POST OFFICE

telecommunications

JOURNAL

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AUTUMN 1955

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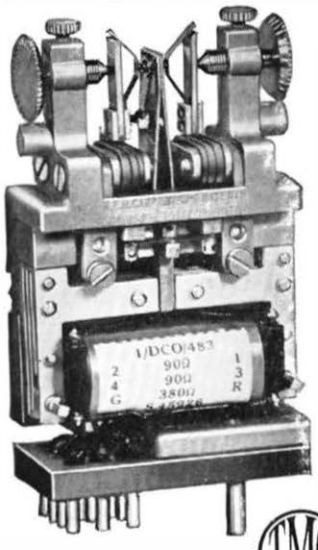

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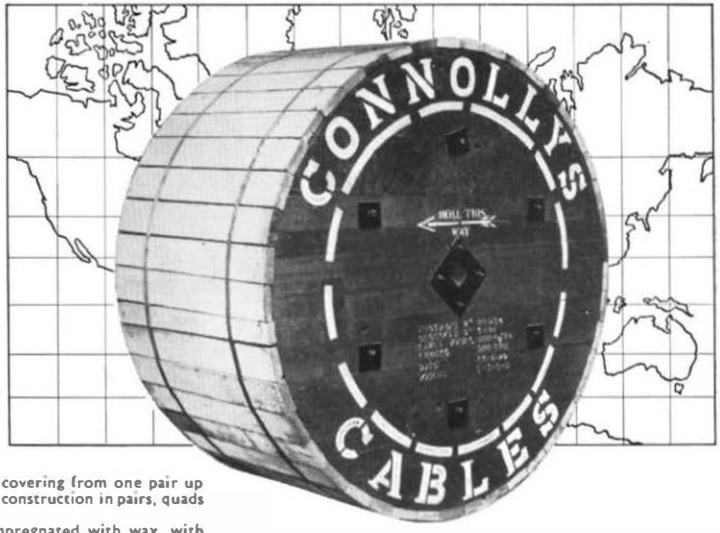

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Post Office Telecommunications Journal

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Contents

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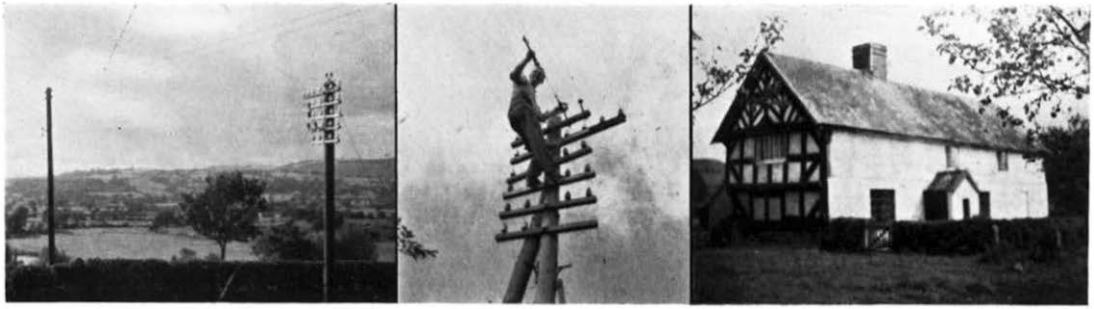
Half-Way

IT IS NOW NEARLY TWO YEARS SINCE THE POST Office, and the American and Canadian organizations who join with us in operating the transatlantic telephone service, concluded an Agreement to provide that service by cable under the Atlantic. In recording this historic decision, in our February, 1954, issue, we commented that the Agreement was only the beginning and that our colleagues here and in North America faced three years of arduous work in bringing the project to completion.

In this issue we record a note-worthy stage in the building of this unique communication system in which British and American techniques, skills and manufactures are being combined over its 3,000 miles course. The making of the final splice in the first of the twin repeatered cables between Scotland and Newfoundland brings to an end this year's cabling operations, and we extend our congratulations to Commander Betson and the crew of the *Monarch* on its successful outcome.

This is a proud moment for all those out of whose foresight, knowledge and skill this great project was conceived and is now being brought surely to realization. But their efforts and the work in cable and repeater factories and on the land-based installations continue without relaxation in preparation for next year's cabling operations and for bringing the system into service towards the end of 1956. Then the difficulties and uncertainties associated with the present radio telephone service will be removed and the benefits of transatlantic telephony by cable will become available to telephone users throughout Europe and North America.



Country Customer

*K. P. Gooder**

THE STORY OF WHAT HAPPENS FROM THE time a letter is received in the Telephone Manager's Office saying that someone wants a telephone until the telephone is installed and ready for use is interesting. Providing telephone service is not a simple business anywhere; it can often be a tale of difficulties overcome by ingenuity and team-work, particularly when service is wanted in a remote rural spot. So, because I work in an Area—Shrewsbury—that is predominantly rural, I am telling the story of how one country customer's order was met, but it is similar to dozens of others.

Many people in the Post Office telecommunications services may not know what is involved in providing a telephone, and even those responsible for one or other aspect of the work may not always see it as part of an important cycle of operations that ultimately leads to satisfied customers, on whom we all depend for our livelihood.

First there is the apparatus in the telephone exchange (calling equipment, multiple and so on); next, a pair of wires in the cable from the exchange to the distribution point nearest the customer's premises; then, a pair of wires between the distribution point and the premises where the telephone is wanted, which in a town will generally be only a matter of yards and need a short length of cable or a span or two of overhead wires, but in the country may often be a mile or more, needing many poles and thousands of yards of wire; and, finally, there is the telephone itself, with its associated apparatus, in the customer's home or office. We are often in difficulties with all except the telephone itself.

Because the demand for telephones since the war has been more than could be met with the resources of men and materials at the disposal of the Post Office, there has had to be a system of priorities to ensure that the most necessary telephones are provided first and to limit the labour and stores expended on each order to a level we can afford. There are several priority categories, and the amount of work which can be undertaken for one customer depends on his priority. Only orders of the highest priority are allowed an unlimited amount of work.

Another measure planned to ensure the best use of our limited resources is shared service. With this arrangement two subscribers share the same pair of wires in a cable, and in the country often the same overhead line as well. Since 1948 all new or removing subscribers who rent their telephones at the residence rate have been liable to share either from the outset or later when asked to do so by the Post Office.

Let us then imagine we are in the sales office of the Shrewsbury Area. A clerical officer has just received the first post. He picks up a letter: "*Dear Sir, . . ., so it is important that I should have a telephone at my farm . . .*". It is not surprising that the letter should be from a farmer because almost a quarter of the telephones installed in this Area during the next few years will be in farm-houses. Farmers' lines, incidentally, cost on an average about seven times as much as other lines in the Shrewsbury Area and the average will

* *See page 38 "Our Contributors", for personal notes about authors of articles in this issue.*

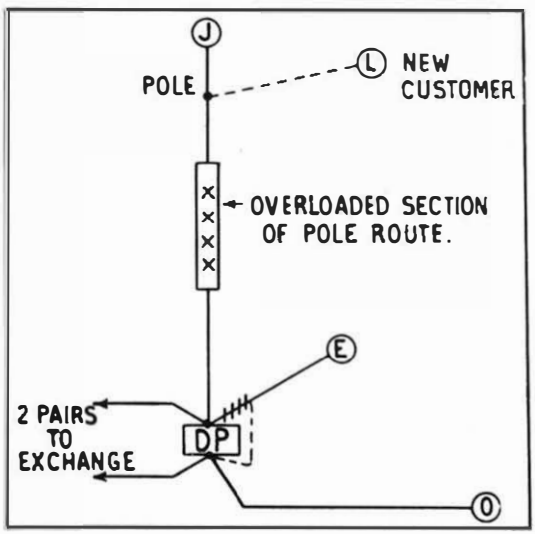
probably rise to ten times (possibly more) that of other lines during the next two or three years; at present the national average is, in fact, ten times.

As each telephone exchange serves a defined geographical area the clerical officer must first decide which exchange the new line should be connected to—if necessary, by reference to maps that show exchange boundaries. In country districts this is not always easy; addresses are sometimes vague, and a visit by an engineering or sales officer may be needed to make sure.

The next question to be answered is whether there is spare apparatus in the exchange to accommodate our new customer. The clerical officer knows the answer to this question because the traffic people keep him informed.

The clerical officer, having checked that the equipment is available, enters details of the order on the order list and marks the entry with the appropriate priority grading. When it is not possible to complete an order at once, the precise reason for the delay is also shown on the order list by code letters. Usually it is because one or more of the essential components mentioned earlier are not available, and cannot be obtained immediately. Sometimes, however, we have so many orders on hand that we just cannot accept any more for the time being even though we have exchange equipment and local cables. Whatever the obstacle is, it can be seen at a glance from the order list.

Pairing arrangements—J (Jones), L (Llewellyn), E (Evans) and O (Owen)
Original wiring ———— New wiring - - - - - - - - - - -



The Sales Representative calls on the new customer

The order is now sent on the next, very important, stage of its journey—to the Engineering Division, where they find out from special maps of the locality which distribution cable should be used. The routing officer may discover that the cables serving the neighbourhood of the farm are fully in use, so special arrangements will have to be made if the order is not to become just another name on the outstanding-order list. A careful check is made to see if a way can be found round the difficulty. The engineering records show that there is a subscriber—say Mr. Owen—in the same locality who has exclusive service at his residence on the understanding that someone else could share the line later.

To find what will be involved in providing a shared line a survey is made on the spot and here another "snag" may come to light. A large part of the pole route that would have to carry the line for the new telephone may already have more wires on it than it was designed for—it is overloaded—and any further weight will certainly make it unsafe. To rebuild or strengthen the route will be costly, and although something will eventually have to be done there are more urgent jobs to be tackled first. To complicate matters still more it is found that 20 new poles will be needed to bridge the gap between the nearest pole on the

existing route and the farm, a larger number than is normally allowed for any one farmer. The survey officer regards these obstacles as a challenge, and after a careful study of the problem he is able to produce a solution.

Farmer Jones, the nearest existing subscriber to Mr. Llewellyn's farm, shares a line with another farmer, Mr. Evans, whose house is near the distribution point about two miles away. The overloaded route carrying the wires for Mr. Jones's telephone lies between his farm and Mr. Evans's. About half a mile from the distribution point, in the opposite direction from Mr. Jones's house, is the residence line that may now also be used for shared service. Mr. Owen rents it. If Mr. Evans will share with Mr. Owen instead of with Mr. Jones, and if Mr. Jones will share with the new customer, there will be no need to place any more wires on the overloaded route, because the wires to Mr. Jones's house can be used jointly for his telephone and the new one. But people don't like changes, and as Mr. Evans and Mr. Jones are business subscribers who are voluntarily sharing with one another they are not under an obligation to accept a change. If, however, we have earned their goodwill by our past dealings with them—as we should have—and approach them in the right way now, they will almost certainly co-operate to enable another neighbour to have a telephone.

Co-operation

But what about those 20 new poles that are needed? The survey officer has noticed that there are electricity supply poles almost all the way from the farmhouse to the nearest Post Office pole, and he knows that the Electricity Authority will be willing to let us put our wires on their poles, because we also let them use our poles for their wires in similar circumstances. All this is reported to the Sales Division, who are also told that the total work involved would be the erection of four new poles and 2¾ miles of double wire if the suggested re-pairings can be effected. This is well within the limits allowed for farmers.

The Sales Division's record of the case is brought up-to-date and then the order is passed to a sales representative so that he may visit all the people involved to get them to agree to the survey officer's plan. After our proposals have been fully explained to Mr. Evans, Mr. Jones and Mr. Owen, they may all be willing to co-operate—such co-operation, incidentally, is one of the heartening features of our daily experience with country folk, for it helps us to fulfil scores of orders annually that would otherwise mean additional names on our lists of waiting customers.

Mrs. Llewellyn watches the fitter

Next, the sales representative calls on the new customer, Mr. Llewellyn, and tells him of the arrangements we have in mind to give him a telephone. The representative carefully explains shared service, for unlike our American cousins we in this country are not generally accustomed to sharing telephone lines and take a little time to get used to the idea.

After a little thought, Mr. Llewellyn thanks the sales representative for all the trouble that has been taken to provide him with a telephone, and says he will agree to have a shared line. He signs an application form setting out the terms under which the telephone is to be installed, the sales representative having previously confirmed from his maps of the district that the farm is within a three-mile radius of the exchange—an important check in an Area like Shrewsbury, where many subscribers are more than three miles from their exchange and, consequently, have to pay a higher rental based on the radial distance involved. Details of the directory entry are decided on, advice on this being freely given to ensure that anyone who wants to call Mr. Llewellyn will be able to find his name in the directory without difficulty. Before he

leaves, the sales representative will settle the question of the type of instrument to be supplied and where it is to be fitted, giving guidance as to what is likely to be most satisfactory.

On receiving the completed application form the sales clerical officer crosses through Mr Llewellyn's entry on the order list, gives the new line a telephone number, and prepares an *Advice Note. This is a multi-copy document, and a copy of it is sent to everyone who is responsible for some of the work of providing the new telephone installation. Although the real work is only just beginning, the most hazardous stage is over. From now on the question is not whether and how we can fulfil the order, but how soon.

The Last Laps

The Clerical Division, at the request of the officer-in-charge of the installation control, gets formal permission from the Electricity Authority to place our wires on their poles; wayleaves are sought from the owner of the land on which we want to erect the four new poles that are needed; and full details of the line stores must be listed, so that the foreman of the installation gang given the job knows exactly what work is involved and what stores he will need. These last two tasks are the responsibility of the survey officer who did the preliminary survey. This done, the installation gang is instructed to carry out the line work; three subscribers' lines have to be rearranged, and the new line has to be put up to Mr. Llewellyn's farm. In due course, this work, which takes the gang nearly two weeks, is finished (see diagram).

Meanwhile, the fitter receives his copy of the advice note, which tells him what sort of apparatus is to be installed in the farm, and away he goes to carry out his part of the work. This is soon done—possibly in two to three hours—but the way the work is done is very important, because Mr. Llewellyn or one of his family will watch the fitter closely while he does it. As usual the work is well done, and Mr. Llewellyn is pleased. The fitter also visits the home of Mr. Owen, who is now to share a line for the first time, and makes the necessary modifications to his installation, taking care to cause as little disturbance as possible. In the exchange—a small one known as a unit automatic exchange—the necessary connexions have been set up, and the equipment allocated for the new line tested to make sure that it is in good working order.

See the May-July, 1955, Post Office Telecommunications Journal.

The outside work having been finished, everything is now ready for the first call, which the fitter makes before finally pronouncing the telephone "ready for use". His last tasks before leaving are to instruct Mr. Llewellyn in the way telephone calls are made and to answer any questions about the telephone. Of course, he leaves a telephone directory and an instruction card so that the Llewellyns will be sure to operate the telephone properly.

Accurate records have to be kept of every installation and these records are prepared as the various copies of the advice note are dealt with: by the Engineering Division, who must know how the line is routed at the exchange and in the cable, and what apparatus there is at the subscriber's premises; by the exchange operating staff, who must know who and what the subscriber is, his number and so on—it is they who put the meter reading for the new line on their copy of the advice note so that Mr. Llewellyn will be correctly charged for his metered calls; and by the Clerical Division, for the normal accounting arrangements and numerous other purposes, including the directory entry.

When the copies of the advice note are finally returned to the Sales Division to show that all the work has been completed, a supply of special post-cards is sent to Mr. Llewellyn so that he may let his friends know that he is now "on the telephone". And another order has been fulfilled—for a country customer.

Our New Cover

This issue starts our eighth year—the first number appeared in November, 1948—and we have marked the occasion with a new cover design by Maurice Rickards. We hope our readers will find it refreshing and will appreciate its simplicity. We propose to continue the policy of having a different colour for each year and volume.

For some time we have designated each issue by the months during which it would be current—for example, November-January instead of merely November, the month of publication. In future, more logically we believe, each issue will be dated by the season; the issues will therefore be known as Autumn, Winter, Spring and Summer respectively. The dates of publication (November 10, February 10, May 10 and August 10) will remain the same.

The New Wall Telephone

H. J. C. Spencer, A.M.I.E.E.

Fig. 1 : The final design which was developed by Ericsson's in collaboration with the Post Office Engineering Department

IN THE EARLY DAYS OF THE TELEPHONE, WHEN the apparatus was bulky and not easily moved around, the wall telephone was a popular and convenient type of instrument. With the coming of neater table telephones its popularity waned, but for some purposes a wall telephone is still ideal for subscribers and it always finds favour with engineers because it is a combined set easily installed, has one less cord than a table set and, once installed, cannot be dropped and broken.

The first telephone in the Post Office series was a wall telephone and ever since 1900 the Post Office has given an applicant the choice between a wall and a table instrument. With the introduction of the handset table telephone of 1936, however, the need for table and wall varieties of the same basic telephone ceased, as this could be fixed on a bracket to form a satisfactory wall telephone when required.

Pre-war Designs

In 1938 a further type of handset table telephone, the familiar 300 type combined set, was put into service. This had space for fitting keys for auxiliary purposes, for extension plans and the like, but it was too long to be mounted on a bracket and used as a wall telephone. A logical further step would have been a wall telephone giving the same facilities; this project was, however, overtaken by the war and only recently has it been possible to fill this gap in the Post Office range.

When peace did come the time was not propitious for going ahead with new designs. Capital for investment in telephones was scarce and demand was great, so the obvious policy was to make do with the pre-war designs for which all the manufacturing tools existed. A conflicting factor, however, was the rapid growth of "2-Party Line" working, re-christened "Shared Service", which enabled use of the limited line plant available to the best advantage.

The type of shared service finally standardized for automatic exchanges required calling subscribers to press a call exchange key, so that the exchange apparatus could tell which of the two subscribers was using it, and could register the call on the right meter. The key was easily accommodated in the table telephones but the lack of a wall telephone in which keys could be mounted was emphasized.

An interim type of wall telephone, designed to fill the shared service requirement only, was therefore introduced in 1948. This telephone, illustrated in Fig. 4, used as far as possible the same parts as the table telephones—the chassis on which most of the parts were fixed being identical. Besides the call exchange key this telephone also contained a relay and other components necessary to prevent the bell tinkling when the partner telephone dialled. This made the telephone rather bulky and, added to the rectangular styling, resulted in criticism of its appearance. In the meantime, a method of bell tinkling suppression which used a tiny thermistor in place of the relay had been developed.

(The heart of the thermistor is a bead of metal oxides which has a very high resistance at normal temperatures, but whose resistance falls to a low value when it is heated. Isolated voltage surges, which would cause irritating tinkles, are insufficient to warm up the thermistor bead and it remains a high resistance isolating the bell from the surges. Genuine ringing signals on the other hand last long enough to heat up the thermistor whose resistance falls allowing the bell to be energized.)

