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Contents

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Finance and Service

THE POST OFFICE COMMERCIAL ACCOUNTS FOR 1953-1954, the telecommunications aspect of which is outlined on page 82, show that the telegraph deficit fell by £.5 million and the telephone surplus rose by £1.8 millions. Nevertheless, the surplus on General Account, although increased from £4.9 to £7.3 millions, was still only 2.7 per cent. of income, which is very low in comparison with the percentage normally budgeted for by large business concerns.

The danger is evident when one considers the provision for depreciation, more especially of telephone plant. Much of this plant is nearing the end of its life and will soon have to be renewed at prices which are still tending to rise and are out of all proportion to the original cost. For some years the Post Office has set aside a special sum annually for depreciation, in addition to the normal allowance, but the Comptroller and Auditor General of the Exchequer and Audit Department, in a note to the Accounts, sounded a note of warning in emphasizing that the question of the right allowance for depreciation has not yet been settled. In an illuminating analysis the *Economist* estimated that the present total allowance is between £10 and £15 millions a year too low.

The Accounts, as usual, present a report in terms of service as well as of finance; and the statistics of telephone service show that the drive towards reducing the order list was maintained during the year despite a substantial rise in the rate of new demand. The dry, prosaic figures reflect a year of immense and productive energy and all the staff concerned can justifiably take pride in the results.

New Cordless Switchboard at Thanet

W. H. Scarborough, A.M.I.E.E.,
Telephone Manager, Canterbury

ON MAY 31, 1951, THE MANUAL TELEPHONE exchanges in the Isle of Thanet were converted to automatic working. The Thanet exchange in Margate, with an auto-manual switchboard, became the main group centre exchange with Westgate, Birchington, Ramsgate and Broadstairs as satellites. The three unattended automatic exchanges, Minster, Manston and St. Nicholas-at-Wade, also serve the Isle of Thanet.

A recent extension of the automatic equipment provided an opportunity to introduce multi-metering to the whole of the non-director area. Subscribers in the area can, therefore, by dialling, complete calls up to a distance of 15 miles.

Cordless Switchboard

The present auto-manual cord type switchboard is shortly to be replaced by a cordless switchboard which has been installed by Siemens Bros. Ltd. in an adjacent switchroom. The design of the Thanet building allowed accommodation for a new switchroom to be equipped with cordless positions while the cord type board in the existing switchroom remained in service. This exchange, with modern facilities, was therefore selected for the first trial of the cordless switchboard in this country.

Although cordless switchboards have been working for some time in Melbourne, Capetown, Amsterdam and other places, it was felt that their design did not permit full advantage to be taken of the "cordless" method of working. A new type has, therefore, been designed by the Post Office in consultation with staff associations and the manufacturer, which permits of an improved lay-out of switchboard positions.

The general principle of a cordless switchboard is that calls are connected to the operator's headset without her having to plug into a calling line and the connections are then set up by automatic switches which the operator controls by means of a key-sender.

The cordless switchboard has the general appearance of a desk and the front has a flat writing position, covered with a non-slip plastic material. To ensure good visibility, the lamp signals are on a sloping panel above the connecting keys. The switchboards are arranged in short suites of four and five positions in double rows across the width of the switchroom with the operators facing one another. The end position of each suite provides facilities for power supplies and cabling, while a framework of aluminium alloy and similar sheeting forms a continuous trough for cabling to intermediate positions.

Main Features

The main features of the cordless switchboards are:—

1. The multiple is eliminated and the operators have every facility available in front of them without having to stretch up or across the switchboard to insert or remove cords. The positions do not have to be in a continuous line round the switchroom.
2. All calls from subscribers will be accepted in rotation by a queueing system, thus avoiding the "unfortunate call".
3. Key-senders are provided on all positions to facilitate setting up outgoing calls.
4. A display panel indicates the type of call in hand.
5. The tops of the desks are covered with a special plastic material which prevents the tickets from slipping. Special arrangements are provided so that tickets may be secured under the front edge of the key panel.
6. Supervision can be exercised either from the front or back of the positions, and the officer-in-charge has a better view of the switchroom than with the cord type switchboard.
7. As the equipment which sets up the connection is in the automatic exchange there is no need for heavy apparatus in the switchroom.
8. The maintenance of equipment on the positions is facilitated by mounting the apparatus on turrets which permit access from the rear of the positions. Most of the apparatus in the positions can be replaced by jacked-in units.

Call Queueing

The function of the cordless switchboard is to complete both incoming and outgoing calls without ancillary answering equipment or outgoing multiple. A call queueing system with automatic storage and distribution enables calls to be answered in rotation, thus tending to equalize times to answer.

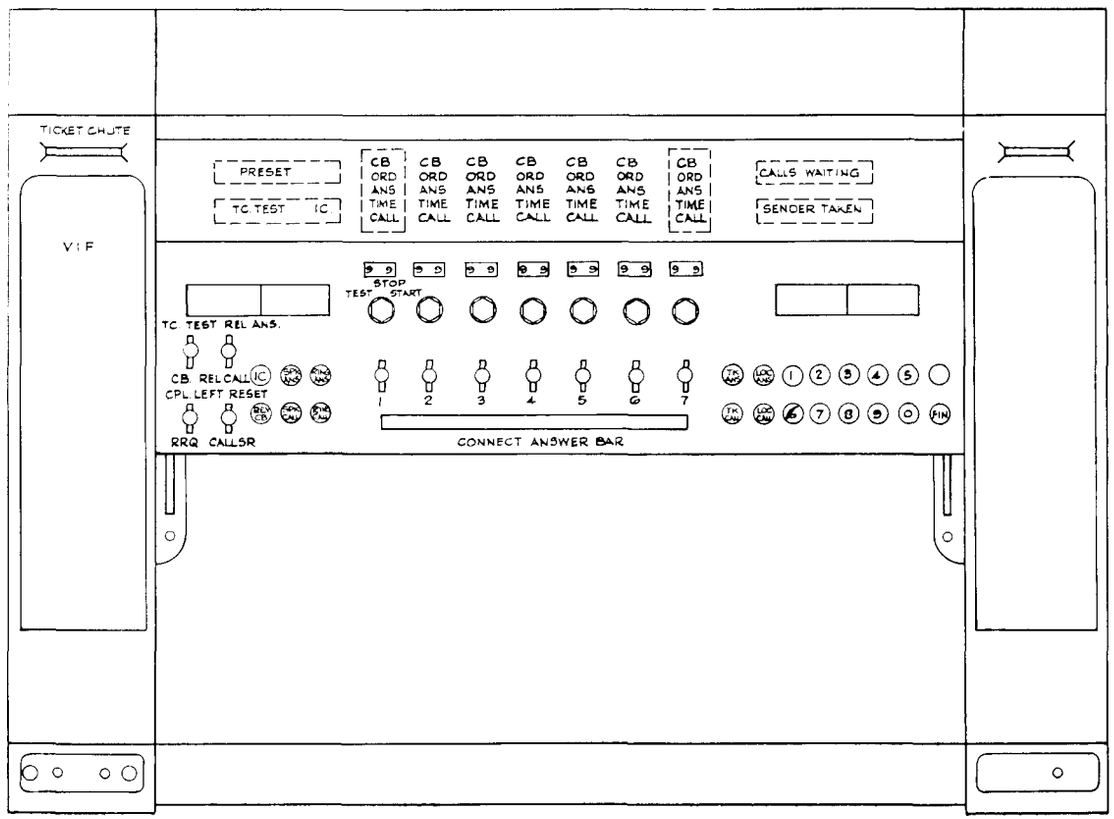
Each incoming circuit from the automatic exchange is connected to a relay set and a distributor hunter, the banks of the hunter providing access to distributors, followed by queue circuits and connecting circuits.

To ensure maximum flexibility and concentration of staff during slack periods, each incoming "O" level circuit has access to all the connecting circuits in the controlling fields. This is arranged by grading the banks of the distributor hunters to the distributors.

Because the capacity of distributors is limited it is necessary to divide the Thanet exchange into two separate fields, each having its own queueing system. One field consists of 14 and the other of 18 controlling positions.

Approximate equality of "times to answer" for calls entering the two controlling fields is arranged by an automatic time control scheme. All calls are timed by the equipment from the moment they

The cordless switchboard controlling position



enter a queue and as soon as the waiting time of any call exceeds a certain duration, to begin with 5 seconds, the queue in which the call is waiting is closed to further calls, which are directed to the other field.

The first queue remains closed until either the waiting time of the longest waiting call falls below 5 seconds or the other queue contains a call which has waited for 5 seconds. If the other queue contains a call which has waited for 5 seconds, the first queue is re-opened but the time control mechanism for both queues is re-set to close the queues when the longest call has been waiting 10 seconds.

If the traffic continues to increase the time control mechanism automatically adjusts itself to close the queues at increasing waiting times of 15, 20, 30, 40, 60, 90 and 120 seconds. When the longest waiting calls in both queues have been waiting 120 seconds both queues will close and further calls will receive engaged tone until the longest waiting call in a queue has been waiting less than 120 seconds when a queue reopens.

A separate queueing system is provided for originating, incoming, enquiry, night service, interception and directory enquiry traffic.

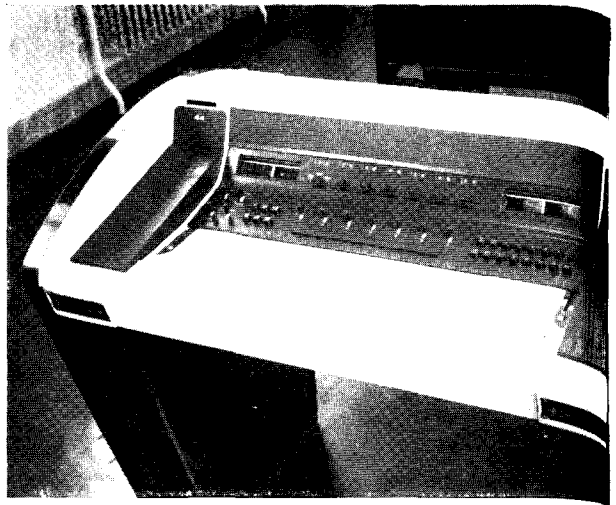
Operating Facilities

In general the facilities provided by the cordless switchboard are similar to those of the sleeve control cord type switchboard though the operating method is different. The positions can be classed under three headings: controlling positions, incoming positions and monitorial positions.

Controlling Positions

The face equipment of a controlling position shown in the diagram is self-explanatory. It will be seen that there are seven connecting circuits for each position, below which is the "connect answer bar". These positions receive originating "O" level traffic from ordinary and call office subscribers. There are special arrangements for "999" emergency calls, which are described later. With an instrument plug inserted into the position jack the position is open to receive calls only when an answer key is operated to the speaking position, and the connect answer bar is depressed for the acceptance of a call from the queue.

One of two signals will glow to indicate whether the call is from an "ordinary" or "coin box" sub-



Controlling position—keyshelf detail

scriber and will continue to glow until the call is released by the operator. Calling and answering supervisory lamps are provided, and a chargeable time clock and time check lamp. The rotation of a control knob in a clockwise direction starts the clock, and in the anti-clockwise direction sets the clock for routine testing.

When a call has been answered, a ticket prepared and the appropriate code for the wanted exchange determined from the visible index file, the call is set up by means of a keyset operated by

Two incoming positions and monitorial suite with pneumatic tube terminal

12 digit key-senders with automatic switching via outgoing relay sets with access to trunk selectors. Above the visible index file a chute is provided for the completed tickets, discharging into a tray at the back of each position.

Pilot lamps exist between each pair of positions, and at each end of each suite for various purposes, such as emergency calls (red), to call supervisor (white glow), or when operators have been withdrawn from a "field".

A section supervisor's telephone jack is fitted at the right-hand end of each suite with an audible alarm.

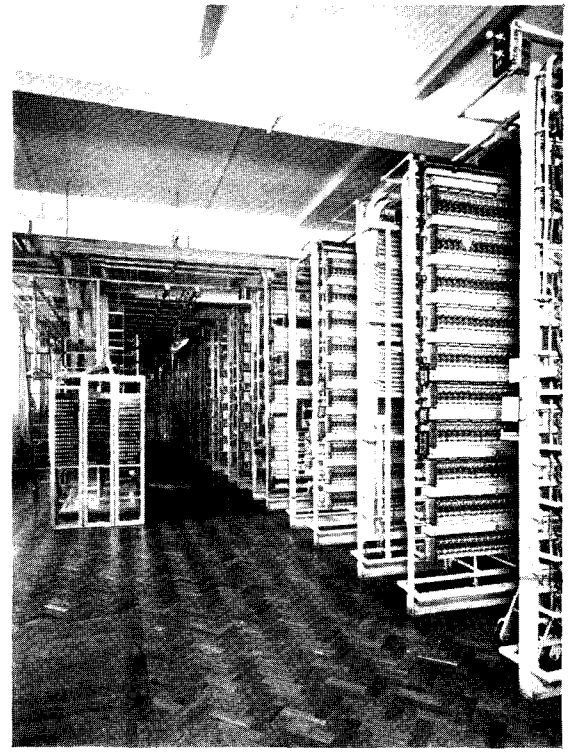
"999" Service

The "999" service is given priority answering facilities and by-passes the call queueing equipment. On arrival at the exchange, the emergency call operates the normal emergency red lamps and exchange alarm, mounted on the wall near the "999" positions. Immediately, six positions in the first field are barred from accepting any ordinary calls from the queue, and the "999" call passes direct to the first marked connecting circuit. Red pilot lamps glow at the position receiving the call and can be seen by the operator and by the Section Supervisor.

Incoming Positions

As most incoming traffic is completed by automatic equipment there are two incoming positions only. The facilities are similar to those described for the controlling positions, except that there are 10 connecting circuits for each position and only one engaged lamp for each connecting

Supervisor's desk and console



Apparatus room with change-over key control

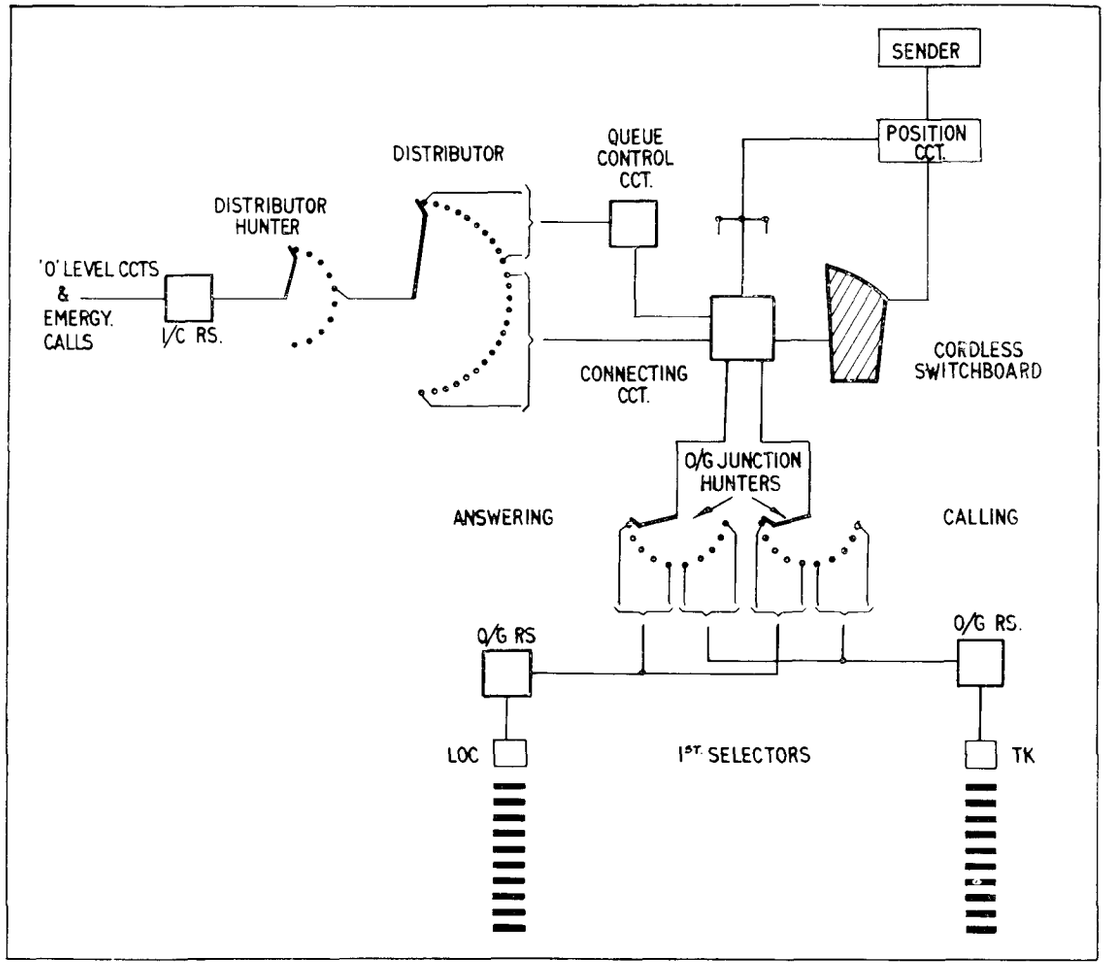
circuit. There is no chargeable time clock. These positions handle traffic from signalling routes from distant exchanges, and assistance traffic from dialling-in exchanges.

