Post Office Telecommunications Journal

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Contents

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"Coronation" Number

THE FIRST ELECTRIC TELEGRAPH CIRCUIT IN this country, which signalised the birth of Britain's telecommunication services, was opened in 1837, the year in which Queen Victoria succeeded to the throne; it carried messages over the 18½-mile railway route between Paddington and Slough. The past century has been one of wonderful invention and progress in telecommunications, as in other fields, and the contrast with the days of 1837 is illustrated by some of the articles in this issue, which describe some aspects of modern telecommunications systems.

In this "Coronation" number it is fitting that we should deal especially with the services provided by the Post Office for this great traditional and historic occasion. Following an expression of loyal greetings to Her Majesty is an outline of the plans for the telecommunications necessary not only for the event itself, but also to achieve world-wide report and broadcast. Other articles deal with phototelegraphy, whereby pictures can be rapidly transmitted by radio overseas; the telegraph system in Canada; and our national heritage as a maritime nation is illustrated by the article on the telephone service in the ocean liner "Queen Elizabeth."

The January storm and floods in these islands and in Holland provided a stark reminder of the hazards of maintaining telecommunication services, even in these modern days. We publish in this issue an article describing the damage that was caused, and paying our tribute to the splendid work by Post Office staff—a record in keeping with the highest traditions of the Service.

Elizabeth R
1953

God Save the Queen

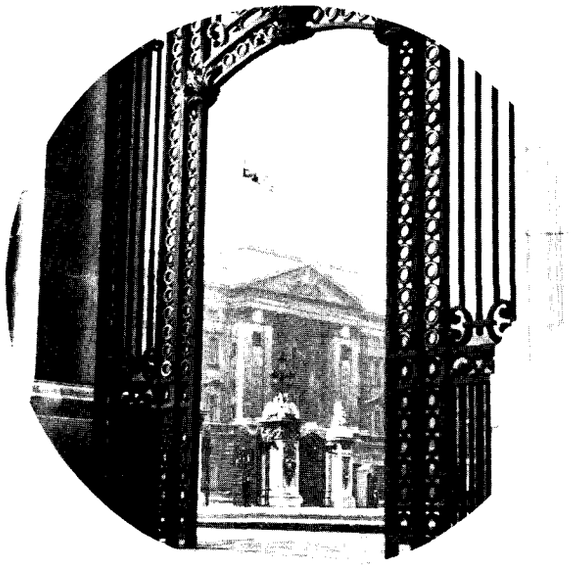
ON THE OCCASION OF THE CORONATION OF OUR GRACIOUS QUEEN ELIZABETH, the Editorial Board, Staff and Readers of the Post Office Telecommunications Journal offer their most humble duty, their loyalty and devotion.

THEY RECALL WITH PRIDE the many occasions on which the Telecommunications Services, founded in the reign of Her Majesty Queen Victoria, have enabled Her Majesty and her predecessors to communicate swiftly with, and to speak to, the many peoples of the Commonwealth in widely separated lands; and they are proud in the knowledge that by means of those services all the peoples of the Commonwealth will be able to join in the Coronation Service on June 2. They hope that they may be privileged to serve Her Majesty on many further occasions for many, many years.

IT IS THEIR HEARTFELT WISH that Her Majesty's reign may bring prolonged happiness and peace.

Photo: Dorothy Wilding

Coronation Control and Report



Planning the Lines of Communication

E. W. Sansom,
London Telecommunications Region

MORE THAN 200 YEARS AGO OLIVER GOLDsmith wrote, "the time for the Coronation approaches. The great and the little world look forward with impatience". In those days the immediate knowledge that the event had taken place was limited to those present at the ceremony, and shared shortly after by those lining the Coronation route back to Buckingham Palace. Thereafter the news was signalled to the rest of the kingdom by beacon flares. Today the world looks forward with equal impatience to June 2, but the Coronation itself and the subsequent procession will be brought almost instantaneously to millions by broadcasting and television. The nations of the world will receive the news almost as quickly by cable and radio.

The fortunate few in Westminster Abbey will see the Archbishop of Canterbury place the crown on the head of Her Majesty Queen Elizabeth II. At the same instant the guns of Windsor, Hyde Park, the Tower of London and Sheerness will announce the news. The signal to the gun bases will have been transmitted by telephone land line from the Abbey.

In these days of technical achievement the broadcasts, television, gun signals, loudspeaker and public address messages, and home and overseas telegraph messages and pictures will probably be taken for granted by the great majority of those who see and hear them. This article describes some of the work that has gone on behind the scenes for many months in preparation.

There will be a small number whose special duty of providing telecommunication links for the ceremony will place them within a few yards of its grandeur but they will be so engrossed with their duties of keeping lines clear, switching to meet requirements and so on, that they will probably see and hear less than the millions of spectators, listeners and viewers. But they and their colleagues who have laid the lines and installed equipment, some of them working day and night, will have the satisfaction of knowing that this historic ceremony could not have reached such a vast audience but for their efforts.

To a small number of Post Office staff some signs of what might be involved became evident as far back as the summer of 1952, when Buckingham Palace telephone traffic began to rise and it became necessary to extend the telephone switchboard for the first time since 1929. This work was carried out in September, while the Court was at Balmoral.

Once the general requirements were known it became clear that a great deal of work would be required and the Post Office welcomed the opportunity of contributing its share to the proud pageant.

A committee was found essential to co-ordinate requirements since a great many interests were concerned. At the first meeting—nine months in advance of the Coronation—the Post Office met representatives of the Ministry of Works, the War Office, the B.B.C., the Press, the Police, and the Fire and Ambulance Services. This meeting was the forerunner of others, and of subcommittees which met at intervals as required.

One Thousand Circuits

The magnitude of the external engineering work to be carried out is exemplified by the fact that the B.B.C. alone asked for 1,000 circuits within about a square mile of the London Telecommunications Region, Centre Area. Although there is a generous provision of underground cables in central London, it was evident at that first meeting that not all requirements within the Coronation "box" could be met from existing spare plant. Early decisions had to be made; for instance, that there should be an upper limit to the number of circuits which could be provided on certain sections of the network. Once this number had been determined and fairly allocated for the various services, no more requests for circuits to certain points could be accepted. It was clear that a special cable, several hundred yards in length, would be required to serve a "Coronation Board" from a Private Branch Exchange frame in Whitehall. The particular type of cable required was scarce and a suitable length was obtained from Scotland.

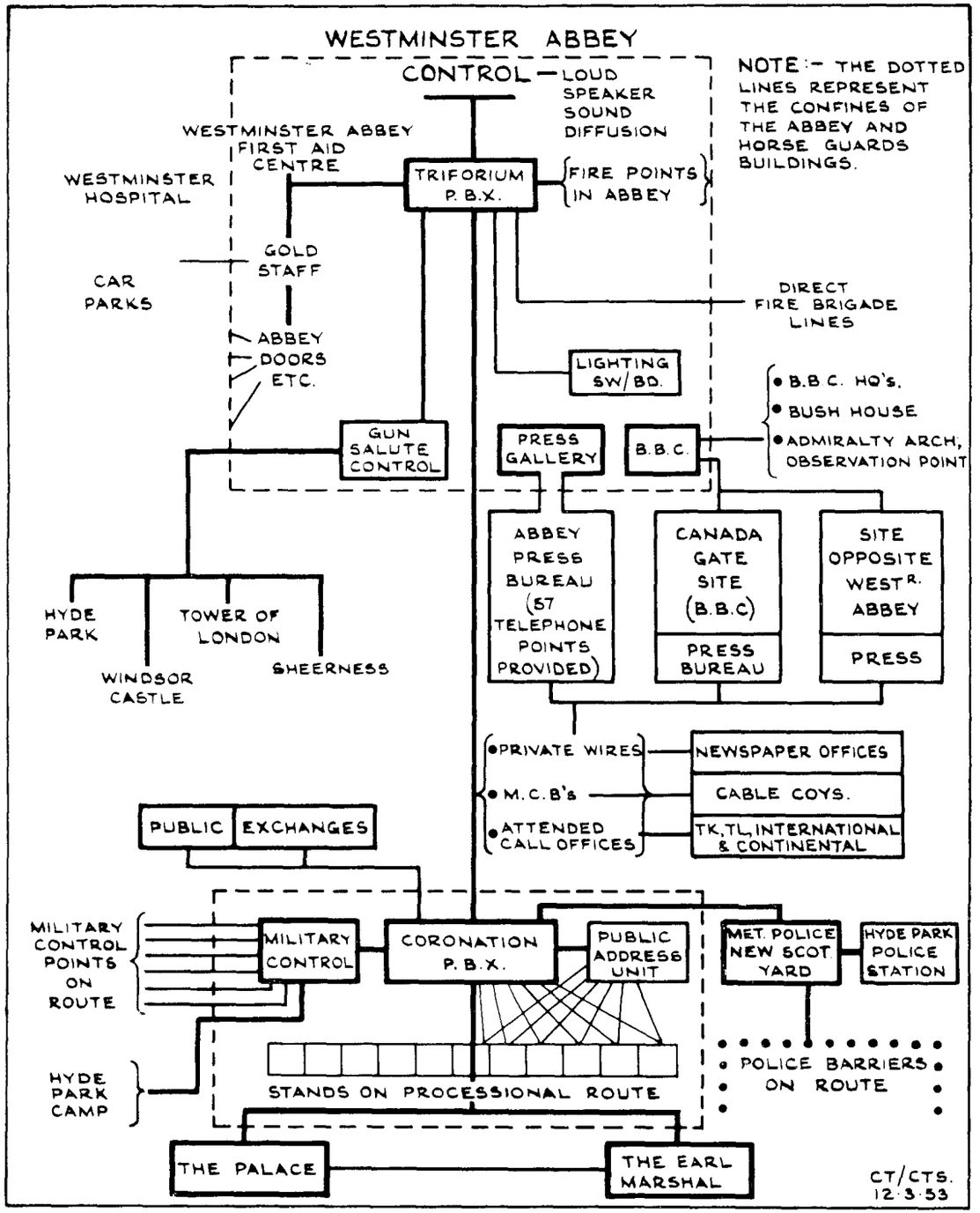
Nevertheless, it was soon realised that more essential lines were still required than could be catered for over certain routes; for instance, between Mayfair and Victoria exchanges. It was accordingly decided to lay urgently a cable of 500 pairs between these two exchanges, under the Green Park and crossing in front of Buckingham Palace—but the Post Office was forbidden to dig up roads on the Coronation route! It was, therefore, necessary to construct a tunnel under the Mall, the work being given to contractors. Miners were employed for the digging; when they reached the required depth they found that the sub-soil consisted of loose sand, so the tunnel was quickly finished, pipes were laid in position, and concrete was poured in to prevent subsidence.

As an example of the need to restrict circuits, first priority in the cables running past Westminster Abbey obviously had to be allotted for the essential speech and signalling circuits connected with the ceremony itself. Next in order came circuits for the B.B.C. to enable them to carry out their broadcasting arrangements with complete efficiency. After this, circuits for the Press, Police, Army, and so on, had to be catered for.

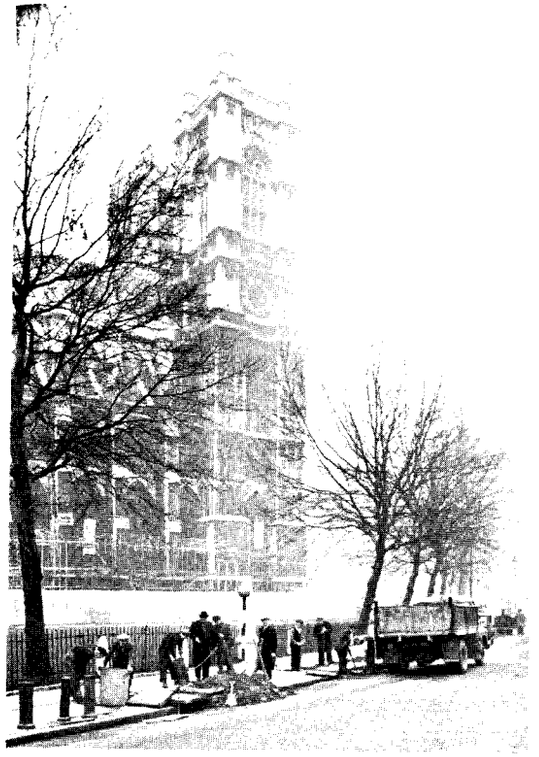
Press Bureau

A Press Telecommunications Bureau has been built outside and against the walls of the Abbey. A chute will enable Press representatives to pass written messages from a Press gallery in the Abbey to their colleagues in the Bureau for onward transmission over direct lines to the newspaper offices, to the main cable companies for transmission overseas, or by telephone elsewhere from one of the many call offices which have been erected. Foreign language speaking call office attendants, provided by the Post Office, will assist in setting up calls and generally helping those making calls. Fifty-seven telephones have been specially provided. Similar facilities for the Press, including call office attendants, will also be provided behind the stands opposite the Abbey and at Canada Gate near Buckingham Palace.

The Coronation service in 1937 was the first to be described to the public by broadcast, and the ceremony in June will be the first ever to be televised. The provision of circuits for the B.B.C. from many observation points to Broadcasting House, and of many speech and signalling circuits between B.B.C. positions, has been one of the major individual tasks performed by Post Office engineers. As previously stated, these circuits number well over 1,000 in the Centre Area of the L.T.R. alone.



Telecommunications Network for the Coronation



Duct work for Westminster Abbey

Communication matters in general have been arranged by the Ministry of Works, which is responsible to the Earl Marshal as representing the Coronation Committee. Many months ago the Earl Marshal set up headquarters in Belgravia where a telephone switchboard was installed for his staff and for that of the College of Heralds. To facilitate priority arrangements among all the interests concerned and to provide an essential control point for the procession, a six-position switchboard (the "Coronation Board") was provided in Whitehall at the end of February. This switchboard has lines to 18 principal stands on the route, private wires to many Government departments and direct lines to certain high officials. Within a few feet of the board is a separate but closely connected installation for broadcasting music and announcements to those who will be in the stands. In addition, multiphone equipment has been provided for Military Headquarters, which will need to be in constant touch with its numerous control points. The Earl Marshal's switchboard, the Coronation Board, and the multiphone equipment for military purposes comprise, in effect, a first-line control unit for the procession. Control of this unit is in turn provided from a central location in the Abbey itself.

Some 80 feet above the Altar at which Her Majesty will be crowned is the Triforium, a gallery running round the main walls. In this gallery there will be staff and apparatus for sound distribution within the Abbey, for radio broadcasting, and for a special three-fold telephone network. The telephone network will provide direct military circuits to the far-distant gun saluting bases, lines for "Gold Staff" (the official who controls all entrances and exits to the Abbey) and lines for the Ministry of Works whose responsibility covers fire precautions, first-aid, lighting and lighting control. Additionally, there is access for the Ministry of Works from the Triforium to the Coronation Board in Whitehall.

The trunking diagram shows the circuits to New Scotland Yard, police barriers, the fire and ambulance services, the military camp in Hyde Park (with its own Post Office and telephone facilities) and the car parks and other miscellaneous points. Technical readers can visualise the problems of balancing circuits, fault repairs, fixing wires to the Abbey walls (where no nails, screws or hooks are allowed) and so on. Traffic, as well as engineering, problems have arisen and traffic staff have had to decide such questions as the number of telephonists likely to be required to deal with extra calls; probable staff needs for duty the night before; canteen facilities; sleeping arrangements, and so on. Alarm calls have provided a special problem, but a figure for the likely demand has been calculated on the records taken at the last Coronation.

