Post Office Telecommunications Journal

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Contents

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Comment

AFTER A SEVEN YEARS' INTERVAL, THE GREETINGS Telegram service is to be revived. First introduced on July 24, 1935, it immediately gained wide popularity. In the year ended March, 1937, 2,200,000 telegrams were sent. In the year before its suspension, over 9,000,000 greetings telegrams were sent. Many people, however, were then sending Greetings Telegrams in place of ordinary social telegrams in order to avoid the implication of bad news which inevitably, in war time, came to be associated with the ordinary telegram.

Since the war, the possibility of reintroducing the service has been considered several times, but paper shortage and the man-power situation have hitherto prevented its resumption. There is clearly a great market for the service. Its popularity will be increased by efficient work by the staff employed at the counter, in the operating rooms and in delivery.

The charge is 2 - for 12 words, plus 1d. for each additional word, as compared with the charge on ordinary telegrams of 1 - for 9 words, plus 1d. for each additional word. This is higher than it was when the service was introduced in 1935, when the ordinary telegram cost 6d. for 9 words, plus 1d. for each additional word, and the Greetings Telegram cost 3d. extra. But none the less, the new Greetings Telegram will, it is believed, be popular, and will be regarded as a good bargain. Its return will be welcome to the public and to the staff in the telegraph service alike.

Suite of new teleprinter automatic switching positions in the Central Telegraph Office, London.

Automatic Switching for Telegraphs

by D. T. Gibbs, O.B.E., T.D., Inland Telecommunications Department

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The article by Mr. F. J. Tickner, which appeared in Volume 1, No. 1 of this Journal, referred to the history of telegraph switching and to the Post Office decision to automatise their inland system. The following article describes in more detail the automatic switching scheme, and the arrangements for the opening of its initial phase, which came into operation on October 30, 1950.

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ARRIVAL OF AUTOMATIC SWITCHING

UP TO 1943, THE DISPOSAL OF INLAND TELEGRAMS between teleprinter offices depended upon a network of point-to-point circuits, and such a lay-out necessitated a number of manual retransmissions on the majority of telegrams. Each retransmission increased both the overall transit time between offices of acceptance and delivery, and the liability to errors.

As an interim measure, a system of switching circuits through teleprinter manual switchboards was introduced, and resulted in a considerable saving of manual retransmissions at intermediate offices, as about 40 per cent. of the teleprinter offices had direct access to each other by through switching at one or two switchboards. This system had two weaknesses, namely, the amount of time taken to set up and to break down the switchboard connections, and the fact that all teleprinter offices were not connected to the switching system. The Post Office has now embarked on the next stage of the telegraph mechanisation programme with the introduction of the first phase of the "Teleprinter Automatic Switching Scheme". On completion of the final phase, any teleprinter operator will, by dialling a number of digits (rarely more than six) be able to set up a teleprinter connection through automatic switches to any other teleprinter office in the country in less than ten seconds and, on completion of the transmission of a telegram, release the whole connection in a fraction of a second.

Under manual switching, the average number of transactions per telegram—each sending and receiving operation in an instrument room, including phonogram and telephone-telegram handlings, counts as one transaction—has been estimated at 4.3. With automatic switching, this figure should be reduced by about one transaction per telegram, and, as the total inland telegrams handled per year is 41 million, a very appreciable saving of operating staff will be achieved. The saving will more than offset the additional annual

Type of Switching Centre			Bothway Teleprinter Trunk Routes provided from centre in first column to :—	Types of Circuits serving Teleprinter Office* which can be connected to centres in first column
	Zone			
Birmingham Leeds	Bristol London North	Glasgow London West	All Zone and Class 1 centres, and to Class 2 centre where justified by traffic.	Physical line with not more than 10 per cent. distortion or Voice-frequency channel with physical extension of negligible distortion.
	Area Centre, Class 1			
Bangor Exeter Liverpool Newcastle	Belfast Grimsby London Centre Nottingham	Edinburgh Hull Manchester Southampton	All Zones and to any other centre where justified by traffic.	Physical line with not more than 10 per cent. distortion.
	Area Centre, Class 2			
Aberdeen Cardiff	Bournemouth Sheffield	Brighton Swansea	Home Zone and to any other centre where justified by traffic.	Physical line of negligible distortion.

** A teleprinter office will be connected direct to its appropriate switching centre, and to that centre only.*

charges on the automatic switching equipment.

THE AUTOMATIC NETWORK—TRANSMISSION REQUIREMENTS

To meet transmission limitations, the network is designed so that no switched connection will be worse than (*a*) four links consisting of two voice-frequency channels and two physical station lines of not more than 10 per cent. distortion, or (*b*) five links with three voice-frequency channels and two physical lines of negligible distortion.

SWITCHING CENTRES

To achieve these transmission requirements and, having regard to economic, traffic and engineering considerations, 24 automatic switching centres will be established. These centres are graded into three types, namely, Zone, Area Centre Class 1, and Area Centre Class 2, and the manner in which they will be inter-connected, and the circuit requirements of offices to be connected to them, are given above. A diagram showing the proposed ultimate network was given in Mr. Penn's article in the May, 1950 issue of the Journal.

NUMBERING SCHEME

The automatic switching equipment is similar to that used in non-director telephone exchanges. Each teleprinter office is identified by the two-letter code of its switching centre plus its final selector number, a three-digit numbering scheme having been adopted at all centres except London North, London West and Glasgow, where four-figure numbers are to be used. For the main instrument room at large switching centres, however, "O" is allocated, as the local extension circuits are taken from first selectors. To obtain any one of the 525 offices at present planned to be connected to the network, a numerical routing code, which may be 1, 2, 3, or 4 digits, is dialled to obtain access to the distant switching centre, and this is followed by the automatic number of the required office. For calls between offices on the same centre, no routing digits are necessary.

TELEPRINTER OFFICE POSITION EQUIPMENT

On each operating position, a dialling unit (see figure 1), which contains the auxiliary components required for the setting up and control of calls, is fitted alongside the teleprinter. This machine, known as the Teleprinter No. 11B, was described in an article in the February, 1949 issue of the Journal.

The dialling unit has the following exterior items:—

On operating panel. Dial, dial lamp and 4 keys giving dial and clear, incoming reset, paper-failure alarm cut off, and out-of-service facilities.

Above operating panel. The dialling list showing primary and alternative dialling codes of the 24 switching centres.

Top of unit. Green connection lamp and a red paper-failure alarm lamp.

For offices requiring not more than eight operating positions, an "L" shaped unit table, containing all the power and auxiliary apparatus required for the

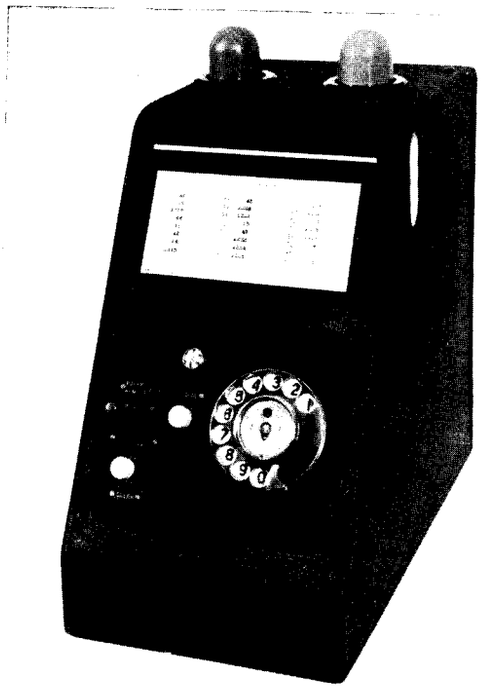
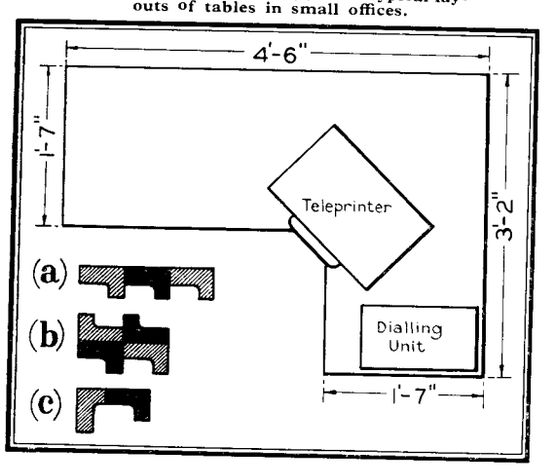


Fig. 1. The Dialling Unit.

teleprinter position, has been specially designed. Figure 2 gives details of the unit table. It shows the ready manner in which the tables may be laid out in a small office; examples (*a*) and (*b*) are standard lay-outs, but other arrangements, such as (*c*), could be adopted to meet accommodation requirements. At large offices, the equipment is mounted on continuous bench tables on the basis of a minimum of 4 ft. 9 ins. length for each operating position.

Fig. 2. Plan of a Teleprinter Unit Table. Examples (a), (b) and (c) shew typical lay-outs of tables in small offices.



SETTING UP A CALL

For the purpose of following the operating procedure, the steps taken to send a telegram from Watford to the Derby office for delivery will be described. The directory number of Derby is "BM 521". The Watford teleprinter operator sees from her dialling code list that the routing digits for BM, that is Birmingham, are "12", making a composite number for Derby of "12521". She depresses the dial key and dials 12521; "12" routes the call via the London North switching equipment to the Birmingham switching centre, and 521 operates the first and final selectors and so makes the connection to a disengaged teleprinter circuit to Derby. The green "connection" lamps on the Watford and Derby dialling units glow, and the teleprinter motors on both sending and receiving machines will have been started. Without the intervention of either operator, the answer-back drum on the Derby teleprinter transmits a signal which causes the office code "BM 521" to be printed on the tape of the Watford teleprinter. The Watford operator depresses her "Here is" key and this results in the Watford office code being printed at Derby. She teleprints the telegram and then operates the "Who are you" key, so that the receipt again of the distant answer-back signal confirms that the connection has been maintained throughout the transmission. She depresses her clear key which disconnects the call completely and stops both teleprinter motors. The green light is maintained, however, at the distant end until an operator attends to the incoming tape.

OPERATING SIGNALS

The equipment incorporates facilities whereby different letter codes are returned and printed on the tape of the sending operator's teleprinter, to indicate certain conditions which may be met whilst the call is being set up. The codes, which have been selected to conform as nearly as possible to those agreed for international use, are listed here; they are produced from motor-driven signal generators which are installed at the switching centres, in duplicate, with an automatic change-over feature.

NC (No circuits). All outlets to a group of selectors, or trunk circuits, engaged.
OCC (*Occupé*). All station lines to required office and its overflow centre, engaged.
DER T (*Dérangement*). Trunk line, or associated switching equipment, faulty.
DER S (*Dérangement*). Station line, or associated switching or teleprinter equipment, faulty.
MOM (*Moment*). Waiting signal.

In the cases of DER T and DER S, the faulty circuit is specially guarded so that it cannot be seized again on any subsequent attempts. Each teleprinter has a paper-failure alarm which, during the process of receiving a message, operates immediately the paper breaks, or fails to feed forward properly, or if the roll becomes exhausted. Visual indications are given to both sending and receiving positions when the call has failed and the whole connection is automatically released. Similar forced release features are incorporated in the equipment to guard against the loss of characters due to line interruptions during transmission.

SUSPENSE AND OVERFLOW FACILITIES

The automatic switching equipment and the circuits between switching centres are provided on a liberal basis so that not more than one call in a thousand will encounter an engaged switch or one call in 500 an engaged trunk circuit.
Because of the relative traffic inefficiency of small groups of circuits, a "suspense" facility is associated with routes to teleprinter offices. With a group up to four lines, one "waiting" contact precedes the line circuit contacts on the final selector bank, and with larger groups, two "waiting" contacts are available. An incoming call, finding all the lines of the required office engaged, remains "in suspense" on the waiting contact and is diverted to the first line to become disengaged. During the waiting period, "MOM" is returned to the sending operator. If no line becomes free after 30 to 60 seconds, the call is overflowed, normally, to the main teleprinter office in the switching centre town, though traffic to certain offices will overflow to auxiliary overflow centres more conveniently situated geographically.
An "out-of-service" key is fitted on each dialling unit and, when thrown, engages the position against incoming calls. If, therefore, all these keys at any one office be operated, for example, when an office closes at night, all its incoming calls are automatically diverted to the overflow centre.

SPECIAL SERVICES

A "Special Service" final selector is provided for engineering testing purposes at all switching centres and, by dialling specified numbers, any teleprinter office can obtain access to test messages with varying degrees of distortion (produced from the signal generator), to "speed test" signals, to engineering speaker circuits, and so on.

NETWORK FOR THE INITIAL PHASE

It is planned to complete the automatic switching scheme during the next few years. The first stage is to act as a field trial and is confined to the installation of automatic equipment at the London North and Birmingham Centres. Traffic passing through these centres is, intentionally, restricted to about 10 per cent. of the total traffic which will be handled by them ultimately.
The manual and automatic systems cannot be inter-connected as the teleprinter alphabet used on the former differs from the International Alphabet No. 2 adopted for automatic working. Two parallel networks must, therefore, be set up. The following ten offices are the first "fully automatic offices":—

Watford, St. Albans, Waltham Cross, Woodford Green. Connected to London North switching centre with overflow facilities at London North instrument room.

Derby, Burton-on-Trent, West Bromwich, Nuneaton, Smethwick, Bromsgrove. Connected to Birmingham switching centre with overflow facilities at Birmingham instrument room.

The London and Birmingham automatic installations are inter-connected by trunk circuits. To give these ten offices wider access on an automatic basis, direct routes terminated on teleprinters at each potential switching centre office (and also at the remaining London Ring Offices, London East and London South) are provided from either the London North or the Birmingham switching centre. These trunk routes will be increased and reterminated on switching equipment as the automatic installations at these distant centres are completed. Further, each existing manual area centre in the London and Birmingham Zones is connected to its appropriate zone centre automatic equipment for the purpose of receiving traffic. Thus, the ten offices will, apart from inter-communication between themselves, have automatic access to some 42 main offices throughout the country. To provide a greater traffic load on these trunk routes and to achieve the 10 per cent.

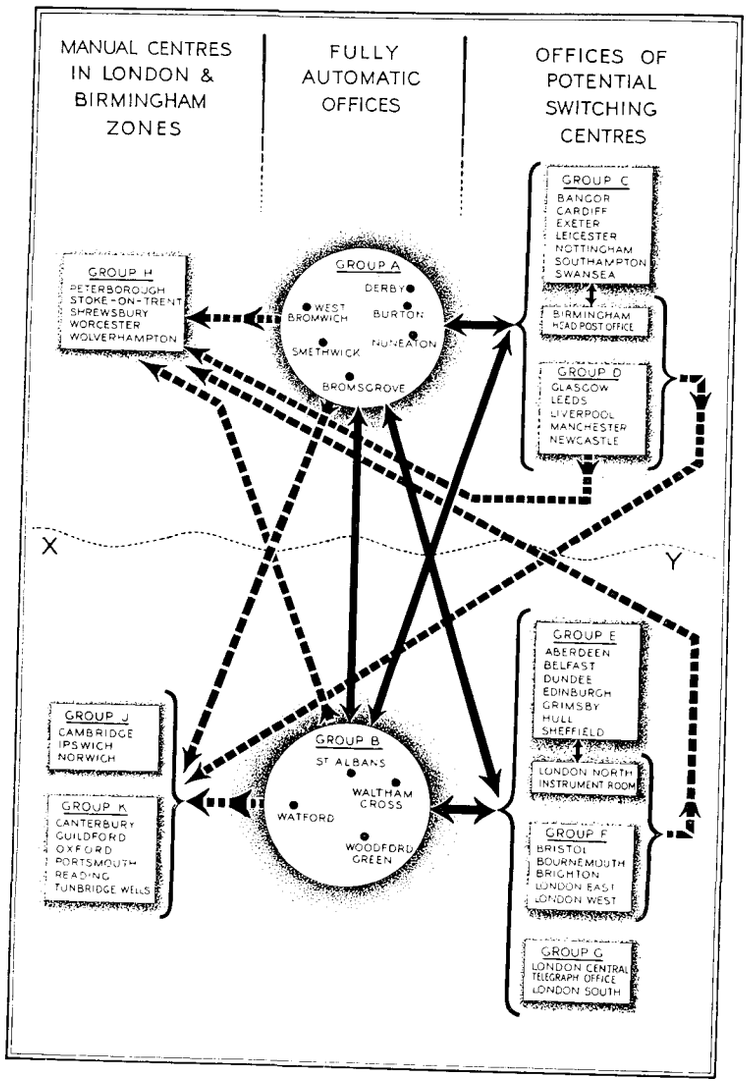


Fig. 3. Details of traffic routed over the automatic switching network during the initial phase. Full lines indicate traffic circulating in both directions, and broken lines shew one-way traffic only.