Monitorial Positions

There are 10 monitorial positions. These differ in appearance from the controlling positions but have many operating features in common with them. The upper portion of the positions have a book-case with sub-divided compartments housing various records.

Owing to the variety of specialized enquiries on these positions, calls are segregated into different queues, with eight displays.

EQ ... General enquiry traffic from subscribers or call office users.
INT ... Changed number or service interception and transfer service.
NS ... Class A night service.
RRQ ... Route and rate quoting.
FXT ... Fixed time or a personal call monitor.
FM ... Faults monitor.
DQ ... Directory enquiry.



The cordless switchboard control circuits

There is one spare display for future development.

The identification signal appropriate to any call will glow when the speak monitor key is operated to the "Speak" position. The signal darkens when the key is restored to normal and will re-light each time the speak key is operated.

Training

Six training positions have been provided for training purposes, which include four practice positions and two controlling positions for simulating originating calls.

The Supervisor's desk looks like a normal office table, with facilities similar to those in a sleeve control exchange. It is made of metal with a plastic top in the style to match the cordless switchboards.

Adjacent to the desk is an exchange control console which matches the desk in height and finish. This has a sloping surface on which, for each field, there are coloured signals indicating the number of staffed positions, the number of waiting calls and the waiting time of the longest waiting call. The console also provides visible and audible alarms, a rotary switch to set the

operating time of the "time to answer" alarm, and meters giving the total calls and their total waiting time.

Some of the displays on the Supervisor's console are repeated on wall panels for the information of the Section Supervisors. Each panel caters for the queue but as many as four panels may be required for the monitorial positions.

The design of the cordless switchboard is such that, while it provides full operating facilities, the transmission path of an established call does not pass through it. The plant lay-out is unique, in that the cordless switchboard exercises remote control of the connecting and auto-switching equipment, which may be in another building.

It will be seen that the equipment in the switchroom is limited to operating requirements such as keys, lamps and time checks; and the need for engineering attention in the switchroom is therefore reduced to a minimum.

At Thanet, the automatic switching equipment, distributors, hunters and queue controls are situated on the apparatus floor immediately below the switchroom. Incoming and outgoing relay sets and timing apparatus, with the power plant, are in the basement of the same building.

Power Plant

The capacity of the power plant has been increased to meet the additional load required. It operates on a divided battery float system and consists of two motor generators with an output of 500 amperes; also one 200 ampere output machine which can be coupled to work in parallel with the large generators.

There are two 50-volt batteries, each of 4,500 ampere-hour capacity.

Considerable attention has been given to the lighting conditions in the switchroom to provide adequate light at desk level without shadow effects. The lighting installation provides a good standard of illumination and comprises 44 special fittings to house 80-watt fluorescent tubes arranged symmetrically over the cordless switchboards.

The installation at Thanet is experimental and when it is brought into service (early this year) a great deal of interest will be taken in its working. It will be important to ascertain the reactions of the staff to the new system of working and careful studies will need to be made to compare the operating time required to set up calls and the quality of service given to subscribers through cord type switchboards.

Television Cables in Northern Ireland

The Northern Ireland television programme is relayed from Kirk-o-Shotts in Ayrshire, Scotland, over an optical radio path to the Post Office receiving station on the top of the Black Mountain (1,200 feet) just outside Belfast. The receiving station is connected to the temporary Northern Ireland TV transmitter at the foot of the mountain by an armoured cable having two coaxial tubes and a number of audio pairs; only one tube is used at a time, the other is a standby.

The mountain side in most places is boggy and a pair of long Wellington boots is an essential part of the equipment of any visitor to the Post Office station. The cable is laid directly in a trench dug down the side of the mountain and the work of laying it was extremely difficult because of the nature of the ground, and the unfavourable weather conditions when the work was done a year ago.

Although the cable was anchored where possible both tubes broke during November last as a result of creepage, but, fortunately for the TV programme and for the Post Office, they broke at different times with an interval of two days between the two faults.

Third Tube

The simultaneous failure of both tubes might result in a 24-hour interruption of local TV transmission because of the great difficulty in effecting repairs. To prevent such a failure a third tube in a separate cable has now been provided. In particularly bad places the new cable trench follows a sinuous path to reduce to a minimum the effects of creepage.

An urgent request to the Engineering Department for advice, a visit to the site by an officer from that Department, the decision to provide a second cable, the supply of that cable, the digging of the trench in abominable weather and the laying of the cable were all done in less than a fortnight.

The Northern Ireland TV programme is now reasonably free from any danger of interruption as a result of cable faults between the Post Office receiving station and the B.B.C. transmitter.

electrode, could remain cold. O. W. Richardson in 1901 first investigated this problem of the emission of electrons from hot bodies, and in 1904 Wehnelt invented the oxide cathode as an emitter electrode which was much more efficient than the tungsten light filaments first used in Fleming's valves. Wehnelt's invention is still used in valves produced today.

Space-charge

It was quickly realized, after Richardson's work on electron emission, that all the electrons emitted from a hot electrode will not be collected by the other electrode if this is maintained at a positive voltage below a certain critical level. The reason for this is that some of the emitted electrons are repelled back to the emitter by their fellows with the same charge, which are congregated in a cloud between the emitter and collector electrodes. This cloud is known as the space-charge and its effect in limiting the collector current was first investigated by Child in 1911. The collector current is in fact drawn from this space-charge cloud of electrons.

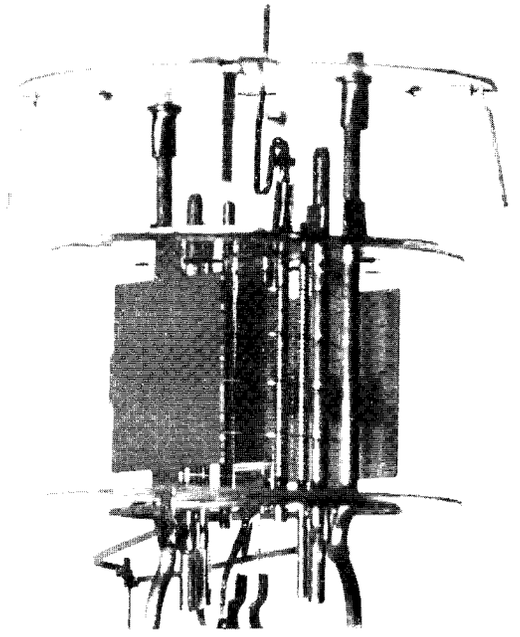
The fact that the current emitted by the hot electrode may be as much as a thousand times greater than the current collected by the collector electrode or anode in triodes, tetrodes and pentodes, as well as in diodes, means that great latitude is permissible in the emitting properties of the cathode. This is a most useful insurance against chemical contamination of the emitter, which must be serious before the tiny drain on the space-charge cloud is affected. In addition, without the space-charge, the controlling properties of the third electrode would be greatly reduced and the spurious noise generated inside the valve would be greatly increased.

This phenomenon of space-charge limitation allowed the functions of generation and amplification of electrical oscillations to be successfully accomplished in a way that was not possible before the invention of the valve. When the advantages of the thermionic valve, using space-charge control of current, were appreciated, it was not surprising that the device dominated the thoughts of circuit engineers for more than thirty years.

By 1939, refinements and improvements in the thermionic valve had made it capable of handling electrical signals up to frequencies approaching 4,000 megacycles per second. Beyond this limit the problems of transit time render the conventional valve useless; by transit time is meant the time taken by the electrons to cross the inter-electrode spaces. Although the electrons attain very high velocities at the collectors of valves, about 4,000 miles per second at the anode of a normal triode, they leave the space-charge cloud with almost zero velocity. Under very high frequency conditions they take too long to get to the plane of the control grid and the valve behaves inefficiently. The situation can be improved by reducing the distance between space-charge cloud and control grid—that is, between emitter and control grid—but there are mechanical limitations to this process and it was finally realized that a search for a new principle of operation was essential for further progress.

This search resulted in the production of devices such as the klystron, travelling wave tube and magnetron, in which the electron transit time difficulty has been overcome and provision made for handling very high frequencies. In the klystron a beam of electrons from the emitter is accelerated and passes through an input resonator where the incoming signal influences the velocity of the electrons in the beam, some being speeded up, some slowed down. As a result the electrons collect in "bunches". The bunched electrons then pass into an output resonator which, under favourable circumstances, is able to deliver more power than was applied at the input.

The interior of a pentode produced by the Post Office for use in telephone repeaters submerged on the bed of the ocean



The travelling wave tube is an even later type of thermionic valve amplifier, which is also used for telecommunications. It operates on the same principle as the klystron, but the "bunching" of the electrons in the beam is achieved by a continuous helix surrounding the beam. The magnetron oscillator, though capable of delivering large outputs, has not found great use in telecommunications.

From this brief review, it will be seen that the thermionic valve has developed into forms which are almost unrecognizable when compared with the first diodes. In addition to the development of the several functional types, diodes, pentodes, kitrons and the rest, each type has been subject to varying degrees of specialization.

For example, the pentode valve has been produced in miniature and sub-miniature form, the latter for use in hearing-aid appliances. Reliable pentodes have been produced for use under conditions of mechanical vibration, and long-life pentodes have been produced for use in telephone repeaters submerged on the bed of the ocean. The pentode has been made non-microphonic and has also been specially designed for use in the output circuit of power units. This specialization has been most complete in the case of the older functional types, but it is also happening in the newer types.

It is difficult to predict what the future holds in the way of new development. It is possible that, faced with the challenge of the transistor at the lower frequencies, development in the thermionic valve will tend to concentrate on forms suitable for higher frequencies. It is certain that the potentialities of the thermionic valve are by no means exhausted.

Trunk Fee Billing in Lisbon

L. A. W. da Costa

Companhia dos Telefones, Lisboa

SIR,—AS REVENUE ACCOUNTANT OF A BRITISH telephone company operating abroad I have followed with interest the Canterbury experiment described in the article entitled "The Mechanization of Trunk Fee Accounting", your August October issue, and as we have had some experience on the same matter I wonder if I could encroach on your space and put forward our own findings.

In our billing here we have to meet yet another complication, namely, the existence of toll calls within an area some 12 miles in radius of city boundaries. This type of call is handled manually and ticketed, the operators not only writing the called number but also pricing the call. The number of these calls is not far short of 2 millions per month.

Situated as we are, we feel it desirable to give our public every facility for checking what is being charged, and in the old days this led to laboriously posting up hand-written statements showing date, destination and cost of each call. I recall that this was a long time ago when traffic was one-tenth of the present level. However, even then, and in spite of a large staff, it was a difficult job keeping the work up-to-date, but still more disturbing was the prospect that unless something drastic were done staff would have to increase practically in direct proportion with the growth of traffic. We found the solution and it is so simple that I imagine you may be interested in publishing it.

Our method is first to sort manually the tickets into originating telephone order, add them up on non-print adding machines, transfer the totals to the bills and *supply the tickets to the subscribers*. Of course this presumes that necessary traffic counts are made before the tickets are sent to the billing organization.

When we first thought out the implications there were some who wagged their heads and murmured that dishonest subscribers would wreck the scheme. Others held that the packing and despatch of bulky packets of tickets would also be a difficulty. I am in a position to say that in practice these objections were not realized.

Very, very few subscribers are purposely dishonest, at least in their relations with the telephone company, and addressograph plates, with a special type of paper sack, overcame the vast majority of despatching troubles. It is of interest to mention that, many years after this system was in force, we read of one of the independent companies in the States using a similar scheme.

Now to turn to long-distance calls. The set up here is that these calls are connected manually and ticketed in a trunk exchange belonging to a different entity from ourselves. Our part in the affair is to supply connection facilities between our subscribers and the trunk exchange and to collect the call fees from our subscribers, paying over the total sum to the entity in question. To enable us to bill subscribers we receive the tickets daily and have to return them within a specified period to the trunk exchange; in other words we are not in a position to hand them over to our subscribers.

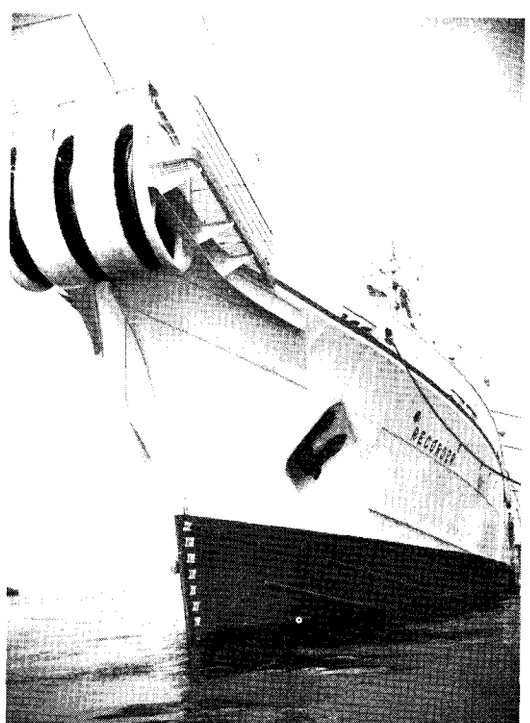
Originally the tickets were hand-sorted and posted manually to statements giving date, destination, type of call, duration, simple value of call and a surcharge fee. The only machine work was the addition of values for posting to the bill. All this was a slow and unsatisfactory job, so we decided to put the work on punched card machines. It is hardly necessary to mention the teething troubles and disappointments at first experienced, but once this phase was over we found the punched card system an improvement in accuracy, legibility and cost over the manual system. Yet it still was not good enough. To cut a long story short, we finally changed from punched card to typewriter-cum-register accounting machines of a standard make, and this is how matters stand at the moment. We can also say we are satisfied with the change.

It may be of interest to explain why we found the punched card system was not quite the best for this particular kind of work. In the first place it was found possible for the trunk exchange, without further labour, to send us the tickets already sorted by originating telephone number order; consequently the sorting advantages of a punched card system were no longer of such weight.

Needless to say, this circumstance is peculiar to our work and has no place in a normal appreciation of punched card versus other methods. But apart from this, we found that the time required for closing the statements, i.e. the interval from receipt of the last day's tickets to the inclusion of the statements' total in the bill, was considerably longer when using the punched card system. The interval could have been reduced, but at a price.

A second important factor was the cost of the cards. The third reason was the cost of punching and tabulating. It seems inevitable that where the information has to be recorded twice—once by punch operators on to cards and again by tabulators to subscribers' statements—that there will be an increase in cost as compared with a system by which the information is posted direct to the subscriber's account. In this respect the mark sensing used with the Canterbury experiment appears a clever method of partially meeting the difficulty.

Please forgive the length of this letter, but I would submit that both in respect of public relations and cost, this matter of trunk fee billing is not the least among telephone administration problems.



C.S. "Recorder" shows her bow sheaves: Cable & Wireless Ltd.'s new repair ship, 3,300 tons

The Function of the Advice Note

R. M. Watson and R. W. Clarke

Inland Telecommunications Department

THE ADVICE NOTE IS THE MULTIPLE COPY document on the authority of which the Post Office performs and brings to account its work in providing, removing and ceasing telephone and telegraph facilities for its customers. It is one of the most important and costly items of stationery in use by the departments concerned and although officers handling Advice Notes are familiar with the appearance and function of the copy or copies proper to their duty, little is known generally about the amount of thought and labour that go to designing and making up the complete pack.