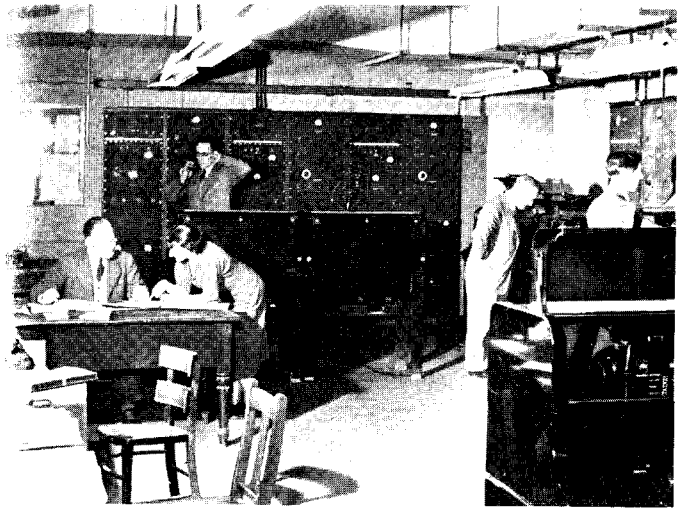
There will also be Coronation activities in many other places besides London. Edinburgh and Caernarvon, for instance, are to hold ceremonies of particular interest, and there will be similar ones on varying scales throughout the kingdom. London, as the centre, has to deal with a highly concentrated and complex system of communications within about a square mile, but other Regions have their problems in the more numerous and dispersed centres to be dealt with.

From the foregoing the variety as well as the magnitude of the work confronting the Post Office

from the beginning of last winter can perhaps be gauged. Other organisations with which the Post Office has co-operated have each in their own field their own complex schemes and difficult problems, and their requirements from the Post Office have had to be modified from time to time, usually in an upward direction. Even at the time of writing finality has not been reached; but by Coronation Day preparations will have been completed and the needs of the B.B.C., Press, Fire, First-Aid, Government departments and the Defence Services will have been met. Telephones, microphones, loudspeakers, P.B.X. positions, underground cables, staffing and maintenance will have been "laid on", and overseas channels in their various forms will be ready. London Telecommunications Region will shoulder a key responsibility as the focal communication point in addition to its job of ensuring continuity of its day-to-day services from normal exchange operation to alarm calls.

On completion the task will be found to have been a formidable one, playing an important part in the first Coronation service to be televised. But on analysis much of it reduces to the application of routine jobs for an extra-special event, although frequently in the absence of precise information which those jobs normally demand. And, as the stages of the ceremony pass, so those responsible for provision and planning will turn their thoughts to the millions throughout the country and the world whom they have served, and will unite with them in saying "God Save the Queen".

Completion of first duct work at Canada Gate, Green Park



Picture Room, Electra House

Picture Telegraphy by Radio

W. C. Allen.

Telegraph Manager's Office, Central Telegraph Station.

Post Office Cable and Wireless Services

WHEN THE LATE KING GEORGE VI WAS crowned in 1937, radio picture telegraphy was in its infancy; transmission was comparatively slow; only four circuits from the United Kingdom—to Buenos Aires, Melbourne, New York and Tokio—were open; and air mail was the fastest method of sending pictures to the world Press generally. But developments shortly before the war and since have considerably reduced the time of transmission and the Picture Room in the Post Office Cable and Wireless Central Telegraph Station, Electra House, London, operates nineteen radio circuits to-day. During May, 1937 (when King George VI was crowned), 199 pictures were transmitted, the total for the six months, January to June, being only 323. When the present Queen was married in 1947, 310 pictures were transmitted overseas, 151 on the wedding day itself. On the day of King George VI's funeral in 1952, 132 pictures were handled, and the total during the fortnight round about the funeral was 640. The Picture Room is expecting an exceptionally busy time during the forthcoming Coronation period.

Historical survey

The advantages of picture telegraphy to commerce as well as to the Press are such that it is not surprising that some of the earliest efforts in telegraphic communication were directed towards developing a system by which facsimiles could be transmitted and received. As early as 1842, only five years after the first telegraph service (Great Western Railway Station, Paddington, to Slough Station) was opened, Alexander Bain proposed a method of transmission similar in many respects to the modern system, though probably the first workable system was that produced by Castelli in 1865. Naturally, picture telegraphy was first achieved over line circuits, and it was not until 1913 that Professor Korn succeeded in transmitting pictures over a radio link. The first regular radio

picture service was opened between New York and London in 1926.

Although the earliest experimenters knew how most of the problems might be solved they lacked apparatus of the necessary sensitivity, and it was not until the photo-electric cell was introduced in 1918 that commercial development really became possible. As the current flow in a photo-electric cell circuit varies with the amount of light falling on it, the cell provides a ready means of converting the lights and shades of a picture into electric currents of varying intensity or amplitude as the picture is scanned. At first a system of amplitude modulated current was used; this is suitable for line transmission but, as some degree of fading is always present over radio circuits and causes a variation in the strength of the received signal, a picture transmitted over a radio path by an amplitude modulated signal is often excessively distorted.

When the London-New York circuit was opened in 1926, employing long wave transmitters in the 15,000 metre band, various means were adopted to minimise the effects of fading.

A marked step forward was taken in 1928 when reliable high frequency radio circuits became available. The Constant Frequency Variable Dot system, commonly known as C.F.V.D., was then introduced; this analysed the picture into a series of dots, similar to the dots of a printer's half-tone block produced by photographing the original through a screen (the illustrations to this article are from half-tone blocks), and each dot was transmitted as a pulse, the duration of which was a measure of the light or shade of the picture.

Figure 1 is a reproduction of a picture received in London from New York in 1931, the magnified portion showing the dot structure. Although this pulse width modulation system largely overcame fading troubles, multi-path effects seriously interfered with reception at times; these effects were caused by the arrival of several rays at the receiving station slightly displaced in time owing to their having traversed different paths of varying lengths between the two stations. A further disadvantage was the comparative slowness of transmission; a normal 10-in. × 8-in. picture took about 45 minutes.

The next milestone in the history of radio picture telegraphy was the replacement of C.F.V.D. by Sub-Carrier Frequency Modulation (S.C.F.M.) in 1938. In this system the gradation from light to shade causes a change in the frequency of the

Fig. 1 Picture received in London from New York, 1931

Enlargement showing dot structure

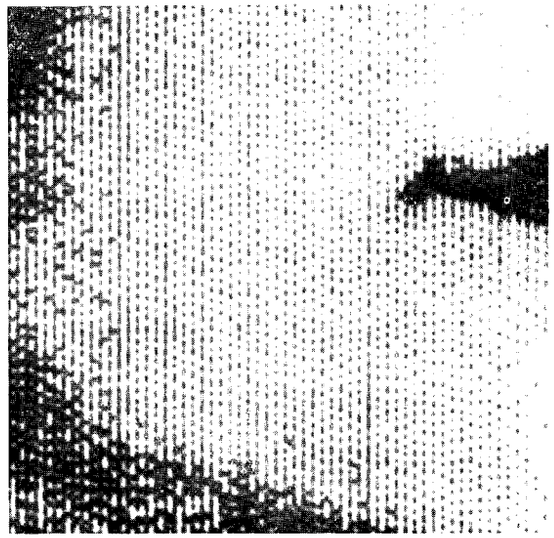
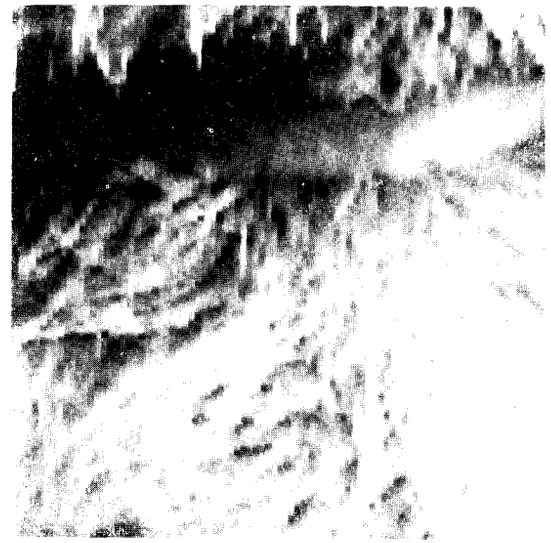


Fig. 2 Picture transmitted by S.C.F.M.

Enlargement illustrating structure



transmitted signal, instead of varying its dot width, and this made possible greater reliability in the service. Figure 2 shows a radio picture transmitted by this system; the enlarged portion illustrates the difference in structure compared with the older system illustrated in Figure 1. A further advantage was that transmission time was reduced from about 45 to 10 minutes.

In the machines at present in use for high fidelity reproduction of pictures the original is attached to a cylindrical drum which is rotated at a fixed speed and scanned by a light spot and photo-electric cell, the traverse of the cell relative to the drum being controlled by a lead screw; a similar method is used at the receiving end. The original is scanned at about 100 lines to the inch. The lead screw and moving parts must be of a high order of mechanical accuracy to avoid showing gear patterns on the photographically processed received copies. The constant speed drive may be by a phonic motor driven from an accurate A.C. supply.

One of several alternative methods of scanning the picture at the transmitter is illustrated, in a simplified form, in Figure 3. The light from the lamps illuminates a small area of the picture, and the reflected light from a still smaller area is focussed on an aperture, and so on the photo-electric cell. As it would be difficult to amplify the very low direct current output from the cell by direct current amplifiers, a "chopper disc" device is introduced between the light source and the cell, and this interruption of the light produces a pulsating current which can be amplified easily by alternating current amplifiers.

At the receiving end a somewhat similar optical system is used, with a mirror galvanometer instead of the chopper disc; a simplified form of this device is shown in Figure 4. The mirror galvanometer deflects in accordance with the received signal, so affecting the amount of light focussed on the drum carrying the sensitised paper or film on which the picture is received. When the whole of the picture has been thus received, the film or paper is developed by the normal photographic process.

The amplified output from the photo-electric cell being, as already explained, unsuitable for transmission over radio circuits, the modulation is changed from amplitude to frequency modulation by applying the rectified output from the cell to a reactance valve at the input of a beat oscillator, which is adjusted so that the black portions of the

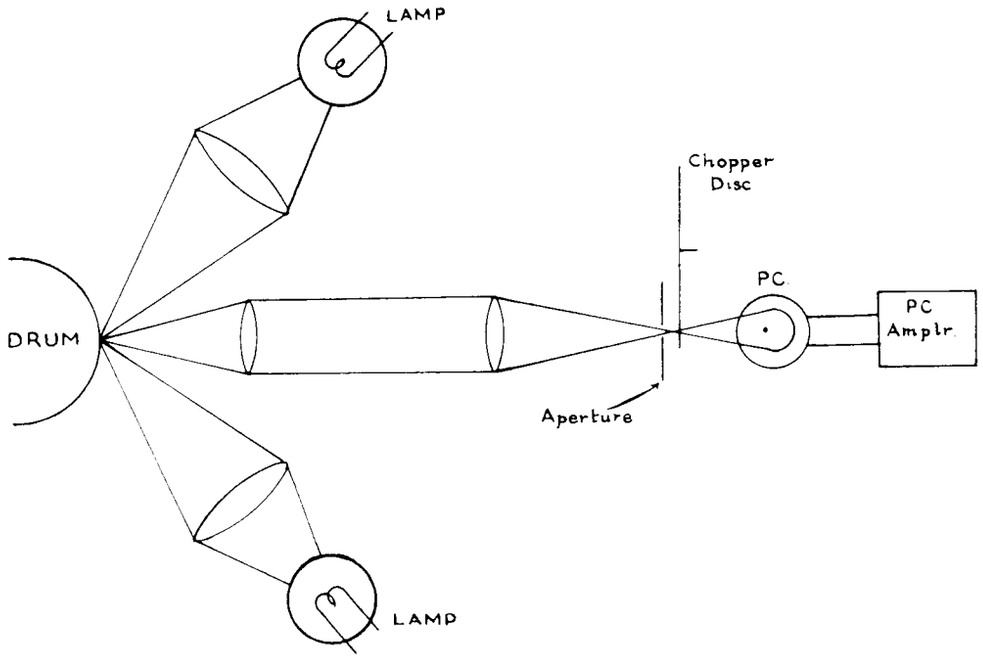


FIG.3. OPTICAL SYSTEM OF TRANSMITTER

picture produce a frequency of 2,300 cycles, and the white portions a frequency of 1,500 cycles; the intermediate tones produce frequencies between these limits.

Whereas the earlier types of pulse width modulation keyed a telegraph type radio transmitter, frequency modulation has necessitated the use of a telephone type sender, and the sub-carrier frequency modulation which carries the picture is applied to this radiotelephone sender in a manner similar to that required for speech. Diversity reception is desirable to ensure adequate signal strength, and the audio signal is reconverted to amplitude modulation at the central office before being applied to the mirror galvanometer.

Suitable radio frequencies can usually be chosen to ensure commercial reproduction and given good propagation conditions a radio picture compares very well with the transmitted original. Figure 5 shows an untouched picture received in London from Singapore.

Fading of the radio signal has not, however, been completely overcome and mutilation of a received copy, owing to fading, appears in the form of black and white streaks across the picture. During high sunspot activity the flaring of a spot can so affect the ionisation and absorption of the atmosphere that almost all the frequencies used are absorbed; this type of fade may last for anything from a few minutes to an hour. This type of radio fade is comparatively rare, but the mutilation caused by weak radio conditions is similar.

Scope of present service

Nine equipments are now in use in the Picture Room at Electra House. Radio services are available between London and Athens, Barbados, Bermuda, Berne, Bombay, Buenos Aires, Cairo, Capetown, Colombo, Lisbon, Melbourne, Montreal, Moscow, Nairobi, New York, Rio de Janeiro, Salisbury (Southern Rhodesia), and Wellington (New Zealand). In addition, 11 European countries are

served by cable routes: Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Italy, Norway, Sweden and Switzerland; and there is a cable route between Britain and the Irish Republic. The continental and inland line services are linked closely with the radio routes and relays from wire to wireless, or vice versa, and automatic conversion at Electra House from line amplitude modulation to sub-carrier frequency modulation are common. Automatic relay, radio to radio, via London, has been possible for many years and is used when one overseas country is out of touch with another. One post-war development has enabled users in London to have direct reception from an overseas country through Electra House, which simply monitors the picture as it passes through.

Newspapers are the largest users of the picture telegraph service but commercial firms are now using it regularly. Balance sheets, weekly and monthly returns, blue prints and so on are regularly telegraphed. A radiotelegraphed cheque has been honoured in the receiving country. When, on the liberation of Singapore, the Cable and Wireless, Ltd. manager wished to re-open the Company's bank account, he obtained authentication of his signature from London by photo-telegraphy within a few hours. Scotland Yard uses the system for exchanging criminal records, including finger prints, with the police of overseas countries.

