POST OFFICE

tele communications

JOURNAL

ONE SHILLING

AND

SIXPENCE

AUTUMN 1965

at last!...

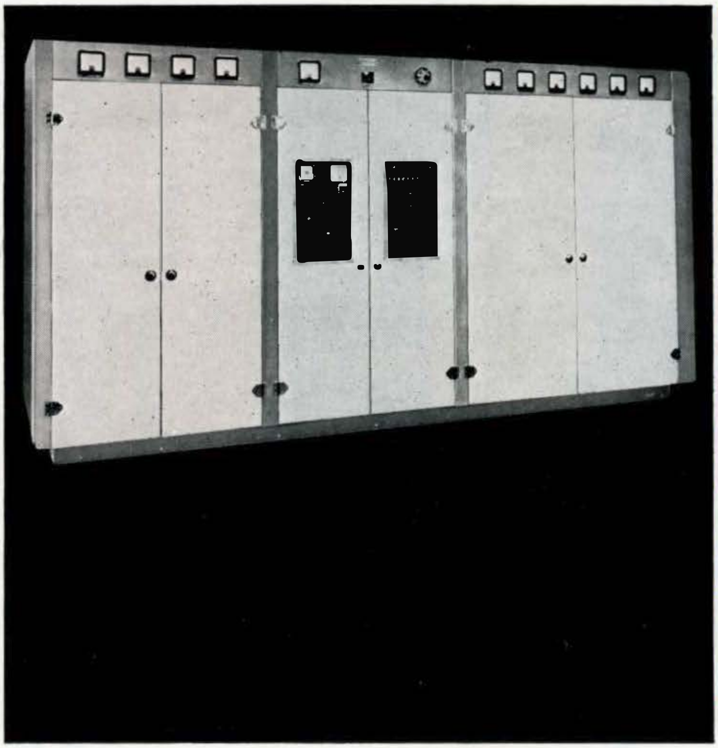
...a semi-electronic teleprinter

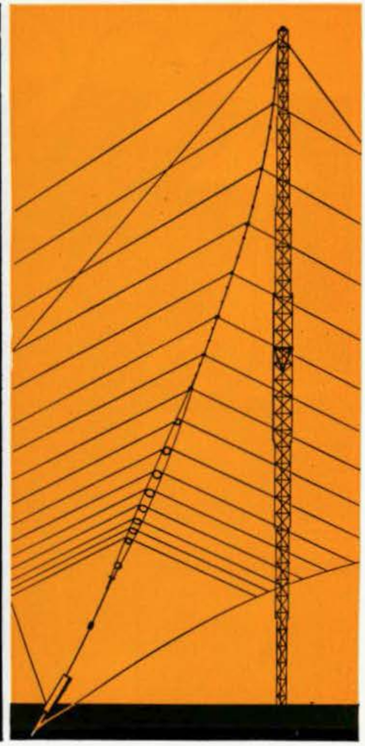
from SAGEM *of Paris*

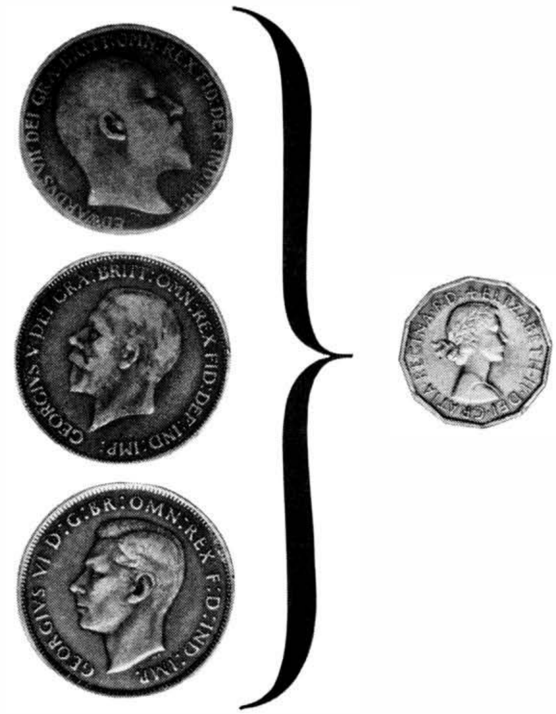
Not exactly their latest creation! but the S.A.G.E.M. Semi-electronic Teleprinter is now available for the first time in this country—a machine designed to work hard throughout a long working life. As a result of being the first **semi-electronic** teleprinter, the S.A.G.E.M. SPE offers an unrivalled degree of precision and reliability for 7.5 unit start-stop transmission, at speeds of 50 or 75 Bauds.

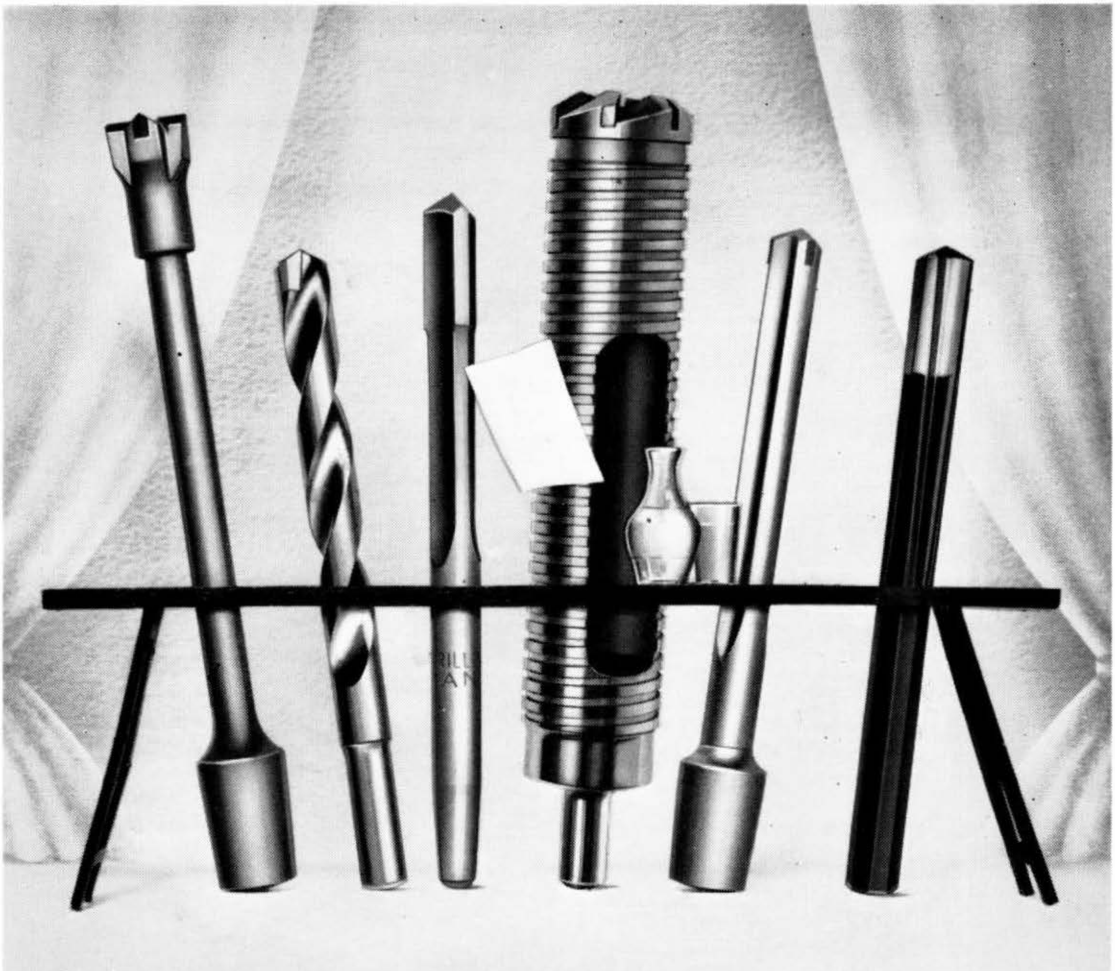
An astonishing reduction in maintenance costs, by comparison with its mechanical forerunners, is yet another important feature, achieved by a completely new design based on junction transistors and printed circuits. Although this machine is especially suited to heavy duty use, it is nevertheless, one of the most light and compact teleprinters on the market today, with an attractive range of associated equipment.

Please write for further information and specification to the address shown below, or better still, accept our invitation to come and visit us at our premises. We'd be delighted to arrange a demonstration for you.
Just telephone Automatic Punched Tape Ltd.
(Paddock Wood 796/797) for an early appointment.
Commerce House Commercial Rd Paddock Wood Kent









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

ALL-FIGURES BY 1970
(*pages 2-6*)

A HELPING HAND ON THE MOTORWAYS
H. Clarke (*pages 7-10*)

FRENCH AT THE DOUBLE
(*pages 10-11*)

PUTTING TELEPHONES IN NEW HOUSES
Miss P. A. Panichelli and H. A. Reid
(*pages 12-15*)

PICCADILLY PLAZA PROJECT
(*pages 16-17*)

PREPARING TO FORGE AHEAD
(*pages 18-22*)

THE ENGINEERS FOUND THE ANSWER
F. G. Finn (*page 23*)

MAINTAINING THE TRUNK CABLE NETWORK
A. F. G. Allan (*pages 24-27*)

SAMPLING THE TRUNK SERVICE
E. J. F. Ackroyd and C. D. Vigar
(*pages 28-32*)

THE PUBLIC ADDRESS CALL SERVICE
T. K. Lord (*pages 33-35*)

TELEPHONES ON WHEELS
J. L. Hyatt (*pages 36-39*)

A NEW AID FOR SUBSCRIBERS
N. C. Nelson (*pages 40-41*)

SPEEDING THE SPACE MESSAGES
J. L. Crowther (*pages 42-45*)

MISCELLANY
(*pages 46-48*)

★

Vol 17 *Autumn* 1965 *No.* 3

THE TEN-POINT PLAN

"THE public is entitled to have a good, reliable and rapid telephone service," said the Postmaster General recently. "Until we can provide it, even news of communications satellites, the introduction of warbling telephones and the use of computers for printing bills may prove more irritating to the man who doesn't get the dialling tone when he 'phones his wife to say he'll be late for dinner."

The Post Office Report and Accounts for 1964-65 (*the subject of an article elsewhere in this issue*) admits that the telephone service is not as efficient as it should be and gives the reasons why.

But remedies are on the way in the shape of a programme for the future which the Postmaster General has named "The Ten-Point Plan." **First,** under the plan, a more detailed system of providing operational statistics has been evolved to give management the information it needs to judge more accurately the efficiency—and, therefore, the deficiencies—of the service. **Second,** schemes are being worked out to reduce the number of uncleared faults carried over to the next day. **Third,** arrangements are being made to deploy engineering staff more effectively to increase productivity and conserve skilled manpower. **Fourth,** four firms of consultants have been invited to review forecasting methods and to propose improvements. **Fifth,** a Director of Statistics and Business Research has been appointed to ensure that management has all the information it requires in its approach to customers. **Sixth,** the plan to transfer clerical labour to computer working is being speeded and a Director of Computer Services has been appointed. **Seventh,** a new capital investment programme is being prepared to meet the needs of the next five years and long-term plans aimed 20 years ahead are taking shape. **Eighth,** new agreements are being negotiated with the telecommunications industry to replace existing bulk supply agreements and to speed the supply of apparatus and exchange equipment. **Ninth,** the Post Office will continue to be a business organisation and a public service but it also intends to meet all its social obligations to the full. And **tenth,** the structure and organisation of the Post Office is being closely studied to ensure that it is organised to do its job as efficiently and economically as possible.

The Ten-Point Plan is an imaginative step forward and it will succeed if all who work in the telecommunications services contribute a maximum effort.

In five years' time all telephones in Britain will have all-figure numbers and all exchange names will have been abolished. The conversion, which is expected to cost the Post Office about £1 million, will help to speed and expand the telephone service both at home and overseas

ALL FIGURES BY 1970

The Postmaster General explains to the Press how the all-figure numbering scheme will operate. Seated beside him is Mr. A. W. C. Ryland, until recently Director of the Inland Telecommunications Department and now a Deputy Director General.

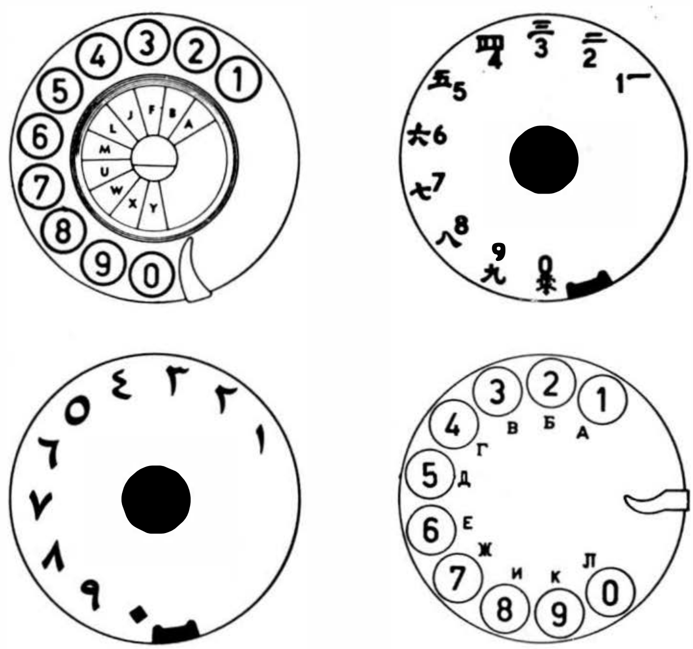
AN important and far-reaching decision which heralds the introduction of all-figure dialling throughout the country and will affect every telephone user in Britain, was announced by the Postmaster General on 26 July.

By the beginning of 1970 all exchange names in the six big cities—London, Birmingham, Edinburgh, Glasgow, Liverpool and Manchester—will have disappeared and the three-letter abbreviations which are dialled to reach them will have been replaced by figures. So, too, will the letters in all Subscriber Trunk Dialling codes and local codes and in the letter codes used to obtain the Information Services.

For almost 40 years telephone numbers in the big cities have been a mixture of letters and numbers—a system first adopted in London when automatic telephones were introduced and later extended to the other big cities. Many STD codes and local codes have always contained letters and some of the service codes—such as TIM, UMP and ASK—have long been household words.

Many will regret the disappearance of exchange names and some may even resent having to adjust themselves to new dialling habits, but the need to change to all-figure dialling is inevitable.

There are three compelling reasons for the change: to help the dialling of international calls; to cater for the expansion of the inland telephone



The all-figure dial (above) which all new telephones will have after the change-over is completed. On the right is a selection of all-figure dials used in Australia (top left); Egypt (top right); Singapore and Hong Kong (bottom left) and in Russia (bottom right).

service; and to improve arrangements for connecting calls both to and within the six big cities by setting up a new system of decentralisation.

Facilities for people to dial their own calls to other countries are increasing rapidly and by the end of this century it is expected that there will be some 600 million subscribers throughout the world—about 20 million of them in Britain—and that most of them will be able to dial their own calls to each other. However, full advantage of these facilities cannot be taken unless all national numbering schemes are on the same basis. Since Britain is now one of the very few countries which has letters and figures in its telephone numbers this handicaps people in other countries who want to dial their calls to British subscribers and impedes the free flow of communications.

The United States, Canada and France are now changing to all-figure dialling and unless Britain does the same it will soon be the only country in Western Europe to have mixed letter and figure numbers. If we wish to keep our place as one of the world's leading business and trading centres we must change over to all-figure numbers and the sooner it is done the better. The longer the change is left the more difficult the problem will become because more people will be affected as the telephone system grows.

The second reason for the change is that the inland telephone service is growing so rapidly. Already the number of connections exceeds six million, a figure which may well be trebled within the next 20 years. This means that many more telephone exchanges will be needed.

At present each exchange in the six big cities needs a unique three-letter code which must begin a pronounceable word. There are 648 different ways in which the letters on a dial (excluding the letter "O" as the first letter since this is needed for STD access) can be arranged. But less than half of these make suitable pronounceable names. In London about 240 of the suitable combinations are already being used and the rest will be needed within the next three or four years. Hence, if the present numbering system continued there would be no way of providing for further growth. But by changing to an all-figure system and still using only seven-digit numbers, the number of suitable codes can be increased to 800, which is sufficient to last for the rest of the century.

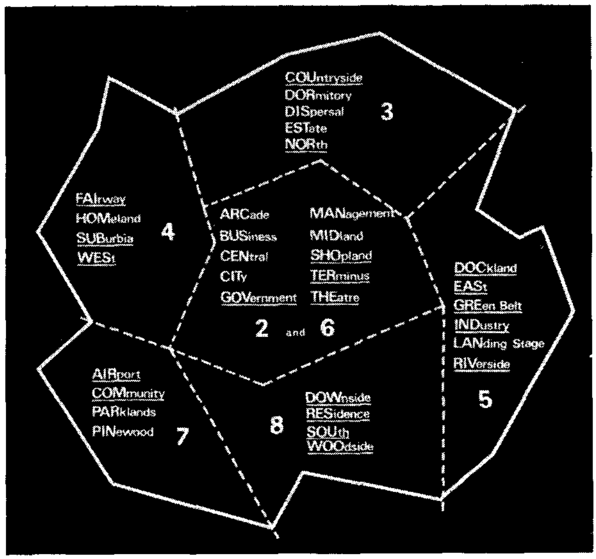
The third reason for the change is the need to introduce decentralisation in the six big cities to cope with the rapidly-increasing number of calls. At present about 6,000 million calls a year are being made in Britain and this figure is expected

OVER

ALL FIGURES BY 1970 (*Contd*).

to double every seven years. Vast numbers of these calls are made within and to the six big cities and their conurbations and are switched at large central exchanges. As the system grows it is becoming obvious that it will be more economic and efficient to decentralise much of the switching to switching centres on the periphery of the big cities, each serving exchanges in particular sectors. Such a system will fit in with the growing tendency of business firms to move from the centres to the outskirts of the cities and, at the same time, ease the demand for sites and buildings in the city centres. In addition, in London at least, decentralisation will bring about an improvement in the audibility of many trunk calls since exchanges will be nearer their terminal trunk centre.

Decentralisation and the setting up of sector schemes can only be introduced, however, if calls dialled from any part of the country—or the world—are routed direct to the correct switching centre. To achieve this, all exchanges in the same sector must have the same early digits in their codes. Changing established exchange names on



This diagram illustrates how a typical big city will be divided into sectors, all exchanges in the same sector having the same initial digits in their codes.

HOW THE CHANGE WILL AFFECT US

How will the change to all-figure numbers affect the engineering, clerical and operator services?

One big problem will be to ensure that during the transition and for some time after, arrangements are made for all calls, whether they are dialled in the mixed letter and figure or the all-figure form, to get through to their destinations equally well. To achieve this, the engineers will have to make some equipment re-arrangements at all director exchanges, at some incoming trunk exchanges in the director areas and at many exchanges on the outer fringes of the director areas. In London alone there are some 200 local director exchanges and all re-wiring will have to be completed before the all-figure system can be brought into use.

All telephone directories for subscribers in the six big cities will have to be re-set to provide the new all-figure style national numbers, but they will continue to show exchange names and numbers for subscribers in other places. Some directories, which cover all or part of one of the big cities and surrounding districts, will contain both types of entry.

