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**PART 3**

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**THE INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS**

# Phonogram Automatic Distribution

H. E. WILCOCKSON, A.M.I.E.E.,  
and H. WALKER

## Part I.—Field Trial Installation and General Facilities

U.D.C. 621.395.341.8 : 621.394

A new type of phonogram equipment, developed within the Post Office, has been installed at Newcastle-on-Tyne and successfully opened for service on the 12th June, 1949. A description is given of this field trial installation and of the facilities provided by the equipment, prefaced by a brief historical survey. Part 2 will describe the basic circuit elements employed in the queuing, storage and distribution of the incoming calls and other elements, including those which provide for the automatic control of the queue size according to the number of available staffed positions.

### *Introduction.*

THE scheme to be described provides for the automatic chronological distribution of incoming phonogram and telephone-telegram (T.T.) calls in cyclic order to free staffed operators' positions and will, it is thought, be of general interest, having in mind the current trend towards the use of cordless type switchboards. The primary objective of the scheme is the elimination of the "unfortunate" call which is subjected to a time of answer well above average (a condition which is inherent in present forms of lamp signalling ancilliaried switchboards), but the use of automatic equipment in place of plugs, cords and multiple jack-field also enables the phonogram operators to enjoy the more congenial working conditions provided by cordless type operating positions.

A number of novel features have been incorporated in the field trial equipment, the relative values of which will emerge during the course of the field trial, thus enabling the facilities required as standard for subsequent installations to be determined in the light of practical experience.

A general view of the phonogram switchroom at Newcastle equipped with standard double-tier ancillary switchboards as it existed in January 1949, just prior to modification, is given in Fig. 1. A corresponding view of the same operators' positions after modification



FIG. 1.—THE PHONOGRAM SWITCHROOM AT NEWCASTLE, EQUIPPED WITH DOUBLE-TIER ANCILLIARY SWITCHBOARDS.

for use with the automatic distribution equipment is given in Fig. 2.

The initial experience gained with the operation of the equipment indicates that the reaction of the operating staff is favourable, and that in addition to eliminating the "unfortunate" call, the improved operating facilities should enable the reduction in the average time of answer to be maintained.

### *Historical Survey.*

The question of the suitability of some form of automatic distribution system for phonogram working, as an alternative to the previous systems of distributing calls—from a manual concentrator or by means of an ancilliaried switchboard—was examined by a Headquarters committee set up in 1928 to consider the type of equipment to be installed in the phonogram office at the Central Telegraph Office (C.T.O.), London. After exhaustive investigation and examination of all known phonogram systems in this and other countries, a report was issued in 1932 recommending the installation of the ancilliaried switchboard system<sup>1</sup> which had been for some time the standard at a few large provincial phonogram offices in this country.

The answering of calling signals in the order in which they originate cannot be assured on an ancillary switchboard, particularly in phonogram rooms, where the operators are unable to keep the calling signals under observation during the writing down or dictation of messages. It is inevitable, therefore, that during pressure periods a certain percentage of calls suffer a time of answer well above the average.

A "Delayed Call Flashing" facility<sup>2</sup> is fitted as a standard arrangement on phonogram ancillary switchboards and provides for the flashing of the lamps of calling circuits not answered within a certain period, usually 15 to 30 seconds, and to which priority is given by the operators. The "unfortunate" call is not, however, entirely eliminated with this facility, as several calls may be flashing simultaneously.

To overcome this undesirable feature consideration was given at a later date to an automatic queuing scheme for delayed-answer calls as an adjunct to the

<sup>1</sup>*P.O.E.E.J.*, Vol. 30, p. 26.

<sup>2</sup>*P.O.E.E.J.*, Vol. 26, p. 7.



FIG. 2.—NEWCASTLE PHONOGRAM SWITCHROOM AFTER MODIFICATION FOR USE WITH AUTOMATIC DISTRIBUTION EQUIPMENT.

ancillary switchboard system. In this scheme calls were normally to be answered in the ancillary field, but should the calling signal remain unanswered after a pre-determined period, say 10 to 15 seconds, the automatic call queueing equipment operated to connect the call to the queue storage equipment. The calling lamp in the ancillary field remained glowing while at the same time a queue pilot lamp, associated with a queue answering jack, was caused to glow on each position. Priority was to be given to the queue. The insertion of a position answering cord into the position queue answering jack by any operator caused the connection of the first waiting call to the particular operator concerned. The calling lamp in the ancillary field, also the pilot lamp of the answering position, ceased to glow. If other delayed-answer calls were connected to the queue storage equipment, the queue pilot lamps of the positions not connected to a call in the queue remained glowing. When all calls in the queue storage equipment had been answered and discharged, the position queue lamps ceased to glow and calls would then be answered in the normal ancillary field.