Fastest on Earth

Telegraphy, including photo-telegraphy, remains the fastest thing on earth (except the mind of man), despite the increasing speeds of air travel. On January 27 Flight-Lts. L. M. Whittington and J. A. Brown achieved a record flight from London to Karachi at an average speed of 441.8 m.p.h., in 8 hours, 82 minutes, 28.2 seconds. Our picture (Fig. 5) shows Flt.-Lt. Whittington having a chat while his Canberra was refuelling; this *Straits*

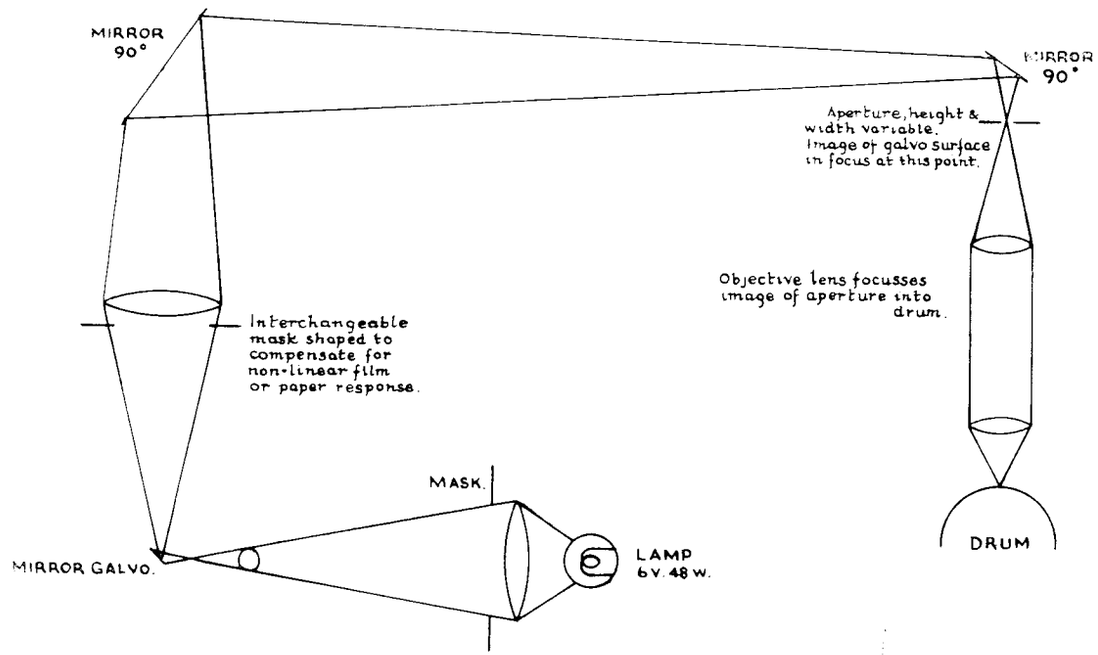


FIG.4. OPTICAL SYSTEM OF RECEIVER

Times picture was telegraphed from Singapore to London in about 10 minutes.

During the Coronation, it is expected that a "pooling" arrangement—under which each picture is transmitted only once, but carries a number of addresses for delivery—will be adopted, as at the late King's funeral. Plans are being made to increase the number of transmitters for use during the period, and there will probably be 12 to 15 on the air. On some circuits single side-band senders will be used; these will offer the facility of up to four picture transmission channels on a single transmitter.

By means of arrangements in Westminster Abbey and along the route for speedy delivery of photographs to Electra House, and by the intensive use of all possible transmitters, pictures of the Coronation will be available almost throughout the Commonwealth and in many foreign countries for publication in the next morning's newspapers—dependent, of course, on the differences in local times. In New York, which is six hours slow on British Summer Time, they will be in the same day's evening newspapers; in Australia, 11 hours fast on B.S.T., the first pictures, at least, will be in the following morning's editions.

Figure 5 *Photo, by courtesy of Straits Times*

Inland Telecommunication Statistics

In the three months ending 31st December, 1952, there were 88,000 new demands for telephone service (compared with 97,000 in the corresponding period of the previous year) and 78,000 new subscribers' exchange connections were installed. The number of shared service connections at 31st December was 558,000 compared with 526,000 at 30th September.

The number of telephones in service at the end of the period was 5,866,000, a net increase during the quarter of 52,000 (including an increase of some 700 public call offices). The number of outstanding applications was 433,000, representing a decline in the quarter of some 15,000.

65,397,000 inland trunk calls were made of which 15,800,000 (24 per cent.) were at the cheap rate. In the corresponding quarter of the previous year the figures were 64,416,000 and 15,092,000 (23 per cent.) respectively.

The number of inland telegrams (excluding Railway and Press) amounted to 8,388,000, including 1,485,000 (18 per cent.) greetings telegrams. In the same quarter of 1951 the figures were 8,732,000 and 1,304,000 (15 per cent.).

At the end of December, 1952, there were 47,607 telephonists, 9,495 telegraphists and 54,470 engineering workmen employed.

The corresponding figures for December, 1951, were 48,291, 10,078 and 54,373.

* * *

All Greetings Telegrams delivered on St. Valentine's Day, 14th February, were on a form specially designed by Mr. Arthur Teixeira Barbosa, who was born in Liverpool in 1908 and educated at St. Edward's School, Oxford. He studied art at the Liverpool School of Art, Heatherley, and the Central School of Arts, London.

The Royal Opening of the Claerwen Dam

Transmitting Reports and Photographs

THE OPENING OF THE CLAERWEN DAM BY Her Majesty the Queen on Thursday, October 23, 1952, created some unusual problems for Post Office Headquarters, Wales and Border Counties, and for the Shrewsbury Telephone Area.

The dam is in wild mountainous country at the remote end of the Elan Valley in central Wales. It has a top water area of 650 acres, is 1,210 feet deep, with a capacity of 10,625 million gallons and is planned to augment the water supply of Birmingham some 75 miles away. The importance of the event—the Royal opening of the largest dam in Britain—attracted wide interest, 60 newspaper-men were present needing speedy transmission of reports and pictures from this remote site to newspapers in London and Birmingham. The dam is about nine miles from the nearest exchange, Rhayader, which, in turn, is about the same distance from Llandrindod Wells, its group centre.

Our first introduction in Shrewsbury Telephone Area to the job ahead was as far back as the previous May when leading Midland newspapers asked for picture transmission facilities from the dam on the opening day. In an Area such as Shrewsbury, where there are only two exchanges with over 2,000 lines out of a total of 224, anything out of the ordinary soon becomes a "special event", but we did not at this stage see what lay ahead.

The only circuits running up the valley from Rhayader exchange were operational circuits for Birmingham Corporation, which obviously could not be released for Press purposes, and two lines for the contractor building the dam; if these became spare, and of this there was yet no indication, they would be required for control and security and could not be surrendered for picture transmission.

It soon became evident that other newspapers were interested, and the trickle of requests now became a stream. We had to think quickly; obviously this was going to be a bigger event than we had suspected. We decided, first, so that all newspapers should have a fair deal, to accept no firm bookings for picture calls until we had a clear outline of Press demands; and, secondly, that we could give no line facilities from the dam to Rhayader, as to attempt to meet all newspaper requirements would need more men and materials than we could afford. Thirdly, as Rhayader was seriously under-circuited on its only junction outlet to Llandrindod Wells, we could not release any public circuits there; and lastly, as a general principle, any picture calls would have to be made from Llandrindod Wells itself, with any "load shedding" on to either Newtown (Montgomeryshire) or Aberystwyth, which are respectively 29 and 34 miles from Rhayader.

Zone Outlets

Late in July we learned that twelve newspapers wanted picture facilities. Things now looked rather critical. Llandrindod Wells has three zone outlets to Birmingham, Cardiff and Swansea; the Swansea route worked generator signalling on a carrier basis but was not particularly reliable, and in any event would not be able to assist us materially; and the outgoing and both-way components on the first two routes totalled just twelve circuits.

The prospects of any relief on the two routes, even temporarily, was out of the question until new cables were laid. We had already decided that the trunk routes should so far as possible be reserved for Press and official traffic, and the routine day-to-day traffic disposed of via alternative routings. Even so, if we met the picture demands, the prospects for reports appeared poor, until our colleagues in Birmingham and Cardiff agreed that their outgoing circuits to Llandrindod Wells should be the first choice circuits for picture calls.

The picture calls would, of course, be "staggered" to meet the needs of individual papers, but we still wanted to avoid any delay to word traffic, which it was difficult to gauge accurately at this stage, and we looked round for other ways of shedding the load.

The position of the accredited Press representa-

tives travelling with the Royal Party had to be specially borne in mind. They had to stay with the Royal Party throughout their tour, and the only "breaks" possible were during the official luncheon and following the taking of tea by the Royal Party. So, although we had previously decided to provide no Press traffic facilities at Rhayader, we had to do something there for the accredited Press. After speaking to Buckingham Palace, the Central Office of Information and the City of Birmingham's Information Officer to get a guide from precedent, we guessed their number as eight; this proved to be correct.

The two Llandrindod Wells-Newtown physical circuits, one carrying a three-channel carrier, are routed via Rhayader, and it was decided to cut the non-carrier physical at Rhayader and set up two 1 + 4 carrier systems using ex-W.D. equipment which we had in the Area.

We thus made two new routes, Newtown-Rhayader and an auxiliary Llandrindod Wells-Rhayader. Rhayader is only a one-position C.B.S. exchange and to avoid overloading it, we decided to terminate the new circuits directly on telephones and work them, for our convenience, as trunk subscribers' circuits on Llandrindod and Newtown, but carrying Rhayader charges.

The Post Office accommodation in Rhayader is restricted and though we could squeeze in the carrier equipment what should we do with the eight journalists? Here again, thanks to the generosity of the City of Birmingham Water Department, who kindly lent us accommodation in which to house four of the telephones, another obstacle was overcome.

Knowing the liking of newspaper-men for "getting a beat" on their rivals, it is not surprising to learn that one of the Midland papers now decided to go ahead with a scheme for transmitting pictures direct from the dam, using a V.H.F. radio link, with a land line from Llandrindod Wells to Birmingham. The purpose was to save time; Birmingham Corporation had already arranged that photographs and copy were to be carried from the dam to Llandrindod Wells by a team of couriers supplied by the Norton Motor Cycle Company.

Shortly afterwards a London newspaper decided to adopt the same technique, but, in the light of their past experience of this method of transmission, they decided to work in a westwards direction. The London newspaper established their radio receiving station in a tent at the top of a high hill near Pontrhydygroes, some eleven miles away on the other side of the mountain ridge, and adjacent to a local subscriber's route. They then sought the permission of two local subscribers for the release of their exchange lines during the operative periods. We, in turn, agreed to the release of two Aberystwyth-Pontrhydygroes junctions and a four-wire circuit was then made available from Aberystwyth via Cardiff to London. The radio relay links were provided under the arrangements made by the newspapers concerned, and it had been made clear to them that the Post Office could not guarantee satisfactory transmission.

Getting a little ahead of our story, the results of these efforts make interesting reading. The Birmingham newspaper got good results during preliminary tests, but on the day itself transmission conditions were only moderate and it was rumoured that this newspaper received the first picture by homing pigeon! The "lining-up" and test transmission for the London newspaper group took place on the day before the event, and when one considers the arrangements shown in the table, it was surprising to find that within a couple of hours it was possible, in addition to providing duplex speech facilities, to send a picture sufficiently good to be relayed from London to the north of England and to appear in an evening newspaper.

Dam Hill at Pontrhydygroes	*Pontrhydygroes Exchange*	*Aberystywyth Exchange*
V.H.F. 11 miles	*Two subscribers' pairs for 1½ miles.*	*Two junctions 11 miles.*

Cardiff Exchange	*London T.K. Exchange*	*Renters*
Four-wire trunk 133 route mileage	*Four-wire trunk 131 miles radial.*	*Local ends*

Teleprinter facilities were also provided and all was set fair for the "big day". It is, therefore, sad to record that owing to an enforced move of the London group mobile transmitter at the last minute, although only of a few yards, the pictures transmitted on the day itself were poor, though the newspaper considered itself repaid by the fact that the teleprinter facilities remained of a good standard.

Some three weeks before the event we decided to confirm the bookings, subject to discussion, and at this stage all the picture transmissions firmly booked were within the capacity of Llandrindod Wells to handle.

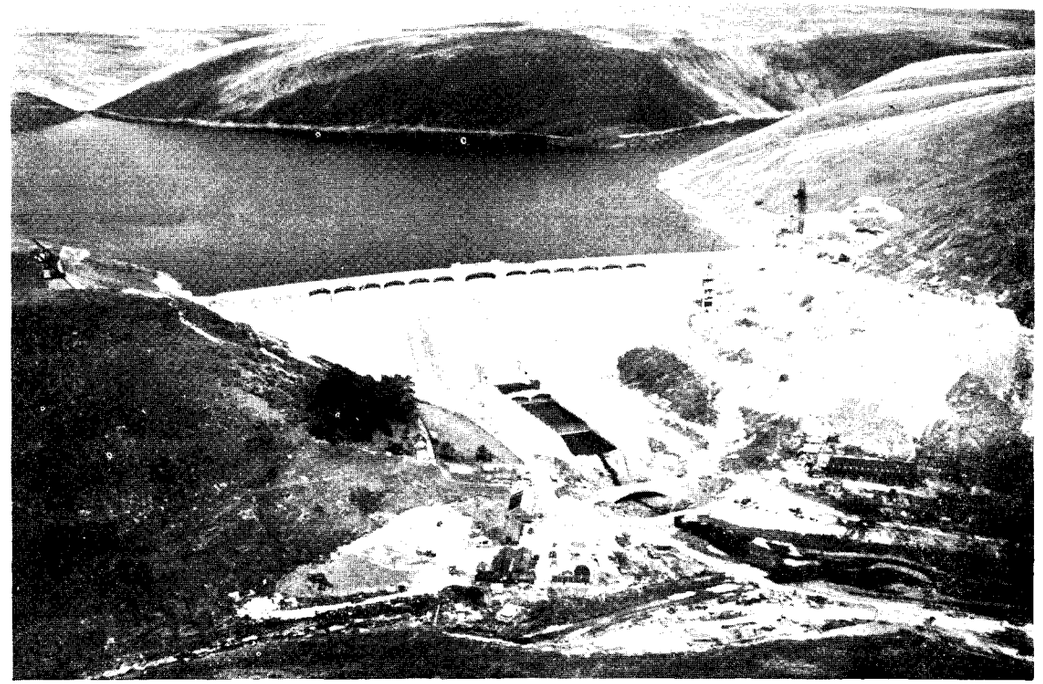
The Head Postmaster at Llandrindod Wells provided a room for the Press Steward, who was acting as the connecting link between the motor cycle courier team and the remaining body of the Press in Llandrindod Wells. Two rooms adjacent to his were converted into Press rooms with a bank of five telephones in each, and a store-room was converted into the picture transmitting room. Space was also made for the portable tents used by certain newspapers who were not using dark rooms in the town, and for parking the mobile vans used by certain papers.

On Sunday morning, only five days before the opening, some ill-intentioned person or persons attempted in the small hours to blow up the Fron aqueduct, some four miles from Llandrindod Wells and 18 from the dam. The pipe line to Birmingham from the Elan Valley (usually referred to as the Elan Aqueduct) is 73½ miles long and this attempt at sabotage, had it been successful, would have had extremely serious consequences. Fortunately, it caused only superficial damage.