To obtain some idea of the number of copies required and the information that must be conveyed by them, it will be useful to look at the simple example of the provision of a new direct exchange line to be connected to an automatic exchange in the provinces.

When the customer has agreed to rent the line and the work is to be put in hand, the Sales Division of the Telephone Manager's Area issues an Advice Note. Normally, there will be eight copies of the Note each containing the instructions necessary and common to them all, but with such differences of design and arrangement as will enable the particular function of each to be carried out.

The instruction is typed on the top copy and duplicated by means of interleaved carbon paper. Figure 1 illustrates a typical top copy Advice Note.

In the example quoted, the pack contains the eight copies in the following order:—

Copy	*For*	*Function*
(1) **Office White**	Sales Division	Library or reference copy.
(2) **Pink**	Engineering Installation Control and Exchange Supervisor	Connection of the new line to the automatic equipment, initial reading of the subscriber's call meter and then to the Exchange Supervisor for advice that the new line has been provided.
(3) **Blue**	Engineering Installation Control, and Accounting	Engineering master copy — certification of completion of engineering work. Accounting.
(4) **Buff**	Engineering Fitter	Provision of apparatus at subscriber's premises.
(5) **Green**	Engineering Installation Control	Control copy on which is recorded the movement of other engineering forms.
(6) **Foreman's White**	Engineering external construction foreman	Provision and proving through of external line plant.
(7) **Yellow**	Exchange maintenance engineer	Testing of completed circuit, and preparation of fault cards.
(8) **Exchange White**	Exchange Supervisor	Preparation of directory enquiry records.

If the new line is to be rented by a business subscriber, an extra green copy is prepared, and the Sales Division sends this to the telephone directory advertisement contractors, who prepare from it an appropriate entry in the official Classified Directory which they issue.

When all the engineering work is completed and the line opened for service, the Sales Division associates the blue and pink copies with their certificates of completion from the Engineers and Exchange Supervisor and sends them to the Chief Clerk's Division, where they are filed after arrangements have been made to bring the new circuit to account. The other copies are eventually filed in the Sales Division.

In addition to the provision or cessation of an exchange line, for which an 8-copy Advice Note pack is normally issued, the Post Office has to provide many other facilities requiring the issue of an Advice Note as an authority to carry out the

necessary work. For these transactions (for example, the provision of private wires, internal and external extensions, extension bells, alteration to Post Office telephone records and subscribers' accounts and transfer of telephone service from one subscriber to another) it is not always necessary to issue Advice Note packs containing all the engineering or exchange copies. There are other transactions, however, such as the provision of circuits that affect more than one Telephone Manager's Area, where it is sometimes necessary to issue two or more duplicate Advice Note Packs.

Apart from the functions already outlined, Advice Note copies have secondary functions largely concerned with initiating and bringing up-to-date various records that are maintained as part of the Telephone Manager's organization for provision and maintenance of service, and circulation is arranged accordingly.

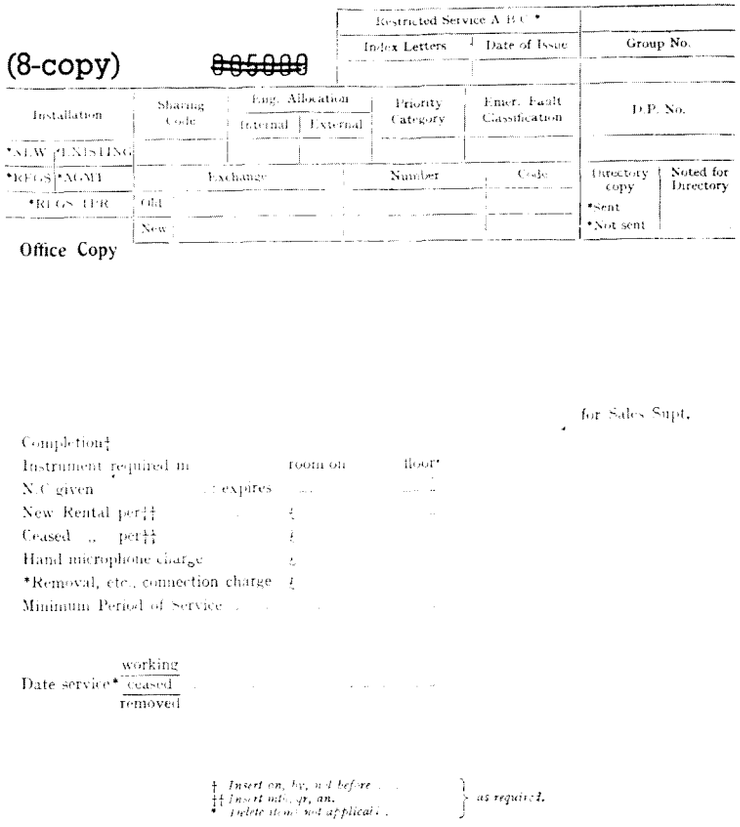


Fig. 1. Typical top copy Advice Note

The Advice Note as it is today has been used without fundamental change for some 20 years, but as the business of providing telephones has become more and more complex, so additions and rearrangements have been made to the form with the result that it is now greatly congested and difficult to understand and handle. This has been realized for some time. In 1949 a committee examining the Telephone Managers' Organization for the Provision of Service made a study of Advice Note procedure in this and other countries and recommended that a small working party of specialists should examine the problem in greater detail.

In 1951 a full-scale investigation was undertaken into the design, production and circulation of Advice Notes. The investigators reported that the current Advice Note was basically sound, that it would not be practicable to produce it by means other than by the typewriter-carbon process, but that much could be done to improve and simplify the lay-out of the individual copies. Some of the recommendations were adopted immediately and others have been the subject of exhaustive practical tests in the Nottingham and Portsmouth Areas, where an interesting experiment to test the value of a new Advice Note incorporating the improvements suggested has been in progress for more than two years.

One major criticism levelled against the Advice Note is that the typescript instructions on the lower copies in the pack are faint and difficult to read. Using a new sheet of carbon paper before

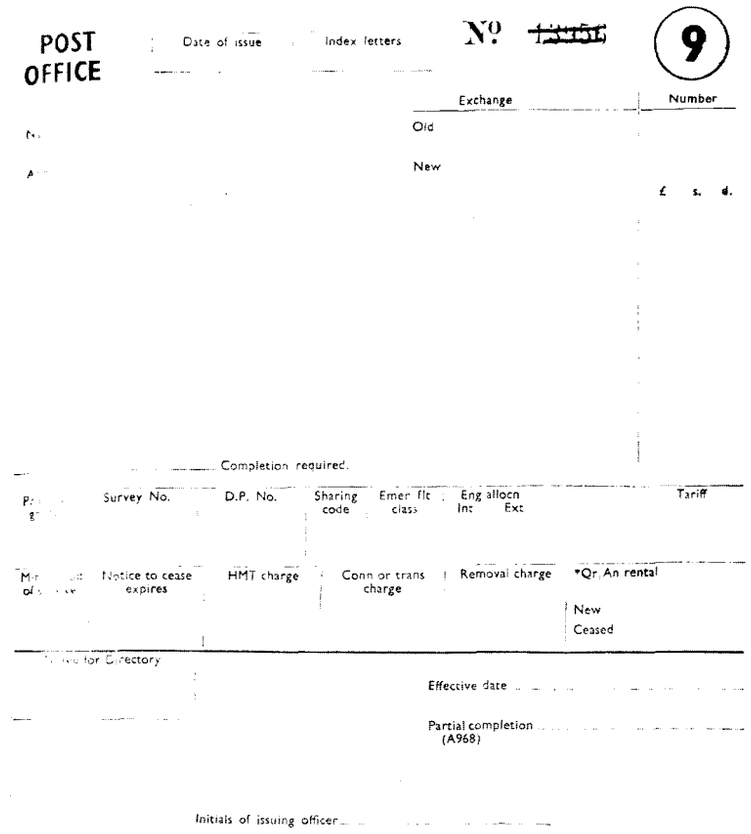


Fig. 2. Lay-out of new Advice Note

the last copy brought an improvement, but greater benefit has resulted from the use of "one-time" (so called because it is used once and then discarded) carbon tissue in the packs. This tissue is pre-interleaved by the contracting printers, a process saving a good deal of time and unpleasant work in the Telephone Manager's office. The carbon area of the tissue extends only as far as is necessary to print the common instructions through to each copy in the pack and is subsequently removed *en bloc* by a sharp pull on the uncarboned portion of the tissue at a cut corner of the forms.

It has been found in practice that, using a typewriter with clean fount (preferably "Pica") against a glass hard platen, it is possible to produce up to nine good and clear copies with manual typewriters. With electric typewriters, on which the required pressure can be pre-set, up to 15 or 16 good copies may be obtained without fatigue to the typist. Electric typewriters are now manufactured in Britain and have been provided for typing Advice Notes in all Telephone Managers' offices.

The lay-out of the forms has been simplified as a result of the field trials at Nottingham and Portsmouth. As far as possible, each piece of information has its own boxed area which is similar in size and position on all forms making up the pack, and the Advice Note can be typed throughout with a fixed platen, thus tending to decrease the time taken in typing. The lay-out of the top copy of the Advice Note shown in Fig. 2 will be introduced in all provincial areas in April, 1955.

An innovation in the new pack has been the introduction of a further copy, a need for which has developed largely because of the increasingly complicated engineering processes involved in providing service. This copy, an "Engineering Red", will serve as an instruction to the engineering survey officer to carry out his work if necessary and to the engineering officer who has to make the wiring connections in the exchange. A copy of the Advice Note for this purpose reduces the number of manuscript and verbal instructions that the Advice Note Control has to prepare and issue. The new copy also permits the Control to plan its installation work knowing that the preparatory work in the exchange is complete.

With the introduction of the red copy, the new provincial Advice Note will be made up in 9-copy, 6-copy and 5-copy packs. The 6-copy pack will

be used for work where the buff, foreman's white and green engineering copies are not required; the 5-copy pack where the pink, exchange white, foreman's white and red copies are not required; and the 9-copy pack where the smaller packs are inappropriate.

As the size of the Advice Note is limited, it is not possible to allow much space between item and item. Thus, accurate registration of the printed matter throughout the pack is all-important. Some of the older packs were very poor in this respect, some items being as much as a quarter of an inch out on different copies. With the co-operation of all concerned, much has been done to improve this and poor registration should now be a complaint of the past.

Fig. 3 is a flow chart showing the circulation of a 9-copy Advice Note for the provision of an exclusive line in an automatic exchange area. Other packs will circulate similarly, but there will be slight modifications, depending on the job in hand and the type of exchange area.

The processes in London have necessitated an Advice Note somewhat different in content and circulation from its provincial counterpart. For this reason, study of the London problem has been postponed until enough experience has been gained in the provinces to point the way to a unified national Advice Note and procedure acceptable under all conditions.

CIRCULATION OF A 9-COPY ADVICE NOTE FOR PROVISION OF AN EXCHANGE LINE IN AN AUTOMATIC AREA (JUMPER OFFICER UNDER THE CONTROL OF THE INSTALLATION CONTROL)

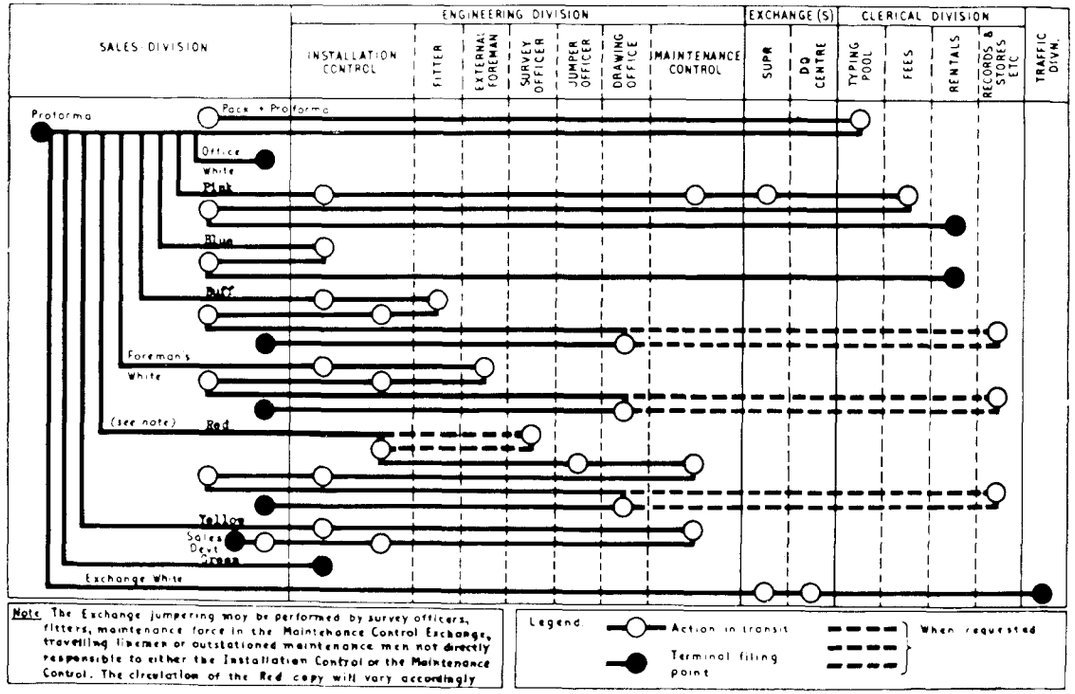
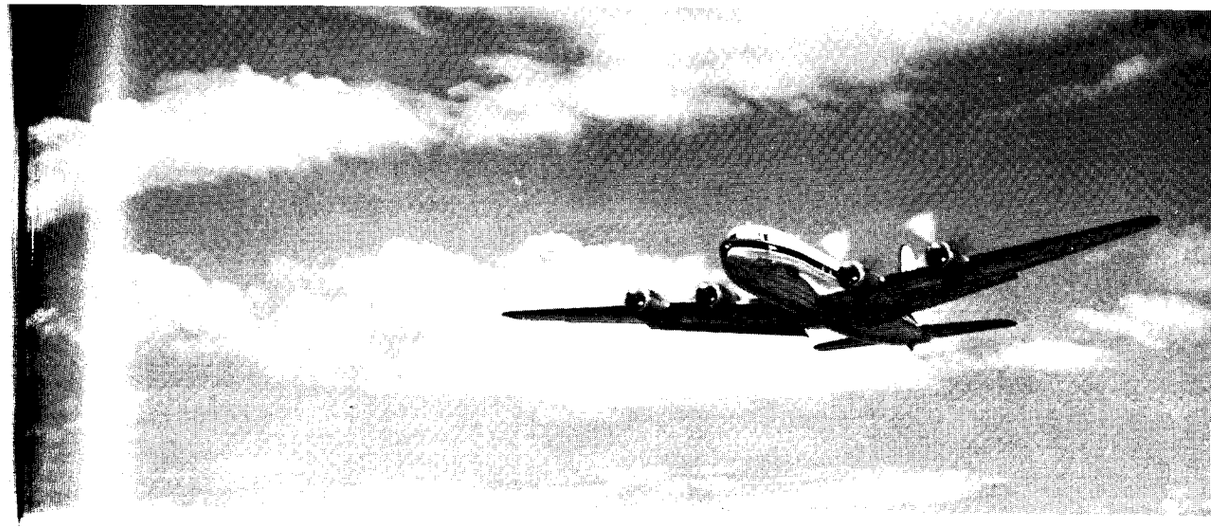


Fig. 3. Flow chart of a 9-copy Advice Note for an exclusive exchange line in an automatic area



New Exchange for Overseas Airways

Lieut.-Col. J. C. Rowe, T.D.,

Deputy Telephone Manager, West Area, London

THE BRITISH OVERSEAS AIRWAYS CORPORATION have been closely associated with London Airport ever since it was opened, and their t phone communications were originally devel- d as part of the Ministry of Civil Aviation's a port system. The role of the Ministry (now the M inistry of Transport and Civil Aviation) was a logous to that of landlord, with the various o rating air line companies as tenants. Telephone s vice for all the companies was provided by e tensions from a P.M.B.X. 1A switchboard, s ffed and controlled by the Ministry who acted v tually as agents for the Post Office in this matter. This had certain advantages, because one of the c iculties of the Post Office has always been the p vision of direct exchange lines from the con- s erable area covered by London Airport to c hanges designed and built long before the A rport existed. The area is divided between four c hanges—Ashford, Feltham, West Drayton and I ves—although it is soon to be served by its own c hange, Skyport. None of these exchanges could c pe with the London Airport traffic as a whole, s the Ministry switchboard was therefore c nected, out-of-area, to Hounslow.