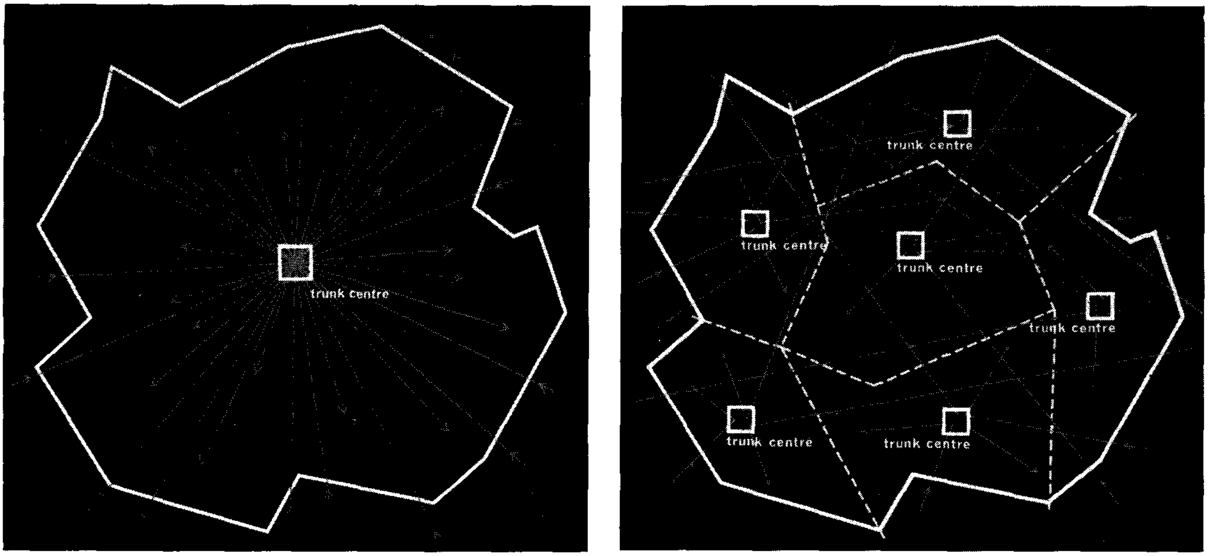
During the transition, directories for the six big cities will show some mixed letter and figure numbers and some all-figure numbers. Subscribers who opt to change to all-figure numbering before they need to, will have their new numbers published in the first subsequent directory issue.

The flexoprint directories used at the directory inquiry positions will also have to be amended to the all-figure form. This will be a particularly heavy task and in the beginning directory inquiry operators will probably have to quote numbers in either their old or their new form. However, the arrangements which will be made to ensure that calls go through equally well whatever form of number is dialled will obviate any inconvenience to subscribers. Visible index files used by operators to determine the routing of trunk calls will also require amendment.

Before the all-figure numbering scheme gets under way supervisors will need to devote refresher training periods to explaining the new system to their operators.

Another big task will be re-designing and changing the notices in call offices.

After the change-over is completed throughout the country, all new telephones will have dials bearing only numbers. The introduction of the new all-figure dial may well lead to a reduction in the number of wrong calls dialled by subscribers. Experience in other countries has shown that although all-figure numbers may be slightly more difficult to remember they are easier to dial.



At present calls made to and within big cities are switched at big central exchanges (left), causing considerable congestion. In future congestion will be eased by setting up switching centres on the periphery, each serving exchanges in their own particular sector.

the scale needed to bring this about would be very difficult to arrange and cause confusion among telephone users. By adopting all-figure numbering, however, the changes can be made much more easily.

The change to all-figure numbering will be introduced gradually so as to cause as little inconvenience as possible to subscribers and telephone users. As a first step—beginning probably early in 1966—all new numbers on automatic exchanges in the six big cities will be in the all-figure form. Existing numbers which do not have to be changed for other reasons will be allowed to continue in their mixed letter and figure form for, perhaps, up to three years by which time about a million-and-a-half all-figure numbers will have been allocated to new subscribers, to those who move from another address and those who transfer to new exchanges. After that date—about 1969—all remaining mixed letter and figure numbers will be changed to all-figure numbers. Ample notice will be given to subscribers of the impending changes.

If subscribers with mixed letter and figure numbers wish to change to all-figure numbers earlier than they would otherwise have to—because, for example, they want to avoid the cost of a double printing of office stationery—they will be able to do so once the transition period has begun.

Subscriber Trunk Dialling codes and any local codes containing letters will be changed to all-figure numbers progressively as new dialling code booklets are issued.

★

THIS IS HOW THE PLAN WILL WORK

Subscribers Numbers All exchange names in London, Birmingham, Edinburgh, Glasgow, Liverpool and Manchester will disappear and the three letters dialled to reach the required exchange will be replaced by figures.

In some instances the figures will be the numerical equivalents of the letters on the dial (for example, ABBey may become 222), but in others, different figures will have to be allocated so as to prepare for sectorisation (for example, ACOrn may become 992).

OVER

HOW THE PLAN WILL OPERATE *(Contd.)*

All remaining manual exchanges in the six big cities will be converted to automatic working by 1970. In the meantime they will retain their names but the code dialled by a subscriber in the same city to reach a manual exchange operator (for example, SAN for Sanderstead) will be replaced by a figure code. The new figure code will be dialled in the same way as the present letter code and, when the operator answers, the required subscriber's number will be given as at present.

No changes will be made outside the six big cities where subscribers' numbers are already in all-figure form.

STD Codes STD codes of places outside the big cities contain letters as well as figures and in each instance the letters will be replaced by their figure equivalents (for example, Aberdeen 34344, which is now obtained by dialling OAB4 34344, will in future be dialled as 0224-34344).

The STD codes of the six big cities, being already in all-figure form, (for example, 01 for London; 021 for Birmingham, and so on) will require no change.

Local Codes Some of the local codes which enable subscribers to dial others on nearby exchanges are already in all-figure form and where this is so no changes will be necessary. Those codes which do incorporate letters will become all-figure—for example, the code for Ashford, Middlesex, at present MX, will become 69.

Information and Other Codes Existing all-figure codes, such as 100 for the operator and 999 for the emergency services, will remain unchanged. Other codes, such as TIM, UMP, ASK, DIR, TEL and ENG, will become all-figure. Although the new codes will not be the figure equivalents of the present letters they will, as far as possible, become easily remembered combinations of figures.

National Numbers At present a subscriber's number is made up of his STD code, together with his exchange code and number in the six big cities, or with his number elsewhere. Since these national numbers contain letters in the STD code or exchange code they will become wholly numerical. For example, the new national number of London ABBey 2870, at present 01 ABB 2870, will become 01-222 2870 (assuming that the letters are replaced by their numerical equivalents).

In the six big cities the national numbers will be shown on the dial centre of each telephone and be quoted in directories. A subscriber in one of these cities calling another in the same city will not dial the complete national number but only those figures after the hyphen which separate the STD code from the local number. In the local number a space is left after the first three figures which designate the exchange.

Outside the big cities, where the national number of, say, Abbeytown 299 is now dialled as OWN 56 299 and will in future be 0965 6-299, the present names and numbers will be shown on the dial centre labels and quoted in directories. Generally, the setting up of local calls will not be affected. Callers will also use place names for calls passed through an operator to subscribers in these places but the full national number will be used for dialled trunk calls. Here, too, the hyphen separates the STD code from the subscriber's local number. In the STD code a space is left, where necessary, after the figures required to take the call to the appropriate trunk exchange, the remaining digits, if any, before the hyphen being needed to route the call to the local exchange. A caller making a trunk call via an operator to ABBey 2870 under the all-figure numbering system will ask for 01-222 2870 and if he were calling Aberdeen 34344 he will ask for Aberdeen 34344 and not the national number.

★

PS to Five Es-in-C

IT was a unique moment. In a conference room at the Engineering Department headquarters in Gresham Street, the Engineer-in-Chief, Mr. D. A. Barron, CBE, sat with four of his predecessors—Sir Archibald Gill, Sir Gordon Radley, Sir Lionel Harris and Sir Albert Mumford.

They had met to say farewell on her retirement to the woman who, in her 41 years' service with the Post Office, had been private secretary to them all, beginning with Sir Archibald Gill in 1948.

"All the Engineers-in-Chief for whom I worked were quite different and I had to adjust my methods to suit each of them," said Miss Thurogood after she had been presented with retirement gifts by Mr. Barron.

Miss Thurogood joined the Post Office in 1924 as a shorthand writer and later became a superintendent of typists at Alder House.

An emergency telephone on the Parkway interchange on the M4 between Chiswick and Langley.

The emergency telephone systems which the Post Office set up on Britain's motorways involve much more than providing the familiar blue and white cabinets, as this story tells

A HELPING HAND ON THE MOTORWAYS

By H. CLARKE, AMIEE

TO most motorists the only manifestation of the motorway emergency telephone system is the sight of blue-and-white telephone cabinets and pedestals at regular intervals by the roadside.

The cabinets are placed along each carriageway at nominal one mile intervals and always directly opposite each other so that those in difficulty will not be tempted to cross the carriageways to get to the nearest telephone. The spacing is only nominal because it can be affected by such features as the positions of bridges—it would not be very useful to place a cabinet immediately on the far side of a bridge where it would be obscured by approaching traffic. Along more recent stretches of motorway the small marker posts placed at quarter-furlong distances indicate the direction of the nearest emergency telephone.

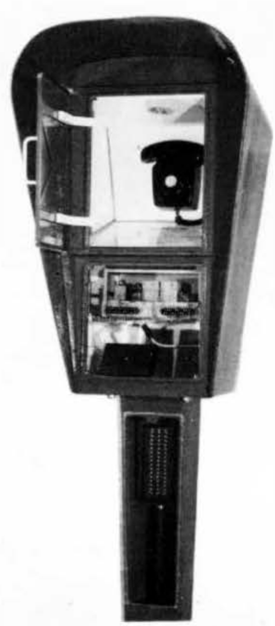
The cable connecting the telephones is a special type developed for motorway use. It contains 40 lb conductors, is armoured (a very necessary

OVER

A HELPING HAND (*Contd.*)

feature), and polythene protected. To reduce attenuation and improve its frequency response it is loaded with 88 mH coils every mile approximately mid-way between any two consecutive telephones. The cable is normally mole-drained into the grass verge beyond the hard shoulder but, where it has to pass access roads and bridges, it is taken through four-inch steel pipes. It runs along only one carriageway, a looped connection being made to the telephone on the opposite carriageway by way of a two-pair spur cable in a steel pipe laid transversely across the motorway. Since the cabinets along one carriageway are almost directly opposite those along the other, these spur cables can be terminated at both ends on the terminal blocks in the bottom of the pedestals, thereby keeping cable jointing to a minimum and facilitating maintenance.

Emergency calls are dealt with by the county police and all motorway telephones are normally connected to a police station within their county boundaries. This arrangement is helpful to the Post Office since the telephone systems along sections of motorway can thus be planned as units and subsequent extensions do not usually necessitate re-arrangements.



The emergency telephones are contained in cabinets at every mile along motorways. Connecting cables are armoured and polythene protected. Each telephone is connected to a police station.

An essential requirement of the motorway emergency telephone system is that a telephone from which a call is being made should be immediately identified at the police station. This could, of course, be achieved by providing each telephone with its own pair of wires throughout but a cheaper, and now standard, method is to associate a maximum of 10 telephones with each cable pair and identify each telephone by a particular combination of two frequencies chosen from five standard ones (that is, the international "two-out-of-five" dialling code which provides 10 possible combinations). Since only one-way calling is required—from telephone to police station—no motorway emergency telephone need be connected to the line until it is actually calling, thereby eliminating a considerable loss of speech energy in the circuitry of the idle telephones. It is not normally necessary to provide amplification in any circuit containing a group of 10 telephones.

Motorway emergency telephones are not connected to the public network, so that requests for

One of the 22 warning signs recently introduced experimentally on the M5 in Worcestershire.

Police at Hounslow keep a watchful eye on M4 traffic with the aid of an electronically operated mimic diagram which pin-points traffic congestion.

assistance are relayed by the police to the appropriate service—ambulance, fire brigade, garage and so on.

On special motorway structures, such as the elevated section of the M4 approach to West London, which has no hard shoulder, a disabled vehicle could seriously impede the flow of traffic, especially if the carriageway is only two lanes wide. In such instances the emergency telephones are spaced at nominal quarter-mile intervals and additional communications are provided so that assistance can be summoned as quickly as possible. The elevated section of M4 is observed by three television cameras, each mounted on a building adjacent to the motorway and connected, as required, to a picture monitor at Hounslow Police Station. The Post Office has provided the video links, amplified and equalised to 625-line standards, between each of the three buildings and a central switching point near the motorway, and between this switching point and the police station. Speech quality circuits are used to convey control signals to the cameras and the switching equipment.

The flow of traffic along the elevated section is monitored by vehicle presence indicators. These consist of inductive loops buried at suitable points in the carriageways and associated electronic equipment in metal boxes by the roadside. Whenever a vehicle passes over a loop a pulse of tone of frequency peculiar to that indicator is transmitted. Twenty-four indicators are connected to one circuit and their signals are conveyed by speech-quality lines, also provided by the Post Office, to Hounslow Police Station where they are used to give a meter indication of rate of traffic flow at any selected point and to operate an alarm if the flow falls below a pre-set value. The places where the flow falls to the pre-set value are indicated by illuminated lamps on a mimic diagram of the elevated section in the Police Station so that the police can see immediately where traffic should be diverted to avoid adding to the blockage. To this end, diversion signs bearing the slogan "M4 closed, Use A4" are placed at approaches to access points.

The emergency telephones on the Severn and Wye bridges and their inter-connecting viaduct will also be spaced at quarter-mile intervals when the M4 in that area is completed and television monitoring of traffic may also be employed.

OVER

FRENCH AT THE DOUBLE

Aspiring linguist operators now receive training at a new language laboratory which will help to bring them up to standard much more quickly than before

Some of the students at the first course listen to a pre-recorded lesson.

A LANGUAGE laboratory which will speed the language training of telephone operators who staff the international switchboards was opened recently at the new International Telephone Exchange in Wren House, London.

The training given at the laboratory is expected eventually to cut the present French course of between five and six months by about half and will mean that operators will be able to qualify much earlier for their linguist allowance. The new laboratory will also, it is hoped, go a long way towards answering the need for more French-speaking operators.

A large number of the operators at Continental Exchange must be able to express themselves with

---

A HELPING HAND *(Concluded)*

Another special structure is the Almondsbury Interchange, which will connect M4 and M5. This will have 16 emergency telephones—one for each of its inter-connecting links.

All motorway emergency telephone cables now being laid have enough capacity also to cater for warning sign systems but, so far, these have only been installed experimentally on the M5 in Worcestershire, where a total of 22 signs are controlled from the Police Station at Hindlip Hall. They give warning of "skid risk", "accident" and "fog" and the appropriate hazard—or hazards—with the additional cautionary word "slow" illuminated. Selection and control of the signs is by combination of tones within the frequency spectrum of a speech-quality circuit.

Following experience gained with the M1, the first motorway to be equipped with an emergency telephone system (using DC signalling and a central battery), motorways and their telephone systems have become largely standardised. This does not mean, however, that the excitement which enlivened the early days has departed entirely from Post Office activities on motorways. Work carried out by the Post Office has to be concentrated into the final stages of the road construction and occupy a small proportion of that period. If, therefore, the road contractor makes good time and it is possible to open the motorway earlier than the scheduled date, the Post Office can find itself in considerable difficulty in a race against time. And, of course, even an armoured telephone cable will never be a match for a contractor's machines going busily about their business—but this would make another story!

★

MR. CLARKE *is a Senior Executive Engineer in the Main Lines Planning and Provision Branch of the Engineering Department.*

Miss Stefania Strassberg, one of the two day-time instructors, who also helped to write the scripts for the lessons, speaks to the students over her control console.

considerable fluency in French since the services between Britain and many other European countries are conducted in that language. Very few people, however, even those who have reached the GCE "A" level, have sufficient command of French to become linguist operators without training so that for some years those with a lower standard of French than is required have been recruited and then given free tuition in their working hours. This has generally meant that a recruit could not qualify as a full-time linguist for about a year, half of that time being spent on basic operator training and the rest on language tuition.

Until now, French classes have been run on more or less conventional lines, instructors giving lessons to classes of students in grammar, the specialised vocabulary used in telephony and practice in conversation (see article *Ici On Parle Français*, Winter, 1964, issue). With the opening of the new language laboratory students can be brought up to the required standard more rapidly.

In the laboratory, which can accommodate up to 12 students at a time, each student sits in a sound-proof cubicle and listens on headphones to pre-prepared lessons on a tape recorder. These lessons are usually a series of questions and answers. The students answer the questions and then listen to the correct answers on the tape recorder. In addition, the students receive oral dictation and other exercises, all concentrating on the spoken word. In this way they improve their pronunciation and vocabulary and their understanding of French grammar.

One of the great merits of this system is that each student can operate her own tape recorder, stopping the lesson at any point and recapitulating or correcting previous work. Each can thus proceed at her own pace without feeling embarrassed or holding up the rest of the class. The class instructor, who sits at a control console facing the students, can listen to all students and speak individually to each of them or address them as a group.

The first two classes held in the new laboratory are for women. Other courses for men will follow. To ensure that students listen to French as it is really spoken, a French-born telephonist at Continental Exchange—Miss Elisa Colombel—made the recordings in her native tongue. The script for the recorded lessons has been written by Miss S. Strassberg and Mrs. G. Hutchings, two day-staff instructors.

Candidates for the new courses must have reached the GCE "O" level in French. Language training in the laboratory does not begin, however, until recruits have completed a 24-week course in continental operating procedure and passed an efficiency test. Then, they receive French lessons for two hours a day, half of which time is spent in the laboratory and the rest with an instructor who takes them through the grammar and vocabulary set out in the recorded lessons. After about six weeks, when most students will have reached the required standard, they spend about six weeks handling calls in French under the guidance of a supervisor. Finally, after a test given by a member of the Continental Traffic staff, the students are upgraded to Class One linguists and qualify for a language allowance of 35s. a week.

As the *Journal* went to press there were vacancies at the Continental Exchange for 80 women and 73 men Class One linguists.

The Post Office is paying increasing attention to the need for houses on new estates to have built-in telephone facilities and has appointed liaison officers in each Telephone Area to maintain the closest contact with builders and local authorities. This article discusses some of the problems of . . .

PUTTING TELEPHONES INTO NEW HOUSES

By Miss P. A. PANICHELLI and H. A. REID, BSc(Eng), AMIEE

Modern overhead construction on a housing estate showing a medium pole and lightweight dropwire.

FOR the first time builders are now able to offer for sale new houses with telephones already installed.

This is one of the important results of a recent reconsideration of the problems of providing overhead and underground distribution of telephone lines on new housing estates.

The rapid rate of building development presents a particular challenge to provide telephone service at the earliest possible date and the most economical and flexible methods of distribution must be used.

For new external plant to be available by the time houses are occupied, installation has to take place when conditions on the site are far from ideal. The attention of planning and construction engineers must, therefore, be focussed on overcoming the many problems which arise in coordinating the provision of new telephone plant with road construction and house building operations. New engineering posts are being created in each Telephone Area for housing-estate liaison-officers, whose duties will be to maintain very close contact with developers and builders at all stages of building. Trenching and cable-laying must be carried out at the right time to ensure the best and most economical installation of the plant, particularly if mechanical aids are used, and to prevent damage by subsequent building operations or installation work by other services, such as gas, water and electricity.

Clearly the Telephone Manager should have details of all proposed new building developments as early as possible—preferably as soon as planning consent has been given. Immediately after information about a new estate is received, the Sales Development Section in the Area check or prepare the forecast of the telephone requirements which the planning engineers use in the design of the telephone cable network and plant layout for the estate. The proposals need to be prepared, discussed and agreed with the developers, estimates made out of stores and labour, stores ordered and obtained and works programmed for execution.

Telephone Managers are being helped to obtain advance information of all proposed new estate works and building developments by advertisements placed in building trade and architectural journals which are designed to encourage developers and local authorities to consult the Post Office about the requirements for providing telephones on their estates. A new booklet entitled *Provision of Telephone Facilities on New Housing Estates* has been published for the guidance of developers.

Local authorities and developers are increasingly asking, on amenity grounds, for underground distribution of telephone subscribers' services but recent studies of relative costs show that overhead distribution to houses in residential estates is still much cheaper than providing underground cables and it remains the standard method.

The estimated national average difference in cost between the overhead and underground methods is about £5 for each dwelling on new estates (other than those contained in high blocks of flats), and it would be unfair for telephone users generally to subsidise the more expensive arrangements.