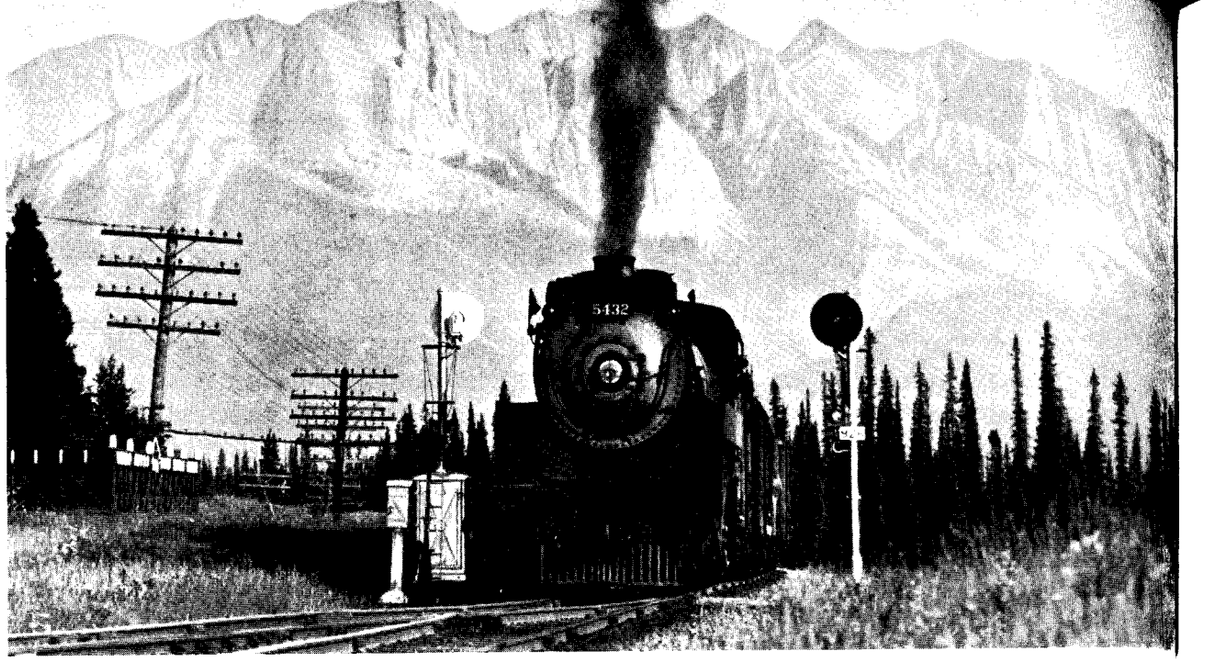
A final Press Conference took place in Llandrindod Wells on the eve of the opening, and we were staggered to learn that 57 newspaper men were present!

During each of the four days, from Monday, October 20, to the opening day, Thursday, the 23rd, long-distance trunk traffic at Llandrindod Wells was 65 per cent. above the normal daily average of about 220 calls. The greater part of the increase was due to the Press, who, it is estimated, made over 450 long-distance calls during the four days, as well as 25 picture transmissions lasting about 62 hours in all.

This record would not be complete without an expression of appreciation for the assistance readily given by many members on Birmingham Corporation staff, the Central Office of Information for Wales, our colleagues in other Areas, and last, but not least, for the co-operation of our friends of the Press.



A "Birmingham Post and Mail" photograph of the dam



Freight train in the Rockies, Bourgeau Range Mts.—note short telegraph poles. *(Photo. by courtesy C.P.R.*

Telegraph Communications in Canada

J. H. Richardson, O.B.E.

CANADA, NOW A MATURE NATION, WITH BUT a fraction of its resources under development, presents to the onlooker, no matter to what field he turns his eyes, an immense and complex picture. If he thinks of geographical space, he realises he is in the largest country in the Commonwealth, with 3,842,410 square miles—an area exceeding that of the United States (including Alaska), or Australia, or Europe. Just as the individual Canadian looks to the limitless prairies and forests and to the countless lakes and rivers still to be explored, so he looks in the industrial sense to the seemingly inexhaustible treasures of natural wealth which nature has stored up in them with so bountiful a hand.

Every visitor to Canada, from Governor General to tourist, senses the optimism that reigns. In this optimism the telecommunications industry shares, though it has not been free from the embarrassments due to the heightened demand for its services. The maturity of Canada is largely due to the efficiency of its communication services, which have, in a sense quite miraculously, overcome the difficulties of great distances and the climate.

The story of communications in Canada inevitably brings in the railways. Two great railway systems, Canadian National and Canadian Pacific, bestride the country in a mainly east-west direction, creating in their course constellations of small communities, the larger towns and cities appearing like stars in the galaxy. On the southern side, spurs from the main routes link with the United States railway systems, while the north routes, which it would be idle to call spurs, reach out to Newfoundland (connected by sea-crossing from Nova Scotia), to Saguenay and Chicoutimi in Quebec Province, through Manitoba to Churchill on Hudson Bay, through Alberta to the Peace River Block at Dawson Creek, and to Prince Rupert, to the most northerly coastal port of British Columbia. Two other railways are in operation, the Northern Alberta Railways Company and the Ontario Northlands Railway, which also run out to Hudson Bay. Supplementing these railway communications is a road system of phenomenal range and size (having regard to the thinly dispersed population—14,000,000 or 3.32 per square mile) appearing on the maps like a grid with a roughly square mesh. Many of these roads are of gravel, but in winter this does not matter. The bull-dozer and snow plough keep them effectively open throughout the year.

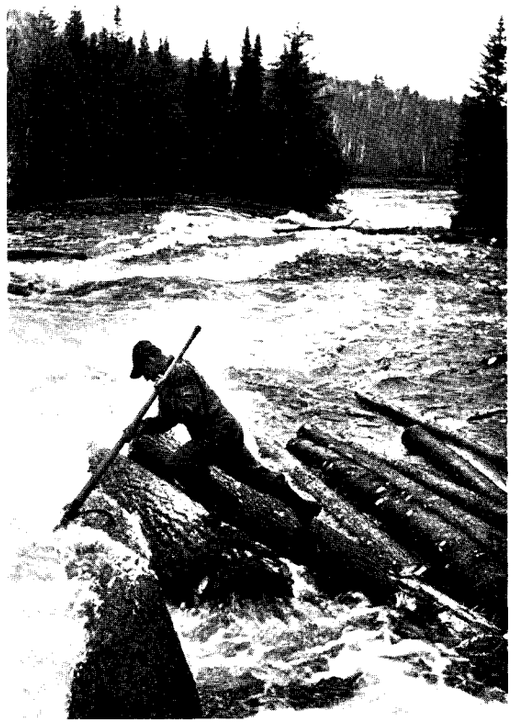
The observer from Britain will note, perhaps with surprise, that in Canada it is the Minister of the Department of Transport and not the Postmaster General who is answerable to the Federal Parliament at Ottawa for the conduct and efficiency of the telecommunication services. There are parallels to this arrangement in other countries, but in Canada there were good reasons for this development. In the pioneering days, when the railway tracks were run into and across virgin country, the railway telegraph circuits used for operating the trains were the only available means for communication of messages. No competitor in the communications field could have afforded to put up special lines and plant over the long distances involved with any hope of successful and economical operation. As the communities developed, the railway circuits attracted public traffic to themselves. That position still holds.

The Minister of Transport's responsibility to Parliament for the telegraph communication services follows as a consequence of his function in regard to the running of the railways. He has similar powers in regard to the telephone and overseas telecommunication services. A statutory body, the Board of Transport Commissioners, keeps a general watch in the public interest on the rates charged for telecommunication services, just as it does on the fares and freight charges levied by the transport services, and adjudicates on applications for increases in such charges. So if, in Canada, you want to send a telegram, you do not go to a post office, but to a railway station or to one of the fairly numerous commercial "offices" located in the main business districts in the cities; or, what is more usual, you telephone your telegram to one of these offices.

The invoice for your telephoned telegram comes to you in due course by post, quite distinct from your telephone account. Your call, if not a toll or long distance one, in effect costs you nothing, as subscriptions for telephone service in Canada are normally on the basis of unlimited local calls. A call from a call office ("pay telephone") must, of course, be paid for.

The Telecommunications Division of the Department of Transport, until March 31, 1950, the Radio Division, now takes within its jurisdiction the administration of the national and international radio laws and regulations and of regional agreements; it undertakes the construction, maintenance and operation of radio communication stations and of radio aids to navigation and the construction, maintenance and operation of the Federal Government telegraph and telephone services. The telegraph and telephone services are largely in nationally important locations where,

Log driver *(Photo. by courtesy Malak, Ottawa)*



owing to their remoteness and the sparseness of the population, successful exploitation is not possible.

In this article I shall deal mainly with the telegraph services; I hope to discuss the structure of the telephone service in a later article.

Telegraph Systems

Six internal telegraph systems operate in Canada. Four of them are run by the railways. The Federal Government operated the Dominion Government Telegraph Service. The sixth, the North-American Telegraph Company, is owned and operated separately. The Western Union and Commercial cable companies, as in Britain, have commercial offices in the large centres. The communication assets in Canada of the Pacific Cable Board, Cable and Wireless Ltd., and the Canadian Marconi Company were taken over in principle in April, 1950, and effectively on June 7, 1950, by the Canadian Overseas Telecommunication Corporation. The Corporation now, as a crown concern, operates the Canadian terminals of cables across the Atlantic and Pacific and with the West Indies via Bermuda, the radiotelegraph services between Montreal and the United Kingdom, Australia, Barbados, New York, the islands at St. Pierre and Miquelon, in the gulf of St. Lawrence, and the radiotelephone links with the United Kingdom and West Indies. The cost valuation of this telegraph industry, including cable, was given for 1950 by the Dominion Bureau of Statistics as $82,295,908 and the operating revenue as $23,922,225. Of these figures, the Canadian National and Pacific Railways are responsible for $62,438,756 and $19,978,075 respectively. Pole line mileage approximated 52,000 miles with a wire mileage of some 415,000. I quote these figures to indicate the major part played by railways in the telegraph service.

The first telegraph circuit in Canada was opened in 1846 by a commercial firm between Toronto and Hamilton. This inaugurated a construction era which eventually resulted in a telegraphic span from coast to coast. As the development more or less coincided with the extension of the railways, it was natural that the telegraph pole lines should follow the railway rights of way. This early association of telegraphs with the railways has resulted in the present existence of two transcontinental communication systems, which are in effect the communication departments of Canadian National Railways and the Canadian Pacific Railways. Today these two departments, working in close collaboration, provide high quality high-speed telegraphic voice and programme transmission channels. The equipment used covers a full range of modern telegraphic apparatus, carrier and telephone, for use with open circuits.

The Canadian railway authorities classify the telecommunication facilities required for the operation of the railway services as "local", "short haul" or "long haul", corresponding to the types of railway traffic they are intended to serve. "Local" covers the numerous public-address systems in railway stations, and the paging and inter-communicating systems in freight sheds and classification railway yards. It includes party-line communication in some cases and in others small automatic telephone systems.

The "short haul" includes point-to-point and party-line telegraph and telephone circuits for handling information between freight yards for inter-communication between maintenance staffs along the lines, and for despatch of trains. The inter-connecting wire is generally hard-drawn copper wire erected as open-wire single circuits or in pairs.

Linesman inspecting fixture at Arbutus Creek, Vancouver, B.C. *(Photo. by courtesy C.P.R.)*

Despatcher checking train positions by telegraph *(Photo. by courtesy N.F.B. Canada)*

The "long haul" classification includes inter-city telegraph and telephone channels for heavy-traffic trunk circuits. Such trunk telegraph channels may be circuits specifically assigned to the railways and operated with teleprinter terminal equipment, or they may be a portion of the general network. The telephone facilities are long-distance telephone circuits terminating in private branch exchanges, and they are used for administrative purposes. The circuits are of transposed copper wire pairs equipped with carrier telegraph or carrier telephone systems.

This brings us to another of these Canadian "magnitudes". During 1950 the volume of railway service telegrams reached a total of 25,000,000. The long-distance telephone network, made available for the administrative business of the railways, comprised some 17,000 miles of channel, of which 43 per cent. was carrier telephone. All this was exclusive of the facilities required for train despatching. The train despatchers operate some 41,000 miles of track, and the trains are despatched by telephone along some 27,000 miles of this length. Telephone train despatching circuits may cover up to 300 miles of track and the section despatched may be at some distance from the despatching office. Transmission considerations, therefore, call for special repeater equipment on the longer circuits; circuits not adjacent to the despatching office are connected with it by trunk circuits which may be derived from carrier telephone channels. In this way, overall line sections of 600 miles or more may have only one central despatching point.

The skill developed by the railways in dealing with their domestic telecommunication problems has put them in a fair way to dealing efficiently with public commercial communications. The

range and variety of these services is shown in the following list:

Telegraph. Telegrams, cablegrams, private-wire telegraph circuits, private-wire teleprinter networks, stock-market ticker services.

Telephone. Local telephone service, private-wire telephone channels, private-wire conference-type telephone networks, programme transmission networks.

In the Montreal area alone the cable plant required for the stock-market ticker and private-wire teletype systems, including that for the railways' own use, exceeds 5,000 conductor miles. In all, there is a total mileage of about 100,000 miles of circuit for these particular services. Among the many telephone exchanges provided by the railways is an 800-line automatic exchange at Gander, Newfoundland, with its associated subscriber plant. In addition, the two railways have co-ordinated their facilities to provide conference-type private-wire telephone networks for the Department of Transport, for air traffic control. These extend from coast to coast and include circuits added in recent years for handling international air traffic routing through Gander.

In 1932 the governmental body then controlling radio selected the communication departments of the two main railways to supply network facilities for broadcasting on a transcontinental basis. The railways work in collaboration with one another and with other communication companies and authorities as necessary. Today, the distribution covers 100 broadcasting stations and 75 repeaters; 12,000 miles of network are in use daily; and 1,000,000 hours of duplicate and special circuits are operated each month. The repeaters are equipped with remote reversal and pre-selection features.

Radio Links

The railways are faced with unusual operating conditions on the lines through the Rockies. None of the communication authorities in Canada regards as abnormal the exigencies of the Canadian winter, when temperatures in many places sink to 40 degrees below zero. The normal techniques have been developed in such a way as to enable the winters to be faced with a degree of equanimity, but in the Rockies, particularly on the western slopes, specially difficult conditions develop in the spring, when the heavy falls of snow thaw causing snow, rock and mud slides which carry away whole stretches of line. The introduction of four radio links, to provide emergency communications in the spring of 1950 was so successful that the system has been extended from four to nine stations. The equipments used are rated at 10 watts output power at radio frequencies of 2 megacycles. These are used on a push-to-talk basis and, with units spaced at 10-mile intervals, any one unit can be used to reach its two adjacent units.