The Post Office decided that this development justified designing a completely new wall telephone and the Council of Industrial Design, which had criticized the interim telephone, was asked to advise on style. On the Council's advice, the Post Office commissioned a designer to produce a prototype telephone, laying down a number of conditions which the complete design had to meet The appearance of this prototype telephone, illustrated in Fig. 5, was not completely satisfactory, so current proprietary wall telephones were reviewed to see if anything better was available. A display of wall telephones, including the newly designed prototype, was held; a "mock-up" of a design project by Ericsson's was included, and the Ericsson design was judged to have the best appearance. The Post Office, therefore, decided that it should be developed to give the many facilities required.

Ericsson's developed the new telephone with the collaboration of the Post Office Engineering Department; the final design is illustrated in Fig. 1. This contains the same parts as the 300 type, and gives the same facilities except that it does not include a directory tray. This could not be included without spoiling the appearance and so it was omitted. The principal parts are mounted on a die-cast base plate, as shown in Fig. 2, the telephone case being a plastic moulding fitting over the base.

Fig. 2 : The principal parts are mounted on a die-cast base plate, the case being a plastic moulding fitting over the base

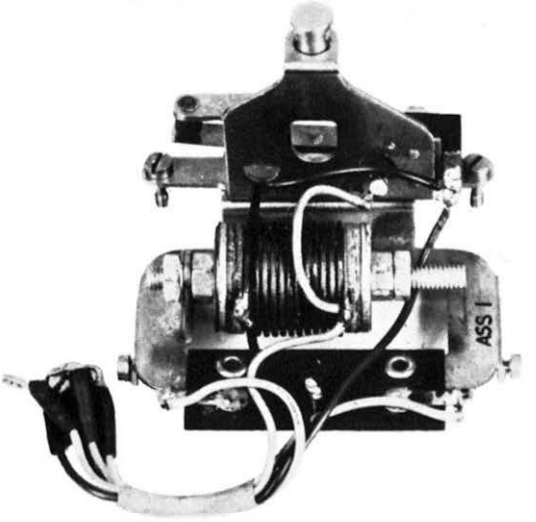


Fig. 3 : The adapter, which comprises the extra key, rectifier and thermistor necessary to convert the telephone for use on automatic shared service systems

Following experience with previous telephones a number of small improvements has been made. The maintenance engineer can remove the dial without removing the case, while the case itself may be removed, revealing all the rest of the telephone, by slackening only one screw. The method of fixing the instrument to a wall is an improve-

Fig. 4 : Interim type : this used as far as possible the same parts as the table telephones

ment on previous wall telephones. It is spaced slightly from the wall by rubber bushes instead of the customary rigid ones; these give flexibility to allow for uneven wall surfaces and for deviations of the fixing screws from their true positions.

A real difficulty for the Post Office Engineering and Supplies departments is the multiplicity of types of telephones made necessary by the different kinds of service to be provided. There are, for example, eight different types of the 300 type table telephones, and with variations in exchange systems and in telephone colours there may be up to 12 stocked varieties of each type, so that the idea of a universal telephone which the installer can simply adapt to provide a number of different facilities is very attractive. This idea cannot economically be taken far, however, for it is wasteful if the price of universality is the provision in every telephone of some part which will be used only in a few.

Flexibility

With the new wall telephone an attempt has been made to provide flexibility economically. This instrument is made and stocked in three basic types only. The first is a simple telephone which gives only the essentials for an exclusive direct exchange line and does not provide for the fitting of keys or any variation. The second type is the "flexible" telephone, to which may be fitted up to three push button keys and the circuit of which may be changed by fitting add-on units within the telephone to give the same facilities as a number of differing table telephones. The third type is a telephone fitted with a trembler bell in place of the usual magneto bell.

An adapter for use within the flexible telephone is illustrated in Fig. 3. This adapter comprises the extra key, rectifier and thermistor necessary to convert the telephone for use on automatic shared service systems. The adaptor is connected in the telephone circuit by the short cord. Apart from the immediate advantages of the flexible telephone there is always the possibility that some future requirement, at present unthought of, will occur which can be met by adding a new simple adapter instead of manufacturing a new type of telephone.

Apart from the immediate advantages of the flexible telephone for adaptation to a variety of current requirements, it does make some allowance for the possibility that new developments, as yet unthought of, may occur which might be met by providing further simple adaptors, so avoiding the time and cost of designing and producing a completely new type of telephone.

Fig. 5 : Prototype : the appearance of this telephone was not completely satisfactory

Rebuilding the City of London

C. W. Davies and D. Midgley

December, 1940 — Central Telegraph Office

DURING THE 1939-45 WAR LONDON UNDERwent a fire comparable with the Great Fire of 1666. This time, not only the City was damaged; practically the whole of Greater London was affected, though the City probably got it worst and, by the end of the war, 115 of its 640 acres were devastated. The City of London is now being rebuilt and the City Telephone Area is busy planning to restore the telephone services.

In many ways the vision and industry of the 17th century Londoners who rebuilt after the Great Fire are being repeated. Before the war ended reconstruction plans were formulated. St. Paul's Cathedral was to be the centre-piece and the whole plan was conceived with the idea of making the Cathedral dominate the scene to a greater degree than formerly; the planners also seized the opportunity to close some streets and widen others, while some new streets also were planned. Finally, like their predecessors, they gave much thought to the new buildings which should rise from the ruins. As befits the business character of the area these are to be mainly offices, warehouses and showrooms, though churches, livery halls and civic buildings have not been overlooked and there is to be some residential building.

Two important conditions were applied. One was that, to facilitate redevelopment, certain buildings near bombed sites could be acquired and demolished if they were more than 50 years old. The second was that, because so much land was being surrendered to make wider or new streets, the new buildings should go much higher than formerly. In consequence there are likely to be many buildings of ten to 14 storeys above ground level and at least one "skyscraper" of 29 storeys.

Until about two years ago these plans existed mainly on paper, but successive Lord Mayors urged the importance of the City as the commercial centre of the Commonwealth and pressed for some allocation of licences for rebuilding. They succeeded in securing permission to build a few, notably two big buildings in Mincing Lane known as Plantation House and Dunster House, and another in St. Swithin's Lane. In 1953, however, licensing became much easier, and in 1954 it was lifted altogether, so that the rebuilding plans, so carefully thought out, are now going ahead at full speed. Large areas are in the hands of building contractors, working on new buildings in all states of construction. Land is taken over almost daily and nearly every new set of excavations reveals something of interest, the most note-worthy being the Temple of Mithras found in Walbrook.

At the same time bombed sites and shattered buildings are disappearing from view. In the main this is a refreshing spectacle, but it is not without some sadness. On many of the derelict sites, pleasant gardens have been laid out, including one which has been tended by Wood Street telephone exchange staff for several years. These are now fast disappearing.

It has been estimated that 27 million square feet of floor space (about one third of the total in the City) were destroyed by the bombing. By the end of 1954 about a quarter of the lost accommodation had been replaced. Although the first quarter took nine years to build, the remaining three-quarters are expected to be completed in six years and already there is ample evidence of the increased speed of rebuilding. Some 150 buildings, varying in size from 20,000 square feet on five floors to 350,000 square feet on 16 floors are being constructed or are about to begin, and about 200 more are in the offing.

A model of one of the larger buildings now being erected in the City of London

Some of the buildings will be occupied entirely by one concern; others are to be let piecemeal and will accommodate tenants occupying anything from a whole floor to two or three rooms.

Where there is only one occupier one large telephone installation will serve the whole building but a variety of smaller installations will need to be provided for buildings occupied by several tenants. Throughout, the method of distribution is to install in each building a common frame on which the cable pairs from the street are terminated. Each building is block wired, the main internal cables being terminated on the other side of the main frame and distributed over the building through chases and risers to subsidiary frames and to numerous distribution cases from which the pairs into the individual offices are run. The frames and distribution cases provide a large measure of flexibility for the internal cable network, besides being points through which each exchange line and extension is connected to the private branch switchboard(s) in the building.

The problem is to know on what scale the block wiring should be provided. Where a building is being occupied by one subscriber and his identity is known well in advance it is possible to agree on the initial and future telephone provision in sufficient detail before the building starts. Unfortunately clear-cut information like this can rarely be obtained and some other basis of forecasting has to be adopted. Here, happily, we are able to draw on experience.

The method used is to calculate the telephones per 1,000 square feet of floor space. It has been found that for office accommodation (by far the largest proportion) an ultimate figure of about ten cable pairs per 1,000 square feet should be allowed for; this includes a percentage for miscellaneous services. Other figures have been worked out for other types of accommodation—for example, halls, shops, restaurants and so on which will be provided in the buildings—all based on floor space. By studying each building separately the development staff calculates the probable telephone needs on each floor or section.

These figures are, of course, mainly for extensions and the exchange connexions must be estimated by applying ratios; these average about one connexion for six extensions in existing accommodation of similar size and type.

With this information it is possible to determine the facilities required of the owner and the architect for frame space, chases, risers and other constructional requirements, and the lead-in arrangements for the underground cables. The block wiring system can be designed, the external

planning can go ahead and the stores put on order. It is usual to have approximate estimates for the block wiring and ducts before the site is cleared. This not only keeps the job well in hand from the outset, but enables the duct scheme to be integrated into the builder's plans when he starts laying the foundations.

Underground Plant

The underground plant requirements have to be studied for every building and must take account of the effects of widening or closing existing streets and of constructing new ones. Provision for growth and for the "fundamental plan" for the neighbourhood have also to be allowed for. These two sentences state the case for a most comprehensive series of local line schemes. After the bombing the underground plant suffered very badly, but little or nothing was done to renew it because the buildings which the cables served had disappeared. All this plant has had to be identified and examined. Much of it is in such a state that complete renewal is the only way to deal with it. Other plant, although serviceable, may be useless because, for instance, it is under a street which will become the site of a new building.

In planning the ducts the fact that most of the new buildings—and certainly all the largest ones which present the biggest problems—are to have deep basements has helped. By agreeing at the outset with the City Corporation on the one hand, and the architect on the other, it is possible to minimize congestion of underground plant of all kinds in the streets, but entry to these new buildings will need to be at varying levels, sometimes even as deep as 20 feet or so, the main frames being close by. Thus the cables can be brought straight into the building, much more easily than formerly, into space which can be laid out as a cable chamber.

All this is, of course, fairly costly but, by planning boldly enough at the outset, it is possible to provide sufficient duct and jointing chamber space to meet needs for many years to come at a reasonable capital outlay, a fair proportion of which becomes repayable instead of being charged to the public network. The sizes of the schemes concerned can be judged from the fact that on main tracks 36-way and 48-way ducts are almost the rule, and for entrances into

Part of the site being cleared for Bucklersbury House : it was here that the Temple of Mithras was found

buildings 9-way ducts or larger are usual.

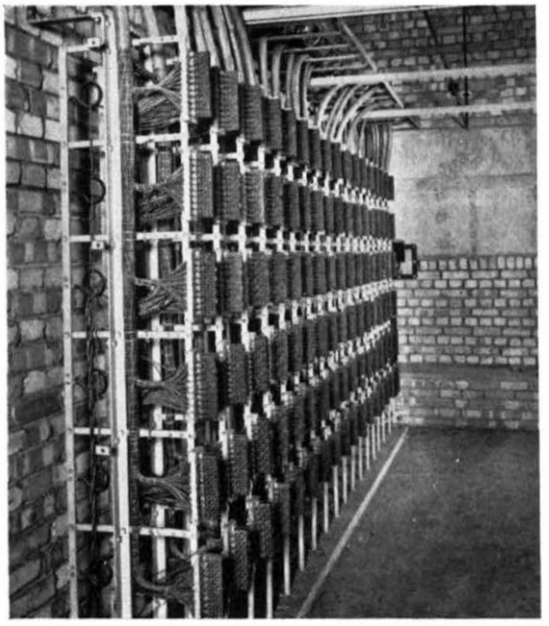
The planning of the underground cabling for the new building, and the ordering of the stores then follows. Five hundred pairs for an average sized new building is the normal scale of provision, and for the largest more than 1,000 pairs are required. Thus separate main or large branch cables to serve one building can often be justified.

The City Area's experience has brought home very forcibly the importance of accurate records of pairs and their allocations on frames and on distribution cases. Nearly every engineering visit to a subscriber's premises involves some work at one or more of these points, and unless labelling, jumpering and recording are kept up-to-date everywhere, a steady increase in "lost" or unidentified pairs occurs, with consequent waste of time in testing. With underground and block wiring schemes of the sizes now being planned the problem is not easy to solve. The Area Engineering Joint Production committee is studying this and new methods will shortly be tried.

Although forecasts tell what the general telephone density in a new building might be, it is not until details can be discussed with the occupiers that the precise needs for subscribers' apparatus can be assessed. In view of the sizes of the installations, the sooner it is known who the subscribers are and their needs discussed with them the better. This will not only give as much time as possible to do the job, but will also make it easier to assess the changes which will occur elsewhere. The occupants of new buildings are hardly ever new subscribers, and their removal means that accommodation elsewhere is made spare and will, in due course, be occupied by other tenants whose telephone needs will most probably be quite different from those of the outgoing subscribers.

Experience shows that, on an average, every move means a series of consequential changes at three other premises, and the work involved at these other premises is often considerably greater in total than the work of equipping the new suite of offices which started off the chain of removals!

In these new buildings the subscribers' requirements are mainly met by private branch exchanges of either the manual or automatic type with, of course, the associated extension telephones, exchange lines, private wires and so on. With the manual type (P.M.B.X.) all calls are handled by an operator, but with the automatic type (P.A.B.X.)



Main frame serving part of Plantation House, a large building recently completed in Mincing Lane

inter-extension calls and outgoing exchange calls are dialled direct by the extension user—only incoming exchange calls being handled by an operator.

In advising a subscriber on the type and size of his installation, operating and accommodation costs must be taken into account as well as equipment charges. Accommodation costs in the City of London are very high—probably about £2 per square foot per year—and, as each subscriber must provide adequate space for whatever installation he decides to take, he likes to be certain that his final choice will give him what he wants with a proper regard for economy in floor space. These same accommodation costs also emphasize the importance in the subscriber's mind of prompt completion dates for his telephone installations, which, in turn, underlines the need for an adequate supply of stores.

Some of the installations are as large as many important public exchanges; for instance, plans for a P.A.B.X. of 4,000 extensions with about 30 automanual positions, 500 exchange lines and numerous private wires are being examined as this article is being written, and installations with over 500 extensions are commonplace. The City Area recently estimated that, annually for the next six

years, it would install about 30 B.E.C.B. No. 10 and 120 P.M.B.X. 1A positions, 20 P.A.B.Xs of varying capacities, and about 800 smaller types of switchboards. In addition, there would be an abundance of every kind of house exchange, plan extension and auxiliary facility and many non-standard items. About the only thing the Area does not foresee is a farmer's line!

There should also be plenty of scope for special services. The City has always been a fruitful ground for these, and the signs are that the occupiers of the new buildings will continue in the tradition. There will be one significant change. The new telex service has arrived just at the time when the rebuilding programme has been stepped up. If the experience so far with the telex service is any guide, it should be possible in the next few years to raise it from a mere adjunct of the other services to a live and vigorous service in its own right, attracting to itself a steadily increasing revenue. There are already about 600 telex instruments in the City. As rebuilding proceeds that number might easily be trebled.

The plans for exchange buildings and equipment could easily form the subject of a separate article. Naturally, with so much expansion afoot, the problem of exchange equipment is well to the forefront. Four large new buildings, each capable of taking two or more director units and appropriate automanual boards, are authorized. The provision is adequate as planned, but the timing will need to be watched. It was recently estimated that if at least two of the new buildings could be assured (each with a full unit installed) by 1960, it would be possible for the City Area to get by—with expedients—although the period 1958–60 would be critical.

This large and rapid programme requires the closest co-ordination between the sales, traffic and engineering planning and construction divisions. This is provided by a representative committee under the chairmanship of the Deputy Telephone Manager; but, to be effective, there must also be full consultation at the earliest moment with the owners, architects, builders and occupiers of the new buildings. In this, the Telephone Manager has been greatly aided by the friendly help of the City Corporation staff from the highest levels downwards who freely advise the Post Office of the building authorities and the architects concerned as soon as details are known.

When Samuel Pepys reviewed the year of the Great Fire in his Diary, he wrote, "The Parliament backward in raising because jealous of spending the money; the City less and less likely to be built again; everybody settling elsewhere and nobody encouraged to trade". There have been moments when some of those remarks seemed true of the post-war period. Despite Pepys' rather despondent outlook the City *was* rebuilt after the Fire on much nobler lines than before. The same thing is happening again, and those in the telephone service whose business lies in the City feel they are playing a vital part in a work which, it is hoped, will be of lasting benefit to the internal and international prosperity of the nation.

Inland Telecommunications Statistics

	Quarter ended 30th June, 1955	*Quarter ended 31st March, 1955*	*Quarter ended 30th June, 1954*
Telephone Service			
Gross demand	129,803	137,742	104,361
Connexions supplied	108,615	107,525	89,287
Outstanding applications	377,240	371,562	376,582
Total working connexions	4,075,676	4,007,053	3,815,607
Shared service connexions	965,110	916,612	775,962
Traffic			
Total inland trunk calls	84,164,000	76,087,000	73,819,000
Cheap rate	22,071,000	18,346,000	18,801,000
Inland telegrams (excluding Railway and Press)	5,394,000	4,747,000	8,759,000
Greetings telegrams	1,028,000	997,000	1,598,000
Staff			
No. of telephonists	48,001	47,414	47,124
,, telegraphists	7,376	7,663	8,348
,, engineering workmen	59,932	59,085	55,288

The Central Station of the Post Office Cable and Wireless Services

C. A. Stradling

Electra House, Victoria Embankment

THE INTERNATIONAL TELEGRAPH SERVICES between the United Kingdom and overseas Commonwealth countries, and foreign countries beyond the European Zone, are operated at Electra House, Victoria Embankment, London, formerly the Cable and Wireless Ltd. Central Telegraph Station and now known as the Main Telegraph Station of the Post Office Cable and Wireless Services. This station also operates Britain's phototelegraph services with both European and extra-European countries. The message telegraph services with most European countries are still operated from the Post Office Central Telegraph Office in the City of London.

The main operating gallery at Electra House (the Instrument Room) covers about one-third of an acre and contains instruments for about 64 radio and 17 cable circuits. Many of the circuits are divided into a number of channels; as many as six channels may be brought into use simultaneously on a circuit which is heavily loaded with traffic. Normal daily traffic varies between 50,000 and 60,000 messages; the volumes of outgoing and incoming traffic are fairly equal but there is also a considerable volume of transit traffic—telegrams which come into London for onward transmission to another country.