Offices above line XY have *direct circuits to Birmingham* automatic switching centre, and calls between offices in the top half of the diagram are set up by direct dialling through the Birmingham centre.

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Calls between offices north of line XY, and those south of the line, are set up through both London and Birmingham automatic switching centres.

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Offices below line XY have direct circuits to London North automatic switching centre, and calls between offices in the lower half of the diagram are set up by direct dialling through the London centre.

target figure, certain traffic between the 40 offices themselves is automatically switched via London North and or Birmingham. Figure 3 gives the precise circulation details.

There remains the problem of passing traffic between the ten offices and offices other than those with access to the automatic equipment. As a temporary expedient, outgoing traffic is normally sent to the instrument room at the potential switching centre to which the required teleprinter office will eventually be connected. There the traffic is re-transmitted over the manual switching network (or point-to-point circuit) to the required office. Traffic in the reverse direction will usually be sent by manual switching direct to the instrument room at London North or Birmingham and re-transmitted to the ten offices concerned. To prevent the unnecessary build-up of re-transmitted traffic for Derby, however, one outgoing and four incoming manual switching circuits are being retained exceptionally at that office.

In making these arrangements, the use of two

different types of teleprinter keyboards for outgoing traffic is restricted to the large centres only, and uneconomic provision of circuits and teleprinter positions, during the interim period when traffic from both systems has to be handled at the same office, is kept to a minimum.

COMPOSITE TRUNKING DIAGRAM FOR INITIAL PHASE

The switching equipment consists of standard 2,000 type two-motion selectors with 200 outlet banks and, to economise in switch provision, access from teleprinter positions to first selectors is via uniselectors. A composite trunking diagram is given at Figure 4; the salient features of this diagram are:—

Instrument Rooms at London North and Birmingham are obtained direct from level "O" of first selectors. Calls overflowed from offices connected to the final selectors are re-routed to level "1", the outlets of which are teed to the "O" level outlets.

Level "9" on all first selectors is reserved in case it is required for the final automatisation of the public telex service.

Potential switching centres are obtained by two routing digits as the circuits are all taken from second selectors, except London Centre and London West, which are from first selectors and have the levels of "6" and "5" allocated respectively. Figures in brackets on the diagram indicate the number of circuits in each route. (Dundee and Leicester are shown in this category as they were originally to be switching centres, and although these are now cancelled, routings have not been disturbed).

Level "7" on second selectors is given access to a separate rank of "Special Service" final selectors for testing purposes.

Individual offices on final selectors are not indicated on the diagram. These comprise the ten fully automatic offices, and the manual area centres. The offices on London North equipment are identified by either 3 or 4-figure numbers, according to whether they are connected to final selectors trunked direct from level "7" of first selectors or from "11" and "41" levels of second selectors. Birmingham offices are all 3-figure numbers as the final selectors are trunked direct from first selectors.

The total numbers of office circuits provided are:—

1st and 2nd Selectors (Potential switching centres)	146
Final Selectors (Fully automatic offices) ..	43
,, ,, (Manual area centres)	39
,, ,, (Enquiry and duplex circuits) ..	11
Total circuits ..	239

In addition, there are 6 outgoing, 6 incoming and 14 both-way trunk circuits between London and Birmingham switching centres.

OPENING ARRANGEMENTS FOR THE INITIAL PHASE

After completion of final tests by the Engineering Department, four weeks were allowed for traffic use of the new equipment before the new system was officially opened. During the first week, preliminary training of a nucleus of the staff at all offices concerned was undertaken. The training was confined largely to oral instructions, but descriptive memoranda, written operating instructions, a film strip and lecture notes were issued. Telegraph typewriters with keyboard layout similar to that of the new teleprinter were also available.

The second week was devoted to a comprehensive pre-transfer traffic test, whereby the operation and facilities of all the automatic and teleprinter position equipment were thoroughly checked under normal working conditions. Training was continued during the last two weeks and the manipulative staff were given practical experience to accustom themselves to the new teleprinters and to the operation of the dialling units.

Teleprinter positions equipped for working to the automatic system had been previously installed at all the offices concerned. A certain number of the positions had, however, to be used for manual switching up to the time of the transfer. These had been provided with a simple adaptor unit, and it was a quick operation to substitute the old teleprinter No. 3 with its adaptor component by a teleprinter No. 11B and to replace the manual relay set in the dialling unit by the automatic one. Thus came to fruition the initial stage of the national teleprinter automatic switching scheme which was first studied in 1935, tried experimentally on a skeleton basis in 1937, held in abeyance for the duration of the war, re-considered in 1945, and thereafter developed and modified to incorporate all the latest developments in design technique which had taken place during the intervening years.

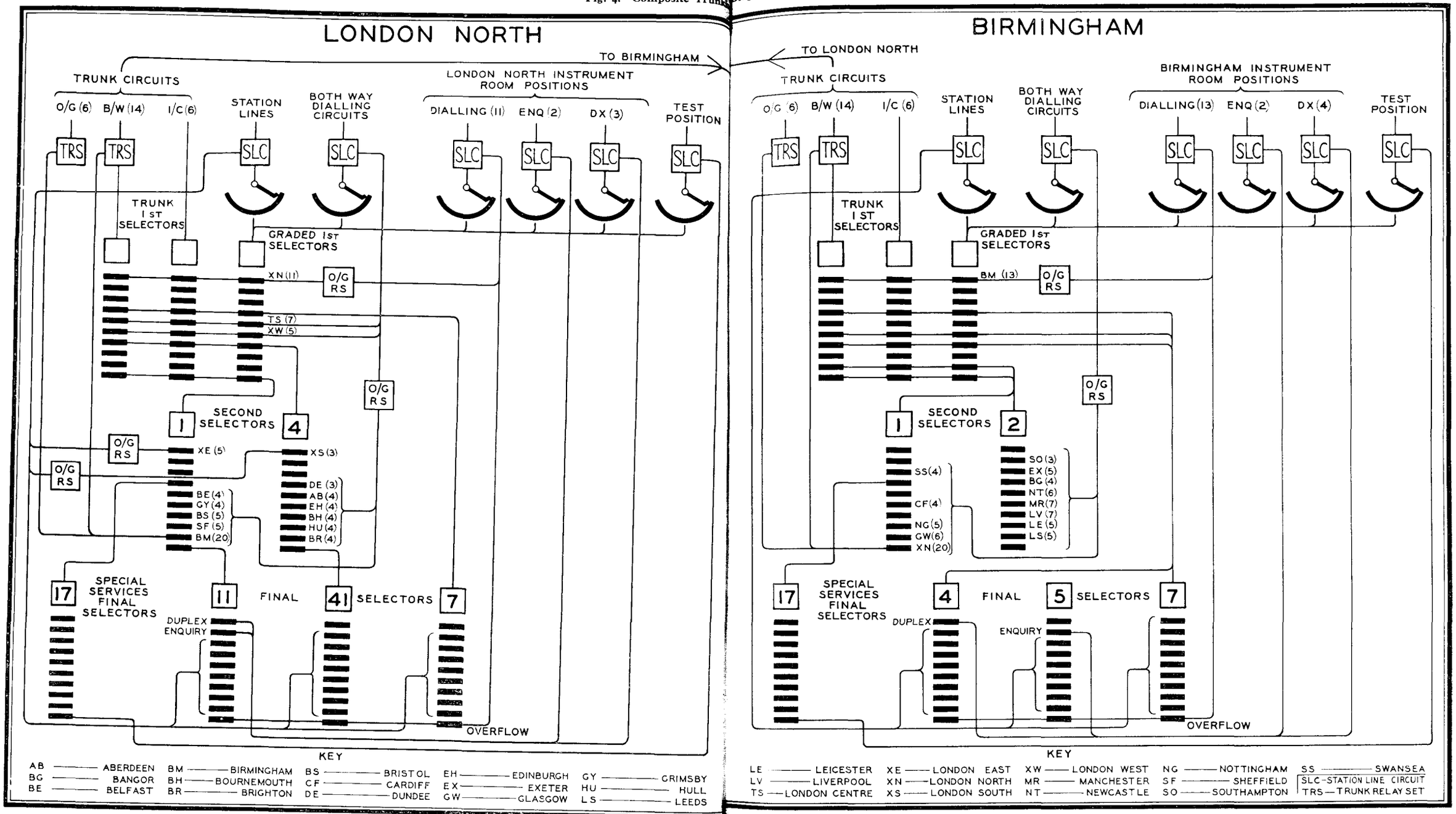
TELEOLOGY IN THE POST OFFICE

The address given under the above title by the Director General, Sir Alexander Little, K.C.B., is being distributed in booklet form with this issue of the Journal.

INDEX TO VOLUMES 1 AND 2

Regular subscribers will receive their Indexes along with the present issue of the Journal. Copies will also be supplied, if requested, to readers ordering back numbers to complete their sets. Binding cases will not be supplied.

Fig. 4. Composite Trunk Diagram for Initial Phase.



Productivity

by R. J. P. Harvey, C.B., Director of Inland Telecommunications

THE SIGN AT THE TOP of this article is becoming familiar to all members of the Post Office in the United Kingdom. It is the sign adopted by the Post Office Joint Production Council, and is a symbol of the great effort that all interests in the Post Office, in common with industry generally, are making to improve productivity. The sign is new, since the Joint Production Council concerned with the non-engineering services of the Post Office was established as recently as August, 1949. A special productivity organisation for the engineering services of the Post Office was established in 1947, following a study made by officers of Post Office Headquarters and of the Post Office Engineering Union. Within the productivity organisation in the Post Office, representatives of the management and the staff are meeting together with the common purpose of improving the efficiency of the service and discussing ways and means of going forward together towards the achievement of that common purpose.

The organisation for engineering services consists of a Joint Production Committee in each of the ten Post Office Regions, and a corresponding Committee in each of the 55 Telephone Managers' Areas, Sub-Committees on functional aspects of the work reporting to the Central Area Committee. Problems affecting the use and supply of tools and stores, and the methods and organisation of engineering work in the field are discussed, and worthwhile suggestions are forwarded to the Engineering Department at Headquarters in order that consideration may be given to their adoption on a national basis. During the past three years, some 10,000 suggestions have been considered by the Production Committees and about one-third of these have been adopted. A mere statement of figures, however, does not provide a basis for assessment of the value of the productivity organisation. An important part of that value derives from the meeting together of people in different branches of the engineering service, from pooling ideas, and even, in the negative sense, from arriving at agreement on why certain things, which at first sight appear to be desirable, cannot, for very good reasons, be adopted.

The productivity organisation for telecommunications services forms part of the Post Office organisation for productivity questions, other than the engineering services. There is a Joint Production Council at Headquarters, consisting of nominees of the Post Office Departmental Whitley Council, Staff Side, and of the Department; and attached to the Council are four Panels—Clerical, Postal, Telecommunications and Internal Relations. The function of the Council is to survey the whole non-engineering field of productivity, and to make recommendations to the Postmaster General. At Head Post Offices, Telephone Managers' Offices, and Regional Headquarters Offices up and down the country, Whitley Committees undertake, on an advisory basis, the functions of local Joint Production Committees.

The Chairman of the Telecommunications Productivity Panel is the Director of Inland Telecommunications (myself), and the Vice-Chairman is Miss Winifred E. Rowe, an Assistant Secretary of the Union of Post Office Workers. The Panel has held six meetings during the past year, the last being on September 20, 1950. In addition to suggestions made by members of the Panel itself, there is a strong and steady stream coming to the Panel from the local Committees. Up to the end of September, 197 suggestions had been received, 98 of which are still under consideration; 14 have been accepted. These figures cover only part of the field, since many suggestions concerning the telecommunications services are dealt with finally by the local Production Committees.

It is, perhaps, early yet to assess the extent of the contribution which this productivity organisation will make to the efficiency of the Post Office services. That it is making an important contribution there is no doubt, and it is our firm belief that that contribution will steadily increase.

Storm Damage at Guildford

by C. W. Davies, Telephone Manager, Guildford

DURING THE EARLY MORNING OF APRIL 26, 1950, a freak blizzard swept across the South of England, doing great damage to telephone plant in a wide belt extending from Canterbury to Southampton. This article describes how it affected the Guildford Area, where the damage was most severe.

Nearly a foot of snow fell. This was accompanied by a frost, sufficient to harden the snow as it collected on the wires, and by a high wind of gale force. The combination of wind and frozen snow applied very great strains on the wires and poles. On one typical route, the transverse strain at the top of the poles must have been upwards of ten tons. The damage was accentuated by falling trees. These were then coming into leaf, and so collected a great weight of snow which played havoc with the branches. The effects of the storm on the trees would make a story of its own. So far as we were concerned, torn branches fell in great numbers across beds of wires, adding further ruin to the already badly battered overhead plant.

It is not unusual for the effects of a serious breakdown to be realised rather slowly. This storm was no exception. Most of our efforts in the early hours consisted of assessing the size of the job, and it was not until the end of the third day that the real measure of the trouble emerged. No part of the Area had escaped. About 12,000

subscribers' lines (or one-third of the system) were out of order, over 800 poles were broken or had heeled over, and many miles of open wire were festooned along the road sides. By contrast, the underground plant fared very well. Notwithstanding the rapid thaw, only three cables were affected by water, and these were quickly repaired. Thus, the junction and trunk networks remained practically intact. Only three small Unit Automatic Exchanges were isolated because of junction failures. Eight others served by overhead power distribution, which had suffered a similar fate to our plant, were, however, isolated by power failures. The heavy drain on the exchange batteries at these exchanges, caused by so many "permanent glows", could not be compensated by increased rates of charging; within a few hours of the storm breaking, these exchanges died for want of current. Finally, it became urgently necessary to clear the litter of wires and poles from roads, footpaths and farm tracks where they constituted a danger to traffic, people and animals. No breakdown of this magnitude had occurred in the history of the Area.

Effect on the Engineering Division

The first act was to eliminate or suspend all engineering work that could be deferred, and divert the staff to "storm" work. Of the 500 available men, about 450 were, within a few hours, directly or indirectly employed on maintenance. The staff on the maintenance controls was nearly doubled, and although their work was streamlined to the utmost, the men were kept busy throughout. The district maintenance staff were employed almost exclusively on providing some sort of service for emergency lines. They went through the main frames at all exchanges at least once a day, disconnected faulty lines, restored cleared lines, provided the maintenance controls with up-to-date details of the faults and attended to exchange faults, many of which were directly caused by the storm. The work on the frames was of vital importance, and, in the larger exchanges, men were detailed for this continuously during the first week or two. It was the only way in which the fault position could be controlled. As might be expected, much was left to the initiative of these men. They reacted well. For instance, they had to find some means of bringing back into service the eight exchanges whose batteries were exhausted and whose power supply was disconnected. This was done by using "Tiny Tim" Lighting Sets as battery-charging units. The effectiveness of these sets as emergency charging plants for small exchanges was amply demonstrated. All the batteries were back in service within 24 hours, and the "Tiny Tims" kept them going until the power supply was restored.

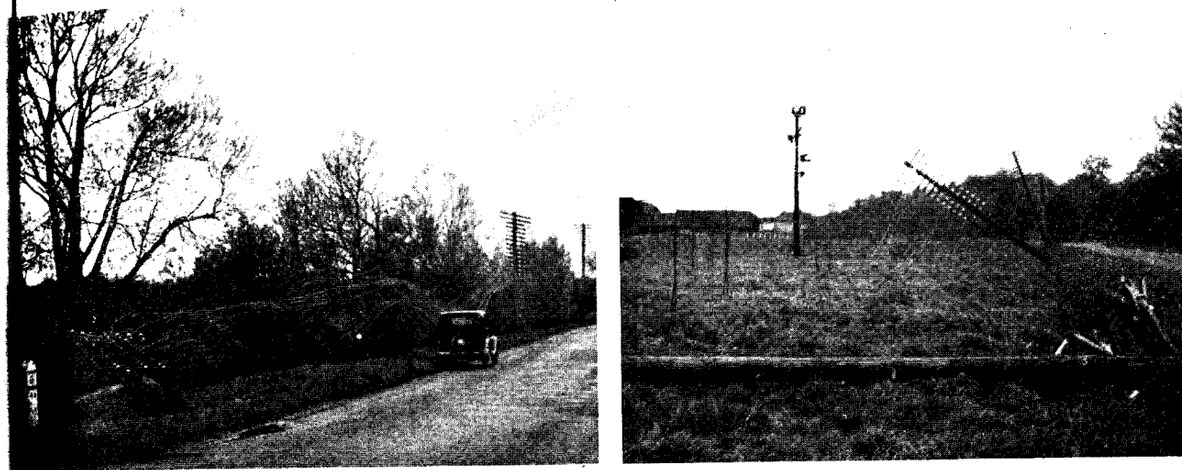
Meantime, the larger problem of restoring the damaged line plant was being tackled. It was decided to convert the major works control into a Storm Control responsible not only for the effective deployment of the gangs, but also for maintaining the records of faulting progress. The order in which the work should be done was decided. First, the emergency and call office faults (not attended to by district linemen) would be cleared, and, at the same time, roads and path ways would be made safe from debris. Then the restoration to service of all other affected lines would be pushed ahead, using any means that local knowledge, ingenuity, experience and skill suggested. Finally, the permanent restoration works would be undertaken.