Underground distribution usually necessitates the laying of distribution cables on both sides of the street. An individual service cable is then laid from the street distribution cable up to each house at the outset in order to avoid disturbing expensive pavings and cultivated front gardens when telephones are subsequently ordered.

Overhead service, on the other hand, normally involves laying a distribution cable on only one side of the street to feed distribution poles from which overhead connections to the houses on both sides of the street can subsequently be provided.

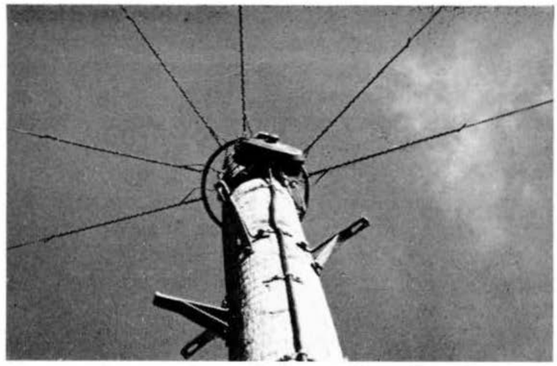
The effort to devise better and more economical methods of providing service, both overhead and

OVER

The standard type of cross-connection pillar, made of asbestos cement, which is now used on housing estates. It can carry up to 200 pairs of wires between branch and distribution cables.

A standard cross-connection cabinet provided on new housing estates. It can carry up to 400 pairs of wires between main cables and branch and distribution cables.

A modern external house termination which is much neater, smaller, easier to fit and less liable to damage than those previously used.



A worm's-eye view of the modern ring-type distribution pole fitted with single spans of the new lightweight, PVC-insulated steel dropwire.

underground, continues. A recently adopted standard is for most new overhead services to be provided from light ring-type distribution poles by means of single spans of the new thin, lightweight PVC-insulated steel dropwire. This new dropwire enables much lighter pole and external house fittings to be used, thus simplifying installation work and at the same time offering an improved maintenance liability compared with the older open-wire methods. The dropwire construction is also less obtrusive than the open wire construction which is now considered obsolescent.

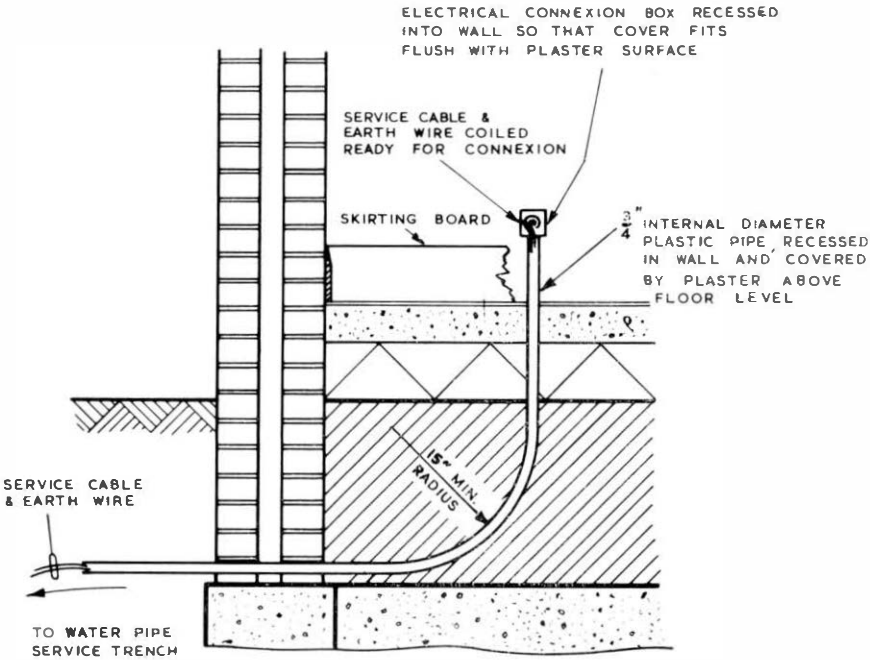
Although overhead distribution must continue as the standard method, underground cables will nevertheless be installed right up to the house if the developer agrees to give assistance in providing them. The Post Office prefers such assistance to be given in kind—that is, direct help in installing the services, with the planning engineer negotiating with the developer for aid equivalent to £5 for each dwelling on the estate.

A very attractive method of providing direct underground services with assistance in kind has been developed on a number of trial estates with the co-operation of the builders. This is for the builder to lay the service cable and an earth-wire in a trench from an agreed point on the street cable up to each house on the estate and then through a lead-in pipe to a flush-fitting connection box inside the house. The Post Office provides the lead-in pipe, earth-wire, connection box and cable, and the builder incorporates the house-fittings in the building fabric and lays the cable free of charge at the appropriate building stages. If the cable is laid as far as possible in the waterpipe trench to the house, the actual cost to the builder is small.

Exceptionally, if the developer objects to overhead construction and is unwilling to make a contribution in kind, the Post Office is now prepared to accept a cash contribution towards the cost of providing the services underground. The developer must pay £5 in respect of every dwelling

A new idea, tried out on some estates, is to provide a flush-fitting connection box in the wall so that a telephone can be connected without disturbing the house fabric.

This sketch shows a typical lead-in arrangement for providing underground service, the builder laying the service cable and earth-wire from the street cable to each house and then to the flush-fitting connection box.



on the estate (other than those in high blocks of flats). Cash payment is less desirable, however, from the point of view of the Post Office which then has to carry out all the work, tying up its manpower resources. A further disadvantage is that, since the preferred method of leading the underground wires through the wall to terminate inside the house can be done only with the builder's agreement to place the lead-in pipe and flush-fitting connection box in the house fabric during construction of the building, service cables have to be laid to external blocks fixed on the outside walls of the houses. Further wiring from the external blocks is then necessary to provide service in the houses. An external buried earth-spike and wiring may also be required.

A lead water pipe and an armoured polythene telephone cable are being led into a house under construction through a common trench.

A further step in the expansion of arrangements for telephone service is the recent decision to make it possible for developers who want to add telephones as extras in their new houses, to arrange with the local Telephone Manager for installation in advance of occupation in return for payment of the standard connection charges as long as there is no waiting list in the area. The purchaser or tenant need only make formal application for service, advising the proposed date of occupation, and the line will be working when he moves in.

THE AUTHORS

Miss P. A. PANICHELLI is a Higher Executive Officer in the Subscribers' Services Branch, Inland Telecommunications Department.

Mr. H. A. REID, BSc (Eng), AMIEE, is a Senior Executive Engineer in the Local Lines Branch, Engineering Department.

A fine example of the advantages of co-operative pre-planning of telecommunications facilities in new buildings comes from Manchester's

PICCADILLY PLAZA PROJECT

THE campaign to persuade builders, architects, local authorities and prospective owners of property to consult the telephone manager at an early stage in planning building projects has met with outstanding success in Manchester.

As soon as details of Manchester's city centre Piccadilly Plaza project became known, the Telephone Manager's Sales staff examined the accommodation which the buildings would provide and forecast the number of telephone and telex lines which would be needed during the first 20 years.

Engineers from North-Western Region then made a building-by-building and floor-by-floor analysis of the requirements and drew up plans for cabling between the Manchester Central Exchange and the Plaza site and for distribution within the buildings.

While the building work was going ahead the engineers installed an exchange cable, carrying 1,200 circuits, to the site and then inserted the distribution cables, which carry a total of 2,200 circuits, so that telephones and telex stations can be provided wherever and whenever needed as firms occupying the buildings take up residence. These distribution cables—four-and-a-half miles long and containing 405 miles of wire—were installed so that all wires are concealed yet easily accessible for maintenance.

As the buildings are leased, the Sales Division contacts each customer to find out what facilities he wants and which type of installation will best suit his needs. Fitters then complete each installation by extending the distribution cables to the point where telephones or telex stations are required and the Traffic Division arranges for the operators who will man the switchboards to be trained in operating procedures and for regular visits to be made to ensure that a high quality of service is maintained.

The biggest single installation so far completed in the Piccadilly Plaza is a private automatic branch exchange with 45 exchange lines and 300 extensions controlled by a supervisor and five operators.

Another large installation, and the only one of its type in North-Western Region, has been provided in the Hotel Piccadilly. It is a non-standard Post Office automatic switchboard, designed to meet all the facilities required by the hotel's residents and administrative staff, and has 23 exchange lines with 342 extensions. All incoming calls to residents are dealt with at a three-position switchboard which has extensions to all rooms and all telephones in bedrooms have an extension to the bathroom. The bedroom telephones are fitted in a stainless steel panel in the bed headboards which also contain a "message waiting" facility in the form of a lamp which remains glowing if the occupier fails to answer to indicate that the switchboard has been trying to make contact. There are also eight coin-box telephones in the hotel connected directly to the public network and not by way of the switchboard.

For the administrative staff, the installation provides 49 extensions which have automatic dialling to each other and to the main switchboard. Selected extensions can get on to the public network by dialling 9 and all extensions have automatic transfer or inquiry facilities to each other while engaged on outside calls.

In spite of many difficulties—for example, some floors of buildings have had to be reinforced to take the weight of the equipment, most of which had to be manhandled into position because main lifts had not been installed at the time—the planning and execution of the telecommunications facilities for the vast Piccadilly Plaza project has been a great success. Thanks to the high degree of consultation between the Post Office, builders and architects from the design stage on, the Government Departments, business and industrial organisations which are moving into the Piccadilly Plaza accommodation are being provided with their telecommunications requirements virtually on demand; and, no less important, the facilities have been installed so that any future alterations and the tracing and correction of faults can be carried out with the minimum of inconvenience and without damaging the structure or the decorations of the buildings.

Post Office staff at work on the Piccadilly Plaza Project. Left: T2A J. Ball strips insulation on a riser cable before jointing. Right (above): T2B C. Slater examines wiring on a main distribution frame; (below): TO W. Helliwell tests a riser.

The Post Office Report and Accounts for 1964-65 tells of a successful year for the telecommunications services and discusses ways in which they are . . .

PREPARING TO FORGE AHEAD

THE Post Office is "preparing to forge ahead . . . and take advantage of technological developments to increase its own productivity and, wherever possible, to improve and expand its services and so give its customers speedier, more efficient and more reliable communications," says the introduction to the Post Office Report and Accounts, 1964-65.

Operationally, 1964-65 was a year of unprecedented growth in the telephone service and of further expansion and improvement in other telecommunications fields, the Report reveals.

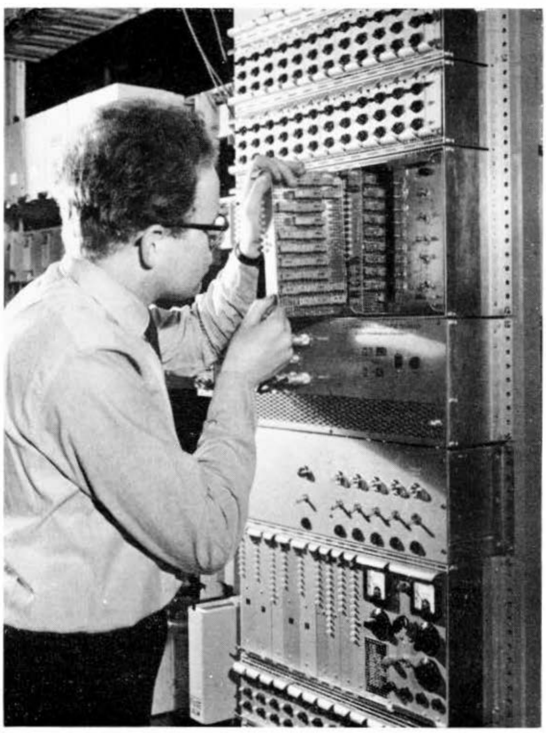
Financially, too, the telecommunications services can look back on a satisfactory year, having increased its profits by £1.2 million to £39.7 million, in spite of reduced charges, amounting to £5.5 million, as a result of the extension of Subscriber Trunk Dialling and an increase in expenditure of £29 million, of which £10.6 million was paid out in pay awards and improvements in conditions of service for the staff.

Here are the details of the past year's achievements and of plans for the future:

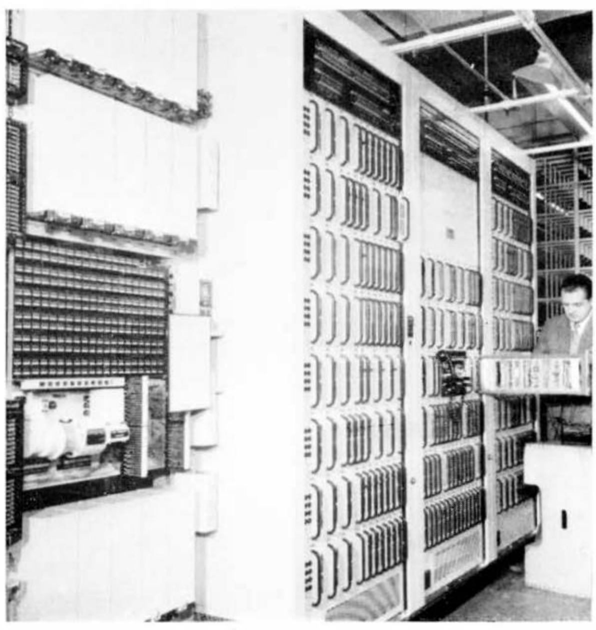
INLAND SERVICES

Telephones

- Demand for new exchange connections reached a record total of 708,000 (excluding the 233,000 applications met by the take-over of existing installations left by outgoing subscribers). This demand was 30 per cent higher than in 1963-64.



***Left:** An engineer examines part of the terminal apparatus of a 23-channel pulse code modulation system. **Below:** The new electronic exchange unit now on trial at Leamington Spa.*



● The record number of 694,000 exchange connections—also about 30 per cent higher than in the previous year—was provided and by the end of March, 1965, there were nearly 10 million telephones in use throughout the country.

● There was also a record number of calls. Local calls increased by 500 million (10 per cent) to 5,600 million, and trunk calls rose by 112 million (17.9 per cent) to 736 million.

● Ninety-six more manual exchanges were converted to automatic working. By the end of March, 1965, the number of manual exchanges in the country had been reduced to 437 and automatic service was available to 91 per cent of all subscribers.

● By 31 March, 1965, 912 exchanges (compared with 688 on 31 March, 1964) and 3.3 million subscribers had STD facilities. About seven million trunk calls (compared with five million in the previous year) were dialled by subscribers every week.

● Three new trunk switching centres were opened at Cambridge, Reading and Tunbridge Wells to provide several thousand more trunk circuits for handling traffic in the Home Counties and diverting through traffic from other centres.

● In 1965-66 contractors will begin to install telephone switching equipment at 155 new exchanges, including three more major trunk exchanges, and to extend 330 existing exchanges. Post Office staff will carry out many equipment extensions and conversions at smaller exchanges.

● New experimental electronic exchange equipment of the "space-division" type and intended for use at exchanges of up to 2,000 lines capacity, was brought into use at Leamington Spa. Another trial is being carried out at Peterborough and the first complete exchange using such equipment will be opened in 1966 at Ambergate, Derbyshire. Work continues on further research and development on "space-division" equipment for use in exchanges with a capacity of over 2,000 lines.

> "In these days of very rapid technological advance, the Post Office has become, in effect, a Ministry of Communications, a science-based enterprise on the threshold of a new era of expansion and improvement made possible by new inventions and the application of new techniques which are changing the art and shape of communications," says the Report.
>
> "The Post Office has a vital role to play in the further development of the nation—a role which can be filled successfully only if the Post Office achieves the maximum possible efficiency and productivity of which it is capable and fully meets the customers' need for first-class services at reasonable prices."

The computer room at Charles House, Kensington, where telephone bills and trunk statements are now being produced, showing the latest LEO 326 computer equipment.

● Seven thousand more trunk circuits (compared with 4,200 in 1963-64) were brought into use. Another 8,000 will be provided in 1965-66 and in the next five years more trunk circuits will be added than were provided in the whole of the last 50 years.

● Work continued on the establishment of the nation-wide microwave radio system to cater for the growth of both telephone and television requirements. By the end of March, 1965, 106 stations had been or were being provided. In the next three years work will begin on 20 more. The first microwave radio link at the Post Office Tower in London will be brought into operation in the summer of 1965.

● Trials took place of a new transmission system—pulse code modulation—which is designed to enable several junction circuits to be provided on two pairs of wires. The system is likely to be installed in many parts of the country by the end of 1967.

● About 480,000 more pairs of wires were installed in the local cable network connecting subscribers' premises to exchanges—a record achievement for any year. A further 600,000 pairs will be provided in 1965-66.

● In spite of large increases in the supply of exchange connections, demand rose so rapidly that the waiting list increased slightly by the end of

OVER

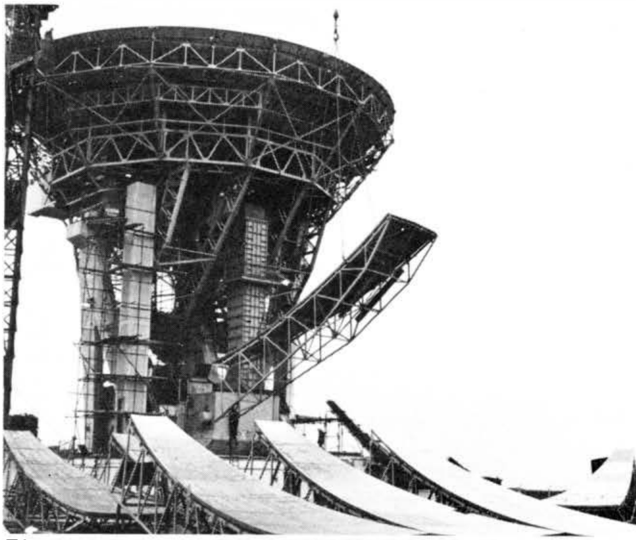
PREPARING TO FORGE AHEAD *(Contd.)*

March, 1965, to about 50,000. However, the number of applicants who had to wait for more than six months for exchange connections was reduced to 12,500. "The relative cheapening of the telephone service, taken with the ever-rising demand for connections," says the Report, "means that while far more people will get telephones than ever before, the number whose orders cannot be satisfied immediately may tend to increase, although every effort will be made to see that the waiting list is eliminated wherever possible and that elsewhere the average length of the wait is brought down. An expanded capital investment programme to meet this new situation has been prepared, but it will take some time before it is translated into exchanges, equipment and lines."

● The Report goes on to say that although in many places the telephone service is satisfactory . . . it is not as good as it should be everywhere, notably in London and the South-East. The national average time to answer calls to the operator improved from nine to seven seconds in the 18 months ended 31 March, 1965, and improvements had been made in all parts of the country. But there were still some exchanges where staff and equipment shortages had to be made good before a satisfactory service could be given.

● The call failure rate in the automatic service had worsened. There were two main reasons for the deterioration in the automatic service. First, sufficient capital was not provided in the past to keep pace with the need for expansion and modernisation. Second, traffic had increased so rapidly in some places—particularly in London, Home Counties, Birmingham, Manchester, Bristol and Leeds—that it had outstripped the capacity of the system to deal with it satisfactorily. Old equipment was being replaced and more equipment to meet growth was being provided as part of a greatly expanded capital programme now under way. The developments will take some time to mature, warns the Report, but they are expected to produce a progressive improvement in the quality of the service.

An operator at a Datel 600 Service installation. Three new Datel services were introduced in 1964-65.



The aerial and equipment at the Post Office earth station at Goonhilly was modified during the past year. Here, one of the new giant reflector petals is hauled into place.

● The number of calls made to the Information Services rose from 124 to 155 million.

● Development work continued on a wide range of subscribers' apparatus, including three types of repertory diallers and a press-button telephone system.

● Two new Branches were set up in the Inland Telecommunications Department to intensify efforts to improve productivity and efficiency. A Management Services Division was also set up in the Engineering Department to intensify efforts on measures designed to improve Engineering productivity.