The instruments are on 23 operating tables, each being wired for 10 positions, five on either side. The wiring is so arranged that all positions are interchangeable and each is able to work on any of the various types of equipment. Great advantage has been derived from a zonal plan under which circuits which can be used as alternatives to each other are in groups, thus giving maximum flexibility in dealing with traffic. The Canadian circuits, for example, are next to the Australian so that if the Australian direct circuits fail, messages may be quickly diverted to the Canadian for transmission by the Pacific route.

Methods of operation vary according to the various terminals overseas and the medium by which the signals are carried. By far the commonest form of transmission on radio circuits is by tape perforated for morse code signals; the tape is fed through an automatic transmitter, the speed of which is governed by the conditions of reception at the other end. Given satisfactory conditions the radio channels should achieve a speed of 100 words or more a minute. The morse code has the great advantage of enabling flexibility in speed.

Since 1936 a variant of the morse code has been used; this is the Double Current Cable Code, known generally as DC3, which is operated on the main line radio networks. Later innovations include the use of Multiplex equipment and of the 5- and 7-unit codes, in which various combinations of signals, always in units of 5 or 7, indicate the various letters and figures signalled.

The 5-unit code is normal for all teleprinter communication. Sometimes the 5-unit signals are recorded automatically as 7-unit signals so that the additional information carrying capacity of the 7-unit code may be used to detect possible errors which may be introduced by noise, fading and so forth on the radio circuits.

The long distance cables are operated with a variant of the morse code, known as cable code, which involves double-current signals. Speeds of operation of cables (and cable chains) vary greatly according to the length and type of the cables involved. Speeds of the order of 70 words per minute are normal.

Near the Instrument Room is the Control Room in which the terminal equipment associated with the various circuits is installed. The terminals of these circuits are concentrated so as to simplify switching the various radio and cable transmitters and receivers to different points in the Instrument Room. The Control Room engineering staff maintains constant communication with the operators about the quality of received signals and frequently check the quality of the outgoing signals. As the quality of radio circuits varies considerably between day and night and between seasons, and is affected by magnetic storms and sunspots, the Control Room engineers also initiate changes of frequency on the radio circuits when transmission conditions make changes necessary.

As far as possible signals coming in from overseas are received either on a direct printer, which automatically translates them into plain language and prints them on gummed tape, or on an automatic receiving perforator from which the perforated tape is fed into an independent printer; the operator then gums the tape on a delivery

Section of the main operating gallery

Transmission in the Main Instrument Room: operating the keyboard perforator into the transmitter

form. However, if the signals are weak they are received on morse undulator tape, which records an undulating line instead of perforations, and runs past the operator who deciphers it and types the message on a delivery form. On some very long circuits slow morse signals are still used, and received as audio signals, the operator using headphones. The modern tendency is to use teleprinters as terminal equipment, and these are already operated on some circuits.

The counterpart of the Instrument Room for the services in the United Kingdom is the Local Room, which occupies an equivalent space immediately below the Instrument Room. The Local Room is equipped with teleprinters for delivering telegrams from overseas direct over private wires to addressees, or to telex subscribers, or over the teleprinter automatic switching system to local delivery offices. Telegrams for transmission overseas are also received by the same routes. Adjacent to the Local Room is the Phonogram Room, for receiving telegrams which are telephoned in by senders, or for telephoning incoming telegrams to them. A large section of the Local Room is occupied by the Issue or Sending Out Department with messengers for delivering telegrams by hand, on foot or by motor cycle.

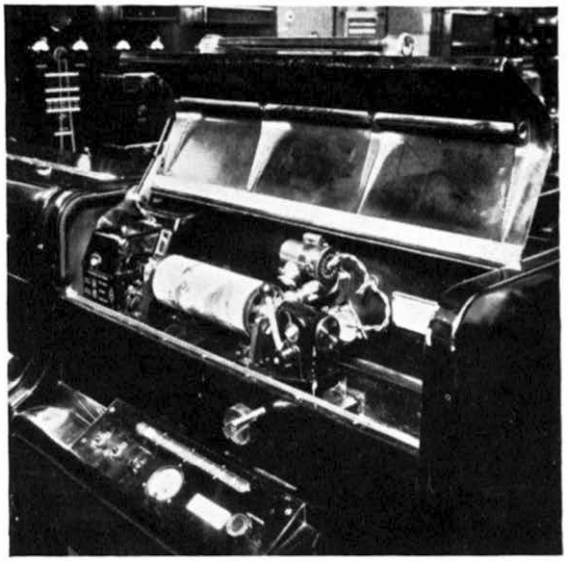
Many business firms and newspapers who send or receive a great many overseas telegrams have

teleprinter private wires for dealing direct with the Local Room. Others subscribe to the telex system under which, by signalling the Local Room number on their teleprinters, they can teleprint a message direct, just as they can teleprint other messages to other telex subscribers. The number of people who thus teleprint or telex their telegrams is growing and the Post Office is doing all it can to encourage these fast and convenient methods.

The busier London branch offices of the Post Office Cable and Wireless Services, at which people can hand in overseas telegrams or from which telegrams can be delivered, have direct teleprinter connexion with the Local Room; others deal with the Local Room by motor cycle despatch rider. Until recently each of the branch offices outside London was connected with the Local Room by direct telegraph circuits but, although some of these are still working, the tendency is for all these offices to work over the teleprinter automatic switching system, which provides an automatic teleprinter network all over the Kingdom.

Telegrams for overseas which are handed in at any of the 13,000 postal telegraph offices in the United Kingdom are sent to the Local Room over the teleprinter automatic switching system, and messages from overseas are sent to them by the same method for local delivery. Telegrams are

Reception in the Main Instrument Room: telegram being received on direct printer and gummed on a delivery form



Muirhead picture transmitting consoles used with frequency modulation apparatus over radio facsimile circuits

delivered by hand within a certain distance of Post Offices or Cable and Wireless offices.

The Phonogram Room contains some 60 positions through which a sender may telephone his message direct to Electra House for onward transmission, or may have an incoming telegram telephoned direct to his office. Each telephonist is equipped with headphones, chest microphone and typewriter, the system being designed to give good service to all callers. There is, however, the problem of a fluctuating load of traffic and some congestion during peak hours is inevitable. One hundred and thirty-two telephone subscribers rent private lines to the phonogram positions. This Phonogram Room is, of course, quite separate from the Electra House Private Branch exchange which handles normal calls with the public.

Paradoxically, the conveyance of telegrams to and from the many acceptance and despatch points in Electra House may present more intractable problems than the actual transmission to an overseas point. An extensive internal system of conveyor belts and pneumatic tubes is used to solve these problems; the tubes also extend to the Central Telegraph Office. One limitation of this system is that all classes of traffic, irrespective of category, are normally subject to the same speed of internal circulation. Each of the operating tables is equipped with a central belt running from end to end, the purpose of which is to transfer incoming

messages from the point of reception to the check point. Each message is then carried by belt to the appropriate point for the next process.

When a telegram for transmission overseas arrives in the Local Room by whatever means, it is conveyed, first, by belt, to the Main Circulation Point. Here it is sorted according to destination, is given a serial number according to its category (Urgent, Full Rate or Letter—each having a different run of serial numbers) and sent on to the appropriate zone in the Instrument Room. It is then distributed to the circuit for the country to which it is to be sent, and the operator transmits it by whatever means is employed on that circuit. The operator endorses the telegram with his signature and, by using an automatic timing device, the precise time at which he completes transmission. After the telegram has been transmitted, the original is transferred to a filing room, where it is padded in serial form and kept for a set period for reference should any enquiries be made.

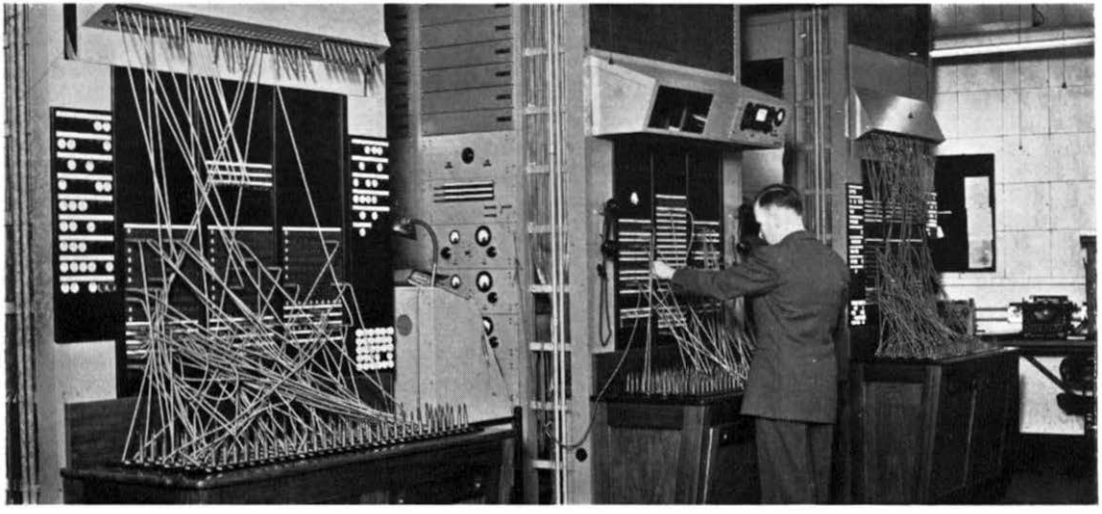
When an operator has gummed or typed an incoming message on a delivery form he counts the number of words to ensure that it corresponds with the number (or "word check") which has been signalled by the sending office; should the check differ or should there appear to be any mistakes or mutilation of words or figures the operator signals back to the sending office for confirmation or amendment. Normally the receiving operator can satisfy himself that he has received an accurate copy of the telegram handed in at the other end and, having signed it and stamped on it the time of arrival, he drops it into the belt which will carry it to the Instrument Room Check—known as the I.R.C.—at the end of his table.

The I.R.C. has to mark off on check sheets the arrival of each telegram, according to its serial number. If it is evident that any message is missing, the I.R.C. Reviser reports by service message to the sending station.

If there is no irregularity the I.R.C. staff send the telegram on by belt to the Local Room for delivery by the appropriate method. During the transfer it is passed through a duplicating machine which produces a "flimsy" copy for filing in case of future enquiry.

The various possible methods of delivery have already been described but the selection of the method may not always be quite simple. Regular users of the overseas telegraph services may vary their requirements at different hours of the day and their instructions may become very complicated. For instance, it is not unusual for a subscriber to demand delivery by teleprinter between hours A to D, by telephone to Mr. X between hours of E to G, by telephone to Mrs. Y between hours H to K, by hand between hours L to N—and a telegram to be held thereafter for delivery at hour Z. The matter becomes further complicated when these demands are varied according to category or other distinguishing feature (signature, first word and

Control Room showing the panels controlling the outlying transmitting and receiving wireless stations



Local Room—concentrator teleprinter section

so on). Fortunately, however, most instructions are straightforward and an efficient delivery service is maintained.

The Issue or Sending Out Department has a complete record of the requirements of various addressees.

When an incoming message is addressed to a firm's telegraphic address, the key to the list of telegraphic addresses has to be consulted before it can be given to a messenger for delivery on foot or motor cycle, according to distance.

Press and Pictures

By reason of the frequency and urgency of the enquiries from the Press, it was found necessary to devise a means whereby the progress of their messages could be closely observed. This has been achieved by using separate conveyor belts and the appointment of Press liaison officers whose duty it is to keep in touch with the Press, inform them of any hold-up, answer their enquiries or if necessary seek the answer from overseas. The Press Liaison Officer has staff on duty throughout the 24 hours in a kiosk in the Instrument Room. Between 50 and 60 million words of news are so handled in the course of a year.

A self-contained section deals with incoming and outgoing phototelegrams†; some phototelegrams are exchanged by wire with European points, but most are carried by wireless to and from extra-European centres.

It is not surprising that the majority of such pictures originate with or are destined for the Press. Every outstanding event in this country results in a large file of pictures addressed to newspapers in various countries overseas and, dependent on favourable ionospheric conditions, they are transmitted in sequence in much the same way as ordinary telegrams. Those which circulate by wire present no great difficulty but radio pictures can be transmitted and received only during periods of good transmission.

Many incoming pictures are addressed to London picture agencies and it is customary to advise them by telephone that reception is impending and they in turn notify the picture room staff of the newspapers to whom the pictures are to be delivered. The technician then connects his receiver to the appropriate private lines, into which the incoming signal is "piped" and the picture is directly received on the newspaper's own apparatus. By this system it is possible to arrange simultaneous delivery to as many as 15 subscribers.

In addition to the Press, a number of firms are using the facsimile service for sending diagrams, balance sheets, pages of typescript, fashion plates and so on. On occasion, the service has been used for despatching finger prints to or from Scotland Yard.

Special Events

It is usual to arrange at Electra House separate circuits providing direct communication with special events, including such occasions as political party conferences, trade exhibitions, sporting events or any such occasion where there

† *An article on "Picture Telegraphy by Radio" by W. G. Allen was published in the May-July, 1953, issue of this* Journal.

is likely to be demand from the Press or public for overseas telegraph facilities. A mobile unit has recently been constructed and it has served to overcome the difficulties which arise when no other suitable accommodation is available. Connexion with Electra House is effected either by a direct line or by the use of the teleprinter automatic switching system.

The overseas telegraph service is, of course, maintained throughout 24 hours of every day of the year. Administrative, technical, operating, feeder and clerical duties entail the employment of nearly 3,000 staff, all of whom are controlled by the Telegraph Manager who is responsible to the Director of the External Telecommunications Executive.

What is a Klystron?

C. F. Floyd

IMPORTANT ADVANCES IN TECHNIQUE FOLLOW so rapidly one after another in telecommunications practice that any individual has difficulty in keeping himself up-to-date in aspects that are outside his immediate interests. The Post Office Engineering Department specializes in many branches of telecommunications engineering, among which radio is playing an increasing part as a means of providing point-to-point communications. The need for expansion of the number of radio circuits, requiring more frequency allocations in the radio spectrum, has led to investigations into the properties of still higher radio frequencies, with the result that micro-waves —that is, frequencies of above 2,000 Mc/s—are proving a very valuable means of carrying telephone and television circuits.

New Techniques

Engineers working with the development of equipment for these ultra high frequencies have, in less than ten years, devised a whole new range of techniques amounting to almost a new branch of electronics. For example, the transmission path carrying the message channels from an antenna to its receiver no longer consists of electric currents in wires but electromagnetic waves moving along hollow pipes, called waveguides. Klystrons and travelling wave tubes replace the familiar multi-electrode oscillator and amplifier valves, and obtrusive metal paraboloidal dishes replace lengths of wire as aerials. All this is very involved, and most depressingly unfamiliar to anyone who does not work on electronics, but wishes to get up-to-date in radio.

Some of his depression may, however, be lifted by *Introduction to U.H.F. Circuits and Components* by Milton S. Kiver (D. Van Nostrand: Macmillan: 45s.). This is not a book for the specialist, and it is devoid of mathematics. The author is writing for the man of average scientific background who wishes to enjoy reading about modern advances in the science of U.H.F. radio. He relies entirely on functional descriptions and analogies to explain how micro-waves travel in waveguides, why magnetrons can oscillate, and so forth; and he does succeed in leaving his readers with the impression that they understand how these components work. The descriptions are clear and comprehensible and, if one overlooks a few cases of over-simplification, reasonably satisfying, despite the absence of mathematics.

Individual chapters are devoted to waveguides, klystrons, magnetrons and travelling wave valves. Some typical applications of these oscillators, amplifiers and more complex circuits are described. A very interesting chapter is devoted to measuring techniques at micro-wave frequencies; among items described are, for example, the measurement of the voltage standing wave ratio, the use of the directional coupler that takes a sample of an electromagnetic wave for measurement, and the various types of power measuring equipment. The book finishes with a chapter on typical U.H.F. receivers and the lay-out of a modern radio station of tower construction.

The book is excellently produced and well illustrated and, strangely for a book of this type, contains a number of simple questions at the end of each chapter. It is an entertaining work, not to be taken too seriously perhaps, but nevertheless with some real value in this age of excessive specialization.

Unified Telephone Operating Procedure

E. G. Crisp

THROUGHOUT THE HISTORY OF THE TELEphone service, the procedure used by telephonists in connecting calls has been continuously changing. Many of the changes are of a minor character and may be no more than an altered word or sentence to meet changing circumstances. For example, under manual conditions an operator said "I am sorry the number is engaged", whereas the introduction of automatic working made it impossible for her to know when hearing the busy tone if it was the actual number or one of the connecting links that was engaged, so the expression had to be changed to "I am sorry the line is engaged". These minor changes do not affect the general pattern of operating but from time to time it becomes necessary to make more sweeping changes so that advantage may be taken of technical developments in equipment and line plant.

Early Days

Before 1930, when nearly all telephone exchanges were operated manually, most of the telephonist's time was spent in connecting local calls. As the programme of conversion of exchanges to automatic working proceeded, subscribers dialled their own local calls but telephonists handled all other originating calls and all incoming calls, and gave assistance to subscribers who had difficulty in obtaining local calls. The method of handling non-local calls remained unchanged, but three different operating procedures were used respectively for junction calls (up to 15 miles chargeable distance) which were untimed; toll calls, which were short distance trunk calls (up to about 50 miles) handled similarly to junction calls but timed by the operator and charged according to the total duration; and long distance trunk calls (to exchanges beyond about 50 miles) also timed but not connected while the subscriber waited on the line as he did with junction and toll calls.

In those days most of the trunk circuits were on overhead routes and required heavy gauge copper wire to keep the electrical resistance of the circuit as low as possible. A circuit between London and Edinburgh, for instance, needed some 290 tons of copper and, even so, the speech currents were very feeble when they reached the end of the more than 400 miles journey. Such circuits were very expensive, both to provide and to maintain, so the operating procedure had to be such that every possible paid second of circuit time was obtained. The available circuits were all too few for the traffic so that every call was operated on a "delay" basis, but with a liberal provision of operators to ensure that circuits were never idle when calls were waiting.

When a subscriber wanted a call to a distant exchange he was connected to "Trunks", where an operator at a position used only for recording calls took down the calling number and the required number on a ticket and then asked the subscriber to hang up his telephone until he was called. The subscriber usually had to wait anything from a quarter of an hour to an hour for his call to mature and longer delays were not infrequent; during this time the ticket was conveyed to another operator who was in control of the trunk circuit concerned and the call took its place in the queue of waiting calls for the distant exchange. Another operator gave close attention to the incoming end of the circuit at the distant exchange so that no time should be lost between the ending of one call and the beginning of the next. On some routes called numbers were passed in advance so that the wanted subscriber could be rung and held in readiness for immediate connexion when the line became free from the previous call.