The maintenance controls were able to identify the faulty emergency lines, and these were all restored in two days. Help in clearing the debris came from three outside sources. Members of the public did quite a lot of clearance work for us. Then we were able to obtain assistance from the military by a direct approach to local Commanding Officers. The third aid at our disposal was the voluntary effort of male non-engineering staff, thirty of whom placed themselves at the disposal of the Area Engineer, at a special rate of pay, for what work could be found for them. Using transport borrowed from the Postal Service, they did good work in various parts of this Area clearing up broken poles and wires. Within ten days, all debris had been made safe.

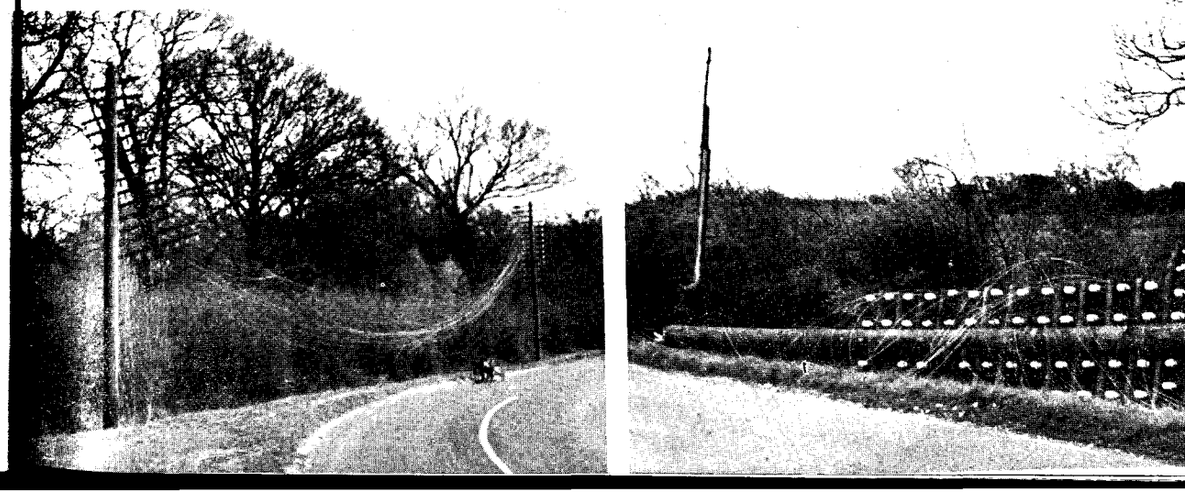
Meantime, the plans for the temporary, and later the final restoration of all lines were proceeding. With widespread damage over about 750 square miles, the first reports gave no adequate picture of what had to be done. This deficiency was remedied by a detailed survey of the Area by the external planning staff. On the day after the storm, this staff was sent all over the Area with instructions to assess the damage, prepare brief but adequate statements of what was required to restore service quickly to all lines, and then to prepare schemes for the final restoration of the plant, either by renewal as before, or by any better means which might be appropriate. This work was organised so that the planning staff surveyed

The driving wind caused the wet snow to adhere readily. After 24 hours, however, the snow had almost disappeared.

Overhead routes became masses of tangled wire and broken poles.



Some poles were broken at the top, others at the base.



the territory for which they were responsible as planning officers. Thus, the final schemes fitted into the long-term development plans. This action soon paid a dividend, for, within three days, the Storm Control was receiving sufficient schemes to enable them to use the gangs on properly co-ordinated storm work. It also provided a clear idea of just how big the job was, and what manpower and stores were likely to be required.

The Man-power and Stores Problem

It was immediately evident that an addition of about 160 men would be necessary for some months to come. An appeal to the Region brought a welcome response. In less than a week, 39 additional gangs, comprising 179 men, with transport, were forthcoming. Some of the men came from the neighbouring Areas of Brighton, Portsmouth and Reading, and were able to travel from and to their homes daily. Others came from as far away as Norwich and Cambridge, and that raised the question of billets. It was decided to station these men at Guildford, Aldershot and Basingstoke. At Basingstoke, it was possible to provide the men with lodgings. Elsewhere, no such solution was available. Rooms in the Guildford Telephone Exchange were therefore converted to dormitories, and food was provided by the Guildford Post Office Canteen, who stretched their facilities to the utmost, not only to feed the men, but also to provide other comforts for them. In the Aldershot district, the problem was solved by the National Rifle Association, who placed at our disposal accommodation on the Bisley Rifle Range, where food was also obtainable.

No less important than staff were engineering stores. The stocks held in the Area were quite inadequate for such a contingency, and it was necessary to augment these quickly. A small group, consisting of Engineering and Clerical staff, was detailed to estimate and secure all necessary stores with the minimum of delay, and to get them on the sites where they were wanted. They naturally had to take short cuts with the procedure, but their close co-operation ensured that the correct accounting and disposal arrangements could be easily picked up afterwards. This squad succeeded in securing 48 miles of interruption cable, 32 miles of D.8 wire (insulated wire from Army sources), 56 miles of rubber-insulated cable, 570 poles, 38 tons of copper wire and 10 tons of stay wire, besides many smaller quantities of miscellaneous stores: all required for restoring service by any available means. They got them out to the gangs in such flow and quantity that at no time was a gang short of material; nor was there any appreciable excess provision. The same group also obtained the stores for the final reconstruction work. The quantities here were quite appreciable and give some idea of the size of the job; over 1,400 stay rods, 10 tons of suspension wire, 47 miles of aerial cable, 12 miles of underground cable and 6 miles of stainless steel cable. The work of this small but vital group would, however, have been nullified had it not been for the excellent co-operation of the Supplies Department. Every request was met at once and without fuss, even to the length of arranging for several tons of copper wire and other stores to be sent to different points in the Area direct from the manufacturers' works.

Programme of Campaign

By the fourth day, the size of the repair work and of the actual and potential resources became sufficiently clear for an organised programme to be formulated, and, on April 29, the first really constructive council of war was held. The overtime restrictions had already been lifted for staff whose efforts could help the job along, and it was decided to take full advantage of the lengthening days and good weather to work the repair organisation until dusk every day, including week-ends, until all lines were back in service. The deployment of the men and stores over the Area was also decided. By these means, all lines could, we thought, be restored in five weeks.

What happened after that meeting was most heartening. Each day saw the number of faulty lines dropping by, first, a thousand a day and then by smaller amounts as the gangs in the areas least affected moved in towards Aldershot and Basingstoke districts where the hard core of the damage existed. As the Storm Control moved the gangs, so were their supervising officers supplied with the Planning Group's immediate restoration plans, which, however, still left plenty to the initiative of the men doing the job. After a fortnight, the position admitted the district linemen to be returned to ordinary faulting—provided their main frame testing was not interfered with. This diversion from storm work proper was necessary to cope with the ordinary faults which had accumulated since the breakdown.

As time went on, the rate of clearance gave hopes of improving even on the five weeks' target date we had set. We therefore decided to aim at a four-weeks' clearance. This faster rate was not

bad estimating in the first place. It was brought about by the magnificent efforts of the engineering staff, both our own and those lent to us. The last subscriber's line was restored at 4.30 p.m. on May 23, just four weeks after the storm occurred. As the arrears of normal faults had all been overtaken by then, the entire maintenance position, from the point of view of numbers of lines out of order, was normal.

Of course, much of the working plant was temporary. It would give good service for some time, but sooner or later it would have to be replaced by something more permanent. We decided to make it sooner, partly to safeguard the position for the following winter, partly to get the maximum out of the storm works order which would have to be closed after six months, and partly to release the temporary materials for use in any future emergency. The Planning Group had already prepared enough schemes, and the Storm Control secured enough materials, to enable this work to commence before the completion of the temporary restoration, and, at the time of writing this account (August 1950), the work is well under way and will be cleared by the time the article is in print. Even storms have their uses, and many of the damaged routes are not to be rebuilt in their old forms. Much greater use is being made of aerial and underground cable with capacity for future growth. Also, there will be a great increase in the number of steel poles. Already about 100 of these have been erected. They have found favour both with the men who have to work on them, and with the local authorities.

Effect on the Traffic Division

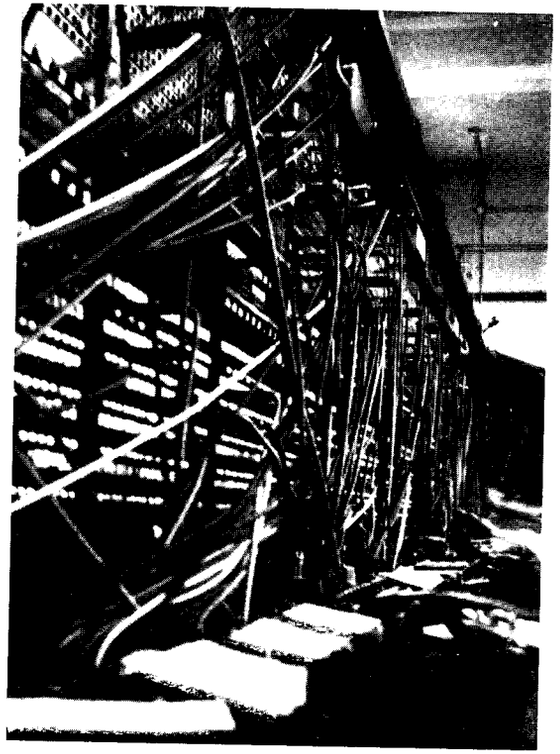
The effect of the storm on the traffic was interesting. With one-third of the lines out of order, it might be imagined that the traffic passing through the system would have been materially reduced. Actually, the effective traffic was reduced by about five per cent. only; whilst the ineffective traffic leapt. The total traffic rose to more than ten per cent. over normal, in addition to greatly increased calls on the enquiry services, and it did not revert to normal until all the lines were restored.

In the exchanges the telephone operators had their work cut out to deal with the flood of enquiries from the public, but it was the monitors' desks that bore the brunt of the storm. The main difficulty here was in keeping accurate track of which lines were faulty. The carried-over list procedure would not work, because of the very large numbers involved. Instead, an arrangement was introduced whereby the maintenance control fault operators visited the control engineers twice a day, and obtained from them details of what lines were faulty, the engineers having, as described, obtained up-to-date information from their colleagues on the frames. These lists, prepared on forms T214, were checked against dockets issued, including those for new faults reported since the storm. With this essential information it was easy for the control monitors, in collaboration with their opposite numbers at other manual exchanges in the Maintenance Control Area, to ensure that cleared lines were promptly brought back into service, that duplicate dockets were not issued, and that correct information about why calls could not mature was available for the public and operators at other exchanges. This last point was important because, during the early stages of the storm, the "number unobtainable" (NU) tone distribution facilities at automatic exchanges were inadequate, and many hundreds of faulty lines merely returned ringing tone, which gave the impression of an ordinary "no reply" condition. Another problem was the plugging-up arrangements. The faulty lines were disconnected on the main frames, but plugging-up was required to let the operators know what lines were faulty. All the emergency plugging-up sets, provided from local resources and borrowed from around the Region, were insufficient to meet the need, and pegging of the multiple appearances was resorted to for the remainder. There was a temporary shortage of pegs, and any substitutes that could be found locally in sufficient quantity, were used. Jointers' sleeves proved to be a useful expedient.

Relations with the Public

We expected, and received, a lively reaction from the public. It is difficult to say how many fault reports and complaints were received about the storm, but in the first week alone, the number dealt with at all points in the Area can hardly have been less than 40,000. The subscribers were, in most instances, able to see the damage for themselves, and this made them more tolerant. The Press in their columns and the B.B.C. in "Radio Newsreel" gave us facilities for telling the story, and these accounts were invaluable in making the magnitude of the task clear to subscribers.

But the complaints contained repeated requests for information about when restoration of service could be expected. At first, this was a difficult



The state of this switchboard at Godalming Telephone Exchange was typical of many after plugging-up.

question to reply to, for we did not know the answer ourselves. Nevertheless, it was necessary that subscribers should be given some idea of how long they might have to wait, and when, at the first week-end, an estimate of five weeks to complete restoration emerged, it was decided that letters should be sent to the public warning them that delays of this order could be expected before every line was reconnected.

This was done by preparing a letter suitable for transmission to all subscribers, asking those whose lines were out of order to report them through the normal channels if they had not already done so; but to refrain from asking us to do anything special for individual cases. It also appealed to those whose lines were in order to allow their less fortunate neighbours to use their telephones on request. The letters were printed, addressographed and despatched to the 36,000 subscribers concerned within four days.

They put an immediate brake on the spate of complaints which had been coming in, and there is evidence that they were generally well received. They also eased the task of those who had to resist the pressure from subscribers who wanted us to do something specially for them. The success of the restoration scheme depended on the methodical use of the available labour, and it was necessary to resist all blandishments which would have meant dispersing our resources over wide areas. With a few justifiable exceptions, this aim was achieved; though not without some struggles. Applications for rebate of rental were fairly well to the fore, but were fewer than expected. Although the September accounts brought in more claims, the total did not exceed 300. Those so far received have been successfully dealt with under the standard storm rebate procedure, and the amount of rebate granted will be in the order of £70.

Considering the extent of the ruin, the claims for compensation for damage to property were remarkably few. The prompt action in clearing up the debris no doubt helped here. Only ten claims were received, of which five were considered fair and reasonable. The amount involved will be about £80.

Cost of the Storm

This can best be shown in tabular form:—

Engineering labour chargeable to storm repair (299,000 manhours)	£44,000
Engineering Stores. New Issues £45,000. Less Value of Recoveries £30,000	£15,000
Operating charges (directly employed on storm work)	£1,500
Operating charges (handling ineffective traffic caused by the storm)	£5,000
Loss of revenue (call charges through lines out of order)	£3,000
Rebates	£70
Claims for Compensation	£80
Costs on Clerical and Traffic Divisions	£1,600
Miscellaneous (including Department's cost of billets and so on) ..	£300
	£70,550

Many of these figures are estimates, and to the total must be added overheads of many kinds, so that, in all, the storm in the Guildford Area alone will have cost the Post Office not less than £100,000.

The Work Done in the Best Tradition of Public Service

Little has been said of the work of the Clerical Division. Naturally, the additional manpower, extra overtime and increased stores and estimates meant much work for them. It was all completed when required, and the effectiveness of their efforts was proved in a recent audit from which they emerged with credit. Nor have the senior officers of the Area been mentioned, though their support was all that could have been wished for. When, after the worst was over, we received a commendation from the Postmaster General, and honourable mention by the Regional Director on the Engineering Whitley Committee, a feeling of personal satisfaction was felt by all ranks, who now know that their efforts were in the best tradition of public service.

Acknowledgments are gratefully made to the local staff for contributing the photographs which accompany this article.