Radio links, as in Britain, have been found an effective means of extending wire line circuits. These extensions have made use of equipments operating in the V.H.F. range. They consist of multi-channel installations providing either telegraph channels or a combination of voice and telegraph channels, according to requirements. One such installation bridges the water gap between Nova Scotia and Newfoundland. One terminal is situated at New Waterford, near Sydney, Nova Scotia, and the other on Table Mountain near Port-aux-Basques, Newfoundland. An intermediate repeater divides the span into two, 56 miles and 72 miles respectively. This link provides communications almost entirely over water by three working voice channels, and a voice order-wire by four separate radio channels in the 70-100 megacycles frequency band. One of these systems carries today 15 channels of voice frequency carrier telegraph and another has been modified to provide a wider sideband for use in the programme transmission network.

It is a far cry from the original 45-mile circuit of a hundred years ago, with its morse keys and receiving 'registers'. Today the railways system works with the most modern apparatus and circuit devices. The use of the teleprinter, reperforator and automatic plant is exploited to increase plant capacity. In a country where huge distances have to be traversed by the plant, its full exploitation is a paramount consideration. During the past ten years, 131,000 teleprinter circuit miles have been added, concurrently with a reduction of 28,000 morse circuit miles. By 1951, the railways were operating on 11 four-channel, 52 three-channel and 85 single-channel telephone systems. In addition, 139 carrier systems were in operation, giving 1,273 channels of carrier telegraphs. These channels add over 500,000 miles of channel circuits to the plant. Plans for the future include further use of teleprinters, of reperforator switching devices, and of multi-channel radio beams (V.H.F. and microwave) for extensions and expansion.

Linesman at work on communication pole *(Photo. by courtesy C.P.R.)*

In the large cities, the boy on the pedal cycle is a familiar figure. So far as I can gather, there is no delivery by motor-cycle. Many offices and commercial organisations are linked by teletype and teleprinter to the telegraph network and, as in Britain, receive their telegrams and cablegrams by these machines, but in the remoter places, the telegrams reach the nearest telegraph office (probably a railway station) and *ad hoc* arrangements have to be made for collection or delivery by the addressee. Some neighbour visiting the railway station may obligingly deliver it, or it may be telephoned to the appropriate spur of a long party line. If it is a confidential telegram, there may be objections to this and the telephoned addressee will be asked to call for his telegram. If there is a convenient postal delivery it may be posted, but here again the mail is often left in a box at a strategic point, conveniently placed for several addresses, some distance from its final destination. Among a small and widely dispersed population, the employment of special staff for delivery in rural areas would be wasteful, but in Canada, particularly in the remote areas, there is a long tradition of comradeship which finds much practical expression in helping public services such as these. Though delays are inevitable under the natural conditions which prevail, failures are few and far between.

Parliamentary sanction of the Canadian Overseas Telecommunication Corporation Act (1949) paralleled similar action by other Governments of the Commonwealth. Canada, as a partner government on the Commonwealth Telecommunications Board,* now has a voice in determining matters affecting world-wide as well as Commonwealth telecommunications.

**See "The Commonwealth Telecommunications Board" by Col. Shaw-Zambra (Journal, August, 1952).*

Canada's position is perhaps more complex and difficult than that of some of the other partner governments, as the Corporation has to compete with other privately owned organisations. Its future policy and the quality of service must therefore be developed in the light of that fact. The first step has been to unify in Montreal the company-owned cable services and the radio services. By international agreement the classification of telegrams and tariffs was revised on July 1, 1950, three weeks after the Corporation had begun operations, but in spite of the adjustments to the rate structure the revenues are being maintained substantially at the same level.

As an indication of the volume of business and the size of the organisation, the following figures are taken from the Corporation's balance sheet for the year 1950.

Income from operations amounted to $1,021,121; operating expenses $699,981. This includes $358,018 for the Corporation's share of Commonwealth network expense and $80,000 as a provision for adjustment; the rest, $261,962, is direct expense. The operating profit was therefore $321,140. Administration expenses were $279,124, diminished by an allowance of $112,415 for the administration of the Commonwealth network in Canada and a very small sundry revenue of $869, making a net expenditure for administration of $165,838. Traffic raising accounted for $66,053 and the Corporation's share of the Commonwealth Telecommunications Board's expense was $1,778. The excess of income over expenditure was $87,470. The initial year, 1950, was exceptional and these figures, having regard to the special provision on the credit side and the allowance on the debit side, should not be taken as typical of other years.

The author wishes to express his indebtedness for many courtesies and assistance in the compilation of this article to the Department of Transport, Ottawa, the Canadian Overseas Telecommunication Corporation, Montreal, the Canadian National and Pacific Railways, Montreal, the Bell Telephone Company of Canada, Montreal, and to the High Commissioner for Canada, Canada House, London.

Trunk Call Analysis

All commercial undertakings and public utilities find it necessary to undertake cost studies, either as a continuous process or by regular checks. They do this to find just how much it costs to make and market their goods, or to supply their services, so that a fair price to the consumer can be fixed. In the same way, the Post Office makes, from time to time, a detailed study of the trunk service to find out, among other things, what is the demand for the various facilities, what it costs to supply them, and whether the charges are adequate to cover these costs. About a million trunk calls are made daily, so that to analyse all trunk tickets for only one day would involve much work, and would interfere seriously with the normal accounting processes.

It is obviously impossible to analyse all calls made during the year, but a reasonably good result can be obtained by selecting quite a small sample of each day's traffic throughout the country. It has therefore been arranged to sample and analyse one call in every thousand and to continue the process over the year.

The analysis form will indicate, by means of appropriate entries, details on which information is sought and the completed forms will be sent to a central point where skilled machine operators will record the information on special cards by means of holes punched in various positions. These cards will be mechanically sorted and used to produce a large amount of very useful information. It will, for instance, be possible to find out how many calls were made in each charge step, what it cost to connect such a call at each distance, and what revenue was obtained from it; to find out, in fact, whether the charge for a call is adequate, too little or too much. Information such as this is essential in planning future Post Office policy in respect of services and charges.

On January 26, 1953, a new Telephone Training Centre was opened in the City of London. The students will be potential telephonists of the Inland Trunk and Continental Exchanges. It is not generally realised that the Telephone Trunk Centres of London constitute one of the major training organisations in the country. Over 6,000 men and women passed through them last year.

Harlow New Town, Essex

New Towns in the Home Counties

J. F. Medland, Telecommunications Branch, Home Counties Region

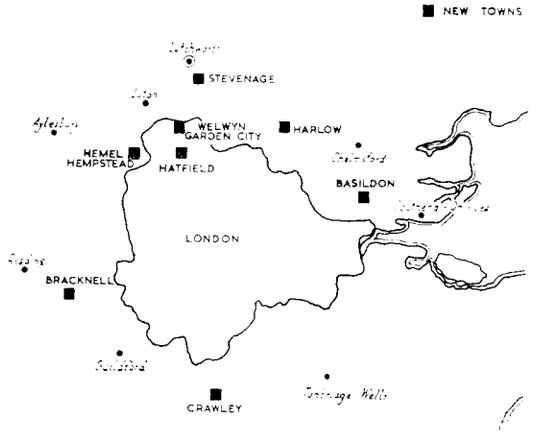
THE LONG RANGE PLANS FOR MOVING POPULATION and industry out of London envisage migration on a very large scale over the next twenty years or so into the adjoining counties. The "reception" territory may be roughly described as a fairly wide ring lying beyond the Green Belt, and although reaching 30 or more miles from London, still well within its sphere of influence. Some migrants are to be housed by existing towns which are to be expanded under the control of the present local authorities. For others new towns of considerable stature are being created in carefully chosen locations by Development Corporations specially constituted for the purpose.

In this article I propose discussing some of the main features of new towns in the Home Counties in so far as they have a bearing on telephone problems now being met.

Location of New Towns

The locations of these new towns in relation to London are shown on Map 1. From this it will be seen that they all lie quite near the common boundary of the Home Counties and London Telecommunications Regions, which runs more or less through the heart of the "reception" territory. Welwyn Garden City, started as a private enterprise between the wars, and nearby Hatfield, are shown to give the fuller picture. Letchworth, started in 1902, also as a private enterprise, and one of the first practical expressions of the technique of the planned new town, has been added as a matter of interest.

It has already been necessary to alter a Post Office regional boundary for a new town. This occurred at Basildon, Essex, where a salient cut right through the middle of the new town territory. At Crawley, Sussex, the area boundary between Brighton and Tunbridge Wells Telephone Areas ran through the new town and this has been altered to bring the whole town within the Brighton Area. No other changes are listed at the moment, but there may well be further regional and area



Map 1. Location of new towns

boundary adjustments, as the new towns gain stature and exert their influence on their surroundings.

Size of New Towns and Scale of Development

An idea of the ultimate size of the new towns and the scale of development expected is given by the following figures of approximate population before and after development:—

New town	*Before development*	*After development*
Basildon	20,000	80,000
Bracknell	5,000	35,000
Crawley	7,000	50-60,000
Harlow	5,000	80,000
Hemel Hempstead...	23,000	60,000
Stevenage	7,000	60,000

New Town Layout

The basis of the layout of the new towns is of general interest, and provides useful background information in connection with telephone matters, particularly long range forecasting of subscribers' line development.

Each new town is planned as a collection of clearly defined functional units carefully integrated according to geographical features and the needs of a well-balanced and self-contained community. These units may be very briefly described thus:—

(*a*) The town centre containing, among other features, the main shopping centre; commercial and government offices (national and local); cultural buildings; entertainments; and often some central garden or similar amenity.

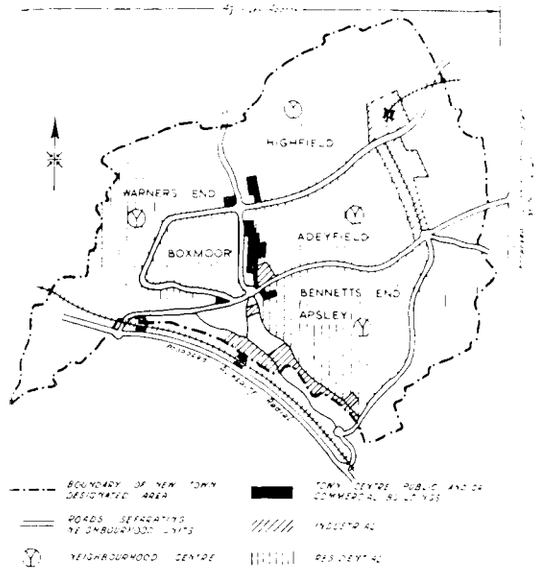
(*b*) Industrial areas (usually two) lying towards the outer fringes of the town, conveniently located for transport and usually to leeward of the prevailing wind.

(*c*) Residential neighbourhood units to a large degree independent of one another in their local needs. There are usually upwards of six of these with populations ranging towards a maximum of about 10,000, but usually about half this size. Each unit is to have its own local shops and centre forming the hub of the neighbourhood unit which will also have its own primary schools. Higher educational facilities are usually planned on a sharing basis. Local service industries, for example, builders' yards, laundries, small workshops (such as for boot-makers) may be located in a group near the neighbourhood centre, but they are sometimes suitably located for sharing between adjoining neighbourhood units.

One arrangement of these functional units round the central area of a new town is illustrated by Map 2 which shows a simplified outline plan for Hemel Hempstead. This new town differs from the others in that before development started it was already a fairly compact town of some 23,000 people with industry existing in the unit, shown on the map to the south-east, and a town centre which is to be redeveloped rather than developed. In most of the other new towns the projected central area is still green fields. Development at Hemel Hempstead started at about the same time in both the new industrial area to the north-east and the adjoining Adeyfield neighbourhood unit. Thus work and workers are near together. Adeyfield, already substantially developed, is expected to be virtually completed very soon. Bennetts End neighbourhood unit to the south of Adeyfield, is now well advanced.

In the new towns development on these lines—that is, from the fringe across towards the centre—is fairly typical. The development of an entirely new central area is usually scheduled in the middle period when the presence of a large and growing number of people demands community services on an appreciable scale.

Statistics of building and construction progress as at 31st December, 1952, (see Table A), show



Map 2. Simplified outline plan, Hemel Hempstead

that achievement is by no means confined to planning and definition of long term objectives:—

TABLE A

New Town	Dwellings: Completed and occupied	Dwellings: Under construction	Miles of road: Completed	Miles of road: Under construction
Basildon	597	335	8.5	3.6
Bracknell	192	197	1.2	4.0
Crawley	1,455	650	20.0	1.0
Harlow	1,712	1,259	18.4	4.1
Hemel Hempstead	1,579	1,259	20.0	—
Stevenage	1,035	644	15.6	13.0

These particulars show only a part of the whole picture, but it will be appreciated that under the general policy of balanced development, industry and community services are growing along with housing and road construction. At Crawley, for instance, 16 factories employing 1,400 persons are already in production. Twelve more under construction will employ an additional 1,400 persons and developments in early prospect will provide work for a further 1,100. Over 1,400 people are at present employed on the industrial site at Harlow and about 2,000 at Hemel Hempstead.

The photographs illustrate a few features of industrial and residential building in some of the new towns.

Telephone Problems

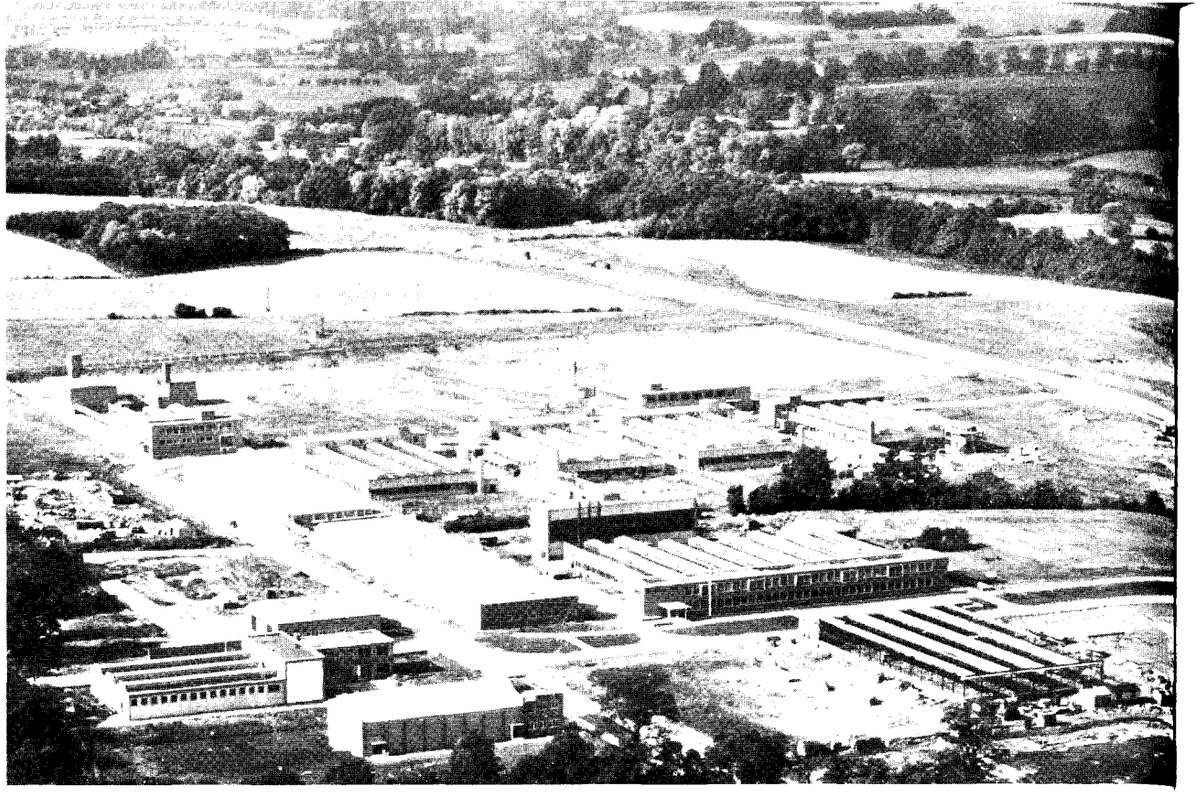
What the developments may mean in terms or new telephone plant, and some indication of the problems to be faced, can be gathered from the comparison in Table B between the present position, and future telephone requirements as envisaged tentatively in long range planning.