Telegraphs

● Traffic in the inland telegraph service fell from 11.7 to 11.6 million. The telex service expanded rapidly, the number of subscribers rising from 12,400 to 14,600 and the number of inland calls from 12.7 to 16.2 million.

● New facilities which enable data to be sent over telephone and telegraph circuits were introduced and will be expanded as rapidly as possible.

Right: The new mechanical pole-erection unit. It carries nine poles, uproots old poles, bores holes and lifts new poles into position.

OVERSEAS SERVICES

Telephones

● Traffic in the overseas telephone service increased by about 20 per cent—from 9.9 million calls in 1963-64 to 12 million. Calls in the short-range telephone service with ships at sea rose from 153,000 to 166,000.

● At the end of March, 1965, operators in Britain were able to dial direct to subscribers in 10 European countries and in Australia, Canada, Japan and the USA. By early 1966 they will also be able to dial direct to lines in New Zealand and within the next two years to Hong Kong, Malaysia, Poland, Spain, Luxembourg and Hungary.

● International Subscriber Dialling was further extended to enable STD subscribers in London, Birmingham, Edinburgh, Glasgow, Liverpool and Manchester to dial their own calls direct to subscribers in Belgium, France, the Netherlands, Switzerland and Western Germany. Ninety per cent of all European calls originated by subscribers with ISD can now be dialled direct.

Cables

● The first two sections of the South-East Asia Commonwealth Cable, linking Singapore, Sabah and Hong Kong, were opened for service. The third link, between Hong Kong, Guam, Madang and Australia, will be completed by the end of 1966.

● The first direct telephone route from Europe to Japan to use submarine cable for all its trans-oceanic links was brought into service.

● Telephone traffic carried by submarine cables between Britain and North America and beyond rose by almost 40 per cent, totalling 1.03 million calls compared with 740,096 in 1963-64.

● A second Anglo-German cable and new cables between Britain and Denmark and Britain and the Netherlands were opened for service. Other cables linking Britain and the Netherlands and Britain and Norway are planned for completion in 1967.

● The first transistorised submerged repeaters ever used in an international submarine telephone cable were inserted in the cable between Britain and Belgium to increase the capacity of the cable from 216 to 420 telephone circuits.

Radio Services

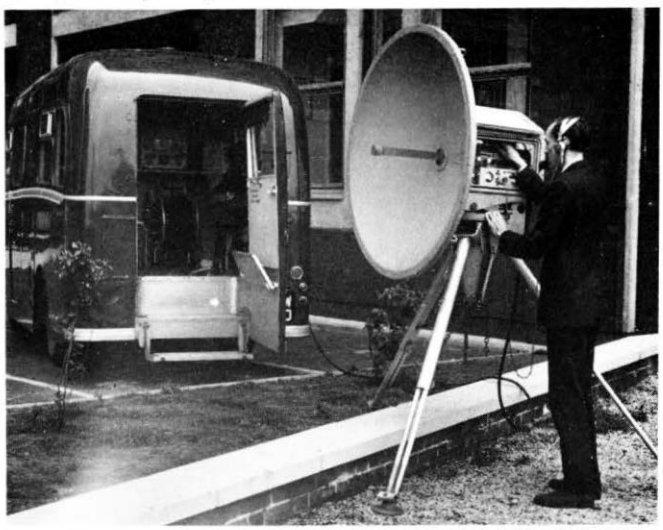
● Lincompex, a new system which improves the performance of long-distance overseas radio-telephone circuits, was brought into use experimentally between London and New Delhi. Lincompex is expected to be introduced on high-frequency radio-telephone circuits between Britain and a number of other countries next year.

Telegraphs

● A contract was placed for the supply and installation by 1967 of a new semi-automatic message relay system. This, with the developing European Gentex network, will ultimately enable between 80 and 90 per cent of all traffic passing through Electra House,

OVER

A Post Office television outside broadcast crew set up a temporary link on Thames-side for BBC.



PREPARING TO FORGE AHEAD (*Concluded*)

London, to be handled automatically. Initially, the new equipment will cater for 50 overases circuits.

- The number of countries to which the international telex service is available increased from 100 to 116 and the total number of calls rose from 7.1 million in 1963-64 to 9.1 million. The number of countries to which subscribers in Britain can dial their own calls direct increased from 12 to 16. Subscriber dialling was introduced between Britain and the United States. Similar facilities to Canada, Australia and New Zealand will become available by the autumn of 1965.
- The number of leased circuits to Europe increased from 115 to 138 and to non-European countries from 148 to 176.
- A record number of 21,527 pictures was handled by the Overseas Telegraph Picture Service.

Data Services

- Successful experiments were carried out in transmitting data from ships at sea and permanent equipment was installed.

Satellite Communications

- Britain, with 44 other countries, signed an international agreement setting up arrangements for creating a global commercial satellite communication system. (The first fruits of this agreement matured when the world's first commercial satellite system between Europe and the United States was inaugurated in June, 1965, by way of *Early Bird.*)

Outlook Cheerful

The financial outlook for the Telecommunications Services is cheerful.

The Report reveals that in the next five years, if pay awards remain within the 3½ per cent "norm", they should continue to achieve a rather better return on capital than the 8 per cent target while absorbing £178 million of increased costs and reducing payments by subscribers through Subscriber Trunk Dialling by some £280 million compared with what they would have paid under the old rates. "Because they are rapidly expanding, technically progressive and intensively capitalised, they are able to absorb rising costs by increased productivity on a scale denied to the Postal Services," says the Report.

Buildings

- A record number of 157 telecommunications buildings were completed, work continued on 62 already in progress and a start was made on 163 others.

Methods of planning operational buildings from standard unit layouts are being devised to open the way to the readier use of industrialised systems for such buildings as automatic telephone exchanges and telephone engineering centres. Prototypes of operational buildings are to be erected in a number of industrialised systems and one—a standard automatic telephone exchange—has been completed at Heath End, Berkshire. Others will follow in the next two years or so.

The new standard automatic telephone exchange building at Heath End—the first of a number of prototypes of operational buildings to be erected in industrialised systems.

The Engineers Found the Answer

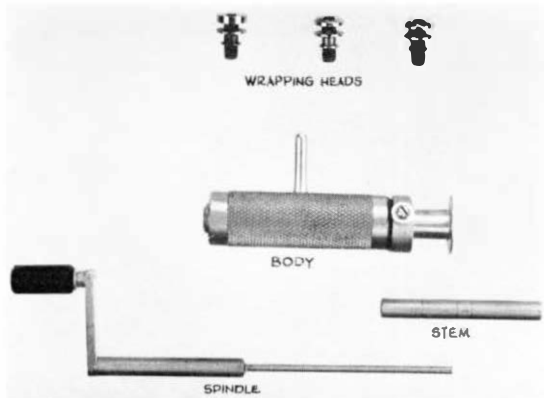
By F. G. FINN

WHEN the Post Office recently adopted the new solderless wire-wrapping technique for terminating wires on telephone exchanges they came up against the problem of finding the right tool, at the right price, to do the job.

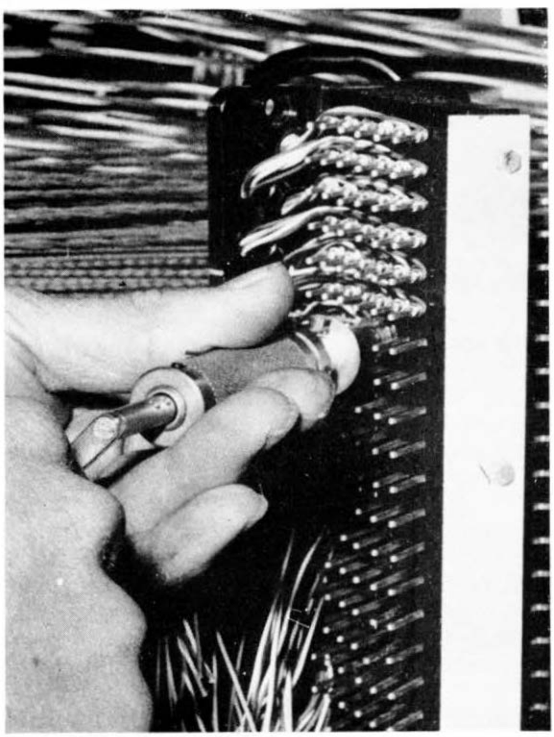
British instrument and equipment manufacturers could not meet the need and those who were using the solderless method were either making their own tools or buying them from the United States. But American tools were expensive and did not do all that the Post Office required.

So the Construction Branch of the Engineering Department got to work and designed a new wire-wrapping tool of their own which costs considerably less than its American equivalent and does the job as efficiently.

The new instrument, which can be operated by hand or be power driven, can cut, strip and wrap most of the variations of wire used in exchange construction work, thus avoiding the need to use a series of different sized instruments. It consists of four main parts: the body; the spindle, to which a handle is attached; the stem; and a detachable wrapping head which is made in three different sizes to accommodate three combinations of wire and tag.



The detachable head, in three different sizes accommodates three combinations of wire and tag.



Below: The tool being used to terminate a cable wire.

When a termination is made, the wire is fed through a hole in the wrapping head and held taut while the tool is slipped along it to the tag. The wire is then passed through stripper blades which cut the protective covering and into a slot in the guide plate and the cropper. The tool is then pushed on to the tag and rotated by its handle. On the first revolution the wire is cut to its correct length and wrapped around the tag. By turning the handle six or seven more times the wrapping process is completed and the instrument is forced back, taking the stripped insulation with it.

The new wire-wrapping tool, which is now being made in quantity for the Post Office by a British manufacturer, has already been successfully used in a number of exchange construction projects. The power-driven version, which will come into use later, will be operated by an electric motor.

This tool is subject to British Patent Application No. 1697/64.

THE AUTHOR

MR. F. G. FINN *joined the Post Office in 1946 as a Labourer in the Tunbridge Wells Area. He was promoted to Technician in 1947, to Technical Officer in 1952, and to Assistant Executive Engineer in 1961.*

Corrosion, creepage and cracking of sheaths are the biggest enemies in the continuous fight to keep the underground trunk telephone cable network free from faults

MAINTAINING THE TRUNK CABLES

By A. F. G. ALLAN, AMIEE

Road widening schemes often mean the costly and time-consuming job of digging up duct tracks and slewing them into new trenches. Carrying out this operation can result in damage to cables.

POST OFFICE engineers are developing novel and less expensive forms of transmission equipment but these can prove of little value if the terminal and intermediate apparatus assemblies are not connected by a reliable medium.

To-day, only about five per cent of trunk telephone traffic in Britain is carried on radio channels and the overall efficiency of the service depends mainly on the state of some 47,000 sheath miles of underground cable of many types.

Not counting the value of duct-tracks, manholes, and other jointing chambers in which they are housed, these cables at present have a capital value of about £200 million, which means that maintenance policies must be correct and standard of workmanship of the highest order.

The fault record of the trunk cable network is good, comparing favourably with the underground networks of many other administrations. The cost of achieving this—less than half of one per cent of the annual capital value—is small in relation to the capital value of the plant but even so it amounts to nearly £800,000 a year, of which nearly £500,000 is spent on replacing lengths of faulty cable.

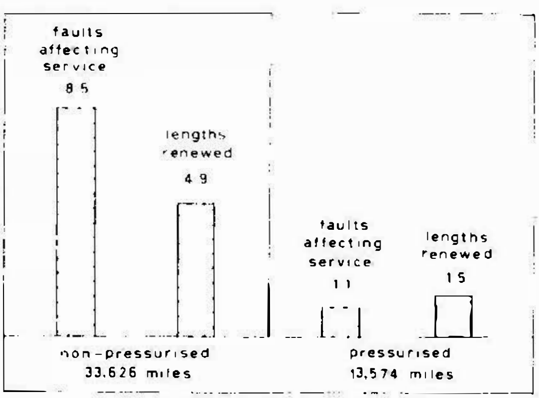
Since the aim of the maintenance organisation is to reduce costs and at the same time improve the quality of service, it was recently decided to pressurise with dry air at nine lb a square inch, the greater part of the cable networks (trunk junction and local distribution cables)—a task which will take three years to complete.

Already the results indicate an impressive improvement in reliability and quality and a significant reduction in maintenance costs. By the end of March, 1965, nearly 13,600 sheath-miles of the 47,200 miles of trunk cable had been pressurised, resulting in an overall decrease in the number of defects leading to service failures and a valuable reduction in the number of replacement cable lengths required.

However, it would be unwise to relax in the belief that pressurisation will solve all cable maintenance problems. Not only must cable defects affecting service be prevented. The reasons for these defects must be studied to decide what steps must be taken to reduce them. A real improvement has been achieved in serviceability but reducing the actual number of defects still poses many problems. For this reason a report is made on every trunk cable failure and these provide the maintenance engineers with valuable information which helps to shape the maintenance policy.

Although part of the steep rise in the defect rate since 1946, might be attributed to the increasing age of the network, there are other major factors, such as cable corrosion (partly an age problem), which contribute nearly one-third of the total defects.

Since 1951, it has been standard practice to provide all new trunk cables with a protective wrapping of hessian and bitumen (or, more recently, polythene) and the situation is now under some measure of control. The corrosion fault



This diagram illustrates the effect of pressurisation on the trunk cable network.

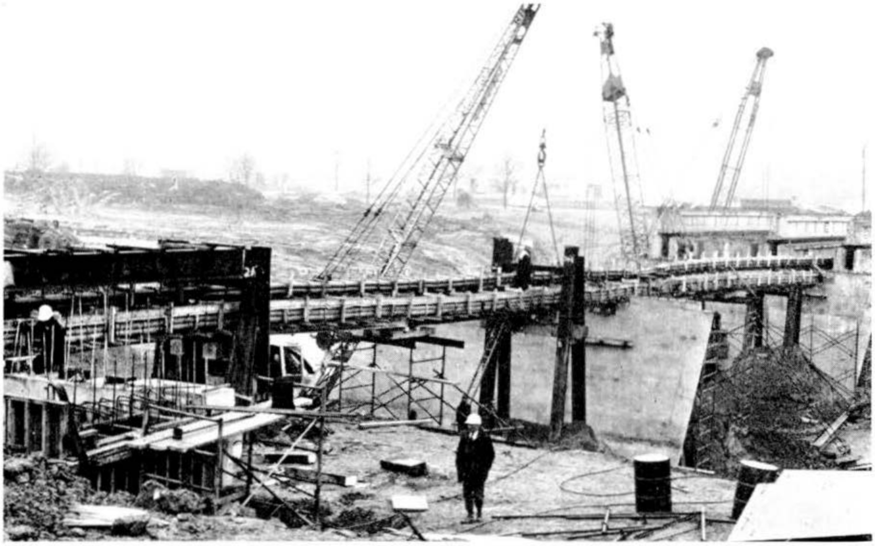

As the underground trunk cable system grows jointing chambers have to be re-constructed.

rate on coaxial cables, only the first few of which were unprotected, is only about a third of the overall rate for all trunk cables. However, some 30,000 sheath-miles of unprotected plain, lead-sheathed cable remain in the network and many years must pass before the corrosion rate is reduced to negligible proportions.

The second major factor, also contributing nearly one-third of all defects, arises from cable creepage and the cracking of lead sheaths, particularly close to jointing points. Both these faults are due to cable movement caused either during construction or installation works or by vibration from traffic. For ease of access for maintenance duct tracks are almost always laid under or along-side roads and generally at relatively shallow depths.

Much is being done by use of anti-creepage devices, joint supporting bars, shock-absorbing wrappings, and so on, to combat the effects of

OVER



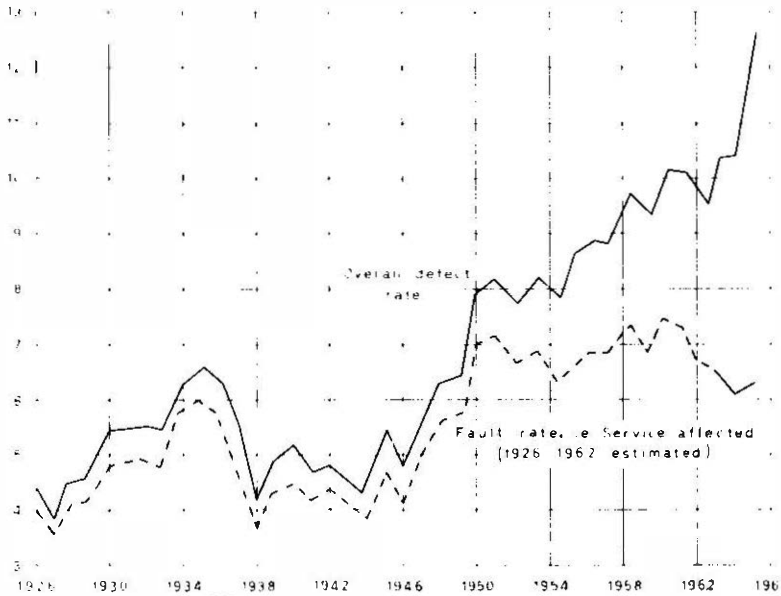
Trunk cables between London and the Midlands are held in place by steel supports as the M1 extension at Brockley Hill takes shape. When the scheme is completed the cables will be carried over the M1 on a new bridge.

MAINTAINING TRUNK CABLES *(Contd.)*

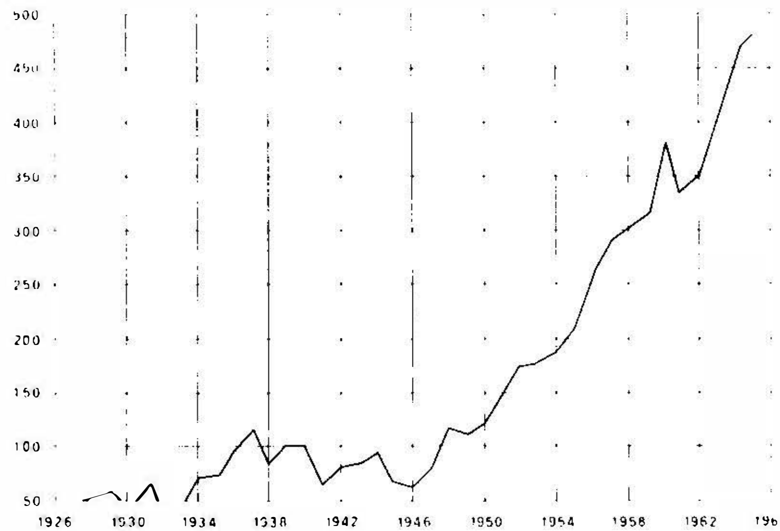
road vibration, but the time may be fast approaching when tracks will have to be placed at greater depths than at present or run across country to avoid vibration effects from the ever-growing volume and weight of traffic. But even if this were done the maintenance organisation would still be responsible for many thousands of miles of cable which must remain in their present locations.

The third major factor, contributing one-fifth of the total cable defects, is damage caused by work carried out on cables or cable tracks when additions or re-arrangement of plant have to be made or when other authorities carry out work close to Post Office cable lines.

Re-building, enlarging manholes or other jointing chambers and the slewing or lowering of duct tracks is fraught with danger for Post Office cables but, fortunately, with fully pressurised cables, the minor damage which most often arises from this type of hazard is instantly detected by the loss-of-pressure alarms and there is little danger of the



This diagram shows the trunk cable defects and faults for a typical 100 sheath miles over the past 30 years. Note the rapid rise since 1963-64.

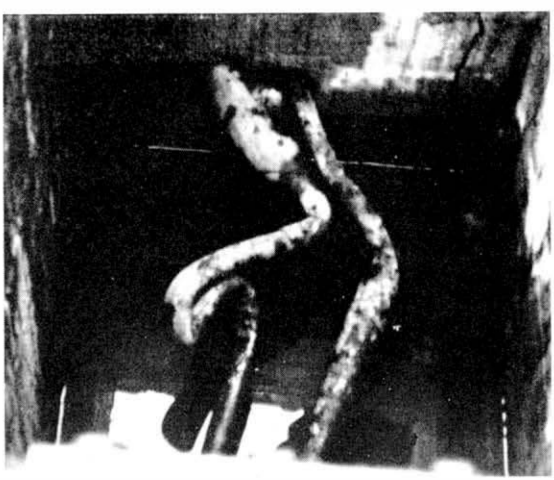


The number of cases of damage caused by work carried out by authorities other than the Post Office in the past 30 years.

cable being put out of service by water seepage.