With the passage of time, the Corporation became the largest subscriber on the Ministry switchboard; indeed, by early 1952, their rented extensions exceeded those of the whole of the other air line companies and the Ministry put together. The question of "service" then became acute. B.O.A.C. took the view that service through an agent, the Ministry, did not meet their requirements and they wanted their traffic, in particular their incoming calls, handled on a personal basis. They felt that they could get this personal service only by having their own switchboard, and their own staff trained to handle their problems and theirs alone. The Post Office could not arrange this for some time, but a 16-position P.M.B.X. 1A switchboard was eventually provided for the Corporation in their own accommodation, in November, 1952. It must be admitted that there was a very strong case for separation, apart from the desire for "personal" service, because the Ministry board had long outgrown its normal design and various expedients had become necessary to extend it to cope with some 1,400 extensions.

Then came a new development. An enormous

hangar, with considerable office accommodation, was designed for the Corporation within the airport boundaries near the Great South West Road. The Corporation intend to concentrate as many of their staff as possible in this building—not only those already at London Airport, but also those from various outstations and their headquarters at Airways House on the Great West Road.

The Post Office was able to serve this building from the new Skyport exchange either by direct exchange lines or by a P.M.B.X. or by a P.A.B.X. The Corporation decided on a P.A.B.X. No. 3, and they wanted to bring it into use as soon as even a part of the new building became inhabitable. Unfortunately, the Skyport exchange project has been delayed and we still have the position that the Corporation is being served out-of-area on Hounslow until the new exchange opens early in 1956.

In the beginning, 800 extensions (internal and external) were needed, with 11 manual board positions; to be increased by 500 extensions and 3 positions by January, 1955.

The problems were considerable. As service was needed as soon as the first staff went in, installation and cabling had to be carried out simultaneously with the building operations. Not unnaturally in a project of this size all sorts of things went wrong. The building suffered serious delays, the weather was bad, there was an electricians' strike, moves of staff were deferred or accelerated, there were labour and accommodation difficulties, heating was sketchy, and it was almost impossible to dry the building. The absence of electric power and lifts, for example, meant that the P.A.B.X. equipment had to be hoisted into the building by a rather unusual process: an external 90-foot crane picked up the load, got it swinging to and fro, and then dumped it on to a ledge at the critical moment. The equipment stood up to this somewhat harsh treatment, and also to being subsequently stored in a damp building. As cabling for all external extensions was not released at the outset, the Post Office had to make arrangements so that service could be given from either the existing P.M.B.X. or the P.A.B.X. As these two installations were over a mile apart, and most of the extensions were in buildings close to the P.M.B.X., the question of transmission was important, particularly as the cable routing had to conform to the ultimate cable scheme (*via* the Skyport site) as closely as possible.

The cut-over to the P.A.B.X. took place on July 17, 1954, with 28 internal extensions and 580 re-routed external ones. Since then an increasing number of internal extensions has been provided, and on October 5, 1954, when Sir Miles Thomas, D.F.C., Chairman of the Corporation, officially opened the new system, there were 135 internal and 600 external extensions. Eventually, of course, most of the extensions will be internal.

Following is a brief technical description of the equipment, which was installed by the Automatic Telephone and Electric Company.

Facilities

Internal Calls.—Inter-departmental calls are made direct by dialling the required extension number.

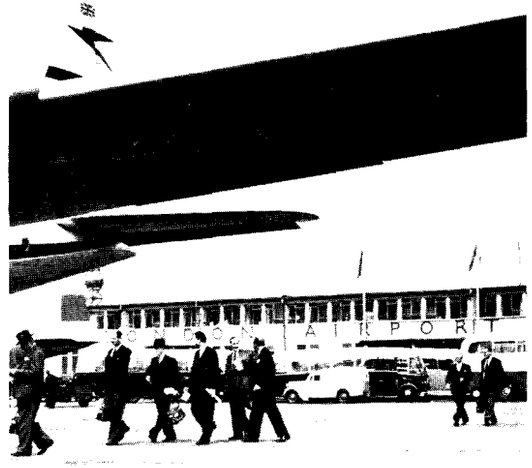
Incoming Exchange Calls.—Calls incoming from the public exchange system are received on the P.A.B.X. manual switchboard and connected to the required extensions by an operator.

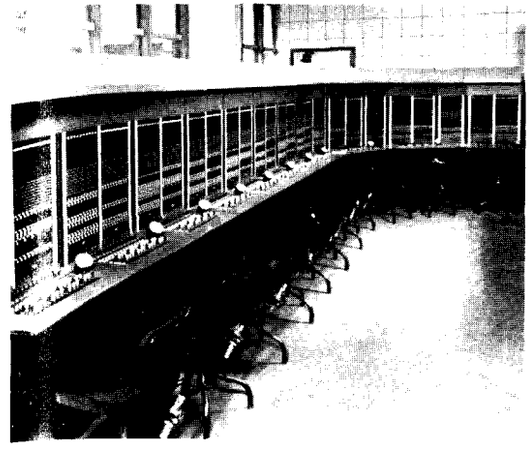
Call-Offering.—If an extension is engaged on an internal call the operator can, if necessary, enter the connection to offer an incoming public call.

"Follow-On Call" Guard.—Provision has been made to eliminate the possibility of an incoming call being incorrectly routed to an extension which has just vacated a public exchange line, should that line be re-seized at the public exchange before the P.A.B.X. operator has disconnected.

Direct Access.—Outgoing local calls to the public exchange system are obtained by dialling

Passengers walk towards a B.O.A.C. aircraft at London Airport (*By courtesy of B.O.A.C.*)





The manual switchroom at B.O.A.C. headquarters (*By courtesy of A.T.E. Co.*)

the single digit 9 followed by the required subscriber's number.

Direct Access.—Local calls may also be made to the public exchange system by dialling O. This calls the P.A.B.X. operator, who obtains the desired number. Trunk and toll calls can be obtained only in this way.

Barred-Access.—Direct access to the public exchange system may be withheld from particular extensions. Such calls from these extensions can only be made via the P.A.B.X. operator.

Through-Clearing.—Timing of a toll or trunk call ceases on replacement of the handset of the P.A.B.X. extension telephone from which the call originated.

Hold-for-Enquiry.—This facility enables extensions to obtain information from other departments. A button on the extension telephone is pressed once to hold the exchange call while an internal extension is dialled. The button is pressed again to re-establish connection with the original call.

Operator Re-Call.—When engaged on a public exchange call an extension user can, by pressing the button on the telephone twice, bring the P.A.B.X. operator to his assistance to give information or transfer the call to another department.

Inter-Switchboard Facilities.—The Corporation P.A.B.X. is connected to other private branch exchanges, enabling the separate premises of the organization to be linked without using the public telephone network. Calls to these private branch exchanges may be handled *via* the automatic equipment or by the P.A.B.X. operator as desired.

Enquiry Desk.—General enquiries are routed to a special enquiry desk.

Supervisor's Desk.—Monitoring and assistance facilities have been provided for the supervisor.

Manual Extensions.—A number of manual extensions has been provided to give priority and preferential service to high executives.

Manual Switchroom

The switchroom lighting is particularly interesting. Fluorescent tubes are fitted over the operating positions, and heavy screening in the lower part of the canopies allows a small amount of light to be projected downwards over the multiple. The canopies are open at the top, and the rest of the switchroom lighting is reflected from the ceiling. There is virtually no natural lighting, as the windows are internal only. The general effect in the room as a whole is rather dull, but the light is excellent for operating. The Supervisor's and enquiry desks have shielded table lights, but auxiliary ceiling lights may be fitted later. The room is fully air-conditioned and the ceiling and walls are acoustically treated to an unusual extent to reduce reverberation and the effects of external noise.

Operating Positions

Each position of the P.A.B.X. manual board is equipped with 15-cord circuits, and has a jack and lamp field of two panels. A complete multiple covers two positions, and the four panels can accommodate 1,600 extension lines. Detachable panels at the rear of the board enable inspection or maintenance without interruption of the service.

Free Line Signalling

The first free line is indicated by the illumination of a green lamp. When lines are taken into service by extensions dialling the appropriate code—for example, 9 for exchange line—or by the P.A.B.X. operator, or by any incoming call, the associated lamp is extinguished and the next free line is indicated.

This facility is supplied on each group of exchange lines and inter-switchboard circuits.

Automatic Switching Equipment

A four-digit numbering scheme has been used. The digit 9 is employed for connecting extensions to the public telephone exchange system, and the digit 0 for the manual switchboard. Other single

digits are used for connecting extensions to inter-switchboard lines.

Racking

The automatic equipment is mounted on open type racks, 7 feet 6 inches high, wired for 1,300 extensions (800 initially, plus 500 on first extension).

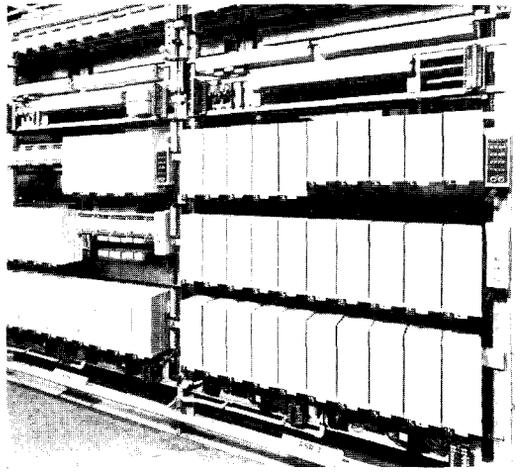
All the equipment is mounted on the front of the racks, and, with few exceptions, the wiring and cabling are taken to the rear to give maximum accessibility. Each rack is a self-contained unit, and each item of equipment has an individual dust cover. The majority of the equipment is of the jack-in type, to facilitate inspection and maintenance.

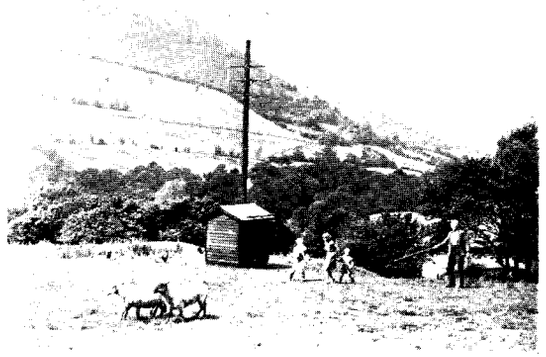
Standard "dial", "ring", "engaged" and "number unobtainable" tones, and ringing current, are provided by ringing machines.

Protection of Service and Equipment

The circuit arrangements are such that if a fault should develop in a selector, extensions are not thereby prohibited from making calls. If a handset is incorrectly replaced, or if a line fault develops, the automatic equipment thus 'held' is released and again made available for general use. Automatic alarms indicating the nature and location of faults are extended to the manual switchboard to receive attention. The automatic equipment and the line circuits are protected from the effects of sudden or sustained excessive currents and high voltages.

Part of the automatic equipment at B.O.A.C. headquarters
(By courtesy of A.T.E. Co.)





Farm terminal

Overland V.H.F. for Welsh kiosk

C. T. Lamping, A.M.I.E.E.
Wales and Border Counties

THERE ARE MANY DISTRICTS IN WALES WHERE, although a telephone kiosk could be a great boon, the cost of connection by normal poles and wires is so great that it is almost out of the question. In many places the exposed terrain may increase the cost of maintenance alarmingly. For these reasons battery operated very high frequency radio circuits are coming into use. The first of these links was recently put into service near Abergavenny in South Wales and as the first link entirely "overland", this may mark the beginning of a new approach.

A kiosk was asked for at a tiny hamlet called Capel-y-Ffin, which is at the head of a quite narrow picturesque valley. In the immediate neighbourhood are only a few houses and farms, a church, a chapel and a monastery now used as a youth hostel. In summer, and for the fishing, quite a number of visitors spend holidays there.

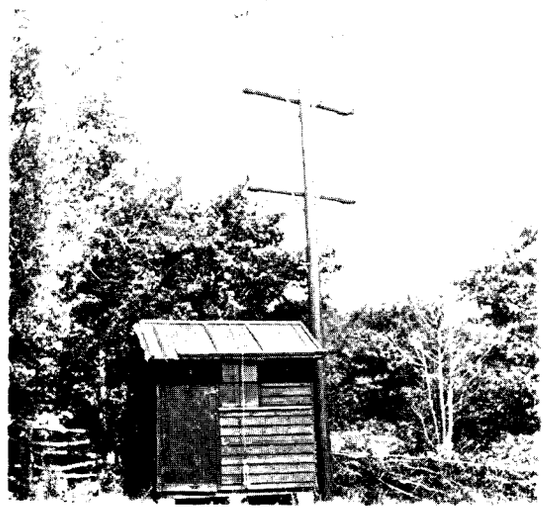
It would have been very expensive indeed, even with the most modern methods and mechanical aids, to have arranged a wired circuit for this kiosk, as the nearest exchange is Llanfihangel-Crucorney, 12 miles away. At first sight it seemed that radio would not be possible because the valley has a very bad bend in it; with the very high

frequency radio systems of the type developed for this purpose it should normally be possible to see from one point to the other.

It was finally established that radio at about four metres wavelength could be used for two-thirds of the distance, provided the aerials were on high ground, which fortunately was possible at each end, and that wires or poles already erected for another kiosk nearby could be used for the remaining distance to the exchange. This saved more than £1,000 and released overhead gang staff for work elsewhere. The picture shows the hut and aerials at the distant end, the kiosk being about 200 yards away.

It was a horrible shock when the permanent aerials and equipment had been installed to find that all that could be heard was a continuous series of very severe clicks. We found that a tractor in a nearby field was causing interference on the radio circuit. Fortunately with a careful "line-up", a very much greater speech signal was obtained with no interference from the tractor. Nevertheless, every tractor in the district likely to cause interference now has a suppressor fitted.

At each end there is a receiver and a transmitter. When the telephone instrument is lifted the transmitter sends a signal. At the other end, the receiver has been so arranged by the "backroom boys" of Dollis Hill and Castleton, that for two seconds in every half minute, it is automatically switched on and "listening". If the signal is received it stays on until the call is finished. This saves batteries but does mean that you may have to wait an average of 15 seconds when starting a call. All the valves are special economy types, and no "wet" batteries are used.



Capel-y-Ffin terminal

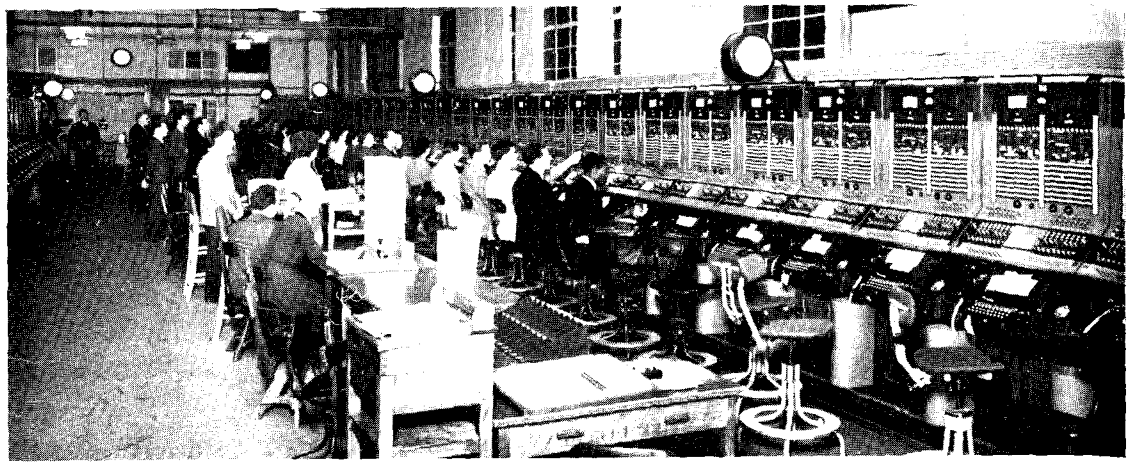
Kiosk at Capel-y-Ffin

Although Scotland has several of these links in use for communication with some of the Western Islands, this Capel-y-Ffin link may be the predecessor of many overland ones, and in due course the major use to which they are put may be for serving odd remote subscribers, and particularly kiosks, where future line development cannot be foreseen. For tiny isolated communities it may even be desirable to develop a system which although cheap, easy to maintain and battery operated, can handle more than one message at a time.

