Post Office Telecommunications Journal

Contents

Comment

TELEPHONES CONNECTED SINCE THE WAR comprise two-thirds of all the telephones now operating in this country, but over 500,000 applicants are still waiting for service. Many people must wonder why the waiting list remains so long.

Of the many reasons, the two major ones are the very heavy and continuous demand since the war and the very severe restrictions on available resources. A look at the year ending March, 1950 shows that the rate of demand for telephones was over half as large again as for the year ending March, 1939. Against this fact, spending on new plant during the last three years, when adjustment is made to pre-war prices, has been at an average rate of about three-quarters of the average for the three pre-war years. Nevertheless, the system as a whole is about half as large again as it was before the war.

Monies made available to the Post Office must provide the necessary new exchange buildings and switchboards; they must provide ducts, cables, engineering equipment and long distance circuits. The demands are many. The amount of national capital which can be spent is limited, and out of the total available, claims have to be met for schools, houses, hospitals, mines and power stations, factories and industrial development, and now the accelerated defence programme. Telecommunications can only have their share.

The task to which the energies of the Post Office staff have been, and will continue to be, directed, is to ensure that the capital allotted is spent to the very best advantage.

Telecommunications Advice Service

## by W. T. Munro, B.Sc., (Eng.), and C. A. Richardson, Inland Telecommunications Department

Introduction

"Telecommunications Advice Service", in the present connection, means giving advice to applicants and subscribers on the best way to meet their telecommunications needs. The process is not merely one of observing and measuring the use made of existing equipment, but involves deciding what facilities a user really needs and how communications of all kinds should be organised to give the maximum efficiency with the greatest economy. This sort of work has to be done. A Sales Representative, a Telephone Manager or a Regional Director, in their differing spheres, may be approached by a subscriber for assistance, and Government Departments have been specifically required by the Treasury to ask for Post Office advice. The work, according to its nature, is undertaken at Area, Region or Headquarters level.

Sales Representatives—Advisory Work, Recruitment, Training

The bulk of the day-to-day work of visiting subscribers or applicants to discuss their telecommunications needs is done in the Areas by Sales

Fig. 1—Demonstration room at Headquarters Sales Training Centre.
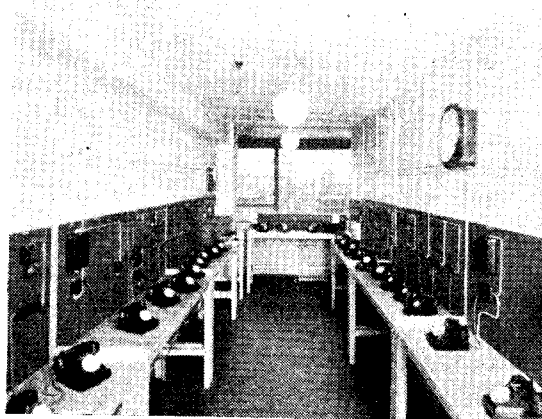
Representatives. Of the 680 in the country, about 480 are on visiting duties. A part of the work of all these people is advisory and if advice is called for on a matter confined to the Area it is on one of them that the job usually falls—at least in the first instance.

The simpler features of telephone service are of course widely known and there is little need nowadays to give specialist advice where only a direct exchange line is required, or a line and simple extension. Even in those cases, however, it is not unknown for advice to be called for—on the best place for the instrument and for the bell, for instance—and the answer even to this is not always by any means obvious. Advice as to the most suitable type of extension is often needed, and this means selecting, out of the available plans, that one which best meets the subscriber's needs, as the Sales Representative can determine them. As far as the staff available allows, anyone asking for an installation involving a switchboard is visited. The job might be anything from a small business, with an exchange line and two or three extensions, to a big one needing a Private Branch Exchange bigger than many public exchanges.

In all these cases, the Sales Representative's job is to examine the subscriber's needs, advise him on the best type of installation to meet them, and in due course to negotiate the agreement. If necessary, he consults traffic and engineering experts and they often go with him to examine and advise on their special aspects of the problem. In complicated cases, the Sales Superintendent may decide to take a hand, in order to give the subscriber the benefit of his greater experience and skill.

Because of the specialist yet wide knowledge needed by those who have to advise subscribers, the staff employed must be well qualified. High standards are therefore set for the recruitment of Sales Representatives. Entry to the grade is at present by Civil Service Competition. Candidates

have to satisfy the Commission that they have reached the required educational standards and they are interviewed by a selection board which assesses their ability to carry out the special duties of the grade. On appointment, they are given the opportunity of practising the operation of most kinds of telephone equipment they will meet in the course of their duties. A photograph of the well-equipped demonstration room at the Headquarters Sales Training Centre accompanies this article (Figure 1).

Advice to Large Organisations

We come now to the question of giving advice to large organisations of the kind that may have branches, factories or offices spread throughout the country, to Government Departments with extensive communication needs, or to industries that have been nationalised and have perhaps acquired communication networks that no longer fit their requirements. Organisations of this kind present problems which are normally outside the scope of an Area's or Region's organisation. The work is therefore undertaken by Post Office Headquarters. Activities are not, of course, confined to Government Departments or nationalised industries, and the very large communications network of Imperial Chemical Industries, Ltd., is among those being tackled at present.

Method of Approach

An investigation usually involves: first, a detailed study of the organisation and its functions; then an examination of the work performed in various branches and of the need for communications inside the organisation and between it and the outside world; and finally, on completion of the study, decision and recommendation. As in the simple example of plan extensions, it is necessary to select from the services available those that best meet the subscriber's needs. To do this, one must determine those needs (which the subscriber has often not been able to formulate), and this calls for a thorough study of his organisation. First of all, what does it exist for?—to sell fish? distribute news? attract the public into houses of entertainment? or what? Hence, what kind of telecommunications does it need?—the distances involved, speeds required and types of messages concerned differ enormously. Where are the various premises? What does each do? How is it controlled and how does it control others? Next: what communications exist, what deficiencies are
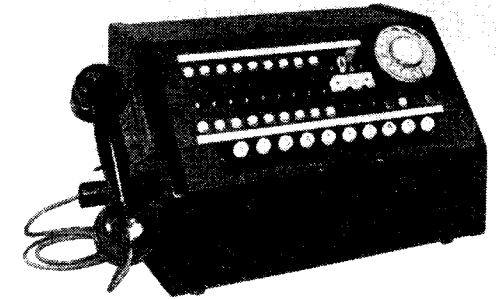

Fig 2—Cordless switchboard for standard P.A.B.X. No. 1.

already known, and where? To what extent is there waste now? From the picture that begins to build up, very often filled in by detailed traffic records, one can usually decide what should be recommended.

The recommendation will normally take the shape of a report, for the subscriber's information and action, as far as he thinks fit. The implementation of any specific recommendations—for example, provision of circuits or installations—will involve some or all Regions or Areas. The extent to which, and the manner in which, the recommendations require to be communicated to Regional Directors and Telephone Managers will vary, but in all cases the officers in the field who may be affected must know what to expect, and a general instruction is usually necessary.

Development of Subscribers' Facilities

Detailed investigation of a particular organisation sometimes leads to the discovery of needs not entirely satisfied by standard arrangements. It may be possible to meet these needs by adaptation of existing facilities, but where this is not possible or not desirable, there may be a case for a special examination to see whether there is a general need for a new facility or service. This may mean that a market research investigation has to be undertaken, various alternative methods examined and cost comparisons made. Activities in this field are necessarily limited in these days, but the future has to be borne in mind and plans made for services to be developed later when conditions improve; it is in the course of the investigations into a number of different organisations that gaps in our range of standard facilities are likely to be observed.
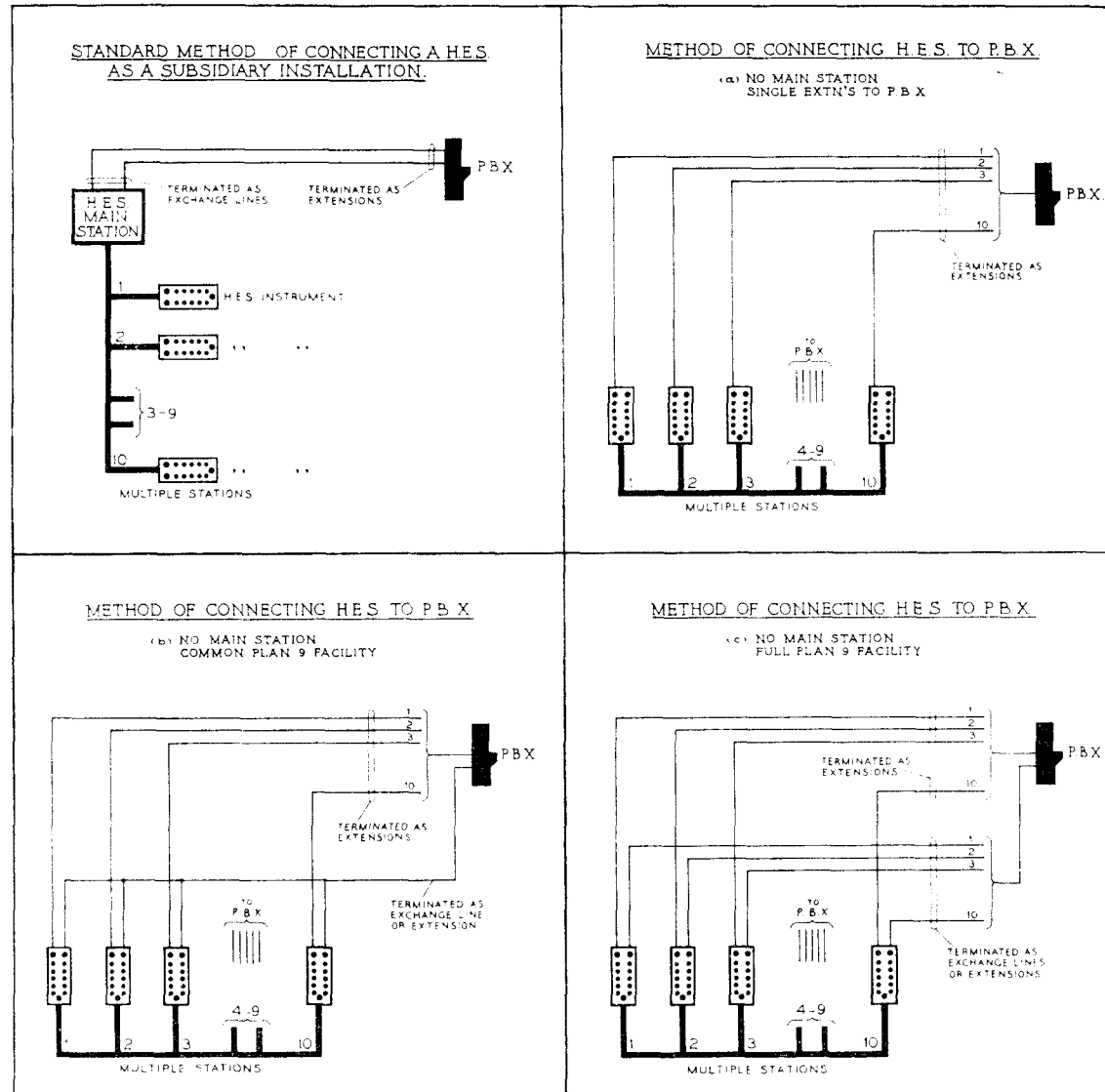
STANDARD METHOD OF CONNECTING A H.E.S.
AS A SUBSIDIARY INSTALLATION.

METHOD OF CONNECTING H.E.S. TO P.B.X
(a) NO MAIN STATION
SINGLE EXTN'S TO P.B.X

METHOD OF CONNECTING H.E.S. TO P.B.X
(b) NO MAIN STATION
COMMON PLAN 9 FACILITY

METHOD OF CONNECTING H.E.S. TO P.B.X
(c) NO MAIN STATION
FULL PLAN 9 FACILITY

Fig. 3—H.E.S. in conjunction with P.B.X.—the standard arrangement and three proposed variants.

Examples of Development Work

A few examples of work of this kind that have been initiated or helped on their way may be of interest. One is the development of the new small P.A.B.X.'s that are coming into production (Figure 2). Another is the standardisation of some tried arrangements of the House Exchange System in conjunction with a P.M.B.X. Subscribers wanting a P.A.B.X. often make their case on the need for rapid and direct communication between a small number of Executives or Heads of Divisions. We can give such facilities, for up to ten people, by the standard H.E.S., but there are disadvantages, for example:—

(i) Incoming calls have to be answered and connected by a clerk at the main station;

(ii) There is a maximum of two channels between the H.E.S. and the P.B.X.
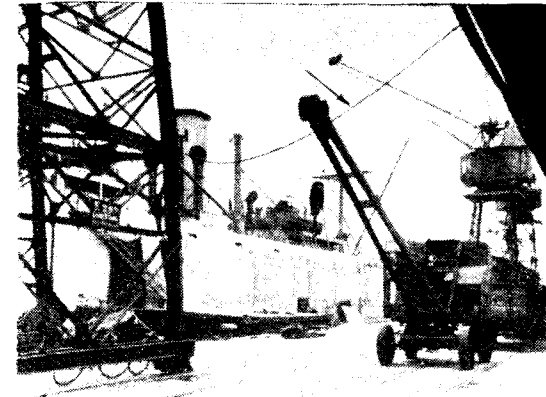
Figs. 4 & 5—The safety of the quayside lead-in (arrowed in the above photograph has been threatened hitherto by many obstructions. The picture on the right shows how this difficulty has been overcome.
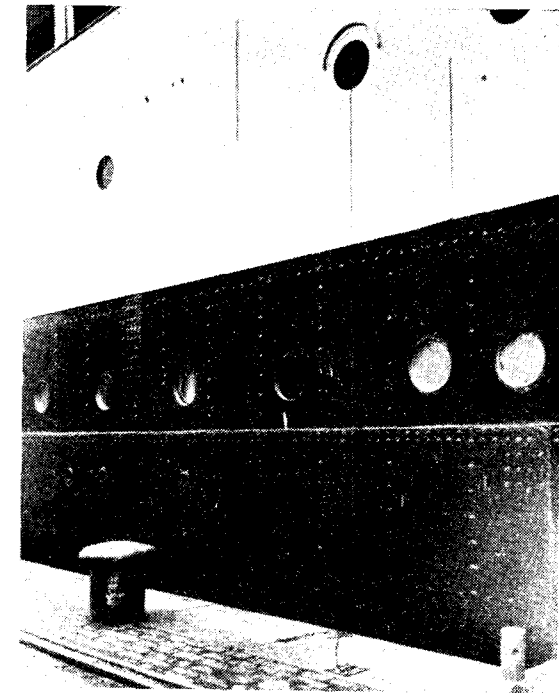
This means that users will commonly have a subsidiary H.E.S., use it solely for intercommunication with the other stations and have a separate P.B.X. extension for all other calls.

These objections will be removed by the arrangements shown in Figure 3, which it is proposed to standardise.

This is a minor example of an attempt to narrow the gap between the present House Exchange System and the P.A.B.X.; others are in mind.

In this field also, there is the work that has been done to improve telephone facilities for ships in dock. Rapid turn-round of shipping and the speedy handling of passengers and cargo are highly desirable aims, and good telephone facilities can help a great deal. Very close attention has therefore been paid to this question and the problem has been examined in collaboration with the Docks and Inland Waterways Executive of the British Transport Commission (representing the nationalised docks) and the representatives of the independent docks. The outcome has been a comprehensive joint report with far-reaching recommendations, which are now being worked on. One of the problems is how best to make the lead-in from the quayside to the ship, and standard methods have been worked out. (See Figures 4 and 5.)

Another aspect was the precise telephone equipment to be used. Portable sets have been in use experimentally in Liverpool since 1946 and a standard design has now been worked out for general use, as illustrated in Figure 6.

Investigations for Particular Organisations

We turn now to examples of investigations that have been undertaken for particular organisations since the war by the Telecommunications Advisory Group at Headquarters.

One concerns the post-war problems of the Board of Inland Revenue. There are about 600 Tax Offices in the United Kingdom, and whatever the success of their tax collecting, the efficiency of their telephone communications left much to be desired. The problem reached the Post Office through a fairly common process: office managers asked for duplicate internal systems because they were dissatisfied with their P.B.X. working. In this case, however, the organisation section of the office of the Chief Inspector of Taxes soon saw that there were weaknesses in the existing arrangements and suspected that the wholesale duplication of telephones was not necessarily the solution. It turned out on investigation that telephone installations had not kept pace with the great changes in tax work. Because of P.A.Y.E., tax is now being paid by a much larger number of people than before the war, and employers have virtually become collectors of taxes.
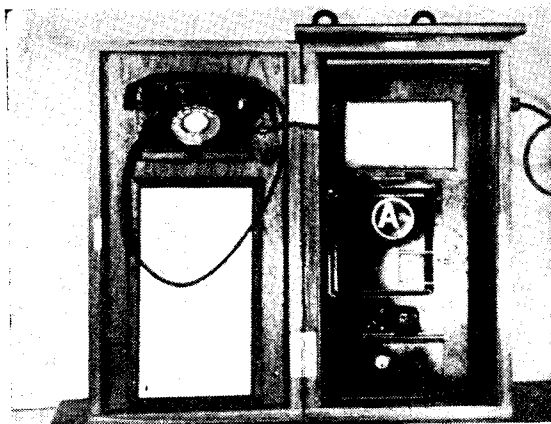
Fig. 6—Portable coin-box cabinet for shipboard use.