Damage caused by work carried out by authorities other than the Post Office is more serious since pressurisation cannot prevent failures caused, for example, by a bulldozer tearing a cable out of the ground, when a cable is punctured by a roadbreaker's drill or a small drill when a gas or water pipe is attached in error to a Post Office cable. The rise since 1946 of over 400 per cent in the defect rate caused by such damage gives cause for grave concern. The Post Office faces similar problems in maintaining the 33,000 sheath-miles of junction cables.

Every effort is being made to reduce the number of cable failures to the barest minimum but it must not be forgotten that absolute remedies do not all lie solely within the control of the Post Office. No doubt the problems will eventually all be overcome, but for the next few years, at least, the cable maintenance organisation in the Engineering Department will have to face up to a very busy and difficult time.



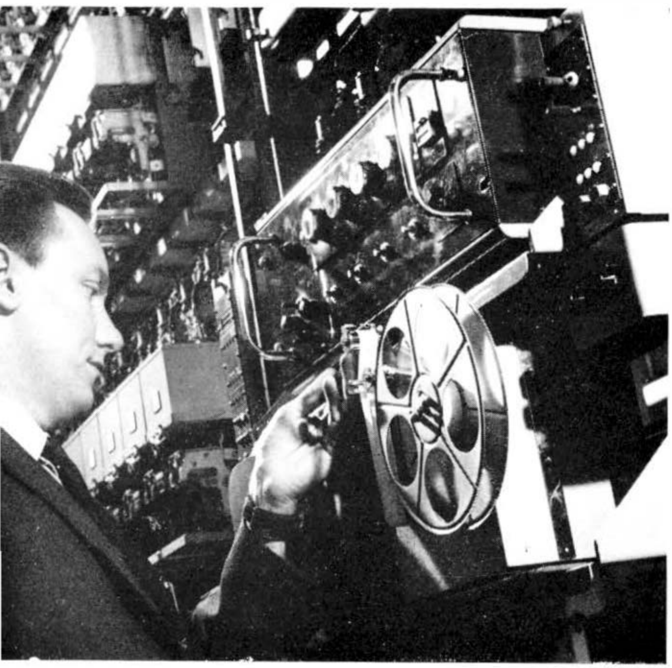
Above: A lead-sheathed trunk cable distorted by creepage caused by traffic vibration.
Right: An example of the effects of corrosion.

THE AUTHOR, MR. A. F. G. ALLAN, *a Senior Executive Engineer in Main Lines Development and Maintenance Branch of the Engineering Department, joined the Post Office in 1932 as a Youth-in-Training. From 1942 to 1946 he worked on communications for the Royal Air Force. On loan to the Air Ministry from 1946 to 1949, Mr. Allan came back to the Engineering Department to help build up communications networks needed on the return of the United States Air Force to Britain, and is now responsible for maintenance of the trunk cable network.*

A new Trunk Traffic Analysis Equipment will soon be coming into service at Group Switching Centres to sample STD calls and so provide data for use in planning future routes, fixing tariffs and helping to formulate telecommunications policy

SAMPLING THE TRUNK SERVICE

By E. J. F. ACKROYD, ERD



Mr. B. E. Briggs, Assistant Executive Engineer in charge of the trials, adjusts the tape of the experimental equipment at the Citadel Exchange. The production equipment will be similar but of a more advanced design than that shown here.

IF a business is to be efficient and prosper its management must have reliable information about the products it is marketing. A firm manufacturing electric light bulbs, for example, will want to know how good the bulbs are and whether, on average, they are within known and acceptable limits. These limits are normally laid down by specification, or by a recognised standards organisation.

To test each bulb would be costly and unnecessary since statistical theory proves that by selecting a number of them and testing only those, the results will show, to a known degree of accuracy, how good all the bulbs are. The sample must be random, however, which means that every bulb must have an equal chance of being selected.

Similar statistics are an important basis for making policy decisions affecting the Telecommunications services and as these services become increasingly automatic statistics about their use have to be obtained by machines.

There has always been a need for data about telephone traffic for use in planning future routes, fixing tariffs and providing background information against which broad policy aspects of telecommunications may be formulated. In the past much of this statistical information was provided by the trunk operator in the form of trunk tickets which were sampled and analysed. Now, with the advent of Subscriber Trunk Dialling, Group Switching Centres (GSCs) are without the services of an operator to make records of the origin and destination of calls and for this reason an equipment has been developed which is connected to all register access relay sets at a GSC and randomly samples the traffic.

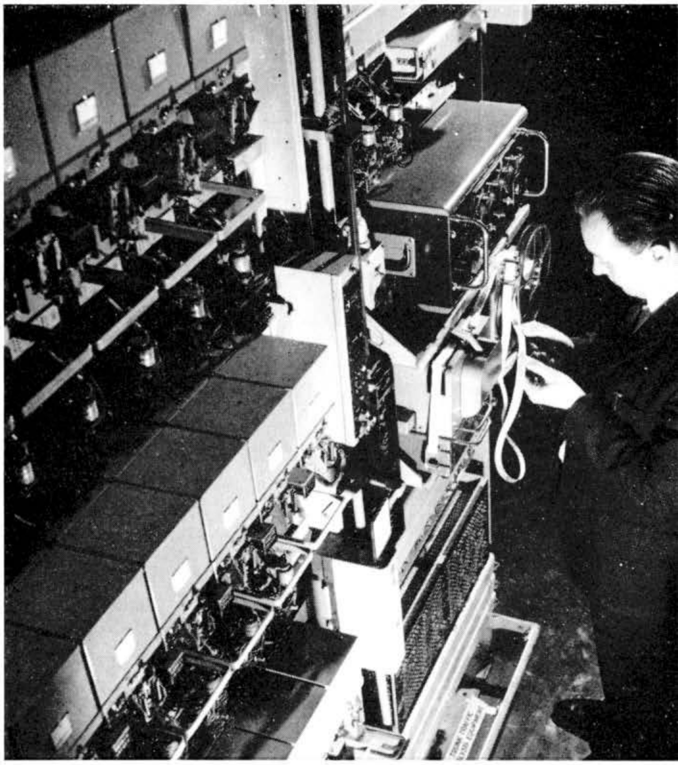
This new equipment—called the Trunk Traffic Analysis Equipment (TTAE)—counts all STD calls coming into a centre and, when the count reaches a predetermined number, records details of that particular call as a sample of all the calls.

The Trunk Traffic Analysis Equipment, which will be coming into limited service this year, will provide information for STD call revenue and tariff fixing purposes. It will be connected to the Register Access Relay Sets (RARS) at 132 group switching centres throughout the inland network and record, in coded information on five-track paper tape, the following information: the time a call is made; the digits dialled; metering pulses; the total duration of individual calls; conversation time; symbols to denote whether the call is from an ordinary subscriber or a coin box, or from a mixed route containing both ordinary and coin-box circuits; symbols denoting a complete or incomplete call; and whether the calls or data apply to full-rate or cheap-rate tariff. The equipment will also record, as general information, the day and week by allocating a three-digit number; sample rates; and, on a separate electronic counter, a count of calls flowing through register translators and other such information for control purposes.

Having obtained one month's information, the tapes from the GSCs will be sent to one of the computer agencies in London for processing. The information thus produced will include such items as the average holding, setting up and conversation times of STD effective calls; the average number of metered units for each effective STD call; and the percentage of effective and ineffective calls. The average holding time of STD effective calls and the percentage of effective and ineffective calls will be given for each charge step and tariff period. In all, some hundreds of separate items of information will be available monthly, including a check on the accuracy of metering. When the system has become established it may be possible to arrange for a distribution of calls by destination from exchanges, within charge groups served by the equipment.

The cost of the new equipment is substantial and administrations faced with the commitment of obtaining statistics in this way must balance the cost of securing them with accuracy they wish to achieve. A study of this problem carried out by the Inland Telecommunications Department and the Department of Statistics and Business Research produced the answer that 132 of the ultimate 365 switching centres could, if carefully chosen, embrace as a sampling population, 95 per cent of all STD trunk calls.

The method of selection has involved allotting switching centres to one of five tiers, or strata, according to the number of STD calls originated.



Another view of the experimental equipment, showing Mr. Briggs examining the tape output. The equipment has been on trial at the Citadel Exchange for the past two years.

Thus, large centres were placed in the first stratum and so on down to the lowest-rated groups in stratum five.

To meet the variations in traffic levels which occur throughout the 24 hours a wide range of sampling rates, from one call in 10 to one call in 9,990, will be applied. A selection of rates will be pre-set to suit each centre and change automatically at the times required.

OVER

THE AUTHOR

MR. E. J. F. ACKROYD *is a Senior Telecommunications Superintendent, serving with the Organisation and Efficiency Branch of the ITD. He entered the Post Office by way of the Engineering Department in 1936 and served throughout World War Two in the Royal Signals, continuing as an Army Emergency Reservist until 1964. He became a Telecommunications Traffic Superintendent in 1949, and shortly afterwords a Grad IEE. He was promoted to his present rank in August 1960 while serving in the Telegraph Branch of ETE. He joined the ITD in February, 1965.*

SAMPLING THE TRUNK SERVICE (*Contd.*)

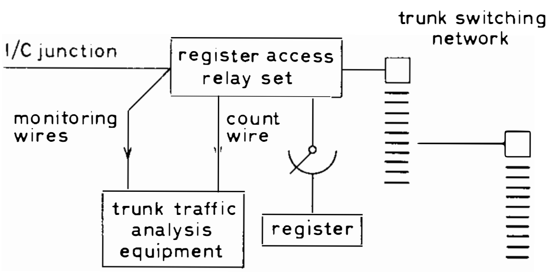
Each equipment can examine about four calls an hour and is suitable for a group switching centre of 1,000 erlangs of originating traffic. Where very large quantities of traffic are to be met, two or more of the new trunk traffic analysis machines will be installed. London will have 16 equipments; Manchester three and Liverpool and Leeds two each. As the level of traffic increases more equipments will be required. The first equipment is expected to be installed at Fortress GSC in London in September this year.

★

HOW THE NEW EQUIPMENT WORKS

By C. D. VIGAR, AMIEE

HOW does the new equipment operate? First, a count wire sends a pulse into the Trunk Traffic Analysis Equipment every time the Register Access Relay Set to which it is attached is seized and this enables the TTAE



This diagram shows how the new equipment is connected into the Trunk network.

to count every call entering the Group Switching Centre. When the predetermined call (designated the nth call) to be examined arrives, a motor uniselector in the equipment finds the Relay Set on which the call has arrived and connects the monitoring wires to the tape control equipment so that the statistical information can be punched on to the paper tape. While this is happening the counter, which will have been re-set, continues to count the calls coming into the Group Switching Centre.

Because the pulses on the count wires are 40 milliseconds long there is a limit to the number of count wires which can be connected together if all pulses are to be detected as individual pulses and not allowed to overlap and therefore be lost as a signal of calls arriving at the GSC. For this reason, count wires are connected in groups of 100 and each group is connected to a unit called a Pulse Separator. The Pulse Separator produces a 2-microsecond output pulse for every 40 millisecond pulse at its input. These 2-microsecond pulses can be connected on the same wire with only a very remote chance of overlapping even at the largest of the centres which is expected to

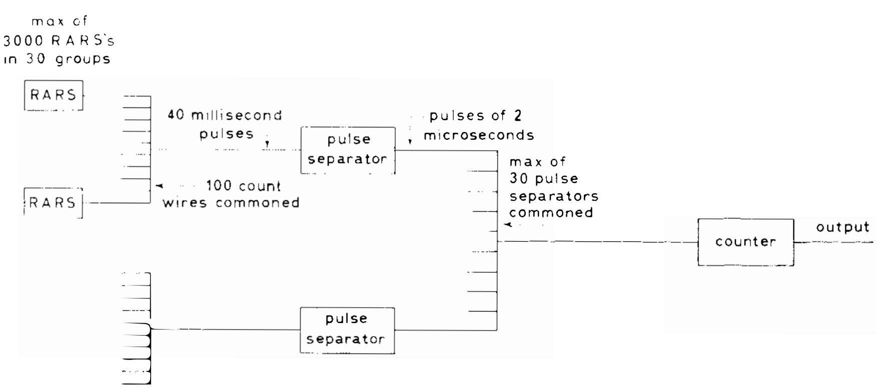
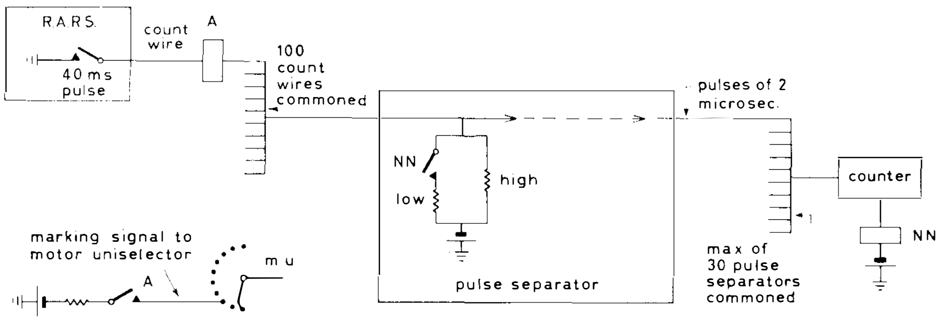


Diagram showing the method of counting all incoming calls to a Group Switching Centre.



The method of marking the Register Access Relay Set carrying the call chosen as a sample is illustrated in this diagram.

have 3,000 Relay Sets. In this way every call entering the centre produces a separate pulse on a single wire connected to the input of a counter which is stepped by the pulse every time a call is originated at the GSC.

When the TTAE samples a call the counter is arranged to give an output when a particular number (the value of n) is reached and this output operates a relay (marked NN on the diagram above). The contacts of the relay connect low value resistors into all the count wires at the pulse separators so that when the sample call arrives its pulse operates an access relay (marked A) in series within the low resistor. This relay marks the bank of the motor uniselector which is set into motion by counter output and the motor uniselector finds the marked bank contact and connects the TTAE to the monitoring wires of the RARS on which the call is about to be set up. Details of this call will then be recorded on the paper tape.

An error in the count could be introduced by pulses overlapping at the input to the pulse separator and also at the input to the counter. However, such errors are less than two per cent and do not affect the usefulness of the sample. For economy reasons, some of the Relay Sets are not provided with an access relay and monitoring wires. These Relay Sets cannot be observed, but

OVER

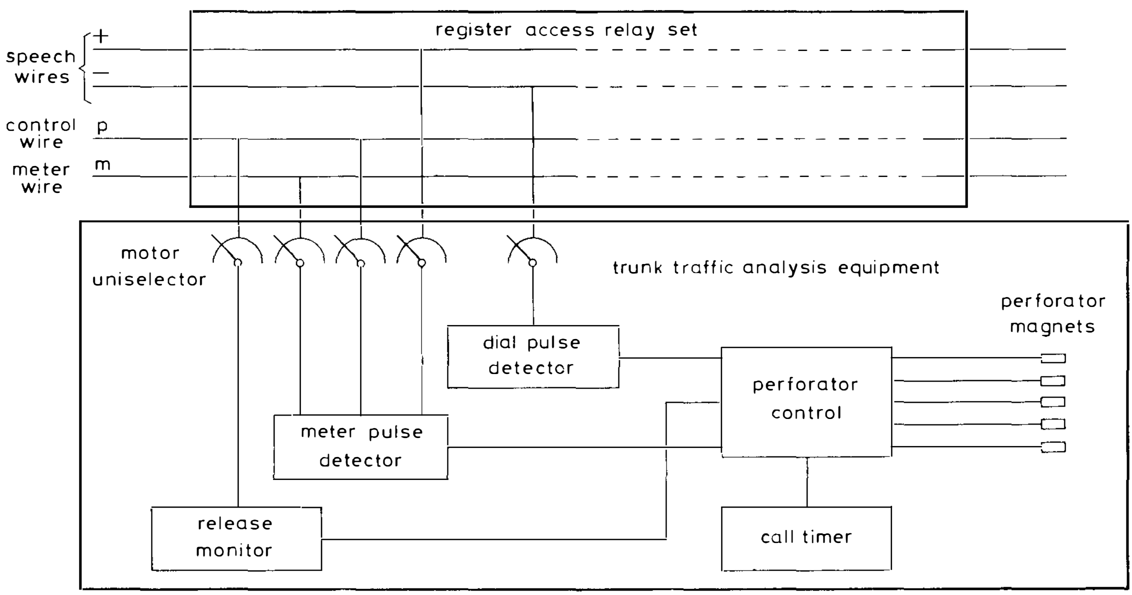


Diagram shows the connections to the Register Access Relay Set which enable the Trunk Traffic Analysis Equipment to record the details of the sampled call.

HOW THE EQUIPMENT WORKS *(Contd.)*

as the value of n is increased by only one or two this has no significant effect on the accuracy of the statistics.

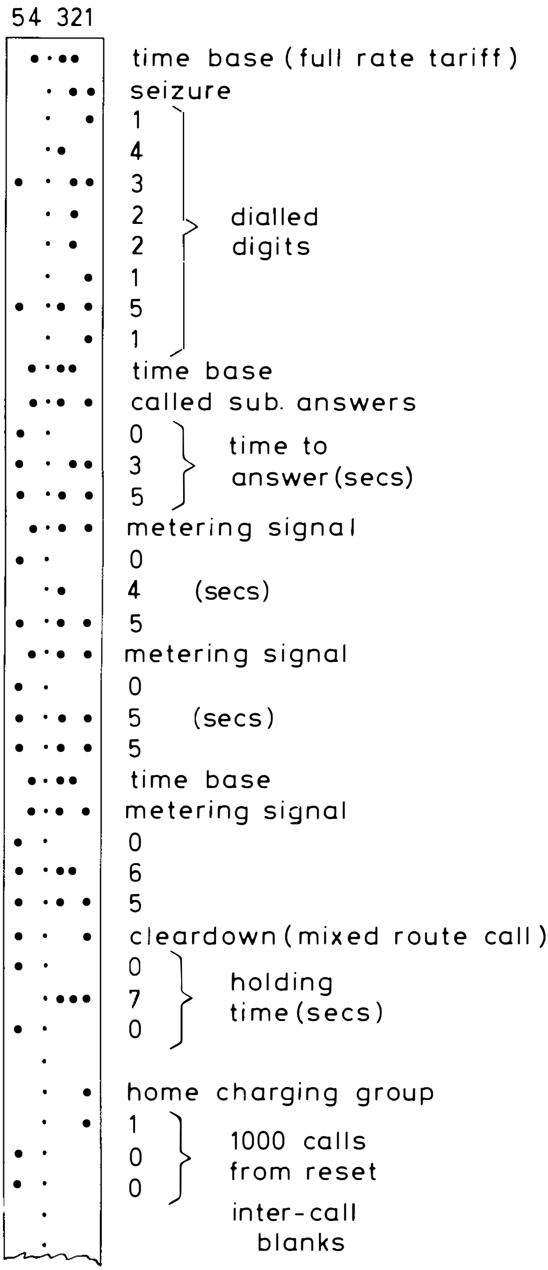
When one of the access relays has been operated, the equipment is connected to a particular Relay Set. The detecting elements connected to the transmission lines by the meter pulse monitor and dial pulse store circuits are of electronic design and have a very high impedance so that they do not affect the transmission of the call. The detection devices connected to the control and meter wires are high resistance relays.

As dial pulses pass into the RARS they are detected by the dial pulse store and stored until an inter-train pause is observed. The dial pulse store then transmits the dialled number to the perforator control to punch it on the tape and returns to the normal state to receive the next train of pulses.