The Lettered Dial in London and Other Large Cities

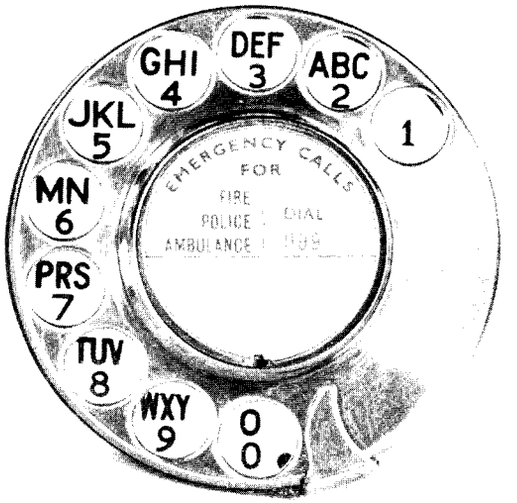
by H. A. Harman,

Inland Telecommunications Department

THE PROBLEM

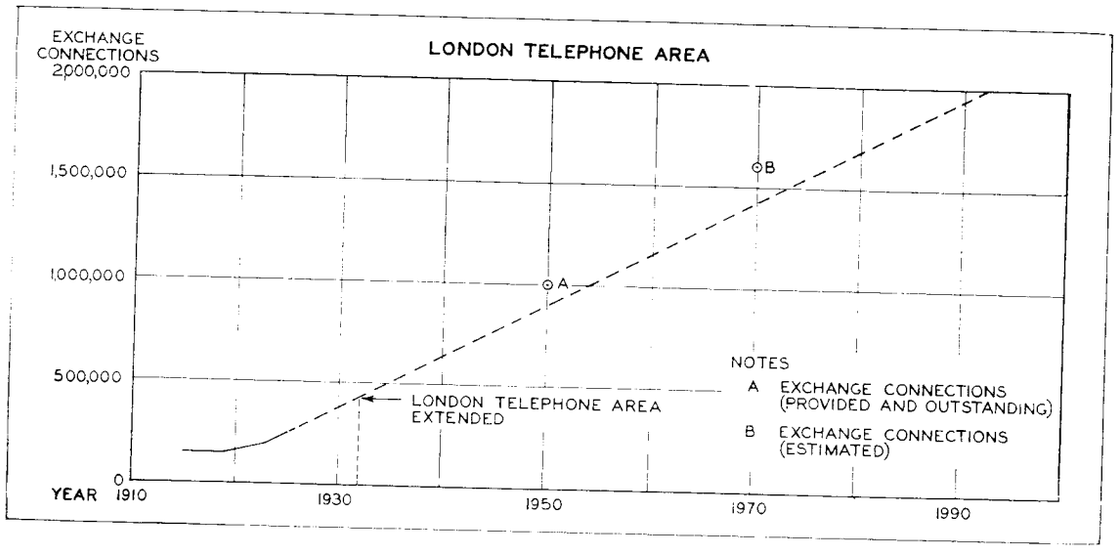
SHORTLY AFTER THE 1914-18 WAR, OUR predecessors began to consider how they should replace the manual telephone exchanges in London by an automatic telephone system. The step contemplated was a bold one, because nobody had much experience of the problems of automatic working in large cities, but, nevertheless, the decision was taken; in 1923, the Postmaster-General, Sir W. L. Worthington-Evans, signed an agreement, and the result was our London Director System.

The first director exchange, HOLborn, was opened in 1927, and today, after more than 20 years' experience of director working, and with more than 100 director exchanges in London, we may congratulate those early venturers on the success of their plans.



THE SIZE OF THE PROBLEM

If you will look at the graph you will see that, in



TELEPHONE DEVELOPMENT IN LONDON

1920, there were approximately 150,000 lines in the London area, and the demand was rising. The dotted line represents the rate of growth then assumed, but no one knew how high the peak would climb or how far away it was. If I judge rightly from the articles published about that time, it was not expected that the number of telephones in the London area would ever exceed 1,000,000. Nevertheless, the choice wisely fell on an automatic system which permitted an ultimate development in excess of this figure.

The future is, of course, no clearer now than it was in 1923, but it is expected that, at 1970, there will be about 1,600,000 telephone numbers in the London area. The London director area does not fill the whole of the London Telecommunications Region to which these figures relate, and the 1970 figure might reasonably be reduced to 1,400,000 for the director area alone.

AN OUTLINE OF THE DIRECTOR SYSTEM

The London director area is a circle 12½ miles in radius, with its centre at Oxford Circus. Eventually, all exchanges within this area will be director automatic exchanges, and all will be within the same linked numbering scheme. The circumference of the 12½ miles' circle forms a ring fence within the confines of which there is one large, but common, numbering scheme. The advantage of a common numbering scheme is that a subscriber on one automatic exchange, who wishes to call another number within the London director area, does not have to consult a list of dialling codes to discover how to reach the distant exchange: all he has to do is dial the subscriber's number. The number consists of two parts: the first three letters of the exchange name, which are used, indirectly, to route the call to the required exchange (including his own exchange), and four numerical digits which are used to distinguish between subscribers on the same exchange. The three letters are also used to determine the call fee (provided it is not more than four units). The letters and digit against each dial hole are electrically equivalent, and the same electrical operations will result from dialling, for example, ABC 2000, BAC 2000, CAB 2000, 2AB 2000, AB2 2000, and so on.

WHY THREE LETTERS AND FOUR FIGURES?

The manual exchanges which preceded the director system were rarely larger than 10,000 lines, and even though some of the exchange names had to be changed because the first three letters had the same numerical equivalents as some other name (for example, BROmley could not be used because it clashed with CROydon), it was possible, by using four figures, to avoid many number changes on conversion to automatic working. Further, although it sounds strange in these days of 5 and even

6-figure numbering schemes throughout the world, in those early days there was considerable doubt whether subscribers could reasonably be expected to manipulate and remember more than four figures in sequence.

The exchange name had always been used as the key to call routing, and, even today, only in non-director linked numbering schemes and some national numbering schemes is the numerical portion of the subscriber's number used to route calls between one exchange and another. It was natural, therefore, that part of the exchange name should be used for call routing between exchanges after conversion to automatic working, and as the use of 2 letters gives only 72 different combinations, while 3 letters give 648 (with the dial labelled the way it is and the "O" level reserved for assistance traffic), the choice of 3 letters was inevitable.

AN ANALYSIS OF THE AVAILABLE 3-LETTER CODES

The 648 3-letter codes available in the London director system can be broken down as follows:—

1. Codes allocated and authorised in the director area	191
2. Codes used or reserved for dialling to the 12½-20 miles' belt	82
3. Service codes in use or reserved	59
4. Unpronounceable codes	97
5. Spare codes	219

The 82 codes which are in use, or have been reserved for dialling from the director area to the exchanges in the fringe, is a requirement which could not have been foreseen when the scheme was planned in the early 1920's. It may be that in future years we shall want to extend the range of multi-metering, and this will eat more deeply into the available codes, though it may be possible to use (probably as numerical dialling codes) some of the 97 unpronounceable codes, which cannot be allotted within the director area. At the outset, it was intended that the director area should be a 10-mile circle, and the extension to 12½ miles was another unforeseen requirement which absorbed pronounceable codes.

WILL THE SPARE CODES LAST?

The number of new director area exchanges that will be required during the next 40 years is unlikely to exceed 100. We might, therefore, conclude that there is an adequate margin of spare codes sufficient to last until the director area is saturated with telephones, but first let us consider the subject of exchange names.

EXCHANGE NAMES

Exchange names are fascinating and almost deserve an article to themselves. In this small country we already have nearly 6,000 named exchanges, and almost 700 named single-line exchanges which we term Rural Call Offices, for example, Molland Botreaux, and the bulk of these constitute call fee points from which call charges are calculated according to distance. The number of exchanges within the London director area is approaching 200, though all within the 5 miles' circle have the same call charges.

Generally, the most satisfactory name for an exchange is the name of the locality which it serves, and in London before the conversion, all the exchange names had some topographical significance. Even today, the bulk of the exchange names in the director area are place names. But we are running short, and the topographical names that remain cannot be used indiscriminately; they must be reserved for exchanges serving the locality to which they refer.

It is, therefore, largely from among the pronounceable arbitrary names that we must christen many of the future director exchanges. Some arbitrary names (namely, MONarch: ROYal: RENown) have served us well, they are the fine-sounding names of which the subscribers may well be proud: they roll from the tongue and adorn the headed notepaper. But this high tradition cannot continue; of the 219 spare codes, very few indeed produce really good names, and some, like PNEumonia, are downright impossible.

Now, having briefly considered the subject of exchange names, I would suggest that:—

(i) Nationally, we have already too many exchange names, and we ought to make a serious effort to reduce them. The Automatic Rates Committee expressed this view before the war.

(ii) It is already difficult for a London subscriber to know, without reference, whether the telephone number he wants is within the London director area or not. If we add to the many exchanges we already have, a collection of curious and arbitrary names giving no clue to the geographical location, a subscriber's difficulties will increase; the object of having a linked-numbering scheme in London will be defeated, and we might as well admit the position by issuing code dialling lists for exchanges in the director area. We could then use the unlettered

* This is an approximate figure since, in some dialects, the most extraordinary combination of consonants can be uttered.

non-director type dial, and revert to the use of purely topographical names irrespective of whether the first letters clashed or not.

That would be one solution. There is, however, another and, in my view, a better; it forms the subject of the next paragraph.

THE 2-LETTER 5-FIGURE SYSTEM

In New York, Chicago, Philadelphia and Boston, a 3-letter 4-figure system was originally used just as in London, but in America it was decided to change to a system which employs 2 letters and 5 figures and which, as will be shown, is more flexible. It was not necessary to make any engineering equipment changes: all that was necessary was to persuade the subscribers to break one established habit and acquire another. Let us see how this would operate in London. You remember that figures and letters in the same dial hole are exactly equivalent to one another, thus HEAdquarters 1234 is exactly the same as HEadquarters 21234.

Theoretically, since we could replace the third letter by any one of ten figures, each named exchange could have its capacity increased from 10,000 to 100,000 with a 2-5 scheme. This is another way of saying that the number of named exchanges would be reduced to one-tenth the number needed now; instead of 200 exchange names we should need a mere 20. In practice, such a drastic reduction could not be achieved, particularly between the 5-12½ miles' belt where exchange sites are call fee points and where there would be difficulty in collecting 100,000 lines in one locality. But at least no more names would be needed, and a considerable reduction would be possible. WHitehall, for example, could be the name given to several 10,000 line units without changing the name of any existing exchange.

Furthermore, recourse to arbitrary names could be largely avoided, and topographical names, which at the moment clash, could be used, provided the first figure of five, as it would then be, was different in each case.

We could use both WOolwich and WOod Green for exchange names, for, although the third letter is the same, with a 2-5 system this would not matter: all that would be necessary would be to ensure that the first figures were different. WOolwich could have a number range 0,0001-0,9999 and WOod Green a range 6,0001-6,9999.

There are many good topographical names waiting to be used with a 2-5 system, for example, CHaring Cross; FArringdon.

At the beginning, however, it would probably be best not to make any number changes at all: at least not in the way we have been accustomed to make number changes. HEAdquarters 1234 could become HEadquarters 21234, and even though, for a time, subscribers continued to dial HEA 1234, it would not matter. The new numbers could be published in the four parts of the London Directory as they were issued, subscribers could be asked to stick on new dial centre labels (without bothering to remove the ring), there could be adequate publicity and I think, within a year or so we should have everybody thinking in terms of the 2-5 system. We should then be able to reap the benefits of the scheme as quickly and as slowly as we wished.

DIRECTOR SYSTEMS IN THE PROVINCES

Director systems have been established in Birmingham, Glasgow, Liverpool and Manchester, but they are a good deal smaller than London, and in no case would it be necessary to change from the existing 3-4 system because of a shortage of suitable names. Nor would it be necessary to change them to a 2-5 system if a change were made in London. The convenience of the local users is always of very much greater importance than uniformity, which might be of assistance to travellers.

CONVERSION OF 5-FIGURE NON-DIRECTOR SYSTEMS TO DIRECTOR

Authority has recently been given to convert to director working the non-director systems at Bristol, Edinburgh and Leeds, because the development forecasts show that these cities will outgrow their 5-figure numbering schemes. Here we are faced with a problem not previously encountered, since earlier conversions to director working were from manual exchanges. If for these provincial cities a 3-4 director system is chosen, all telephone numbers such as Bristol 23456 will have to be changed; the name Bristol will be lost; code dialling between non-director and director exchanges will be necessary during the transition period; and several new exchange names will have to be introduced.

Before the war, it was estimated that the cost per line of making number changes was of the order of one pound; it seems likely that this figure is now between two and three times as large. The cost

and inconvenience to the telephone public cannot be estimated and is not, therefore, included in the figures I have mentioned.

The loss of the town name is to be deprecated, and the introduction of code dialling offends against the fundamental principles of a linked numbering scheme.

The advantage of having a 2-5 system in Bristol and Leeds, and retaining the present name and numbers as well as avoiding the need for code dialling lists is clearly great, but it is understood that in Bristol, where the engineering implications are being considered, there may be some difficulties to be overcome. It is not known whether a similar position would arise at Leeds.

It is hoped this article will stimulate thought, particularly in regard to the practical difficulties of making these changes, and the manner in which numbers should be published in the directories, which are matters I have had largely to exclude from a short article. I have taken an extract from the London Telephone Directory and compared it with entries from the American Directories in order to illustrate one method of presenting a 2-5 number and to show how it compares with our presentation of a 3-4 number.

* * *

LONDON TELEPHONE DIRECTORY

Roberts, R.....**HOWard** 2197
Roberts, R.....**ELGar** 6968
Roberts, R.....**GIPsy** Hl 0612
Roberts, R.....**LIBerty** 2439
Roberts, R.....**CANonbry** 3922

AMERICAN DIRECTORY ENTRIES

American Vault Co.....**LAvenport** 6-1136
Acme Vault Co.....**VIrginia** 7-5526
Seal Locks Vault Co.....**ILlinois** 9-8444
Belmont Cement Case Co.....**IVyridge** 2-4833
Mead Suydan Co.....**ORange** 3-9126

* * *

Finally, I would remind you that, in my first paragraph, I paid a tribute to the wise planning of the pioneers of automatic telephony in large cities, and I would suggest that it is up to us today to plan as boldly against the years to come.

Cardiff "Colonial Week" Exhibition

This Exhibition, which is now touring the country, was held in the magnificent setting of the Cardiff City Hall Assembly Rooms from July 8-29. The Post Office installed a teleprinter in the vestibule so that visitors to the Exhibition could see their free Commonwealth Social Telegrams start on their long journeys to distant Colonies and Protectorates. The Post Office teleprinter, with its red and cream decorations for the table and publicity notices, was set in an attractive floral display and was a centre of interest throughout the Exhibition.

Greetings messages were teleprinted over a direct circuit to Cardiff Instrument Room, and thence over the teleprinter manual switching network to Electra House, London. No fewer than 774 messages were sent to all parts of the Empire.

(By courtesy of the "Western Mail.")

The Lady Mayoress of Cardiff watching the despatch of a cablegram from the Lord Mayor and Citizens of Cardiff to the Chairman of the Township Authority of Aden.

GREETINGS

Here Come the Greetings Telegrams Again

by J. H. Richardson, Public Relations Department

ON THE PRECEDENT OF THE PRE-WAR SERVICE, the Greetings Telegram service will have to make its own way with the public. There is little doubt that the biggest factors in fostering the use of the service are the attractiveness of the Greetings Telegram form itself and the efficiency of the service. The use of the Greetings Telegram service for birthdays offers the potentially biggest market as there are about 130,000 birthdays each day. There are roughly 3,000 weddings each week, and the circulation of the Greetings Telegrams amongst the guests tends to stimulate interest in, and to extend knowledge of, the service. On the average of, say, ten telegrams per wedding, there is again a potential market of 30,000 to 40,000 a week. And these are not the only occasions when Greetings Telegrams will be sent!

★ ★ ★

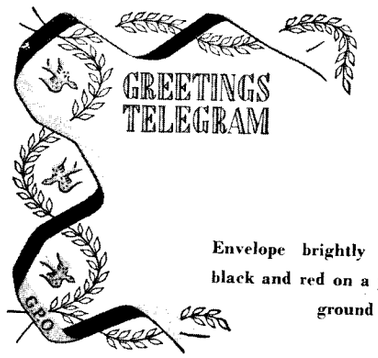
The United Kingdom Post Office earned a good deal of prestige before the war by the originality, variety and beauty of the designs. It could be said of most of them that they were also noteworthy for the excellence of the printing. No effort was spared by the Stationery Office (who placed the contracts for the printing) to ensure a worthy result. From the point of view of printing technique, the Rex Whistler telegram probably represented, for a mass production job, the high water mark for colour printing in this or any other country. It passed through the printing machine more than a dozen times, and was a remarkable example of the printer's pride of craft. Unfortunately, it had a coloured panel for the writing space, and this gave rise to difficulties in operation as the printed surface did not take writing or gummed slip easily.

★ ★ ★

Perhaps the most original of the designs was that produced by the artist "Rojan" for St. Valentine's Day of 1938. Conceived in the style of the old "Penny-Plain, Twopence Coloured" lithographs, it hit off very happily the public sentiment which was beginning to revive in connection with St. Valentine's Day. No doubt the return of the Greetings Telegram will bring a recrudescence of interest in the ancient festival and we may expect to see Valentines appearing widely in the stationers' shops as they did in the early days of the century.