The number of enquiries from employers and employees has increased enormously and many more people are visiting Tax Offices to discuss their problems. After learning some of this necessary background by visits and discussions, we examined selected sample offices in detail, studying the work and telephone needs of different divisions of the offices and of different grades of staff, from registry clerks to Senior Inspectors of Taxes.

We found that existing instructions were inadequate and that there were often simple remedies, but that there was a field for telephone systems using press buttons or dialling for direct internal calls. The final report on the investigation made a number of specific recommendations covering P.B.X. operating, office management of telephone matters, concentration of switchboards and the details of extension arrangements and future designs. Examples were given of the selection of plan numbers for individual Tax Office conditions, and the case for and against intercommunication systems such as P.A.X.'s

and P.A.B.X.'s was impartially presented. Copies of this Report were distributed among Tax Offices and to Telephone Managers.

The enquiry just mentioned was one where all Telephone Areas were concerned with the results, which had therefore to be made known throughout the country. Another, which turned out very different in character and scope, was for the National Coal Board. The Tax Office investigation was concerned mainly with the problem of internal communications in a large number of fairly similar offices; the National Coal Board investigation was concerned, rather, with linking together the geographically separated parts of the N.C.B. organisation concerned with administration and marketing. The recommendations in the final Report were in more general terms and since neither coalfields nor the premises used as N.C.B. Divisional Headquarters occur in all Areas—or even in all Regions—it was not necessary to broadcast the Report.

Another example of investigation on a national scale is that for the Road Haulage Executive. Under the Transport Act, 1947, the British Transport Commission was charged with the duty of unifying and co-ordinating the transport services of the country. Co-ordination of road haulage services was delegated to the Road Haulage Executive, an autonomous body dealing with road freight haulage.

In 1949, the Chairman of the R.H.E. asked the Post Office to undertake an investigation into their communication needs. We were asked to recommend the best system for linking up the various offices and units then being set up to administer and operate the haulage firms that were being taken over by the R.H.E. This investigation has been proceeding at the same time as the R.H.E.'s organisation has been crystallising and as its field of operation has been extending.

Fig. 7—General (heavy) haulage lorry.

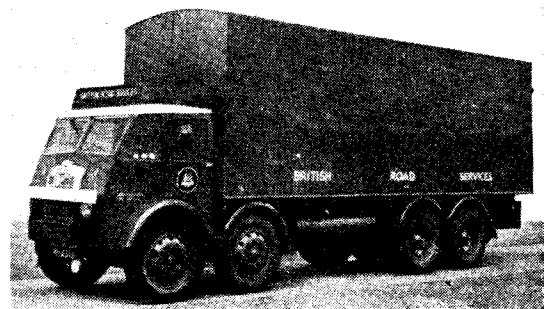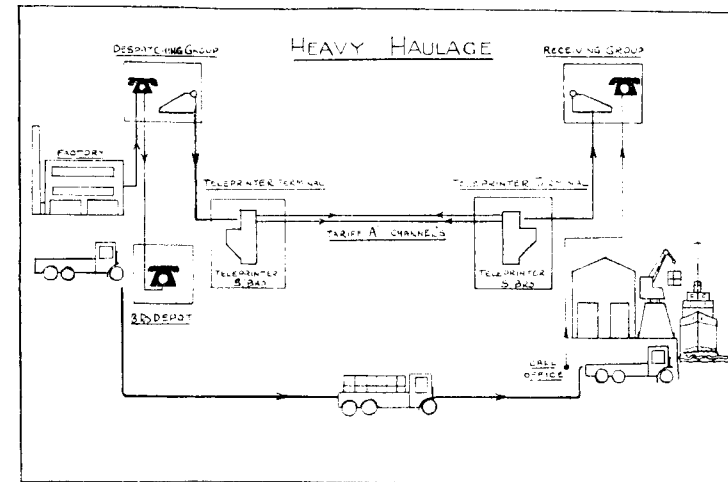Fig. 8—A 14-ton vehicle used for parcels haulage.

Fig. 9 — The telecommunications arrangements appropriate to general (heavy) haulage.

A very brief outline of the industry's organisation and of the course that the investigation has been taking may be of interest, not the least so because of the many similarities with our own organising or operating problems. Just as we have a Headquarters, Regions, Areas or districts, and telephone exchanges or post offices, so Road Haulage has a Headquarters, Divisions, districts, and such things as Groups and Depots. The Divisions and districts are administrative and the Group is the operating control unit.

There are three broad categories of freight: Parcels, General and Excluded. Excluded traffic is roughly anything that needs a highly specialised vehicle—a hundred-ton steel cylinder, 11 cubic yards of unrefined sugar, live race horses, meat and so on. This is handled by the Special Traffics Division, which is thus different from the other eight "territorial" Divisions. General (i.e. heavy) haulage is concerned with direct transport of consignments between customer and customer, for example, a load from a cement factory to a building site or from a factory to a ship in dock. There is no intermediate handling and once a load is taken on board a vehicle it is not normally touched until it is unloaded at its destination. A standard vehicle used for this is the 7-tonner illustrated in Figure 7. Parcels haulage, or "smalls", is the collection, transport and delivery of small loads, for which class of work regular road services are operated between parcels depots, with local services of collection and delivery. These trunk services are of course a means of bulking traffic into economically large loads, and a typical vehicle for this is the 14-tonner shown in Figure 8. This may seem a large vehicle to use

for parcels, but "smalls" are not necessarily all small; a consignment up to one ton in weight may be a "parcel". Figures 9 and 10 give a clear picture of the telecommunications arrangements used in road haulage.

Now, the communication needs of general and parcels haulage are rather different. On "parcels", we have:

  (i) the request from the customer;
  (ii) arranging collection;
  (iii) forward advices of bulk vehicle loads, the main purpose of these being to organise the work at the loading and unloading bank.
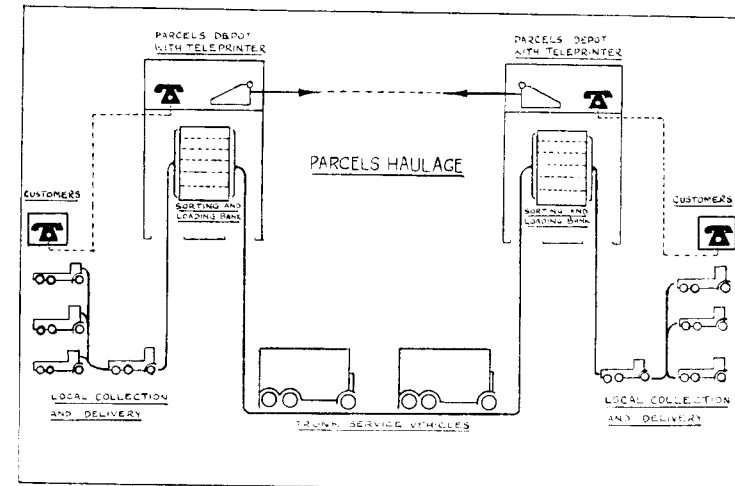

Fig. 10 — Telecommunications facilities suitable for parcels haulage.

General haulage requires the assignment of vehicles individually to particular loads and the transmission of movement instructions. One of the primary requirements of general haulage work is to obtain return loads wherever possible. In running a fleet of vehicles, the difference between making a profit or a loss depends very much on the proportion of journeys made with full loads in each direction. It is necessary, therefore, that advice of goods despatched should reach the destination control point early enough for reception and delivery arrangements to be co-ordinated and for return loads to be arranged. The public trunk telephone service was used extensively by most undertakings for their "vehicle advices". For all but the larger firms, there was indeed no real alternative. A number of the larger firms operating fleets of vehicles found it economic, however, to instal point-to-point private teleprinter circuits, for passing information in connection with the operation of road vehicles.

On investigation, it soon became clear that the teleprinter was the most efficient method of handling messages for operational control of all classes of haulage work. The first step was to make more efficient use of the existing teleprinter circuits. This was done by diverting a number of them terminating at different addresses in one city to a central switchboard and providing facilities for teleprinter communication to surrounding offices. At the same time, arrangements were being made for the diversion of the message traffic through this system. As a result of steps like this, we have had in operation for a short time the nucleus of a national R.H.E. teleprinter network, which has enabled us to examine the efficiency and cost of this method of operating the traffic.

On the results of the trials in handling messages by means of a teleprinter network, the Executive has decided to set up an extensive network, in stages. Very large savings indeed are confidently expected as the traffic is diverted to the planned teleprinter system.

Conclusion

In this brief review of activities in the advisory field, many gaps have been left. There has been no mention, for instance, of the advisory work undertaken in the London Telecommunications Region, which deals with so many of the Government Department Headquarters in and around Whitehall; nor has anything been said about the work done in connection with the Festival of Britain, both for the South Bank site and the travelling exhibitions.

Enough has perhaps been written, however, to convey something of the extremely varied and interesting nature of this Telecommunications Advice work. It calls for a great deal more than mere familiarity with the basic material of Sales work—the facilities, tariffs and terms of hiring standard apparatus. Inevitably questions arise, and have to be answered, on which knowledge of engineering, traffic, or even accounting matters is required.

In a sense this is true of all Sales work, but the type of investigation that has to be carried out by the specialist Headquarters group tends to run off the beaten track and one has to be sure of calling in specialists from other Divisions or Departments at the right time and co-ordinating their activities. Equally, one must not trespass on the responsibilities of Regions or Areas, yet it is in the nature of the work that a job, once undertaken, must be carried through to the subscriber's satisfaction. The policy of the Headquarters Sales Division is, therefore, firstly, not to undertake commissions that can reasonably be undertaken by a single Region, and secondly, having accepted a commission with wide implications, to devolve the work to Regions and Areas at the earliest possible stage after investigation and planning. The value of an impartial advisory service on telecommunications matters is great and the benefits in general goodwill, in prevention of complaints, and ultimately in economy to the subscriber and the Post Office alike, are undoubted.

At the Headquarters end of the organisation, the direct value of the service to "the customer" is shown by the fact that we have more work on hand than we can keep up with and we cannot yet see our way to undertaking the more general studies which would be of profit to the Post Office and to subscribers.

In his Presidential address to the Post Office Telephone and Telegraph Society of London, last October, the Director General, Sir Alexander Little, K.C.B., said: "We must give the best general satisfaction that our resources allow." This could not be improved on as a description of the aims of the Telecommunications Advice Service.

WORLD CABLES ON THE SCREEN

★   ★   ★

Those of our readers who visit the Festival of Britain and see the film which has been made by Cable and Wireless, Ltd., will be interested to read the following account of its production, written by Maurice Harvey (Director of Concord Productions, Ltd.). He wrote the script and produced the film in collaboration with F. G. Ridley, formerly of the Cable and Wireless Marine Staff.

MAKING DOCUMENTARY FILMS, LIKE repairing deep-sea cables, is a job that keeps you guessing. No two cable runs are alike; there are so many variable factors—wind and weather, the nature of the bottom, the available equipment, the way the ship is handling, and so on—but at least the factors which vary are always the same.

In film-making, we not only have to deal with familiar problems of lighting and camera positions, but each new assignment confronts us with a fresh set of technicalities to be mastered.

In the last year or two, I have filmed down a coal mine; up in an aircraft; in a cool, efficient factory; amongst the fun and games of Margate's Dreamland; on the deck of a torpedo-firing warship, and in the timeless peace of the English countryside. An interesting life, certainly, but not one that gives you time to get set in your ways.

Nearly every job provides one or two particular puzzles, and the Cable and Wireless, Ltd., film for the Festival of Britain was no exception. Our brief was to tell the story of cable repairing, in the setting of the Company's international telegraph system. This had to be done, for many good reasons, without leaving this country. If the subject were to be properly tackled, this meant reconstructing, not only the repair itself, but at least one overseas cable station, to show the actual effect of the break and the repair on communications.

We wanted a station which would give as impressive a picture as possible of the scale of the Company's operations. After much poring over maps, Ascension Island stood out as the best example. It owes its existence as a settlement to Cable and Wireless, Ltd., and stands in mid-Atlantic with its cables spreading out for thousands of miles, like the legs of a gigantic starfish. Another advantage was that it had no native population, or even animal or plant life, to complicate our "faking" problem.

Ascension Island, of course, is tropical. This meant tropical rig for the complement of *Norseman*—the ship which was made available to carry out our dummy repair. White duck was none too warm in the very English climate off Plymouth last August. It sent our "actors" scurrying for their overcoats as soon as each "shot" was finished. I need hardly say that we imported no professional actors, who might have been somewhat out of their element, and Captain C. C. R. Evans, First Officer A. Tudor and Bo'sun W. G. Mason-Richards were prominent in a distinguished cast who played their parts, as themselves, with great skill and assurance.

They, too, had some faking to contend with, since no actual repair was scheduled in British waters. Working with an odd length of old cable from store (new cable would have been unrealistic), they had to reproduce all the effects of strain and spread on the cable that would occur with 1,000 miles of cable lying at a depth of 2,000 fathoms.

At one point, the "damaged" cable had to be raised, encrusted with the oysters and coral growth often found in tropical waters. We supplied oysters (out of season) from a restaurant and borrowed coral from the zoo aquarium. But how did they get on to the cable as it was pulled up from the depths? A nice problem for Captain Evans. I won't tell you how he did it—it might spoil the effect when you see the film.

The script included a sequence where a boat's crew go to pick up a buoy in a rising sea. No convenient studio tank was available for us, and

Bo'sun Mason Richards had to take a crew out and do it. Not once, but twice—once so that we could send a camera out in the boat, and again so that we could take pictures of the boat from *Norseman* without including our camera.

It seemed rough enough to me, sitting in the stern clinging to the cameraman's waist to give him extra support in the bucketing boat, but the Bo'sun was leaping chamois-like from boat to bouncing buoy and back again as unconcernedly as if he were boarding a bus in Piccadilly Circus. Captain Evans told me afterwards that if this had been an ordinary repair, he'd have thought twice about sending the boat out. But they did it, and we got the pictures.

Turning Porthcurno into Ascension Island was relatively simple. An arc-lamp throwing tropical sunlight through slatted windows, the effect of a punkah twirling on the ceiling, and there we were. Tropical gear was reasonably comfortable in the regulated warmth of the School's Regenerator Section. Only the Manager was called upon to brave the elements, including rain squalls, for a beach scene designed to introduce the lonely island outpost of "Ascension".

You might think from all this that most of our work is faking. On the contrary, faking is one of the things we least enjoy in documentary films, and we do it only when it is forced on us. Apart from the tropical trimmings, we regarded our film as a straight job of reporting.

For the scenes in Electra House, very little faking was required. These scenes illustrate the wonderful way in which the Company's world-wide fleet of cable-ships is controlled from London, and help to underline the theme of British achievement in the service of the world—the theme of the Festival of Britain—for which this film is primarily designed.

I never feel that maps on the screen give a true impression of either the vastness of the world or of its essential unity, achieved by communication, so I had set my heart on a vision of the globe turning in space. This involved us in three weeks' studio work, following many weeks of planning. The globe on its trolley weighed nearly half a ton and the star-studded heavens formed a twenty-foot double backcloth.

The action of the grapnels under water set us another teaser. The possibility of using actual photographs by a "frogman" was considered, but abandoned, partly for fear the frogman might get caught by the grapnel himself. Accurate and workable nine-inch models were provided by the Engineer-in-Chief's Department—but to make their action convincing in a fish-tank of corresponding scale was no easy matter.

Not only does each new film present us, the producers, with a fresh set of technical conditions, but film-making itself is new to most of the people we work with. Many people approach it with the idea that it is a glorified form of taking "snaps" and find it hard at first to believe that the breaking-up of the most simple actions into numerous "shots," each involving meticulous preparation, is really necessary. Some of them, I fancy, are a bit incredulous even after it is all over! Of all the groups of people with whom I have worked, I can think of none who have been more friendly, co-operative and understanding of the requirements and difficulties of film-makers, than the members of Cable and Wireless, Ltd., whether in Head Office, ship, or Engineering School; in the Public Relations Office whose particular "baby" I was; or anywhere else, and I should like to seize this chance of thanking them all once more.

(Text and illustrations by courtesy of the Editor of "Zodiac", the house journal of Cable and Wireless, Ltd.)
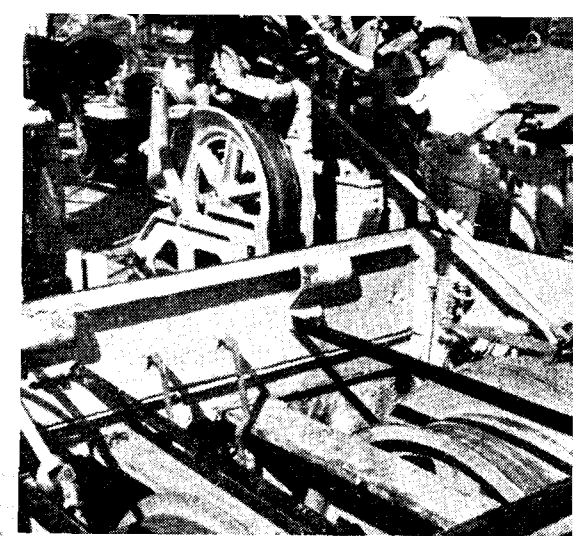
Scenes from

the Film

1. The bo'son and his mat straddle a faulty cabl section with a stopper a it comes over the bo sheaves.

2. *Norseman's* cable drum

3. A corner of Porthcurr Engineering Schoc rigged to resembl Ascension Island instru ment room.

4. Bo'sun's mate cutting th cable before hauling th faulty end aboard fc tests.

5. Job done, *Norsema* leaves the cable-groun

Communications for the Festival

by C. G. Dann, London Telecommunications Region

ON THE 3RD OF MAY THIS YEAR, HIS Majesty the King, after a State service in St. Paul's Cathedral, declared the Festival of Britain open. The opening ceremony took place on the steps of the Cathedral and the Post Office assisted by providing lines for the world-wide broadcast.