TABLE B

New Town	Exchange(s) serving bulk of designated area	Approx. line capacity	Probable exchange system serving developed new town	Approx. line capacity
Basildon ...	Basildon U.A.X. 13. Laindon C.B.S.2 (4 posns.). Vange U.A.X.14	200 700 1,000	Group Centre auto-manual board; main non-director auto exchange with possibly two satellites.	9,500
Bracknell ...	Bracknell C.B.10 (8 posns.).	950	Remote non-director exchange.	3,500
Crawley ...	Crawley C.B.10 (10 posns.). Pound Hill U.A.X.14.	1,400 800	Group Centre auto-manual board with main non-director exchange.	6,500
Harlow ...	Harlow U.A.X.7 Potter Street C.B.S. 2 (4 posns.).	800 360	Ditto	9,000
Hemel Hempstead	Boxmoor C.B.10 (11 posns.).	1,500	Ditto	7,500
Stevenage ...	Stevenage C.B.S. 2 (6 posns.).	700	Ditto	7,500

As this shows, all the new towns except Bracknell, the smallest, are expected to become group centres for trunk traffic. The probability that Basildon will require two non-director satellite exchanges, in addition to the auto-manual exchange, arises from the fact that the new town area is elongated and includes the two existing scattered communities centred on Pitsea and Laindon. Satellite exchanges are unlikely to be required in the remaining four new towns which are all smaller and more compact.

It should not be assumed, however, that the telephone problems of even the last four new towns follow a strict pattern to which a standard approach could be applied. Although much the same in their long term telephone needs, each has to be treated on its individual merits, particularly during



Industrial site development, Harlow New Town

the transition stages between existing and ultimate provision.

Exchange Equipment and Local Line Network

The main practical telephone problem at present in all the new towns might be simply described as that of stretching existing meagre resources to meet immediate growing needs until it is necessary or advisable to provide permanent and expensive capital plant on a scale in keeping with towns of the size ultimately expected. Even at Crawley, where the present manual exchange, and a U.A.X.14 at Pound Hill, can together provide enough exchange capacity for a few years, the problem is not a simple one. One of these exchanges is on the new town boundary and the other some way from the permanent automatic exchange site. If future growth were taken by them for too long, the growing local line network would converge on the wrong point thereby causing heavy wastage of plant later when all new town subscribers have to be connected to the permanent automatic exchange.

Alternative plans, both costly, may have to be considered: exploitation of the existing exchanges for some time to come, either by providing heavier gauge cable to connect the remote subscribers or by converting Crawley manual exchange from 22 to 40 volt working, and provision of a manual exchange in a temporary building on or near the site selected for the permanent automatic exchange. The same kind of local line problem seems likely to arise at Basildon where the two larger existing exchanges are near the probable practical centres of the two satellite exchanges and the projected town centre in open territory at the intersection of three existing exchange areas.

Because of this situation it is generally impracticable to start building the permanent automatic exchanges and general equipment policy has tended towards providing new manual exchanges in temporary buildings. These temporary exchanges may be on or near the automatic exchange site, as at Stevenage and Hemel Hempstead, or "off centre" but in the heart of the territory now being developed, as at Harlow. The initial equipment of the Boxmoor temporary manual exchange serving Hemel Hempstead opened in September, 1952, was 15 positions and 1,800 subscribers' lines, and its ultimate capacity 27 positions and 3,500 subscribers' lines. It should last about ten years or so, that is, up to the middle period of the new town development.

In the sparsely developed parts where the new towns are now growing, existing local line plant usually consists of small isolated overhead routes. These are used to serve building contractors, construction engineers, kiosks and a few essential subscribers until the new main underground duct and cable network, and the associated subscribers' distribution system, can be brought into service. It is economic to lay duct, based on the 20-year forecast, simultaneously with the extensive road construction now taking place. In addition to local line requirements the duct now being put down frequently includes provision for large numbers of trunk and junction circuits.

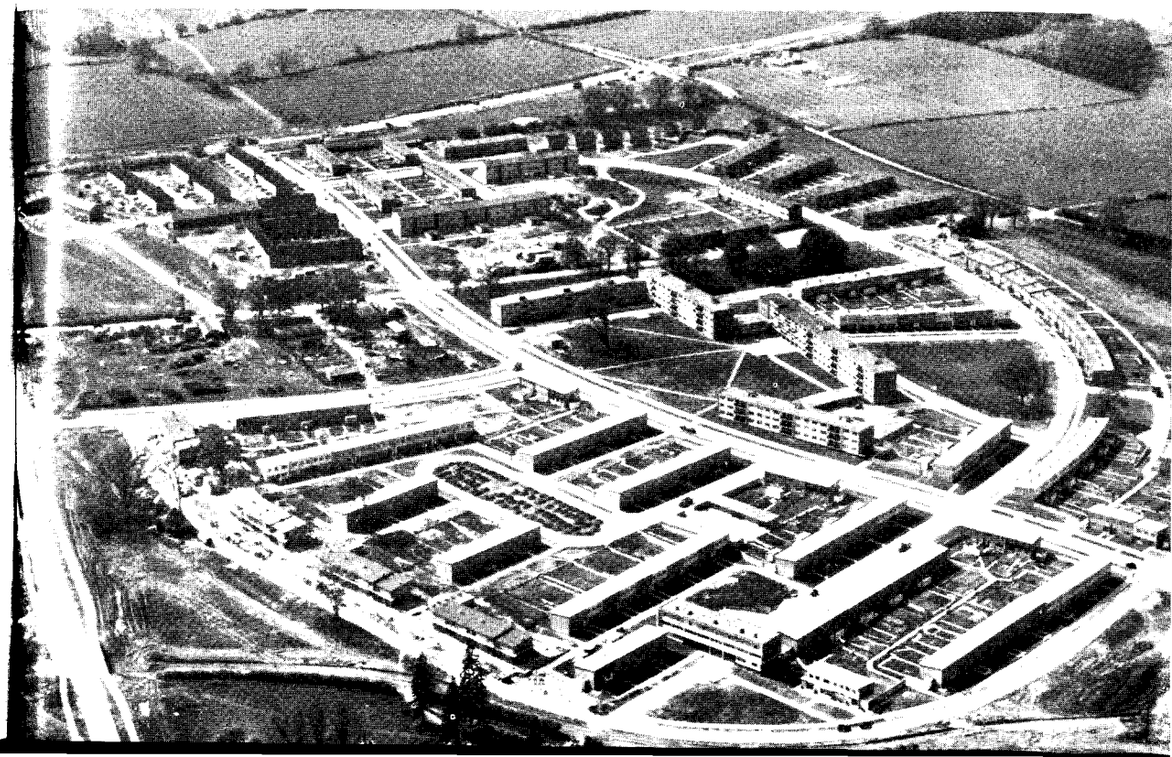
At the present time the cost of duct laying contracts in the new towns amounts to an appreciable proportion of the limited Regional annual financial allotment for this class of work, and it may well increase. The order in which the programme of road construction is carried out can, incidentally, further increase Post Office outlay, as, for instance, at Stevenage, where major roads, along which the larger telephone distribution cables would normally run, will not be constructed until a late stage in the development of the new town.

Site and Accommodation

Although there is no prospect of starting any of the permanent buildings for the automatic exchanges for some time, the size and location of sites required have to be determined in the very early stages. In addition to exchange requirements, provision has to be made for repeater station equipment and for the usual engineering accommodation such as motor transport, maintenance and installation controls, storage and so on. A temporary repeater station may also have to be catered for.

The practical centre for the projected main automatic exchange in each new town falls within or near the central area, where there may be restrictions on heights of buildings, but other exchange sites may be needed elsewhere, as at Basildon, where two satellite exchanges are

Part of Markhall North Neighbourhood, Harlow New Town



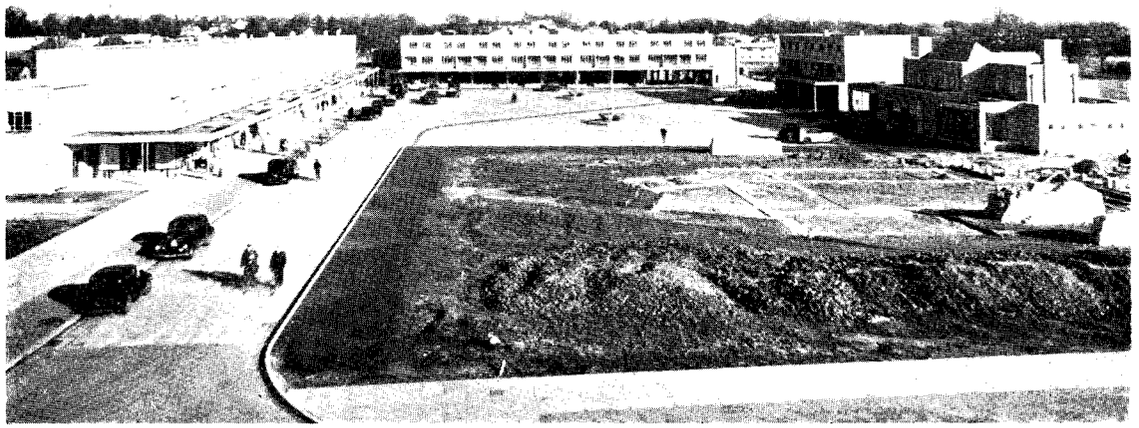
possibilities. Wherever practicable telephone exchanges and postal buildings are to be separate.

As mentioned in Table B all the new towns except Bracknell are visualised as becoming group centres later on. With the exception of Basildon the constituent exchanges in each group have been provisionally decided upon after careful consideration of the adjacent groups already existing or in prospect. Absorption of other groups by new town group centres is not yet entirely ruled out. Trunk and junction circuit requirements have already been forecast so that provision can be made in the national network, where necessary, when new audio and coaxial cables are being planned. As the new exchanges are well within the sphere of influence of London, their requirements in connection with such schemes as London trunk mechanisation and subscriber dialling into the fringes of the London Director System, have also to be determined now in broad terms.

Forecasts of trunk and junction traffic are usually made by applying growth factors to present day traffic, but while this method is acceptable for established communities, it is obviously of little value for exchanges in new towns because the present day traffic quantities have no meaning in relation to the future, after abnormally high development has taken place in a short time. A method used for long range forecasting is to base total traffic and direct routes on those existing and forecast for selected existing group centres which resemble the new town groups as envisaged at successive future stages in their main characteristics: for example, population, the proportion of potential business, industrial and residential users, location and community of interest with London and other nearby main traffic centres. No one existing group closely resembles the new town as envisaged in all aspects, but the picture for each new town group is usually derived from a composite impression of several likely groups. For instance, Slough and Luton, though larger than all the new towns, possess something of the probable industrial character of new towns and their traffic needs have been used as a guide in making forecasts for new towns, particularly those to the north of London.

Subscribers' Distribution Arrangements

Normal construction policy, based on engineering economics, is followed in deciding whether subscribers' distribution plant shall be overhead



"The Queen's Square", Adeyfield Neighbourhood Centre, Hemel Hempstead New Town

or underground. Thus, speaking generally, the town centre areas and the industrial sites are likely to have underground distribution. Elsewhere overhead or underground will be used according to circumstances. It has had to be made clear in this connection, that, in deciding between the overhead and underground, forecast telephone penetration is not the sole criterion in making comparative cost studies. Architectural layout and type of building for example, block flats, tower flats, distance between footway and building line, building on one or both sides of the road are of equal importance.

Forecasting Subscribers' Line Development

The Development Corporations can now supply us with approved outline plans of the new towns giving design particulars of the location and surface area of the individual functional units. They can also give us their figures for the total maximum population with breakdown into the various neighbourhood units; housing densities or, alternatively, average number of persons per dwelling for the neighbourhood units and the central high density residential area; estimated distribution of houses and flats over the lower, middle and higher income ranges; ratio of shops to population, and so on—in fact, most of the bulk statistical information familiar to Area Development Staff. In addition they can give us the broad picture of the expected rate and direction of construction and development.

These figures can be translated by Development Staff into their equivalents under the standard forecasting procedure and bulk forecasts of total lines in the new towns, as a whole and in each separate functional unit, thereby produced. When development of a particular unit is imminent a more detailed forecast on standard lines is made as soon as the building contract maps become available. It is at this stage that engineering cost studies are made to determine whether underground or overhead subscribers' distribution is appropriate.

At Regional Headquarters bulk forecasting is approached from a rather different angle for purposes of check. The process is mainly statistical and the approach one of breakdown rather than build-up. Examination of national and Regional development trends and statistics, and forecasts for towns which the new towns are likely to resemble in their main characteristics, suggests that a ratio of population to subscribers' lines at full development (say 1970) of the order of 9 : 1 is a reasonable assumption for planning purposes (the national ratio is about 10 : 1); and that the line forecast obtained by applying this ratio will comprise roughly two residential lines for every one business line. Totals of business and residential lines thus derived can then be allocated to the separate functional units, the greater bulk of business lines finding a home in the commercial and industrial units.

The allocation of business lines as between commercial and industrial units raised a difficulty which has been dealt with by sampling the ratio of lines per acre on the Slough Trading Estate and the Letchworth industrial unit. The enquiry suggests that this ratio is a fairly stable one, and can be used for new town studies provided the factory layout and distribution as between small, medium and large factories, is likely to be somewhat similar. This method of sampling seems likely to be capable of more extensive use in forecasting telephone development in new towns.

The Telephone Area and Regional approaches between them produce long range forecasts which are generally accepted as sound and reasonable provided the new towns develop roughly according to plan. We can also take heart in the fact that for exchange site and duct purposes, and long range needs generally, a certain amount of deviation from forecasts can be withstood without seriously affecting the broad picture of long range planning needs, and the decisions being taken in this connection.

Although, for obvious reasons, I have been able to touch only lightly on a variety of new town features, I hope I have given a broad indication of what is happening and how events are affecting our telephone organisation. The article reflects mainly the experience of the Regional Telecommunications Branch, but it seems likely that Telephone Area and engineering experience in these matters offer likely subjects for future articles.

I would like to express my thanks to my many colleagues in the Areas and at Regional Headquarters who have assisted in producing this article, and also the Development Corporations who were kind enough to supply some of the photographs, maps and statistics.

LONDON TELECOMMUNICATIONS REGION,

Mr. H. M. TURNER, Telephone Manager, formally hands over Coronation exchange to Mr. N. SIZER, M.B.E., Assistant Chief Engineer, Ministry of Works.

