be a new concept. In fact, there is nothing unconventional about what is being done. The worst that can be said is that it is a bit wholesale for the simple reason that it was obviously opportune to do it as a feature of a major reorganisation. The essential logic of creating a sense of corporate responsibility is most attractive.

The development side of the Telephone Manager's Offices also presents the problem of who can best be associated in the organisation. There is the argument in favour of keeping planners together that the phasing of internal and external works is thus made easier. On the other hand, there are superior arguments in favour of keeping planning and construction together, which is a feature of the LTR reorganisation.

The four inner Areas will each have a local service load comparable in size with that of a typical outer Area. But there are also in inner London a sizeable number of major installations either not parts of the local network or not concerned with limited territories. They are: two tandem and five sub-tandem exchanges; twelve trunk exchanges and five more at various stages of planning and construction; the main telex exchange and two more being planned and an exceptional operating commitment, employing some

AFTER: This is how the grouping of subscribers in the North-West Area will be arranged in future.

A view of Impact House, headquarters of the new South Area at Croydon, which has been formed by hiving off part of the territories of the old South-East and the South-West Areas.

2,000 staff, for Government offices in Whitehall. Also many staff are engaged on Post Office work not wholly an Area responsibility—for example, the operating of overseas manual switchboards, the maintenance and construction of various engineering installations for the overseas service and of the equipment for the inland telegraph services. All these activities will be shared among the inner Areas, generally according to their location. One exception—although others may follow after further study—will be telex. All three telex exchanges will be the responsibility of one Telephone Manager although they will be located in three different Areas.

The trunk network poses the special problem that since in this respect London is one place, a central control for some activities is necessary. Hitherto, the central control has existed in the Long Distance Area which is now to be terminated. The opportunity is being taken under the reorganisation of giving relief to the control so that it can cope with its ever-growing commitment and at the same time transfer it to Regional level.

The South-West Area Telephone Manager's Office in Wimbledon, which has been relieved by the setting up of the new South Area.

Growth demands an increase in the management force which in turn creates pressure on office accommodation. In addition, the growth of the telephone system has made it imperative to remove from operational buildings any activity occupying space large enough to allow its use for equipment and this has created a demand for yet more office type accommodation. There is a great need, now and in the immediate future, for a sizeable increase in office space at a time when it is particularly difficult to obtain, either in the quantity or in the location desired.

Present prospects of obtaining in London buildings big enough to provide conventionally planned Telephonne Managers' Office are so slight it is likely that new TMOs will be established in pairs or groups of buildings not necessarily close to each other, and that existing TMOs will be relieved by taking over small office buildings some distance away. Hitherto, the situation has been met by setting up outstations of a division or part of a division, thus worsening the effects of excessive specialisation. We can now consider the alternative of bringing together in a secondary building the staff who are associated territorially on service matters. But there is no common answer; each problem must be solved on its merits.

The rapid growth of London's telephone service should be a source of satisfaction to all LTR staff. It offers a great challenge and opportunities to do many things in better ways

THE AUTHOR

Mr. A. B. HARNDEN, TD, *has been Director of London Telecommunications Region since April, 1962. He joined the Post Office in 1925 as a Youth-in-Training and subsequently served as an Area Engineer in City Area before becoming a Principal in the Personnel Department in 1949. In 1953 Mr. Harnden was appointed Deputy Controller of the Factories Department and in 1956 Deputy Regional Director of Home Counties Region.*

In World War Two Mr. Harnden served with the Royal Corps of Signals, attaining the rank of lieutenant-colonel. He is an artist of note and has exhibited paintings at the Royal Academy and at many other art galleries.

—to build a progressive, friendly and efficient organisation.

The changes which will come about as a result of reorganisation are designed to help achieve these objectives and they constitute a major operation which can be carried through to successful conclusion only with the full understanding and co-operation of every member of the staff. In the end the London Telecommunications Region will be better equipped to meet the business and social needs of modern life.