Demand and Toll Working

The new technique of using underground cables with amplifiers at regular intervals for long distance trunk circuits made them much more plentiful and much cheaper so that it became possible to expand the trunk network very considerably. By 1930 this process had reached such a stage that the number of trunk circuits available was sufficient to enable the great majority of trunk

calls to be put through without delay. Accordingly, following a study of American methods of trunk operating, the "demand" system of trunk operating under which the caller remained at the telephone while the call was set up, was introduced into the inland service.

One might well ask why at this stage a unified operating procedure was not adopted for trunk and toll calls. There were two main reasons. First, as each trunk circuit still required its own individual wires the cost of the longer trunk circuits still loomed large in relation to operating costs and it was economically sound to give closer attention to calls passing over them than to calls over shorter distances. Second, although automatic signalling was practicable over the shorter trunk circuits, calling and clearing signals over the longer circuits had still to be given by ringing (generator signalling) and the operators did not get automatic supervisory signals to indicate when distant operators or subscribers answered. So, when the demand system was introduced in 1932 1933, it replaced trunk operating by means of booking and subsequent completion but it neither superseded nor accorded with the existing toll procedure.

Circuit Improvements

Since the introduction of demand working the cost of trunk lines has been progressively reduced by the introduction of 12-channel carrier, which enables 12 conversations to be carried on simultaneously over one physical circuit, followed by 24-channel carrier cables which carry 24 conversations on the pairs which previously carried twelve, and coaxial cables which can carry up to 600 simultaneous conversations over the same physical circuit. At the same time voice frequency dialling has considerably reduced the number of routes over which generator signalling is necessary.

A Unified Procedure

With the abolition of generator signalling on most routes, the provision of standard supervisory signals from the called subscriber, and a further reduction in the relative cost of trunk circuits, special long distance operating procedure was no longer necessary. Unification of the toll and long distance operating procedures was, therefore, introduced in April this year. This has obvious advantages from the point of view of the operators, who need to learn only one procedure instead of two, and who therefore need never be in doubt about which procedure to use. In addition, it allows the volume of operating instructions to be reduced and very much simplifies and thus eases the work of those responsible for training operating staff.

The New Procedure

It is not possible in the space of a short article to mention all the differences between the former long distance and toll procedures which have been abolished by the unified operating procedure, but one example will perhaps suffice to illustrate the kind of change that has been made. Under the old procedure the operator would give listening supervision during the whole setting up process for a long distance call, whereas she would rely on supervisory signals during the setting up of a toll call and thus be able to deal with another call at the same time. Under the new procedure the operator is instructed to avoid waiting unnecessarily on the line and she now deals with all calls in the way in which she dealt with toll calls in the past.

In preparing the new instructions the aim has been to simplify wherever possible and to give the telephonist more opportunities for using discretion and initiative so that the work may be made more interesting and effective. For example, although the procedure for dealing with "no reply" calls is described in full, the instructions also tell the operator that if she thinks (from previous experience or local knowledge) that a reply is unlikely, she need not waste effort by going through the whole routine, but should give "no reply" advice to the caller as soon as she thinks it reasonable to do so. Under the new procedure, incoming operating also is simplified and becomes largely a matter of acting on the controlling operator's instructions; this change is helping to pave the way for more widespread trunk mechanization under which the control of calls is vested entirely in the "originating" operator.

From a subscriber's point of view the new procedure will probably pass unnoticed, as few in the past will have observed any difference between the handling of toll and trunk calls, these differences being mainly in the procedure and operating expressions used between operators. In London, Birmingham and Manchester subscribers are instructed to dial TOL and TRU according to whether or not a wanted exchange is contained in a list displayed in the directory preface. In a number of other centres too, the subscriber is asked to use a different code—for example, 94 for obtaining

certain of his long distance calls. In general, however, "O" is dialled for all calls obtained through the operator. The arrangements at London, Birmingham, Manchester and the few other centres where special codes apply must remain in force for some time to come as it would be uneconomic to replace the existing equipment, but eventually subscribers in these places will dial a common code for all their trunk and toll calls.

It would be rash to try to forecast what the pattern of operating procedure in the future will be because new technical developments may be just round the corner. No matter what degree of mechanization of the telephone service becomes possible, however, or how far subscribers may be enabled to dial their own calls, telephone operators will always be needed to help with difficulties and to provide special services which it would be impracticable to provide by mechanical means.

Decentralization in the Manchester Telephone Area

A preliminary survey of the Manchester Group in 1948 made it clear that some relief would be required for Manchester toll trunk exchange in 1955, because available switchroom capacity (645 operating and enquiry positions) in Telephone House would by then be exhausted.

The first stage in providing relief was the introduction in the Manchester director area of multi-metering which is now complete, except for a few routes which cannot be provided because of equipment difficulties at the terminating end. The relief from multi-metering amounted to approximately forty toll positions.

A further stage in the relief scheme was the opening of Manchester trunk control centre (T.C.C.) Ashton on October 23 last, which, with its 34 joint trunk and eight enquiry positions, will cater for all operator controlled and enquiry traffic from six automatic exchanges (Ashton, Denton, Droylsden, East, Mottram and Stalybridge) and demand traffic from three manual exchanges (Glossop, Hyde and Mossley) on the east of the Manchester Telephone Area. The relief on the Manchester toll trunk exchange will amount to only 17 positions because, until the Manchester trunk mechanization scheme is completed, demand traffic from Ashton T.C.C. will be routed via the Manchester trunk incoming suite at Telephone House.

Two further T.C.Cs are planned and the first of these, Peterloo T.C.C., is scheduled to be ready for service in May, 1956. Peterloo derives its name from the historic event in 1819 near the exchange, which contributed to the movement for parliamentary reform. It will be equipped with 101 joint trunk and 19 enquiry positions and will cater for all operator controlled and enquiry traffic from Ardwick, Central and Collyhurst director automatic exchanges. The other T.C.C. to serve exchanges in the south of the area will be brought into service about 1959.

A feature of the T.C.Cs will be the introduction of joint trunk working as distinct from the segregated TOL and TRU working at Manchester Toll Trunk exchange. It will not, however, be possible to abolish the TOL and TRU dialling codes until after mechanization, but the joint trunk feature will be obtained by routing calls to joint trunk positions over a route utilizing a common director translation for both TOL and TRU.

Automobile Association

Negotiations have been going on for some time to replace the busy 8-position C.B.10 P.M.B.X. serving the Automobile Association Headquarters, at Fanum House, near Leicester Square, London, with a 450-line P.A.B.X. The new automatic installation will serve the very much enlarged building which will extend over the site of the once famous Thurstons billiards hall. The P.A.B.X. is to be installed by the Automatic Telephone & Electric Company and is planned to open in April 1956.

An interesting feature of the A.A.'s telephone service is that, outside normal business hours telephone inquiries to their four main offices in the Home Counties, namely, Guildford, Reading, Maidstone and Chelmsford, are routed by night service equipment and long distance external extensions to the London office, where the calls are filtered through to a suite of 20 special inquiry positions of the 20-line key and lamp unit type. Thus attention is given to members' inquiries from a very wide area of London and the Home Counties, without the country member, or the stranded motorist, having to make another call to WHItehall 1200 after an abortive call to the local office.

Fig. 1: New outside broadcast vehicle

The Post Office Outside Television Broadcast Service

M. B. Williams, B.Sc.(Eng.), A.M.I.E.E.

A NEW TYPE OF GREEN VAN (SEEN IN FIG. 1) of pleasing appearance and carrying the legend "Post Office Television Outside Broadcast Service", has been seen about the country in the past two years. The first van of this type appeared in Hyde Park during the Coronation celebrations, and since then several more have been put into service to assist in providing temporary vision links on Post Office cables for B.B.C. television outside broadcasts.

These vans serve the dual purpose of carrying staff and equipment and of operating as mobile repeater stations (Fig. 2). The service began on a small scale in London under laboratory supervision after the war, has rapidly grown and now is one more regular Post Office service operated entirely by Regional field staff. Specialist units are based in London, Manchester, Cardiff, Edinburgh and in Birmingham.

The means adopted to link an outside broadcast site with the main television network vary according to circumstances and may include a combination of:

(*a*) Portable radio links set up and operated by the B.B.C.

(*b*) Temporary short links set up on specially equalized telephone cable pairs as and when required. These are used, either directly into a switching centre or injection point, or as "starting" and "finishing" links giving access to high points for micro-wave transmitters and receivers.

(*c*) Temporary links set up according to a prearranged plan on permanently rented balanced pair or coaxial cables. At present such special cables exist in London only.

(*d*) Injection of vision signals into a convenient intermediate point on the main return television links.

All but the portable radio links are the responsibility of the Post Office; the B.B.C., however, uses its own micro-wave receiving equipment to inject into the Kirk o'Shotts-Manchester television link. To link an outside broadcast site to the main network calls for close co-operation between many different engineering staffs, Post Office and B.B.C. That these methods work and this co-operation exists is demonstrated nearly every day by the presence on television screens of pictures from remote sites, rarely showing any sign of impairment due to transmission.

The objective in the provision of outside broadcast line vision circuits is the completion of a channel from the site to the nearest B.B.C. switching centre; at present, there are switching centres at London, Birmingham, Manchester and at the Kirk o'Shotts and Wenvoe transmitters.

The table (overleaf) shows the equipment and scope of the Regional specialist teams as planned for the end of 1955 to meet the requirements of

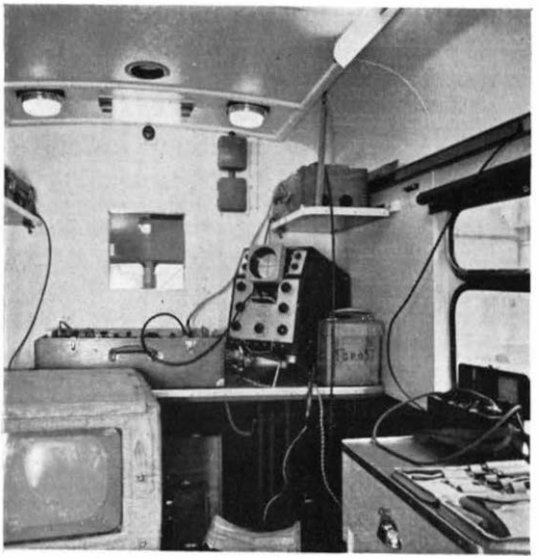


Fig. 2: Mobile repeater station—internal view showing video repeater equipment

an analogous distribution of B.B.C. mobile units, known as "mobile control rooms".

The specialist mobile team is engaged fully in operating and maintaining its equipment. Enough technical staff is available, permanently attached to the team or on call, to man all equipment continuously during test and transmission times. This is necessary to ensure continuity of service, since portable equipment has its own hazards and

Table: Equipment and scope of the Regional Specialist teams as planned for the end of 1955

TEAM'S BASE	TERRITORY	EQUIPMENT
London ...	L.T.R. and Home Counties Regions	(i) Video repeaters.* (ii) 3–7 Mc/s carrier equipment for use on coaxial cables. (iii) 3–7 Mc/s injection equipment for the Birmingham–London link. (iv) 0·5–4 Mc/s injection equipment for the Wenvoe–London link.
Manchester	North-Western and North-Eastern Regions	(i) Video repeaters.* (ii) 0·5–4 Mc/s injection equipment for the Manchester–Birmingham link.
Edinburgh	Scotland	Video repeaters.*
Cardiff ...	Wales and Border Counties; South-Western Region	(i) Video repeaters.* (ii) 0·5–4 Mc/s injection equipment for the Wenvoe–London link.
Birmingham	Midland Region	(i) Video repeaters.* (ii) 3–7 Mc/s injection equipment for the Birmingham–London link.

* Video repeaters are used on telephone pair circuits; for example, on subscribers' and junction cables.

the process of setting up and adjusting may be prolonged; final adjustments to give the best compromise of the overall circuit (mobile control room to switching centre) are often made just before an actual broadcast. Furthermore, the equipment is not completely duplicated.

An office organization operates in parallel and deals with all orders and enquiries from the B.B.C. The technical possibility is first examined. If a telephone pair circuit is required, reference to the Area cable records will show if suitable plant exists. The transmission loss over telephone cable pairs at the upper television frequencies used (three megacycles per second) is so high that the signals must be amplified every mile or even at shorter distances. Repeaters are usually installed in telephone exchanges, but occasionally the local Area external staff may make a roadside interception (see Fig. 3) and install a repeater in a vehicle. When a possible route has been worked out, a field survey is sometimes made to check the suitability of the cable pairs, since characteristics which are unimportant for telephone circuits may be serious when attempts are made to use a cable for television. When it is clear that the circuit can be provided, an estimate of the cost is given to the B.B.C.

The Telephone Manager's Area (Regional Telephone Branch in London) nominated to handle

Fig. 3: Silverstone. "Whittlebury D.P." repeater point

all orders for the Region or Regions covered by the mobile team receives a firm order for a vision circuit on telephone pairs. Normal Advice Note procedure is followed as far as possible for the actual provision and recovery of the circuits. At some stage, the planning officer will visit the site and any intermediate and final repeater points to arrange for cable terminations (naturally, the provision of control and programme circuits is co-ordinated) power supplies, accommodation and parking. This information is recorded and filed ready for the mobile team which will move in to set up the circuit one to three days before the day of the transmission. The normal Area staff carries out all temporary cable work and interceptions, and close co-operation is maintained between the local staff and the visiting specialist team.

Enquiries and orders for injections into the main links or for coaxial carrier circuits are dealt with in a similar way, except that less survey or experimental work is necessary. The plant concerned is designed as high frequency plant of predictable performance and the stations in which it may be used are pre-determined. Special power supply arrangements may, however, be required.

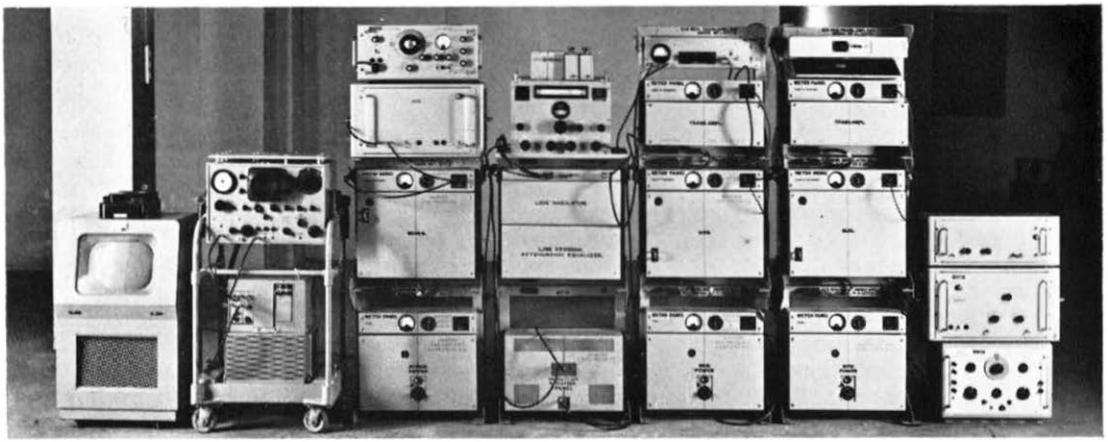
Fig. 4: Intermediate video repeater point at Cardiff automatic telephone exchange

Video Links on Telephone Pairs

A new type of equalizer-amplifier (Amplifier No. 98A) has recently been introduced and has many advantages over the old models which, however, will be giving good service for a considerable time. Difficulty is occasionally experienced with the older type of repeater when used in certain situations: for example, in telephone exchanges or near electrically-operated lifts; for outside broadcast work the comparative immunity of the new design to this kind of interference is of very great advantage.

Interference from high power radio transmitters is sometimes introduced into an underground cable from an open-wire span. The adverse effect on the vision signal may be minimized by using a special "phantom coil", which must be separately designed and constructed to give sufficient suppression of the interference without introducing appreciable

Fig. 5: 0.5-4 Mc/s injection equipment assembled with test and monitor gear



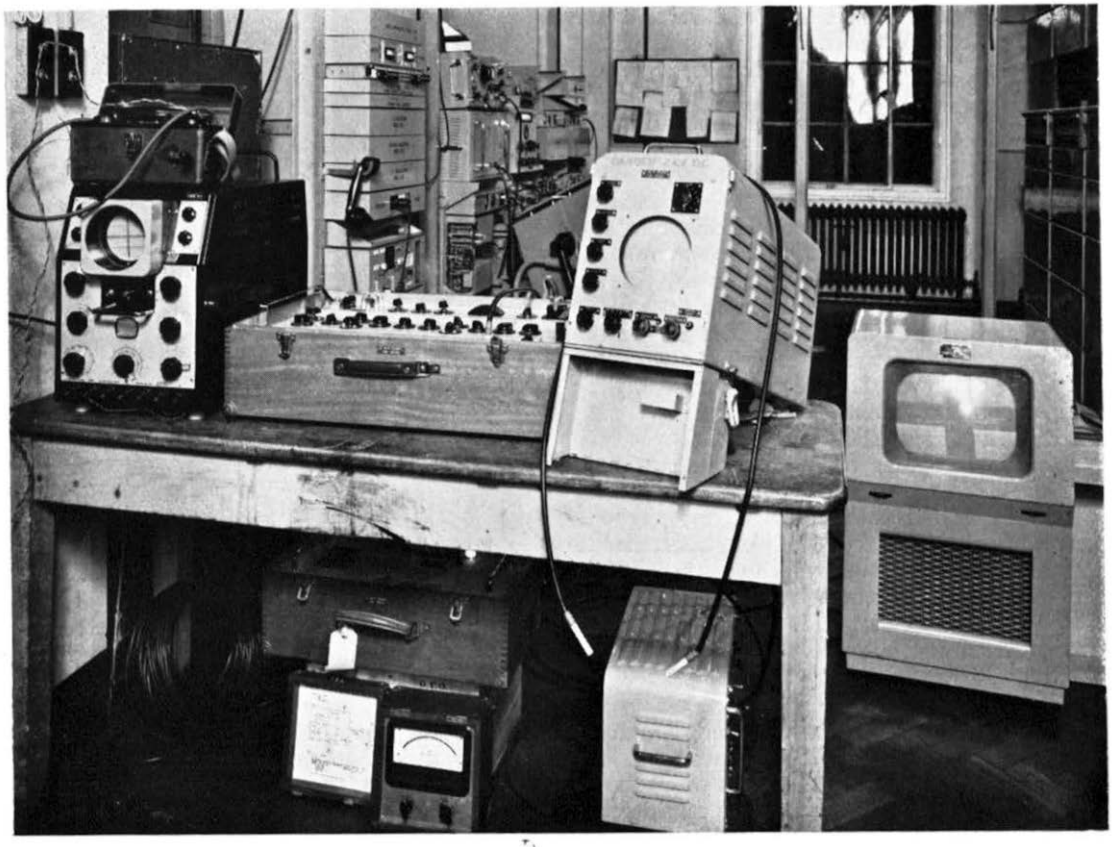


Fig. 6: Terminal video repeater and injection equipment at Cardiff repeater station

loss to the vision signal. An efficient phantom coil is fitted to the new amplifier but, even with this, radio frequency interference is one of the major difficulties met in the field. It is unpredictable and often unsuspected until a late stage in providing the circuit because the offending transmitter may operate only during limited hours. As a last resort, an auxiliary high-level "send" amplifier can be made available to strengthen the signal and so reduce the effect of the interference.