★ ★ ★

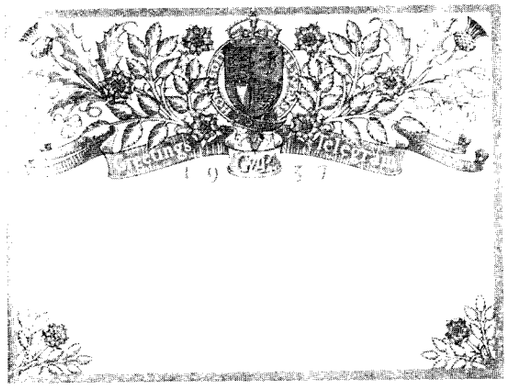
The impossibility of reproducing in colours the Greetings Telegrams in the advertisements in the public press proved rather a drawback; but the advertisements were admirably written and beautifully designed in themselves. They form a remarkable and justly famous series. It is, perhaps, not generally known that they owed much to the imaginative genius, both literary and typographical, of Sir Francis Meynell. The coming of the four-colour rotary-gravure machine, which was used to print a popular weekly, gave the first opportunity to reproduce one of the designs in a coloured advertisement. But even this had its limitations, as the designs were, as a



Envelope brightly designed in black and red on a yellow background

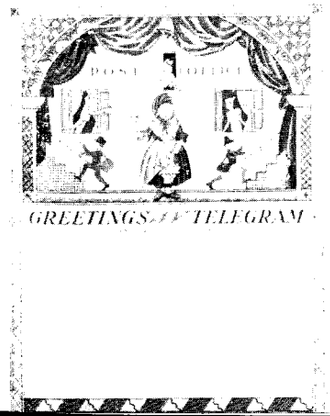
Artist: **REX WHISTLER. 1936.**
Festoons of flowers and fruit. A splendid specimen of the printer's craft, requiring 14 colours

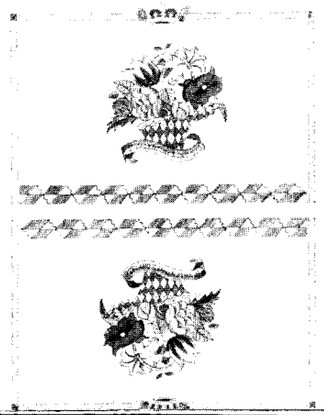
Artist: **MACDONALD GILL. 1937.**
Bright colours featuring the national emblems for King George VI's Coronation.



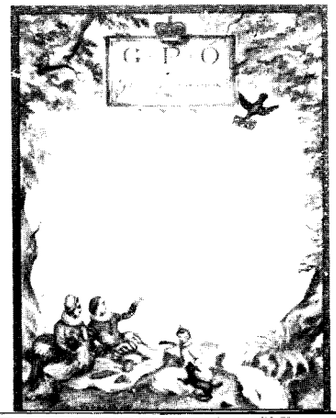
Artist: **LESLIE HOLLAND. 1939.**
Design in line and "flat" colours, with a humorous treatment of greetings telegram "occasions"

Artist: **"ROJAN". 1938.**
Valentine in "Penny Plain and Twopence Coloured" style. Conventional baskets of flowers on reverse





Artist: **J. S. GOODALL. 1938.**
Elizabethan picnic. The message space happily incorporated in the design



Artist : **"GWYNN". 1938.**
Winter scene with crocuses, and bluebird of happiness carrying golden envelope

rule, rather intricate and required, for faithful reproduction, eight or nine processings to get the requisite precision of detail and truth to colour.

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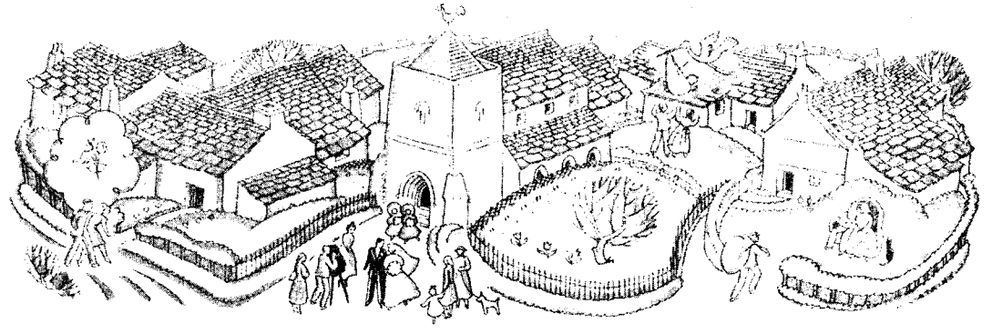
The design with which the service was opened is by Mrs. Claudia Freedman. It embodies that filigree floral work for which she is famous, and which proved so popular before the war. The monochrome representations of the Greetings Telegram at the top of this article cannot convey the richness of colouring which was always regarded as the prime feature in ensuring the popularity of the designs and of the service. The envelope design is by Miss Evadné Rowan.

Two press advertisements. Weddings and Births

Artist : **KATHLEEN ATKINS. 1942.**
Originally designed in several colours, but war-time austerity printing on inferior paper reduced them to two



The Post Office Circuit Laboratory

by C. H. Wright, A.M.I.E.E., Engineer-in-Chief's Office

AN IMPORTANT PART OF ANY DEVELOPMENT organisation is its testing and proving ground. It is here that new designs are tested to prove that they function as the designer intended, that they are free from defects, that they will have an adequate life, and that the components are accessible for maintenance and adjustment. Ideally, apparatus should function indefinitely and be fault free. Practically, this is not possible. Parts wear and lose their adjustment, and maintenance attention may be frequent. Hence the need to correct defects rapidly and simply places emphasis on accessibility. There must, of course, be adequate testing facilities and a competent staff of engineers and technicians.

The Circuit Laboratory is the testing ground of the Engineer-in-Chief's Telephone Development and Maintenance Branch. It is responsible for testing and reporting upon the new designs produced by the development engineers of the Branch or by the Telephone Manufacturers. The Laboratory also assists the maintenance engineers to solve current problems and difficulties, provides testing facilities for any of the Branches of the Engineer-in-Chief's Office who may need them, and performs certain work for the Services, particularly the construction of experimental assemblies. It has facilities for life-testing telephone and automatic switching apparatus, for examining in detail, by optical means, the physical dimensions and the surfaces of piece parts, for measuring the hardness of materials, and for practical photography in the field of micrography, enlargement and measurement. It is equipped for measuring, electrically or photographically, the speed and the characteristics of repetitive or non-repetitive impulses, or other electrical disturbances, down to a few millionths of a second. It has a comprehensive range of electrical and mechanical measuring instruments, and has facilities for controlling the temperature of apparatus under test from 100 degrees Centigrade to minus 33 degrees Centigrade.

The Laboratory has wiring and mechanics shops, which are called upon, when time does not permit the normal routine of other construction departments to be followed, to build equipments and assemblies, not only for test purposes in the Laboratory, but for installation elsewhere.

During the 25 years of its existence, the Laboratory has been closely associated with most major telecommunications developments, and has made contributions to the solution of many communication problems. It has dealt with over 4,800 investigation cases, issued over 8,000 test reports and completed nearly 9,000 separate works of construction.

The Laboratory is located on the second floor of the Sorting Office Block of the Head Post Office, King Edward Street, E.C.1, where it has grown from the original staff of three in 1924, occupying a floor area of 550 square feet, to the present accommodation of 13,500 square feet and a total staff of 110.

In the beginning, it was part of the Engineer-in-Chief's Automatic Telephone Training School where, from necessity and economy, it had to have joint access to the racks of automatic apparatus provided for training purposes. Its function was to carry out tests upon the samples of automatic switching equipment designed and produced by the telephone manufacturers in connection with the decision taken in 1922, to automatise the telephone system.

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Organisation of the Laboratory

Figure 1 shews a general view of the Laboratory as it is to-day. On the surrounding racks is mounted the apparatus to be tested, together with many permanent assemblies which are representative of the equipment to be found in typical automatic and manual exchanges throughout the British Isles. In addition, there are replicas of subscribers' apparatus and manual switchboard circuits. With these facilities, any new design may be tested in conditions comparable with those in actual service.

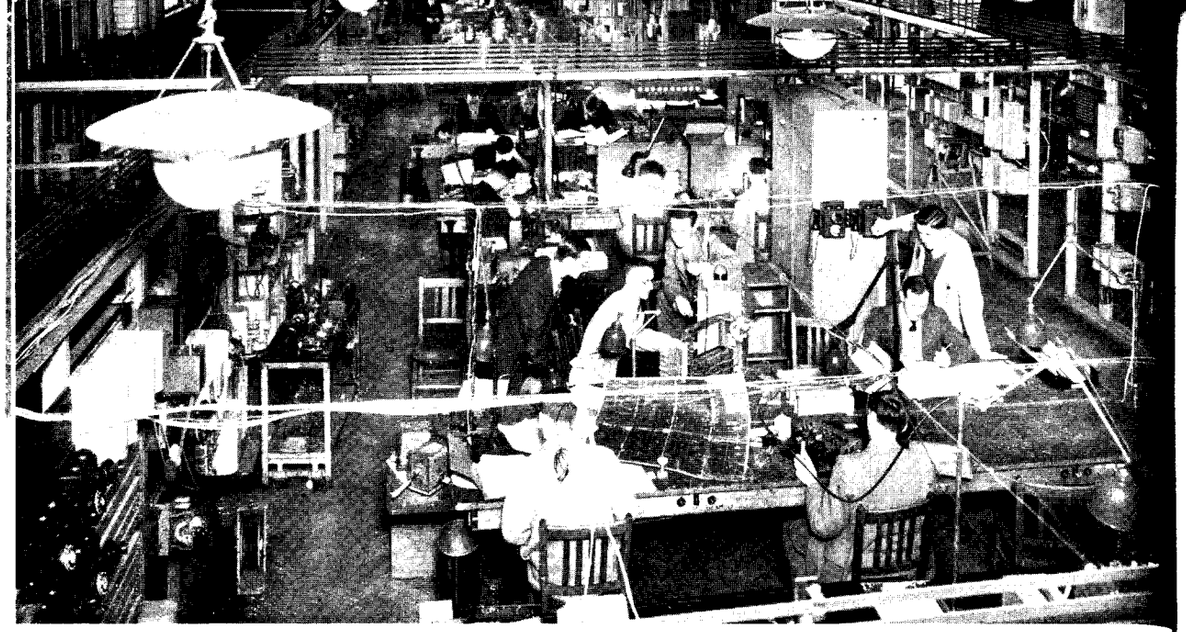


Fig. 1. General view of the Testing Laboratory. The testing groups are arranged progressively along its length.

At present, there are magneto, central battery signalling (CBS) and central battery (CB) manual exchanges, and various types of main automatic exchanges and unit automatic exchanges (UAX), any of which may be interconnected; the Circuit Laboratory tests ensure that they can be.

The parallel copper conductors, seen above the racks, distribute the power supplies, at the voltages used in telephone exchanges, to the testing groups. At the several tables extending through the Laboratory are the testing groups of Technical Officers and Technicians, who are under the direction of Assistant Engineers. There are ten Assistant Engineers, who control a technical staff of some 45-50 men, employed on testing and investigation work. Two Engineers co-ordinate the work of the Assistant Engineers, and give them technical direction and advice. The remaining staff is made up of workshop and stores personnel, youths-in-training and clerical force. Control of all the Circuit Laboratory operations is the responsibility of an Executive Engineer.

The ten testing groups are organised on a functional basis, and each is adequately equipped to undertake investigations within a limited specialised field. The main divisions of equipment, systems and circuits on which tests are required are distributed to the testing groups as follows:—

1. Manual Exchange Systems, Private Automatic Branch Exchanges, Artificial Traffic Equipment.
2. Director Exchange Systems.
3. Impulsing problems, that is, the response of apparatus to dialled and machine-generated impulses, and the interconnection of equipments over lines, by impulses.
4. New signalling systems. Recent examples are Long Distance Direct Current Signalling (LDDC), a Separate Channel Signalling System, and Single Commutation Signalling.
5. Voice Frequency Signalling Systems, both National and International. Non-Director Exchange Systems.
6. Relays of all types, mechanical adjustments and life tests.
7. Automatic Exchange Systems, mechanical adjustments and life tests.
8. Automatic Routiners and Testers for the maintenance of Automatic Exchanges.
9. Subscribers' Apparatus, Unit Automatic Exchanges (UAX), Satellite Exchange Systems.
10. Special Measurements and Electronics.

Testing Facilities and Equipment

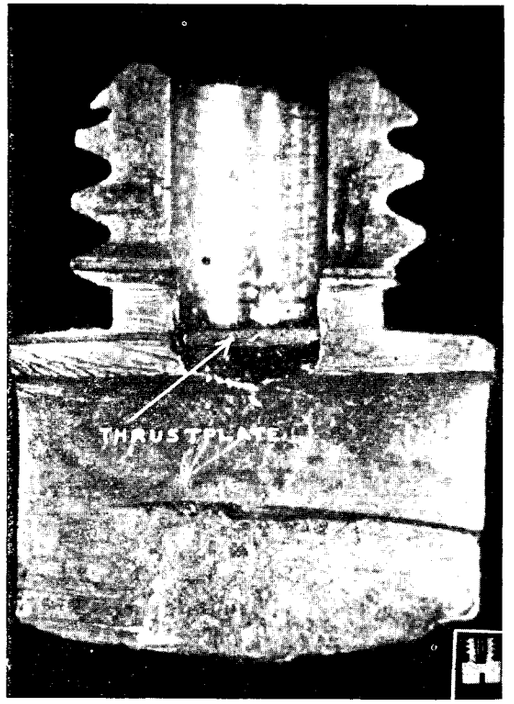
Notable advances have been made in the testing facilities in the Laboratory. Just over 1,300 square feet are devoted to the Special Measurements Group, which is responsible for a number of

special measuring instruments. It also maintains the measuring instruments lent to the testing groups, and is responsible for, and operates, the oscillographs. The latter instruments are capable by a combination of electrical, optical and photographic methods, of drawing traces on sensitised paper of the variations in the voltage and or current in electrical circuits. Traces of the simultaneous variations in six parts of a circuit can be recorded on the latest of the three oscillographs held. These oscillograms, as they are called, are invaluable in solving many development problems.

Included in this group is the Photographic and Optical Section.

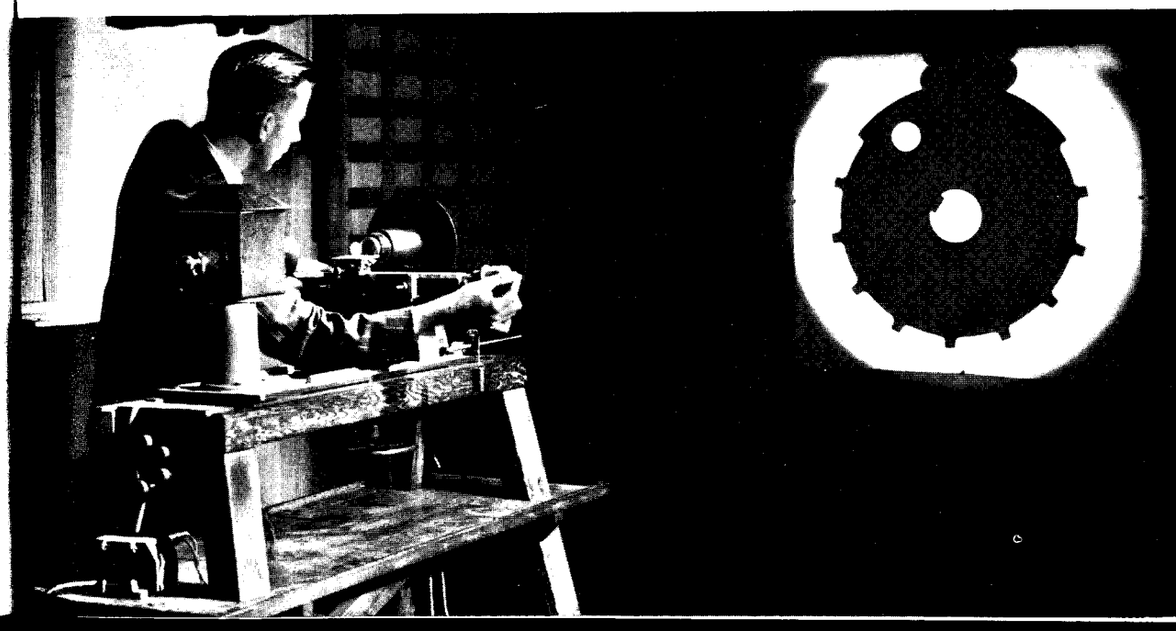
Photographic Work

This is specialised work, and does not compete with the general photography carried out by recognised groups outside the Laboratory. Objects can be directly photographed in sizes from quarter plate to whole plate, and the photographs can be enlarged subsequently to any size within practical limits. There has been an ever increasing need—in fact, a demand—for more photographs to supplement technical reports. They simplify considerably the written narrative, and provide irrefutable evidence of the condition of a test piece prior to, and immediately after, testing. Micrography is employed to examine small objects and surface areas for physical defects, dimensional errors and other irregularities. Figure 2 is a photograph of the thrust-bearing of a subscriber's dial which was cut through to shew the position of