Nowadays no exhibition could be complete or efficiently managed without the facilities provided by the Post Office telecommunications services. How different from the days when the great exhibition was held in Hyde Park a century ago, when there were no telephones; indeed, it was not until 1876 that the forerunner of the modern telephone was first invented. Since then, great progress has taken place in the whole field of electrical transmission and many examples of this progress will be publicly displayed at various exhibitions during the Festival.

Apart from the exhibition, however, the Post Office has had, and will continue to have, a large and essential part to play in providing service for the administration of the Festival, both in London and throughout the country.

Although the Post Office will be concerned with services on a nation-wide scale, this article deals with the telecommunications provided for the main feature of the Festival—the South Bank Exhibition, covering over 30 acres.

When deciding upon the telephone requirements of such an enterprise, it was important, in order to ensure efficient co-ordination, to consider, in addition to the actual main site requirements, the intercommunications necessary for linking together the many subsidiary sites. In various parts of London there are eleven principal centres, five of them being Festival administrative offices and the remainder being necessary for dealing with London exhibition matters.
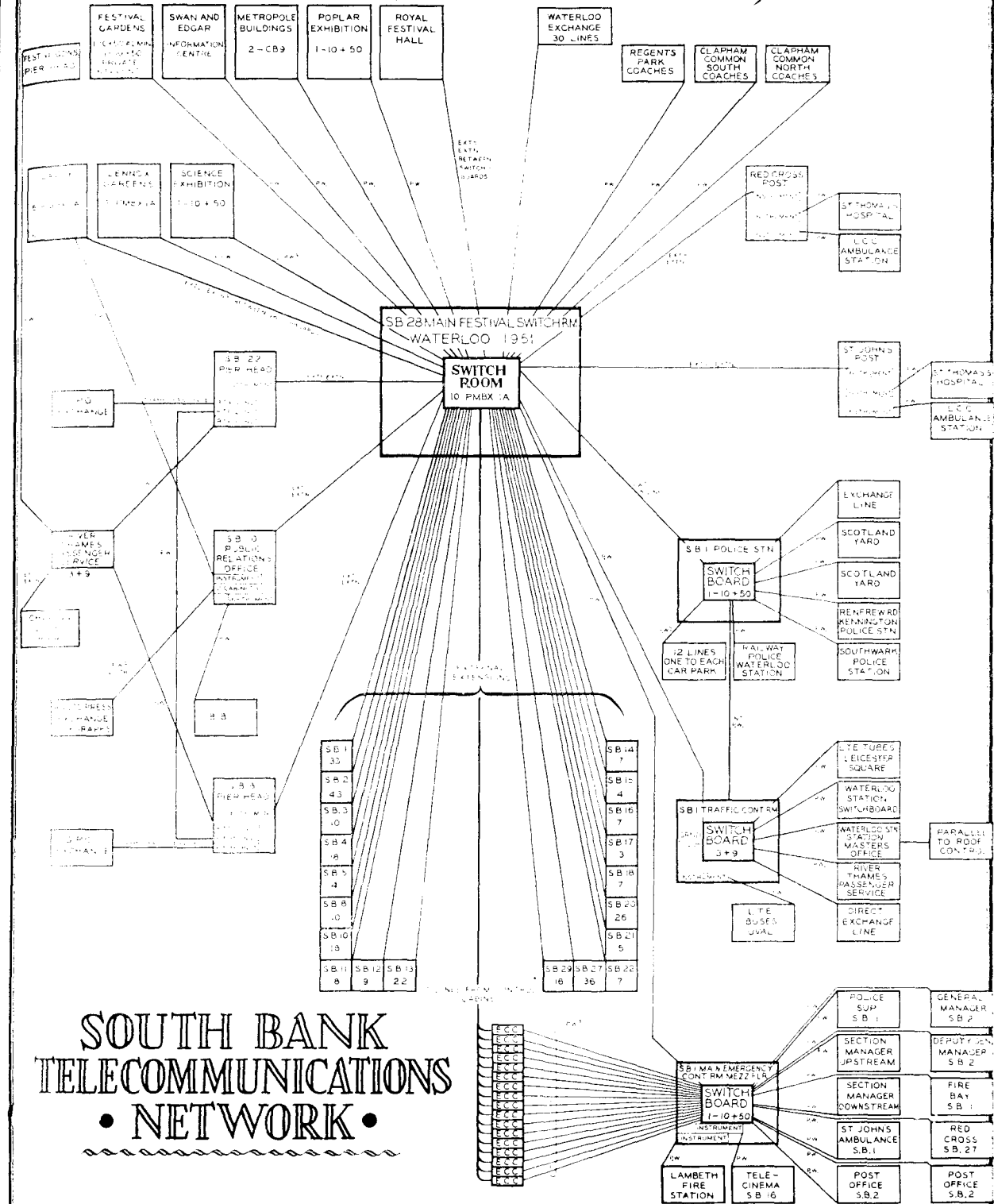
It was decided well in advance that as the South Bank Exhibition was to be in the Waterloo Telephone Exchange area, the telephone number WATerloo 1951 should be allocated to it. Initially, this number was used on an "out-of-area" basis for the installation at the main administrative offices in Savoy Court: it was subsequently transferred, before the Festival opened, to the South Bank premises, the Savoy Court

offices being linked to the latter by means of inter-switchboard extensions.

The principal telephonic facilities at an exhibition of this size are those required for enabling the organisers and operating staff to deal readily with the day-to-day problems that beset the exhibition authorities. It was decided that the requirements could best be met by the provision of ten P.M.B.X.1A switchboards, with provision for 30 direct exchange lines and approximately 320 external extensions within the exhibition perimeter. In addition, the requirements of the satellite centres had to be met, as shown on the schematic diagram, either by external extensions where transmission and signalling standards were satisfactory, or alternatively by private wires.

Furthermore, the Management Section of the Festival has had to provide for the safety of the large crowds of sightseers. Their first problem was to know, at any given time, just how many people were in the grounds, and for this purpose "crowd counting" equipment provided by a private contractor has been installed. The exhibition grounds are estimated to hold 60,000 people and upon this figure being reached, all gate entrances are advised by telephone that no further visitors should be admitted. In order to avoid congestion outside the exhibition and to prevent people from being disappointed upon arrival, a special network known as "Traffic Control" has been provided. By means of this, the London Transport Executive, British Railways and the River Thames Passenger Service receive information enabling them to take the necessary action within their own organisations to regulate traffic to the South Bank Site.

The Festival authorities have also installed an "Emergency Control Network". This comprises a modified 10 + 50 switchboard with about 20 emergency control cabinets erected throughout the grounds. These will be used solely by the Festival staff for the purpose of reporting back to the Control Room any untoward incident calling for immediate action; there are other direct connections also for police, ambulance and other services. A special police station has been built in the exhibition and this functions as a normal part of the police administration. Again, a 10 + 50

Festival of Britain 1951

SOUTH BANK TELECOMMUNICATIONS • NETWORK •

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MODEL OF THE SOUTH BANK EXHIBITION, FESTIVAL OF BRITAIN

switchboard has been provided, equipped with extensions radiating to various points in the vicinity of Waterloo.

Accidents will be the responsibility of the Red Cross Society and the St. John Ambulance Brigade, who have direct access to the main Festival switchboard in addition to private wires to the London County Council Ambulance Station and St. Thomas's Hospital. A special private wire between the base and summit of the Shot Tower has been installed.

In various parts of the exhibition grounds, there are some 67 telephone call offices and kiosks. They have all been specially designed by the Festival architects and some of the designs are unique. With a few minor departures, however, the majority are equipped with standard backboards. A specially designed suite of attended call offices is available to the public during normal Post Office hours. The room in which they are fitted is very pleasantly laid out and is fitted with an attendant's counter of unorthodox design. A 3+9 modified telephone switchboard has been provided on the counter, with direct lines to Continental and International Exchanges. Four cabinets have been specially reserved for this service. The remaining ten cabinets have been provided with normal multi-coinbox facilities. An attendant is on duty to give help to any user unfamiliar with the British system.

It is the intention of the Festival authorities to control lighting in certain areas on the site from a remote control position, and for this purpose a special switchboard has been supplied by a private contractor. The Post Office has provided the necessary 150 pairs of wires and 150 relay switches. One end of each pair terminates on the switchboard with its appropriate "on and off" switch; this in turn, operates the actual light switches.

The P.M.B.X. suite of switchboards will be in operation 24 hours a day during the whole period of the exhibition. It is staffed by Post Offic operators. The welfare accommodation for the postal and telegraph staffs is within the Festival Post Office building, while the telephone operating and engineering staffs have been provided with rooms in the separate building housing the main switchboard. A staff canteen is provided by the Festival Management Committee, and arrangements to meet the other welfare needs of the Post Office staffs have been made in consultation with the Staff Associations.

The Post Office building has been incorporated in the general scheme of the Exhibition and, like the other buildings, it has a most unusual and interesting architectural design. The shape of the public office counter is quite new. Each of the eleven positions is offset at an angle of 20 degrees, giving the appearance of a saw-tooth edge. The grilles are of plate glass, with vertical slits to assist speech. Both the tables for public use and the interpreter's office are of a novel design. Letters posted within the Exhibition bear a Festival of Britain cancellation mark.

As the purpose of the Exhibition is to advertise British goods, great care has been taken in the selection of the industrial products to be displayed. This selection has been in the hands of the Council of Industrial Design, who are also responsible for the expert staffing of the industrial information bureaux that are available in the grounds to help and advise interested visitors. The Council offices and these advice bureaux have all been provided with telephone facilities. It has been necessary to instal two 10+50 switchboards with approximately 10 direct exchange lines and 50 extensions.

The Post Office has also made provision for B.B.C. radio and television broadcast circuits. Lines have been connected to the Concert Hall and many other points of interest.

It is not possible in this short article to give a comprehensive description of everything that has been undertaken, but the following approximate figures of engineering stores used in the task will give some idea of its magnitude:

8 miles of underground cable; 12 miles of internal wiring; 10 P.M.B.X. 1A switchboard positions; 8 smaller switchboards; 6 teleprinters; 135 direct exchange lines; 700 telephones; 67 call offices and kiosks; 65 private wires.

The Post Office can feel justly proud of its contribution to this great national enterprise. Although the most concentrated portion of the work has been in London, much has been done in other parts of the country. There are special installations, for example, aboard the Festival ship *Campania*, for the Land Travelling Exhibition, and in connection with the many other Exhibitions and Art Festivals that are being held in provincial cities and towns. The Post Office staff have had one object in view—to get the work completed and to do their part in ensuring the success of the Festival. All those concerned with the work will look back on it as a job that has been very well worth while.
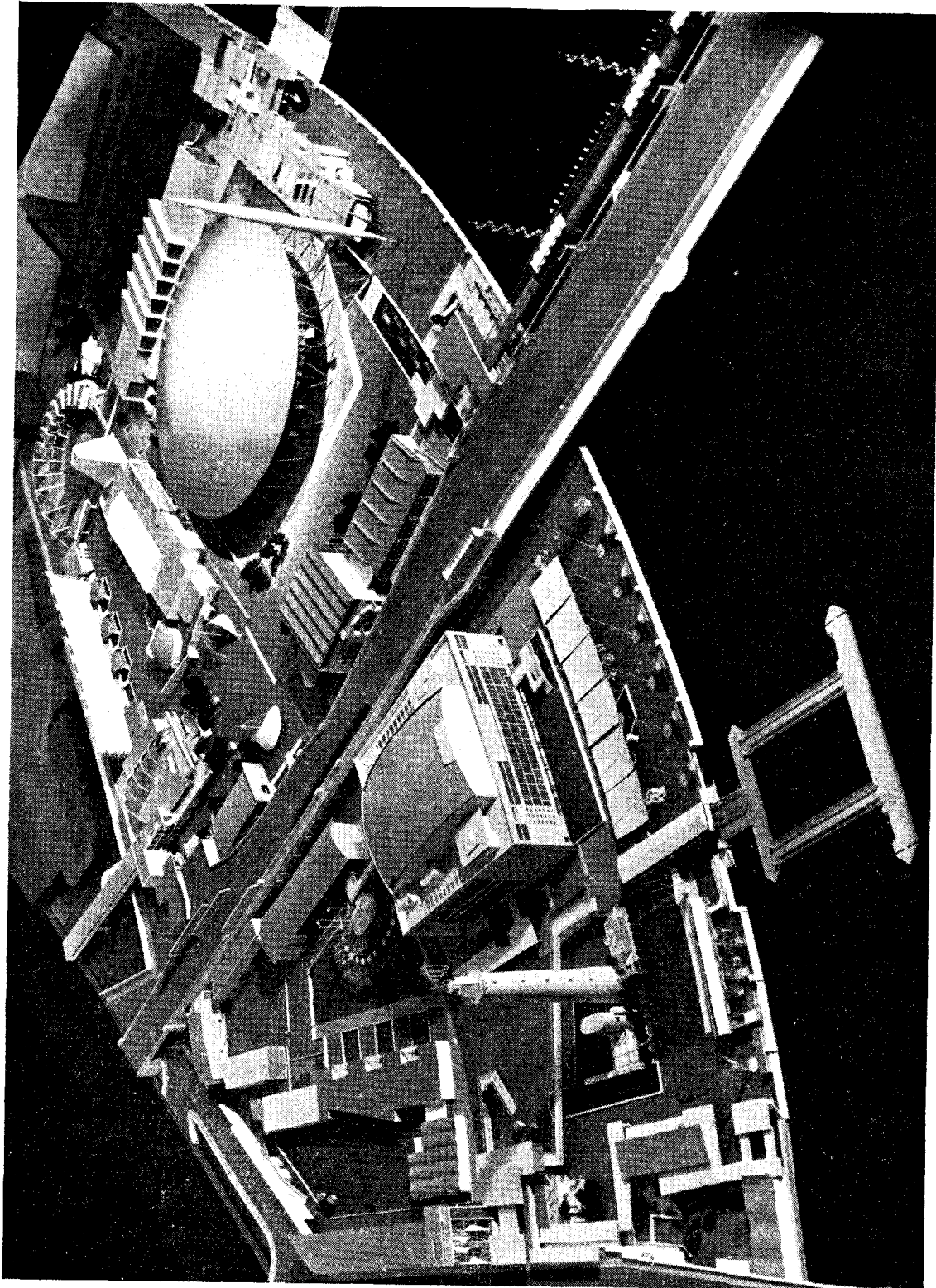
Contemporary Telephone Mechanisation Abroad and Possible Future Trends (3)

by J. A. Lawrence, A.M.I.E.E., Engineer-in-Chief's Office

The author's first article dealt with local automatic systems abroad; in his second contribution, he went on to discuss subscriber-dialling over longer distances; the final stage, national dialling, forms the subject of what follows.

★　　★　　★

Long Distance Subscriber-Dialling and National Numbering

THE SUCCESSFUL DEVELOPMENT OF SUBSCRIBER to-subscriber dialling over short distances inevitably gives rise to speculation as to the possibility of introducing, ultimately, universal subscriber-to-subscriber dialling. Prior to the recent war, the development of universal subscriber-to-subscriber dialling facilities remained very much in the "paper" stage, except, perhaps, for Switzerland, where plans for a nation-wide dialling scheme had reached the development stage by 1938. Since the war, however, all of the important administrations in the world have studied the problem intensively and have produced, or are considering the introduction of, national numbering schemes as a preliminary step.

Not all the administrations concerned are yet fully convinced that universal subscriber-to-subscriber dialling is desirable even as an ultimate objective. Thus, in France, although a national numbering scheme has been planned, it is intended primarily to facilitate the introduction by stages of single-operator trunk dialling. Subscriber-dialling is a secondary objective and will be limited to traffic between important centres for which the charge does not exceed eight or nine unit fees, where the unit fee may be regarded as being roughly comparable with that of Great Britain. Again, in the United States, a national numbering scheme has been planned and partly implemented. This scheme covers the United States and Canada and is intended to make possible a high-speed operator trunk dialling system. It is not, in its present form, intended to permit nation-wide subscriber-dialling, although it has been so planned as not to compromise the ultimate introduction of such facilities. On the other hand, Switzerland, Holland, Belgium and Sweden have all embarked on programmes which are intended to lead, by stages, to nation-wide subscriber-dialling. Among these, Switzerland has almost completed the programme. In the other countries, the programme has been delayed by the war, but is now gradually accelerating. Extended subscriber-dialling, with nation-wide subscriber-dialling as an ultimate objective, is probably the next great step in the planning of national telephone systems and, as in the case of local telephone systems, the highlights of the problem can be seen from a study of the many schemes which have already been proposed by other administrations. While it is not possible here to examine all the schemes in detail, the principal features of national numbering and dialling schemes which have been adopted in Europe are given in the accompanying Summary.