Farewell to Long-Distance Area

The re-organisation of LTR means the dissolution of the Long-Distance Area. The Area was formed in 1943, operating on a functional rather than the orthodox territorial basis, and assuming special responsibilities for trunk and overseas telephone services. The total staff complement reached about 6,000, of which some 4,000 were telephonists and supervisors—the largest number in any Area in the country.

Under the re-organisation, part of the Area's responsibilities pass to Centre Area and North Central Area but the major component passes to the new City Area.

In the picture above are shown the members of the last Long-Distance Area Board. They are (seated, left to right): Mr. B. H. Moore (Area Engineer), Miss K. F. Beckett (Secretary), Mr. D. M. Rogers (Telephone Manager), Miss O. M. Kinnard (Area Accountant), and Mr. E. S. Russell, MBE (Chief Telecommunications Superintendent, ETE); Standing (left to right): Mr. G. A. Aldrich (Area Engineer), Mr. J. E. Isherwood (Area Engineer), Mr. R. A. C. Keeping (Chief Telecommunications Superintendent) and Mr. R. F. Gurney, ERD (Chief Telecommunications Superintendent).

Mr. Isherwood was a founder member of the Area and Miss Beckett Secretary to all the Telephone Managers over the past ten years.

★

WELL PLAYED!

POSTMASTER GENERAL LONDON... NOW COMPLETED MY TOUR OF WORLD CUP GROUNDS AND PRESS CENTRES AT LONDON MIDDLESBROUGH SUNDERLAND SHEFFIELD BIRMINGHAM LIVERPOOL AND MANCHESTER.... EVERYWHERE I HEAR TREMENDOUS PRAISE FOR THE STAFF AND FACILITIES PROVIDED BY THE POST OFFICE... JOURNALISTS OF THE WORLD DELIGHTED... SO AM I... PLEASE ACCEPT MY THANKS AND CONGRATULATIONS... DENIS HOWELLS MINISTER FOR SPORT...

This is the text of a telegram sent by the Minister for Sport, Mr. Denis Howells, to the Postmaster General during the World Cup Football Competition in July. The story of how the Post Office provided special facilities for the Competition was told in the Summer, 1966, issue of the *Journal*.

THE POTTS PROGRAMME

"Making yourself understood" is the subject chosen by Mrs. B. P. Purcell, LRAM to open the Post Office Telephone and Telegraph Society's 1966/67 programme of lectures at the Assembly Hall, Fleet Building, on 18 October.

Mr. D. J. Harding, Research Branch, Dollis Hill, will talk about "Microelectronics" on 15 November and on 18 January, 1967, Mr. L. F. Scantlebury, OBE, External Plant and Protection Branch, Engineering Department, will speak on "Mechanical Aids in the Post Office". Mr. N. H. Bennett, CBE, FHCI, Chief Catering Officer of the Post Office, will give a lecture entitled "Post Office Catering" on 15 February and the series will end on 14 March, when a London Telecommunications team (Mr. A. E. Hammond, Mr. T. J. Morgan, and Mr. G. E. Price) will talk on "Design and Production of a Telephone Exchange".