The answer signal is in the form of the first meter pulse. If it is signalled by metering over junctions it will be detected on the transmission wires; if on a local junction it will be detected on either the meter or control wire. When the meter pulse monitor observes the answer signal the perforator control punches this fact on the tape along with the time of each event which is fed to the perforator control by a call timer.

At the end of the call the release monitor observes that the RARS has been released and signals to the perforator control to record the release character and the time of release on to the tape.

Two types of information are punched on the tape. The time is recorded by punching codes on the tape every five minutes and at midnight to show the week of the year and the day of the week. The details of an observed call are punched by using various code symbols to represent the occurrences in setting up and releasing a call.



Left: Reproduction of part of a punched tape, showing the codes used to record the progress of an effective call.

THE AUTHOR

MR. C. D. VIGAR, AMIEE, *is an Executive Engineer in TPD Branch of the Engineering Department where he is engaged on design of new switching apparatus for local telephone exchanges. Before his transfer to the Engineering Department in 1956, he was employed as an Assistant Engineer in the London Telecommunications Region on External Construction and Local Line Planning.*

For more than 30 years the Post Office has provided the Public Address Call Service which relays speech or music to distant locations over high-grade temporary links for loudspeaker presentation. This article describes how the Service operates

THE PUBLIC ADDRESS CALL SERVICE

By T. K. LORD

TWO Regional teams of specially-trained engineers have been set up—one in London and the other in Manchester—to provide the Public Address Call Service. Between them they will handle all requirements throughout the country.

This new arrangement will enable the Post Office to give a more comprehensive service than ever before.

The Public Address Call Service originated with a requirement in the early 1930s to relay a speech from the United States over the New York-London radio circuit to an audience in Britain. Subsequent requests for similar services resulted in the setting up of a Public Address Duty equipped with specialist apparatus and in 1936 the first wholly inland service was engineered.

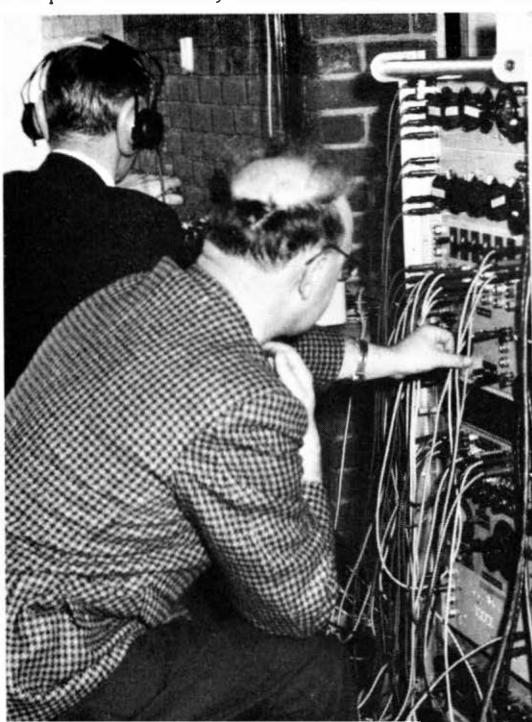
The Service normally caters for customers who, unlike the broadcasting authorities, have little or no experience of transmission problems and is restricted to occasions when transmission over Post Office plant is required. It is used when complex conditions, which often include the need to relay a programme to large audiences, demand the use of high-grade equipment and lines. Two broad categories of service are offered. The first is the one-way transmission of programmes from a central source in Britain to one or more other points either in this country or overseas. The second is two-way transmission between two points in Britain or between this country and another. For this second type of service the use of four-wire, high-grade circuits between the two locations is essential.

Temporary provision is made for each call, using the existing Post Office high-grade occasional programme circuit network linking the communication centres in Britain for the broadcasting authorities and other users, and special local end pairs to the programme control points. These circuits are rented only for the time they are actually used.

Most people know of the conventional public address system in which one or more high-quality microphones are used with an audio power amplifier and loudspeakers to provide local sound reinforcement. This system sometimes suffers from "singing" or "howling" caused by the excessive feed back of sound from the loudspeakers to the microphones. If a programme is relayed over Post Office lines it is important to avoid "singing" and to ensure that the signals sent to line are of the correct level to avoid overloading the line plant. For these reasons, the Post Office engineer in charge needs to have all the equipment under his immediate control and he becomes, in effect, a programme engineer, controlling microphone mixing and switching the various sources of programme material.

To provide this type of service each specialist team holds a set of public address equipment, some units being modified proprietary items and

OVER



Post Office technicians at work behind the scenes when the first of the Public Address Service calls conducted under the new arrangement was broadcast between London and Aberystwyth on 15 May this year.

PUBLIC ADDRESS CALL SERVICE *(Contd.)*

others specially made to Post Office requirements. This equipment enables a satisfactory temporary installation to be set up in any indoor location. The limited demand for outdoor service does not justify the teams holding external equipment so that where this type of service is needed the customer is normally requested to engage a public address contractor who takes an audio signal from the Post Office control equipment.

Several types of microphone are held by each team, all of high quality but with different directional frequency response characteristics to suit various operating conditions. The microphones to be used are connected to a multi-channel pre-amplifier to permit microphone mixing and to establish a suitable signal level for transmission to line. Directional loudspeakers are used to beam the sound in the desired directions and so help to minimise the risk of "singing", but the ultimate success of any installation rests with the programme engineer who has to consider all factors affecting acoustic feedback when installing and "lining up" the equipment.

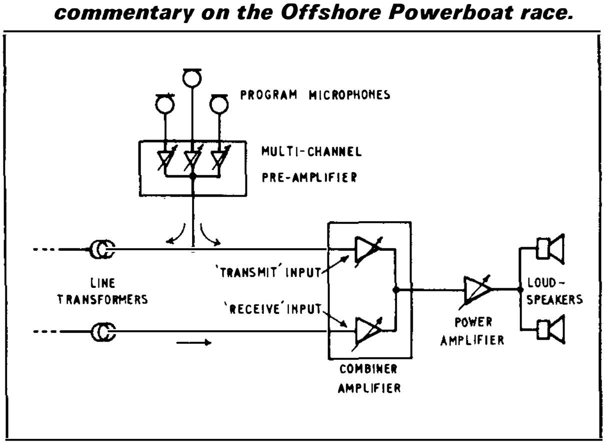
When installation and connection are complete, the local equipment must be "lined up", that is, all items of equipment must be adjusted to give the correct operating conditions, account being taken of the fact during testing that the acoustic characteristics will change when the audience is present. First, all channels of the microphone pre-amplifier are adjusted individually to give the correct signal levels for transmission to line. The local sound reinforcement is then set by adjusting the "transmit" gain of the combiner amplifier and the gain of the power amplifier. A local test signal is used in place of an incoming signal to set the "receive" gain of the combiner amplifier until the desired balance of levels is obtained.

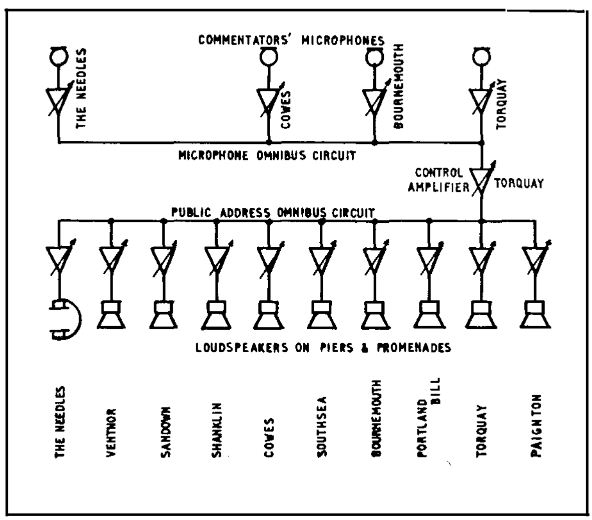
At the distant location a similar procedure will have been followed. On inland calls an overall test is then made, well in advance of the scheduled programme. On international calls this is usually impracticable because of international time differences and the problem of arranging simultaneous availability of premises and also because the international circuit time used for a test would be fully chargeable (to be of any practical use a test period may well exceed the scheduled programme time). A test immediately before the programme is restricted to line checks since, at the time, the individual local proceedings, or audience assembly, may already have begun. At the scheduled programme time the lines are connected and the public address equipment is switched on.

In addition to his engineering knowledge, the programme engineer has to have experience of programme production since the customer may have only a limited knowledge of the facilities available and of the best way to achieve the desired presentation using sound only. On occasions, the engineer also has to help with the preliminary planning and may even be called on to help prepare the script.

On long-distance international public address

(Below) The basic circuit of the terminal equipment for a typical Public Address call. (Right) A "hairpin" circuit used for the commentary on the Offshore Powerboat race.





The Public Address Call Service has been used to relay a wide variety of events both in this country and overseas.

The first inland ceremony for which the Service was employed was the opening in 1936 of a cinema in Kingston-upon-Hull when Gracie Fields' voice was relayed there from a Blackpool theatre. Since then, the Service has been used to relay many scores of ceremonies, including the opening by the Queen of the Commonwealth Pacific Cable; the launching of a ship in a Belfast shipyard by remote control from Australia; the remote start from a ship at sea of the Premium Savings Bond monthly draw (one of about 30 similar ceremonies); the annual relay of religious services from the Keswick Convention to about 100 churches, chapels and assembly halls throughout the country; and medical conferences on different occasions between a panel of experts in Britain and similar bodies in India, Scandinavia, the United States and Canada.

One unusual service is the relaying of the commentary on the *Daily Express* off-shore power-boat race. Descriptions of the start, progress and closing stages of the race are relayed to the public at a number of south coast holiday resorts.

calls precautions have to be taken to prevent echo effects which can make a speech unintelligible or a conversation impossible. The echo is caused by microphones picking up incoming signals from the loudspeakers and re-transmitting them to the distant source. On a call between Britain and Australia such an echo would be heard about one-third of a second after the original signals had been transmitted.

The use of echo suppressors is unfortunately impracticable because the level of the echo and the extent of the loop transmission delay are not known until the programme begins. Maladjusted suppressors would give rise to serious mutilation of the programme and further it would be difficult to ensure that compatible suppressors were available at both terminal points, the remote one being in any part of the world to which there is access for the Public Address Call Service.

Requests for a Public Address call are normally made to the Sales Division of a Telephone Manager's Office who advise either the Inland Telecommunications Department, if an inland call is required, or the External Telecommunications Executive, if an international call is needed. A direct approach can also be made to ITD or ETE.

When a request is received the appropriate Headquarters Department assumes control and authorises the planning and provision of the facility.

The author listens in to a commentary during the Daily Express powerboat race to check the quality and continuity of the broadcast.

It therefore rests with the programme engineers to site and operate their equipment in the best possible way to minimise re-transmission and, if necessary, to switch off the microphones when they are not in use. This calls for considerable anticipation and manual dexterity because it is a "switch for someone else to talk" procedure.

The setting up of the two specialist engineer teams will bring about improvements in the Public Address Call Service for which there is a considerable potential demand. This demand may grow rapidly as the Service becomes more widely known and several more teams may be needed in the future.

THE AUTHOR

MR. T. K. LORD, who has engineered the Public Address Call Service for the past eight years, is an Assistant Executive Engineer in the Main Lines Development and Maintenance Branch of the Engineering Department. He joined the Post Office in 1938 as a Youth-in-Training at Rugby Radio Station. Before his appointment to the Engineering Department Headquarters he worked at Criggion Radio Station.

The Postmaster General (left) makes the inaugural call to Richard Dimbleby (right) here shown demonstrating the radiophone in his immaculate Rolls Royce in Post Office Headquarter's yard.

TELEPHONES ON WHEELS

By J. L. Hyatt

A new telephone service has been introduced which enables its subscribers to keep in touch with any other telephone in the country while they are travelling on the roads in 1,700 square miles of Greater London

DURING a Press conference at Post Office Headquarters, the Postmaster General made a telephone call to Richard Dimbleby, the television personality, who was sitting in his chauffeur-driven Rolls Royce as it cruised along the Embankment.

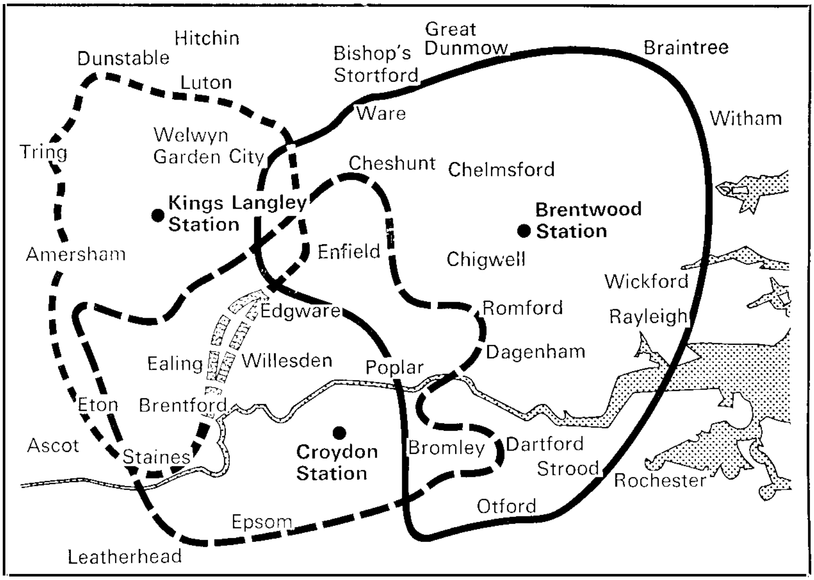
A few minutes later, Miss Catherine Stone, a linguist operator at Continental Exchange, telephoned the Postmaster General while she was sitting in a car in Central London.

These two calls marked the official opening on 5 July of the London Radiophone Service—a new facility which enables any subscriber who has a radiophone in his vehicle and is within the service area, to make and receive telephone calls to and from any other telephone in the country.

The London Radiophone Service which, in the beginning, will cater for up to 350 subscribers, covers an area of between 25 to 30 miles in a rough circle around the centre of the city—bounded approximately by Luton and Hertford, in the north; Amersham, Slough and Staines, in the west; Epsom, Biggin Hill and Strood, in the south; and Rayleigh and almost to Southend, in the east.

The service is divided into three sectors, each with its own base radio station. The base stations at Kelvedon Hatch, near Brentwood, in the north-east part of the service area, and at Bedmond, near King's Langley, in the north-west, are Post Office microwave stations whose 300-ft high aerial towers support the radiophone aerials at heights of between 150 and 300 feet. The third base station, at Beulah Hill, near Croydon, in the south, uses the Independent Television Authority's 550-ft high aerial tower, the radiophone aerials

This map shows the area covered by the London Radiophone Service. The shaded lines between Edgware and Willesden indicate a district in which reception may sometimes be indifferent.



being located at between 250 to 300 ft., with the radio equipment accommodated in the adjacent Livingstone Telephone Exchange.

The central control station has been set up at the Tate Gallery Telephone Exchange which was chosen because it is a sleeve control exchange with ample accommodation in the switchroom for operators' positions and in the apparatus room for the terminal equipment which connects the base stations to the switchboard. In addition, Tate Gallery Exchange's position in the London Director system gives it advantages in dialling access for the public network.

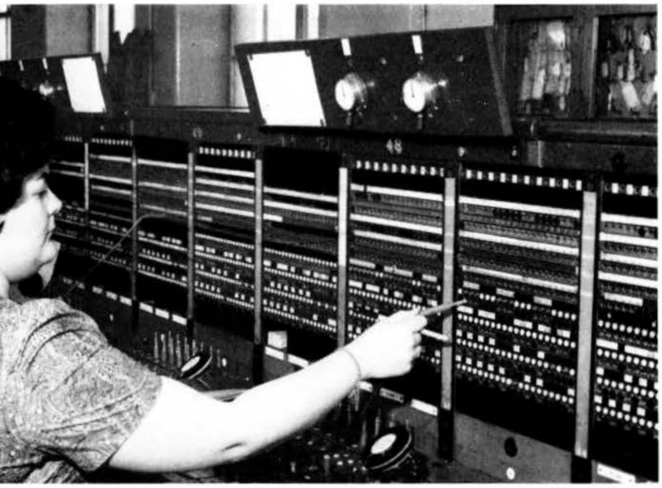
Subscribers on ordinary telephones in the London Director Area obtain the services of the Radiophone operator at Tate Gallery by dialling 141. Elsewhere, access to the service is obtained by calling an exchange operator and asking for London Radiophone. Each mobile subscriber is issued with a six-digit code number. The first two digits denote the telephone area in which the subscriber is based and the last four are peculiar to each radiophone set and equivalent to a telephone number. Only these four digits are dialled by the operator when she calls a radiophone subscriber.

Initially, ten radio channels are being provided which will operate in the VHF band. There will be three traffic channels at each base station and one common control channel which, because of its importance, is duplicated throughout. Thus, there are five circuits to each station, connected to Tate Gallery Exchange by four-wire land line circuits. To aid identification of the channels each base station has a block of traffic channel numbers—5–12, for Kelvedon Hatch; 13–20, for Bedmond; and 21–28, for Beulah Hill—and each of the three sectors is associated with a colour: red for the north-east; yellow for the north-west; and blue, for the south sector. The service area map which is issued to all radiophone subscribers and the channel selector buttons on the mobile equipment are coloured and numbered in accordance with this arrangement.

At present, two manufacturers are making radiophone sets which have been approved by the Post Office for fitting into a subscriber's vehicle. Both sets consist of a radio and decoding unit, or units, and a control unit and are operated from the vehicle battery. The radio and decoder units are installed in the vehicle boot and the control unit is usually mounted beneath the dashboard. The subscriber can have either a telephone handset or a loudspeaker and separate microphone.

The control unit contains all the devices required for normal operation—an on/off button, a call and acknowledge button and nine traffic channel selector buttons. Two lamps are provided to indicate whether a channel is engaged and that a call has been received. A buzzer is also fitted to give an audible warning of a call. When the handset or microphone is placed on its rest the

OVER



An operator at the Radiophone central control station at the Tate Gallery Telephone Exchange.

"The new Radiophone Service will prove to be a very reliable and useful new form of communication," said the Postmaster General when he inaugurated the service. "It is going to be of very great value, particularly to businessmen who have to use their cars in the London area and to newspaper, radio, television and similar people who have to keep in touch with their work almost constantly."

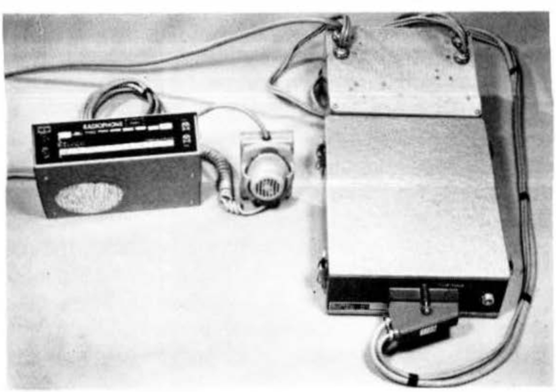
equipment automatically switches to the control channel.

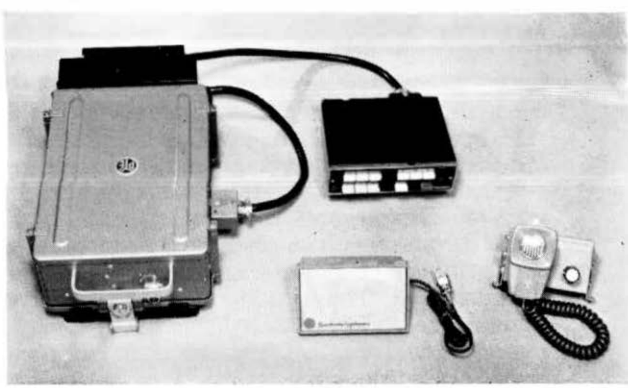
Making and receiving calls is different from the usual mobile radio procedure, but is not difficult to master. To make a call the subscriber first checks from his service area map which sector he is in and then selects a free channel for that sector by pressing one of the appropriate channel buttons. If the lamp glows to indicate that the channel is engaged he presses another channel button and if all are engaged he waits until one is free. Having obtained a free channel, the subscriber calls the exchange by pressing and releasing the call button. This automatically transmits a tone-modulated signal to the exchange. When the operator answers, the subscriber gives the telephone number he wants and is connected. If reception conditions are poor, the operator may direct him to another channel, possibly one serving another sector if he is in a position where the sectors overlap.