Generally speaking, nation-wide subscriber-dialling raises problems which are likely to be more troublesome to the administration than to the equipment engineer. A study of foreign systems shows that the design of trunk switching equipment has not, so far, departed in principle materially from the design of local switching equipment. Moreover, trunk switching can be carried out by any of the three basic methods of switching already described, with the proviso that if subscribers are to be allowed access to trunk switching equipment, translating registers provide economically the best solution. As regards administration, it might reasonably be said that, technically, nation-wide subscriber-dialling is already practicable. Before, however, any positive steps in this direction can be taken, a national numbering scheme must be laid down and the method of charging decided upon. Both questions are very difficult. With national numbering, the numbering scheme must not only fit the existing network, but must provide for all future development. Moreover, the scheme must be such that subscribers can understand readily what they have to do, not forgetting such questions as the layout of directories. In this connection, there is the very important matter of the use of lettered dials. So far, France is the only country which proposes to use lettered dials for ultimate nation-wide subscriber-dialling. In attempting to incorporate letters in the dialling codes, the French administration has encountered the difficulty of associating the letters with exchange names and, in many instances, it has reduced the letter component of a code to a single letter and grouped a number of exchanges under the same letter but with different following figures. It may, of course, ultimately prove worth while to be able to break up the dialling codes with letters, but in view of the fact that most other foreign administrations are basing their ultimate nation-wide dialling schemes on all-figure codes, there seems to be a reasonable doubt as to whether the use of letters, in national numbers offers any advantage over well-planned

SUMMARY OF PRINCIPAL FEATURES OF NATIONAL SUBSCRIBER-DIALLING SCHEMES

Country	Number of Digits Dialled for a "Local" Call	Number of Digits Dialled for a National Call	Method of Charging	Remarks
Switzerland	Five or six (all figures).	Eight or nine (all figures). First digit uniformly 'O'.	Multi-Metering—local calls unit-fee untimed. All other calls as multiples of unit-fee repeated every three minutes.	Subscribers may have meters fitted at their premises.
Belgium	Five or six (all figures).	Eight uniformly (all figures). First digit uniformly 'O'.	Some multi-metering but automatic ticketing is being introduced for trunk calls. Local calls unit-fee untimed. Other calls multiples of unit-fee timed.	
Sweden	Four, five or six (all figures) except Stockholm, which will have seven digits ultimately.	Nine uniformly (all figures). First digit uniformly 'O'.	Multi-metering as explained in text.	
Holland	Three, four, five or six (all figures).	Eight, nine, ten or eleven (all figures). First digit uniformly 'O' followed by a four-figure code and the wanted number.	Multi-metering as explained in text.	Subscribers may have meters fitted in their premises.
Germany	Five or six (all figures).	Nine uniformly (all figures). First digit uniformly 'O'.	Multi-metering. Details not available.	
France	Six containing one letter and five figures or two letters and four figures, for example, C2-1234 or BA1234.	Ten consisting of '16' uniformly as prefix followed by two figures and wanted six digit number, for example, 16-34-C2-1234.	Multi-metering up to nine unit fees, operator dialling beyond.	

all-figures national numbering schemes. The national numbering scheme of the United States is also based on the use of lettered codes, but so far the scheme is intended to simplify the work of a trunk operator.

It seems that the most difficult aspect of the problem of charging is likely to be that of deciding whether or not the public would accept bulk-billing for all calls, instead of bulk-billing for local calls with individual trunk accounts.

Experience in Switzerland, the numbering scheme of which calls for eight-digit all-figure numbers for long distance calls, suggests that subscribers are willing to dial numbers for themselves when the service is good. For example, when a new long distance route is opened for service, the number of calls handled manually is usually large for the first few months but decreases rapidly towards an ultimate steady value of the order of eight per cent. Also in Switzerland, the use of bulk-billing for all calls does not lead to an abnormal number of complaints, but to argue that this means that bulk-billing is acceptable ignores the fact that there is, in Switzerland, only a five-to-one ratio between the maximum and minimum call charges. Clearly, the latter must have an important bearing on the problem. In both Sweden and Holland, the experience of the administrations is again that subscribers take willingly to dialling and also that the bulk-billing of call charges causes no trouble.

From Sweden, for example, it is reported that when a link between two automatic networks about 50 kilometres apart was opened recently for subscriber-dialling service, with timed multimetering, the service was well received by subscribers and the traffic between the two networks showed a substantial increase over the traffic previously experienced with manual operation. Again, in Holland, owing to a shortage of circuits between Amsterdam and The Hague, it has been found necessary to operate this link manually between 8.0 a.m. and 5.0 p.m. Subscriber-dialling is, however, permitted after 5.0 p.m., and it is now common experience to find that demands fall off rapidly after about 4.0 p.m., only to peak-up sharply when subscriber-dialling is permitted, that is after about 5.0 p.m. Subscribers appear to find it better to defer their calls until 5.0 p.m., and to use the fully automatic service, instead of the semi-automatic service available via the operator. The real test is however yet to come. What is

likely to happen in a network as large as that of Sweden (about 7,000 exchanges), when it is possible for a subscriber to dial to any part of the country, is a matter of guesswork, and it may well be that subscriber-to-subscriber dialling may not be worth while, except within an area surrounding each originating exchange and containing perhaps a maximum of 1,000 exchanges. This is, in effect, the state of affairs now existing in Switzerland, Sweden and Holland. The use of automatic ticketing would permit the development of nation-wide subscriber-dialling facilities without any need to modify the tariff system; but in those systems where subscribers' lines are already equipped with meters, it is doubtful whether automatic ticketing for all calls will ever be economic. Even if it be assumed that both area-to-area charging and bulk-billing are acceptable both to the administration and to the subscribers, there would, in a fully automatised network, still be difficulties to overcome with such services as personal calls and with the problem of advising subscribers such as hotels, clubs and so on, of the charge incurred for a call. In Sweden, and to some extent in Holland, it is argued that since a subscriber is charged only a small amount for say the first 20 seconds or so of a call, he can cut-off and try again later if a particular person is not available. This, it is suggested, will be more attractive than a personal call charge and should, therefore, ultimately reduce the demand for personal calls to a tolerable level.

In Switzerland and Holland, subscribers may, for an appropriate additional rental, be provided with a call charge meter at their own premises. This meter is operated over the line from the exchange and, from the indication given, the subscriber can calculate the charge. In this way, clubs, hotels and such places may collect fees as incurred.

Conclusion

The discerning reader will have realised by now that more has been left unsaid than said. What has been said may, however, help those whose interests are fully occupied with the detailed operation and administration of the present telephone system in this country to see their own problems in a new light, and to realise that, in the years ahead, the national and international aspects of telephony are likely to play an ever-increasing part in the development of our national system.

An Experimental Directory Enquiry Installation

by F. N. Thomas, Southampton Telephone Area

ONE IMPORTANT STANDARD BY WHICH THE efficiency of a telephone system is judged is the arrangement for ensuring that users of the service can obtain information about the telephone number of any subscriber with whom they may wish to communicate. It would clearly be out of the question to provide every subscriber with a complete set of directories for the United Kingdom, but even if this were done the directories would not show all the day-to-day alterations that take place between one issue and the next.

The present practice in this country is to supply each subscriber with a directory which covers the whole of the Telephone Manager's Area (the whole Region, in London). In some cases, smaller local directories and directories of adjacent Areas are also supplied. In order that subscribers may obtain information beyond that included in these directories, they are given ready access, without charge, to a Directory Reference Centre. There is generally one Directory Reference Centre in each Provincial Telephone Area, which can give up-to-date information concerning all the subscribers in that Area, together with the latest printed information for the remainder of the country. Information that cannot be given from these records is obtained for the subscriber from the Reference Centre serving the distant town.

The Directory enquiries dealt with at an Area Reference Centre fall into two broad classes:—
  (1) Those for the telephone numbers of subscribers in the local Telephone Area who are not yet in the local directory;
  (2) Those for the telephone numbers of subscribers who are proper to a directory not available to the enquirer.

Thus two fundamental records are required: the first, to give particulars of all additions, deletions and other amendments that are necessary to keep the local Area Directory up to date; the second, a complete set of Directories for all the Telephone Areas in the United Kingdom.

For many years it was the practice at most provincial centres to write the amendments in specially bound copies of the telephone directory, in which the printed pages were interleaved by pages of lined writing paper; at the largest provincial centres, an alternative system using a rotary-drum type of index was brought into use some years before the war. More recent experience suggests that, at medium-sized offices, a loose-leaf system is the most satisfactory method of keeping the local Area Directory up to date. With this system, all changes are recorded on separate sheets, which are distributed daily and filed in alphabetical order. These loose-leaf files are used in conjunction with an ordinary copy of the Local Area Directory, from which are deleted daily all cessations and other entries which would otherwise require considerable manuscript amendment.

These two fundamental records require considerable space and with the present standard enquiry position it is often not possible to arrange for all the information to be within easy reach of each monitor; in this case, the best solution is the segregation of Directory Enquiry work and the provision of equipment specially designed to handle it. This calls for the design of a new type of desk to accommodate both bound directories and supplementary loose leaf files, and several experiments are being made with the object of determining the best design. A description of

Fig. 1—GENERAL LAYOUT OF THE SUITE.

the desk installed at Southampton may be of interest.

The Directory Enquiry work at Southampton requires a busy-hour staff of eight, and opportunity has been taken of the need for additional enquiry positions to devise and construct locally special equipment for this work, involving the provision of a "953" level for the segregation of Directory enquiries from the normal "91" level calls.

A general layout of the suite is indicated in Figure 1. The equipment has been constructed to

fit on ordinary standard tables No. 365 (6 ft. for end and 5 ft. for centre sections). These tables also provide accommodation for exchange clerical and writing duties at the rear of the panels.

The essential features of a Directory Enquiry suite are that all records should be readily available to each operator; there should be unrestricted writing space; the design should be simple, to facilitate manufacture, and should be capable of extension in two-position units up to a maximum of 20 positions; difficult enquiries should be segregated. The way in which these requirements have been met is described in the following paragraphs.

All records available to each operator. The accommodation for records is provided on a basis of one complete set of directories, together with capacity for 16,000 loose-leaf insets, to each pair of operators. See Figure 2.

Design of equipment. The equipment is cordless, with no keys on the writing shelf. Mahogany has been used throughout, but the writing shelf is faced with red fibre.

Segregation of difficult enquiries. This is arranged by the provision of two types of panel equipments:—

(a) Ordinary Directory Enquiry panels, (Figure 3), containing 40 answering equipments, with a complete ancillary field in each panel.

Fig. 2—HOW THE RECORDS ARE ARRANGED.
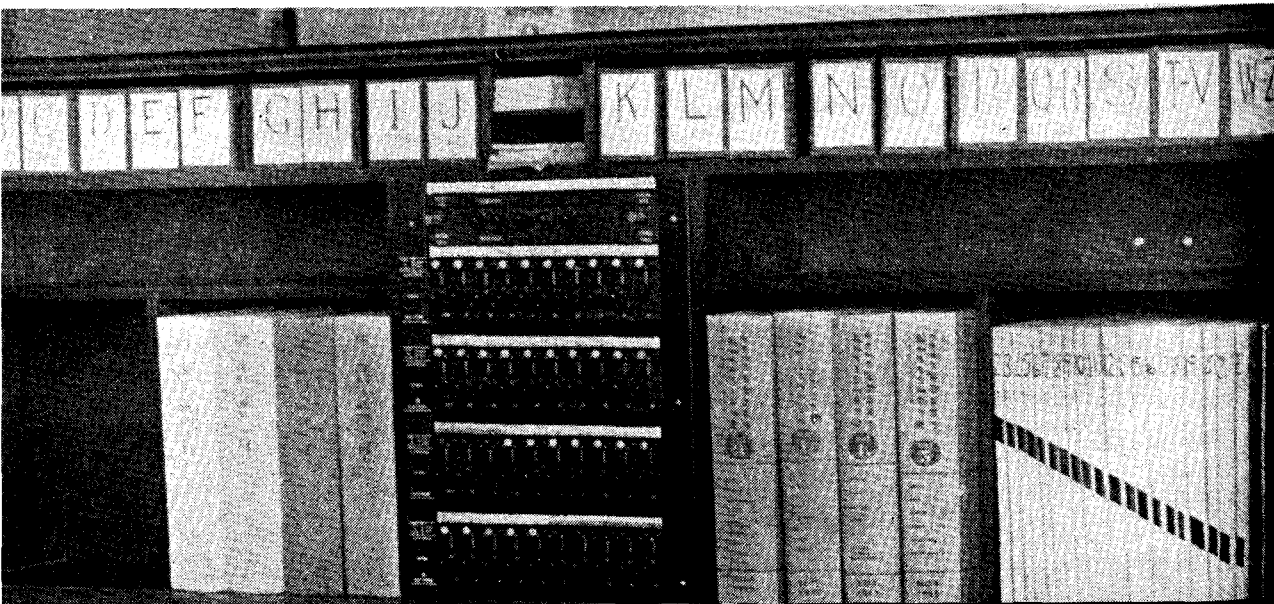
(b) Special Directory Enquiry panels (Figure 4) which have, in addition to the normal panel equipment, provision for up to 8 circuits outgoing to the manual board.

In both types, the principle of one panel for two operators is followed. The circuits call on lamp signals and there is a key for each circuit on each panel. The operator on the left hand side obtains access to the circuit by throwing the key upwards and the operator on the right hand side by moving it downwards.

The ordinary Directory Enquiry monitor has no outgoing circuits and she passes difficult enquiries, i.e. those involving reference to some other exchange or record point, to the Special Directory monitor by pressing a self-restoring press-key which is associated with each circuit. The special monitor's equipment has two calling lamps per circuit; a white one actuated by the caller and a green one by the press-key referred to above. This monitor takes over an enquiry by operating the speak key on a circuit displaying a green lamp and receives preliminary particulars from the Directory Enquiry monitor who has been handling the initial enquiry. During this time, the subscriber is out of circuit, but comes back automatically when the original Directory Enquiry monitor restores her key to normal.

The Special Directory Enquiry monitor gains access to the telephone network via the manual board by operating a key associated with one of the outgoing circuits. The subscriber is normally in circuit during the subsequent enquiry stages, but the monitor can speak on either side separately if desired, by using a "master splitting key" to cut out the other side.

Where the equipment is used in conjunction with automatic plant, two groups of incoming circuits only are necessary, viz. Auto from level "953" and Manual board. Standard supervisory conditions are provided on both types of circuits, but manual-hold is not given via "953".

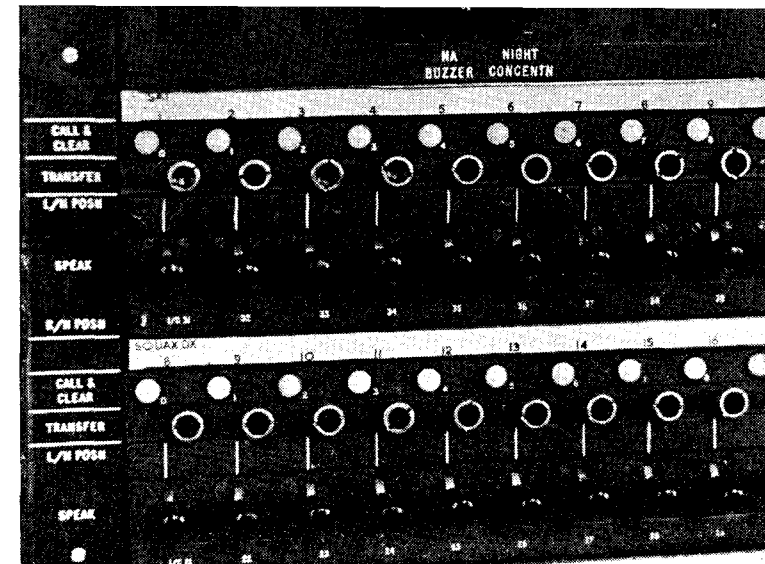It is estimated that the panel and book-

Fig. 3—THE ORDINARY ENQUIRY PANEL.

shelf space is adequate for the requirements of Directory Section Reference Centres covering a group of about 100,000 telephone stations.

The equipment has had an extended trial at Southampton, during which time it has become extremely popular with the staff, who appreciate particularly the sloping bookshelf, free of keys and cords, and the ease with which the heavy directories can be handled.

Fig. 4—THE SPECIAL ENQUIRY PANEL.
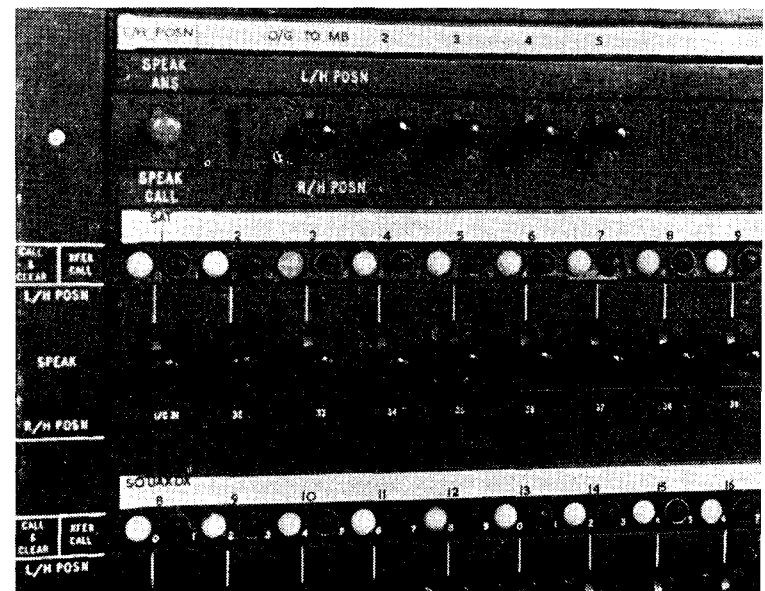
Telephone Call Valuation

by L. T. Andrew, Inland Telecommunications Department

TELEPHONE CALL VALUES NOT ONLY govern the working load of some 48,000 telephone operators employed in over 2,000 manual and automanual telephone exchanges, but are also instrumental in determining the quality of service enjoyed by millions of the community who use the telephone for business or social purposes. The subject is, therefore, one of vital concern, both to the Staff and to the Administration. It is the aim of this article to discuss briefly the broad basis of the call valuation system and then to say a little about the review of values which has been made during the past three years. Telephone call valuation is simply a system of work measurement specially adapted to telephone exchange requirements. If every telephone call involved the same operating effort, then an estimate of the number to be set up in any half-hour, multiplied by the time required to handle each, would give a measure of the work to be done and, therefore, of the staff to be provided. As it is, the wide variety of local, toll and long distance calls handled on telephone switchboards has led to the practice of evaluating each type of call in terms of a common unit. The unit adopted originally was the total time to set up a call between two subscribers on a medium sized Central Battery manual exchange, which came out at the convenient figure of 18 seconds, so that the standard load was defined as 200 such calls in an hour. With the progressive conversion of manual exchanges to automatic working, the early derivation of the 18-second standard has become of little more than academic interest and nowadays it can be regarded solely as a convenient unit of operating time, i.e. as 1/200 of an operator-hour, rather than as relating to a particular class of call or type of exchange.