The process of equalizing a telephone-pair circuit is guided mainly by observation of pulse wave-forms. It is a rapid process and the great flexibility of this method of adjustment permits some compensation to be made for cable irregularities or, exceptionally, for small deficiencies elsewhere in a composite link.

Figure 4 shows a typical intermediate repeater point. Each point is staffed continuously during testing and transmission. In addition to the video repeater, a picture monitor, a video oscilloscope and a wide-band decibelmeter are provided to assist in alignment and in tracing transmission faults.

Injection

During the planning of the first television cable links, it was realized that they passed near to potential outside broadcast sites or to suitable pick-up points for micro-wave links, and that a valuable facility would be obtained by providing portable terminal equipment which would permit the injection of a video signal at any intermediate repeater station on the main link, after modulation into the correct carrier band.

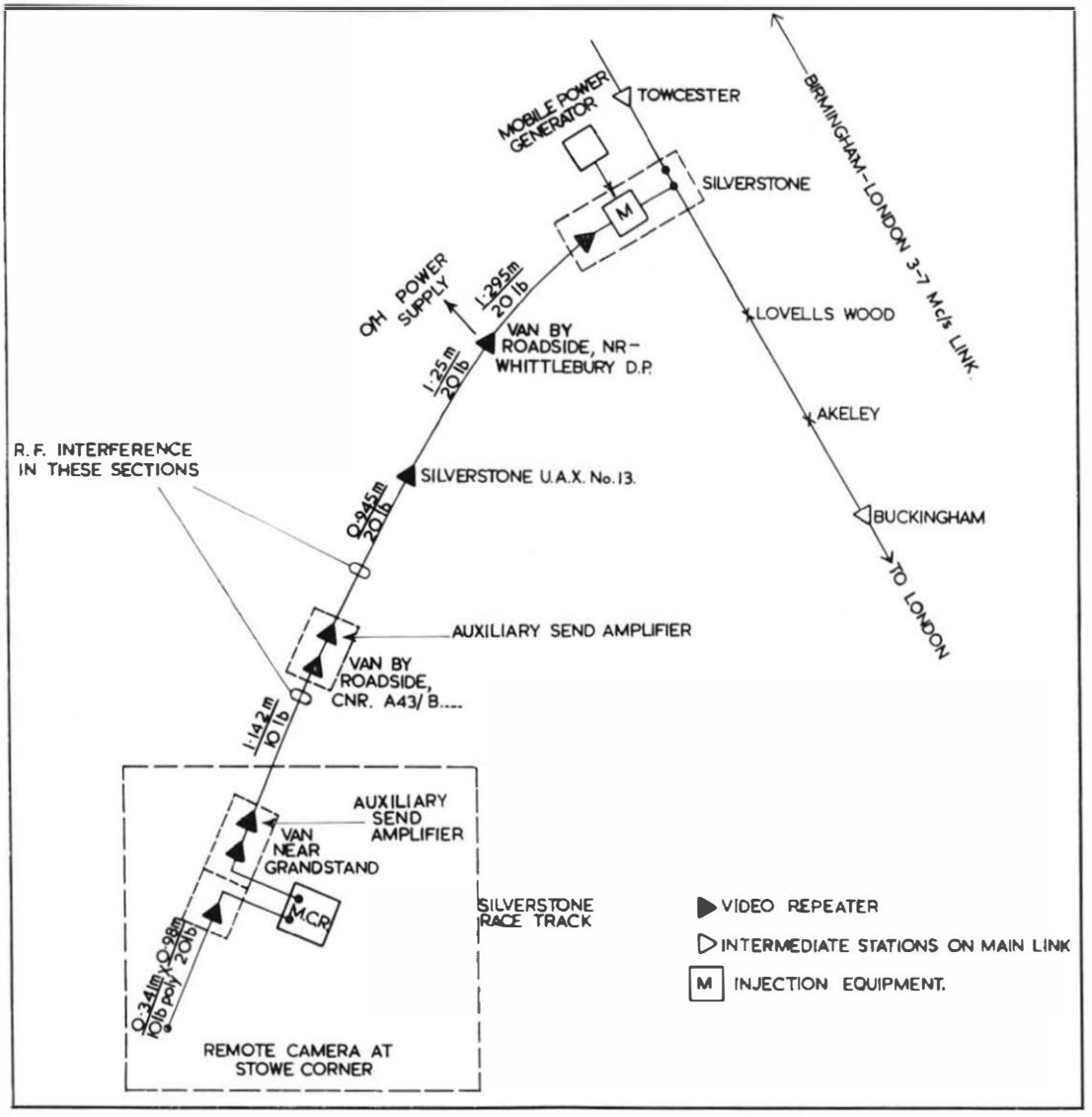
Such injection equipment has now been provided for the Birmingham-London link and for the Manchester-Birmingham and Wenvoe-

London links. Although the designs of the types of equipment are very different, the facilities provided have a common basis.

Each injection equipment is completely self-contained, having normal and stand-by facilities and all necessary test and monitoring equipment. It is built on special small racks to permit easy handling. The equipment used for 0.5-4 Mc/s links, which is necessarily very large and complex, has been broken down into functional units mounted on stackable racks. This can be seen from Fig. 5. Figure 6 shows a typical installation of injection equipment in position for an actual outside broadcast transmission.

Three examples of the more complicated circuits using the techniques described may be interesting. These show how the potentialities of the telephone and television network are exploited and give some

Fig. 7: Schematic diagram showing routing of Silverstone circuit



idea of the temporary work required in providing the circuits.

Silverstone, July, 1954

The television broadcasts of the British Grand Prix at Silverstone in July, 1954, were routed back to London entirely by line link. A rather difficult video repeatered link was provided on telephone plant from the race-track through Silverstone exchange (U.A.X.13) to an intermediate repeater station on the Birmingham-London link. Injection equipment was set up at this point. Figure 7 shows a straight line diagram of the circuit. A war-time perimeter cable was used in addition, to provide a remote camera link from "Stowe Corner" to the grandstand. Three special vehicles were in use, one as the sending-end control and a receive-repeater point for the remote camera link, and two as road-side repeater-points on the main video circuit.

At the "Whittlebury D.P." site (Fig. 3) a temporary mains power supply was provided by the local Electricity Board as a tee from a convenient pole on the overhead distribution. This, and the Post Office cable drop feed from the distribution pole are visible in Figure 3. Possibly because of the temporary aerial spans of "mole-drainer" twin cable, there was considerable radio interference (probably from the nearby 647 Kc/s B.B.C. broadcast transmitter at Daventry) in the first two sections, and auxiliary sending amplifiers were needed at two points to give an acceptable signal/noise ratio.

At Silverstone Repeater Station hut (an un-equipped station on the Birmingham-London cable link) the receiver repeater and the injection equipment were operated from portable engine sets as there was no mains supply at this station.

Oxford, February, 1954

A series of broadcasts was made from well-known buildings in Oxford. These required a combination of Post Office cable starting links, B.B.C. micro-wave links and an injection into the Birmingham-London cable link at Grandborough, near Aylesbury. Video repeater equipment was installed in the Telephone Manager's Office (the roof serving as a convenient starting point for the B.B.C. micro-wave link) and in Oxford telephone exchange. Five short cable links from here gave access to the various sites.

Television has been prominent in reporting State occasions by outside broadcasts. Vision circuits were provided for the State visit to Edinburgh in June, 1953. A B.B.C. control unit was set up in the test room in Rose Street telephone exchange, which also accommodated the terminal repeaters for the video links connecting six sites to the control unit. The vision signals were then brought into the main network by B.B.C. micro-wave links via the Castle to Kirk o'Shotts.

Future Developments

The total number of vision circuits provided each year has grown from 38 in 1947 to 407 in 1954.

This growth has followed the opening of transmitters giving national coverage and the provision of B.B.C. mobile outside broadcast units for the B.B.C. regions. The present phase of expansion of the Post Office service to meet B.B.C. requirements should be completed during the current year and full exploitation of the present facilities should lead to a fairly steady increase in the total number of outside broadcast circuits provided for the B.B.C. So long as the present hours of broadcasting remain, no great change is to be expected.

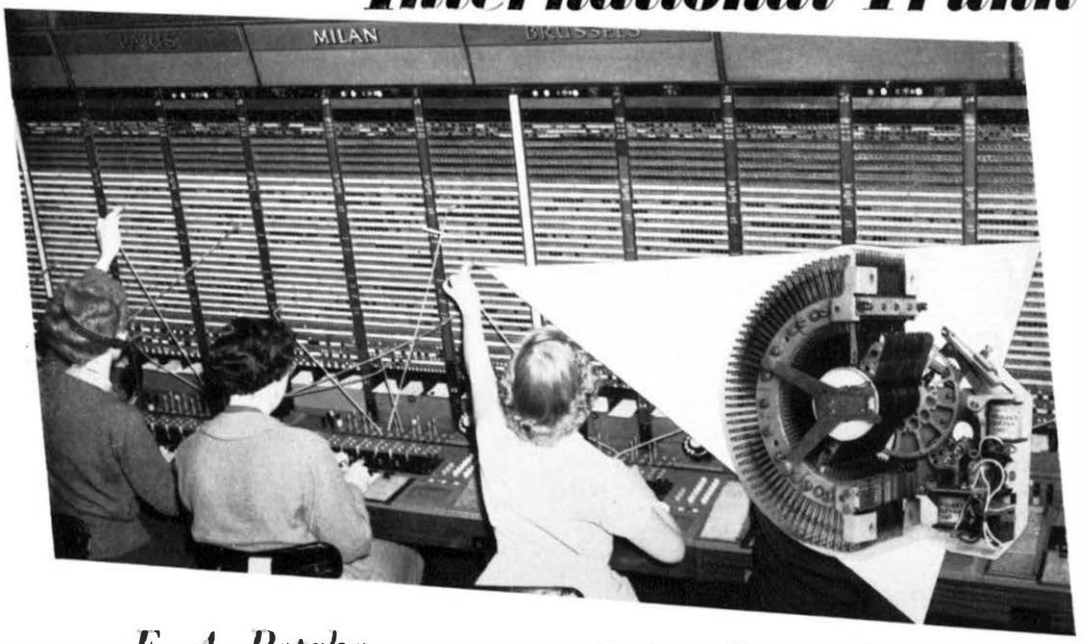
There is now, however, a new factor to be considered. The introduction of commercial television and the opening of the new stations of the Independent Television Authority will bring a demand for outside broadcast circuits of magnitude comparable with that of the B.B.C. television service.

This will lead to considerable increase in outside broadcast circuit provision by the Post Office. Additional special equipment and staff are being provided. Such additional work will bring new problems, particularly if simultaneous transmissions are required from the same or neighbouring sites, since cross talk conditions may not permit the operation of two video circuits in the same telephone cable.

A special position exists in central London, where the B.B.C. has exclusive use of a low-loss television cable linking many important sites and strategically sited exchanges. Most B.B.C. television outside broadcasts in central London use this network.

Technical developments are likely to be limited to simplification of equipment and methods of working. This will be most desirable under the different conditions which may exist in the future when outside broadcast activity becomes more widespread. Some developments in local cable networks, such as reduction in conductor gauge or the adoption of a non-metallic cable sheath, may restrict the extent to which the local telephone network can be exploited for television.

International Trunk Mechanization



E. A. Petche

PROGRESS TOWARDS MECHANIZING THE EUROpean international telephone service is following the familiar pattern of transition from a manual delay service to demand working and thence through semi-automatic operation to the ultimate goal of subscriber dialling.

The stage has now been reached where the operating facilities and technical standards for semi-automatic working have been agreed, thus completing a task regarded by the International Telephone Consultative Committee (C.C.I.F.) as having been without parallel in its history; it certainly affords a unique example of international co-operation in the telecommunication field.

As the European national telephone networks have developed on independent lines the international semi-automatic system had to be designed to be compatible with a variety of impulsing arrangements, tones, answering and clearing conditions and so on, in a way which also reconciled the individual national attachments to particular operating and technical practices. Strongly held preferences for two methods of signalling—one employing a single signalling frequency and the other two frequencies—caused further complication.

Because of the post-war shortage of exchange equipment and staff, the operating services were in urgent need of an economical method of handling the terminal traffic between capital cities, which represents the bulk of international calls. There was, however, a body of opinion which considered that in the long term it would prove advantageous for the signalling system to cater for "transit" switching (that is, routing over international circuits in tandem through automatic switching centres), and automatic alternative routing which would, incidentally, enable the American system of "high usage" and "final" routes to be employed if this method of circuit exploitation proved desirable in European conditions. The American system takes account of the fact that the late choice circuits in a group carry relatively little traffic; in suitable circumstances there is economy in dispensing with the low efficiency late choice circuits and arranging for the calls they would have carried to overflow to alternative routes selected in a pre-determined order. There can, of course, be no overflow from the last route to which traffic overflows; hence the terms "high usage" and "final" routes.

The two signalling systems were subjected to

field trials with public traffic over direct circuits between the participating centres, and this gave an opportunity to conduct technical tests of transit switching and automatic alternative routing. Ten countries purchased and installed the equipment necessary to create the two field trial networks shown in the diagram. The Scandinavian network of 22 circuits on the two frequency system came into service between November, 1952, and January, 1953. The Western European network began with the Amsterdam-London route in November, 1952, and, although most of the routes came into service during 1953, the final complement of 90 (42 1V.F. and 48 2V.F.) circuits on the two signalling systems was not reached until late 1954.

Operating Facilities in the Semi-Automatic System

The two types of international field trial equipment were fully described by J. V. Miles in the October, 1952, and January, 1953, *Post Office Electrical Engineers Journal* and A. H. Mowatt discussed the likely developments in semi-automatic operation in the Spring, 1953, issue of the *Telecommunications Journal* ("Talking Between Nations").

For the present purpose it will suffice to recall that both signalling systems employ a system of coded signals in which the digits 1–0 are used for numerical routing codes and subscribers' numbers. In addition to the numerical codes there are others for supervisory signalling purposes and to afford access to incoming "B", suspended call and "assistance" operators. Calls which cannot be dialled (or keyed) direct are routed through an incoming operator obtained via Code "11", while a suspended call operator can be reached via Code "12", followed by a position number which will direct calls to either:

(i) a group of suspended call positions for the purpose of dictating a call order, or

(ii) a nominated suspended call position - known to be holding the ticket for a particular suspended call because the number of the position concerned has been recorded on the incoming call order ticket.

There are individual keys in the operators' key-sets for Codes 11 and 12 since these codes are outside those for the range of digits 1 0.

An operator who encounters language difficulty or an unrecognised tone on a call directly dialled to a subscriber can, by sending a forward transfer signal, provoke the intervention of an incoming "assistance" operator who will subsequently retire, leaving the original connexion undisturbed. Just before the field trials it was decided that on calls routed via a Code 11 or 12 operator, the forward transfer signal should provide an operator recall facility.

The service language to be spoken between operators varies from route to route, and since the "assistance", Code "11" and Code "12" circuits comprise three automanual board groups common to all semi-automatic incoming circuits, a discriminatory language signal must be given on each group at the incoming end so that an operator with the requisite language qualification can answer. This requirement is covered by a language digit which is sent manually or automatically from the outgoing international exchange following the "country" routing code or, on direct circuits seized in a manual multiple (when the "country" code is unnecessary), before the called subscriber's number.

There is an important difference between the two systems for transit calls as follows:

In the single frequency system the complete number (including the international code) is re-transmitted progressively from exchange to exchange. In the two frequency system the outgoing register retains control of the setting up of the call; it sends to each international transit exchange only the code of the country of destination and sends the national number of the called subscriber directly to the incoming terminal exchange over the chain of circuits set up. As a result, when alternative routing is used, the two frequency system can give the outgoing international operator an indication of the route used beyond a transit exchange as well as from the outgoing exchange (so that the call ticket can be suitably noted for international accounting purposes); the single frequency system can give an indication of the routing at the outgoing centre only. If access to the circuits from the outgoing exchange is by selectors, the two frequency system can divert calls to an alternative route from the originating centre if engaged circuit conditions are met at a transit exchange.

For the purpose of a limited trial of the route indicating facility with automatic alternative routing, the London 2V.F. equipment included, on the outgoing positions, a strip of lamps, five of which were labelled A, B, C, 1, 2. The glowing of

the lamps marked B2, for example, would indicate that the first choice outgoing route was occupied and that the outgoing register had taken a circuit in the second choice (B) route; the figure "2" would show that the outgoing register had received two "transit" proceed-to-send signals. The exchange ticket staff encountering a ticket for a call to Milan would ascertain from a printed list that "Milan B2" meant that the call had not gone over the direct route but via Paris and Zurich, and they would make international accounting entries accordingly.

Field Trials Operating Results

Much thought had been given to the language problem during earlier consideration of semi-automatic operation and the field trial procedure covered various methods for the use of outgoing operators having little or no knowledge of a language well understood in the country of destination. By the time the field trials began, however, operators had already acquired considerable experience in the manual demand service in speaking directly with subscribers in foreign countries and virtually no language difficulty was experienced. The "assistance" facility was, in fact, used on less than one per cent. of calls in the Western European network for language or tone explanation purposes. Carefully controlled experiments under conditions in which language difficulty might be expected were therefore carried out over the Amsterdam-Paris and London-Paris routes. The two experiments on calls incoming to London were conducted over manual circuits which were monitored so that language assistance would be instantly available.

Experiment A : The Paris operator attempted to set up both ordinary and *pré avis* (personal) calls using French only.

Experiment B : The Paris operator attempted to set up ordinary calls only, using the expression "Paris is calling, one moment please"; she knew no English apart from this phrase and left the subscribers to identify each other.

The results of these two experiments are summarized in Table A:

EXPERIMENT	TYPE OF CALL	% OF CALLS ON WHICH THE METHOD WAS UNSATISFACTORY	LANGUAGE USED IN SUBSCRIBER'S CONVERSATION			
			French	English	French and English	Other
A	Ordinary	43.2	17.6%	74.4%	7.1%	0.9%
	Pré avis	52.1				
B	Ordinary	12.6	21.2%	72.6%	5.8%	0.4%

Table A

Similar experiments in the direction London-Paris were only slightly more successful and the French and United Kingdom Administrations are agreed that it would be unsatisfactory to employ operators who do not speak the language of the called subscribers in the semi-automatic services between their two countries. Calls from Paris to the multi-lingual Netherlands' subscribers were equally successful whether English or French was used.