A disadvantage of the scheme, unless an excessive provision of equipment additional to the normal ancillary switchboard equipment was to result, was that when the queue storage equipment was occupied to its full capacity, further calls waiting to enter the queue storage equipment did so on a chance basis. Hence, under conditions of heavy delay, when the benefits of the proposed scheme were most needed, the queueing facility for delayed calls was inoperative. The development of the scheme was finally abandoned at the outbreak of war.

In 1943, consideration was again given to the type of equipment to be installed at C.T.O., London, this time to replace the temporary manual concentrator system which had been installed in refuge accommodation when the standard ancillary equipment was

destroyed in December 1940. The question of the automatic distribution of traffic was again raised, but it was decided that the equipment to be installed in the new accommodation at C.T.O., London, should be similar to that in the refuge accommodation, i.e., manual concentrator. It was appreciated, however, that the standard ancillary system was not wholly satisfactory in practice, especially in regard to the speed of answer during busy periods, when calling subscribers may experience inordinate delay in obtaining a reply. For this reason, and because the equipment of the standard ancillary system had become obsolescent and would, in any case, require modernisation for future installations, it was decided that an experiment in the automatic distribution of phonogram traffic was justified as soon as circumstances would permit. The basic facilities to be provided for such a scheme were given further consideration

at a Phonogram Conference held in March 1945, after which active development work was commenced and Newcastle phonogram office was selected for the field trial.

#### GENERAL FACILITIES

The automatic queueing and distribution equipment has been designed to eliminate the "unfortunate" call which is inherent in the present standard phonogram ancillary switchboard system and also the manual concentrator system.

Fig. 3 shows in block schematic form the items of equipment providing the call queueing and automatic distribution facilities, as well as the complementary services for outgoing calls, transfer of calls, etc.

Facilities are provided whereby effects of sudden peaks of traffic are smoothed out by automatically increasing the number of staffed positions to which incoming calls have access, with the possibility of still further increasing the availability of staffed positions by means of a master key under the control of the Chief Supervisor, should the peak be sustained.

Provision is made for the automatic distribution of incoming calls to free staffed positions on a cyclic basis, and for the calls to be connected direct to an operator's headset without the manipulation of keys on the part of the operator. When a free position is not available, calls are queued in the order of arrival and are distributed in that order to positions as they become free. Busy tone is returned to calls arriving at the installation when all available queue positions are occupied.

The range of operating positions is divided into three separate groups, i.e., incoming positions, bothway positions and outgoing positions. The positions are, however, universal and may be included in any of the three separate groups by the strapping of a single tag on a terminal strip, situated on the position apparatus rack, to the appropriate group.