CENTRE AREA

The Traffic Division of Centre Area, London Telecommunications Region, is in two parts, each under a Chief Traffic Superintendent. One part is for the control of exchanges and the other for the control of Government P.B.X's in the Area.

The P.B.X. traffic staff is responsible for the equipment, staff and service of some 160 Government P.B.X's, several of which are comparable in size to London public exchanges, the largest having a staff of over 70. The total telephonist and supervising staff employed in these P.B.X's is approximately 1,500.

Many special P.B.X's have been installed to provide telephone facilities required in connection with events of national importance and interest, the most recent one being the special Coronation P.B.X. which was opened in February of this year. The photograph shows the formal handing over of the P.B.X. to Mr. N. Sizer, M.B.E., Assistant Chief Engineer, Ministry of Works, by Mr. H. M. Turner, Telephone Manager.

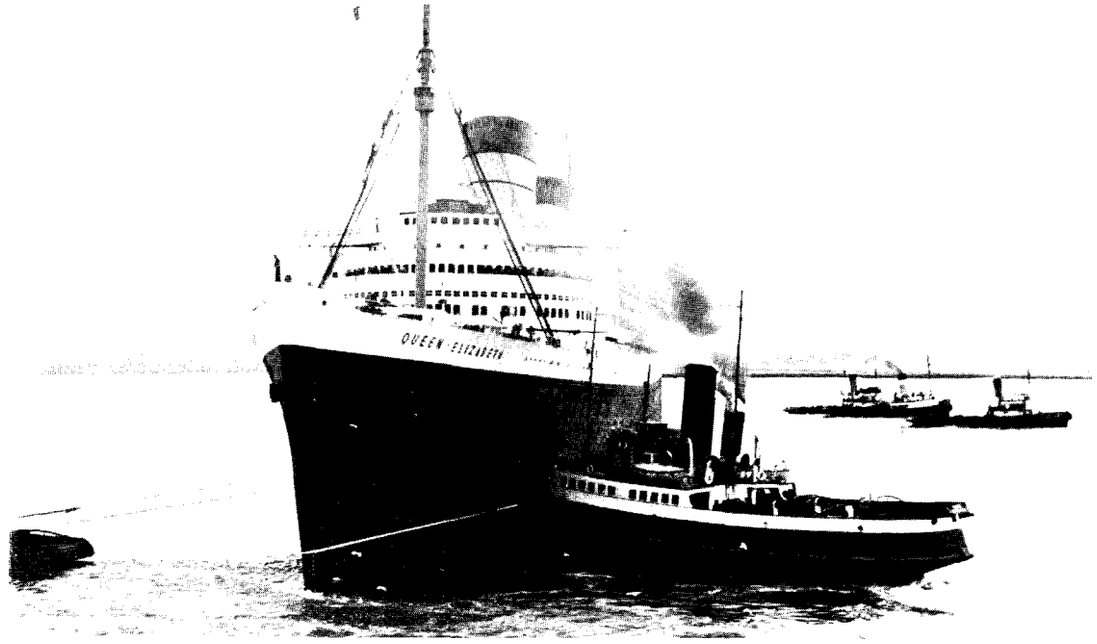
PORTSMOUTH TELEPHONE AREA

Portsmouth—steeped in Naval tradition and known familiarly in the Senior Service as "Pompey" will bring back many recollections to those who served in the Navy during the two world wars The Royal Dockyard, known the world over, was visited on many occasions by Pepys when Secretary to the Admiralty, and he makes frequent reference to the town in his Diary. It was from here that Nelson sailed to Trafalgar and it is here that his Flag Ship is now high and dry in a graving dock—attacked by the death-watch beetle, a more dangerous enemy than any she met at sea. The history of the city is not all of the past, nor is it entirely Naval; Field Marshal Montgomery was Garrison Commander here in 1938 and from Spithead and the Solent his armada sailed on "D" Day. In the world of literature Portsmouth is represented by Charles Dickens who was born here in 1812, his birthplace is now a museum visited by many each summer, particularly Americans.

Although a small one geographically, the Area, opened in 1939, covers part of Hampshire and West Sussex and includes such beauty spots as Goodwood, the loveliest English race course, and the Isle of Wight, well known to holiday makers. During the summer season the Solent and Spithead are the scene of great yachting activity culminating in Cowes week, known to yachtsmen internationally. Spithead, traditionally the scene of Naval Reviews, will this year see the Coronation Review, when the Fleet headed by H.M.S. Vanguard, our largest battleship, will be inspected by Her Majesty. The scene will be a memorable one.

The Area is 640 square miles; 44 auto exchanges—20 manual; 39,700 exchange connections; 61,100 stations; and 868 total staff.

Left to right: W. J. E. JENNER, Chief Clerk; E. McGONIGLE, Senior Sales Superintendent; J. E. CARR, Telephone Manager; R. GOFORD, A.M.I.E.E., Area Engineer; and J. W. G. TATCHELL, Senior Traffic Superintendent.



"Queen Elizabeth" *(Photo. by permission of Docks & Inland Waterways Executive)*

Telephone Service in Ocean Liners

F. E. Ferneyhough, Telephone Manager, Southampton

THE *Queen Elizabeth* CAN CARRY A FULL complement of nearly 2,300 passengers and over 1,200 staff. She is 1,031 feet long, has 1,050 rooms and a gross tonnage of 83,673. There are 10 decks above the water-line and the keel is nearly 40 feet below it. The bridge extremities look down 95 feet into the sea, and passengers may enjoy the pleasures of a swimming bath, hairdressing salons, shops, the cinema and many sporting activities. They may move about the ship by lifts or stairways and general comfort is assiduously considered to the smallest detail.

Such a "floating city" needs an extensive and complex system of communications between one point and another throughout the whole structure for the service of passengers and control of the catering, medical and other needs of the ocean traveller.

The following non-technical impression of the communication facilities aboard the *Queen Elizabeth* has been written with the kind co-operation of the owners, the Cunard Steam Ship Company, and of the International Marine Radio Company.

Passenger Service

A 6-panel, 3-position lamp-calling C.B. switchboard, equipped for approximately 700 extensions and six junctions, caters for general passenger requirements. The junction lines are not in use while the ship is at sea but they allow for shore service by ship to shore cable when she is berthed either at the Ocean Terminal Dock at Southampton or at New York.

At Southampton the six junction circuits are proportionately divided and connected to the switchboards of the Cunard offices and of the Docks and Inland Waterways, to which all incoming calls to the ship must be directed. There is

no public service direct to the ship.

The junction circuits from the switchboard are wired in parallel to " shore terminations " fitted in special compartments on both sides of the ship, where special arrangements are also made to include terminations for four public call office circuits. Connection with the shore is made by means of a 10-pair flexible cable which is brought aboard immediately the ship is berthed and connected to the shore terminations on the side nearer the quay by means of specially designed plugs and sockets.

The panel space of each of the three switchboard positions is occupied mainly with the answering jacks and associated calling lamps of lines from the main deck, 'A' deck and 'B' deck first class cabins.

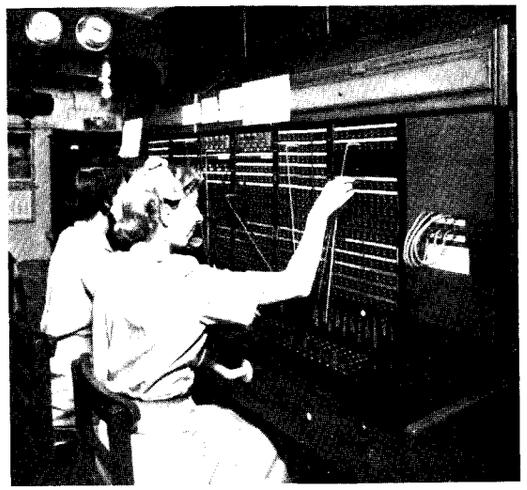
The two panels on each position are equipped with jacks corresponding, respectively, with the cabins on the port and starboard sides of those decks, the left hand panel of each pair corresponding to the port side cabins and carrying odd numbers, the right hand one relating to the starboard side cabins and carrying even numbers. The remaining lines from first class cabins on the sun and promenade decks, with numerous miscellaneous circuits, are spread over the six panels.

A pantry steward serves a set number of cabins. On the panel face the group of jacks corresponding to the cabins served by one pantry steward carry a distinctive colour. The outgoing jack of the circuit to the pantry steward serving those cabins carries a similar coloured label and by means of this colour code a call from any cabin occupant needing room service can immediately be connected by the switchboard operator to the correct steward.

Passengers' Telephones

Each first class cabin has its own telephones. The tourist and cabin quarters are not equipped with individual instruments, but there are telephones in the tourist and cabin deck corridors, and in all such places as the swimming baths, main hall, restaurants, cocktail bars and the passenger call cabinets—wherever, in fact, telephone service is likely to be an advantage to the convenience of passengers.

Four of these telephones, two in the first class main hall and one in each of the cabin and tourist class corridors, are arranged so that they can be converted for use as the " shore public call offices " when the ship is at Southampton. They are converted at the ship's exchange where the operation of special equipment diverts the calling signal via the " shore terminations " to the Southampton Post Office Telephone Exchange. Coin boxes are fitted in the cabinets so that when the circuits are switched to the shore, calls can be made by passengers to any part of the inland telephone system without the assistance of a ship's operator.



Three-position C.B. switchboard
(By permission of the Cunard Steamship Co., Ltd.)

The cabinets also contain American telephone instruments and coin boxes for similar use when the ship is in New York.

These telephones are extremely busy at times and they can be used for outward calls only. Their use for inward calls would, in any case, be precluded by the difficulty which would be experienced in finding and bringing to the telephone the person required.

As already mentioned, the majority of the switchboard extension lines are individually connected to the first class cabins on the several decks. Each cabin is equipped with an ivory coloured hand-microphone giving each passenger from his or her own cabin immediate access to other passenger friends aboard, to the various ship's quarters and to ship's personnel for many individual services. They may, for instance, get in touch with the Purser, the Chief Steward, the cocktail bar, the hairdresser, the valet service room or the hospital. For staff purposes there are lines, among others, to the Captain, the Chief Engineer, the sanitary engineer, the chief electrician, the wheelhouse, the generating room and the refrigerating machinery compartment.

It might be asked why in these days an automatic system has not been installed, but it is obvious that the manual system has distinct advantages when catering for a continuously changing complement of passengers. An operator can give ready guidance and advice on many different questions and can act as a personal enquiry bureau for the hundred and one questions asked by passengers who may be unfamiliar with their surroundings and in need of such helpful assistance.

A luminous call system enables any passenger, by means of cabin press buttons, to call either the bedroom steward or stewardess by the lighting of a red or green lamp in one or other of the sixteen continuously staffed stewards' pantries. As the pantry lamp is illuminated a similar coloured pilot lamp is lighted in the appropriate corridor, and an individual one outside the calling cabin. The calling cabin can thus be identified and the steward made aware of the precise point where attendance is required, in a matter of moments.

Kitchen Clerks' Cabinet

Any passenger may, by telephoning one of the various pantries or by using the luminous call service, demand special room meal service. For this reason an auxiliary telephone system is installed by which each pantry is directly connected by a line terminating on a jack with associated calling lamp to a small switching panel in the ship's main kitchen. Three clerks attend the panel which, being equipped with three single cords, allows a maximum of three simultaneous calls to be answered by means of associated hand-set telephones.

Switch panel in ship's main kitchen
By permission of the Cunard Steamship Co. Ltd.

As the required orders are given by telephone to the kitchen, a messenger is despatched from the deck pantry, with a copy of the order, to the deck waiter responsible for a particular group of cabins. On receiving the order the waiter goes to the kitchen, where he finds the order waiting or being prepared.

The Radio Receiving Room

The *Queen Elizabeth* radio installation, which is owned and operated by the International Marine Radio Company, is provided with four basic "two-way" operating positions. Two positions are primarily for radiotelephone circuits and two for radiotelegraph. However, the two radiotelephone positions may be also used for radiotelegraph purposes outside the hours when the telephone circuits are not in use. Although each radiotelephone operating position is nominally associated with a "two-way" circuit, it may be expanded to include further receiving points using the same transmitter on a "break-in" system. On the maiden voyage, as many as eight circuits were in operation at one time—for example, two radiotelephone and six radiotelegraph.

The design of the whole station is such that a number of radio circuits may be operated simultaneously or in multiplex, as it is more usually called, without mutual interference. Multiplex operation may be regarded as something of an achievement as, aboard ship, space is limited and it is impossible to separate transmitting and receiving aerials by more than a few hundred feet, whereas on land transmitting and receiving stations may be several miles apart thus greatly easing the interference problem.

Although the bulk of the *Queen Elizabeth's* radio traffic is passed through a limited number of stations in Europe and America, her range is world-wide and she regularly operates direct with stations in Australia, South Africa, South America and other areas. Direct radiotelephone circuits to London and New York are maintained throughout the voyage. For London the land link is the Post Office station at Rugby with its remote receiving points at Baldock and Cupar. The American side is usually handled by the American Telephone and Telegraph Corporation's station

A corner of radio transmitting room *By permission of International Marine Radio Co., Ltd.*

at Ocean Gate and associated receiving point at Forked River.

Radiotelegraph traffic for the United Kingdom and for many other parts of the world is passed through the Post Office station at Burnham in Somerset. Other European stations are also worked direct as required. In North America, where the radiotelegraph service is privately operated, traffic is dealt with mainly by the stations of the Mackay Radio Company and Radiomarine Corporation—for example, Amagansett, Long Island and South Chatham, Mass., respectively. Long distance traffic for Canada is handled mainly by the Canadian Government station at Halifax, Nova Scotia.

On board, the passenger usually deals with the radio accepting office on the promenade deck, through which most radiotelephone and radiotelegraph enquiries are initiated, either by a visit to the counter or by telephone from state-rooms. Radiotelephone calls can be made direct from the passengers' state-rooms or from the telephone kiosks distributed throughout the ship, via the telephone exchange. To ensure secrecy the line via the ship's exchange cannot be monitored by anyone except the technical radio officer.

Apart from the purely radiotelephone and radiotelegraph services the radio department is responsible for diffusing adequate radio news bulletins. Broadcast news from both sides of the Atlantic is relayed direct over the ship's public address system, but when it is broadcast at inconvenient times a magnetic wire-recorder is used. Radiotelegraph world-news from the United Kingdom and America is received and incorporated in the ship's newspaper, which is printed on board and issued to passengers.

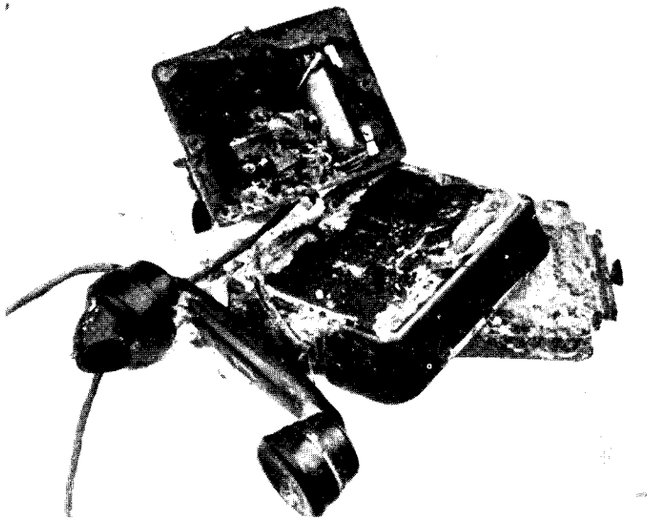
The radio staff varies in strength from 9 to 14, dependent on season and hence volume of traffic.