More than 140,000 semi-automatic call tickets were analysed during the field trials on a basis designed to enable the effectiveness of various operating procedures to be judged. However, such satisfactory results were obtained with a procedure similar to that already adopted for manual demand operating that the other methods were not proceeded with; since then the C.C.I.F. has evolved a single composite instruction for both manual and semi-automatic operation. This is important to the United Kingdom, which uses multiple type switchboards at which combined line and recording operators handle calls for all destinations to which a demand service is given. Many international exchanges abroad, however, are organized on the basis of a distribution of calls to groups of positions serving particular routes and uniformity of procedure seems to be regarded as of less importance. Nevertheless, the summary of the analysis for the Western European network (Table B), shows that the percentages of calls completed without reference to a suspended call position, and the total effective calls, were very satisfactory with semi-automatic operation.

TRANSACTION	% of total calls	
	Ordinary	*Pré avis*
Effective at outgoing positions:		
On first attempt	84.3	61.8
After up to three attempts ...	94.1	84.3
Calls established at suspended call positions :		
(*a*) without reference to suspended call positions at the incoming centre.	1.1	3.4
(*b*) with the assistance of suspended call operators at the incoming centre.	0.6	1.7
Total effective calls ...	95.8	89.4

Table B

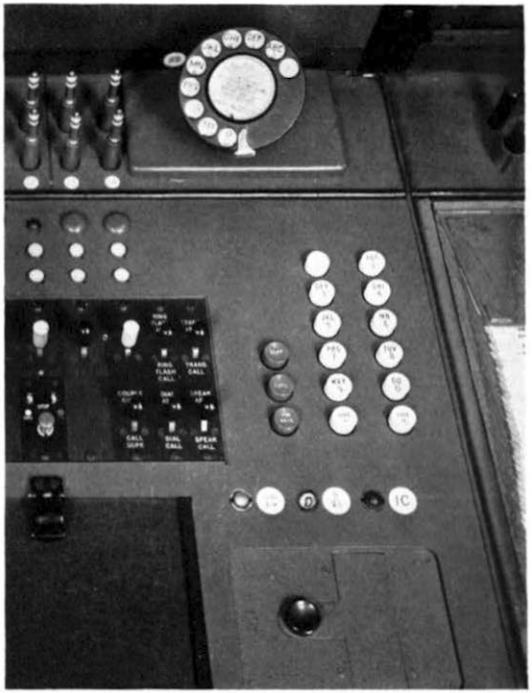
The results shown in Table B were among those relating to general information which Administrations took the opportunity to obtain during the trials and were not concerned with the relative efficiency of the two systems; but, as will be seen from the summary at Table C, the results of quality of service observations, intended to afford a direct comparison of performance, were so close that they in no way helped to resolve the difficulty in choosing a single standard system.

The conclusions drawn from the field trials were that, in the conditions under which the trials had been made, the semi-automatic circuits with either of the signalling systems had given complete satisfaction to the operating service, and that the fault statistics gave no evidence of any superiority of one signalling system over the other and had established no evidence of any systematic faults arising from the principles of either system. Faced with this inconclusive result the Field Trials Committee, in presenting its final report, had no alternative but to draw attention to the difficulties to be foreseen with terminal and transit traffic if international standardization of a signalling system did not take place at the time of the C.C.I.F. Plenary Assembly in the Autumn of 1954; and, for the guidance of Administrations in choosing a signalling system, to provide a detailed statement of the operational and technical factors to be taken into consideration. This statement covered the possibilities available to the operating services, reliability, costs and flexibility for adaptation to meet new or different requirements.

In September, 1954, a joint meeting of the C.C.I.F. 6th and 8th Study Groups, which deal

Table C: Comparative ser ice obser ations (Western European Network)

SYSTEM	ATTEMPTS	NO. OF OBSERVATIONS	%
1V.F.	Effective	12,860	77.1
	Ineffective for reasons other than faults	2,403	14.4
	Ineffective because of faults	1,426	8.5
	Total	16,689	100.0
2V.F.	Effective	22,897	77.8
	Ineffective for reasons other than faults	4,438	15.0
	Ineffective because of faults	2,116	7.2
	Total	29,491	100.0



Keyshelf of Continental Exchange position showing key-set. The engraving corresponds to the Paris director dial which is similar to ours except that the letter "Q" is used

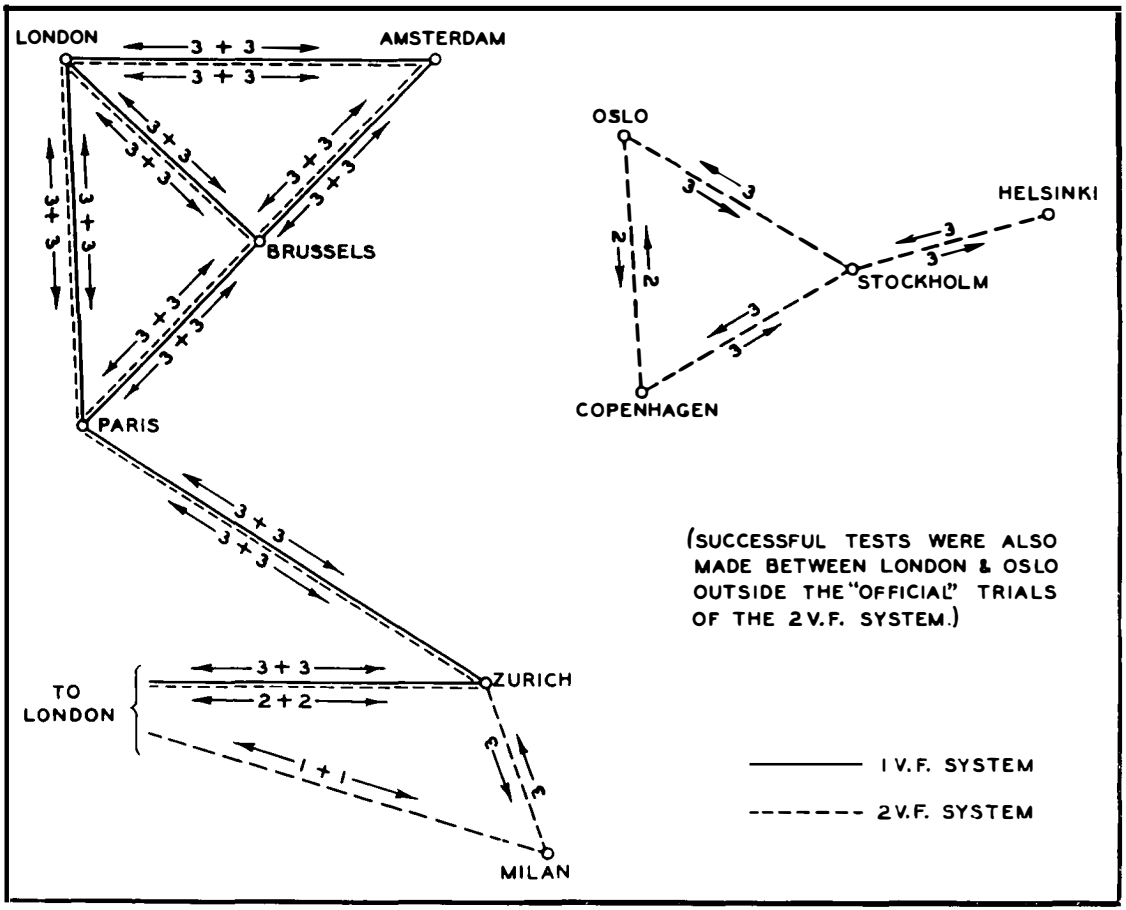
respectively with operating and switching questions, met to consider the final report of the Field Trials Committee and to prepare a recommendation for approval by the Plenary Assembly in the following month. All the factors affecting the choice of system were reviewed and opinions expressed anew on the facilities which should be afforded by a standard international system. It was clear, however, that while there was broad agreement on the facilities required, it would be impossible to arrive unanimously at a recommendation for the exclusive use of one international signalling system; and a Working Party was charged with the task of finding a compromise solution likely to find unanimous acceptance in the Joint Meeting. The Working Party succeeded, and the recommendation finally adopted by the Plenary Assembly reflects not only the spirit of compromise always shown in C.C.I.F. circles, but also the capacity to afford administrations the greatest possible freedom of action.

The recommendation advocates the use of one or other of the two signalling systems. It recognizes, however, that semi-automatic operation in the

direct terminal service between two countries is solely a matter for bilateral agreement. To facilitate such agreement it proposes that the system to be employed in each direction, over a route used solely for terminal traffic, should be the system used (or preferred) at the originating exchange—because such a rule offers advantages at certain exchanges by permitting a single common access from the outgoing positions to common equipment for all destinations. However, a footnote adds that by agreement between Administrations the signals can be by means of dial pulses without recourse to the special signal codes used for numerical information in each of the two standard systems.

For transit traffic, which is a matter for agreement between more than two administrations and for which the co-existence of two systems would entail difficulty, the recommendation takes account of differences of opinion concerning the value of transit (and, therefore, alternative routing) facilities; thus: ". . . the majority of countries which prefer the one frequency system attach, in 1954, little importance to transit routings, while the majority of countries which consider that transit operation will be of importance in the distribution of their traffic, and desire to see a rapid development of transit operation, are in favour of the two frequency system. . . . ;" and proposes that Administrations should normally use the two frequency system for transit operation, except when special agreement is reached between three or more countries to use the single frequency system for transit operation between them.

Diagram showing the Field Trials Networks—as at May, 1954



Reconciliation of views about the desirability of transit operation and automatic alternative routing has proved impossible. The United Kingdom view has been that since the C.C.I.F. system is extending to the Mediterranean Basin and the Middle East and beyond, and until the economics of automatic alternative routing in Europe have been thoroughly investigated, it would be unwise to exclude these possibilities. Moreover, alternative routing may prove helpful in solving the problem of reducing delay during cable breakdowns under subscriber dialling conditions. The semi-automatic international exchange for London is to be designed so that the facilities can readily be added if they are required.

In January, 1955, arrangements were made for delegates to a C.C.I.F. meeting to discuss tentative agreements about the semi-automatic service between their respective countries. It is probable that the routes from London to Denmark, Germany, Holland, Italy, Norway, Sweden and possibly Switzerland will be operated in both directions on the two-frequency system; from Belgium and France, in accordance with the C.C.I.F. recommendation, we shall arrange to receive single frequency signals. The new semi-automatic equipment in London, with an initially wired capacity for some 700 outgoing and incoming international circuits, will probably be ready for service in the latter half of 1958.

Prospects of international subscriber dialling

The current demand operating procedure already limits the work of international incoming operators to a minimum so that, although semi-automatic equipment will result in a speedier service and should prove to be economically desirable, it is clear that the staff savings will be small compared with those that could accrue from mechanization of much of the work of outgoing international operators. Administrations are already considering the next step, since the early introduction of subscriber dialling in this rapidly expanding service would avoid expenditure on new manual international exchanges likely to have a very short life; and it has been agreed that in preparing the final specification for semi-automatic facilities, account shall be taken whenever possible of the requirements of full automatic working.

The successful introduction of international subscriber dialling depends upon factors which apply also to its national counterpart (a necessary preliminary); that is, the facility must be attractive to subscribers both as regards ease of use and call charging arrangements. But in the international service there are at present the additional problems of language and the determination of the outpayments due to other countries for their part in the service.

One problem will be to reduce the proportion of personal calls; these amount to some four per cent. of the inland trunk traffic but in the Anglo-Continental service nearly 50 per cent. of the calls are booked as personal, and the figure has been rising since the earlier post-war years. The proportion rises broadly with distance and on some routes reaches 75 per cent: in the long distance radiotelephone services, nearly every call is booked as personal. The proportion of personal calls incoming from Europe is lower than in the outgoing direction and it is probable that many callers in this country use the personal call facility to avoid real or imaginary language difficulty in reaching their correspondents. More self-reliance may be encouraged in various ways; the heavier business users might, for example, consider it worth-while to use linguist P.B.X. operators if the directly dialled call charge reflected the reduced operating cost as compared with a manual service.

The problem of international accounts may prove difficult to solve to the satisfaction of all Administrations. Telephone authorities are becoming increasingly convinced that it is time to find some less expensive method than the present one whereby every minute of chargeable conversation, personal call fee and so on is accounted for; as traffic increases and more modern operating methods save switchboard staff the accounting costs become more noticeable and the older practices more difficult of retention. This matter is now the subject of C.C.I.F. study and two of the most widely canvassed suggestions, which have yet to be subjected to formal discussion are:

(i) that two adjacent countries should merely keep their own collections from subscribers, thus obviating the need for international accounting altogether,

(ii) that, particularly where transit countries are involved, international circuits should be paid for on the basis of a fixed annual charge.

There are complications with both of these proposals: for example, unbalance of traffic and multiple national charging zones for foreign calls; but no doubt the financial, technical and operating C.C.I.F. Committees will jointly find an acceptable solution.

THE CITY OF LONDON TELEPHONE AREA

Territorially the City of London Telephone Area is the smallest in the country, but for telephones it is among the largest and most congested in the world.

The Area's 9.1 square miles comprise the City and portions of adjoining boroughs. The dominant natural feature is the Pool of London, which divides the Area into two parts.

The City, representing London within its ancient boundaries, is the financial and business centre of London. Here are the head offices of the principal banks, insurance companies and mercantile houses, and the headquarters of the Post Office which has been in the City for centuries.

In addition, buildings with an historical interest range from the Roman Wall and the 15th-century Guildhall to the baroque splendour of St. Paul's Cathedral and the architectural beauty of Wren's spires.

The City of London was described by Tacitus in A.D. 61 as a "busy emporium for trade and traders". Today, our staff, numbering 3,800, have an opportunity with the restoration of the City—see article on "Rebuilding the City of London" on page 9—to provide amenities for the great financial, shipping and other commercial interests for which it is famous. Already the Area contains over 200,000 telephones, served by 17 of the busiest exchanges in the country and the annual revenue is £5.5 million. London rebuilt will entail a great increase in these services, including the provision of many large subscribers' installations each bigger than most public exchanges.

The Area, in addition to its telephone commitments, also performs the telecommunications engineering work for the Central Telegraph Office as well as other voice frequency and teleprinter responsibilities for the whole of the London Telecommunications Region.

★

Left to Right (*seated*) E. J. MARKBY, A.M.I.E.E., Deputy Telephone Manager; C. W. DAVIES, Telephone Manager; J. A. SHEPPARD, B.Sc., A.M.I.E.E., Area Engineer.
Left to Right (*standing*): H. T. A. SHARPE, A.M.I.E.E., Area Engineer; H. J. WHITE, Chief Clerk; R. F. BLOXHAM, Chief Traffic Superintendent; R. G. FORSYTH, Chief Sales Superintendent; L. R. WATSON, Area Engineer.

Commander Betson watching a repeater being laid

Buoy away !

Hello Oban!

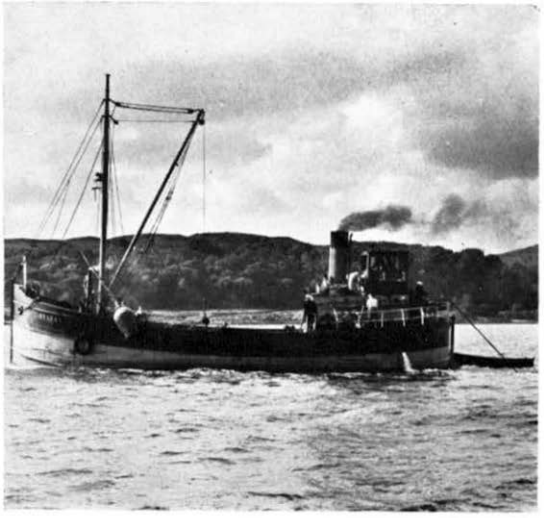
First speech by cable

AT FIVE O'CLOCK ON MONDAY AFTERNOON, September 26, 1955, the final joint in the first telephone cable to cross the Atlantic was lowered over the side of Her Majesty's Telegraph Ship *Monarch* into the sea off Oban.

Clarenville, Newfoundland, had been joined to Oban, Scotland, by 2,000 nautical miles of submarine telephone cable, with 51 submerged repeaters spaced evenly along its length: the longest repeatered submarine telephone cable in the world at the greatest depths ever attempted—2½ miles below the surface—had been completed. Engineers in Clarenville and Oban at once went into action to apply searching tests to it, and those in Clarenville soon made history by talking to those in Oban over the longest submarine telephone link in existence.

This trans-ocean link in the transatlantic telephone cable system requires two identical cables, each transmitting speech in one direction; not until the second cable, to carry speech in the direction from Oban to Clarenville is completed, next year, will two-way conversation be possible. For the time being, speech in the opposite direction between the testing engineers is by radio link.

S.S. Glenaray laying shore end of cable from Oban Terminal Station. She is one of a class of small shallow draft cargo vessels known as "puffers"



Clarenville Here!

across the Atlantic

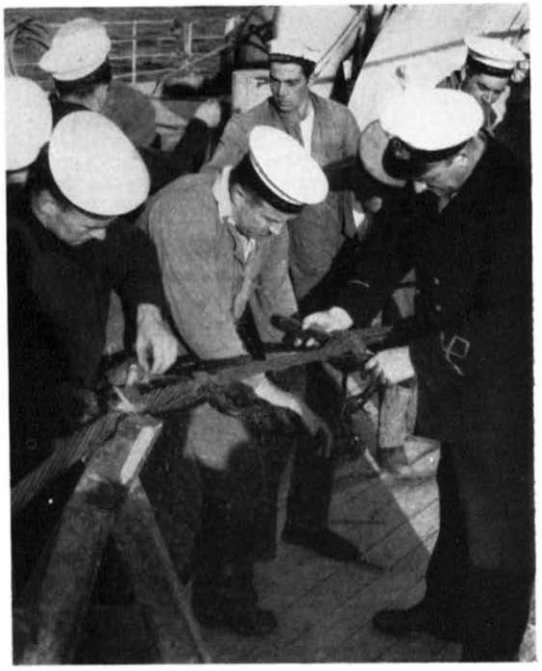
The successful laying of the first cable completes the first phase in the construction of the trans-atlantic telephone cable system. After nearly two years of intensive activity over the engineers' drawing boards, in the laboratories and in the cable and repeater factories *Monarch* arrived at Clarenville on June 22, 1955, with her first load of cable and repeaters. After a colourful ceremony at which representatives of the Canadian and Newfoundland Governments and of the Canadian, American and United Kingdom Post Office partners in this great joint enterprise, launched the cable and bid God Speed to *Monarch* in her historic task, she steamed out of Clarenville to lay the first 200 nautical miles. This completed and after a return voyage to Erith to load more cable and repeaters, *Monarch* started on August 10 to lay the important deep-sea section of 1,300 nautical miles across the deepest parts of the Atlantic. The end of the now continuous 1,500 nautical miles of cable from Newfoundland was temporarily buoyed off on the Rockall Bank on August 18.