Above : **Fig. 2. Defective governor bearing of a subscriber's telephone dial. The thrust plate should rest flat on the base of the hole. The inset shews a bearing, approximately actual size.**

Below : **Fig. 3. Horizontal Profile Projector. Projecting the silhouette of the impulse wheel of a subscriber's dial, preparatory to checking dimensional accuracy.**



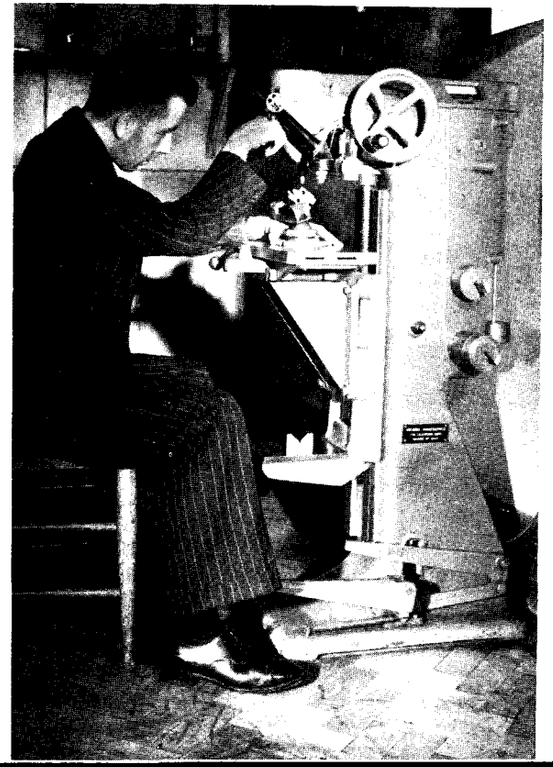
the hardened steel thrust plate, against which the spindle of the dial governor presses. A bearing, approximately actual size, is inset in the photograph. There are three dark rooms with facilities adequate for most forms of photographic processing, including a Kodak print drying and glazing machine. The Laboratory has had extensive experience of High Speed Photography in collaboration with Kodak Ltd., and latterly with the Post Office Research Station at Dollis Hill. This is a special branch of photography, and cameras have been designed which, with very intense lighting of the subject, can take very clear and sharp photographs at a speed of 3,000 pictures per second. When these pictures are projected at the normal rate of 24 frames per second, the high speed movements of the subject are slowed down more than 100 times. This enables movements to be analysed in great detail. With the aid of micrography, many mechanical defects have been corrected.

Optical Processes

The Laboratory possesses a Horizontal Profile Projector (figure 3). This most useful instrument is designed to project on to a screen the silhouette of any object interposed between the lens system and the light source. It is positioned relative to the screen so as to throw an enlarged shadow of the object, true to scale. It is particularly helpful in checking the dimensions of irregular objects, the internal dimensions of holes, angles, and the radii of curved edges, and comparing accurately the profiles of production samples against the relevant drawings.

The projector is equipped with a carriage controlled by a micrometer head, which can resolve dimensional differences of one ten-thousandth of an inch.

Fig. 4. The Diamond Pyramid Hardness Tester. A specimen under test.



Microscopy

There are microscopes of several different designs, each specially suited for a particular form of observation; one, such as metallurgical, has an internal illuminator for examining opaque objects; another, a binocular or double eyepiece, which gives a solid view of the object, that is, it has depth as well as area. There is also a travelling microscope, with accurate scales in both the horizontal and vertical planes, which enables differences in height or width to be measured to one ten-thousandth of an inch.

Mechanical Measuring Instruments

Among the mechanical measuring instruments in the Laboratory is the Vickers Diamond Pyramid Hardness Tester (figure 4). This instrument employs a pyramid-shaped diamond indentor controlled by a mechanism to release it slowly on to the test piece. It is loaded by weights operating through a simple lever system, the load being varied to suit the material under test. The test piece is placed upon an adjustable plane table and brought into close proximity to the indentor, which is released by a hand lever. The diamond is forced into the material and makes a diamond-shaped depression in proportional size to the depth of indentation. For a given load on the indentor, the depth of the depression will be related to the hardness of the material. After indentation of the test piece, the table is moved sideways by a lever to bring the depression under a microscope equipped with means of measuring its maximum horizontal and vertical dimensions. The depression appears as a black diamond on a light background. The measurements are converted into Vickers Hardness Numbers by reference to tables of figures. The results can be repeated with great consistency.

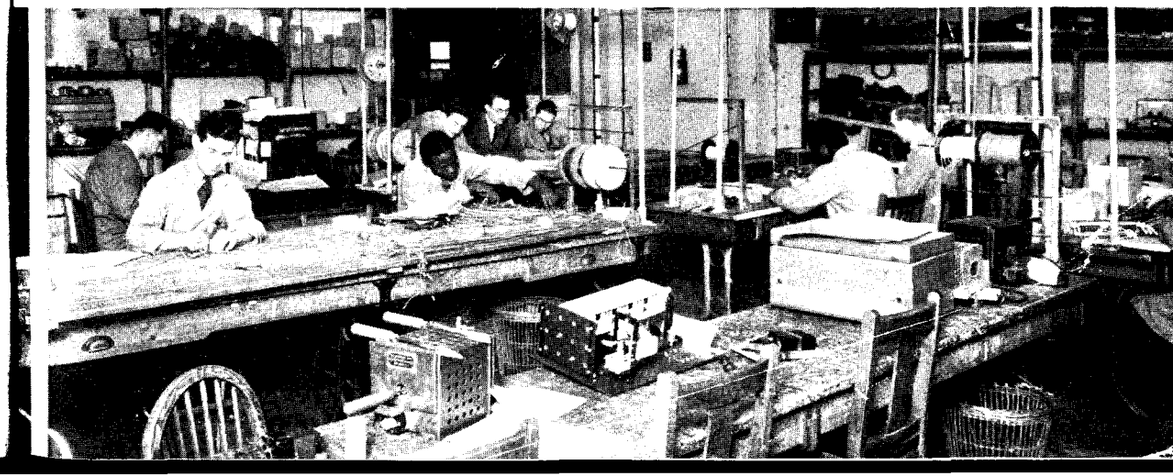
Electrical Measuring Instruments

There is, in the Laboratory, a large number of electrical measuring instruments of the standard patterns as well as special instruments for use in obtaining results of greater accuracy. The more interesting are those connected with the measurement of time. There are many ways of measuring time, and each has its particular advantage. Time figures largely in the function of telephone apparatus. For example, the "operate" and "release" times of relays must be known to ensure reliable circuit operation. The speed of certain dials, for instance, must be limited between 9 and 11 impulses per second if the best service is to be achieved in dialling over junctions to other exchanges. The speeds of rotation of machines, which generate exchange tones and voice frequency currents for long distance dialling, need to be kept within close limits if the connections are to be established effectively.

Fig. 5. Mechanical Adjustments and Life Testing Group. The apparatus undergoing life test is housed in the silence cabinets on the left of the picture.

The latest and most spectacular timers are those using electronic principles. They operate at speeds easily up to a million separate events a second, and are used in measuring very small intervals of time, such measurements being virtually impossible by any other means. The Laboratory has two of these timers, one which will count in units of 100-millionths of a second, and the other in ten-millionths of a second. The latter has the special facility that it can be pre-set to measure the time between any two events in a string of connected events. In other words, it is possible to select and measure the duration of a pulse in a train of ten pulses from a dial or the interval between the starting and stopping of any two selected events in a train of ten impulses.

Fig. 6. The Laboratory Construction Group.



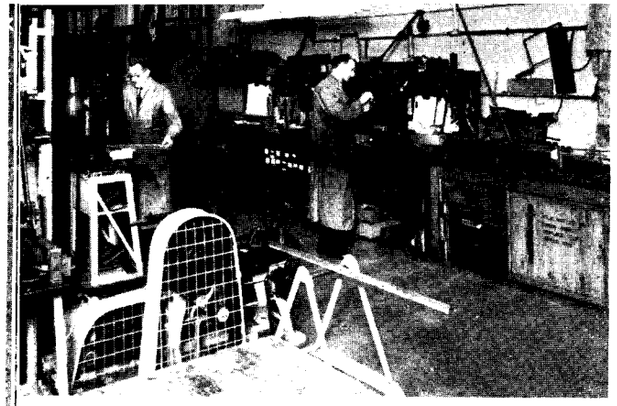


Fig. 7. The Mechanics' Shop.

Life-Testing

Life-testing is under the control of the Mechanical Adjustments and Relay Groups (figure 5), but other groups may require facilities, from time to time, to life-test equipment for which they are responsible. Any component subject to mechanical stress or wear by bending, rubbing or impact, has a limited life, that is, it begins to wear out at the first operation and will ultimately be discarded when worn sufficiently to become a source of trouble. It is the designers' aim to get the maximum number of fault-free operations from a component. The apparatus to be tested is wired or placed in conditions which simulate those in practice, or in even more arduous conditions if an accelerated test is desired. It is accommodated in a silence cabinet, to reduce the noise in adjacent parts of the Laboratory. In some cabinets the dust conditions to be met in a telephone exchange are reproduced. Each cabinet is supplied with power and a control alarm circuit which operates when the equipment fails. The tests continue day and night. Seven-figure meters register the number of operations, and the following are typical examples of the magnitude of the tests.

	Half Revolutions	*Contacts*
Heavy Duty Uniselector	17,000,000	425,000,000
Light Duty Uniselector	2,000,000	50,000,000
		Operations
3000-Type Relay (general duty)		14,000,000
Durability of contact materials		90,000,000
Durability of Lever-type Key Springs		300,000

The Construction Group

This Group comprises the Wiring Shop and the Mechanics' and Carpenters' Shops. The Wiring Shop (figure 6) is responsible for the assembly and wiring of equipment for investigation and test, and for special works of construction. During the War, this group completed numerous special assignments for the Services, and constructed many equipments which were installed in the defence centres, where they were destined to play an important role in the defence of this country and in the counter offensives.

The two mechanics shewn in figure 7, and a carpenter, are kept fully employed constructing racks and rack details, boxes for testers, and other fabrications of their trades. The shop is equipped with a number of machine tools which assist materially in increasing production, and have facilitated model making in connection with switch mechanism developments.

The Relay Shop

The Relay Shop (figure 8) holds a comprehensive range of relay spring sets, relay coils and relay piece parts to be used for building new relays for the equipments to be tested in the Laboratory. Individual relay coils can be wound. The shop holds complete data of all 3,000-type relays of approved design. Information of all new coded designs is circulated to the Laboratory.

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Enough has been written to shew the part the Circuit Laboratory has played, and is playing, in the development and perfection of the communication system, and there is no doubt that it will continue to be associated with, and make its contribution to, future developments. It is alive to the need to keep abreast of the times, and is ever receptive of new ideas to improve its testing facilities, and to add to its technical experience. It is the ambition of everyone associated with the Laboratory to continue to produce test results and workmanship of the highest possible standard.

Fig. 8. The Relay Shop. The staff are adjusting 3,000-type telephone relays.

From left to right: J. ORR, Chief Clerk; S. D. MELLOR, B.Sc.(Eng.), A.M.I.E.E., Area Engineer; G. GREEN, Telephone Manager; T. McLAUCHLAN, M.C., Chief Traffic Superintendent; E. P. LLOYD, Senior Sales Superintendent; J. E. COLLINS, Area Engineer.

NEWCASTLE-ON-TYNE TELEPHONE AREA

The Area covers 2,300 square miles and stretches from Berwick-on-Tweed on the Scottish border to a line south of the cathedral city of Durham. The Area varies in character. It embraces, on the one hand, hamlets in the foothills of the Cheviots and on the long stretch of Hadrian's Wall, fishing villages and seaside resorts on the long coastline, heather moors of north Durham and, on the other hand, the extensive coal fields and busy shipbuilding yards on Tyne and Wear.

Of the 144 exchanges serving the Area, 115 are automatic, whilst line plant comprises a network of nearly 500,000 miles of wire, 36,000 miles of which are overhead. The 100,000th telephone was connected in June of this year, the Area being the first in the North Eastern Region to attain that distinction.

The number of staff, excluding the operating force, is 1,487.

DUNDEE TELEPHONE AREA

The Area covers the East Central district of Scotland (3,265 square miles), has a wide range of contrasts, from rugged mountains of the Highlands to soft-rolling cultivated lowland, and a varied coastline. Dundee (population 180,000) is usually associated with the three "J's"; Jute, Jam and Journalism, but many new light industries, for example, watches, plastics, cash registers and batteries, have been started in recent years to give a more varied industrial structure.

Perth, the next largest city (population 40,000), is an important rail and road centre. It is the ancient seat of Scottish kings, who were crowned at nearby Scone. It is also the market for a rich agricultural district, including the Carse of Gowrie. Its Bull Sales in the spring attract buyers from many parts of the world.

Perhaps the best known place in the Area is St. Andrews, famous for its University (the oldest in Scotland) and for its association with the royal and ancient game of golf.

There are 101 automatic and 37 manual exchanges with some 30,000 lines and 48,000 stations. The staff on the Telephone Manager's pay-roll numbers 700 and in addition there are 450 operating staff on the pay-roll of the Head Postmasters.

From left to right: D. M. SOUTAR, Senior Traffic Superintendent; J. KNOX, M.Sc., A.M.I.E.E., Area Engineer; MISS V. M. ADAM, Secretary; W. F. PRATT, Telephone Manager; J. WILLIAMSON, Chief Clerk; D. FALCONER, Senior Sales Superintendent.

(*By courtesy of H. L. H. Laurence*)

"D" Day at the Fish Docks

by A. Scarborough, Bradford Telephone Area

(Formerly of Lincoln Area)

ON SATURDAY, APRIL 15, 1950, CONTROLS on the distribution and price of fish were abolished, and immediately the telephone switchboards serving the deep-sea fishing ports of Great Britain became centres of intense activity. In the report on traffic conditions at one port, the demand for calls was described as "unmanageable". Reports from other centres mentioned "indefinite delay" on long distance routes.

Causes of the Traffic Increase

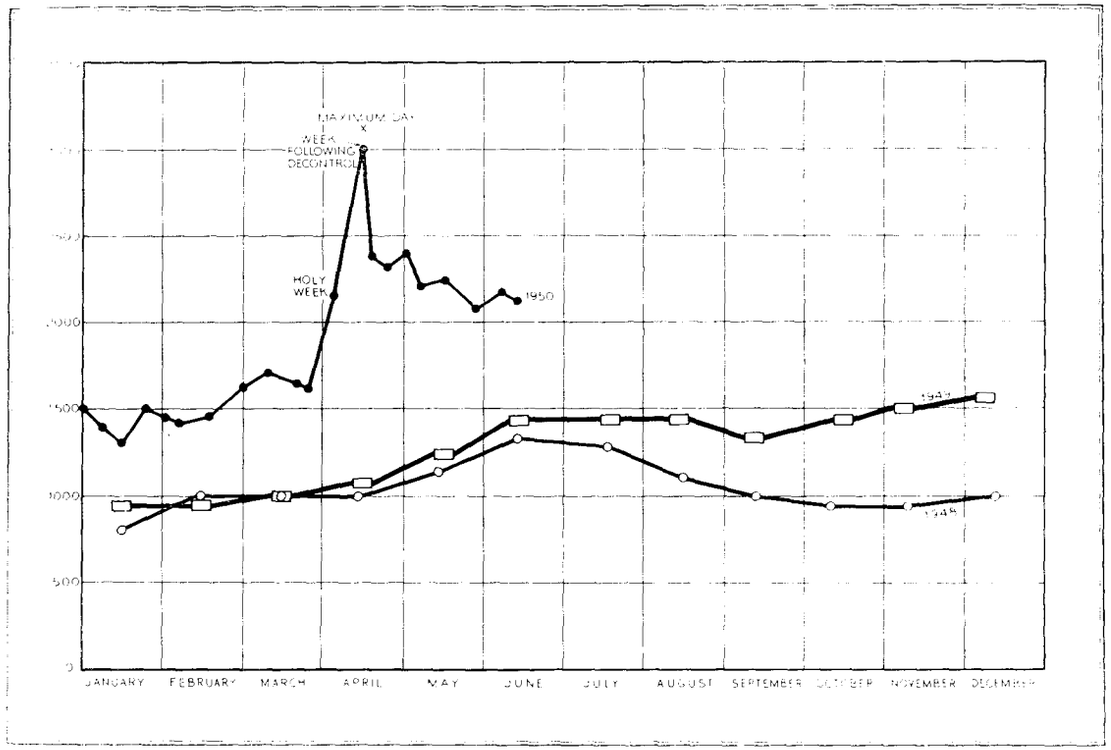
To understand the reasons for this sudden and unprecedented rise in the calling rate at the trawler ports, it is necessary to know something of the history and marketing methods of the industry. Obviously, I can give only a brief outline. As soon as controls were applied, the free market disappeared, and during the period 1940 to 1950, there was no competition between merchants either in buying on the market or in selling to the retailer. The retailers were tied to their respective wholesalers (rather like the registration of the customer in the ration scheme), and each merchant

was allocated so much of the fish landed each day. On top of all this, the ceiling price of each class of fish was fixed. Thus, the wholesaler at the ports became little more than a collector and a distributor, buying allocated quantities, boxing it up and despatching to his various clients. With competition gone, certainty of selling what could be obtained and price matters settled, the previous competitive spirit was absent from the fish docks. Thus, it is not difficult to appreciate that telephone and telegraph traffic to and from the docks consisted chiefly of routine instructions and enquiries regarding the amounts of each variety likely to be available. With the abolition of the controls, the fish is sold by auction on the quay to the wholesalers, and no one can know for certain in advance what the prices will be. Quantities available can be assessed only on examination of the market, and the whole business is now controlled by supply and demand. Astuteness in buying determines the success of the merchants. At Grimsby, there are some 600 merchants. The manager of one of the larger Grimsby firms interviewed some time before the withdrawal date prophesied "It will be utter chaos on the docks for the first week". It was. We, in the Lincoln Area, had, fortunately, some experience of what could happen on days when certain classes of fish were "declared free sales". This occurred at a gradually increasing frequency towards the end of 1949, and the position was carefully watched not only weekly, but daily, as the curve in figure 1 shows.