The *Queen Elizabeth* handles over 2,000,000 words of radiotelegraph traffic (excluding navigational messages and weather reports) and over 4,000 radiotelephone calls during an average year.

The Bridge

The bridge of the ship, as well as carrying all the intricate navigational instruments, is fully equipped with many telephonic aids which come into play largely during the normal manoeuvring during docking and departure periods. At that time all control staff are at stations and it is necessary for instant communication to be available to the engine room, to the various deck controls and to the fire station. All these many and various points are served by direct line from telephones associated with a main bridge panel.

Storm and Flood—The Aftermath



One of the many telephones which were completely submerged

POST OFFICE STAFF IN THE NORTH-EAST of Scotland and on the east coast of England will long remember the night of January 31 and the hectic days that followed.

The first blows fell on Scotland. The worst storm for many years, with the wind reaching velocities above 100 miles an hour, brought down trees in their thousands, and poles in their hundreds, wrecking in the process miles and miles of overhead wire. Some 180 telephone exchanges were soon isolated, 10,000 subscribers were either without service or were cut off from the main network and 500 trunk and junction circuits were put out of action. In the Aberdeen Area alone, 150 exchanges, 6,000 subscribers and 375 trunk and junction circuits were involved.

Sweeping south down the east coast of England the wind piled up an already high tide and in the darkest hours of the night the sea broke through the coastal defences in many places. Sutton-on-Sea and Jaywick telephone exchanges were soon flooded to a depth of 5 feet and the equipment was put out of action. At Sheerness, Canvey Island and Mablethorpe several inches of water entered the telephone exchanges, but, fortunately, damage to equipment was limited and restoration was possible when the water subsided. Nine other exchanges were isolated. In all 12,000 subscribers on the east coast were deprived of service.

The Humber coast radio station was flooded to a depth of several feet and was put out of action. The story of the great efforts made by the staff to keep the service going under terrifying conditions has been told in the March issue of the *Post Office Magazine*.

Such was the position when Regional Directors took stock the next day. Scotland had clearly the biggest task, and by Monday, February 2, gangs were on their way from other parts of Scotland, from Areas in England as far south as Exeter, from Wales and from Northern Ireland. In all 59 gangs consisting of 240 men were brought into the storm damaged area together with 27 men borrowed from the Army. At the height of the work no less than 900 men were working to restore the situation in Scotland. Progress was astonishingly rapid as is evident from the following statement :—

Date	*Exchanges isolated*	*Subscribers cut off*
1st Feb.	180	10,000
2nd ,,	119	8,400
3rd ,,	75	7,400
4th ,,	49	7,500
5th ,,	27	7,000
6th ,,	22	6,400
7th ,,	8	5,900
9th ,,	5	4,600
13th ,,	1	3,200
17th ,,	—	1,956

Damage to a kiosk at Sutton-on-Sea

Much of the repair work was, of necessity, on a temporary basis and will remain so for several months. Indeed some of the overhead routes will never be rebuilt as the opportunity is being taken to put the more exposed routes underground.

The quantities of stores used in this operation were simply staggering. Amongst these were 140 tons of copper wire, 145 miles of interruption cable, 100 miles of cable I.R.V., 169 poles and 10 tons of stay wire. And this is only a beginning. For restoration of service on a permanent basis it is estimated that over 100 man-years work will be involved and that the cost of the work, including the value of stores, will be of the order of £170,000.

The tragic devastation caused by the floods in England is well known. The work of telephone repair went ahead as conditions permitted, and in many places the staff had to work under very trying conditions. Restoration of services went on at a great pace. By Monday, February 2, all exchanges were working again except for Sutton-on-Sea, Jaywick, Mablethorpe and Canvey Island and even in these areas temporary service to emergency lines was being given; at Canvey Island from an emergency switchboard installed and working by 9.30 a.m. on February 1, in other areas from neighbouring exchanges. By February 6 service had been restored to 7,500 subscribers and of the exchanges affected only Sutton-on-Sea and Jaywick were still not working; at each of these places it was clear that facilities would have to be given for a time by means of a mobile U.A.X. and in fact a site for one had already been obtained at Jaywick. The temporary exchange became fully operational on February 10.

At Sutton-on-Sea, however, the area was evacuated as further flooding was feared. Little was possible in this area until March 21, when all danger of further flooding had passed. On that day a mobile U.A.X. was moved in and on March 23 it was brought into operation.

Providing emergency service at Sutton-on-Sea

A temporary mobile radio station was set up at Louth on February 4 to take over the work of the Humber radio station, which would clearly be out of action for some time.

As in Scotland much of the work of restoration was carried out on a temporary basis and the permanent repairs will take many months to complete. The estimated cost of restoring the situation in England is about £100,000.

This is a brief outline of the damage to Post Office plant, but it does not represent the whole of the part played by the Post Office. As soon as news of the floods was issued, telephone calls and telegrams poured in from people with friends in the stricken areas, and there was considerable congestion on many routes. On the telegraph side the difficulties were increased by the fact that seven offices were flooded and another isolated.

During this time the Post Office also provided additional facilities for other hard hit Departments. A teleprinter network for flood warnings was set up between the Headquarters of the Ministry of Agriculture and seven centres in the Eastern Counties as well as a line to Broadcasting House. The request for these facilities was received on February 6; the first four of the circuits were working the same day and the whole network by the next evening.

Generous tributes have been paid in the House of Commons to the work of Post Office staff during this period. We have rather come to look on devotion to duty, and immediate answer to demands in emergency, as a matter of course, but the Assistant Postmaster General recognised more than these when he said in the House of Commons "What struck me so much about this was that in England and also in Scotland the Post Office staff did not have to be sent for—they turned up".

Radio and Radar Technique

RADIO AND RADAR TECHNIQUE. By A. T. Starr. Sir Isaac Pitman & Sons, Ltd. 812 pp., 75s. 0d.

Dr. Starr's book is intended for students of radio and radar who have already acquired, in the words of the preface, "the more elementary and well-known body of information . . . in the course work for a University degree"; and, to quote again, he aims in 812 pages "to cover the essentials of the radio and electronic field in one volume".

Accounts of radio technique of this advanced level have hitherto been confined to original papers and to text-books restricted to one part of the field, and it is usually considered essential that senior students should develop the ability to find and use the information contained in original sources. However, the volume of publication, even in so limited a field of knowledge as radio and radar, is so great that few can hope to keep abreast of developments over the whole field. Books like the present one have their part to play in bringing to the non-specialist, and to the specialist outside his normal sphere, a body of information more advanced than he would normally have conveniently available.

Though comprehensive, this book shows some evidence of its author's particular interests. Microwave techniques are treated more fully than those of lower frequencies, though it is true that much has recently been achieved in that range. The book is divided into 510 pages of main text and 281 pages of mainly mathematical appendices, but the division is not always clear and makes for a somewhat disjointed treatment. Appendix I, a table of morse code symbols, seems oddly out of place.

Communications engineers have been in the habit of referring simply to "Star", and meaning the author's earlier book "Electronic Circuits and Wave Filters", and it is safe to predict that the success of the present volume will soon make that simple reference ambiguous.

F.J.M.L.

Six Figure Telephone Numbering Scheme

Because of the development of the telephone system in Leeds a six figure numbering scheme has been introduced. This is the first time in this country that all subscribers on an exchange will have six figure numbers. As an aid to memory the six figure numbers will be printed in the telephone directory with a hyphen before the last four figures.

NOTES AND NEWS

G.P.O. Productivity Team — First Polythene-Insulated Cable — Robot Subscriber — Good Work — Radio Communication for Shunting Locomotives

G.P.O. Productivity Team.—A Post Office Engineering Productivity Team has spent five weeks (February to March) in the U.S.A. studying the maintenance of automatic telephone exchanges, fault liabilities, service personnel and welfare and general organisation. Their report will be published by the British Productivity Council (formerly the Anglo-American Productivity Council), and we hope to publish shortly an article by the leader of the team, Mr. R. W. Palmer, Assistant Staff Engineer, of the Engineering Department, Organisation and Efficiency Branch.

The team represented both the official and staff sides and included Mr. E. Hopkinson, Area Engineer, Bradford; Mr. W. J. A. Hughes, Southend-on-Sea, and Mr. C. Morgan, Birmingham, both Technical Officers of the Post Office Engineering Union; Mr. J. Prescott, Area Engineer, Centre Area, London, and Mr. A. C. Young, Assistant Engineer, Brighton, of the Society of Telephone Engineers.

This was the 67th British Productivity Team to visit America, but was the first wholly Post Office team.

* * *

The First Polythene-Insulated Carrier Cables for Land Communication.—The first installation in the world of polythene-insulated carrier cables for land communication was formally handed over to the Copenhagen Telephone Company in January.

The two 12-quad-polythene-insulated, polythene sheathed cables were manufactured by the Telegraph Construction & Maintenance Company of Greenwich, and were laid between Copenhagen and Roskilde (approx. 20 miles). Each pair can carry 48 telephone channels with a possible increase to 60 channels per pair.

The installation forms part of the first stage of an extensive new telephone network now being installed in the Island of Sjealland by the Copenhagen Telephone Company.

In contrast to normal paper-insulated, lead-covered telephone cables, the copper conductors are completely insulated with solid polythene and the cable is sheathed in polythene. The cable, as a result, is remarkably light in weight, which makes installation easy, and the fault liability is low, since polythene is unaffected by water and if the sheath is accidentally penetrated, without damage to the insulated conductors, circuit continuity is maintained.

* * *

Provision of Service.—During the quarter ended 31st December, 1952, the gross demand for telephone service increased by 9,812 as compared with the previous quarter, but was down by 8,884 on the corresponding quarter of last year. Outstanding applications fell during the 3 months by 14,774 to 433,122.

* * *

B.B.C. Outside Broadcasts.—During February 640 outside broadcasts were provided for the B.B.C. compared with 400 for February 1952. This is the highest number recorded for any single month. A large number of these circuits were provided to enable the B.B.C. to broadcast special news items on the flood disaster.

* * *

Robot Subscriber.—To assist in tracing faults in automatic exchanges—especially elusive or intermittent faults, which can be both exasperating and time-consuming—a machine has been developed which acts like a robot subscriber, having a selection of exchange lines. It dials selected spare numbers, without haste but without pause, until it encounters a fault condition, when it announces the fact so that the maintenance engineer can identify the offending piece of mechanism and make the necessary adjustment. The machine, known as the Artificial Traffic Equipment, differs from standard routiners in that it imitates calls going right through the exchange system whereas the routiners confine their tests to selected portions of the exchange. The Artificial Traffic Equipment has been made up in transportable form so that it can be taken from exchange to exchange as needed. Simple strapping alterations make it suitable for practically any type of automatic exchange in the United Kingdom. If desired, the machine can be set so that instead of stopping when a call fails, it merely records the fact and carries on testing. Used in this way it provides an index of the plant performance which is a useful supplement to the service observations, and which is, moreover, obtainable immediately.

To help new subscribers and others to complete their sets of the Journal, *the Business Manager will be pleased to supply copies of issues during the first two years (November, 1948, to August, 1950, inclusive) at the reduced price of 6d. a copy, plus 1½d. postage.*

The full price remains chargeable for later issues.

* * *

Good Work.—Every month on the last editorial page we name the members of the Editorial Board, the editorial staff, and the Regional Representatives. It would occupy too much space to name, also, the 140-odd Sales Representatives throughout the Kingdom, but they should not be overlooked. However excellent the contents of the *Journal* they would be wasted unless they were read by the largest possible number, and it is to the work of the Sales Representatives that we owe our wide circulation.

One, in particular, deserves to be named in this issue, Miss E. M. Upfold, of Bournemouth Telephone Area. In twelve months, in spite of increasing economic difficulties and the increase in the price of the *Journal*, she has increased sales in her Area by some 77 per cent. Such a result was achieved only by enthusiasm, originality and hard work.

* * *

Radio Communication for Steel Works Shunting Locomotives.—According to the "Railway Gazette" radio communication is being used between control centres and the locomotives used on the railway system of the Steel Company of Wales, Ltd. The equipment was installed by the General Electric Company, Ltd., three control centres are linked to a central fixed transmitter. To avoid interrupting working locomotives, other than the one called, the operator at a control point dials the number of the wanted locomotive. By means of a tone sequence system this dialling causes a bell to ring and a lamp to light only in the cab of the called locomotive. At the same time an engaged lamp lights in all other locomotives warning the drivers that they cannot be answered if they call before the lamp is extinguished. Similarly, each Controller knows if the others are using the station. Incoming calls from the locomotives are heard at all three control points and can be answered by any of the three.

A woman telegraphist operating an "A.B.C." instrument of the 19th Century at the C.T.O. Exhibition in 1939. An article on "Early Telegraph Instruments" will appear in our next issue

* * *

Broadcast Receiving Licences.—12,890,473 Broadcast Receiving Licences, including 1,892,832 for Television and 172,657 for sets fitted in cars, were current at the end of 1952.

Book Review

MEASUREMENTS AT CENTIMETRE WAVELENGTH. By Donald D. King. D. Van Nostrand Company, Inc., New York. Messrs. Macmillan & Co., Ltd. 327 pp. 42s. 0d.

The author of this book, which is one of the Van Nostrand Communications Engineering series, is Assistant Director of the Radiation Laboratory of the John Hopkins University. The title is a little misleading as Mr. King states in the introductory chapter that the term "centimetre wavelength" is used to mean roughly 1 centimetre to 3 metres. However, although there is considerable material dealing with coaxial line apparatus, the main emphasis is on waveguide circuits.

The book is written as a treatise for design engineers and is set out in the form of a handbook suitable for easy reference. The reader is assumed to have a professional standard of mathematical knowledge and general telecommunications background.

Two chapters are devoted to the theory and practice of transmission of power in lines and waveguides, and to the types and characteristics of centimetre wave generators. Although this material is not strictly "measurements" it is desirable that the reader be familiar with these subjects in order to appreciate the remaining chapters, which deal with the measurement of power, frequency, spectrum distribution, impedance, and radiation and antenna measurements. The methods of measurement given are up to date and the principles, advantages and drawbacks of the various methods, and the features of the measuring apparatus required, are discussed. In conclusion, there is a glossary of symbols and a subject and author index.

The book is copiously illustrated with diagrams and has many references to other technical articles. Many useful formulæ are given in the text and the reader is not confused by the inclusion of mathematical proofs. The style is in some places a little abstruse, but, generally speaking, the material is presented in a clear manner. It is unfortunate that a rather light typewriter-style of type has been used for the text, which is not easily readable—at least, it is not familiar to English readers.

D.G.J.

Correction—We regret that in the article "Restoring the Transatlantic Cable" (February-April issue) H.M.T.S. Monarch was once referred to by inadvertance as H.M.T.S. Renown.—Editor.

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Contributions. The Editorial Board will be glad to consider articles of general interest within the telecommunication field. No guarantee of publication can be given. The ideal length of such articles would be 750, 1,500 or 2,000 words. The views of contributors are not necessarily those of the Board or of the Department.

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