Another trip to Erith for fresh supplies saw *Monarch* back at Rockall on September 17 ready to lay the last 500 nautical miles into Oban. But,

Rockall Ridge, September 20, 1955. Wind force > 12; hurricane; estimated velocity 90 knots; wave height approximately 40 feet

Looking down Kerrera Sound from Oban: cables are laid in this Sound to the Oban Terminal Station

The final splice



for the first time in the operation, bad weather intervened. Arriving at the position of the buoyed end *Monarch* ran into violent winds and heavy seas which she had to ride for five days before they moderated sufficiently to allow operations to proceed. However, once having joined on to the end of the previously laid cable, she laid the 500 miles into Oban in 3½ days without further incident.

At Oban the short shore ends into the repeater station, which had been laid earlier in the month by one of the smaller Post Office cable ships, were picked up; in about eight hours the final splice had been completed, and in the presence of representatives of the partners in the enterprise and of the Press and the broadcasting organisations the final splice was lowered overboard.

Cable laying operations for this year are now completed. Meanwhile work goes on at top speed all along the land sections of the cable system, and on the connecting links, in the United Kingdom, Canada and the United States, as in the cable, repeater and equipment factories on both sides of the Atlantic. Towards the end of 1956 the whole system will be completed and trans-atlantic telephone communications by cable will shortly afterwards be available to subscribers all over North America and in the United Kingdom and the rest of Europe.

Our Contributors

R. W. C. ALFORD ("Training Telephone Supervisors") is the Representative for the *Journal* in the North East Region. Before promotion to Leeds as A.T.C.I. in 1952, he served in the Engineering Department, the Traffic Division at Manchester, and the Inland Telecommunications Department at Headquarters, London.

E. G. CRISP ("Unified Telephone Operating Procedure") entered the Post Office in 1926. During his career he has been four years in the Engineering Department, four years on traffic work in the London Telephone Service, six years in Headquarters Traffic Division, 10 years in Telecommunications Branch at Scottish Headquarters and is now a Senior Inspector at London Headquarters, Inland Telecommunications Department, Operations Branch (Telephone Operating Section).

C. W. DAVIES and D. MIDGLEY ("Rebuilding the City of London"). Mr. Davies entered the service as a Youth-in-Training at Bournemouth in 1924. Two years later he became an Assistant Traffic Superintendent and, after 22 years in the traffic grades in various parts of the country, was promoted to Deputy Telephone Manager, Liverpool, in 1948. He held the post of Telephone Manager, Guildford, in 1950, before becoming Telephone Manager, City Area, in 1952. He has contributed to the *Journal* before, an article on "Storm Damage at Guildford" in November, 1950, issue.

Mr. Midgley entered the service at Manchester in 1930. After nine years in the Postal Service, he became a Sales Representative in 1939, in which capacity he served in the Manchester and Canterbury Areas. He was promoted to Sales Superintendent at Cambridge in 1951, and transferred to the City Area two years later.

K. P. GOODER ("Country Customer") has been head of the Sales Division in Shrewsbury Telephone Area since April, 1954. A Lancastrian, he entered the Post Office in 1927 as a Youth-in-Training at Burnley, then in Blackburn Section, North Western Engineering District. He left the Engineering Department in 1935 to become a Sales Representative in Chester Telephone District, and was appointed to Aberystwyth, later to Chester.

From 1939 to 1945 he served in the Admiralty Armament Supply Department at Bath.

In 1946 he returned to the Post Office as a Sales Representative at Shrewsbury and was promoted Sales Superintendent in 1948. Mr. Gooder has been President of the Telephone Sales Supervising Officers' Association since 1952, and is a member of the Standing Joint Committee of Telecommunications Sales Grades.

E. A. PETCHE ("International Trunk Mechanization") is a Chief Traffic Superintendent and has served in various appointments in Headquarters and the London Telecommunications Region. During the war he was lent to the Home Office to handle civil defence communications matters in London and the provinces He became a member of the External Telecommunications Executive when it was established in 1952 and is a Post Office representative on the C.C.I.F. Committees concerned with the development of international dialling.

H. J. C. SPENCER ("The New Wall Telephone") joined the Post Office as a Youth-in-Training in the Reading Telephone Area in 1937 and served in that Area until 1950, apart from a break of four years during the war in which he served in the Fleet Air Arm. He was then promoted Executive Engineer in the Engineer-in-Chief's Office, S Branch, where he is now employed on telephone design. He is an Associate Member of the Institution of Electrical Engineers.

C. A. STRADLING ("The Central Station of the Post Office Cable & Wireless Services") was appointed Press Liaison Officer of Cable & Wireless Ltd. in 1946, and has continued in that post since the Post Office acquired the Company's United Kingdom Services in 1950. In the course of his 39 years' career he has served the Company in England, Gibraltar, Egypt, Aden, Mauritius, Rodriguez, South Africa, Gold Coast and Nigeria, becoming a Supervisor in London in 1933.

M. B. WILLIAMS ("The Post Office Television Outside Broadcast Service") is a B.Sc. (Eng.) and an Associate Member of the Institution of Electrical Engineers. His Post Office service has been in the London Telecommunications Region and in the Inspection and the Main Lines branches of the Engineer-in-Chief's Office where he was promoted Senior Executive Engineer in 1952. From 1943–1945 he was seconded to the Ministry of Supply, Signals Research and Development Establishment, for work on military line transmission equipment.

Training in Telephone Supervision

R. W. C. Alford

"WHAT CAN THEY TELL ME ABOUT THIS JOB after 20 years?" "How can they possibly fill up a fortnight talking about this job?" These and similar questions are doubtless in the minds of many Assistant Supervisors now that training courses for first line supervisors are to be held nationally. Our experience in the North Eastern Region in running pilot courses may help to give some of the answers.

What has been done before?

There was little organized training in telephone supervision before the war, but since 1946 every telephonist selected for an Acting List or about to substitute for an Assistant Supervisor has attended an Acting List course. Many substantive supervising officers, too, attended this course in 1946. It comprised one week at a training centre followed by a few days at a selected exchange in the care of substantive officers. It has proved most valuable as an introduction to the work which our senior telephonists are going to undertake and has earned its place as a permanent feature of our service.

Why is More Needed?

The work and responsibilities of the first line supervisor have been changing gradually over the years. Some of the changes have affected all types of exchanges but their effect has been more marked in the larger ones. The change to automatic working has changed the pattern of operating. The simple local calls have gone from the operator's control leaving only those calls which require rather closer attention on her part; moreover each calling signal is from a number not readily identifiable and often appears simultaneously before a number of operators working with different supervisors. The personal relationship between subscriber, operator and supervisor has thus been loosened. Full employment in industry has resulted in constantly changing staffs with less overall experience. Clerical work, operator training and other functions are increasingly being handled specially. These factors, coupled with technical and operating developments (with their consequential change of procedure) have made it more difficult for supervisors to keep up-to-date and to maintain their position as experts who can give on the spot guidance to telephonists.

One effect of all these changes may have been to make the powers and responsibilities of supervisors less obvious; possibly this has tended to affect efficiency and to lessen the satisfaction which supervisors get from their job. The truth of the matter, however, is that the changes have increased the value of alert supervision and the role of the section supervisor is as vital as ever to the telephone service. The need, therefore, is to pass on that conviction to our supervisors and help them to do their jobs in the new circumstances.

What is needed?

The answer to this question follows logically from the conclusion in the previous paragraph. The aim should be to:

(i) examine and expand knowledge of the job;
(ii) widen background knowledge;
(iii) give guidance on human relations problems;
(iv) set a target to aim at for developing supervising technique.

The progress in this direction achieved during the course would need to be consolidated and continued through the medium of local controlling officers.

Preparation

We had given some preliminary thought to the course early in 1954, as our Regional Training Officer had been consulted by Headquarters. At the end of July we were asked to run a series of pilot courses during the winter. Each course was to last two weeks. Two instructors (one telecommunications Traffic Superintendent and one Supervisor) and reserves would be required and given instruction at Headquarters Training Centre. The preparation of briefs was to be shared with Headquarters and South Western Region, who would also run pilot courses. We had to move quickly and for the following months our Training Section was fully occupied. We held meetings in telephone areas to collect material for the course and attended meetings at Headquarters to discuss the syllabus and organization. We selected instructors, found accommodation, ordered furni-

Front row: Instructors (*left to right*) Mr. J. Newton; Miss M. McPherson; Miss K. Brown; Mr. R. H. Fitzpatrick.
Back row (*left to right*): Mr. K. H. Clegg, T.T.O.; Mr. F. C. Davies, R.T.O.; Miss D. Ward, Clerical Telephonist; Mr. R. W. C. Alford, A.T.C.I.; Mr. T. E. Lang, A.C.T.II

ture and equipment, prepared and examined briefs and prepared time-tables. We secured the co-operation of Telephone Managers and Head Postmasters, ran a series of appreciation meetings (two days) for all supervisors above first line, sent invitations to our Assistant Supervisors and arranged for visiting speakers. The climax was reached when we opened Course No. 1 on January 31, 1955, at 5, New York Road, Leeds.

Premises

Leeds has many advantages as a training centre, but availability of good accommodation is not one of them. The premises we finally obtained in New York Road were suitable so far as size was concerned, but the heating proved to be inadequate for the exceptionally bitter winter, while the noise of building contractors working overhead was a serious draw-back. However, these problems were minimized by various expedients and the courses went through.

We had one large lecture room in which most of the talks and discussions were held, two small rooms which were used for syndicate work, a retiring room, a cloak-room, an instructors' office and a room equipped as a cinema.

Classes

Each course comprises 12 Assistant Supervisors, in the proportion of three women to one man, the total being divided about equally between those from larger and smaller exchanges. We find this formula broadly meets our total needs and produces the right atmosphere for discussions. The presence of officers in charge from small exchanges with exchange section supervisors from larger exchanges ensures that easy generalizations do not slip by unnoticed. None has less than a years' experience in supervision. About half travel daily and the remainder find temporary homes in Leeds and district.

We have four trained instructors; two are Telecommunications Traffic Superintendents and two are Supervisors; they shared the work of the pilot courses more or less equally. This is most valuable. In the autumn one team will be in reserve at the start, though we do intend to give them a spell of work so that they may keep their hands in. The T.T.Ss. are responsible mainly for the human relations sessions and the Supervisors for the job sessions. A clerical telephonist gives general assistance and, naturally, Regional staff give considerable attention to the course.

Content of the Course

Earlier in this article, I outlined the aims of the course under four broad headings. The first was knowledge of the job. The way in which this is tackled is typical of the course method. We break down the telephonist's job into its component parts and see what can and does go wrong. We try to show that operating procedure is a logical, reasonable and simple means of meeting the needs of the average customer within the limitations of

the facilities that the equipment can provide. We look at the enquiry operators' and section supervisors' jobs in a similar way, relating each to the other and to our overall objectives. From time to time we examine particular examples of procedure which have actually occurred. The Assistant Supervisors themselves make a very big contribution to the course, for they soon overcome an initial shyness and intervene readily in discussions with examples and problems they have met. In this way they hardly realize that they are acquiring knowledge of the job, just as general knowledge is acquired by casual reading, observation and conversation rather than by specialized courses of study. The instructor is there to stimulate and guide this process, sessions being conducted on conference, rather than class-room, lines.

The second broad heading was background knowledge and in this class we look objectively and critically at local organization, at the work of the Telephone Manager's Office and of specialists inside and outside the exchange and at foreseeable developments which will have an impact on exchange conditions. In examining these features, we try to relate them to the supervisor's own job and to stress the importance of the supervisor's part as a link in management.

Next comes the question of human relations. Here we examine the background and characteristics of telephonists as people, the individual variations, discuss their incentives to work and how supervisors can help to get the best from them and help them to enjoy doing the job. We discuss how and when advice and correction may be given and the qualities of leadership.

Finally, by discussion periods and from talks given by visiting speakers we try to put together a picture of the whole organization, high-lighting the supervisor's part in it.

Visiting Speakers

These are a most valuable and popular feature of the course. The Regional Director demonstrated his confidence in it by opening (or closing) and the Telecommunications Controller by closing (or opening) each course. Each Telephone Manager in turn has addressed a course with an outline of the organization of his Area and advice on the service aspect of the supervisor's duty. Head Postmasters of the larger offices have also

A group in discussion : a third row of five tables was withdrawn for this photograph

come along and talked about what may be expected of a first line supervisor and have discussed the new promotion procedure with the classes. The Staff Controller has added to the value of the study of disciplinary procedure by offering advice from his wide experience of this subject. We have a speaker from the Telephone Manager's Fees Group who enlivens the discussion on "Ticket Troubles" with many practical examples and finally a panel speaker (Staff and Official side alternately) on Whitleyism.

Prepared hand-outs are not used on the course, but a copy of the blackboard record of the discussion in each session is given to each assistant supervisor. This, we feel, may help them to recall the discussion and permit successive visitors from each exchange to compare notes.

Full use is made of training aids, that is, gramophone records, films and film strips.

I cannot stress too firmly the great value of the group's own contributions. We have no new story to tell, no panaceas to offer and the instructors would be the first to admit that their part is that of guide and discussion leader rather than teacher. Members of the groups have brought out many of their day-to-day problems and all have learned by hearing how others have dealt with similar situations. In this, as in other training fields, it is noticeable that a group sense quickly develops among the participants, including the instructors, and groups have demonstrated, quite spontaneously, the pleasure and satisfaction which this new experience has brought them.

The Crucial Test

The course will not bring about a revolution in exchange supervision. It will be difficult to measure the value obtained from the course, but those who have attended it will know whether it has been worth-while. From what they or their local controlling officers have told us, we are satisfied that they have gained in confidence and satisfaction in the job from having been to Leeds and we hope that efficiency and *esprit de corps* in our telephone exchanges will benefit as a result.

Plaque for Marconi

The Antrim County Council in Northern Ireland have decided to erect a plaque at Ballycastle, Co. Antrim, in commemoration of Marconi's wireless experiments there.

The plaque, surmounted by the County coat of arms, will bear the following inscription:—

> MARCONI
> Site of Wireless Experiments 1905
> Erected by
> the Antrim County Council

There has been some local controversy about the correctness of the date, some people are of the opinion that Marconi's experimental work between Rathlin Island and Ballycastle was carried out several years earlier, and, in a letter to the *Belfast Evening Telegraph*, Mr. Hopkins of the Marconi Wireless Telegraph Co., says that " the Rathlin Island experimental station was in operation with Ballycastle from July 25 to September 2, 1898".

The engineer in charge of the station on Rathlin Island was, unfortunately, killed while climbing the cliffs in search of geological specimens on August 22, 1898, and it is possible that the station ceased to be operated shortly after this date.

In the following year, 1899, Mr. Davis (an associate of Sir Oliver Lodge) and Mr. J. E. Taylor of the Engineer-in-Chief's Office started work on a wireless telegraph system between the island and the mainland and this was opened in February, 1901, for the transmission of Lloyds messages and public telegrams. On Rathlin Island the apparatus was installed in the East Lighthouse and operated by a Lloyds signalman, while at Ballycastle it was installed in the Post Office and operated by the Sub Postmaster. In the following year the service for Lloyds ceased and the apparatus on the island was transferred to the Post Office, where it also was operated by the Sub Postmaster.

In 1905 Marconi came to Ballycastle and started experimental work on a wireless link with Rathlin Island. The new apparatus, which was the outcome of these experiments, was brought into use in 1906 and remained in operation for the transmission of telegrams until 1935 when it was replaced by a radio-telephone.

Rathlin Island was the scene of Robert Bruce's famous encounter with the spider and perhaps this story encouraged Marconi to "try, try again" until wireless communication was accomplished.

Post Office Development and Finance

Points from the White Paper

THE POST OFFICE AIMS TO MAKE ABOUT 1,500,000 new telephone connexions in the coming three years, to have eight million telephones in service by March, 1959, and to start about 200 telephone buildings during 1956–57; some three-quarters of these will be exchanges. Also during 1956–57, about 100 new post and sorting offices will be started.

These immediate aims are outlined in the White Paper—*Report on Post Office Development and Finance*—presented to Parliament on October 26, the essence of which may be summed up under two headings:—

1. Plans have been made to overcome large arrears of capital development as speedily as the country's economic position will permit.

2. Charges for many services, especially the telephone service, are to be increased to more economic rates; greater provision is to be made for depreciation; and the relations between the Post Office and the Treasury are to be changed.

The general economic position demands, for the immediate future, some restriction of the expanding development programme that the Post Office could otherwise undertake. Even so, the outlay required during the next three years is slightly over £300 millions, nearly 95 per cent. of which will be spent on telephones.

Telephone Development

Longer-term telephone development plans include:—

Replacement of remaining manual, by automatic, exchanges.

Continued work on the application of electronic techniques to telephone switching; a limited experiment has been in progress for the past two years at Richmond (see article on p. 161 of our last issue).

Development of a radio relay system to increase the number of trunk circuits.

Development of subscriber trunk dialling—the first installation should be ready in four years.

Introduction of new coin box to enable long distance dialling from call boxes.

The development programme also includes completion of the transatlantic telephone cable next year.

Telex

Plans are also being made to convert the Telex service to a national dialling system in about five years' time.

Rising Costs

During the past four years Post Office costs have risen by £50 millions; by 1956–57 known increases will have added a further £17 millions. The increase during the past four years has been met to the extent of £14 millions by internal economies and by a reduction in the surplus on commercial account; £5 millions have been raised by increased charges to other Government departments; and £31 millions by raising tariffs.

In spite of further economies, growth of expenditure during the coming financial year will outstrip income by £8 millions, which would convert the 1954–55 surplus of £5 millions into a deficit of £3 millions in 1956–57.

Telephone Tariff Increases

The White Paper shows that the telephone services are largely being run at a loss, owing to uneconomic charges to subscribers. For example, the excess of costs over rentals for residential telephones ranges from 26s. a year in London (exclusive or shared line) to 128s. for an exclusive line outside London. New residential lines outside London and the four large cities are being provided at less than half their current cost.

Increases in rental, from January 1, will vary from £1 a year for the London business subscriber to £3 a year for the residential subscriber outside London and the four large cities. These new rental charges, which are estimated to bring in £9.75 millions a year, will still leave rentals for subscribers outside London and the four large cities below cost. Increases will also be made in charges for extension rentals and in some minor charges.