Fish has always been a staple food of the people of these islands. Practically no dollar expenditure is involved in its production and distribution, and, in consequence, it is a very valuable commodity in the British fight for existence and financial independence. I have no space to discuss the drift away from fish as a protein food, stated to be

Fig. 1. Grimsby—long distance originated calls daily (5 a.m. to 6.30 p.m.).

NOTE: The 1948 and 1949 curves represent the average of the daily traffic Monday—Friday for each month. The 1950 curve represents the average Monday—Wednesday (inclusive) daily traffic each week. This has been done in order to eliminate the effects of fluctuations, which have been prominent since decontrol, on Thursdays and Fridays.



due to the housewives' reaction to the fantastic prices paid by merchants in the first few days after decontrol, nor the subsequent slump in the industry, laying-up of trawlers, and so on. Similarly, I shall not comment on recent allegations in the Press that the marketing arrangements of the deep-sea fishing industry are archaic, wasteful and inadequate to the needs of the industry. I merely mention them in passing in order to show that long-term planning for telecommunications purposes in the larger fishing ports is a chancy business in which only the man with real local knowledge, reliable contacts in the industry and a flair for anticipating queer trends has any hope of success.

Not all our fishing ports are large. Some, like Milford Haven and Buckie, are small and little known outside the trade. Others, like Hull, Grimsby, Lowestoft, Fleetwood, are well known. The problem, in the case of the smaller centres, has probably not created very acute difficulties, because the increases in traffic due to decontrol are comparatively small percentages on the total traffic at the Group Centres concerned. In the case of the larger centres, however, the basic characteristics of the traffic have been substantially altered, upsetting planned extensions and the exhaustion dates of equipment and buildings.

The Problem at Grimsby

Through the courtesy of the Telephone Manager, Lincoln, who was good enough to give me permission to complete this article after I had left the Lincoln Area, I shall now describe the steps taken to meet the pressure at Grimsby, which is one of the largest fishing ports in the kingdom. Because Grimsby is a smaller town than Hull, the impact of the increased traffic on the exchange system has been much greater there than at the latter. Comparative figures of long distance bookings in the busy hour at each centre are as follows:—

BUSY HOUR LONG DISTANCE BOOKINGS
(REPRESENTATIVE FIGURES)

	Before decontrol	After decontrol	Percentage Increase
Grimsby ...	425	770	80
Hull	1,000	1,200	20

Unfortunately, there was already an overload (on the then existing call values) of some 20 per cent. in operating positions during the 1949 "season", due partly to the very successful summer holiday season; this augmented the usual increase in traffic at Cleethorpes, which is served by the manual switchboard at Grimsby. To what extent this seasonal traffic would be repeated in 1950 was already under consideration when the rumours of fish decontrol began to circulate.

Staff Arrangements

An analysis revealed that 75 per cent. of the long distance traffic originated during the period 9.0 a.m. to noon was from subscribers in the fish industry. It was decided that, for the 1950 season, an increase of 100 per cent. would accrue in the purely fish traffic, while 10 per cent. would be adequate for the remainder. This estimate produced satisfactory working requirements for a complete staff revision and enabled recruitment to commence in good time—actually in December. Half-hourly distribution of the traffic—inevitably distorted due to the shortage of operating positions—was decided by graphical methods. (See figure 2.) There was an interesting feature as regards the early morning traffic, that is, that before 8 a.m. Before the war, it had been necessary to commence a number of the women telephonists' duties at 6.30 a.m., but during the period of control, these duties had been started at 8 a.m. Additional "through-night" attendances by the men, and the later opening of the market, had enabled 7 a.m. to be fixed as the earliest attendance of the day staff under the new conditions, and a 6 p.m. cut-off was substituted for the original "mixed staffing" between 6 p.m. and 8 p.m., thus effecting a reduction of one hour in the period covered by female staff.

As the traffic continued to rise, the staffing was augmented by part-time staff, particularly when it was later found possible to extend the original scheme for provision of Portable Trunk Units. This will be mentioned later. At the time of the decontrol (April 15), the number of operators employed in the busy hour was 71 compared with 45 in the 1949 season.

Additions and Alterations to Equipment

It was obvious from the outset that additional equipment of standard design could not be provided in the time available. It was equally obvious that as many additional temporary controlling positions as could be used and accommodated would be necessary in order to safeguard the service from collapse.

It was decided to employ Portable Trunk Units. (See figure 3.) Three (giving six additional operating positions) were first installed, followed by three more as soon as it became clear that they could be connected up. Some rearrangement of

switch groups was necessary in order to make available the necessary outlets to the automatic plant.

A further measure of relief to the overloaded main suite was provided by diverting 20 incoming long distance circuits to an existing manual relief suite (PMBX 1.A.), which consisted of six positions, only three of which were staffed in the busy hour. The cord circuits of this suite were not suitable for the job, but this was considered of minor importance compared with the relief afforded.

Four "booking positions" were provided at a table behind the first suite of Portable Trunk Units. These consisted of four signal junctions from the Outgoing Junction Multiple, each terminating on an indicator, keys and operator's jack.

The following table gives a summary of the working positions of all types available before and after the additions mentioned above:—

Type of Position	Before	After
Joint Trunk and Delay	36	36
Monitors'	4	4
Manual Relief	3*	6
Portable Trunk Units	—	12
Booking	—	4
Totals	43	62

* *Six fitted, but only three required to meet the load offered by the manual subscribers connected.*

Local Circuits

Twenty-three additional switches were added to the Line Finder Groups in December, and twenty-four circuits to first selectors were provided for the Portable Trunk Units. One Trunk Offering Circuit was provided which was made available to all operators on the Portable Trunk Units. This is not a standard feature of these units, but it proved to be absolutely essential. Internal groups were strengthened wherever rack space was available. 14 additional "O" level circuits were provided, but not brought into use immediately. It was considered better that the caller should be given "engaged" at the height of the pressure than that he should get no answer. In practice, the grade of service fell to about one lost call in ten.

Long Distance Circuits

One hundred long distance circuits—all generator signalling—existed. Estimates had been prepared in the autumn of 1949 for an increase to 130 which, had they been available, would have been adequate. No additional circuits could be provided by the decontrol date, but special efforts on the part of all concerned resulted in five additional becoming available within a few weeks.

Miscellaneous Preparations

(*a*) Three circuits trunked out from third selectors to jacks on the relief suite were provided as a kind of alternative "O" level. The original idea was that subscribers waiting to make bookings—particularly batches—might be given this special code. In practice, it was not used.

(*b*) Letters were sent to 7,000 subscribers in the Automatic Area and neighbouring exchanges, warning them that congestion would probably occur, and asking all to co-operate by making calls either earlier than 9.30 a.m. or after noon. Special letters were sent to the editors of the two local papers, who later sent reporters and gave the Post Office some very helpful publicity.

(*c*) The operating staff were given intensified refresher training in delay working and delay "preparation" duties.

(*d*) Two delay assistants were made responsible for the distribution to the delay operators of all tickets for calls booked. They were provided with a table fitted with special ticket clips and a telephone. This arrangement relieved the Assistant Supervisors, and proved invaluable in smoothing the flow of traffic.

The Results

The proof of the pudding is in the eating. The Grimsby service "pudding", immediately after decontrol, could scarcely be described as "first-class Mrs. Beeton", but not even the operators, who worked like Trojans, and the Supervisors, from whom almost super-human efforts were required to control the fluctuating requirements of the traffic, suffered other than temporary indigestion.

It would take too long to describe the scene on those first few days, and I shall content myself by adding a few statistics which I hope will speak for themselves.

A. *Traffic*	Long Distance Traffic (Typical 1949 figures)	First Week (Busiest Day)	May (Average)
Day (24 hours)	1,600	3,100	2,300
Busy Hour	425	940	770
B. *Delays*			
London	Nil	2½ hours	1½ hours
Leeds	,,	2½ hours	1 hour
Nottingham	,,	1 hour	Nil
Sheffield	,,	Nil	Nil
Manchester	,,	1 hour	Nil
Birmingham	,,	2 hours	1–1½ hours
C. *Speed of answer* during busiest period	7.5 seconds	27 seconds approx.	22 seconds

D. *Complaints*
Only three written complaints were received, and these related to delay in completion of calls and not to any worsening of the speed of answer. A few oral complaints were made, but subscribers generally accepted the position.

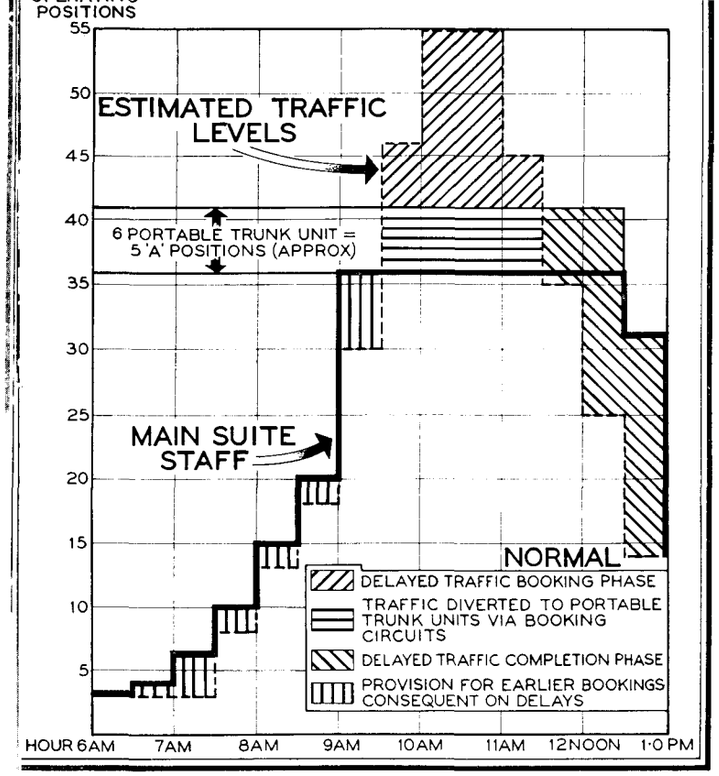


Fig. 2. Distribution of the traffic.

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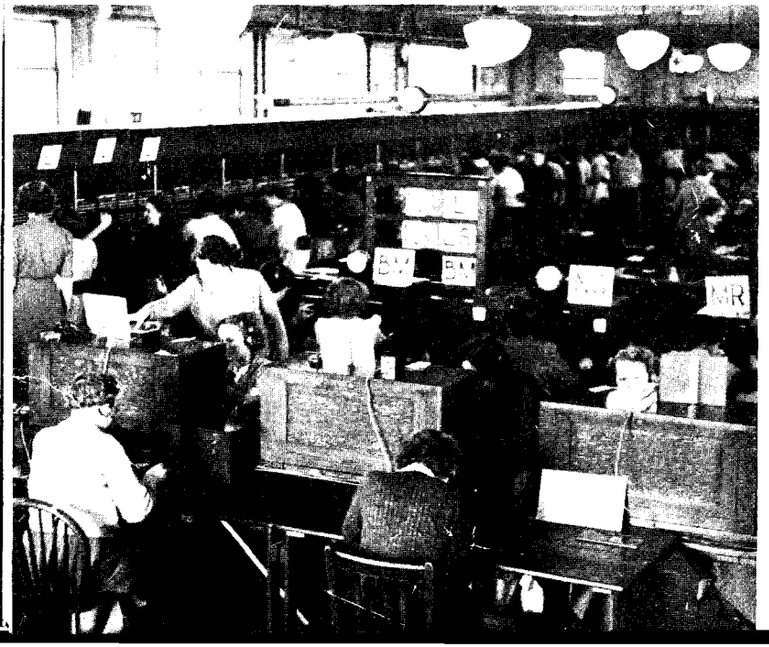
Fig. 3. Portable Trunk Units in use at Grimsby Telephone Exchange.

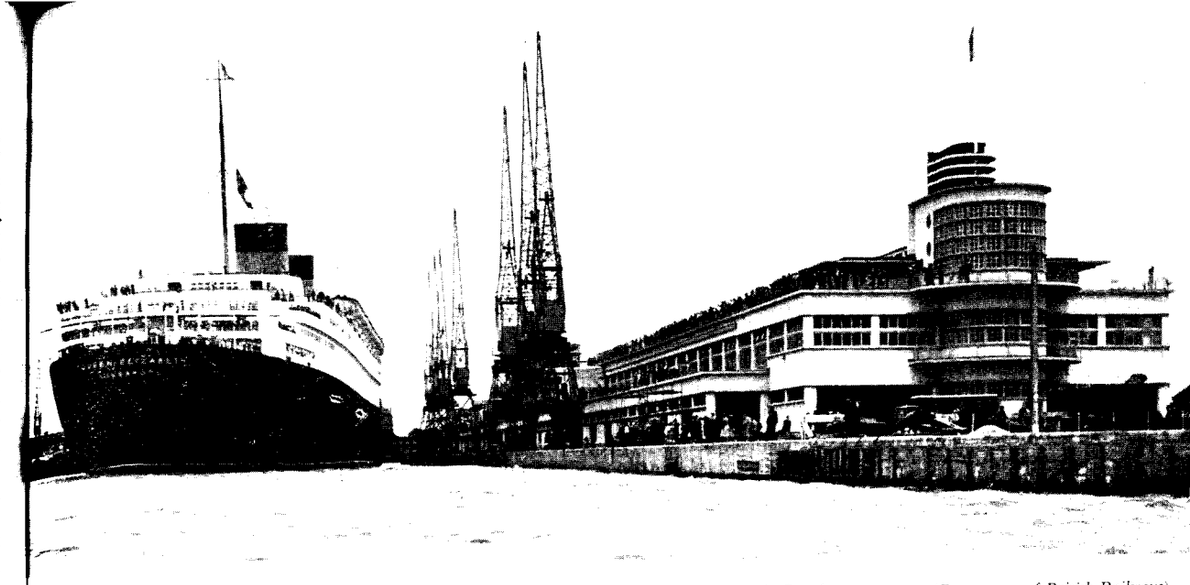
(By courtesy of H. L. H. Laurence)



The Future

One of the basic questions remaining to be decided is whether it is really economic to cater for a demand service in the busy hours with a percentage of busy-hour to day in the region of $33\frac{1}{3}$ per cent. If sufficient operating positions are provided to enable a demand service to be maintained (some 87 are estimated for April, 1951), it will be impossible to avoid a very high percentage of part-time staff, a feature which would be most undesirable. In addition, there is the high cost of providing an appreciable quantity of plant which would lie idle for some 22 hours of every working day. Consideration has, of course, been given to the spread of the traffic, but with the present marketing arrangements on the docks, very little appears possible. The compression of the traffic is due to the lateness of completion of the auctions—about 9.45 a.m. normally—and the critical hour of 11 a.m., occasioned by the departure of the main fish train at noon.