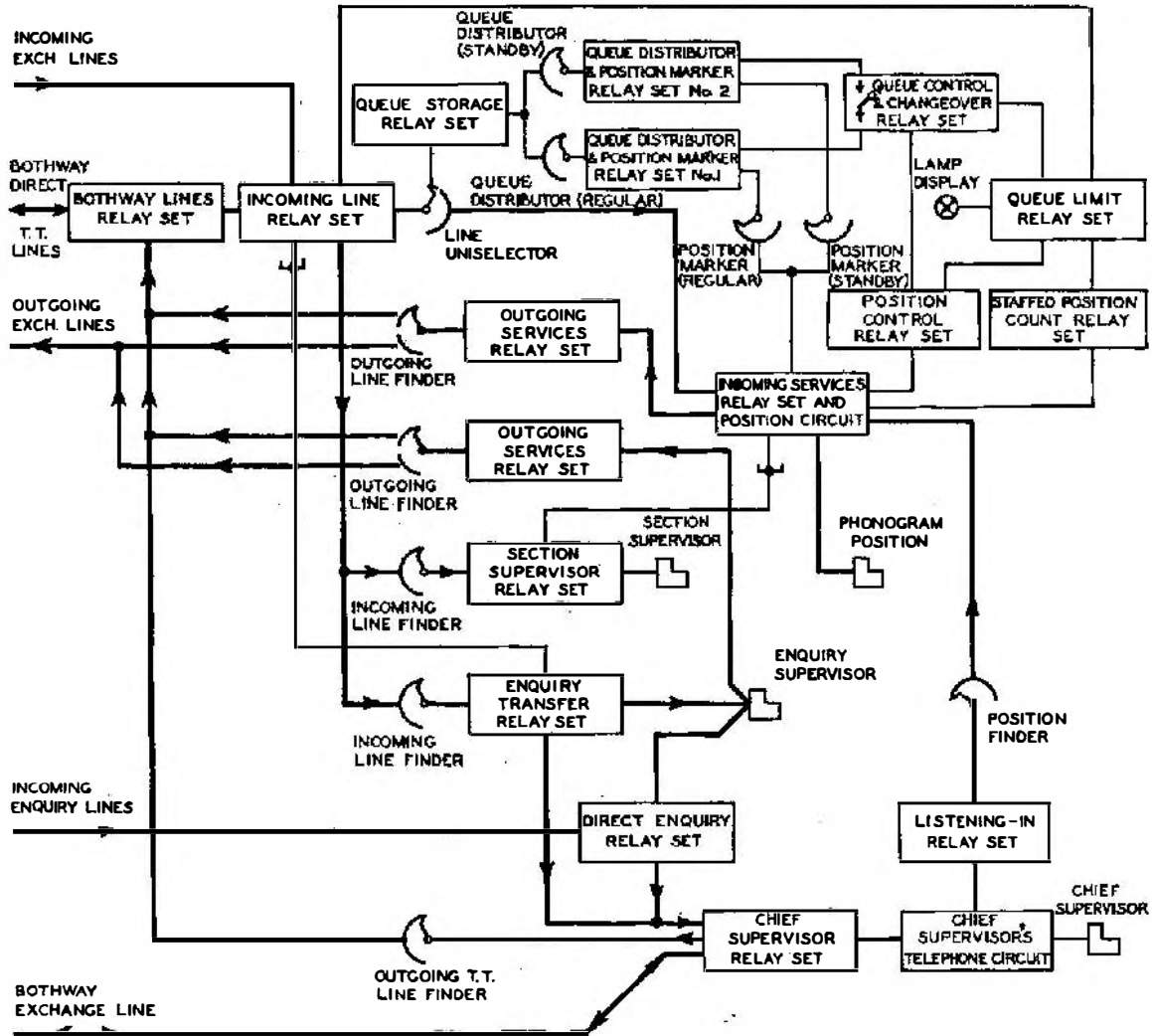


FIG. 3.—BLOCK SCHEMATIC DIAGRAM OF CALL QUEUING AND AUTOMATIC DISTRIBUTION EQUIPMENT.

Incoming calls are presented in the order of arrival to free staffed incoming positions in cyclic order. The bothway positions normally function as outgoing positions, but should all the available incoming positions be engaged and an incoming call be waiting connection, this call is automatically routed to a free bothway position. To meet seasonal traffic or sustained peaks of traffic, all the bothway positions may, at the discretion of the Supervisor, be converted to incoming positions by the operation of a master key. This key, when operated, includes the bothway positions in the cyclic distribution of calls, and calls are presented in due order to free bothway positions, whether or not a free incoming position is available. Following the operation of the master key, individual outgoing positions may also be converted to incoming positions at the discretion of the Supervisor, by the operation of keys provided on the basis of one per outgoing position. Thus all positions may be made available to incoming traffic, if desired.

#### Queue Control.

The number of queue positions available at any

time may be decreased or increased, up to a maximum of 15 positions, according to the number of staffed positions available to incoming traffic. This variation may be carried out manually by the Supervisor, or automatically. In the manual operation the setting of a rotary type switch determines the limit of the queue positions, whereas, for automatic operation, the removal, or insertion, of an operator's headset from the position jack causes a counting device to function. At the conclusion of the counting operation the number of queue positions is automatically limited in accordance with the staffed positions available to incoming traffic. The ratio of queue positions is pre-set, but may be altered from time to time, should the necessity arise, by means of straps on a terminal strip.

#### Lamp Display.

A queue lamp display, easily visible by the phonogram operators, is provided as part of the operator's desk equipment. This display, which is situated between each pair of operators and functions only when all available staffed incoming positions are engaged, gives individual indication of the state of the

first five queue positions and a common lamp for "Over 5" positions. In addition, a "Queue Full" lamp glows when the limit of the queue is reached.