* * *

Bransdale, one of the loneliest dales in the North Riding—some of its isolated farms, which are often cut off by snow in winter, are six or eight miles from the nearest telephone—is also to have an overland V.H.F. radio link to establish contact with the nearest exchange.

"Only a radio link could be used", says Col. H. Slingsby, Chairman of Kirbymoorside Rural District Council, according to the *Yorkshire Post*. "A telephone line over those moors would probably be out of action when it was needed most—in gales and snowstorms."



The New Telex Service

F. G. Phillips

Inland Telecommunications Department

THE NEW TELEX SERVICE MENTIONED IN OUR last issue was opened on November 15, 1954. In numbers of working lines it is already the third largest system of its kind in the world, only the United States and Germany having more subscribers.

The new service replaced the old "telephone-telex" service which was opened in 1932 and operated over the public telephone exchange system. Each subscriber rented a teleprinter, using a telephone to set up the telex connection. When communication was established, the teleprinter was switched in at each end and messages transmitted by printed word.

The service had certain draw-backs and its development was slow. It had fewer than 1,000 subscribers when it closed down, and, since full inter-communication between all subscribers was not technically possible and full telephone trunk rates were charged for telex calls, the volume of telex traffic was extremely small; each subscriber made on average only one trunk call a week. The printergram facility, however, by which telegrams could be handed in and received by telex, was used considerably.

The Telex Development Study Group, set up in 1947 to determine the future of the telex service, concluded that the "telephone-telex" system failed to meet the needs of commerce and industry, and recommended the introduction of a new (telegraph) telex system which would provide facilities for making and receiving both inland and international calls. This meant that the international telex service, which was described in the November-January, 1953-54, issue of the *Journal*, would be integrated with the inland service. The new system was opened experimentally in August, 1952, for civil Government departments; altogether, 13 ministries, with a total of 350 lines, have been connected to it, thus enabling the Post Office to obtain useful operational experience of the new system before transferring commercial subscribers.

The rental for the old inland telex service was £75 a year for the teleprinter, plus the normal exchange line rental. For the international service, for which a separate line (and usually a separate teleprinter) had to be rented, different charges were made in London and the provinces. In London, the rental was £75 for the teleprinter, plus Tariff B private-wire rental for the exchange line, the average inclusive figure being about £90. The service was not extended to the provinces until late 19[illegible], and here an inclusive charge of £160 was made.

A provisional tariff rental of £160 for the new "combined" service was fixed for Government departments in 1952. The whole tariff structure was carefully reviewed in the light of practical experience before the service was offered to commercial users, but it was decided that the rental should continue at this figure.

This decision involved a heavy increase in rental for all subscribers other than "international only" users in the provinces. The new rental covers the teleprinter with sound-reducing cover, table and associated equipment, the exchange line, and free calls to printergrams and Post Office Cable and Wireless offices (for which the previous charge was 1[illegible] a call). The use of telegraph instead of the more expensive telephone circuits allowed a reduction in telex trunk call charges and over the longer distances these are now approximately half the corresponding telephone rates, the maximum being 2s. 0d. for three minutes for any distance over 125 miles.

An attempt has been made to bring the new tariff into line with modern costs, which have shown a continuous upward trend since the war, and now are more than double the pre-war level. The main aims in establishing the new tariff were to fix the rental at an economic figure, and to set call rates at a level which would encourage the growth of traffic and stimulate development.

In the telephone service, call charges are measured from the subscriber's local telephone exchange. For the measurement of telex call charges, however, the country has been divided into 50 charging areas, which are, in the main, co-terminous with Telephone Managers' Areas. The principal exception is in London where the London Telecommunications Region forms a single charging area. In each of these areas, one town (usually the Telephone Managers' office town) has been nominated as the telex centre or call-fee measuring point. Calls between subscribers in the same charging area are charged as "local" (2d. a minute, minimum 6d.); calls between subscribers in different charging areas are based on the distance between the telex centres of the two areas concerned.

The country is divided into six zones for call routing purposes. Each provincial zone has a distinctive initial digit and this appears in the routing codes allotted to the charging areas within the zone. Thus, the Glasgow zone is identified by the digit 7, and the routing codes for its charging areas are: Aberdeen 73, Dundee 76, Edinburgh 72, Glasgow 77, Inverness 75 and Belfast 74. Each subscriber has a telex number comprising a routing code (which identifies the charging area in which he is situated for call routing and charging purposes) and a switchboard multiple number, the two being separated by a hyphen; no exchange names are used. Thus 33-123 would be a subscriber in the Birmingham area, 77-123 a subscriber in the Glasgow area and so on.

The schemes of charging areas and "national" numbers were introduced to simplify routing and

Inland Telex Exchange in the Central Telegraph Office, London. The suite (right) comprises 40 switchboard positions; (left) part of a new suite of 32 positions can be seen. Eight enquiry positions and ticket-pricing and sorting tables are (centre) between these suites.

																33	34	35	36	37	41	42	43	44	45	46	47	48	49	51
33	6	6	8	6	6	5	5	8	8	8	8	8	6	3	5															
34	6	5	6	6	6	5	5	6	6	8	8	6	8	3	4	3														
35	8	8	8	6	8	6	6	8	8	8	8	8	8	5	6	4	5													
36	8	6	8	6	8	6	6	8	8	8	8	8	8	5	6	4	5	3												
37	6	5	6	6	6	6	6	8	6	8	8	6	8	4	4	4	3	5	4											
41	6	8	8	5	5	6	6	6	6	6	8	8	3	6	8	6	8	8	8	8										
42	8	8	8	6	8	8	6	8	8	8	8	8	6	8	8	8	8	8	8	8	5									
43	6	6	8	5	6	6	4	6	8	6	8	8	6	4	6	4	5	5	6	6	6	6								
44	[illegible]	8	8	5	6	6	5	6	8	6	8	8	6	6	8	6	6	6	6	6	5	5	3							
45	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	6	4	8	6						
46	8	8	8	6	6	8	6	8	8	8	8	8	6	6	8	6	8	6	8	8	5	3	5	4	5					
47	5	6	8	4	4	6	5	5	6	5	6	6	3	6	6	6	6	8	8	8	3	6	6	5	8	5				
48	8	8	8	8	8	8	6	8	8	8	8	8	8	6	8	6	8	6	6	8	6	5	5	5	6	5	6			
49	8	8	8	6	6	6	6	8	8	8	8	8	6	6	8	6	6	6	6	8	6	5	4	3	6	3	6	3		
51	8	8	8	8	8	8	8	8	8	8	8	8	8	6	6	6	6	6	5	5	8	8	8	8	8	8	8	8	8	

Call Charges, November, 1954

Telex call charges are calculated from the prefix figures of the calling and called subscriber's numbers. The table, a portion of which is shown here, shows the charge in pence per minute according to the prefix figures in darker type.

Calls between subscribers with the same prefix figures are at the rate of 2d. a minute. Charges for calls from subscribers whose numbers have no prefix are calculated as for prefix 2.

All calls are charged for a minimum of three minutes and minute by minute thereafter.

charging arrangements on the manual system and so far as possible to facilitate the conversion of the system to automatic working, with subscriber trunk dialling, at a later date.

To enable a smooth change-over to the new numbering scheme, the numbers of the 350 Government department lines were changed a month before the main transfer of commercial subscribers. This gave the switchboard operating staff an opportunity to become familiar with the new system before the transfer. The scheme has worked well, and has simplified the process of routing calls, since this can now be done without the use of visible index files. Ticket-pricing work in exchanges is simpler too, since a charge table showing call rates between any two of the 50 telex centres is all that is required. This charge table is printed in the preface to the telex directory to enable subscribers to calculate their own call charges, and so avoid the need for "advice of duration and charging" (A.D.C.).

Thirteen new manual exchanges with a total of 40 switchboard positions were installed for the service when it was opened in 1952 for Government departments. Most of these were extended to cater for the increase of traffic expected from commercial subscribers, and three new exchanges were added. The total number of switchboard positions installed now, including the International exchange in London, is 180, and a growth to nearly 300 positions is expected in five years. These exchanges are interconnected by a network of voice frequency (V.F.) telegraph circuits, an additional 250 of which were provided for the transfer, and tested out in advance. The majority of provincial exchanges have been provided with a direct route to the International exchange in London to facilitate rapid handling of international calls to and from provincial subscribers.

In towns where there are not enough telex lines to justify a manual exchange, it is proposed to install automatic sub-exchanges. (At present subscribers in these towns are connected to the nearest telex centre.) The automatic sub-exchanges—18 will be installed—have been designed to serve groups of up to 20 subscribers. These subscribers share a route of up to 10 junctions to a "parent" manual exchange, at which all calls originated from the sub-exchange (including "local" calls) are controlled. The subscriber makes a call in the

Zone indicator	Zone	Zone Centre routing code	Routing Codes of other charging areas within zone	
1 and 2	London	2	10 Cambridge 11 Norwich 12 Reading 13 Guildford 14 Luton 15 Oxford	16 Tunbridge Wells 20 Southend 25 Brighton 26 Canterbury 27 Colchester 29 Portsmouth
3	Birmingham	33	31 Coventry 32 Peterborough 34 Leicester	35 Shrewsbury 36 Stoke-on-Trent 37 Nottingham
4	Bristol	44	41 Bournemouth 42 Exeter 43 Gloucester 45 Plymouth	46 Taunton 47 Southampton 48 Swansea 49 Cardiff
5	Leeds	55	51 Bradford 52 Hull 53 Newcastle 54 Sheffield	56 Lincoln 57 York 58 Middlesbrough
6	Manchester	66	61 Chester 62 Liverpool 63 Blackburn	64 Carlisle 65 Lancaster 67 Preston
7	Glasgow	77	72 Edinburgh 73 Aberdeen 74 Belfast	75 Inverness 76 Dundee

Zone Plan

New suite of printergram positions in Central Telegraph Office, London, which serve the new telex system; all telegrams to and from subscribers in London and the Home Counties are handled here

ordinary way by depressing the "call" button on his signalling unit, but provision is made for special signals to be received on his teleprinter where "junctions engaged" or "junctions O.O.O." occurs. These are the "LTRS" signal transmitted at intervals of $\frac{1}{2}$ and $1\frac{1}{2}$ seconds respectively. On incoming calls, individual lines are selected by the parent exchange operator by dialling the last two digits of the subscriber's number.

Some 14 telegraph offices in the country are nominated as "printergram centres": that is, they are equipped to handle telegrams to and from telex users by teleprinter. It was necessary to install the new type of telex equipment (similar to that provided for subscribers) at each of these centres, and a total of 130 new teleprinter positions were fitted and tested out before the transfer commenced. Each printergram position is linked to the telex manual exchange which, in all cases, is located in the same building as the printergram centre.

As soon as the tariff structure for the new service had been settled, all subscribers to the "telephone-telex" service were visited, and asked to accept transfer to the new system. These visits were made by officers from Area Sales Divisions, except for the cable companies and other large organizations such as I.C.I., Shell-Mex and British Road Services, who were approached by the Inland Telecommunications Department. Although the rental for the new service was almost double that for the old, the results of all these visits were encouraging, for roughly 70 per cent. of the old subscribers accepted the new service. The Area Sales Divisions were also responsible for negotiating a new agreement with each subscriber, for sending out formal notices to cease the old service, and for issuing advice notes to effect the changeover.

The first public announcement of the new service was made by the Postmaster General in the House of Lords at the end of July, 1954. This received a good Press, appearing in almost a hundred newspapers and technical journals, and led to many fresh applications for service, and general enquiries from interested organizations.

The planning and execution of the work involved in the transfer of commercial subscribers to the new service last November were a "combined operation" which, either directly or indirectly, affected many thousands of staff of various grades. A working party was set up at Headquarters in 1951 to undertake the preliminary planning work and to control the transfer to the new service of the civil Government departments and commercial subscribers. The transfer of commercial users was complicated by the fact that, for technical reasons, interworking between the old and new telex systems was not possible. This meant that, during the period of transfer, those

subscribers who had been changed over to the new system were unable to communicate with those who had not. It was clear, therefore, that the change-over period had to be as short as possible. The simultaneous transfer of all lines would have been the ideal solution, but the large amount of engineering work involved in such an arrangement on a national scale prohibited this.

Subscribers were placed in one of five groups, depending on the use they made of telex service, and the transfer was spread over a period of three weeks. The first two groups, comprising those who used telex for communication with "printergrams" and cable companies only, were transferred piecemeal; the remaining groups were changed over during three successive week-ends. Wherever possible, subscribers were provided with duplicate table equipments and lines. For such subscribers the new equipment was installed and tested in advance of the change-over date and left ready for the subscriber to bring into use on the appointed day. There was unfortunately a large number, however, where this could not be done, due either to insufficient space in the subscriber's premises, or to a second line to the premises not being available. Here the engineering staff had to install the new equipment and test it to the telex exchange in advance of the transfer, and then to store it until the day of the change-over. This meant a concentrated effort over the week-end periods of the transfer in some areas, and it is to the credit of the staff engaged on this work that the change-over was effected smoothly.

The printergram facility was made available on both new and old systems during the period of the transfer. For the offices of the Post Office Cable and Wireless services and those of the cable companies new telex positions were installed and tested out before the transfer, but the old telex positions were not recovered until after the transfer, so that during the change-over period these offices were able to communicate with all telex users, whether or not they had been transferred.

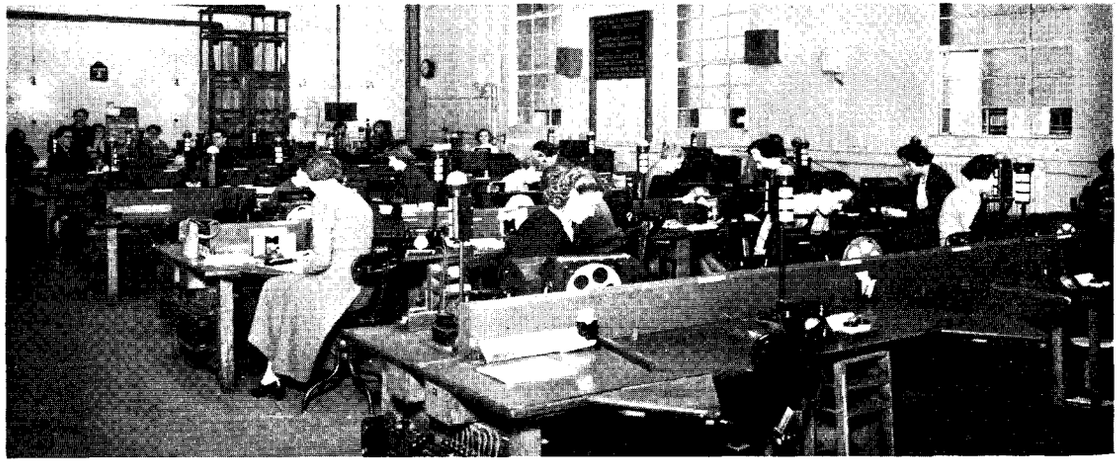
Each subscriber was visited before the transfer by a telegraph service representative (formerly known as a "visiting operator"), who instructed the subscriber's operating staff in the new procedure, carried out operational tests, and distributed copies of the new directory. This directory was prepared by the flexoprint process, which enabled it to be produced much more quickly than would have been possible by normal printing.

The new system on which over 1,600 lines were working after the transfer promises rapid development; during the three months immediately before the transfer, a waiting list of applicants was formed and this totalled nearly 400 when the transfer took place. From the results of a market survey undertaken a year ago, it has been estimated that the service will double itself in two years, and that it will grow to at least 8,000 lines within 15 years. If this estimate proves correct (and it may well be exceeded) the service should make a real contribution towards national efficiency in commerce and industry. The first year's development will be closely watched, since it has been decided to start a sales canvassing and general publicity campaign to stimulate growth from the outset.