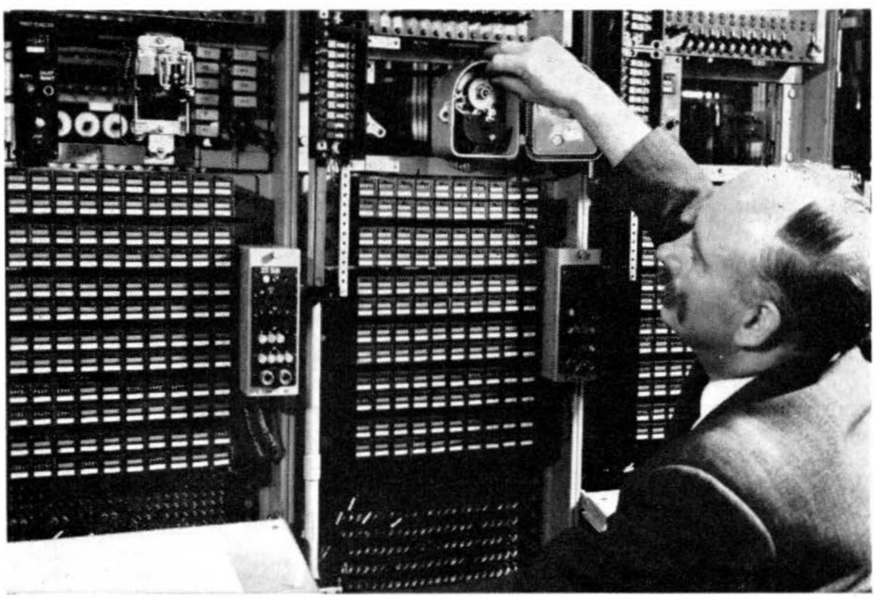
Membership of the POTTS is open to all Post Office staff, fee two shillings. Hon. Secretary is Mr. A. H. White, London Telecommunications Region HQ, Waterloo Bridge House, SE1, telephone number LTR 8000, Extension 570.

A BETTER SYSTEM FOR RECORDING TRAFFIC

The Post Office will shortly be introducing at all automatic exchanges a new system which will increase the efficiency of traffic recording and enable future traffic growth to be forecast much more accurately

By J. A. POVEY, BSc(Econ), C.Eng, AMIEE

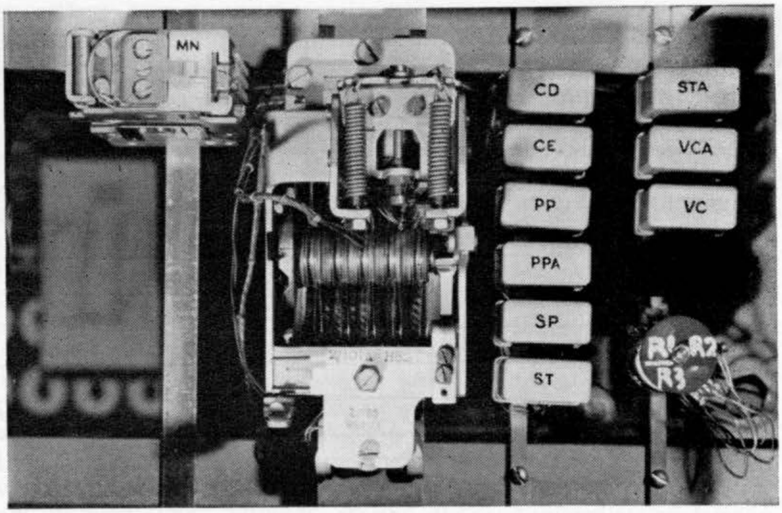
Mr. G. S. Donn sets the time switch on the field trial equipment in the Citadel Exchange.



A NEW and more efficient method of recording traffic at automatic exchanges has been developed by the Post Office as a result of studies aimed at increasing productivity and providing more accurate methods of forecasting traffic growth. It will be introduced shortly at automatic exchanges throughout the country.

Designed to meet the needs of the rapidly-expanding telephone service, the new method—which is based on the principle of the "time-consistent busy hour"—enables records to be taken more frequently than in the past without detriment to the accuracy of traffic measure-

A close-up view of the additional equipment which will be provided on a traffic recorder.



ments and without needing an equivalent increase in staff.

The highly-mechanised telephone service depends to a great extent on accurate and reliable forecasts of traffic growth if over- or under-provision of equipment is to be prevented. For proper forecasting and for detecting early changes in patterns of growth, regular and frequent estimates of traffic are essential. This is where the new method of traffic recording will play a vital part.