It has long been recognised that in order to ensure a reasonable time-to-answer on a telephone exchange switchboard handling fluctuating traffic, it is necessary to provide an allowance of time over and above that required for the manipulative operations involved in setting up calls. Thus the total or gross time has come to be regarded as comprising the operational or "directly occupied" time and the non-operational or "indirectly occupied" time.

Directly occupied time is the time spent in setting up and disconnecting telephone calls. It is thus the sum of a series of steps, some of which are inevitably separated either by indirectly occupied time or by directly occupied time spent on other calls. The time to set up a connection is clearly dependent upon the method of signalling on the circuit over which the call is connected and different times will apply for signal junctions, generator signalling circuits and so on. Different times, again, will be required for "number (line) engaged" calls and "no reply" calls. The directly occupied time of any call is thus a weighted average for both effective and ineffective connections.

Indirectly occupied time can be sub-divided into two parts:—

(a) Time spent on miscellaneous tasks and duties associated with telephone operating, but not directly related to the setting up of any particular call. This is indirectly occupied time in the strict sense of the term and examples are:—

    answering the instruction circuit;
    reporting a fault;
    seeking the Supervisor's help or advice;
    personal wants, e.g. blowing one's nose, adjusting one's head set.

(b) Time provided to allow for the waiting between calls, which is essential if a satisfactory service is to be given. There will be periods when subscribers are kept waiting for an answer because all operators are engaged; but how frequently and how long they wait will depend upon the proportion of free operating time allowed.

Two points emerge from these definitions. The first is that the directly occupied time depends on the efficiency of both operator and equipment. The second is that there is no such thing as an absolute call value, all values being related to the quality of service.

The advent of the war inevitably dislocated the smooth working of the previous valuation system and in 1941 a 10 per cent. increase to the basic long distance trunk values was authorised to offset the complication arising out of delay working and priority traffic. With the rapid reversion to normal conditions from 1945 on-wards, however, the time appeared propitious to undertake a long overdue review of the whole call valuation structure. On the toll side, little other than minor adjustments had been done since 1937, while on the long distance trunk side, where a review had been made in 1939, new developments during and after the war years, particularly the extended use of long distance trunk dialling and the more liberal basis of circuit provision, had rendered that study equally out of date. Moreover, considerable progress had been made towards the unification of long and short distance operating techniques. One aim of the study was to produce a more simple structure of up-to-date values sufficiently flexible to meet future developments, such as the introduction of cordless switchboard working, and it was decided to tackle automanual exchanges first.

The Staff Associations co-operated fully by assisting in the selection of the centres to be visited and also by publicising to their members through Staff Journals and local representatives the purpose and nature of the investigations. Observations were taken on operators of average ability, working in conditions just as in day-to-day practice, full account being taken of congested and faulty equipment, difficulties of 2-V.F. working and any other factor liable to inflate operating times. No attempt was made to determine the over-all rate of working of individual operators observed. Thirty-four provincial automanual exchanges were visited during the course of the review, varying in size from Birmingham and Manchester to St. Helens and Darlington. Altogether, well over 50,000 timed observations have been taken by a team of 6 Assistant Supervisors, mostly on operating staff with at least 12 months' experience. Subsequently, attention was turned to London, where over 25,000 observations were taken in local automanual exchanges and in the London Trunk Exchange itself. A small sample of continental demand calls was also obtained.

The standard of operating observed naturally varied considerably. When more time was spent on a call than was strictly justified, this has been accepted as a practical condition, and all the time has been included in the summarised results. The method of observation was for an observer to listen in parallel with an operator, preferably from a spare position, and to time pre-determined steps of the call by means of a stop watch. Before starting observation, the observer would explain the purpose of the timings to the operator on
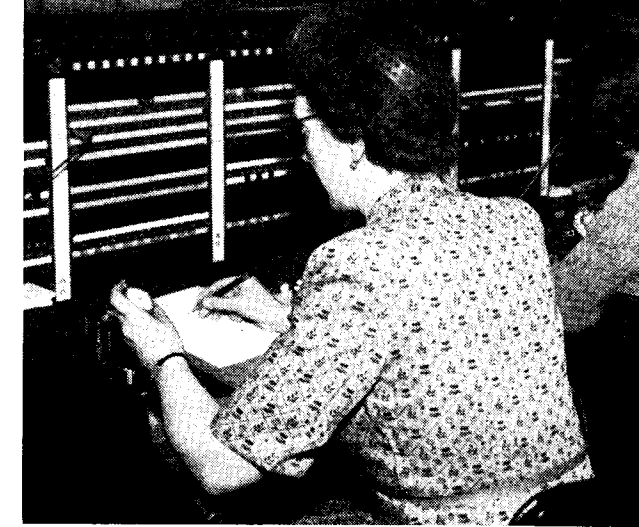
whom she was to observe and emphasise their impersonal nature. This did much to put the staff at their ease. A picture of observations in progress is shown in Figure 1.

Summarisation of the directly occupied time measurements was undertaken by the Headquarters Hollerith punched card unit, a separate card being punched for each observation. This involved a certain amount of intermediate summarisation and numerical coding of items like exchange, class of call, etc. It has been a simple matter to extract from the cards items like the average time-to-plug-in and answer, the time to consult the visible index file, the interval to "time on" and so on for each readily identifiable operating step. The extraction of time values for individual steps in this way should facilitate adjustment of the values to new conditions. The Senior Rolling Total Tabulator, which forms an integral part of the Punched Card Unit, is shown in Figure 2. The cards are sorted by machines of the type illustrated in Figure 3.

Besides a study of directly occupied times, attention has been directed to the sliding scale formula for indirectly occupied and waiting time. The original formula was:—

$$y = 1.75 \, x - 4$$

where y is the total time allowance for the call and x is the operational or directly occupied time. For example, a call on which the directly occupied time amounted to 20 seconds would be given a total time value of $(20 \times 1.75) - 4 = 31$ seconds and an operator would therefore be expected to deal with 116 such calls in an hour. This formula dates back with minor modifications to the

Fig. 2—A statement of results being printed on the tabulator.

Call Valuation Committee of 1923 and was based originally on a study of local calls and straight order-wire calls at C.B. manual exchanges. The use of the relationship for the more intricate manually handled traffic at automanual boards, however, was not entirely satisfactory and as early as 1934 it became necessary to make some adjustment, the effect being to increase slightly the indirectly occupied time and waiting time component on the more difficult calls, the new relationship becoming $y = 1.75 x - 3$, which has remained in use up to the present time.

The factors governing the relationship between the directly and indirectly occupied time are:—

(a) The average operator holding time, i.e. the interval during which, on the average, an operator, having started an operation, is held engaged before she becomes free again to answer a fresh calling signal;

(b) The percentage of waiting time and thence the operator-occupancy;

(c) The number of operators who can answer any calling signal, i.e. the operator-availability;

(d) The quality of service and, in particular, the time-to-answer on the switchboard;

(e) The human factor and the environment in which the operators work.

At any one exchange, the fifth factor is reasonably constant. By confining attention initially to the day-to-day operation of a single exchange or a group of exchanges with similar characteristics, the relationship between waiting time and time-to-answer can be studied in the various conditions encountered. Subsequently, by extending the research to a number of exchanges of different size and type, the modification to the basic relationship to take account of human and environmental factors can be determined.

Of the factors to be measured, the number of operators who can answer any calling signal is obtainable by counting. An absolute measure of waiting time would involve simultaneous observation of every operator, which is clearly impracticable. Recourse was made, therefore, to sampling. Two or three operators were observed in each sample (Fig. 4) for periods of 15 to 20 minutes and each second of their time identified as either directly occupied, indirectly occupied, or waiting time. By arranging the form in which these records were maintained, information was obtained at the same time about operator-holding times. In order to furnish a check on the individual waiting time measurement, independent counts of the number of free operators were made each minute over two supervisors' sections. Finally, the time-to-answer was measured as in service observations, a sample of between 40 and 50 timings being obtained in each observation period.

Attempts to reconcile the practical observations with mathematical theories in other fields were only partially successful; evaluation of the observations has been difficult because of the varying conditions under which they were obtained, and it may be found in the light of further experience that a new approach may be required. Nevertheless, a considerable advance on the original system has been made. In the new scheme, the waiting time component at any exchange can be determined more specifically than hitherto by the practical conditions at the exchange. With the empirical $y = 1.75 x - 3$ formula, the proportion of indirectly occupied time varies from 27% to 42% on different types of calls, but irrespective of where any particular call is set up—whether at a small manual exchange or at one of the biggest automanual centres—the indirectly occupied time or waiting time

remains a fixed proportion of the directly occupied time. With the new arrangement, it is possible to apply varying proportions of waiting time on similar calls dependent on the characteristics of the traffic in the exchange where they are handled.

To obtain average call values at an exchange, an analysis of traffic will still be required, as at present. The number of categories into which the long distance calls will be analysed is, however, greater than formerly, while the number of toll categories and of separate allowances to be added is less, the overall object being to simplify the exchange work. When the analysis has been taken, the proportions of calls of each type will be valued according to the standard directly occupied time allowances for the particular kinds of calls. An average figure, still in terms of directly occupied time, can then be calculated either for the exchange as a whole or for each of various classes of traffic. To these averages an appropriate factor can then be applied to arrive at the final call value including the allowances for indirectly occupied and waiting time, which is used for staffing purposes.

The test of the new valuation system is a matter for the future and adjustments may need to be made in the light of practical experience. Throughout, the keynote has been to devise a flexible structure, so that partial revisions may be carried out expeditiously as conditions change or new developments arise, without having recourse to a complete call valuation review.

Fig. 3—The sorting machine.

Fig. 4—Observations being taken to ascertain occupied and waiting times.
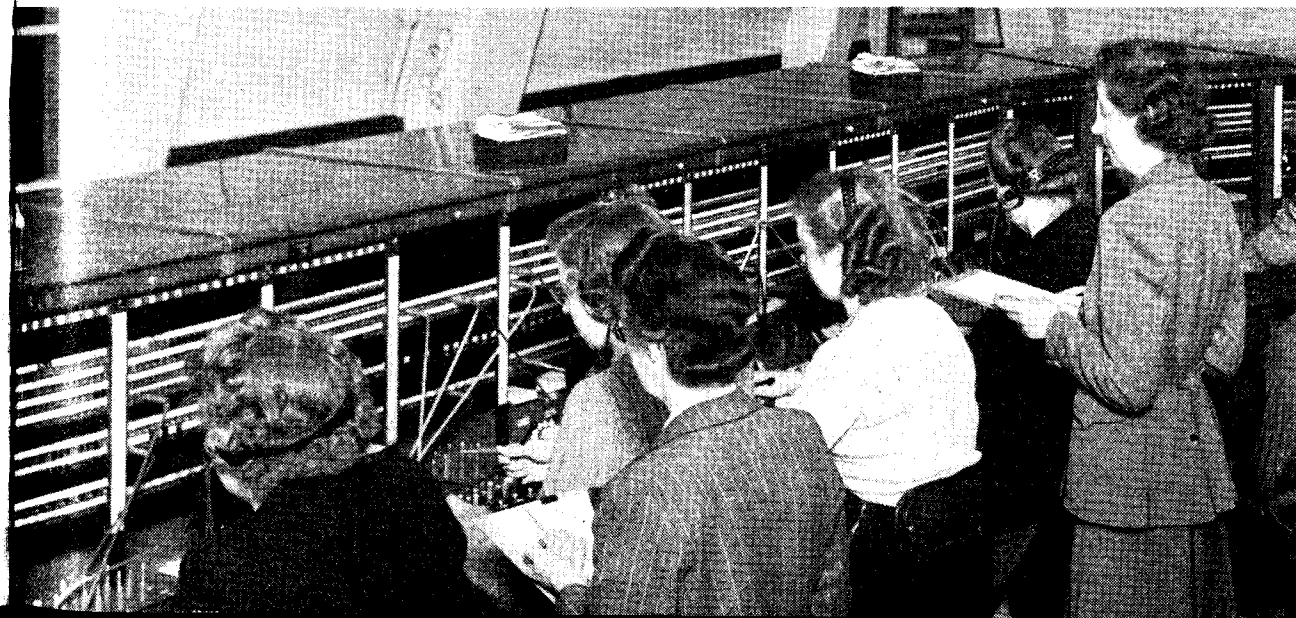
BRISTOL TELEPHONE AREA

The Bristol Telephone Manager's Area includes the City and County of Bristol, together with portions of Gloucester, Somerset and Wilts, covering an area of 1,343 square miles. The industrial parts of the Area are mainly situated around Bristol and Bath. In contrast, the agricultural districts embrace such beauty spots as Cheddar, famous for its gorge and caves, the City of Wells, noted for its Cathedral and astronomical clock, and the Mendip Hills. To the South West of the Area are the well-known holiday resorts of Weston-super-Mare and Clevedon.
Bristol, of 450,000 population, plays an important part in the maritime life of the West Country. It is a city of mixed industrial and commercial activities, including Tobacco, Aircraft, Chocolate, Paint, Boots and Shoes, Printing and general light engineering. From here John Cabot sailed in 1497 on his voyage which culminated in the discovery of Newfoundland.
Bath, the second largest city in the Area, is renowned for its Roman Baths and its Georgian architecture. The 124 exchanges, of which 93 are automatic, serve over 66,000 exchange lines and 110,000 stations. The total staff, including 1,350 in the engineering grades, numbers about 1,700. The supervising and operating staff in the Area approaches 950.

CAMBRIDGE TELEPHONE AREA

To most people Cambridge means the town of the old University and the celebrated "Backs" through which flows serenely the river Cam. The Cambridge Telephone Area, however, is much more extensive, reaching from the northern boundary of London to the Wash, and covers an area of 2,500 square miles. In the south there are some light industries, but the central and northern parts mainly comprise large tracts of agricultural country. Barley, sugar beet and market garden produce are grown extensively. The extreme north of the Area includes the forests of Norfolk and Sandringham.
Telephonically, the Area is highly automatised; 151 of the 169 exchanges are automatic and the conversion of three more manual exchanges is already in hand. There are 36,192 exchange lines, 61,943 exchange stations and 1,149 private stations.
The total staff, excluding the exchange operating force, numbers 864.

The Telephone Manager

by W. J. Bentlett,
Telephone Manager, Glasgow

THE JOB OF A TELEPHONE MANAGER COVERS a very wide range, and it is quite impossible to deal with every aspect of it within the compass of a short article. There are fifty-six Telephone Managers and I have no doubt that they would write fifty-six quite different articles about their jobs, according to the type of Area of which they are in charge and the importance which the various problems assume in those Areas. If one is to write something more interesting than a list of duties, one tends inevitably to concentrate on those facets of the work which strike one as most important, and, in doing so, one may seem to do less than justice to others; but I am sure that readers of the Journal will appreciate that the approach to an article of this kind must inevitably be a very personal one, as must be the opinions expressed.

The Glasgow Area

Glasgow is an extremely compact area of some 15 miles radius. The city itself is slowly being converted to Director working, and the remainder of the area has a mixture of CB, CBS2 and all types of U.A.X's. There is one 360-position joint Manual Board and Trunk exchange, which is also a Group and Zone Centre.

The Telephone Area contains the area of the Head Postmaster of Glasgow, in which the Telephone Manager functions as a Head Postmaster in regard to operating staff, and Paisley, in which the Head Postmaster is in charge of the operating staff and acts as the Telephone Manager's agent on service matters. One of the two Chief Traffic Superintendents is responsible for service and day-to-day staff problems; the other controls the equipment programme and provision of staff. Emphasis must be placed on the magnitude of the promotion and discipline work arising from the control of the very large operating staff in a city such as Glasgow.

The duties of the four Area Engineers are split on a functional basis:—
(a) Internal and External Planning and Development and Radio Interference;
(b) Exchange Construction, Subscribers' Apparatus Installation, Teleprinters, Workshop and Electric Light and Power;
(c) External Construction and Underground Maintenance;
(d) Exchange, Subscribers' Apparatus and Overhead Maintenance.