The procedure for providing telex service in the past has been extremely complicated and has resulted in excessive delay. The procedure has now been streamlined with the aim of providing service within one month of the subscriber's signing an agreement, and eliminating reference to Headquarters, except in difficult cases.

The Post Office's ultimate aim is to convert the new service to automatic working, and preliminary planning and engineering design work are already proceeding. Subscriber trunk dialling on a national and, so far as practicable, an international scale is envisaged. Some of the main centres will require assistance and enquiry positions, to set up calls on an assistance basis; for example, in the event of route break-down and to handle general enquiries, fault reports and complaints. The conversion of the network to automatic working may have to be carried out gradually, and the need for inter-working between the manual and automatic elements of the system, possibly for a period of years, must be considered. The earliest demand for an automatic exchange will be in London, where the aggregate multiple capacity of three manual exchanges will probably be exhausted in five years' time. Accommodation has been reserved (in the new "Fleet" building in Farringdon Street, London) for an automatic telex exchange, with an ultimate capacity of 6,000 lines to serve the London area.

Old suite of printergram positions in Central Telegraph Office, London, which served the telephone-telex system closed on November 15, 1954



Exchange Visible Index Files.—One of the tools of a telephonist is the visible index file from which she can ascertain how a call should be routed, where she can get assistance if she has difficulty in setting up the call, and the charge for the call. The file comprises a series of printed sheets (insets) assembled so that the bottom edges of the sheets are visible to form an alphabetical index it is fitted on the operating positions.

The arrangement for the production of the insets has never been wholly satisfactory, because of shortage of printing capacity and it has been possible to reprint insets only about every two years. Between reprints, the insets have to be kept up-to-date by manuscript amendments and this is almost a full-time job at the larger centres. Operating errors can occur if the manuscript amendments are not neatly made and towards the end of their life the insets become worn and dirty.

Several other methods of inset reproduction have been considered. The most promising is the "Flexoprint" process. This involves typing each line of the inset on to a special card; these cards are then assembled in a frame so that an enlarged picture of the inset is formed. This picture is then photographed and the inset is printed from the negative. When an amendment is required to an inset a card can readily be replaced by one bearing the required information, and a new inset prepared by re-photographing and re-printing.

In an experiment some twenty exchanges have been provided with insets produced and kept up-to-date by the "Flexoprint" process and both service and financial advantages have accrued from the scheme.

Correspondence. From the Posts and Telegraphs Department, Port Moresby, New Guinea, Mr. W. C. Gee, M.I.E.E., writes:—

"It was with considerable interest and pleasant memories that I read in the *Journal* (November-January, 1953-54) of the ceremonial opening of the radiotelephone link to the Island of Stroma.

"I was one of the first operators on the Island during a period of three months in 1915-16. I was then a wireless telegraphist in the Royal Navy and was sent with an R.N.V.R. Chief Petty Officer to Stroma to install and operate a radio station consisting of a 10-inch induction coil with Leyden jars and so on, and a really up-to-date Carborundum crystal set at the lighthouse.

"We established communication with H.M.S. *Royal Arthur*, then the guard ship at the boom entrance to Scapa Flow, where the Fleet was based. After the circuit was established the Chief Petty Officer left, and I was left in sole command....

"The population of the Island was very small and consisted mostly of crofters. Food was often scarce as communication with the mainland was by a small boat which went over weekly, if the weather was suitable. Our breakfast was often supplemented by seagulls' eggs which I used to collect by dangling on a rope over the cliffs."

Mr. Gee adds that he was well looked after by the lighthouse keeper and his wife—he lodged with them—and it was there that he first read *The Electronic Theory of Electricity*.

TWO NORTH WESTERN TELEPHONE AREAS

Wycoller Packhorse Bridge (By courtesy of C.P.R.E., Lancaster Bch.)

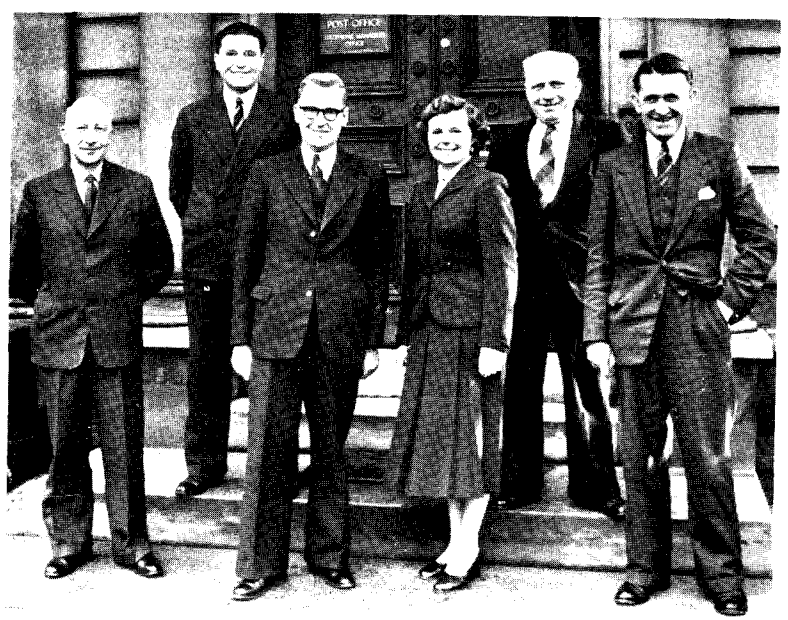
BLACKBURN

The Blackburn Area, which is situated astride the Lancashire and Yorkshire border, comprises the four large manufacturing towns of Blackburn, Bolton, Burnley and Rochdale, the towns of the Rossendale Valley and the surrounding districts. Although the southern part is industrial, it contains large tracts of moorland and, to the north, the forests of Bowland and Pendle, the Ribble and Hodder Valleys, all of which are of exceptional natural beauty.

There are many places of historical and literary interest in the Area—notably Pendle Hill and Whalley Abbey around which Harrison Ainsworth and other writers have woven their stories about the Lancashire Witches. At Wycoller, on the border of the Area, near Colne, is Wycoller Hall which Charlotte Brontë in *Jane Eyre* calls Ferndean Manor. The Grant Brothers, mill owners of Ramsbottom, were the originals of Charles Dickens' Cheeryble Brothers. Downham is regarded as one of the loveliest villages in England, at Ribchester the Romans had a station, while at Hoghton Tower in 1617, James I was so pleased with the loin of beef served at table that he knighted it "Sir Loin".

The inventions of the flying shuttle by John Kay of Bury, the spinning jenny by James Hargreaves of Stanhill on the outskirts of Blackburn, the spinning frame by Richard Arkwright of Preston, the combination of the jenny and frame by Samuel Crompton of Bolton, and the invention of the steam engine by James Watt in 1770, led to the erection of spinning mills, and at the beginning of the 19th century Blackburn had three such mills and home spinning and weaving began to decline.

Blackburn is now the centre of what is probably the largest cotton manufacturing area in the world, but many other heavy and light industries are also carried on.



Blackburn and Accrington automatic exchanges, opened in 1916, are among the oldest automatic exchanges in the country and many leading townsmen of Blackburn played an important part in the early days of the National Telephone Company. Among them were Mr. W. E. L. Gaine, General Manager, and Mr. Eli Heyworth, Chairman of the Executive.

The Area covers about 622 square miles and contains 48 exchanges with 50,814 exchange connections and 81,214 stations. The total staff (excluding telephonists) is 872.

Left to Right: J. ROSS, M.C., Chief Clerk; A. J. CHAPPELL, B.Sc. (Eng.), A.M.I.E.E., Area Engineer; W. R. BEACH, Wh.Sch., A.C.G.I., D.I.C., Telephone Manager; Miss M. P. RAMSBOTTOM, Secretary; E. HART, Senior Sales Superintendent; A. V. SANDERSON, Chief Telecommunications Superintendent.

LANCASTER

Lancaster Telephone Area covers about 3,000 square miles, including the whole of Cumberland and Westmorland and parts of Lancashire, Yorkshire and Northumberland. It is predominantly rural and possesses an astonishing diversity of attractive scenery. One can find precipitous mountains and island-studded lakes, green fells and limestone crags, fast-flowing rivers and fertile valleys, rich rolling farmland and lonely sand dunes and salt marshes.

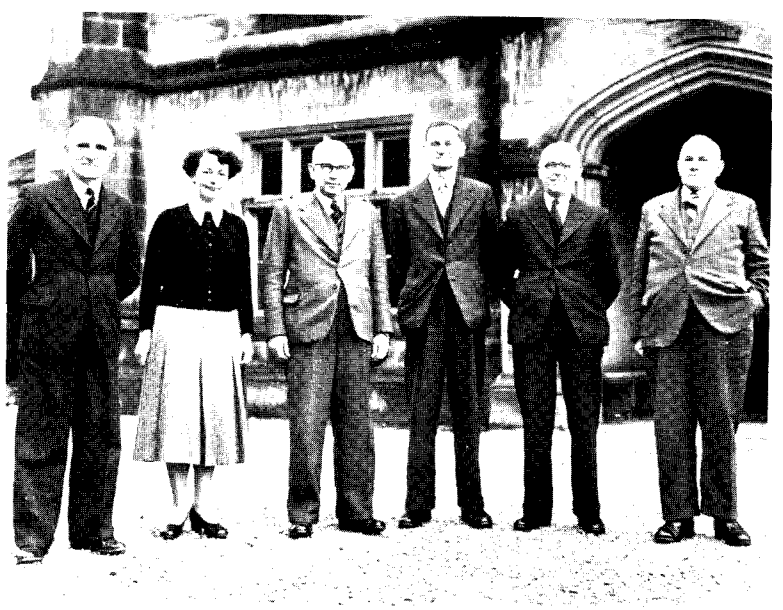
Snow on Great Gable—view from Wastwater

Probably its best-known feature is the Lake District, which has delighted tourists from all over the world since the days of Wordsworth and which is now a National Park. The principal valleys of the Lake District radiate like spokes of a wheel from the main mountain block in the centre which contains Scafell Pike, England's highest mountain. To the south lie Morecambe Bay and Walney Island, and to the north the Roman wall and the fox-hunting country of John Peel. To the east, beyond the A6 road linking Lancaster and Carlisle, lie the valleys of the Lune and the Eden. These lovely rivers rise in the Pennine Range, which reaches its highest point at Cross Fell, a mountain renowned in the north west for its violent "Helm Wind". Around Ingleton, a Pennine village famous for its "pot-holes" and waterfalls, the Area takes in part of another National Park, that of the Yorkshire Dales.

Over most of the Area the principal occupations are sheep and dairy farming. There are relatively few large towns and these lie either on the coast or on the A6 road. Nevertheless, there is a wide variety of important industries. At Lancaster there is a world-famous linoleum factory, at Barrow an important shipyard, at Workington and Whitehaven coal mines and steel works, and at Carlisle engineering, textile and biscuit factories. Modern developments in West Cumberland include the Atomic Factory and Power Station at Sellafield.

Despite the difficulties presented by the sparsely populated and mountainous terrain, the Area has expanded rapidly since the War. It now has a staff of 850 (excluding telephonists), 650 of whom are engineers. It has 130 exchanges, 95 of which are automatic, 33,030 exchange connections and 50,617 stations.

The annual revenue is £1,000,000.



Left to Right: E. F. COWLEY, Senior Telecommunications Superintendent; Miss S. MOORE, Secretary; C. W. LEMMY, A.M.I.E.E., Telephone Manager; L. A. TRIFFIT, B.Sc., A.M.I.E.E., Area Engineer; J. W. HUMPHRY, Senior Sales Superintendent; R. WEBBER, Chief Clerk.

The Work of a Telecommunications Controller

Colonel M. G. Holmes, B.Sc.(Eng.), M.I.E.E.

Post Office Headquarters, Scotland

Colonel Holmes discusses the work of Telecommunications Controllers generally, but inevitably he relates his description particularly to Scotland.

Scotland has a population, largely scattered, of 5,000,000; 2,000,000 live in Edinburgh, Glasgow, Aberdeen and Dundee, and only 200,000 north of the Caledonian Canal.

Glasgow, the zone centre for the west of Scotland, is a home of industry and commerce, with rapidly developing housing estates; Edinburgh, zone centre of east Scotland, is a city of Government offices, professions and light industries; Scotland West includes the rich agricultural areas of the south-west, the industrial belt round Glasgow and the sparsely populated Islands, in the Dundee Area are the Perthshire mountains with their hydro-electric schemes; and Aberdeen ranges beyond mountains and sea to Skye, Lewis, Harris and Shetland.

Altogether there are about 360,000 exchange connections in Scotland, 120,500 of which are in the Glasgow Area.

THE TELECOMMUNICATIONS CONTROLLER HAS a job of great variety and absorbing interest; one could write at great length without exhausting all its aspects. Within the scope of this article it is enough to outline the broad range of the job, which is a combination of administrative, executive and inspectorial functions. The extent to which particular problems predominate depends on the territory over which one operates, and the job in Scotland is particularly varied.

The Controller's functions and responsibilities may be divided conveniently into those exercised in the main through the Telecommunications Branch, and those which are more personal. The general scope of the job can best be outlined by a break-down of the various responsibilities of the Telecommunications Controller as head of his Branch, turning later to the more personal aspects.

The Telecommunications Controller is responsible to the Director for the quality of telephone and telegraph service to the public, for interpreting national policy on provision of service—particularly the use of priorities—and for the general level of expenditure in operating the system. He is also charged, with his colleagues, the Chief Regional Engineer and the Finance Officer, with settling the structure of the engineering programmes for each financial year, including the expenditure on provision of telephones, subscribers' and junction cable plant, before the programme is forwarded to Headquarters for approval.

The programme having been approved, the Telecommunications Controller and his colleagues have to keep a close watch on expenditure through the year to ensure that the programme is being carried out as planned, and that money is being spent on the classes of work intended. The Controller exercises the powers of the Director in approving the proposals and expenditure on individual schemes; for example, new exchanges, which have been provided for in the annual estimates.

The Telecommunications Branches in the United Kingdom differ in structure according to the weight of particular jobs. The diagram below shows the structure in Scotland.

The Branch has a staff of 29, including a Senior Assistant Telecommunications Controller who takes charge of a specific block of work, but also deputizes for the Controller in his absence, two Assistant Controllers Class I, seven Assistant Controllers Class II and three Managers in charge of Post Office Cable and Wireless Offices.

The individual functions can be divided broadly (in Scotland) into planning and operational.

Equipment and Accommodation

Taking planning first: the equipment and accommodation group generally supervises the programme of converting exchanges to automatic working, and of extending automatic exchanges and operator trunk dialling. The Telephone Areas, therefore, have to supply the group periodically with accurate information about the equipment position at each exchange. This work involves a critical review of all cases for the preparation of an annual programme of contract equipment orders, which is agreed with the Engineering Branch and finally with Headquarters. The group also plays an important part in preparing the annual building programme, including discussions with the Ministry of Works. In co-operation with the Engineering and Buildings Branches it agrees at all stages the plans for new telecommunications buildings, and representatives attend the monthly progress meeting with the Ministry of Works.

The group runs the control sheet system to further the progress of new exchange and extension schemes, and advises the area on the general design of new exchange schemes.

The lines group is responsible for the annual estimates of trunk and junction circuits which are prepared in the Telephone Areas and, as far as circuits over 25 miles are concerned, are approved by the Telecommunications Branch. These requirements are co-ordinated and forwarded to Headquarters for agreement.

In co-operation with their opposite numbers in the Engineering Branch the lines group prepares and maintains a five-year programme for the provision of junction cables, and the yearly programme for inclusion of particular jobs in the annual estimates. The submarine cable programme and the special needs of the Defence Services for equipment and lines are also handled by this group.