A local call, at present charged 1½d., costs the Post Office a little over 2d. and, as new plant grows, the cost is increasing. The call fee for subscribers, for local calls, will therefore be increased to 2d. a unit.

The proposals will increase an average subscriber's bill to about 80 per cent. above pre-war charges—rather less than the increase for many goods and for many other services. The White Paper makes the point that the distribution system for telephones is more complicated than for electricity, water or gas.

Rates for ship-shore radiotelegrams, and some postal charges, will also be increased.

Telegraphs

No changes in telegraph tariffs are suggested but from January 1 universal free delivery of telegrams and later acceptance of overnight telegrams are to be introduced, and the latest hour for accepting overnight telegrams is to be extended from 10 p.m. to midnight.

Finance Generally

The proposals include a return in a modified form to pre-war relations with the Treasury. During and since the war the whole of the Post Office annual surplus has been paid to the Treasury. In future, there will be a standing payment of £5 millions a year, to be included as a charge against income; any surplus will remain at the disposal of the Post Office.

During the past 10 years the Post Office has made special provision for depreciation to the extent of £17 millions but during the same period the excess cost of renewing old plant at current prices has totalled £60 millions. The historic cost of the telephone system will be nearly £700 millions by the end of 1955 but at current prices the cost of a system giving equivalent facilities is estimated to be over £1,000 millions.

The White Paper proposes the provision of £12½ millions more to make good the difference between provision on an historic cost basis and provision based on today's prices. This will reduce the Post Office's draft on the nation's resources for capital development.

The Post Office proposes to raise altogether a further £25¾ millions a year, including the £5 millions payment to the Treasury, £12½ millions additional for depreciation, £8 millions to convert the prospective £3 millions deficit into a working margin of £5 millions, and £250,000 to meet the cost of improving services on current account.

Publication and Price. This *Journal* is published in November, February, May and August. Price 1/6. The annual postal subscription rate is 6 6 post free to any address at home or overseas.

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."

POST OFFICE TELECOMMUNICATIONS JOURNAL

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November, 1954—August, 1955

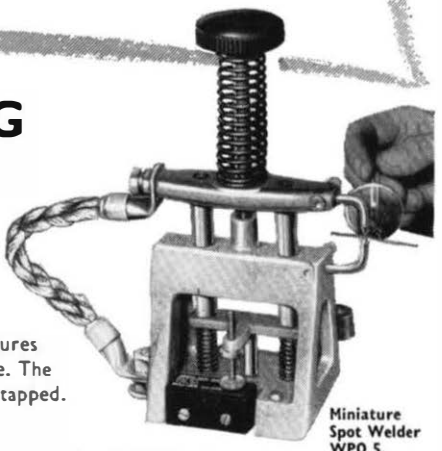
ALPHABETICAL INDEX

GROUP INDEX

SPECIALISED
ELECTRICAL EQUIPMENT

FOR WELDING SMALL PARTS

Vertical movement of the upper electrode allows accurate alignment of the work; electrode pressure is variable without increasing foot pressure. The pilot initiating switch has a micro-adjustment, and the electronic timer ensures accurate, high-speed repeat performance. The large capacity transformer is secondary tapped.



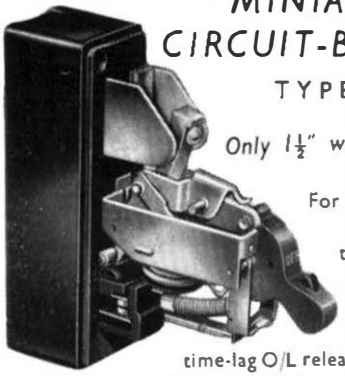
Miniature Spot Welder WPO 5.

AUTOMATIC PROTECTION

MINIATURE CIRCUIT-BREAKER

TYPE S121

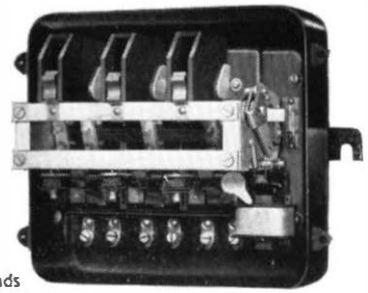
Only 1½" wide x 4⅜" high



For power and lighting circuits up to 30 amps 250 v. Instantaneous short-circuit and Thermal time-lag O/L releases. Neutral link. Breaking Current capacity 4700 Amps.

The S.12 CIRCUIT-BREAKER

Complete protection is afforded to three-phase and D.C. Motors up to 25 H.P. at 660 volts against sustained faults and short-circuits, while permitting harmless temporary overloads and high starting currents.



Rating up to 40 Amps. 660 volts. Double and Triple-Pole.

Protects against overload, short-circuit, no-volt, earth leakage.

Tested at an Authorised Short-Circuit Testing Station

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(GREAT BRITAIN) LIMITED

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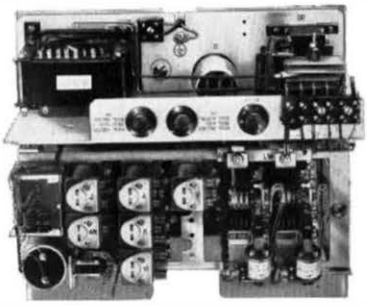
MEMO TO TELEPHONE ENGINEERS

Something here you'll be looking for.

Cut out this page for reference!

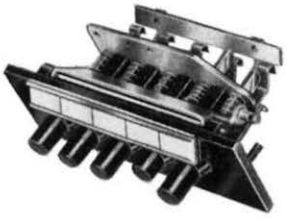


MINIATURE PRIVATE AUTOMATIC EXCHANGE

A switchboard for ten lines, with one connecting circuit (allowing one conversation at a time) and built-in mains unit. Wall mounting, strong metal cabinet.

BUZZER

A compact and efficient Buzzer D.C. resistance 10 ohms. Operates from 6 volt supply. Special resistance coils can be wound to suit individual requirements.

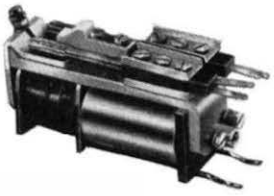


PRESS BUTTON UNITS

Interlocking self-releasing units, can be coupled to form banks of 20 buttons.

HAND MICROTELEPHONE

Complete with 3-way flexible cord. Can be supplied with extra sensitive receiver if required.



MAGNETIC RELAYS

Wound to suit your individual requirements.

JUNCTION BOX

Well-designed Bakelite housing for two 20-way terminal strips. Strips can be supplied separately if required.

SEALED JACK

Suitable for P. O. 'A' gauge Plug. Ideal for pressurised and watertight equipment. Auxiliary contacts can be incorporated.

SHIPTON

E. SHIPTON & CO. LTD.

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London Showroom: BRIDGE HOUSE, 181-6 QUEEN VICTORIA STREET, LONDON, E.C.4. Telephone: CENtral 0791-5 (P.B.X.)

Automatic Generating Plant

Quality, Sir, is a matter of detail.

Take a diesel engine and an alternator, bolt them down to a bedplate, couple them together and supply some switchgear. There you have a generating plant. Good enough for some jobs, perhaps, but not for the kind of job Austinlite plant is designed to do.

To see the difference you have to look closely. At the solid steel bearing housings with their special high speed bearings; at the patented bearing wear detection system; at the subsidiary emergency bearings which only come into play in the very unlikely event of main bearing failure; at the electrical equipment 'tropicalised' by methods developed as a result of much experience in the supply of plant designed to operate dependably in hot, humid climates.

It is detail of this kind which accounts for the high reputation of Austinlite wherever reliability is an essential. That, and one thing more; Austinlite engineers always enjoy tackling the jobs other people cannot fit. Because, although we make many standard types of generating plant, made-to-measure plant is our forte.

Austinlite **AUTOMATIC GENERATING PLANT**

Tailor-made by STONE-CHANCE LTD.

(The Makers of Sumo Pumps & Stone-Chance Lighthouses)

28 ST. JAMES'S SQUARE, LONDON, S.W.1. · TELEPHONE: TRAFALGAR 1954

A remarkable NEW head telephone set by Standard

Here's the most interesting telephone news for years! A new, lightweight, one-piece head telephone set moulded in nylon plastic and weighing only 4 oz!

Available in black or ivory finish, this revolutionary instrument, designed, developed and manufactured by Standard Telephones & Cables Ltd., for telephone switchboard operators, introduces an entirely new concept in comfort, elegance, economy and operational efficiency.

No other operator's head telephone set available to-day has all these additional advantages:

- ***Self-contained Nylon moulding incorporating high-quality, super sensitive transmitter and receiver.***
- ***Weight only 4 oz (compare this with the 15 oz weight of the conventional head and breast type operators' set).***
- ***Attractive appearance.***
- ***Only one instrument cord required.***
- ***Finely balanced to ensure comfort and stability.***
- ***Mechanical shock absorber to avoid breakage at transmitter horn junction.***
- ***Adjustable head grip with resilient band.***
- ***Moulded frame for operator's identification label.***

Ask for brochure T.D.16 which fully describes the

4406 Telephone Head Set

Standard Telephones and Cables Limited

Registered Office: Connaught House, Aldwych, London, W.C.2

TELEPHONE DIVISION
OAKLEIGH ROAD · NEW SOUTHGATE · LONDON, N.11

Marconi VHF Multi-Channel Equipment

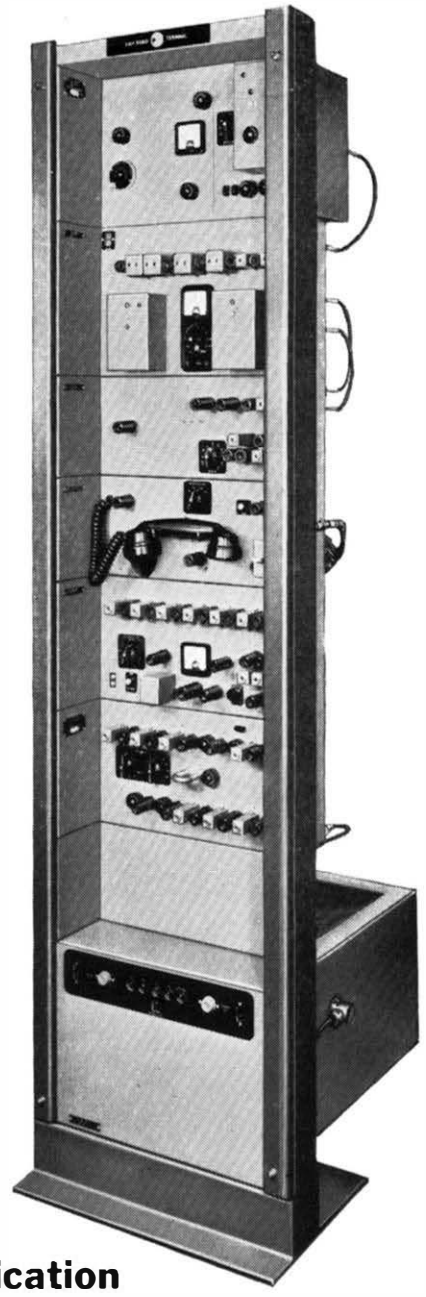
TYPE HM 181

Multi-channel radio links are not only recognised economic alternatives to line and cable routes wherever the latter are costly because of intensive urban development or the wild nature of the terrain; they are frequently preferable in their own right. The type HM 181 equipment has been designed for comparatively simple schemes using two terminals working point-to-point or with a limited number of repeaters. It operates in the frequency range 150-200 M/cs, employs frequency modulation and gives high performance with low distortion.

It provides the following facilities:

- 8, 16 or 24 channels
- Repeaters with easy channel dropping facilities
- Unattended operation
- Engineer's order wire
- Ease of access for maintenance

Over 80 countries now have Marconi equipped telegraph and communication systems. Many of these are still giving trouble free service after more than twenty years in operation.



Lifeline of communication

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Partners in progress with The 'ENGLISH ELECTRIC' *Company Limited*

MARCONI'S WIRELESS TELEGRAPH CO. LTD., CHELMSFORD, ESSEX

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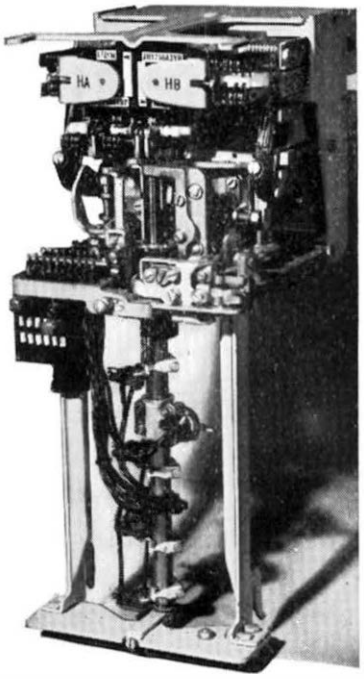


Carlton Exchange, operated by the Jamaica Telephone Co. Ltd., is a typical example of British enterprise in the Caribbean.

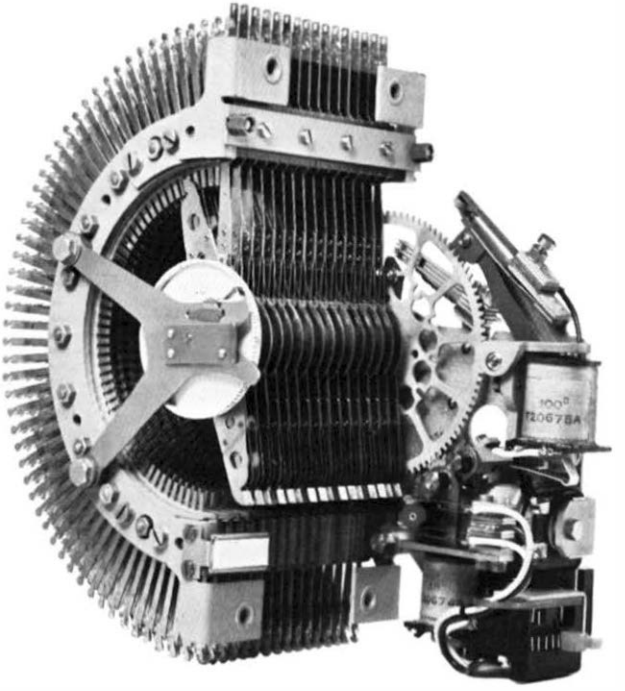
Carlton Exchange is of 3,000 lines capacity and is equipped at all selecting stages with the type 32A selector, the basic unit of the Strowger system, as manufactured by Automatic Telephone & Electric Co. Ltd. The simplicity and flexibility of the system are factors of considerable appeal to this and other administrations who are concerned with providing an economic and reliable service to their subscribers on an easily expandable basis. This is only one of many exchanges supplied and installed by Automatic Telephone & Electric Co. Ltd., in the Caribbean area.

Another Strowger Exchange

AUTOMATIC TELEPHONE & ELECTRIC CO. LTD., Export Department, Strowger House, Arundel Street, London, W.C.2.
Telephone: TEMple Bar 9262. Cablegrams: Strowgerex London. Strowger Works: Liverpool, England.

Automatic Switching Equipment for Long Distance Calls

Since 1933 Siemens Brothers have been pioneers in switching techniques for long distance calls. The design of the High-Speed Motor Uniselector illustrated is one of the Company's major contributions and this switch has been adopted by the British Post Office, Australia Post Office, South Africa Post Office and Canadian Administrations for their automatic trunk networks.



The chief features of the High Speed Motor Uniselector which subscribe to its reliability in operation are :—

Searching speed of 200 outlets per second.

Absence of wiper cordage.

Twin contacts between wipers and outlets

Complete absence of reciprocating movements.

Small number of adjustable parts.

Simplicity and permanence of adjustment.

Accessibility of all parts of the mechanism and contact bank.

Machine-made bank multiple connections.

The mechanism is also available for local switching purposes in the No. 17 Main Automatic and Private Automatic Exchange Systems, and is employed for many other purposes where reliability is of paramount importance.

SIEMENS BROTHERS

SIEMENS BROTHERS & CO. LIMITED,

WOOLWICH, LONDON, S.E.18

Telephone : Woolwich 2020

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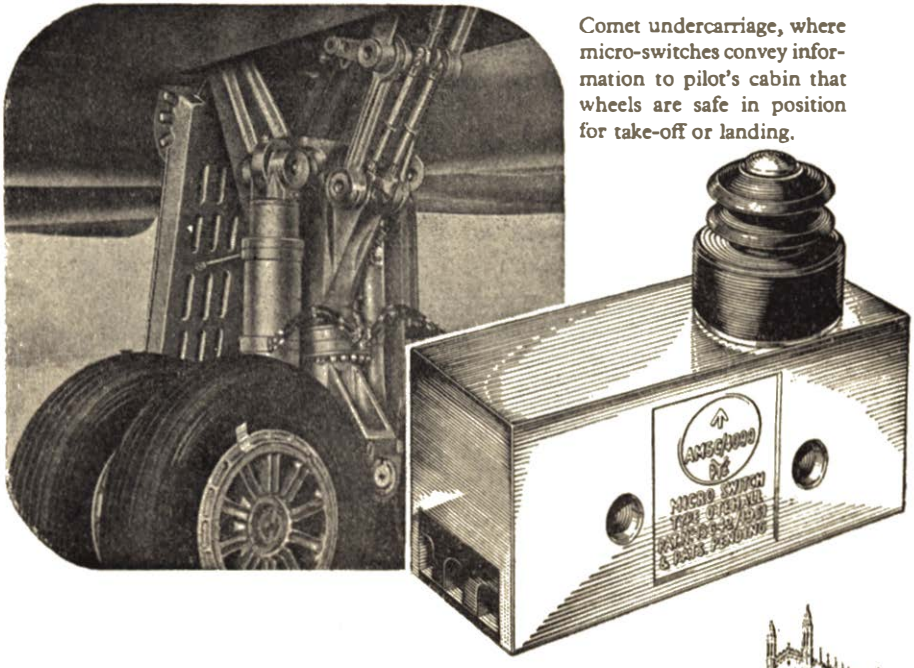
THE PYE GROUP

Precision

Precision engineering makes a major contribution to the success of finished products in all factories of the Pye Group. From time to time particular processes call for further mechanical aids and if these are not readily available they are designed and produced by the Group for its own use. A case in point is the new Pye micro switch which gives precise and positive switching between temperature extremes of 100°C. and —20°C. and has proved so successful that it is now marketed for the use of Electrical and Electronic Engineers in many industries. The Pye micro switch has been approved by R.A.E. Farnborough.

MICRO SWITCH



Comet undercarriage, where micro-switches convey information to pilot's cabin that wheels are safe in position for take-off or landing.

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