There is no very rigid division of responsibility between the Telephone Manager and Deputy Telephone Manager. The practice in this respect varies in different areas where there are Deputy Telephone Managers, but at Glasgow we prefer that the one should act as a deputy of the other over the whole field. Subject to this, the Telephone Manager looks after overall planning and the bulk of the day-to-day work, whilst the Deputy takes Engineering staff and accommodation problems, otherwise being left as free as possible for investigation into facets of the work that seem to need special attention.

Co-ordinating problems arise in the Area because the staff is split between four widely separate buildings. Although care has been taken to keep related groups together, this has not been possible in every case. Sales Development, Engineering Planning and Development, Traffic Equipment and the Budgetary Control Group are in one building, but the Sales General Office and Installation Control Group are separated. The Works Control and associated Clerical Groups, unfortunately, are housed nearly three miles away from the Headquarters of the Works Inspectors.

Policy—Staff—Public

The Telephone Manager is the main executive link between Headquarters and the public, and

in the nature of things much has to be left to his discretion. Personal contact with the public is through the fitter, the maintenance man, the Travelling Supervisor, the Sales Representative and the Clerical Officer dealing with counter enquiries and these are the people who must understand and explain in reasonable terms practices which frequently seem to the Public to arise from restrictive bureaucracy. There is, and must be, a regular demand on the Telephone Manager to see the most awkward and persistent complainants. The larger the Area, the greater the magnitude of this demand and the greater the need for discreet screening and protection if there is to be time for other work. Nevertheless, this screening must not be overdone, as it is essential that the Telephone Manager be available always to stand as the final spokesman of the Area staff in their dealings with the public.

Daily Work

It is difficult to separate the average day's work into rigid sections, but broadly it can be split into incidental paper work, check of work performance and quality of service, planning and visiting. Whatever idea one starts with, one soon realises that it is quite impossible to read all instructions and examine in detail every paper signed and still leave time to do anything else.

It follows that the time spent on paper work must be reduced to a minimum, and with experience one comes to judge instinctively which cases demand close personal attention and which can be disposed of quickly by following, without too close a scrutiny, the line of action recommended by one's staff.

Personal Records

I have found that the best way to avoid overloading with incidental paper work is by keeping personal records and adopting a sampling approach to all matters. An elaborate statistical measure of almost all aspects of the work exists and from this can be extracted information which is the minimum necessary for general control. Numerous examples will come to mind. A good idea of the maintenance service is obtained by graphing on one sheet faults per telephone per annum, service observation plant failures and carried-over faults. If to these are added manhours per maintenance work unit, the need for some special attention can frequently be spotted before anything serious results. Speed of answer

plotted against the ratio of employed to justified staff gives a quick picture of the operating position in an exchange. The number of trunk and local tickets handled by the Accounts Sections, together with correspondence and number of trunk detail enquiries, gives a good measure of the growth of work for the groups concerned, whilst total revenue compared with write-offs shows any tendency to shortage of money which may lead to a change in the rate of cessations or need for attention to outstanding accounts. In each of these instances, much more information is available, but a return which comes regularly for scrutiny and signature is apt to arrive at a rush moment and to be signed without close examination. If a record of carefully selected items is personally maintained, at least these items will be noted and be available for study in more leisured moments. The continuity of the method over the years helps to show tendencies, and in all routine work one must be on the lookout for indications of failure or change. As an example, although percentage wrong numbers from service observations at manual exchanges had been quite satisfactory, the similarity of a number of written complaints (each in itself not serious) seemed to point to some increase in the frequency of wrong numbers. From the examples quoted in the letters, it seemed likely that keysender routes were giving trouble. No analysis is made regularly of this particular type of traffic, and a cursory examination of the observation results did not suggest that anything was wrong, though the proportion of keysender calls included in the total sample was admittedly small. A one-day record of calls from a large exchange proved that whereas the overall proportion of wrong number calls was 4%, the percentage for keysender calls was 18%. To complete the story, special maintenance and supervision improved the service slightly, but the biggest improvement resulted from prefixing the number by the exchange name, since, although this was unnecessary for routing, it was found on analysis that a large number of mistakes was occurring owing to the first digit being wrongly heard. The lesson is that while it is not possible to examine everything all the time, one must be always alert for indications which show where more critical examination is necessary.

Co-ordination

Satisfactory links of organisation throughout the
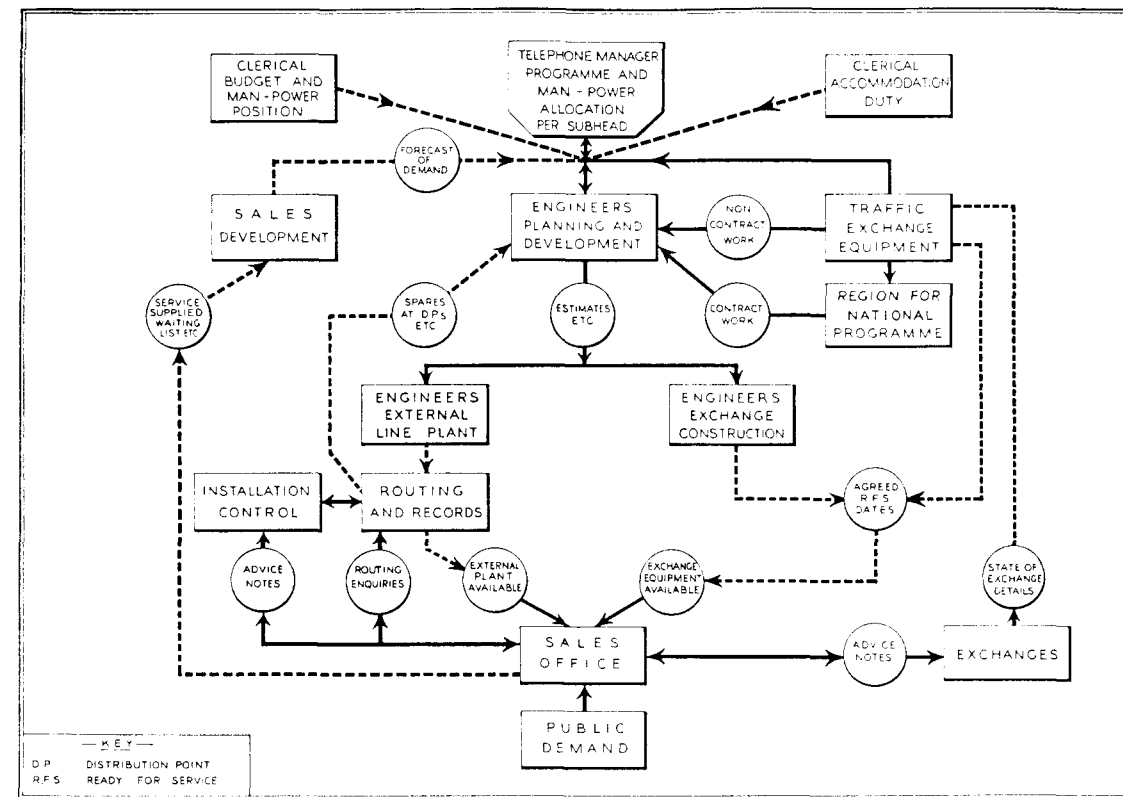
THE FLOW OF WORK IN A TELEPHONE MANAGER'S OFFICE

office are most important and must be watched by the T.M. Any examination will show that whereas the vertical links of our organisation are extremely good, the lateral links need constant attention. Team work between Divisions must be encouraged and inter-office correspondence kept to an absolute minimum. The H.C.O. on the Stores duty should take his Clerical staff to visit Section Stock; Sales Staff should meet the staff of Installation Control; it helps, even, for Clerical Officers on Accounts duties to see the metering arrangements in an automatic exchange. The Area in which all the Heads of Divisions and most of the staff are housed in one building is at an advantage in establishing mutual understanding and co-operation.

The larger the Area, the greater the problem. As a first step in its solution, a meeting of the Heads of all Divisions is held weekly, at which the emphasis is on raising problems that affect more than one Division. New instructions particularly

are watched, as it is possible for one section of the staff to comply with an instruction from their own point of view and yet cut across the needs of some other section.

As there is a frequent need for a break-up of Headquarters Instructions for issue to sections of the staff locally, whenever possible the people who are actually doing the work at the various levels are brought together to agree the terms of these local instructions. At the present time, with the difficulties of handling the mass of work on the Waiting List and the need for great accuracy in the local line plant records, co-operation between the various Divisions is vital and each must appreciate the other's need. The flow of work that can be issued by the Sales staff each month is not smooth, nor is the amount of work that can be undertaken by the Installation staff, as this is entirely governed by the number of men available month by month. By mutual co-operation, it is possible to avoid having a mass of

Advice Notes outstanding for a long time, giving rise to a considerable amount of irksome correspondence from irate would-be subscribers, and, at the other extreme, having such a small pool of Advice Notes that ineffective and travelling time of fitters becomes excessive. The control will not work smoothly unless all concerned appreciate the problem. Encouragement is given for every section of the staff to ask for a talk by a representative of any other section. Extremely valuable work has been done this way, particularly with the Sales staff.

Direction of Effort

As the formation and completion of the year's programme is all-important today, it is perhaps the best example of the need for accurate records and for general co-ordination. This applies particularly to the problem of establishing the relative importance of the installation of telephones against the provision of internal and external plant. The diagram accompanying this article shows the main lines of flow of information or work, and although these are fairly obvious, it can be seen that at the top there is considerable need to knit together all sections concerned. From the public demand coming into the Sales office, together with field surveys, a forecast of anticipated growth is made. A total for the whole exchange only is needed for the equipment programme (unless there are to be area correction transfers), but it must be split into growth in small groups of houses, offices etc., for planning external cables. With this information and details of the utilisation of existing local line plant, the needs for meeting growth can be programmed. Similarly, the exchanges provide a monthly statement of spare equipment available to the Traffic equipment staff, who, from this and the forecast of growth, are able to prepare a programme of exchange extensions or new exchanges required. Combined, this would be an ideal plan, ensuring external cables and exchange equipment being available at all times.

The limitation of expenditure and the ceiling on manpower make the whole problem much more complex. First, sufficient men must be allocated for maintenance, provision of trunk and junction needs and all other basic services. The remainder can then be used either to bring spare plant into service by installing telephones, or to provide additional plant. To strike a happy balance, it is essential to establish accurate records of man-power expended on the various classes of work, together with regular statements on the spare internal and external plant. The Budgetary Control duty, particularly, must be fully aware of the needs for supplying information in a suitable form. It is difficult to work in terms of either man-hours or money, owing to the magnitude of the figures, and in any case "bodies available" is the main criterion. All considerations are based on the establishment of the average working week and turning the forecasts or expenditure under each class of work into men working such a week, month or year.

From records of what has been done in previous years and the existing state of the plant, it can be decided whether or not more plant should be provided than is to be brought into use, and the men allocated accordingly. The amount of exchange equipment likely to become available from the national programme of contract work is examined and the best external relief programme formulated. It is certain that this must be a compromise, as the total needs will be beyond the limits of the money or men available. The waiting list of business applicants, together with the probable equipment programme, may give an obvious choice, but the choice can be extremely difficult. The percentage of cable distribution points (D.P.'s) where the spares are exhausted or are approaching exhaustion gives a useful measure, but it does not differentiate between business and residential needs. Similarly, size of waiting list cannot be the only criterion, without being considered cable area by cable area. The procedure we have adopted in the Glasgow Area is to arrange exchanges at which there is or will be exchange equipment in order of an index obtained by adding percentage of exhausted or nearly exhausted D.P.'s to percentage waiters over working lines, plus ten times the percentage of business waiters over working lines. This gives a selection for a rough comparison to be made of the cost per added pair, leading to a final choice of the most economic programme within the limits of expenditure and manpower.

Obviously the clerical groups on Payslips, Estimates, Contracts, Budgetary Control etc., together with the Sales staff on Forecasts and maintaining the waiting list, must be made aware of the use made of their work, if they are to prepare it in the most suitable form, and similarly the Budgetary Control duty must be kept up to date with all changes in works or programmes, if they are to assess the likelihood of keeping within the limits of the estimates or, more unlikely, adding to the programme.

The present time is one of radical change in this Area. Almost all demands for service where plant was available had been met by December, 1950, and the external plant position has steadily improved. The spare automatic exchange equipment position has worsened, however, owing to the incidence of the Contractors' programme. Now several extensions and new exchanges are in course of installation, and with a pegged staff and the need to find men for this equipment programme, followed by the increase in maintenance force, it becomes necessary to reduce installation work to a much lower level. Moreover, the auto-conversions make a demand on the external staff for transfer arrangements, thus reducing the amount that can be spent on the provision of additional local line plant. This will reflect on the work of the Sales Division, as it seems certain that the Waiting List, after being reduced by 25% in the past two years, is likely to increase by 50% in the next two years. The maintenance of accurate records of "Waiting Labour" cases will govern whether or not the time spent now on surveys and records is lost when orders can be accepted.

Many basic problems arise in this work. For example, do we get the best geographical distribution of our forecast growth by applying an average factor to groups of houses without taking into account in all cases the existing telephone density of the particular groups? Do we spend too much time on surveying and recording applications which cannot be completed for many months, or do we over-sacrifice economy for good ethics by keeping rigidly to date order of application? Should we not get better planning if we had fewer grades brought together under one control, instead of having no common control lower than the Telephone Manager? Obviously it is not possible to examine these questions in this short article.

Personal Relationships

Despite all efforts, it is not possible to get to know the staff in a large Area as well as one could wish, and it is therefore important that there should be accuracy and consistency throughout all staff records and appraisements. This is not easy to achieve, and where more than one executive is concerned in appraising members of the same grade, it is the practice in the Glasgow Area to arrange a meeting to ensure that as far as possible a uniform standard is adopted in making the reports and in particular in assessing the qualifications of those people who are regarded as justifying a recommendation for promotion. Obviously second thoughts are sometimes necessary, and because of the numbers and wide range of rank of reporting officers, Acting List and Promotion reports for the operating staff can be particularly difficult.

There has been a considerable change of outlook on staff relationships, and this is all to the good. Joint Production Committees may not produce very radical departures of practice, but apart from the value of the suggestions on the Agenda, they are a useful means of obtaining the opinions of the staff. In a Class I Area, the Telephone Manager is a member of the Head Postmaster's Whitley Committee and Joint Production Committee, and these meetings have tended to bring home to the members of the Committee from all sides of the house the different points of view of the various sections of the staff.

Relationships with sports and similar associations present a certain amount of difficulty in trying to steer a course between being an omnipotent Chairman of a Committee for which one does nothing and being the leader or originator of some particular activity—a certain way to produce jealousies and accusations of favouritism. A helpful attitude is the keynote in these relationships, coupled with being available to any member of the staff—whether Union representative, ardent worker for the Benevolent Society or simply one who is over-worried by irksome subscribers—without short-circuiting the immediate superior.

Particular attention is paid to new entrants, as it is felt that they come as strangers to a very large organisation and may feel lost without some guidance. Efforts are made to give them full information of all social activities and any facilities available for them; they are also given talks on the overall organisation of the Post Office and the part played by the various sections in which they may work.

In the smaller towns, if the Telephone Manager is a member of the local Rotary Club and a regular attender at the meetings of the Chamber of Commerce, local contacts with the townspeople are fairly easy to establish. In fact, the demands from the town's social and welfare activities may

become overwhelming. In the large city this is more difficult, but it is an important side of the job. The Press are usually keen enough to get personal opinions, with the help of which they put over a good deal of useful publicity.

In all relationships with the public, the Telephone Manager has to be careful to avoid giving the impression that his job is simply to carry out instructions dictated by a remote Headquarters. He should always endeavour to understand fully and then to identify himself with the general policy of the Post Office.

Conclusions

Much remains unmentioned: the Telephone Manager's relationship with Regional Head-quarters and with Head Postmasters; the problem of redeployment of Engineering Staff, which may become more difficult with alterations to the periods of military service; the comparison between efficiency and fairness in arranging rotation of duties for clerical staff, or the problem of boredom in the work of the Fees Group and its effect on accuracy; P.M.G. cases; interviews with waiting applicants, from the man who wants priority because "They are ill next door and can't afford a telephone" to the woman who persuades older waiters in the neighbourhood to give up their turn to her; and so on. Of the work of a Telephone Manager it might truthfully be said that time does not wither nor custom stale its infinite variety.

Anglo-Continental Telephone Service

The first telephone calls between the United Kingdom and the continent of Europe were made sixty years ago by representatives of Reuters Telegraph Company in London and of Agence Havas in Paris. On the following day, the service was opened to the public. It proved very popular. New cables were laid and service was opened with Belgium in 1903 and Switzerland (via Paris) in 1913. At the outbreak of the first world war, there were only 14 circuits in use—nine to Paris and five to Brussels. From 1914 to 1919, the public service was suspended.

London was linked with the Netherlands in 1923, and by 1926 the circuits to the continent totalled 32. 1926 marked the commencement of a period of rapid growth and the establishment of London as an international telephone centre. Research work in cable design had produced cables of new types, able to carry more circuits of better quality, and in the next five years, services with 15 additional countries were opened, so that by 1931 there were 106 circuits in use to 18 different countries. Traffic, too, increased from about 40 calls per day in 1891 to 500 in 1921 and 3,000 in 1931.

At the outbreak of the second world war, there were 184 circuits in use, handling 5,000 calls a day. On August 31st, 1939, all public services were suspended. It was not until late in 1945 that service with Belgium, France and Switzerland was reopened.