Provision of Service

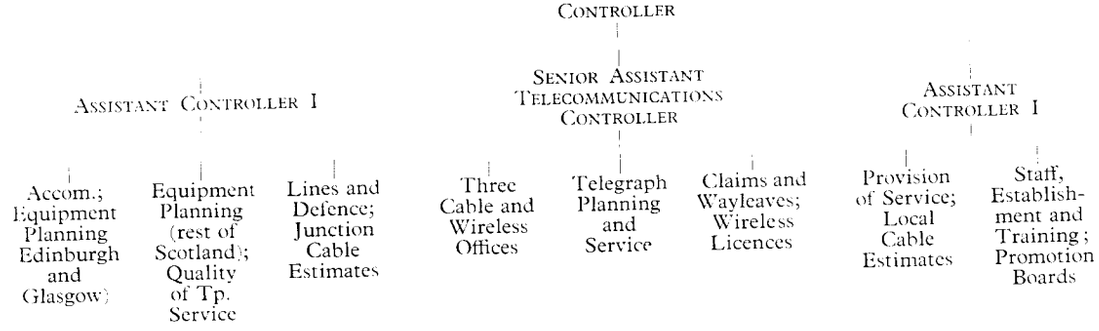
The provision of service group is responsible for adapting national policy on provision of service to meet the special needs of the Directorate or Region. It has to study the trend of demand and supply of telephones, with the effect on the order list, and with this in mind agrees the annual estimates for provision of telephones and local cables, besides authorising the financial expenditure on individual schemes as they arise. The staff in this group spend much of their time in preparing draft replies to letters to the Postmaster General from Members of Parliament on behalf of their constituents; the majority of these letters are from people who are waiting for telephones.

Other jobs include approving an annual programme of provision of rural kiosks, and supervising progress in meeting long outstanding applications, especially those which are over the present limits of construction.

Telegraph Group

A heavy programme of converting a large number of our teleprinter offices to automatic switching has just been completed. This has involved the design, in co-operation with the

TELECOMMUNICATIONS BRANCH



Engineering Branch, of the requirements for each office and supervision of the installation and change-over.

The telegraph group organized the setting up of the Government and commercial user telex system, with manual teleprinter switchboards in the larger centres. Supervision of special events arrangements is one of its duties.

The telegraph group is also operational, and generally supervises the quality of service on the teleprinter automatic switching system and the times to answer on phonogram suites. It also prepares quantitative traffic statistics, watches the man-power used to operate the system, and investigates all matters which concern economy in staffing at individual offices. In particular, the group gives much study to the best methods of adjusting telegraph delivery staff to traffic and maintaining at the same time a good quality of service.

This group is also responsible for the general operation of the service in the local Post Office Cable and Wireless Offices, and for dealing with the special problems of handling overseas telegraph traffic.

Staff, Establishments and Training

The staff, establishments and training group is responsible for overall control of telephonists and supervisor establishments in the Telephone Areas, and of man-power, by study of staff adjustment returns and so on. It also deals with establishments of traffic and sales staffs in the Areas and some personnel questions relating to these staffs. Supervision of the training arrangements and instructional staff in the telephone and telegraph training centres, and such matters as Branch organization and Branch complements, are also among this group's duties. A considerable part of the time of one of the Assistant Controllers Class I is spent as chairman of promotion boards at local offices for telephone and telegraph supervising staff.

Quality of Telephone Service

The group responsible for quality of telephone service studies the service observation results (day and evening) relating to local and long distance calls at manual, auto-manual and trunk exchanges and, in co-operation with the Engineering Branch, those relating to local calls at automatic exchanges. Trends in particular aspects—for example, time to answer—are observed carefully and investigations are made into those cases where improvement is necessary.

Claims, Wayleaves, Wireless Licences

The claims, wayleaves and wireless licences group is concerned with the legal and financial problems arising from claims by the Post Office for damage to its plant and alterations due to road operations, and claims against the Post Office for damage and injury caused by its own operations, exclusive of motor transport. It also deals with difficult wayleave cases, both public and private.

Wireless licence work involves the close scrutiny of sound and television licence statistics to determine where special efforts are needed to bring in defaulters, the organization of "combs" for non-payers and the use of television detector cars and decisions on prosecutions.

All these varied responsibilities cannot be exercised entirely in the office, and there must be a measure of inspection and discussion on the spot. Telecommunications Branch staff are therefore enjoined to visit Telephone Managers' Offices and Head Post Offices as well as exchanges and telegraph centres from time to time, not only to discuss specific cases but also to inspect. In Scotland, a schedule of desirable frequencies of visits has been issued, and although, unfortunately, it has not always been possible to achieve the ideal, these visits do help to further correct policy and procedure in the field.

Personal Side

Following the general structure of the Branch organization the Controller's personal activities fall naturally under the broad headings of planning and operational.

Planning

During the past few years all planning has had to be carried out within the framework of limited resources, and the problem has been one of making the most economical use of these resources to produce results. For example, in Scotland, in August, 1950, 46,250 applications for telephone service were outstanding. Of these, 22,000 were awaiting underground plant, 8,000 were awaiting exchange equipment, and of the remainder 8,800 were awaiting engineering labour to connect the lines to available plant.

A more uniform policy was needed to direct the telephone areas in their attack on this situation, and a study group was appointed with two Telephone Managers and representatives from the Engineering and Telecommunications Branches, with the Telecommunications Controller as chairman. This study group's task was to investigate planning and provision of service procedure, and to make recommendations, taking into account the particular problems of each Telephone Area. The group visited each Area and produced a report, concerned mainly with planning methods and correct interpretation of the priority scheme. This report has been the basis of effort for the past three years.

Watching Trends

It is a part of the Controller's work to watch the level of telephone demand and cancellations—including the organized removal of "dead-wood" from the telephone order list—the level of supply in each Area, and the number of outstanding applications awaiting underground plant, equipment and labour. These trends influence to a considerable extent the distribution of funds between the main classes of engineering work in the annual estimates and the forecasts of engineering expenditure for a current year.

The trends in each Telephone Area also affect the distribution of funds between Areas.

It has been necessary to ensure that the Telephone Areas which serve large cities should have a fair share of our resources, not only to cater for commercial and business needs, but also because the labour required for each new telephone is relatively low and a high achievement in terms of additional lines and revenue can be obtained. It is most important, too, that these Areas should have funds to lay down ducts and local cable plant to meet future growth and that, as far as possible, there should be no shortage of exchange equipment to hold up provision of telephones when cable plant becomes available.

Continuous attention has to be given to the problem of long outstanding applications, a large number of which require overhead line work beyond the present limits of construction. The remainder are mainly on the outskirts of the cities where housing development has gone ahead so rapidly. In many places there is little, if any, Post Office cable plant and, because of the previous lack of funds, there is still considerable delay in providing it.

Each Area has had its "waiting labour" problem, but it weighs most heavily on Areas such as Aberdeen, Scotland West and Dundee where long lines for farmers (there are still 1,600 outstanding in Scotland) and rural kiosks absorb a considerable proportion of their resources. Furthermore, there is a serious shortage of overhead junctions between rural exchanges, a commitment involving hundreds of poles and miles of wire.

Fair distribution of funds is therefore a difficult job and an objective which has not entirely been reached because of the inadequacy of total funds, the uneven impact of defence work and fluctuations in the availability of stores. This is enough, however, to show that the Controller, with the Chief Regional Engineer, the Finance Officer and their assistants, must meet frequently to discuss the distribution of the allotted funds among Telephone Areas, the trend of expenditure on the main classes of work throughout the year, and periodical financial forecasts. There are also the conferences with Telephone Managers under the chairmanship of the Director, in which the main subject of discussion is the best use of resources, the most important item in all the year's work.

New Phase

With extra funds allotted this year for providing telephones, and the promise of higher capital expenditure for next year, we are entering a new phase. The number of outstanding applications in Scotland is now 33,000. Those awaiting labour have been reduced to 6,700 from a peak of 14,000, but the number awaiting underground cables (at present 12,500) is now rising and the number awaiting equipment (5,000) is likely to rise in the future. Previously the emphasis has been on reducing the number awaiting labour and, although still much remains to be done, planning for new underground cables and automatic exchanges is now the high-light.

To deal with certain special problems in Scotland, Area planning committees have been set up in Edinburgh and Glasgow.

The Controller must take a close personal interest in progress on the annual buildings programmes agreed with the Ministry of Works; he attends the yearly programme meeting and, very important, the monthly buildings progress meeting with the Ministry. There is a close tie here with the equipment ordering programme for new automatic exchanges and extensions which is so dependent upon building progress. This programme is discussed annually with representatives from Headquarters, the Inland Telecommunications and Engineering Departments, after a close review of the equipment requirements for future years.

On the telephone operational side, the Controller has to direct his personal attention to the deployment of the staff in his own Branch, and traffic and sales staff in the Areas, to the returns of telephonists and supervisors employed, and general measures for economy, especially on non-operating work. He also controls the submission of telecommunications establishment questions to Headquarters. He has to keep quality of service at the main telephone exchanges under review, and to take up cases needing attention, as occasion demands.

On the telegraph side the Controller's interests are mainly on the alignment of instrument room and delivery staff to falling traffic, assisted by manpower returns. The delivery staff problem is particularly important because the cost of delivery of a telegram is about 40 per cent. of the total operational cost. A good deal of the Controller's time will soon be occupied in dealing with the question of redundant telegraph staff because of the recent drop in traffic.

Most of these matters requiring the Controller's supervision cannot be studied without adequate records. Apart from the standard records, graphs are maintained to depict the trends in such features as, for example, quality of service, supply of telephone service, engineering expenditure, wireless licence growth and so on. They are maintained in the Branch and, of course, are available to the Controller at all times.

Personal Jobs

Finally, there are the completely personal jobs. First the Controller is a member of the Directorate or Regional Board which, as far as telecommunications is concerned, discusses the broader issues of the engineering programme, supply of telephones, quality of service and so on. Progress reports from the various Branches are considered as well as monthly reviews from Telephone Managers. The Controller also, of course, takes his full part in discussions on general matters of policy.

He is a member of the Board which makes recommendations to Headquarters for Head Postmaster and Postmaster appointments. This Board also makes regional promotions in appropriate instances. The Controller also serves on interviewing boards for regional posts, clerical appeals boards, and takes appeals by traffic staff.

There is as well the annual Head Postmasters' conference at which the Telecommunications Controller presents papers. This conference discusses telecommunication matters of all kinds. There are also the conferences which each Telephone Manager holds with local Head Postmasters at which the Telecommunications Controller usually speaks.

Visiting

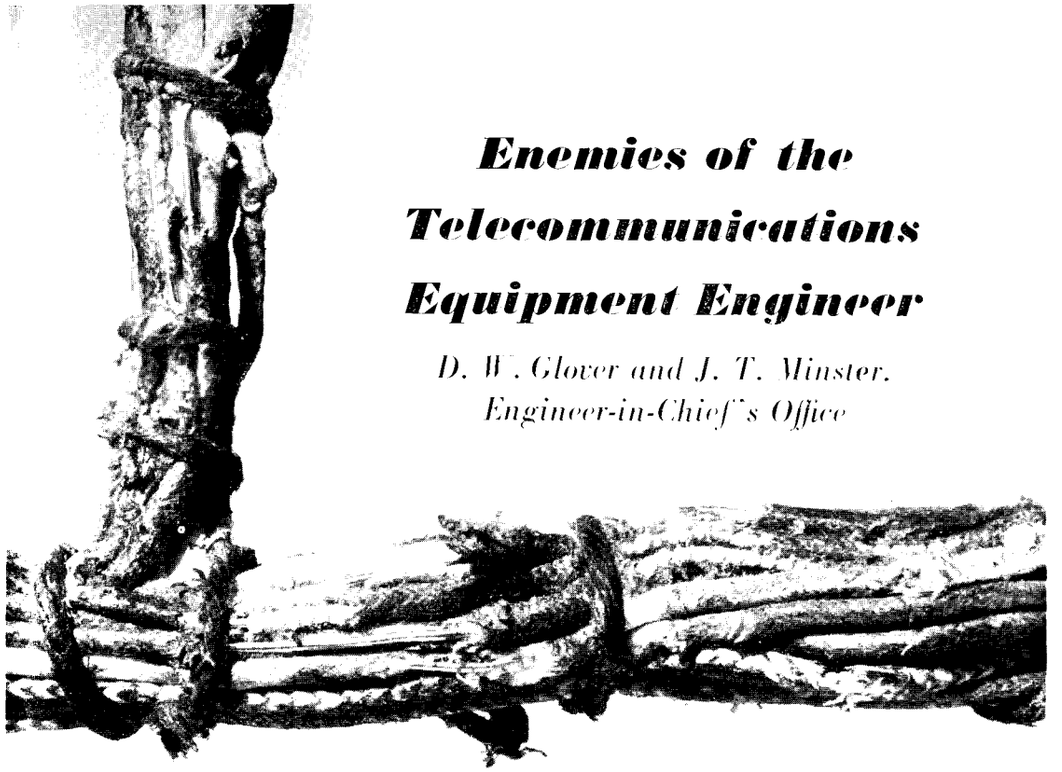
Visits to Telephone Managers' and Head Postmasters' Offices are a very necessary part of the Controller's job, affording as they do the opportunity of seeing the work in the field and making personal contact with Telephone Managers, their traffic, sales and clerical staff, and Head Postmasters and their telephone and telegraph staff. The purpose of visiting is not only to see how the work is progressing and to discuss particular problems, but to get to know the staff, particularly at the higher levels. Seeing the progress of new buildings and telephone exchanges, discussing service matters with supervisors at working exchanges and telegraph offices, and knowledge of local accommodation problems are all extremely useful adjuncts to planning and operations in the office. Visits to the Post Office Cable and Wireless Offices should not be overlooked because these offices are doing excellent work on the overseas telegraph side.

In Scotland distance and time make it impossible to do all the visiting that is necessary, although some of the more distant offices can be reached by air. However, larger offices which require more frequent attention are, in the main, not too difficult of access.

This outline of the job has by no means covered all its aspects. There are still visits to Headquarters, London, because Controllers are members of Headquarters' Study Groups, Advisory Committees, Joint Production Panels and so on. There is also the six-monthly conference of Telecommunications Controllers at which telecommunications policy and problems are discussed with Headquarters' officers.

The Controller takes advantage of these visits to discuss various questions with the appropriate officers at Headquarters; for example, those concerned with traffic and sales staffing, and provision of service. I cannot over emphasize the value of these contacts because knowledge of current national policy is most valuable for the proper execution of his work in the field.

In conclusion, I can truthfully say that the work is so full of interest that never is there a dull moment.



Textile insulation can sometimes be scraped off switchplate wire by the finger nail after a few years of exposure in town exchanges

Enemies of the Telecommunications Equipment Engineer

D. W. Glover and J. T. Minster.
Engineer-in-Chief's Office

LITTLE INFORMATION IS AVAILABLE ABOUT the maintenance difficulties which telegraph and telephone equipment engineers encountered in the early days. Probably in those times of cheap labour and materials the engineers were too much concerned with design and installation problems to worry overmuch about occasional failures. They chose the best materials they could think of, allowed enormous margins of safety regardless of expense, and on the whole obtained excellent results. Without decrying their achievements, however, we can fairly say that the systems they operated were not very extensive or complicated by today's standards and their terminal plant was housed in permanently staffed roomy buildings which were reasonably heated and ventilated.

The advent and rapid growth of the automatic telephone system and the impact of modern economics have altered all this by enforcing compactness, economy of materials, and the utmost practicable reliability in the face of far more rigorous electrical and mechanical requirements. Apart from the very much greater complexity of automatic telephony, which inevitably increases fault liability, the compression of the apparatus into small space usually makes it difficult of access and faults are harder to repair when they occur. Still more recently the introduction of small unattended exchanges has brought with it problems caused by dampness and fluctuating temperature.

The telecommunications engineer of today designs his equipment with the utmost care, draws up rigid specifications for the materials to be employed, supervises manufacture and erection, and tests the installation very thoroughly before putting it into service. He intends it to have a long and trouble-free life and takes every precaution to this end but, although on the whole successful, he encounters many difficulties. When one considers the total amount of apparatus installed in telecommunications systems and the volume of traffic handled, failures affect an ex-

ceedingly small fraction but they give occasion to worries that occupy a great deal of time and attention. The causes of such defects are seldom obvious; slow and insidious actions occur with gradually cumulative effect until some part of the system fails to function and prolonged effort may then be necessary to elucidate the cause of the trouble and devise means of overcoming it.

Of the many enemies to be opposed the most persistent and ever present is the all pervading atmosphere. Pure dry air is relatively harmless to electrical equipment but the atmosphere in which we live is never dry and is often far from pure, especially in large towns. The disastrous effects two years ago of "smog" on human beings are fresh in our memories; the cause of the trouble being an unusually high degree of pollution in the air. Although the "smog" was exceptional and temporary, the impurities which were responsible are nevertheless always present in the atmosphere to some extent.