Other serious problems are connected with the high incidence of number engaged calls on incoming routes and on delayed originating calls, the telephoning of telegrams and the fact that there is no alternative manual board within dialling distance which can offer material assistance. Several palliatives are in use, e.g., re-booking at Lincoln and the booking of daily fixed-time calls at the distant trunk centres, but these devices are makeshift arrangements, and introduce their own problems and anomalies. Long-distance dialling into and out of Grimsby, coupled with a comprehensive local line plant development scheme for the docks, will go some way towards a solution, but whatever that solution proves to be, "D" day (Decontrol day) will live long in the memory of all connected with the telephone service at Grimsby.



The "Queen Elizabeth" docking at the Ocean Terminal, Southampton. *(By courtesy of British Railways)*

Telephone Services for Ships-in-Dock Passengers

by F. N. Thomas, Southampton Telephone Area

SINCE THE END OF THE WAR, THERE HAS BEEN a growing demand for telephone facilities from passengers aboard the ocean liners during the periods from embarkation to departure and from arrival to disembarkation. On the largest ships these periods can be considerable. When a ship like the *Queen Mary* arrives late in the day, many passengers do not disembark until the following morning; similarly, many passengers embark in the afternoon for a sailing the following day. It is, therefore, not difficult to appreciate that ship to shore telephone communications are of considerable advantage to passengers. For many years it has been the practice in a number of ports for ship-shore telephone facilities to be provided for the conduct of ships' business. Where a Private Branch Exchange is available aboard ship, as on the largest ships, shore connection is made to this switchboard; but in the other cases, a single telephone is put on board. Both these arrangements provide very restricted facilities and, as a consequence, cannot be made available to the passengers except in the case of emergency. Various methods have been employed at different ports to meet this "passenger demand", and the particular problems have been considered and reported on by a Study Group. The basic solution in each case has been the provision of call office circuits aboard the ships.

Mr. F. N. Thomas

Southampton, as the main passenger port in the United Kingdom, has had a live interest in this problem, and first installed public call offices in ships in 1946, when four were provided in the *Queen Mary*. Since this date, the number, excluding portable telephones used on the troop ships, has been extended to 32, serving 14 ships.

First-class waiting hall in the Ocean Terminal. *(By courtesy of British Railways)*

Except for the two "Queens", the present arrangements are generally quite adequate, but on these ships, the demand is considerably in excess of the facilities which can be readily provided aboard ship. This is due, of course, to the size of the passenger list and the relatively long periods they spend on the ship before sailing and after docking. This difficulty with the telephone service is typical of the troubles encountered by a ship of exceptional size, and calls for a much more elaborate shore organisation than is necessary for the ordinary passenger ship. Realising this, the Southampton Docks authorities have recently brought into service an Ocean Terminal, which is, in effect, a station designed to give all the amenities required, and is provided for the priority use of the two "Queens". It is a two-storey building about a quarter of a mile long. The ground floor provides the baggage handling space and railway platforms, together with facilities for passengers departing or arriving by road transport. The first floor accommodates the Customs examination rooms with associated waiting halls. All the amenities required by the passengers, namely, Banks, Travel Agencies, Theatre Agencies, Cable and Wireless, Post Office, Refreshment Buffet and so on, are provided in the two waiting halls which are inside the Customs barrier, and are, therefore, open immediately to passengers.

The public telephone facilities consist of a suite of attended call offices in each waiting hall together with a number of ordinary kiosks on the ground floor. The latter are for the use of the general public, whereas the former are generally for the use of passengers, as access between first and second floors is restricted by Customs limitations.

(By courtesy of British Railways)

Telephone call office suite in the Ocean Terminal.

The attended call office suites were provided as a direct result of the experience gained with the call office circuits fitted aboard the ships, as the waiting halls can be regarded as part of the ship. Whilst the users, who are of all nationalities, generally have no language problem, they are frequently unfamiliar with our coinage and automatic telephone system. Directory enquiry facilities are also a feature of the suites and a considerable proportion of the calls made require directory reference. Here again the services of an attendant are invaluable.

Each suite has twelve cabinets, with an associated attendant's position which can accommodate two attendants at the busy periods. Use of the exchange lines from ten of the cabinets is controlled by the attendant, and the remaining two cabinets are fitted with ordinary automatic public coin-box circuits for the use of callers who understand them. These two cabinets are also available during slack periods, when the ten "attendance" cabinets are closed down.

Simplicity has been the keynote of both the equipment provision and operating procedure. The attendants are each provided with a headgear receiver and transmitter, connected with a separate line direct to the Southampton Telephone Exchange, for "booking" the calls with the exchange operator. The attendant's transmitter incorporates a switch so that when the transmitter is moved on its swivel, towards the mouth, a signal is sent out to the exchange to attract the operator's attention. The attendant's receiver is continuously in circuit, so that if the operator at Southampton Exchange wishes to call the attendant, she simply plugs into the line and speaks.

During the quieter periods, when only one attendant is on duty at a suite, the two booking lines are connected to one headgear receiver and transmitter.

In assisting callers, the attendant records particulars of the call, accepts the charges, and passes particulars to the exchange operator over the booking circuit. The exchange operator, in setting up the call, tells the attendant to which cabinet she will connect it, and to this cabinet the caller is directed. The attendant is ready to provide further assistance and to collect additional charges, if necessary, on the advice of the exchange operator.

The attendant's position is located in the centre of the entrance to the telephone enclosure, and its design is such that, even with one officer on duty, each cabinet is within the range of easy observation. The counter of the position is on two levels—one convenient as a working surface for the seated attendant, and another, about a foot or so directly above, at a level convenient to the standing caller who wishes to book a call. This reduces the space required for the counter, and eliminates the need for a grille between caller and attendant.

The attendant's cash-bowls are recessed in the lower working surface, and the space between upper and lower counter surfaces is glazed on the caller's side. In the accompanying photograph, this glass panel has been removed to show the working counter together with the arrangements for accommodating the two complete sets of directories.

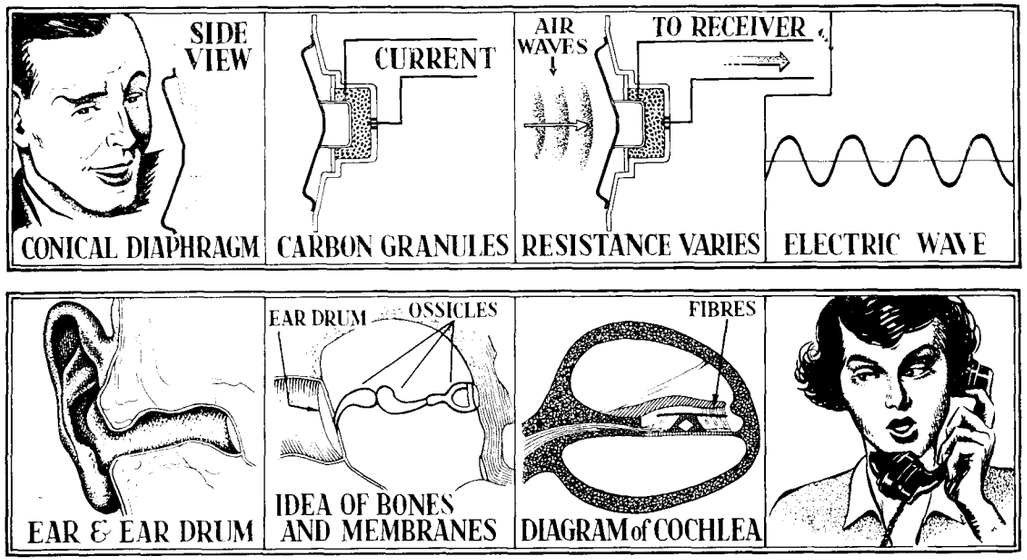
Bulletins Help Us Get Together

by V. Bowles, London Telecommunications Region

WITH A SMALL STAFF, IT IS EASY TO BUILD up a good family atmosphere and to learn to appreciate one another. Even the presence of three or four different ranks can be a help rather than a hindrance, for then there is the stimulus of the simultaneous exposition of different viewpoints. But with a large staff assembled together, you run the risk of losing touch. In the London Long Distance Telephone Area, there are thousands of operating staff and hundreds of supervising staff, nearly all working in Faraday Building. Keeping in touch with the individual is the problem. The traffic staff can gather together and be briefed in a few minutes; but the policies, the procedures, the news, the ideas and ideals must reach all ranks.

Of course, much has to be done by way of instructions and, wherever possible, these explain not only how something has to be done, but why. Sometimes we can include technical data. Then there are the various official meetings such as the Whitley and Joint Production Committees which cover many aspects of the work and help the interchange of ideas. We are lucky to have a local magazine run by our Social and Sports Association. These diversified contacts, while good in themselves and very good in their total effect, still leave some part of the problem unsolved, so we issue a monthly bulletin. Right from the start, three years and more ago, we agreed it would be free in scope and language so that readers might come to expect it always to be interesting and free from the reproach that it was just another rehash of observation results. We had misgivings, as probably most bulletins writers have, but they were needless. Our supervising officers to whom the bulletins were addressed were kindness itself in their reception; at a stroke of the pen they had become more closely associated with the writer and through him the "powers-that-be".

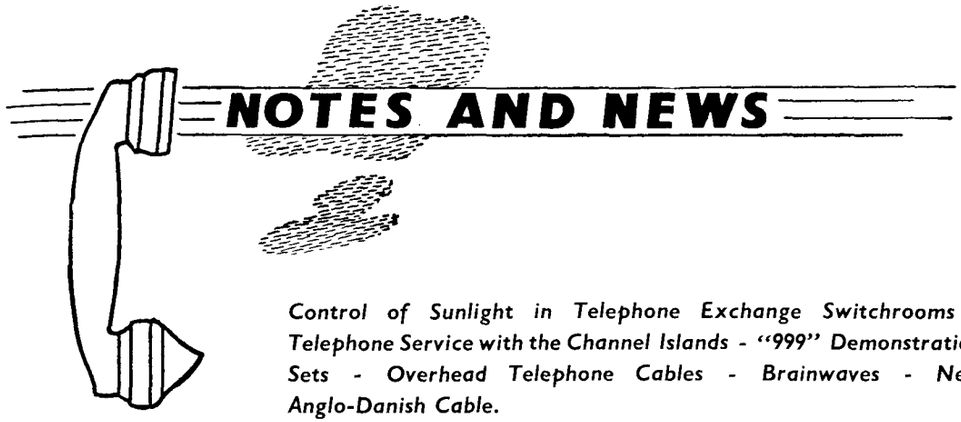
The very appreciation of the recipients made the production of the bulletin each month a little more onerous, for it was clear they deserved our best! The fear that we should run out of ideas died away, for help and suggestions came from many quarters. The bulletin has proved to be an admirable channel for giving news, for stressing the right outlook on service problems, for pinpointing weaknesses and for praising the many examples of work well done. The circulars and bulletins issued by Post Office and Regional Headquarters have provided many items of general or special interest to telephone people.



So our bulletins have usually been general rather than particular. But now and then we have devoted one to a specialised subject; for example, one explained briefly and in everyday language the complicated subject of "Vote" and "Loan" expenditure. This proved more interesting to most readers than we thought it would. Another bulletin ambitiously set out to explain in a few hundred words and a handful of sketches, how speech was produced, carried through the air, through a telephone transmitter and receiver into the ear; and, as if that were not enough, how the ear itself worked! Of course, the subject had no direct bearing on the duties and responsibilities of switchroom supervisors, but was a typical background item. The story of the telephone transmitter was told by picturing a hypothetical George telephoning an imaginary Georgina, as shown below.

In devising the pictures, and in writing and condensing the story, we realised the dangers of introducing technical inaccuracies in the desire to make the subject clear to the lay mind. We browsed in our technical books and consulted our expert colleagues. The receiver was treated in the same way. But that extraordinary piece of mechanism, the human ear, was allowed a little more space. Much of our information about the ear came from Sir James Jeans' book *Science and Music*.

In devising this bulletin, our phraseology had to be carefully precise although colloquial in phrasing. But most of the bulletins have been couched in very informal and even racy language, and have, at times, not been free from what Mr. Polly called "sesquippledan verbojuice". Our supervisors accept cheerfully the axiom taken from the desk calendar; they are not put out by the quotation from Macbeth or the occasional irruption of a rare polysyllabic word designed to send them to their dictionaries. We are friends. We share common ideals of service, and we value this point of contact with one another.



Control of Sunlight in Telephone Exchange Switchrooms - Telephone Service with the Channel Islands - "999" Demonstration Sets - Overhead Telephone Cables - Brainwaves - New Anglo-Danish Cable.

Control of Sunlight in Telephone Exchange Switchrooms.—Operators seated at the low type of switchboard may have had first-hand experience of the glare effect of sunlight over the top of the switchboards when these back on to windows. This is a problem which, together with its counterpart, the dimming effect on lamp signals, has been the subject of study for many years. The provision of ordinary blinds at windows and of screens on top of the switchboard positions has greatly helped, but may not be the complete answer. Experiments with new types of proprietary blinds are to be made at a few exchanges. It is claimed that these blinds will permit control of direct sunlight without detracting greatly from the switchroom lighting.

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Telephone Service with the Channel Islands.—As foreshadowed in the article in the Journal of February, 1950, two-frequency trunk dialling equipment is being installed to enable operators in Guernsey and Jersey to dial to subscribers on automatic exchanges in the London Director system. This will enable an appreciable proportion of the traffic to the mainland to be completed by direct dialling, and will supplement the improvement in the service which had already been brought about by the introduction of standard demand working to and from the Islands. Previously, all calls were connected on a delay basis, and controlled, in the case of calls to the Islands, at special positions in the London Trunk Exchange, but now any trunk operator in the country can set up and control these calls in the normal way, delay working being resorted to only at peak traffic periods.

"999" Demonstration Sets.—By arrangement with the Home Office, the Post Office has provided three specially constructed "999" display panels for use by the Fire, Police and Ambulance authorities in towns where it is desired to educate the public in the use of the "999" Emergency Telephone System. With the aid of illuminated channels and pictures, the unit demonstrates, stage by stage, what happens when "999" is dialled. The three emergency services, Fire, Police and Ambulance, are shewn and, by means of a switch, the course of a "999" call to any one of the three services can be followed.

A wider understanding by the public of the scope of the Emergency Service is aimed at. Special attention is drawn to the fact that the caller's first contact is with the Post Office telephone operator, to whom it is necessary to indicate the service required.

Over 1,000 automatic exchanges of all sizes now have the facility of dialling "999" in order to obtain an immediate reply from the exchange in an emergency; about one-third of these has been so equipped during the past twelve months.

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Overhead Telephone Cables.—The problem of the suspension of overhead telephone cables, which contain a large number of wires, between poles in rural areas is likely to be eased by an improved method, of American origin, now being adopted by the Post Office. The new method still requires a stranded steel wire rope between the poles. The end of the cable from a drum in a lorry is taken up and fastened to the rope. A machine called a "spinner", which is loaded with soft wire, is

placed on the suspension rope, and as the lorry moves along paying out the cable, the spinner is pulled along the rope. The movement causes the spinner to rotate, and this has the effect of binding the cable to the suspension rope with the soft wire with which it is loaded. The new suspension method is expected to eliminate the damage to cables which arose under the old method, which provided rings or cradles fastened to the steel wire rope as support for the cable. It is also much neater in appearance.

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Brainwaves.—During the quarter ended 30 June, 1950, the General Post Office Awards Committee granted awards amounting to £732 for 352 suggestions made by Post Office men and women for improving the services. There were 124 awards ranging from £1 to £47 for adopted suggestions, one interim award of £3, and 227 encouragement awards ranging from £1 to £3. The highest award for the quarter went to Mr. F. W. Taylor, Technical Officer, Glasgow Telephone Area, for a suggestion in connection with shared service working, whereby first code selectors are prevented from locking up. The second highest award of £20 was paid to Mr. R. E. Sutton, Technical Officer, Peterborough Telephone Area, for a suggestion concerning the supply of test cord No. 2/12a with each A unit of a No. 13 Unit Automatic Exchange. Other awards for adopted suggestions included £10 each to two Technicians, Class 1, £10 to a female Traffic Officer and £10 to an Overseer in the Birmingham Factory.

Since the General Post Office Awards for Suggestions Scheme was introduced 44 years ago, more than 130,000 suggestions have been received and some £44,000 paid as awards. Thousands of suggestions contributing to the improvement of Post Office services have been put into operation. Each Post Office servant is at liberty to submit a suggestion, and even although it may not be suitable for adoption, the suggestor is often given an encouragement award.

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New Anglo-Danish Cable.—H. M. Telegraph Ship *Monarch* has recently completed the laying of a submarine telegraph cable between England and Denmark. This new cable is 320 miles long and weighs 3,000 tons. It was manufactured in this country for the Great Northern Telegraph Company of Denmark. The ultimate capacity will be 36 circuits, a number of which will be used for handling telex traffic between London and Scandinavian countries.