The post-war years have seen an even greater growth than that experienced in the late 1900's and 1930's. Coaxial cables with submerged repeaters have been developed and operating methods are being improved. There are now over 300 circuits to 45 European towns, serving every country except Albania. Every day nearly 10,000 calls are exchanged between the United Kingdom and Europe.
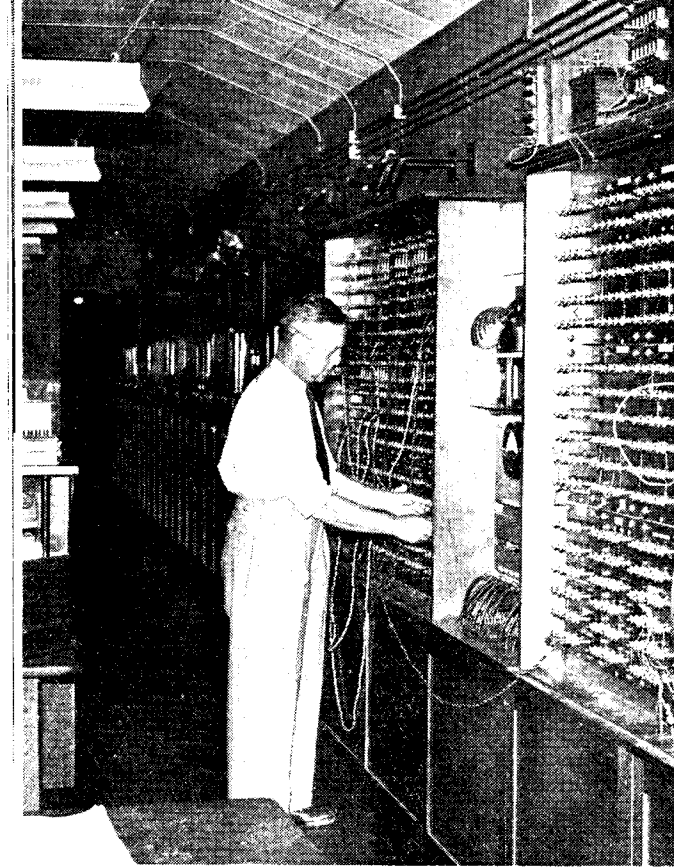
Porthcurno

by J. H. Ricketts,

Public Relations Department

MANY OF THE LARGER CITIES OF THE WORLD provide the observer with ample opportunities of tracing the clear connection between earlier civilisation and present-day achievements, but in the smaller hamlets and villages of this island it is not so easy always to draw a clear parallel between past and present. At Porthcurno, however, on the rocky Cornish coast between Penzance and Land's End, such continuity exists; that this continuity is emphasised by a degree of contrast makes it none the less real. To this spot, over 2,000 years ago, came the Phoenicians, some of the first people from the outside world to trade with these islands. They brought merchandise which, being unobtainable here, was bartered for such things as the tin in which that part of Britain was rich.

Now, from the station of Cable and Wireless, Ltd., in this same cove, go out thirteen cables which, with their extensions, encircle the globe and carry messages relating to Britain's trade over routes which cover more than 150,000 nautical miles. The parallel between past and present can be extended further to cover not merely trade but also the wider aspects of civilisation. On the cliffs above this beach, in the fifth century, lived St. Selevan, a simple and pious Celtic hermit, who devoted his life to the self-chosen task of bringing peace and learning to the wild inhabitants. Now from the Training School of the Company, built within sight of the saint's cell, young men go out every year to all parts of the earth, to places some of them almost as primitive as the Cornwall which he knew, whose job, it could be said with

At work in the station.

justice, is not only to man the stations on the Company's cable routes, but also by their example to take civilisation to these remote places.

The present importance of Porthcurno—PK to cablemen all over the world—can be dated with accuracy to 1870, since in that year was landed the shore end of a cable which ran to Carcavelos in Portugal and which was operated by the Falmouth, Gibraltar and Malta Telegraph Company. In 1872 and the following year, this Company amalgamated with others and became the Eastern Telegraph Company and from that date the cove became the site of the Company's cable station and also of its training school for operators and cable technicians. This parallel development continued until 1919, when the school was transferred to London. As mentioned later in this article, the joint function of Porthcurno has now been restored, the Training School having been re-opened in 1950.

During the eighty years of the station's existence, the whole technique of cable operating has naturally undergone drastic changes as a result of technical development and scientific progress generally. Many of these developments have been evolved by men whose earliest technical training was received there and it is therefore only fitting that the station in its present form should contain, as it does, the most up-to-date equipment both for the transmission of messages and for the location of the faults which develop from time to time in the submarine cables themselves. The earliest form of operating was completely manual, and it was therefore essential that messages should be received, written down and re-transmitted at each station on any cable route. Porthcurno, under these conditions, was therefore the first or last relaying station between the Central Telegraph Station in London and the most distant overseas station. In the earliest days of the system, reception of a message required the services of two operators, although an innovation brought in in 1878, at the suggestion of one of the operators, made it possible for this number to be reduced to one.

Later developments can be divided briefly into three main parts:—

The introduction of automatic working;
The development of the direct printer;
The evolution of the chain system and of regenerator working.

It is not the intention to discuss the technical aspects of these developments here, but it will be apparent that the first two brought about an immense increase in the speed of working by the abolition of manual Morse operating and manual reception. Probably the greatest impetus however to the system was given by the third. By linking the different cables into chains and installing at each intermediate station apparatus which took the mean of the signal and not only boosted it to the power of the original transmission but also restored it to the original degree of clarity, it becomes possible to transmit messages between any two stations on the system, regardless of distance, without intermediate reception and re-transmission.
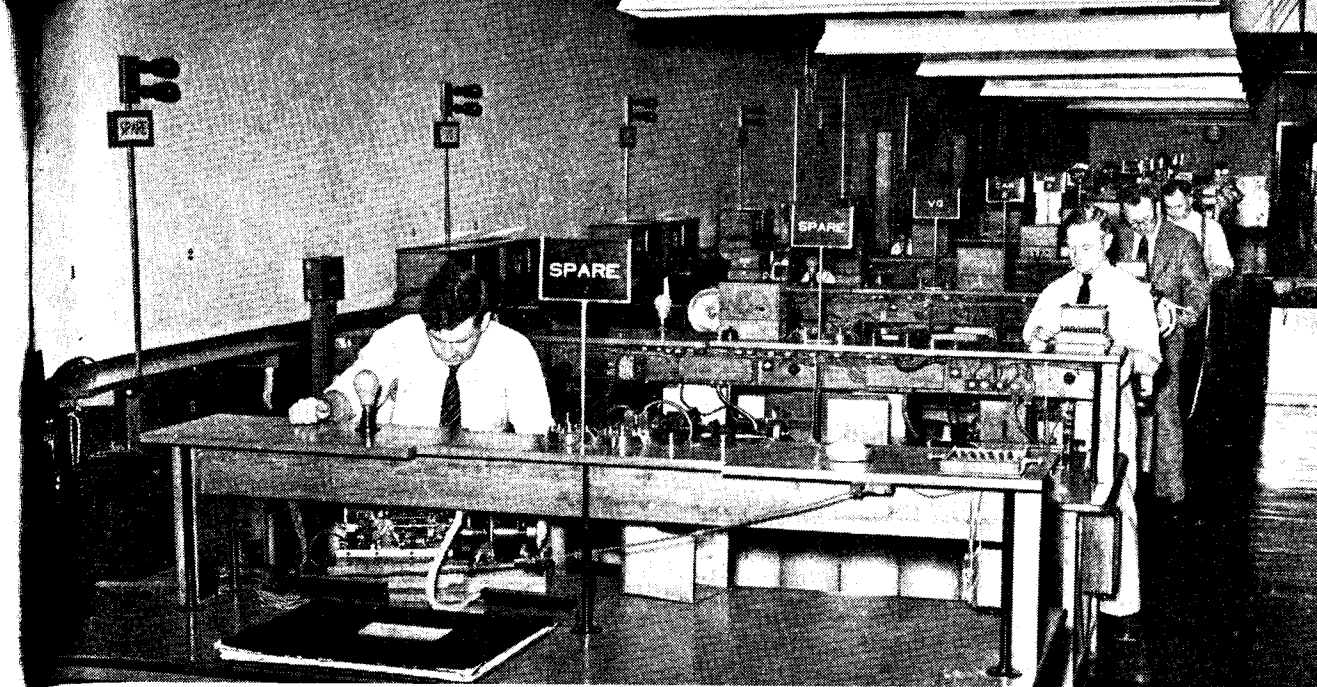
(Above)—A general view of the instrument room.
(Below)—Training School instrument room.
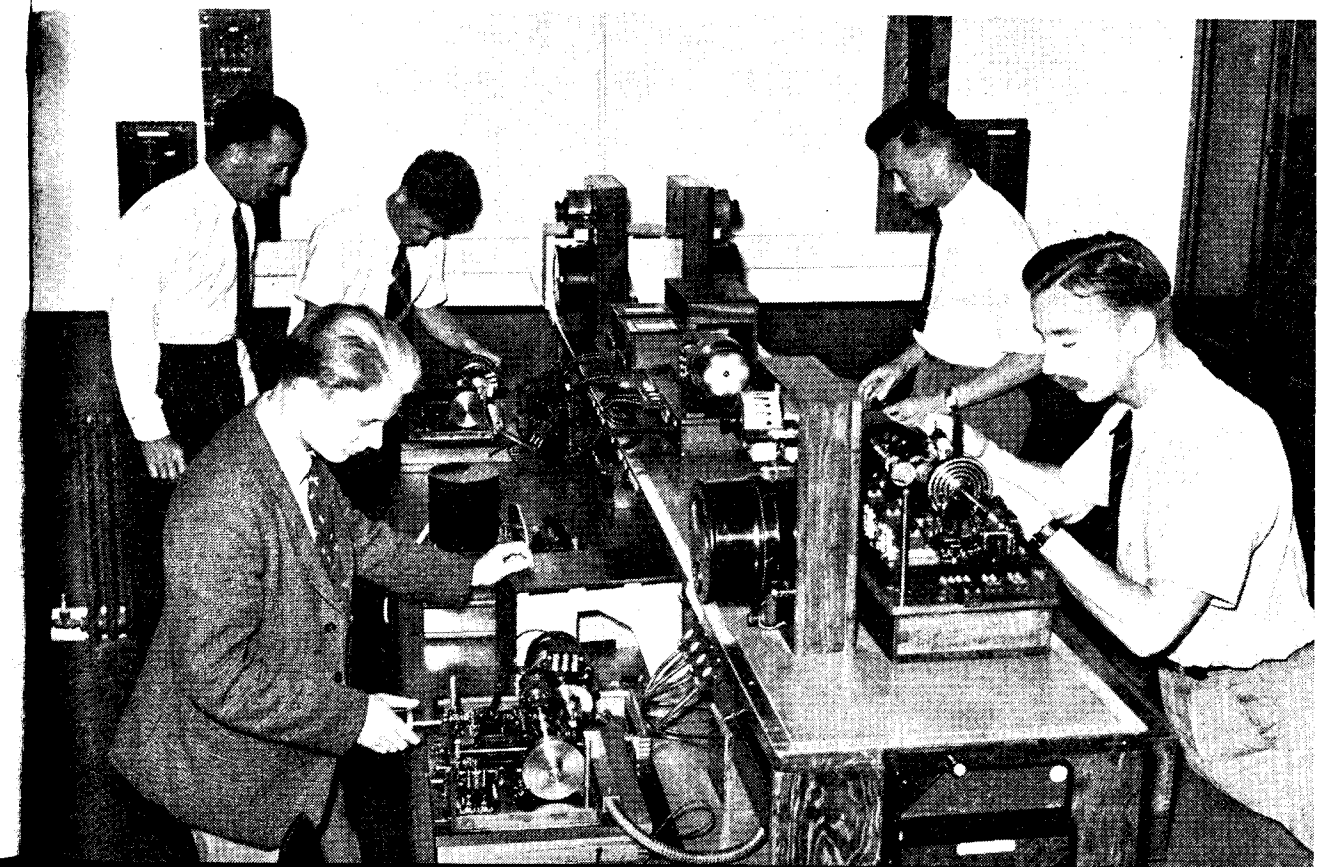
When war broke out in 1939, it was obvious that the cable system with its speed, its secrecy and its relative freedom from interference was to play an ever-increasing part in communications. Very special measures of protection were therefore called for. A plan was evolved, magnificent in the simplicity of its conception, but involving an immense amount of planning and of labour. On the details of this plan and the special problems which it brought in its train this is not the place to enlarge; one may record however that, as the direct result of it, vital communications were kept going without interruption and when the station reverted to the normal social and commercial traffic of a peacetime world, it was with the happy consciousness that the immense load and grave responsibility it had been asked to carry had been faithfully borne.

It would be wrong to write of the cable station at Porthcurno without making reference to the other function of this lonely but very busy little spot. In addition to the operational aspect, there is also the very important question of training those people who at remote spots on the globe operate and maintain the circuits which terminate here. The major part of this is also done locally. Before 1912, the whole training course was carried out at Porthcurno, but thereafter it was transferred to London. In 1950, the old order was renewed, when Sir Stanley Angwin said:

"I now declare open the Cable and Wireless Engineering School at Porthcurno in my home county of Cornwall . . ."

The difference between 1912 and 1950 rests on the one word "engineering". Whereas in earlier days the whole course was covered in the one school, there is now a division. Students on entering spend the first half of their eighteen months' course in London: this time is devoted to the elementary training in operating and electricity and magnetism. Whilst there they study during the day but live the normal life of any London citizen in their spare time. After the completion of this part of the course, however, students go to Porthcurno and there two changes occur, designed to fit them for their chosen career. The emphasis changes from electricity and magnetism as an academic subject to the very practical problems of cable testing, of balancing and perhaps most important of all of the intricacies of that most essential of all features of modern cable working—regenerator working. This change of emphasis is certainly important, since the real

requirement for a cable man these days has changed from operating to electrical engineering. The other change however which occurs at Porthcurno is equally important and that is a much more personal one, since it is a change of outlook and of habits of life. Cablemen overseas live, owing to the requirements of the service, in isolated communities, some very small, and the development of a tolerant communal habit of mind is essential to the efficient and happy working of any station. The school building, which has grown out of houses which were already a part of Porthcurno before the station started, has been completely modernised and extended to provide very well equipped accommodation for 40 students. During their nine months' stay at Porthcurno, students live either in single or double rooms which are pleasantly furnished. They have, in addition to a mess which is bright and attractive, accommodation in which indoor games may be played and a lounge in which they can entertain their relatives and visitors. Another attraction is a small but excellently equipped theatre in which theatrical shows and films are given. This side of the school is run very much on the lines of an Army mess and by inference rather than by direct instruction trains the young student in the kind of life he will lead overseas. Mess matters such as accommodation and entertainment are in the hands of an evenly balanced committee, partly of the permanent staff and partly of members elected by the students, and the result is an extremely good one. Since sport plays a large part in the spare-time activities of the overseas staff, due emphasis is given to this and it is the aim of the whole course to achieve two objects—to produce men who are technically capable of doing all those things which the service demands and who are personally equipped fully to represent the traditions of this country and of the Company. At least from the outsider's point of view, it is safe to say that the school achieves both these objects with an extremely high degree of success.

There is a very satisfying sense of completeness about this little colony. Not only is it the focal point of a world-wide network of cable routes, but there, also, are trained all those men who in many and varied foreign stations keep the service going. As a result of this dual function, it can be fairly described as the heart of the whole complex system.

NOTES AND NEWS
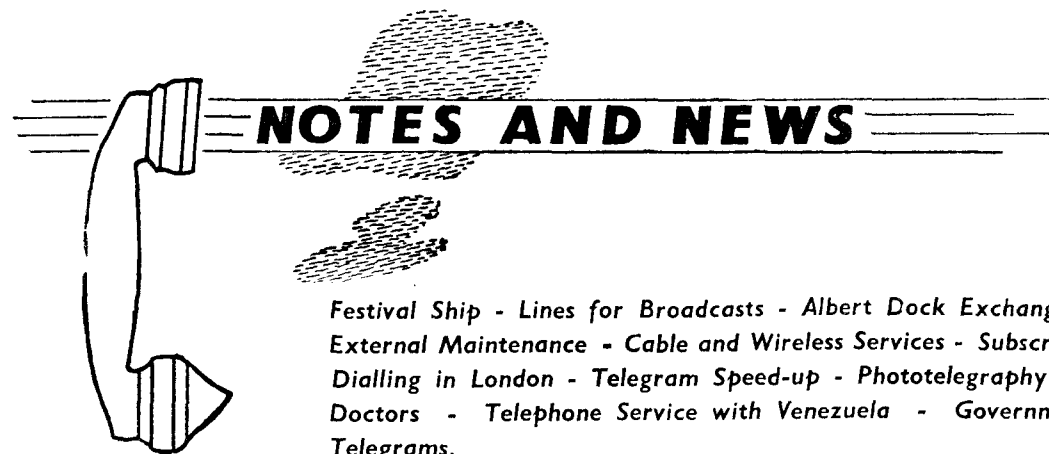
Festival Ship - Lines for Broadcasts - Albert Dock Exchange - External Maintenance - Cable and Wireless Services - Subscriber Dialling in London - Telegram Speed-up - Phototelegraphy for Doctors - Telephone Service with Venezuela - Government Telegrams.