Factories, gas works, power stations, railway engines and domestic chimneys pour out smoke, soot, grit and sulphurous fumes, and decaying organic matter on mud banks in estuaries can add a significant contribution to the general collection of impurities in the air. In addition, even on a dry day, a "good washing day", the air contains a considerable amount of water vapour, while during a prolonged wet or foggy spell its condition may approach saturation. So there is always present a dirty damp atmosphere continually acting on all the delicate pieces of apparatus to the utmost of its malignant ability.

Temperature Changes

In this country normal temperature changes, as such, do not exert a very significant effect on apparatus, their influence on staff comfort and efficiency being a much more prominent problem. Sometimes and in some places, however, it is necessary for technical reasons, to minimize temperature fluctuations; an example being the need to maintain master oscillators in repeater stations at as constant a temperature as possible to prevent variations in frequency.

Cold air, however, cannot hold as much water vapour as hot air and in consequence temperature has a profound indirect influence on the behaviour of communications apparatus, because if damp air is progressively cooled there comes a stage, known as the "Dew Point", at which it becomes saturated, and further cooling results in the deposition of liquid water; a sudden fall in temperature may, therefore, have very adverse effects on unprotected equipment.

In some tropical countries where the humidity is often very high and the temperature range extreme, heavy condensation occurs regularly and causes deterioration of some materials at a rate quite inconceivable in this country.

Fortunately, dampness seldom becomes excessive in large heated exchanges, though it is frequently troublesome in unattended automatic exchanges (U.A.Xs). There is some compensation, however, in the fact that U.A.Xs are usually in country districts where the air is relatively free from impurities.

Various systems for exercising a close control of humidity exist, but they are complex and expensive both to install and to maintain, and have not so far been used in telephone exchanges in this country.

Preventing Dampness

Early attempts were made to remedy dampness in telephone exchanges by gas heating, but the flues fitted to the burners were inefficient and sulphurous combustion products came into contact with the apparatus, making the last state worse than the first. Fumeless heating by electricity is much preferable and is now employed where essential, while central hot water heating is installed in large exchanges. Such exchanges, as a rule, are also provided with forced filtered ventilation—largely to benefit the staff by removing excess heat generated by the apparatus and the odour of warm insulating materials in hot weather. These systems introduce into the buildings far more air than would be provided by open windows, and with it, as the filters are effective only for removing the coarser range of dust particles, a considerable amount of very fine dirt. This fine dirt has most objectionable properties as it is exceedingly difficult to remove it from objects to which it becomes attached. At one time filters coated with thick sticky oil were used in an effort to improve the efficiency of the process but, although these may have captured a higher proportion of the fine dust, large numbers of particles still passed through carrying a coating of the oil with them, thus becoming still more objectionable than they were originally.

The most recent device to deal with this problem is the electrostatic precipitator, which first imparts an electric charge to the dust particles and then attracts them to a mesh of wires which are maintained at a high opposite potential. This device is claimed to be the most efficient known, but its ability to achieve a material improvement in exchange conditions remains to be proved.

Dust causes more than enough trouble in one's own home, but telecommunications buildings are even more susceptible to its baleful effects, since electrical charges and convection currents of air due to heat generated by the apparatus combine to precipitate, in the most inaccessible places, dust which would normally have remained suspended in the air and passed out of the room by ventilation.

Apart from its obvious ability to convert the lubricants of moving mechanism to an abrasive grinding paste, dust contains chemical substances which can produce a hundred and one harmful effects. Moreover the handling of plant becomes dirty and unpleasant for the staff and the complexity of much of the equipment renders effective cleaning almost impossible.

The amounts of dust, soot, grit and so on, falling from the atmosphere in an industrial area are often astonishingly large. To quote a particularly severe instance, in parts of Leeds over 700 tons to deposit per square mile have been recorded in one year and deposits approaching this are common in many other manufacturing centres. It is, therefore, quite understandable that the struggle to keep town exchanges clean calls for considerable effort.

Atmospheric Dust

Atmospheric dust consists mainly of soot, but other components are grit from the chimneys of factories where pulverised fuel is used, industrial dusts of all kinds, particles from the abrasion of road and earth surfaces, and the heterogeneous collection of finely divided materials arising from the many "dusty" jobs of everyday experience. Near the coast fine particles of salt become dispersed in the air, especially in windy weather owing to spray being blown off the sea and dried. Many of these particles can be identified by microscopic or chemical examination.

In addition to this large variety of objectionable solid matter in the atmosphere, coal and its derivatives coke and coal gas all contain small but significant amounts of sulphur compounds which on combustion are converted chiefly into sulphur dioxide, a gas that, even when present in the atmosphere only to its normal extent of a fraction of one part per million, is very active in promoting the deterioration of many types of material. Much smaller concentrations of other sulphurous bodies such as sulphuric acid, sulphuretted hydrogen and organic sulphur compounds are also formed by the burning of common fuels, and there is evidence that these minute amounts may at times be even more aggressive than the relatively more highly concentrated sulphur dioxide. No attempt has so far been made to exclude these very small concentrations of gaseous impurities from telecommunications buildings, as the necessary preventive plant has been considered too costly.

Wax Impregnation

Turning now to the effects of these atmospheric impurities, it has long been realized that the main adverse effect of damp and dirt on electrical apparatus is to lower resistance of the insulation. The textile covered wiring in automatic exchanges has suffered perhaps more severely than any other material from this cause, as much of it is in the form of multiples to which the atmosphere has free access. Wax impregnation has been used to protect it, but wax is not a very effective barrier to water vapour and has also the disadvantage of introducing a serious fire hazard.

The ill effects go beyond the temporary lowering of insulation resistance during damp weather, for resulting leakage currents produce aggressive bodies electro-chemically from traces of impurities in the textile which slowly but progressively decompose it to the extent where short circuits ultimately occur.

In the days of manual exchanges the wiring was largely in the form of cabling, protected by wooden cabinets, and the apparatus rooms were well heated so that the importance of this effect was not realized when the early automatic exchanges were built, and insufficient care was taken to purify the textiles used. All insulating textiles now used are carefully washed before being applied, until the soluble impurities are reduced to an acceptable minimum. It is hoped that this treatment will improve the life of the insulation considerably, but it does not entirely solve the problem as the fine dust which, as previously explained passes through most of the existing ventilation filters, itself contains sufficient impurities to contaminate any textile insulation on which it may settle. Hence this particular kind of fault is unlikely to disappear completely as long as textile covered wiring remains in use.

Another objection to exposed wiring is that in smoky districts it soon becomes so dirty that it is

such as the loss of plasticizer from a plastic, the rate of corrosion of a metal, the deterioration of insulation or its deformation under a load applied for a decade or so. Some kinds of degradation can be speeded up by subjecting materials or apparatus to extremely adverse conditions for a relatively short time, but then difficulty arises in correlating the life in such circumstances with that obtained under ordinary working conditions.

It would be a great advantage, for instance, to be able to predict that a certain number of weeks endurance under standardized artificially severe conditions, would correspond to an equivalent number of years of practical service, but our own lives are too short to cover the long period of time that would be necessary to establish such a relationship with certainty. Valuable information, however, is often obtainable from comparative tests between known and untried materials under abnormally severe conditions and this, combined with practical experience, usually enables a very fair judgment on which to base further advances.

Post Office Commercial Accounts: 1953-1954

As with the *Post Office Commercial Accounts* for 1952-1953 (February-April, 1954, *Journal*) we summarize a few salient facts relating to the telecommunication services from the Accounts for 1953-1954, which were published in December (H.M.S.O., 2s. 6d.).

Following are the main financial results of the telecommunication services, compared with the previous year:—

	1952-53 £m.	1953-54 £m.
Telegraph		
Income	14.3	15.0
Expenditure ...	17.9	18.1
Deficit	3.6	3.1
Telephone		
Income	106.3	115.1
Expenditure ...	102.6	109.6
Surplus	3.7	5.5

The telegraph deficit is the lowest since 1947-48. The upward turn in the telephone surplus came after two years of decline.

Telegraph Services

The improvement in the telegraph finances occurred despite a continued decline in inland traffic, which decreased by 6 per cent. compared with 1952-53. The consequent loss of revenue of about £200,000 was more than offset, however, by additional revenue from Private Wires (partly due to the tariff increases imposed during the previous year), and by an increase in the credit taken in the telegraph accounts for the Post Office's expenses in handling Broadcast Receiving Licence work. Altogether, telegraph income rose by £700,000.

Telegraph expenditure increased by only £200,000, despite a heavy item of additional expenditure for pay awards—about £500,000—and other miscellaneous increases; these increases were offset by savings amounting to £400,000 from reductions in staff made possible by the decline in traffic.

When the telegraph accounts for the current year 1954-55 come to be prepared, they will of course show the effect of the higher tariffs introduced a few months ago.

Telephone Services

Telephone business grew substantially during the year. Compared with 1952-53 local call traffic went up by 6 per cent. and trunk calls by 5 per cent., while 268,000 additional telephones were connected. Altogether the growth of business brought in additional income of £6,300,000 and the full year effect of the tariff increases introduced in July, 1952, produced a further £2,500,000.

Telephone service expenditure went up by £7,000,000. Pay awards cost £2,500,000 and provision for plant depreciation and interest went up by £2,600,000 and £1,500,000 respectively. Other items showed a net increase of £400,000.

Following the practice of the post-war years, the amount provided for depreciation of plant includes a contribution towards meeting the heavy costs of renewal which will have to be met in future years; the contribution included in the 1953-54 accounts is £1,500,000, making a total of £16,000,000 provided to date.

Capital expenditure on telephone plant rose appreciably. It accounted for £46,700,000 out of a Post Office total of £56,500,000, and compares with a telephone capital programme of £42,000,000 on 1952-53 and £31,400,000 in 1951-52.

The table shows a few outstanding statistics.

	1952-53	1953-54	Increase or Decrease
Local exchanges at end of year—			
Automatic	4,383	4,494	111
Manual	1,507	1,419	88
	Thousands	*Thousands*	*Thousands*
Exchange connections at end of year—			
On automatic exchanges	2,567	2,748	181
On manual exchanges	1,024	1,021	3
	3,591	3,769	
Exchange connections at end of year—			
Business rate—Exclusive	1,488	1,511	23
Shared	117	131	14
Residence rate—Exclusive	1,406	1,400	6
Shared	474	611	137
	3,485	3,653	
Exchange service stations at end of year	5,826	6,094	268
Applications for connections during year	347	413	66
Applications outstanding at end of year...	427	376	51
Inland Calls—			
Trunk	264,064	277,880	13,816
Local	3,165,000	3,370,000	205,000
Overseas calls—Continental cable service—			
Outward	1,484	1,629	145
Inward	1,379	1,498	119
Transit	22	24	2
Radiotelephone services—			
Outward	79	84	5
Inward	78	82	4
Transit	20	20	—
Total overseas calls	3,062	3,337	275

Inland Telecommunications Statistics

In the three months ended 30th September, 1954, there were 110,567 new demands for telephone service and 107,000 new subscribers' exchange connections were installed. The number of shared service connections at 30th September was 815,100 compared with 776,000 at 30th June and the number of outstanding applications was 372,318 representing a decline of 4,000 during the quarter.

79,068,000 inland trunk calls were made of which, 21,319,000 (27 per cent.) were at the cheap rate. In the corresponding quarter of the previous year the figures were, 72,100,000 and 19,273,000 (27 per cent.).

The number of inland telegrams (excluding Railway and Press) amounted to 7,449,000 including 1,402,000 (19 per cent.) greetings telegrams. In the same quarter of 1953 the figures were 9,584,000 and 1,726,000 (18 per cent.).

At the end of September, 1954, there were employed, 46,933 telephonists, 8,067 telegraphists and 55,849 engineering workmen. The corresponding figures at September, 1953, were 47,926, 9,019 and 54,745.

NOTES and NEWS

Unified Operating Procedure.—At present the operating procedure used when setting up a long distance telephone call differs from that used on short distance (toll) calls, in that the operator gives more individual attention to each call and it therefore takes up more of her time. In the Post Office Midland Region a common procedure based on the present toll practice for both types of call has been in use since August, 1954, and has worked satisfactorily. This procedure reduces the time needed by an operator to deal with calls, and should lead to economies and improvements in the service.

* * *

Telephone Records.—Massachusetts Audubon Society (bird-watchers) have organized a system by which anyone in Boston, by ringing a given telephone number, may hear a 30-second record of latest reports of arrivals supplied by voluntary bird-watchers. The caller then has 30 seconds in which to report any information he may have.

* * *

Hurricanes in U.S.A.—On August 31, 1954, a hurricane struck the north east States of the U.S.A. putting some 334,000 telephones out of service. A few days later service on 50,000 telephones, some of which had only just been restored after the first devastation, was disrupted by violent thunderstorms, while on September 11 a further hurricane swept these unfortunate States and left in its wake some 295,000 telephones out of service. The course of the second hurricane had been carefully watched and assistance (men, supplies and transport) from telephone companies in neighbouring States, which had been prepared in advance, enabled the restoration work to be completed in five days. The total cost of making good the devastation to the telephone service by these two hurricanes is estimated at approximately $12 million.

"Use, but don't Abuse".—The Signals Officer of a large Forces establishment in the Oxford area put up this poster because too many telephones had been damaged.

* * *

Six Digit Numbers at Bristol.—To meet the increasing demand for telephone service in Bristol the existing numbering range has had to be enlarged. The first step was taken at midnight on November 27-28, when some 4,000 subscribers' numbers at one of the satellite exchanges were changed from 5 to 6 digits.

Although suitable publicity was given, a "changed number announcer" was also provided, the recording being made by Mrs. J. Packer, the successful Bristol telephonist in the local "Golden Voice" competition. So perfect was the recording one caller was heard to say "All right, Miss, there's no need to tell me again, I heard you the first time".

Further number changes from 5 to 6 digits are to be made, and in all some 15,000 of the 40,000 subscribers will have 6 figure numbers.

In conjunction with the number changes and the issue of the 1954 Area Directory, opportunity was taken to introduce hyphens preceding the last four digits on the Bath and Bristol 5 and 6 digit numbers. Although these were provided as an aid

to memory and with no technical significance, some subscribers have put unexpected interpretation on the hyphen, concluding that the preceding digit referred to the postal district only, or indicated the number of auxiliary lines rented by the subscriber, or that the hyphen itself meant duplicating the preceding digit so that Bath 2-2345 became Bath 222345.

* * *

Engineers fight storm damage.—As we go to press in mid-January reports are coming in of damage to telephone lines from the snow storms and blizzards in the first two weeks of the month, but just as the Commons rose for their Christmas recess Mr. David Gammans, Assistant Postmaster General, paid tribute to the engineers "who have worked so hard to complete [the] great task" of clearing up after the November and December storms. Rather more than 70,000 telephones were put out of order by flood and storm in December; more than 60,000 of them were in Wales and south west England, and nearly 200 small exchanges were temporarily isolated.

Space does not permit us to record more than a few examples; in two days last November 186 trunks and junctions were faulty, and 2,000 subscribers affected, in Northern Ireland, but in spite of further trouble the engineers were able to contain the position through the following days. Thirty thousand subscribers' instruments were put out of order in the south west. Equipment at the little village of Creetown in Kirkcudbrightshire (where over a hundred people were made homeless) was damaged beyond repair and engineers, including a mobile exchange from Edinburgh, were rushed in and restored services over the week-end. In most places serious flooding hampered the work of restoration, but by general agreement the Post Office men did a find job; perhaps public opinion may be summarized by quoting the *Galloway Gazette* on the Creetown incident: "Congratulations are due to Post Office Headquarters, the Telephone Manager, and a special pat on the back to the engineering staff for their doggedness in carrying on under most difficult conditions until the job was thoroughly completed . . . It was a magnificent feat".

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Contributions. The Editorial Board will be glad to consider articles of general interest within the telecommunication 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 Department.

Communications. Communications should be addressed to the Editor, Post Office Telecommunications Journal, Public Relations Department, Headquarters G.P.O., London, E.C.1. Telephone: HEAdquarters 4345. Remittances should be made payable to "The Postmaster General" and should be crossed "& Co."

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(Continued overleaf)

GROUP INDEX

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