A traffic recorder is a special type of statistical sampling equipment installed in automatic telephone exchanges to collect information on the flow of telephone traffic through the various sections of the exchange. Resulting traffic measurements are required not only to check that the existing switching equipment quantities are adequate but also to provide important facts for obtaining forecasts of future possible levels of traffic.

Although the present traffic recorder is a vast improvement on the previous laborious method of collecting traffic data in which a team of people periodically had to count quantities of busied switches, its design and application has remained unchanged since it was introduced about 30 years ago and it still involves a great deal of labour. In exchanges, the recorder has to be set up and tested, and meters—one or more for each group of circuits—have to be read at half-hourly intervals over a one-and-a-half or two-hour period for three days, and the readings entered on forms. In Area offices, the readings must be processed manually and it has proved impracticable in the past to take records more frequently than at six-monthly intervals in local exchanges and once every three months at trunk exchanges.

By adopting the principle of the "time-consistent busy hour"—that is, taking a particular hour of the day as the busy hour and recording measurements over that same hour on each day, it is possible to reduce the amount of work involved. In contrast with the existing method no time will be lost in searching for the highest value.

The validity of traffic recording techniques is based on the fact that the average traffic carried by a group of circuits during an interval of time, say an hour, is numerically the same as the average number of calls in progress over the group, that is, the average number of circuits busy. The average number of busied circuits is estimated at present by examining the group of circuits at 30-second intervals during the period of interest. The number of circuits engaged at each test is counted and the total is divided by the number of tests. To enable the recorder to detect whether a circuit is busy, a wire is taken from each circuit to the traffic recorder, usually an earth potential indicating that a circuit is busy and a disconnection that it is free.

OVER

METER CODE					A1			A2			A3			
FIRST DAY	Meter readings	(3)	(4)	(5)	5232	6239	7341	3848	7846	1848	7103	8455	9827	
	Meter readings	(1)	(2)	(3)	3188	4172	5232	6900	0136	3848	5439	6034	7103	
	Hourly differences	(3)-(1)	(4)-(2)	(5)-(3)	2044	2067	2109	6948	7710	8000	1664	2421	2724	
SECOND DAY	Meter readings				0644	1652	2811	3469	7468	1508	3354	4726	6113	
	Meter readings				8391	9569	0644	5896	9524	3469	1261	2122	3354	
	Hourly differences				2253	2083	2167	7573	7944	8039	2093	2604	2759	
THIRD DAY	Meter readings				5816	6931	7995	2667	6489	0531	9320	0676	2113	
	Meter readings				3687	4692	5816	5398	9090	2667	7355	8301	9320	
	Hourly differences				2129	2239	2179	7269	7399	7864	1965	2375	2793	
3-DAY BUSY HOUR TOTAL					6601			23903			8276			
ERLANGS					22·00			79·68			27·59			

This diagram shows how meter readings for three selected days have been recorded in the past on a form for trunk exchanges and then converted into post-selected busy hour measurements of traffic.

A meter is associated with each group of circuits and the traffic recorder automatically counts the number of busy circuits by scanning over the wires, one at a time. The meter operates once every time it encounters a busy condition. To measure the traffic carried by each circuit group in the exchange at the same time, therefore, the recorder has to be able to examine every circuit once in each cycle of 30 seconds. This is not possible at large exchanges where recording may take up to four weeks to complete: three weeks to measure the traffic carried by circuits held during the duration of a call, and an additional week for short-holding-time equipment, such as registers.

For a local exchange using the existing method, two periods about six months apart are chosen, and three days in each week are selected for the record to be taken. Records are made on each of these three days for one-and-a-half hours in the busy period, meter readings being taken at half-hourly intervals. This provides four readings each day which are entered on a special form. The period of the record for each day, therefore, contains two overlapping hours and the order in which the readings are entered enables the total for each hour to be obtained by subtraction. The higher of the two values is then added to similar values obtained for the other two days. The total is then divided by 300, the number of cycles for three hours less the time required for meter reading, to provide an estimate of the average busy-hour traffic.