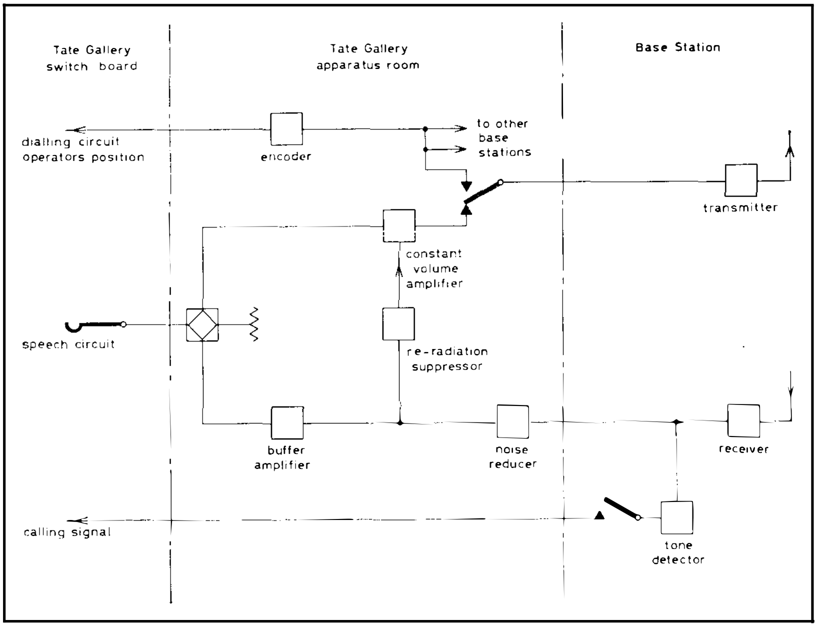
When a call is made to a radiophone subscriber, the exchange operator dials the subscriber's code number over the common control channel from all three base stations so that the whole of the service area is covered. Receipt of the call signal by the mobile equipment causes the call lamp to glow and the buzzer to sound. The subscriber acknowledges by pressing the call and acknowledge button and lifts the handset to announce his identity and location when the exchange operator challenges him. She will then tell him to switch to a suitable traffic channel and connect the caller to him.

Both types of radiophone at present used in the London Radiophone Service are operated on the simplex basis, that is, the transmitter cannot be switched on while the receiver is in use and vice-versa. The subscriber must, therefore, remember to depress the press-to-talk button on his handset

Shown (below) are the two types of radiophone equipment at present available.







This diagram shows how calls are routed to and from a car radiophone by way of the Tate Gallery Exchange and any of the base stations.

when he is speaking and to release it when he is listening. Future radiophone sets may be of the duplex type and the press-to-talk button will not be necessary.

The subscription to the London Radiophone Service is £7 10s a quarter. Calls made within the radiophone area are charged at 1s 3d for the first three minutes and 5d for each additional minute. Calls made to numbers outside the service area are charged at normal trunk rates plus 1s for the first three minutes and proportionately thereafter. Each of the two radiophone sets at present available costs about £350 to buy outright or they may be rented for about £30 to £35 a quarter.

As the *Journal* went to press the new service had attracted over 250 orders.

It All Began In Lancashire

THE London Radiophone Service is, in effect, a development of the South Lancashire Radiophone Service which was introduced in 1959 as a pilot scheme to cover the Manchester-Liverpool and Preston area.

The South Lancashire Service, which is operated from two base radio stations, each initially equipped with three radio channels, with a control centre at a manual switchboard position in Peterloo Exchange, Manchester, has 120 subscribers. Unlike the London Service, the South Lancashire system depends on voice calling which means that subscribers have to keep continuous listening watch on the calling channel if they want to avoid the risk of losing a call.

Because of the different signalling methods there is no direct compatibility between the South Lancashire and London Services, although all the channels in the former are used in the latter and the calling channels in the two services are the same. The London equipment can, in fact, be used in South Lancashire but requires modification to enable the subscriber to switch the calling channel permanently to the speaker when in South Lancashire.

The South Lancashire equipment has only five of the London channels and is not fitted with either a decoding equipment or a calling tone generator. However, the Post Office is studying ways by which some compatibility can be achieved.

THE AUTHOR, MR. J. L. HYATT, *joined the Post Office in 1939 as a Youth-in-Training at the Leafield Radio Station. On promotion to Assistant Engineer in 1950 he joined the Radio Interference Group of the Engineer-in-Chief's Office and since 1961, when he was promoted to Executive Engineer in the Radio Planning and Provision Branch of the Engineering Department, he has been concerned with the development of VHF radio services.*

A NEW AID FOR SUBSCRIBERS

By N. C. NELSON

New equipment is to be introduced which will provide subscribers on unit automatic exchanges with the temporary transfer and call interception facility

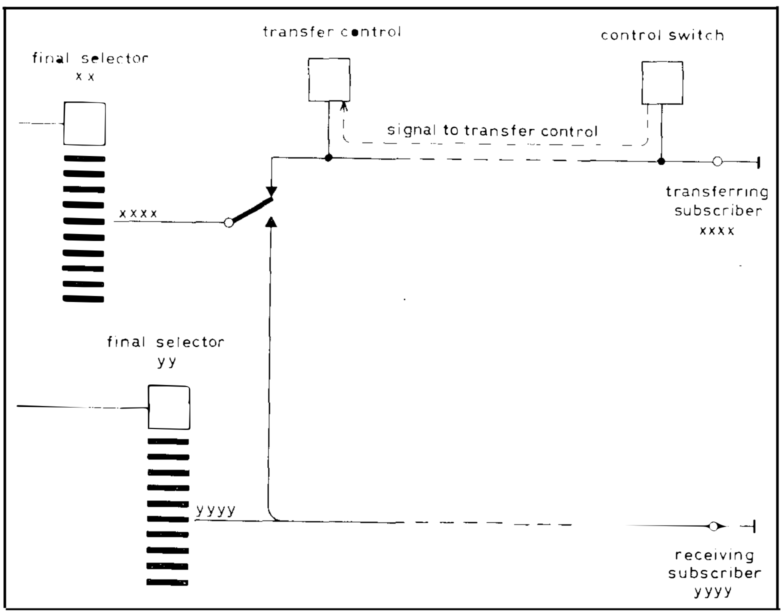
WHEN the Post Office introduced the small types of unit automatic exchanges over 30 years ago, the aim was to bring the telephone within reach of the smallest village and hamlet and to provide a simple but efficient service. Even after World War Two the emphasis was still on simplicity of design, although unit automatic exchanges were then replacing larger manual exchanges rather than extending the scope of the telephone service.

Although the facilities given by the unit automatic exchange satisfied most subscribers, a demand for a more sophisticated service grew in rural areas. A doctor connected to a manual or large automatic exchange could have his calls transferred to another telephone number on the same exchange or intercepted by the operator and the caller referred to a number on another exchange during his absence. But no such facility was available at the small unit automatic exchange.

With the spread of the unattended automatic exchange to more populous places it was decided that an extension of facilities which would be offered to subscribers was necessary. One outcome of this policy has been the development of subscriber-controlled call transfer equipment which has been made possible by the use of transistors. This will enable, in future, many subscribers on unit automatic exchanges to be given the temporary transfer and interception of calls facility.

At the outset there will be two systems of equipment available. The first will be the single transfer, which will provide for calls to one exchange number to be diverted automatically to one other number on the same exchange. The second will be the group transfer facility by which calls to one or more numbers will be diverted automatically to any one of a fixed selection of up to ten numbers.

On both systems calls may be diverted to the exchange operator as an alternative to another



This diagram shows how an incoming call is diverted. The change-over contact diverts the call at the final selector (XXXX) to the telephone of the receiving subscriber (YYYY).

number where the subscriber wishes to refer his calls to a number on another exchange, provided changed number interception equipment exists at the parent exchange. It will not, however, be possible for technical reasons to give automatic transfer to subscribers whose exchange lines are served by manual exchanges, wired for shared service, served by line connectors, connected to 50-point linefinders, or with barred trunk facilities where the barring equipment is located at the public exchange and precedes the calling equipment.

Transfer will be simple and effected by the subscriber operating a switch adjacent to his own telephone. In the case of the group system he will, in addition, have to dial the single figure code allocated to the subscriber to whom he wishes to divert his calls. An extra final selector number will also be permanently connected to his line if he has incoming calls regularly transferred so that he can still receive incoming calls from friends who know this alternative or "by-pass" number. This number will, of course, be ex-directory.

The new methods of transfer will replace the existing operator-controlled switching of a subscriber's line gradually since it is not proposed to replace existing exchange equipment until the end of its economic life. Telephone Managers will, however, be including estimates for both types of new equipment when preparing initial equipment or extension traffic data for exchanges.

For the time being it will still not be possible to give subscribers on the smallest automatic exchanges interception of calls but development work to overcome this deficiency is in hand. Engineering studies of subscriber-controlled transfer of calls from one exchange to another have been completed and the circuits are now being designed, but it will be some time before the equipment becomes available.

The successful development of a subscriber-controlled transfer equipment was carried out by the Telephone Exchange Systems Development Branch of the Engineering Department. The equipment was first applied, on a trial basis, at a number of main exchanges and at two unit automatic exchanges.

Engineering studies of the subscriber-controlled transfer of calls from one exchange to another were completed some time ago, but the final details of the method by which transfer will be effected have still to be decided. It will therefore be some time before even a field trial of the proposed facility can be launched.

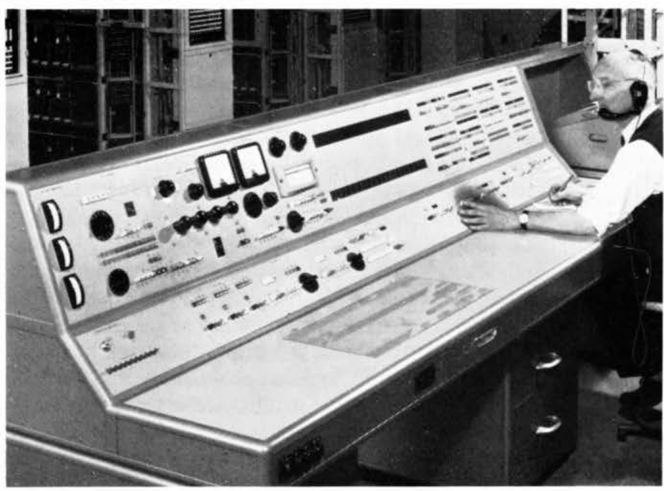
On Trial at Leighton Buzzard

This picture shows an engineer at work on a test console at the experimental electronic exchange system which is being installed at Leighton Buzzard.

The new electronic system, designed to cater for exchanges larger than 2,000 lines, is being developed by the Joint Electronic Research Committee and uses reed relays (*see article "A Step Forward at Leamington Spa", Summer, 1965 issue*).

The console shown here tests both the subscribers' lines and exchange equipment. It uses keys and rotary switches instead of the normal plugs and cords for selecting all test conditions and the results are displayed on lamps and illuminated panels. The teleprinter (*right*) can be arranged to give a printed record of all test and fault conditions.

The Leighton Buzzard electronic exchange equipment is being supplied by Associated Electrical Industries Ltd., Standard Telephones and Cables Ltd., and the Automatic Telephone and Electric Co. Ltd.



Speeding The Space Messages

By J. L. CROWTHER

The London switching centre, a vital part of the communications system which collects and passes on information about American manned space flight and satellite projects, is being improved and enlarged to provide an even better service

THE United States National Aeronautics and Space Administration sub-switching centre in the Overseas Telegraph Terminal at Electra House is being reorganised, expanded and improved to provide the increased speed and flexibility in relaying speech, teleprinter and high-speed data information required to support future NASA space projects.

The sub-centre, which is operated by staff of the British Post Office, is one of the biggest and most important in NASA's world-wide communications system.

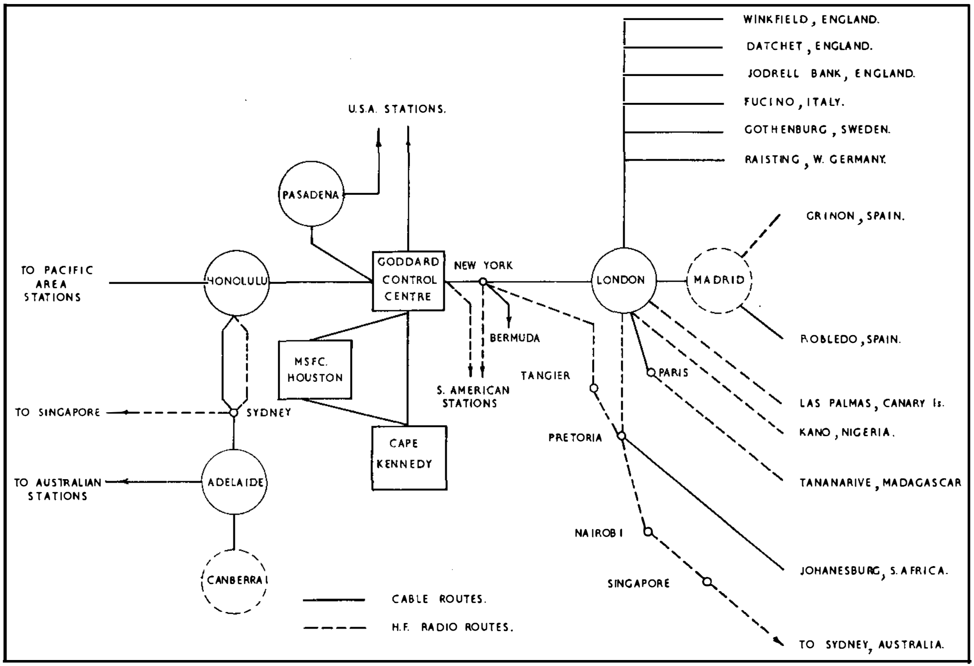
The manual circuit cross-connection facilities for relaying speech and high-speed data which were brought into service when the London centre was set up in 1961, have already been replaced by push-button controlled switching equipment. In the near future the existing torn-tape telegraph message relaying equipment is to be replaced by an automatic system embodying two Univac 418 on-line computers.

The NASA communications system, which was established in 1958, uses speech channels and teleprinter networks to transmit speech, telemetry and radar tracking data received from space satellites in orbit to the major data analysing computer and space flight control installations in the United States. These installations—at the Goddard Space Flight Centre, Maryland, the Manned Space Flight Centre, Houston, Texas, and at the Cape Kennedy, Florida, rocket launching site—predict orbit paths and retro-rocket firing times and send executive instructions back over the communications system to the satellite. Regular data transmissions from scientific observation and weather satellites as well as NASA administrative traffic are also carried over the system. The main control centre is at Goddard where teleprinter message relaying computers and push-button speech and data channel switching equipment have been in use for some time.

The new push-button controlled switching equipment (foreground) recently installed in the London centre and (background) part of the teleprinter torn-tape relaying equipment which is soon to be replaced by an automatic computer system.

The system has expanded rapidly and now has some 40 overseas tracking and data acquisition ground stations in addition to many ground stations in the United States.

To funnel traffic from these stations into the control centre at Goddard, sub-switching centres have been set up at London, Honolulu, Adelaide and Pasadena and others will shortly be established at Canberra and Madrid. The London and Canberra centres will have telegraph message relaying computers and push-button controlled speech and data circuit switching equipment. Honolulu and Madrid will have push-button speech and data equipment and Adelaide and Pasadena



Diagrammatic layout of the NASA Communications system network made up of cable and high frequency radio routes.

will retain their manual cross-connection facilities.

At present speech transmissions are passed between ground stations and London over five radio and three cable telephone channels which can be switched singly or in conference groups to Goddard by the new push-button switching equipment using telephone channels in the trans-Atlantic cables. Several of the ground stations can also send data as an alternative to speech and data speeds of up to 1,200 bits a second are in daily use on some of these circuits.

The push-button speech and data switching equipment installed at London in May this year provides full switching and conference facilities for an ultimate maximum of 10 telephone channels to Goddard and 20 extensions to ground stations. Up to 10 separate conference arrangements can be set up simultaneously. The associated line terminating and amplifying units are transistorised and can be easily and rapidly removed for maintenance.

The two computers for relaying teleprinter messages are expected to be installed in the London centre this autumn and extensive preparations for their arrival have been made. The floor area has been almost doubled and raised flooring has been extended over the computer area for ease of cabling and cleanliness. Two five-ton air conditioning plants (main and standby) have been installed to maintain a constant temperature of 72 degrees Fahrenheit at 50 per cent humidity over the equipment area and thus ensure reliable operation of the magnetic core and drum stores of the computers and prevent overheating of transistors. Two electric motor alternators, each weighing 2,000 lb, are being provided to convert the local 415-volt alternating current supplies into the 208-volt supply needed to operate the computers.

The introduction of computers for relaying teleprinter messages will greatly increase the speed of message handling and afford more flexibility in relaying messages in priority order. Signalling between the computers in London and the communications computers at Goddard will be in data form at 2,400 bits a second over two telephone channels (main and standby) in the TAT cables. Normal-speed teleprinter signals will still be passed between the London computers and ground stations. All traffic will be routed by way of the Goddard computers which will recognise traffic priorities and automatically forward messages in their correct priority sequence.

Each of the two London computers will consist of a high-speed processor with a 12,000 word core store, a magnetic drum store of 260,000 words

OVER

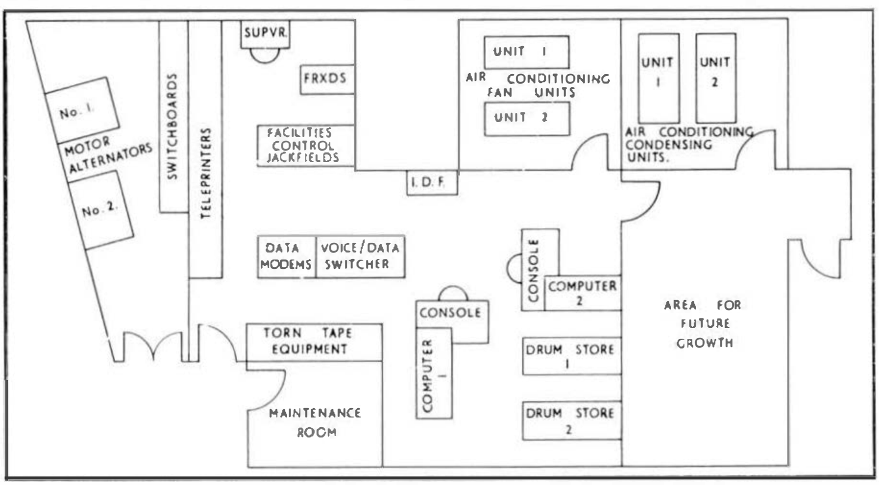
(Left) The control panel of a Univac 418 computer at Goddard. (Above) Information from the computer memory store is read out on high-speed printing equipment during tests at the Goddard Space Flight Centre. Similar equipment will be installed at the London centre.

SPEEDING SPACE MESSAGES (*Contd.*)

capacity, line termination units and a control console. They will be able continuously to accept five-unit teleprinter characters which will be processed as they are received from the ground station radio and cable channels. As the characters are received they will be built into separate blocks for each circuit, each block containing 90 circuit characters plus circuit identifying information and check bits to ensure that the block has been correctly formed. As soon as a block for any circuit is complete it will be sent by the computer to Goddard as a serial bit stream at 2,400 bits a second via a phase-modulated data modem.

The Goddard computer will carry out checks to ensure that no block has been mutilated during transmission and will then decode the five-unit characters and send them at teleprinter speeds to the correct circuit address.