The Chief Supervisor is also provided with a queue lamp display, but in this display individual indication is given for the maximum queue together with an audible alarm whenever the "Queue Full" lamp glows. Independently of the queue lamp display, provision is also made for the number of staffed incoming positions to be indicated automatically to the Chief Supervisor by means of lamps.

#### *Position Lamps.*

A dome-shaped opal cover containing a green and a red lamp is accommodated on each position. These lamps, which glow only when a position is engaged on an incoming call or an outgoing call respectively, facilitate the supervision of the operators by the Section Supervisor and also enable the officer distributing messages for outward transmission quickly to locate a disengaged position.

The green lamp glows steadily whenever the staffed position is engaged on an incoming call. If, however, the operator fails to operate the position release key within 15 seconds after the clear down of the calling subscriber, in order to free the position for the receipt of a further incoming call, the green lamp changes from a steady glow to a flashing signal.

The red lamp glows whenever a position is engaged on an outgoing call.

#### *Transferred Calls.*

Incoming calls to the phonogram operators may be transferred to either the Enquiry positions or the Section Supervisor by operation of the appropriate transfer key on the operator's position. In each instance the phonogram operator may be released from the transferred call and therefore free to accept further incoming calls, by the operation of a "Release" key at the Enquiry or the Section Supervisor's position. Calls transferred to the Enquiry positions may be further extended, if required, to the Chief Supervisor.

#### *Forced Release Calls.*

Calls may be "Forced Released" from an operator's position only by transferring the particular call to the Section Supervisor and the operation by the Section Supervisor of a Forced Release key fitted on her position. The call is then cleared from the operator's position and the Section Supervisor's equipment, and the line relay set concerned holds to the calling or fault condition. An audible and visual alarm is given if the line relay set holds to the calling condition beyond a predetermined period. It will be appreciated that incoming calls to an operator's position can only be released from that position by the clear-down of the calling party or by transfer from the operator's position to either the Enquiry position or the Section Supervisor.

#### *Common Equipment.*

Automatic change-over to standby equipment is provided should the regular common control equip-

ment fail to function correctly. The standby equipment is positioned to agree with that of the regular common control equipment upon taking over. Manual change-over is also provided for maintenance and test purposes.

#### *Outgoing Services.*

Outgoing calls may be originated from any position over the exchange network or to direct telegraph-telegram (T.T.) circuits by the operation of the appropriate outgoing key on the position, which also busies the position to the receipt of incoming calls. The operation of the position "Exchange" outgoing key causes a uniselector associated with the position to hunt over a common group of exchange lines for a free outlet. Busy tone is returned should all outlets be engaged. Direct T.T. circuits are obtained by the operation of the position "Direct T.T." outgoing key and the dialling of a pre-arranged code. Standard tones, indicating the condition of the called line, are given. A common 8-level uniselector is used for both outgoing services. The operation of the particular outgoing key selects the levels of the position uniselector to be brought into service.

#### EQUIPMENT AND INSTALLATION ARRANGEMENTS

The field trial equipment provides for 75 incoming line circuits, a total of 35 operators' positions (these being arranged, initially, to function as 10 incoming, 15 bothway and 10 outgoing positions), and for a maximum of 15 calls to be held in queue storage positions under peak traffic conditions. Provision for two Enquiry positions, three Section Supervisor's positions, one Chief Supervisor's desk and one remote listening-in position, all with key-ended circuit terminations, has also been made.

To avoid any extensive modifications to the existing conveyor belt and pneumatic tube systems, such as would have been necessary had the automatic distribution equipment been sited in new accommodation, it was decided that the field trial equipment should be located in the same accommodation as that occupied by the ancillary switchboard equipment. It was also decided that the revised requirements for the operating positions should be met by modification of the existing desks, thus avoiding the delay which would have been incurred by the design and manufacture of new desk equipment.

Fig. 4 shows the floor layout plan for the field trial equipment. In the Phonogram Room the recovery of the ancillary switchboards, position wiring and cabling, and the subsequent modification and rewiring of the desks was carried out by the local engineering staff who also undertook the recovery from the apparatus room of the apparatus racks associated with the ancillary switchboards. The subsequent installation and cabling of the four 10 ft. 6 in. by 4 ft. 6 in. 2000-type apparatus racks (Fig. 5) required for the mounting of the automatic distribution equipment was carried out by Ericssons Telephones Ltd., who were also responsible for the manufacture of all the automatic equipment required for the field trial.