A similar procedure is used at trunk exchanges, the recording being made at three-monthly intervals on trunk routes. Recording is carried out for two hours on each of the three selected days and five meter readings are entered on the form for each day. The highest value from three overlapping hours is used to find the average level of traffic in the busy hour.

In the time-consistent method, the procedure is the same for both trunk and local exchanges An hour is chosen as the busy-hour by selecting the centre hour of the recording period or from local knowledge, or from other information such as the trace from a recording ammeter which has measured the current drawn from the exchange battery. Since this hour is fixed for the period of the record, the recorder may then be started automatically under the control of a time switch, which is an immediate, although small, improvement in efficiency.

Without modifying the existing recorder much of the advantage of the time-consistent busy hour may be realised by measuring the traffic over the five working days, Monday to Friday. The meters need then be read only before the start of the busy hour on the Monday and again after the Friday busy hour. By recording for 50 minutes a day, that is, 100 cycles a day, an estimate of the average busy-hour traffic carried is obtained by dividing the difference between the two meter readings by 500.

To achieve the maximum benefits from the

Right: In the new time-consistent busy hour measurement of traffic the calculations for each meter are reduced to a single subtraction.

application of the time-consistent principle, a small additional unit to the traffic recorder has been designed. This changes the test-cycle periodicity from 30 seconds to three minutes, that is, 20 cycles an hour. It also arranges for automatic starting from a time-switch, counts the test-cycles each day and automatically stops the traffic recorder after 20 cycles have been registered. It has been established, both theoretically and from measurements, that increasing the periodicity to three minutes has no significant effect on the accuracy of average traffic estimates obtained from measurements taken over five hours. In fact, it is considered to be satisfactory to record with a periodicity of as long as twice the average holding time of a call.

Recording over five days also avoids the need to select three days for recording, a procedure not always satisfactory in the past. The modified traffic recorder may be left virtually unattended in the exchange since it starts and stops automatically at the required times each day. Only the initial and final meter readings of the week need be recorded.

In the Area office, calculations have now been reduced to a single subtraction. Division by 100—the number of test-cycles at 20 a day for five days—is obtained simply by putting in the decimal point. The figures used are those applying to conversational-holding-time equipment; a similar procedure applies to short-holding-time equipment which will result in testing for 1,000 cycles a week.

Two complications may arise in practice and these must be guarded against in the new procedure. First, circuits that are busy because they are faulty will over-estimate the value of real traffic carried. Allowance must be made for this if estimates are to be as accurate as possible. This means that maintenance staff in exchanges must make an estimate of the total circuit out-of-order time during the record. Second, the full scheme cannot be operated if records are to be taken of traffic levels in the afternoon and evening as well as the morning busy hour. In that instance, meter readings will be needed during each day to find the total for each busy hour. However, this still represents a significant saving compared to the existing method.

METER CODE	B1	B2	B3	
Final reading	3076	8852	9721	
Initial reading	2501	8504	3015	
ERLANGS	5·75	3·48	67·06	

Traffic measurements and forecasts are not used by themselves but are associated with grades of service to determine the required quantities of switching equipment. A grade of service, or probability of congestion, indicates the proportion of calls that will fail to mature in the busy hour because all circuits are engaged on other calls. It is a necessary adjunct of any type of queueing system in which demands are unregulated and occur according to some random process. As post-selected busy hour traffic recording methods have become established over the past 30 years so have their results been applied to well-known grades of service.

The time-consistent busy hour method necessarily produces traffic estimates that are lower than post-selected estimates of traffic. If both are obtained for the same volume of traffic, the latter is calculated by selecting highest values and, commonly, these values are highest merely because of random fluctuations. To achieve the same level of circuit provision, therefore, these lower estimates of traffic must be used with better grades of service. The resulting difficulties in interpretation in changing from one principle to another are considered to be worth accepting, however, because of the advantages to be obtained in adopting a time-consistent busy hour.