Transmission of messages from Goddard to London will be essentially the reverse of this process. Input signals will be fed to both the on-line and standby London computers and each computer will concurrently process them. Under fault conditions the output from either computer can be manually switched to line.



The new layout of the NASA switching centre in Electra House which will cover an area of 1,900 sq. ft.

The London computers will be controlled by switching programmes, prepared in punched paper tape form at Goddard. Similar programmes control the computers at Goddard so that the communication system's switching functions and traffic priority control can be changed to meet the requirements of particular space missions by introducing new programmes.

British Post Office staff at the London centre operate under the direction of an American NASA centre manager. They will be instructed in operating the new computers by a Univac Ltd. programmer and the equipment will be maintained by resident Univac engineering staff.

After the computers have been installed in the London and Canberra centres, NASA intends to establish high speed data transfer between the communications computers at the Space Flight Control installation at Goddard and the Manned Space Flight Centre at Houston. Between Goddard and Houston transmission of 4,800 bits a second are to be established while within Goddard information will eventually be passed between communications and space flight control computers by core-to-core transfer at 40,800 bits a second.

With the introduction of the new equipment and modern techniques the London centre will play an even more important part in giving efficient communications support to the later stages of the present Gemini two-man spacecraft missions and the future Apollo manned moon landings at present scheduled for 1970.

THE AUTHOR

MR. J. L. CROWTHER *joined Cable and Wireless Ltd. in 1947 as a Technical Assistant. He was promoted to Executive Engineer at ETE Headquarters in 1965, and is GPO Liaison Officer for NASA projects and planning engineer for the new telegraph centre at St. Botolph's House, Houndsditch.*

★

A NEW BOOK ON MODERN FILTER DESIGN

A NEW BOOK ON MODERN FILTER DESIGN

"Design Theory and Data for Electrical Filters", by J. K. Skwirzynski. D. Van Nostrand Company, Ltd. 730 pages, 185 figures, 142 tables.

A GREAT number of books on modern network theory have appeared in the last decade, most of them written on a high intellectual level. Their value to the progress of science cannot be doubted, but they are not of the type required by engineers who have to design hardware without being able to indulge in esoteric studies.

This valuable book by Skwirzynski fills some of the gaps between network theory and engineering. It deals specifically with the design of reactance filters which are to be operated between resistive source and load impedances and whose attenuation characteristics are of the Chebyshev type, that is, having equal ripples of permissible amplitude in the pass-band(s) and equal minima of required value in the stop-band(s). Design methods for such filters have been known for about 25 years. but computing the element values is still an intricate and time-consuming task even for the expert.

About half the book's content consists of tables from which the element values can be obtained in a simple manner for low-pass, high-pass, band-pass and band-stop filters of one to three sections. Band-pass and band-stop filters are necessarily restricted to those whose characteristics are symmetrical on a logarithmic frequency scale. Two different terminating conditions are offered for cases containing half sections. Element values for filters which are open-circuited or short-circuited on one side are also given. Apart from element values, a great deal of information on the properties of these filters is tabulated, e.g. the amount of dissipation permissible in the components.

The first half of the book presents an introduction to the underlying theoretical principles. Users of the tables will not necessarily have to refer to this part, but it offers a deeper understanding. The theoretical treatment is essentially tailored to the type of filters mentioned; it covers the ground thoroughly without overburdening the reader by too much generalisation. Many will welcome the chapter on delay equalisation which includes a practical method for finding suitable networks and hints on their alignment.

The book will have considerable appeal not only to the practising engineer but also to the expert quite apart from its time-saving tables. Methods differ considerably between workers in this field, and it is always of interest to compare notes, particularly when they can be studied in printed form.

A book of this nature could escape criticism only by a miracle, and the author's contemporaries may differ with him on points of presentation, although hardly on principles. These points may well include his choice of symbols and normalisation, and certain omissions in the tables such as the minimum attenuation (although this can be read from graphs).

Such points are arguable and do not reflect on this most welcome effort of the author who offers, together with the mathematical tools, a vast amount of tabulated results and some valuable advice on the physical and technological problems which present themselves when applying network theory. In the hands of many communication engineers and designers, this book will pay for itself with its first application. **J.M.L.**

M I S C E L L A N Y

KEEPING CLOSER IN TOUCH WITH THE WORLD

A NEW International Telephone Exchange which will play a big part in increasing the capacity of Britain's exchange system to handle the rapidly-growing volume of traffic and help to speed the telephone service to and from all parts of the world, was opened on 29 June by the Postmaster General, the Rt. Hon. Anthony Wedgwood Benn.

The new exchange—accommodated in a former warehouse near St. Paul's Cathedral and now called Wren House—will augment the services of nearby Faraday Building. It has 198 manual switchboards housed with their associated apparatus in four switchrooms. A further 70 switchboards have been left in Faraday Building to handle the rest of the international traffic, making a total of 268 switchboards compared with 190 before.

In addition to expanding the manual switchboard operating capacity for the inter-Continental services, the fitting out of Wren House has enabled a switchroom in Faraday Building to be vacated for use by additional international subscriber-dialling automatic switching equipment.

In the beginning all outgoing services from Britain to North America are being operated from Wren House, together with most of the radio-telephone services from London, including those to India, Pakistan and South America as well as many to Africa and the Middle East. Among those international calls at present being handled at Wren House are those which cross the Atlantic by way of the *Early Bird* commercial satellite system. Calls on the ship-to-shore radio-telephone service also pass through Wren House. Later, telephone traffic to and from many more non-European countries will be switched at the new International Exchange.

The Postmaster General dials a call to the United States at the new International Exchange.

In the past five years international telephone traffic has more than doubled. Today the total number of calls between Britain and overseas countries exceeds 12 million a year and the rate of growth is about 20 per cent a year.

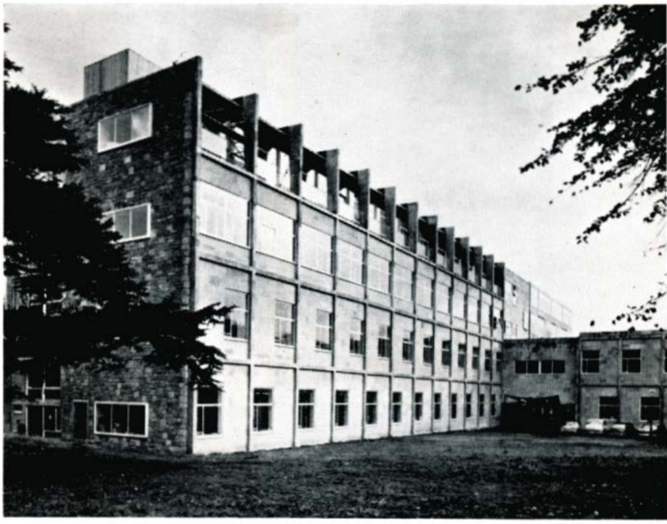
★

A SIMPLER AND CHEAPER GOONHILLY AERIAL?

WORK on the proposed new second aerial at the Post Office satellite communications earth station at Goonhilly (*see the Autumn, 1964, issue of the Journal*) has been suspended and plans are going ahead for the building of a simpler and cheaper one.

The second aerial was to have been an improved version of the first, able to look at any part of the sky and track fast-moving satellites moving almost overhead. Recently, however, polar orbit systems have not found favour among international committees working on future satellite systems. As a result, the Post Office is now considering the possibility of providing a simpler and cheaper aerial of limited steerability for the next phase of operations. If polar systems come back into favour, however, the design of the originally-planned second aerial could well be revived.

A New Exchange For Scotland



Edinburgh's new trunk centre. It cost £2½ m.

THE opening on 9 July of the new Woodcroft Telephone Trunk Centre marks a big step forward in the development of the telecommunications services in Eastern Scotland.

Through this new centre, which cost nearly £2½ million to build and equip, now pass all long-distance telephone calls between Edinburgh and the East of Scotland, on the one hand, and the rest of the United Kingdom on the other. Its opening has enabled Subscriber Trunk Dialling and International Trunk Dialling facilities to be given to subscribers on eight more exchanges in Edinburgh and considerably increases the number of other STD exchange areas to which subscribers are now able to dial their own calls.

When he performed the opening ceremony, the Director General of the Post Office, Sir Ronald German, KCB, said that Woodcroft was only one of many schemes under construction and being planned to improve the telephone service in Scotland. In 1965 nearly 7,000 new telephones will be provided throughout Scotland—more than twice as many as two years ago—and in 1966 it was planned to fit 85,000 more.

Telephone service was being provided more quickly in Scotland than in either England or Wales. Well over half the orders for telephone service were completed in two weeks. There had also been a tremendous increase in the number of calls. Long-distance calls were about 20 per cent more than a year ago and local calls had increased by nearly 8 per cent.

"Our plans for expansion in Scotland are very large indeed," said Sir Ronald. "In the past five years we have spent on capital projects nearly £55 million. Our current rate of expenditure on capital projects is £17 million a year and this level seems likely to continue for many years."

The switching equipment in the Woodcroft centre handles calls over 2,500 trunk circuits to and from 36 other main switching centres in Britain and deals with calls over shorter distances through another 3,100 circuits. The manual trunk switchroom contains 40 operators' positions where calls which subscribers cannot yet dial are connected and controlled.

★

THE POTTS

The first of the 1965-66 series of lectures arranged by the Post Office Telephone and Telegraph Society of London takes place at Fleet Building on Wednesday, 6 October, when the subject will be computers. Other lectures during the year will deal with data transmission, satellite communications, market research and television.

A number of visits—for example, to the Hawker Siddeley works at Hatfield, the GEC Research Laboratories at Wembley, the STC works at New Southgate and the Atomic Energy Research Establishment at Harwell—are also being arranged for members of the Society.

Membership of the Society costs only 2s. a year. All details can be obtained from the Secretary, Mr. A. H. White (LTR 8000 extension 570); the Assistant Secretary, Mr. M. D. Bawcutt (LTR 8000 extension 468); or from the Treasurer, Mr. J. Maxwell (Gerrard 8060 extension 212).

OVER


Mr. A. Wolstencroft.


M. A. W. C. Ryland.


Mr. W. A. Wolverson.


Mr. K. H. Cadbury.

TOP LEVEL CHANGES

THE *Journal* extends its congratulations to Mr. A. W. C. Ryland, CB, Director of Inland Telecommunications since 1961, on his appointment with effect from 1 September as a Deputy Director General of the Post Office. Mr. Ryland succeeds Mr. W. A. Wolverson, CB, who retires in November, and will be known as Deputy Director General, Telecommunications. Under the Director General, he will be operationally responsible for the entire telecommunications services.

The new Director of Inland Telecommunications is Mr. K. H. Cadbury, MC, who has been Director of Clerical Mechanisation and Buildings since 1963.

Mr. Ryland, who was educated at Gosforth, Newcastle-upon-Tyne, became an Assistant Traffic Superintendent at Gloucester in 1934 and was later appointed an Assistant Surveyor at Shrewsbury. During World War Two he served with the Army Postal Services, rising to the rank of Colonel, and on his return in 1947 became an Assistant Postal Controller, Midland Region. Since 1949 Mr. Ryland has served at Post Office Headquarters, first in the Postal Services Department and then as Private Secretary to the Postmaster General before being appointed Director of Establishments and Organisation in 1956.

Mr. Cadbury, educated at Bootham School, York and Birmingham University, rose from Gunner to Major in World War Two when he won the Military Cross and a mention in despatches. In 1946 he joined the Foreign Office and a year later entered the Post Office as an Assistant Principal. From 1952 to 1955 he was seconded to the Cabinet Offices and served as secretary to several committees and conferences, including the Commonwealth Prime Ministers' Conference in 1955. Later he became Secretary to the Committee of Inquiry into Welsh Broadcasting and the Committee on the Telegraph Service. In 1960 Mr. Cadbury was appointed Deputy Director of Wales and Border Counties Region, and in 1962 Director.

A keen sportsman, Mr. Cadbury has climbed the Matterhorn and includes among his many interests a liking for archaeology.

Mr. Wolverson, who joined the Post Office in 1928 as an Assistant Traffic Superintendent, became the first Commandant in 1951 of the Post Office Management Training Centre at Clacton and in 1952 the first Director of the newly-formed External Telecommunications Executive. In 1955 he was appointed Director of Radio Services and in 1960 Deputy Director General.

★

TRANS-ATLANTIC DATEL

ONLY six months after it had been introduced in Britain, the Datel 600 Service, which enables coded information for computers to be sent over the public telephone network, has now been extended across the Atlantic.

The Datel 600 Service, which transmits data at speeds up to 150 characters a second, became available between Britain and the United States on 1 July and was first used to carry copy between the London and New York offices of a well-known publishing house.

As the *Journal* went to press the Post Office was negotiating with several other European countries for the extension of the Datel 600 Service to the Continent.

For use over international circuits the Post Office will supply Datel modems No. 1A which convert the data signals into a form suitable for telephone transmission. This equipment provides data transmission in the 600 to 1,200 bits a second speed range.

Telecommunications Statistics

In this issue the figures presented are for the complete financial year to 31st March, 1965, compared with those for the two previous years.

	31 March, 1963	*31 March, 1964*	**31 March, 1965**
The Telephone Service at the end of the Year			
Total telephones in service	8,927,000	9,366,000	**9,980,000**
Exclusive exchange connections	4,254,000	4,506,000	**4,853,000**
Shared service connections	1,100,000	1,114,000	**1,176,000**
Total exchange connections	5,354,000	5,620,000	**6,030,000**
Call offices	74,530	74,780	**74,764**
Local automatic exchanges	5,387	5,486	**5,588**
Local manual exchanges	624	533	**437**
Orders on hand for exchange connections	161,000	172,000	**175,000**
Work completed during the year			
Net increase in telephones	†303,000	†438,000	**615,000**
Net exchange connections provided	434,000	555,000	**699,000**
Net increase in exchange connections	145,000	†266,000	**410,000**
Traffic			
Effective inland telephone trunk calls	545,000,000	624,000,000	**736,000,000**
Cheap rate inland telephone trunk calls	125,000,000	139,000,000	**161,000,000**
Overseas telephone calls:			
Outward	4,391,000	5,094,000	**6,316,000**
Inward	*4,382,000	*4,652,000	***5,647,000**
Transit	*99,000	*120,000	***141,000**
Inland telegrams (including Press, Service, Railway and Irish Republic)	13,947,000	11,684,000	**11,610,000**
Greetings telegrams	3,135,000	2,618,000	**2,592,000**
Overseas telegrams:			
Originating UK messages	6,318,000	6,468,000	**6,928,000**
Terminating UK messages	6,381,000	6,545,000	**6,864,000**
Transit messages	5,216,000	5,133,000	**5,304,000**
Inland telex:			
Metered units (including Service)	†99,000,000	†125,000,000	**161,000,000**
Manual calls (including Service and Irish Republic)	126,000	154,000	**121,000**
Overseas telex calls	5,545,000	7,173,000	**9,110,000**

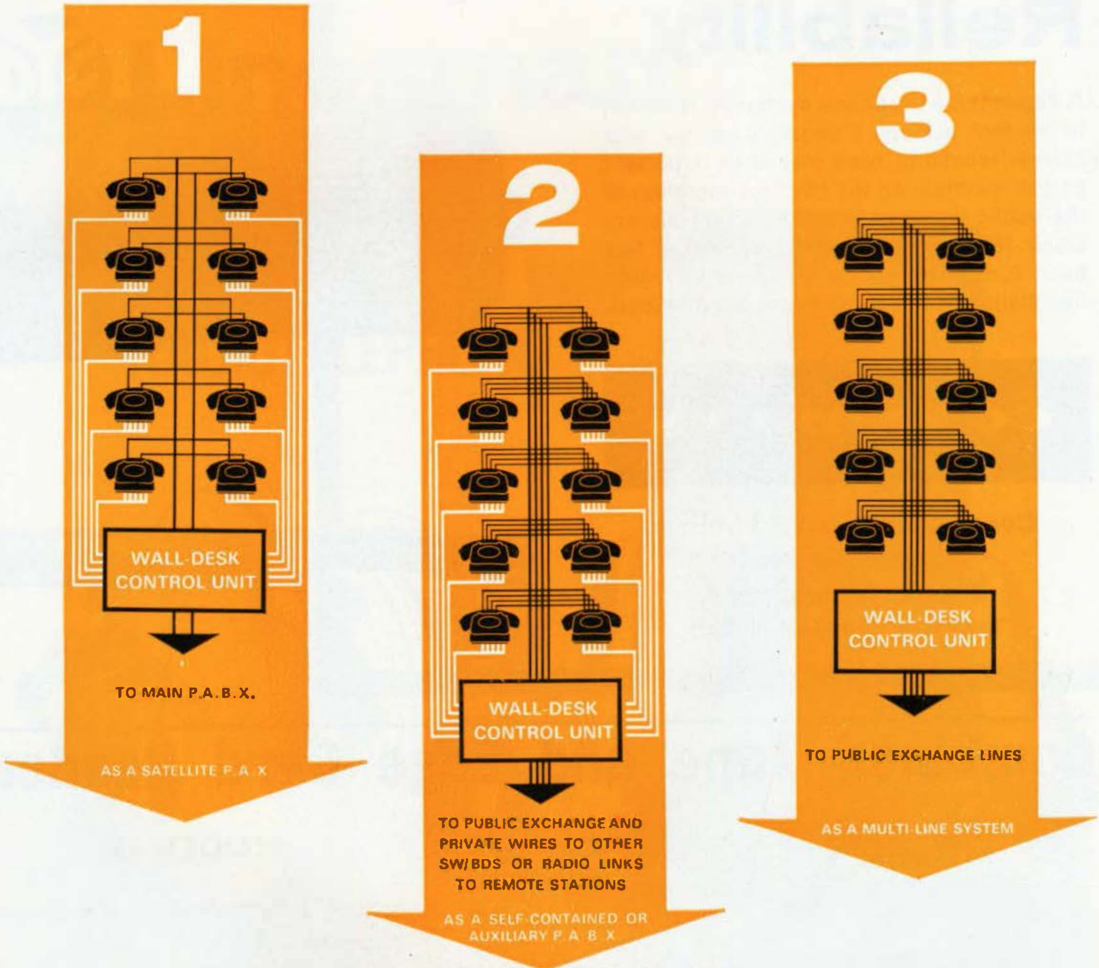
†*Amended figures.*
**Includes some estimated figures.*

Publication and Price. The *Journal* is published in February, May, August and November, 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.".

GPO



MULTIPHONE

Makes a triple attack on telecommunications problems

'Multiphone', as its name suggests, is capable of a multiplicity of applications. Serving up to 10 telephones of Plan-Etelphone type, it can be conveniently arranged by adjustment in a number of circuit modules to function as a 4-line PABX, PAX or multi-line system. Its value to all overseas administrations is increased further by its ability to work over a diversity of external circuits, so permitting a preferred arrangement to be connected as requirements demand.

Main Operational Features: Single-digit dialling of internal calls. Lamp signalling and supervision of all calls signalled, held or in progress. Internal calls made secret or non-secret by simple strap adjustment. Exchange-line exclusion feature for selected stations. Power unit operation and continuing exchange-line service during mains failure.

For further information please apply to:—

Plessey Telecommunications Group

ERICSSON TELEPHONES LIMITED · ETELCO LIMITED

Head Office & Main Works: Beeston · Nottingham · Tel: Nottm. 254831 · Telex 37666
Registered Office: 22 Lincoln's Inn Fields · London · WC2 · Tel: HOLborn 6936

PTE 73MA

THE POST OFFICE TELECOMMUNICATIONS JOURNAL IS PRINTED FOR H.M. STATIONERY OFFICE BY FOSH & CROSS LTD., 80/92 MANSELL STREET, LONDON, E.1, AND IS PUBLISHED QUARTERLY IN NOVEMBER, FEBRUARY, MAY AND AUGUST BY H.M. POSTMASTER GENERAL AT THE POST OFFICE HEADQUARTERS, LONDON E.C.1