Festival Ship "Campania".—The Postmaster General was asked to select five female telephonists and a supervisor to operate a telephone switchboard and public address equipment on the Festival Ship "Campania" during its voyage around the shores of the United Kingdom from 24th April to 29th September, 1951.

The telephonists were selected in such a way that the complement is as nearly as possible representative of the staff of the United Kingdom. The final selection from the applicants was made at Headquarters. The telephonists for interview at Headquarters were chosen by lottery from suitable applicants.

The installation consists of a single-position Private Branch Exchange with 43 extensions and a public address system which is used for making announcements. Both installations require to be staffed from 8.30 a.m. to 10.30 p.m. when the "Campania" is in port.

The "Campania", which contains an Exhibition, is voyaging round the coast, calling at Southampton — Dundee — Newcastle — Hull — Plymouth — Bristol — Cardiff — Belfast — Birkenhead — Glasgow, staying in each port for periods averaging 12 days, as part of the Festival of Britain.

★　★　★

Telephone Lines for Broadcasting.—The Post Office provided 371 circuits for outside broadcasts of the B.B.C. during January, 1951, as compared with 347 for January, 1950.

Telephone circuits suitable for broadcasting have special characteristics required for "high fidelity"

transmission, and in addition an ordinary telephone circuit is provided for control purposes.

★　★　★

Albert Dock Telephone Exchange.—The Albert Dock telephone exchange in London, which serves the busy "Royal" group of docks, Albert, Victoria and King George V, forms a link with the telecommunications network for many of the ships berthed in the docks.

Telephone service for ships in dock—a facility which is of course available in all large ports—is provided by two means. At a number of berths, permanent exchange lines are terminated in boxes with sockets at the quayside, and an equivalent number of portable instruments, with long, flexible plug-in cables and sets of London telephone directories, are housed in cabinets. These cabinets are held by the Dock Superintendent, who issues them, on application, to the masters of ships whose owners or agents wish to avail themselves of the facility of telephone service to their ships. For ships at other berths, telephone service is provided, upon application, by means of temporary exchange lines which are specially run to the berths as required.

The Albert Dock exchange was first opened in 1897 and a new exchange was built in Coolfin Road, Victoria Docks, in 1925. In 1939, the exchange was converted from manual to automatic, and while there were only 182 working lines in 1925, the number just before the war was 1,869.

During the last war, the area served by the Albert Dock exchange was heavily damaged and the exchange itself was hit several times.
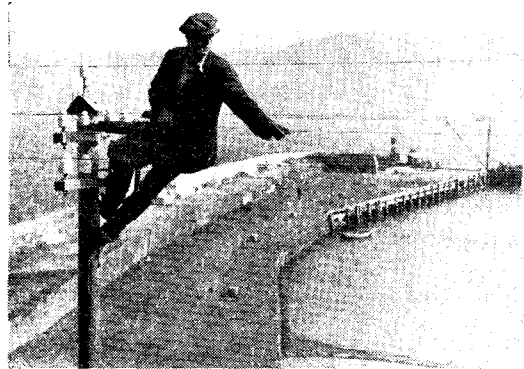
Lineman at work. Photograph taken at Waterfoot Harbour, N. Ireland.

Over 27,000,000 Miles of Wire to be Maintained.—The Post Office telecommunications system involves maintenance to over 27 million miles of wire, of which more than 25 million are underground and nearly two million miles overhead. Telephone wires in areas of high telephone density are generally in cables placed underground, and where the subscribers are few—usually in rural districts—the wires are placed overhead. Spells of stormy weather with gale and flood conditions cause widespread disruption of the telephone service in many areas. Post Office engineers work at high pressure restoring the disrupted service.

The work of restoring telephone service interrupted by floods cannot be started until the floods have subsided and the water has been pumped out of the cable ducts. Damp is then removed

Pumping out a flooded manhole.
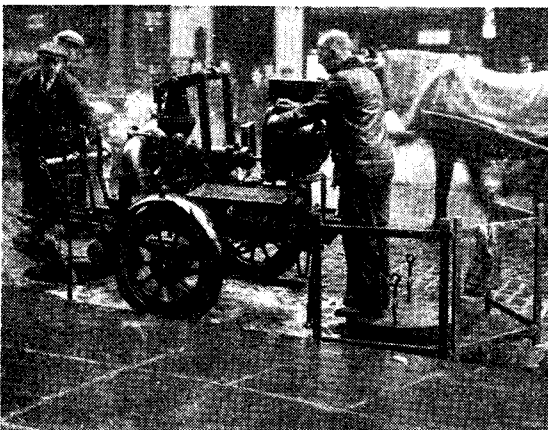
from the inside of cables by means of heat from a plumber's blow lamp or by pumping through the cable air which has been dried by being passed through calcium chloride. Carbon dioxide is also used for the purpose. Motor pumps of various types are employed, according to the situation. For the pumping operations, a hole is pierced in the sheathing of the cable and a nozzle connected by a flexible tube to the pumping apparatus is inserted. The lead sheath is removed from the cable at the other side of the fault and the moisture is driven out.

★ ★ ★

Post Office Cable and Wireless Services.—The completion of the M.C.C. tour of Australia meant the transmission by Cable and Wireless of 1,691,728 words of ordinary press, 167,514 words, of urgent press and 131 radio pictures. The total gross revenue from these services totalled approximately £11,847.

During February, 1951, Cable and Wireless handled a total of 1,844,843 overseas telegrams. Of these, 929,078 were outgoing and 915,765 were incoming. Compared with February, 1950, the total represents an increase of 16.3 per cent.

★ ★ ★

Extended Subscriber Dialling Facility Available on More London Exchanges.—The extended dialling facility, which was introduced in 1948, has now been extended to subscribers on Mayfair, Regent and Grosvenor exchanges. The facility is now available at some 70 Director exchanges in London. Extended dialling enables subscribers connected to Director exchanges provided with the facility to dial direct to subscribers on certain exchanges, e.g. Watford and Slough, which formerly could be obtained only through the intervention of an operator at "TOL". The charges for these calls are recorded by a multi-metering system.

Lists of the exchanges which have this dialling facility and the distant exchanges which can be dialled appear in the preface of the London Telephone Directory.

★ ★ ★

Telegram Speed-up.—The Post Office has now completed plans for the second stage of the teleprinter automatic switching scheme, which was described in our issue of November last.

This scheme is a revolutionary development in telegraph technique, designed to speed up transmission of telegrams, and it is being introduced in four stages. The first stage, which was completed in October last, provided for a national network based on a switching centre in London and another in Birmingham.

The second stage, which has now been put in hand, provides for extensions of the centres in London and Birmingham and for new switching centres in Bristol, Glasgow, Leeds, Exeter, Manchester, Liverpool, Newcastle and Nottingham. The provisional date for the completion of this stage is in the autumn of 1952.

The full scheme embraces a total of 24 automatic switching centres and so far as can be foreseen it will be completed at the end of 1954.

★ ★ ★

Wireless Phototelegraphy Service for Doctors.—X-Ray photos can be telegraphed overseas by means of the Post Office Cable and Wireless phototelegraphy service. This can be of the utmost importance when a doctor wishes to have an urgent consultation with a colleague in another country. The charge depends on the size of the photo to be transmitted and also upon the country of destination. It ranges from £1 10s. for a small picture to Belgium or France up to £15 for a large one to the United States. A reply can be paid for in advance and express delivery can be arranged at a small additional fee. Full particulars can be obtained at any Cable and Wireless Office and the large Post Offices, or by telephone to London: Temple Bar 1222, ext. 282, and Monarch 8060, ext. 305.

A public phototelegraph service between this country and Israel (Tel-Aviv) was opened on February 25th.

★ ★ ★

Telephone Service with Venezuela.—Telephone service with Venezuela was reopened on Monday the 19th March, 1951, and is available between 1 p.m. and 4 a.m. G.M.T. on weekdays and between 1 p.m. and 1.30 a.m. on Sundays. Service is limited in Venezuela to Caracas, Maracaibo, Maracay and Valencia. The charges for a three-minute call are £3 15s. od. on weekdays and £3 os. od. on Sundays, and the report charge (where applicable) is 4s. od.

★ ★ ★

Reduced Rates for Government Telegrams.—Specially reduced rates for government telegrams have existed for many years. In the majority of cases, they were granted by private operating companies, such as Cable and Wireless, Ltd., in return for cable landing rights and telegraph concessions in Commonwealth and foreign countries. Over the years, competition between the various telegraph companies has led to an extension of the practice, since, where several companies operate from the same country, all companies have had to grant the same concession in order to secure traffic. The practice of affording reduced rates for government telegrams is now so widespread that the telegraph companies are in effect granting substantial subsidies to governments and international organisations. The formation of United Nations with its many subsidiary organisations has made matters worse, since it has been agreed internationally that United Nations shall receive telegraph privileges equal to the most favoured nation on any particular route.

For many years, the United Kingdom has been one of the prime movers in the attempt to abolish these reduced rates and, at the International Telegraph and Telephone Conference in Paris in 1949, the question of charging ordinary rates for government telegrams was considered. The principle was agreed and a new paragraph was introduced into the Paris Revision of the International Telegraph Regulations stating that "except in cases of special arrangement . . . . . . , government telegrams shall be charged as ordinary private telegrams". This paragraph is an indication of majority opinion of world telegraph authorities that there is no justification for handling at reduced rates government telegrams which, by virtue of the special treatment afforded them, actually cost more to handle than fully paid ordinary private telegrams. General agreement to abolish existing preferential rates was not, however, forthcoming.

Having failed in the attempt to get rid of all reduced rates en bloc, an arrangement which would have simplified matters considerably, the United States and the United Kingdom have been negotiating with individual countries for abolition. Done piecemeal, abolition presents many thorny problems and it will be appreciated that countries in which overseas services are operated by private companies are very reluctant to forgo their rate privileges.

However, a start has been made. We have abolished government rates between the United Kingdom and the United States and it is hoped to secure abolition very shortly on all traffic with the self-governing countries of the Commonwealth. Progress is also being made with other countries.

Letter to the Editor

From W. H. Cleaves,
London Telecommunications Region.

Mr. H. A. Harman's article in the November 1950 issue of the Journal was timely, because the exchange-name problem has for some time past been engaging attention at London Regional Headquarters. There is no doubt at all that despite the comparatively large number of spare three-letter combinations on the director dial, the determination of names for new London exchanges, particularly in the director area, is becoming something of a problem, and the adoption of the American dialling system would undoubtedly go a long way to solving this difficulty. Mr. Harman uses the term "2-5" when referring to this system. I would prefer to call it the "2-1-4" system, because no change in the form of the subscriber's number is involved; 4-figure, and not 5-figure, numbers would still be used. It is the code that would be altered—from the "3-letter" to the "2-letter 1-figure" type—and this fact should be firmly kept in mind when the problem is studied.

The very attractive features of the "2-1-4" system outlined in Mr. Harman's article have led to a careful examination being made of the possibility of adopting it in place of the now well established "3-letter 4-figure" system in London. The question is very controversial, chiefly because the change involves an alteration in the average subscriber's approach to the simple process of dialling a train of 7 digits to call another subscriber in the director area. London subscribers, from long custom, now readily associate the 3-letter director codes with the names of the well-known London exchanges to which they correspond. They see "HAM" and think at once of Hampstead; "MAY"—Mayfair; "PAD"—Paddington; and so on. If the "2-1-4" scheme is introduced, this habit of thought must be changed and the subscriber must be induced to think of Hampstead as "HA-6", Mayfair as "MA-9" and Paddington as "PA-3", because these are the types of codes we would see in the telephone directory and which would be dialled instead of the 3-letter codes (followed by the 4 numerals) to call subscribers on other automatic exchanges. Moreover,

the change must be effected in such a way that the amount of dialling error must be very small indeed, since more than 20,000,000 calls are dialled over the London director system every week and as little as 1% error would produce a considerable amount of called-in-error trouble. The danger is that, during the period of transition, whilst the 4 volumes of the London telephone directory are being changed to show the exchange codes in the "2-1-4" form, subscribers would be apt to dial the old three-letter code, then the numerical portion of the new code, and then the four numerals, e.g. for Hampstead 2345, the caller might dial "HAM-6-2345" and call inadvertently Hampstead 6234. This is the principal snag and it will be readily appreciated that some subscribers would be the recipients of exceptionally large numbers of "wrong number" calls. For example, Paddington 3700 could expect to receive many calls meant for Paddington 7000 (Paddington Railway Station), and the additional traffic could very well cause congestion on the 3rd level of the 1st selector switches at Paddington Exchange.

Another difficulty is the practice followed by many subscribers of inscribing the 3-letter codes of their exchanges on all sorts of notepaper, bill heads, cars, vans, lorries, shop fronts etc. This practice would have to be broken down, if confusion were to be avoided. In addition, precautions would be required at provincial group centres which dial into London, to ensure that demands for London subscribers in the "2-1-4" form (e.g. Hampstead 6-2345) were recognised by the controlling operators as referring to 4-figure and not 5-figure numbers. This could be achieved by using distinctive entries in the provincial V.I.F., and it is thought that with a little experience, the operators concerned would quickly become accustomed to the new system.

Despite these disabilities, I believe that the balance of opinion in London now favours the change of system, but at the time of writing a final decision has not yet been taken. Doubts have been expressed by some, who hold that sufficient names could be devised from the spare 3-letter combinations to meet requirements for another 50 years, but I think the result would be

a much lower standard in the field of exchange names and we should find such names as "HYACINTH", "HICKORY" and "HUMBOLDT" being used. Those who favour the change hold that a bold policy should be followed and that with careful publicity the disturbance to the smooth working of the London director system could be kept to the minimum. It is visualized that the exchange codes would be changed by printing the 3rd digit as the numeral corresponding to the 3rd letter of the name in the successive volumes of the directory, the reason for the change of notation being carefully explained to the public.

2-letter 1-figure" codes are being used to an increasing extent in London for subscriber-dialling from the London director area to the larger automatic exchanges in the "fringe" area, and while these codes are at present notified by means of dialling code cards and lists in the preface to the directory, it would be very useful if they could also be included in the text. With "2-1-4" working in the director area, this object could be achieved.

As regards the type of directory entry, I think the American style illustrated in Mr. Harman's article is probably the best. Variants of this form, such as the printing of the code as well as the exchange name, would take up too much space.

The proposal to reduce the number of exchange names in London by using one name for several director units could follow when the "2-1-4" system was fairly established, but it would take time, and local opposition may be expected when well established names are to be withdrawn from public use: but that, I think, is another problem.

Books Received

At one time it was customary to include in each book on telegraphy, telephony or radio a good deal of information on fundamental principles which are common to all aspects of telecommunications. This was due largely to the fact that the City and Guilds of London Examinations in these subjects included these principles in the syllabus of their subjects. Later, Telecommunications (Principles) was taken as a separate subject. There is thus good reason why text books on telephony, telegraphy and radio should not each include subject matter on fundamental principles but that a separate text book should be available to cover this subject.

The present work sets out to do this and the Author mentions in his preface the help he received in its planning by Mr. T. E. Herbert, whose classic works on Telegraphy and Telephony are well known and under whose joint authorship this book was intended to appear. It

is a large book, well written and illustrated, which appears to cover adequately the syllabus for Grades I, II and III of the City and Guilds of London Institute examinations.

The author has assumed a rather low mathematical standard on the part of the potential reader and has excluded the use of the differential and integral calculus in the body of the text, although he makes amends to some extent by including in a separate section of an Appendix on Mathematical Notes some of the more important proofs which require application of the calculus. This is probably a wise decision, not so much because of the difficulty of the average student in dealing with the calculus—although undoubtedly this exists—but because proofs avoiding the calculus (such as, for example, those employing graphical methods) often give a much better mental picture of what happens.

The text is relieved with many worked-out numerical examples which should prove a great help to the student.

Although the price of the book is high, at present prices it is good value. It fulfils the purpose for which it is intended and covers all branches of the subject, from electrons, power and energy, magnetism, generators, alternating currents, meters and measurements and electronics to sound. There are in addition a number of useful appendices on mathematics, electrical units, letter symbols, chemical elements and their composition, the Greek alphabet, useful numerical constants, conversion factors, British Standard graphical symbols for telecommunications, and finally syllabuses for the City and Guilds of London Institute examinations in Telecommunications Principles.

The work can be recommended confidently to all students of Telecommunications.

TELEPHONY, VOLUME 2 (AUTOMATIC EXCHANGE SYSTEMS)—
J. Atkinson, A.M.I.E.E.; published by Sir Isaac Pitman & Sons Ltd.;
872 pp., 808 ill., Price 50s.

This book, together with Volume 1 (General Principles and Manual Exchange Systems), forms an up-to-date authoritative standard work on the subject of telephony.

In Volume 2, the author first gives a broad picture of Automatic Exchange Design, including the general principles of switching, traffic and trunking, switching mechanisms and apparatus racks and cable. A wide range of basic circuit elements are then described in detail, so leading up to more complex complete exchange circuits of the non-director and director systems, unit automatic exchanges and the junction circuits between them. The concluding chapters deal with the important subject of long distance dialling, the mechanisation of trunk and toll services and private branch exchanges and include an informative survey of the problems arising in the conversion of the exchanges from manual to automatic working.

This volume will be a standard work on automatic exchange systems for many years to come, as it gives a detailed exposition of the telephone exchange systems of the British Post Office and also an outline of switching systems used by other telephone administrations, such as those employing marker control uniselectors, power drive systems, relay system and crossbar system.

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Publication and Price. This Journal is published in November, February, May and August. Price 1 - The annual postal subscription rate is 4/6 post free to any address at home or overseas.

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