The difference between the two methods of estimating the same volume of traffic is significantly greater at trunk exchanges than at local exchanges. This is because at the former the highest of three, instead of two, values is chosen so that there is a greater chance of a higher value occuring because of random fluctuations of traffic. The details in changing over to the new scheme must, therefore, be different between local and trunk exchanges.

The time-consistent busy hour principle,

OVER

together with monthly traffic records, is first being applied at trunk exchanges. The reason for this is that there is an urgent need for more information about the growth of traffic on trunk circuits because of the rapid expansion of Subscriber Trunk Dialling and dialling on international calls. Also, since there are only a small number of trunk exchanges, it is possible to introduce the scheme simultaneously. Application of the method to local exchanges generally will follow.

The improved method of traffic recording was introduced to obtain immediate benefits using existing equipment. A new traffic recorder is now being developed which will not only produce its results in a form suitable for processing by computer but will enable all circuit groups in an exchange to be examined at once. It is hoped that it will also automatically adjust for false traffic generated from faulty equipment. Advantage will be taken of modern techniques of traffic engineering and circuit design.

THE AUTHOR

MR. J. A. POVEY *is a Senior Executive Engineer in the Telephone Exchange Systems Development Branch of the Engineering Department. He joined the Post Office in 1946 as a Youth-in-Training in the Tunbridge Wells Area.*

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POST OFFICE TO BE A PUBLIC CORPORATION

THE Post Office is to become a public corporation which will have more independence to develop its services.

Making this announcement to Parliament on 3 August, the Postmaster General, the Rt. Hon. Edward Short, said: *"During recent years the Post Office has developed into a complex of vast business enterprises. It now faces considerable problems of expansion, modernisation and re-organisation if it is to meet the growing demands of the economy.*

"In considering whether or not the Civil Service context in which the Post Office functions is appropriate in present circumstances, the Government have recently carried out a fundamental survey of its management, structure and functions. After the most careful consideration it has been decided that the time has come to make a change and that, instead of being a Department of State, with a Minister at its head, the Post Office should become a public corporation, the members of which would be appointed by and responsible to a Minister.

"Within this corporation the management of the various services would have an opportunity to develop on more independent lines, but always with a primary responsibility for the maintenance of comprehensive national services available to all citizens in all parts of the country.

"A final decision on the exact form of the re-organisation and of the internal management structure must await publication of the report of the Select Committee on Nationalised Industries, which is now examining the Post Office, and the fullest consultations with the staff. These consultations will now be put in hand and a White Paper will be presented to the House in due course setting out the Government's final proposals.

"The Government believe that this decision to modernise the status and management of the Post Office will make a considerable contribution to its efficiency, and the efficiency of Britain, in the years ahead."

In answer to a number of questions following the statement, the Postmaster General said:

¶ Parliament had to face the fact that it could not keep the Post Office tied to its apron strings for ever and expect it, at the same time, to be a forward-looking, go-ahead, bustling and developing industry.

¶ *Employees would cease to be civil servants when the Post Office became a public corporation. The question of status and change-over was a matter which he would be discussing at great length with staff associations in the next three years. On the management side he hoped there would be cross-fertilisation with outside industry.*

¶ One of the benefits which would flow from the reorganisation was that management would be allowed to expand on more independent lines . . . "If the Post Office is given its independence we believe that it will enable management to spread its wings and develop in a way which it has never been able to do before."

Telecommunications Statistics

In this issue the figures presented are for the complete financial year to 31st March, 1966, compared with those for the two previous years.

	31 March 1966	31 *March* 1965	31 *March* 1964
The Telephone Service at the end of the Year			
Total telephones in service	**10,720,000**	9,980,000	9,365,000
Exclusive exchange connections	**5,241,000**	4,853,000	4,506,000
Shared service connections	**1,294,000**	1,177,000	1,114,000
Total exchange connections	**6,535,000**	6,030,000	5,620,000
Call offices	**74,629**	74,764	74,780
Local automatic exchanges	**5,687**	5,592	5,486
Local manual exchanges	**342**	437	533
Orders on hand for exchange connections	**227,100**	175,200	171,500
Work completed during the year			
Net increase in telephones	**740,000**	615,000	438,000
Net exchange connections provided	**808,000**	694,000	555,000
Net increase in exchange connections	**505,000**	410,000	266,000
Traffic			
Effective inland telephone trunk calls	**841,000,000**	736,000,000	624,000,000
Cheap rate inland telephone trunk calls	**186,000,000**	161,000,000	139,000,000
Overseas telephone calls:			
Outward	**†7,686,000**	6,316,000	5,094,000
Inward	*Not available	†5,647,000	†4,652,000
Transit	**†176,000**	†141,000	†120,000
Inland telegrams (including Press, Service, Railway and Irish Republic)	**10,892,000**	11,610,000	11,684,000
Greetings telegrams	**2,575,000**	2,592,000	2,618,000
Overseas telegrams:			
Originating UK messages	**7,192,000**	6,928,000	6,468,000
Terminating UK messages	**7,180,000**	6,864,000	6,545,000
Transit messages	**5,635,000**	5,304,000	5,133,000
Inland telex:			
Metered units (including Service)	**173,000,000**	161,000,000	125,000,000
Manual calls (including Service and Irish Republic)	**80,000**	121,000	154,000
Overseas telex calls	**†10,630,000**	9,110,000	7,173,000

Figures rounded to nearest thousand.

*Figures no longer available.
†Estimated element.

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.

Communications. 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.".

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TYPE	FRE-QUENCY Mc/s	POWER OUTPUT WATTS (Min)	V_{CC} VOLTS	GAIN dB (Min)	EFF. % (Min)	PKG.
40340	50	25	13.5	7	65	TO-60
40341		30	24	10	60	TO-60
40290		2*		6	70	TO-39
40291	135	2*	12.5	6	70	TO-60
40292		6*		5	70	TO-60
40280		1		9	60	TO-39
40281	175	4	13.5	6	70	TO-60
40282		12		5	80	TO-60
2N3553	175	2.5	28	10	50	TO-39
2N3632		7.5		6	70	TO-60
2N3375	400	3	28	5	40	TO-60
2N3733		10		4	45	TO-60

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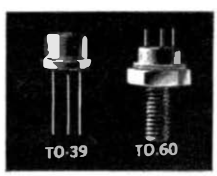

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Marconi Self-Tuning H.F System
—the first in the world to be station
planned from input to output

breakthrough

MST 7½ kW transmitter H1100 series

An h.f linear amplifier transmitter for high-grade telecommunications
Frequency range: H1100 and H1101, 4—27.5 Mc/s
H1102 and H1103, 2—27.5 Mc/s
Output power: 7—8 kW p.e.p, 5—6 kW c.w.
The H1100 series meets all CCIR Recommendations.

saves 85% floor space

Transmitters can be mounted side by side and back to back or against a wall; built-in cooling fan; no external air-ducts. These features lead to smaller, simpler, cheaper buildings or more services in existing buildings.

simplicity

R.F circuits have only three tuning controls and two range switches. Final valve can be replaced in 30 seconds. Miniature circuit breakers (used instead of fuses throughout) can be reset instantly. All sub-assemblies are easily tested because they are electrically complete units.

rugged reliability

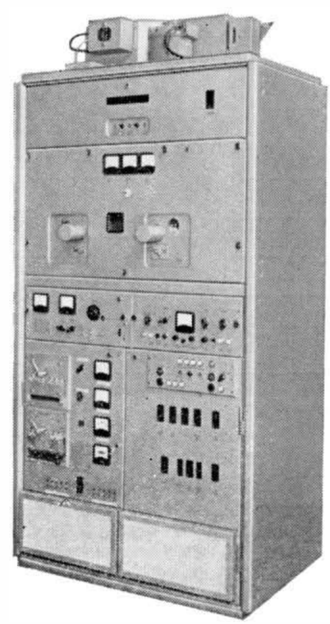
Stainless steel shafts in ball-bearings in rigid machined castings; stainless steel spur gears meshing with silicon bronze; heavy r.f coil contacts with high contact pressure—some examples of design features giving long term endurance and operational reliability. Specified performance achieved with ample margins.

self-tuning

Types H1101 and H1103, used with MST drive equipment, give *one-man* control of an entire transmitting station and continuous automatic aerial loading.

MANUAL TUNING

Manually tuned versions, types H1100 and H1102, are available which, when fitted with built-in drive units, become entirely self-contained transmitters for four spot frequencies and all types of modulation.
Manual tuning takes less than 60 seconds.



Marconi telecommunications systems

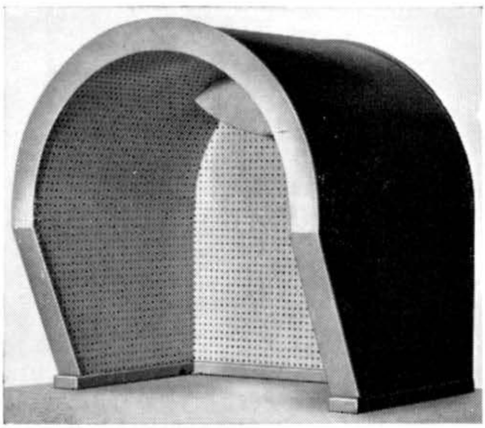
The Marconi Company Limited, Radio Communications Division, Chelmsford, Essex, England LTD/H50

WHITELEY

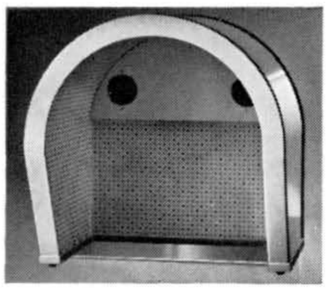
for acoustic hoods

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.

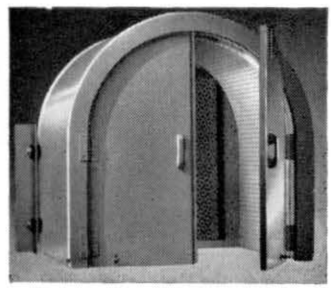
Whiteley acoustic hoods are strongly made from resin bonded ply and finished in a cellulose enamel which makes them suitable for indoor or outdoor use.



Standard Hood dimensions
25" high × $20\frac{1}{4}$" deep × $24\frac{1}{2}$" wide



Fitted with loudspeakers

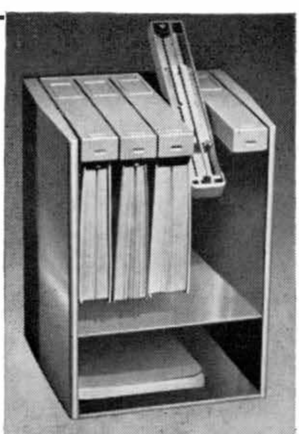


Fitted with doors for outside use

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

& directory holders

Directory
Holder
dimensions
$17\frac{1}{2}$" high ×
$13\frac{1}{2}$" wide ×
$13\frac{3}{8}$" 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.

See us at the S.B.A.C. Exhibition stand no. 106

For further details please write or telephone :—

WHITELEY ELECTRICAL RADIO CO LTD
MANSFIELD · NOTTS *Tel : Mansfield 1762/5*

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