To enable the phonogram and T.T. services to be maintained during the rearrangements, a manual

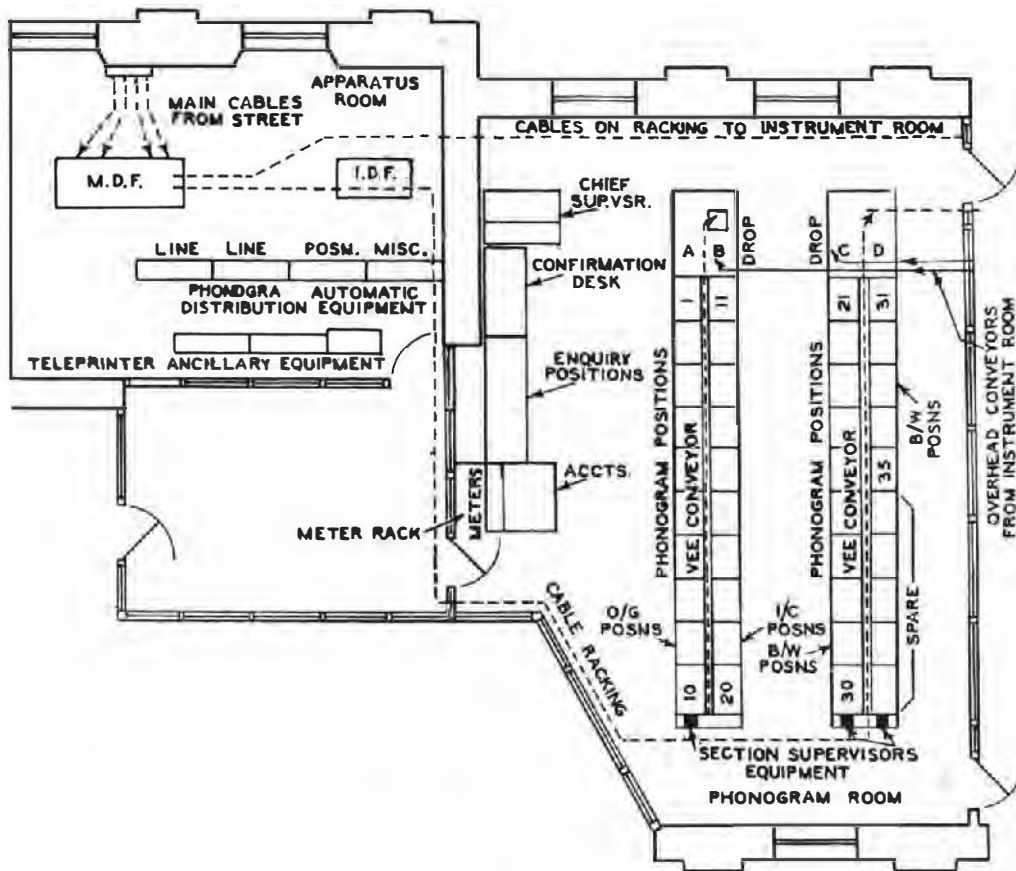


FIG. 4.—FLOOR PLAN OF FIELD TRIAL EQUIPMENT AT NEWCASTLE.

concentrator system, consisting of one concentrator (switchboard) position and 30 operators' positions, was installed by the local engineering staff in temporary accommodation.

The use of automatic switching equipment for the

distribution of calls, in place of plugs, cords and jacks, naturally involves the provision of additional rack-mounted equipment, but allowance should be made for the fact that with ancillary switchboard equipment the position relays were mounted under the desks, whereas with the automatic distribution equipment all the relay equipment is rack-mounted.

The rack-mounted equipment employs standard components as used in automatic telephone practice and, in consequence, requires a 50V power supply. Ringing tone and busy tone, not previously connected at phonogram installations, are also required for the automatic distribution equipment.

To meet these requirements the existing 22V power equipment was moved to temporary accommodation thus permitting the installation of two 50V batteries, each of 200 Ah capacity, motor generators, power panel, ringers, etc. in the permanent accommodation. The 50V power plant is arranged for divided battery float operation, and is connected by cable to the standard 50V busbar distribution arrangements on the 2000-type apparatus racks.

(To be continued).

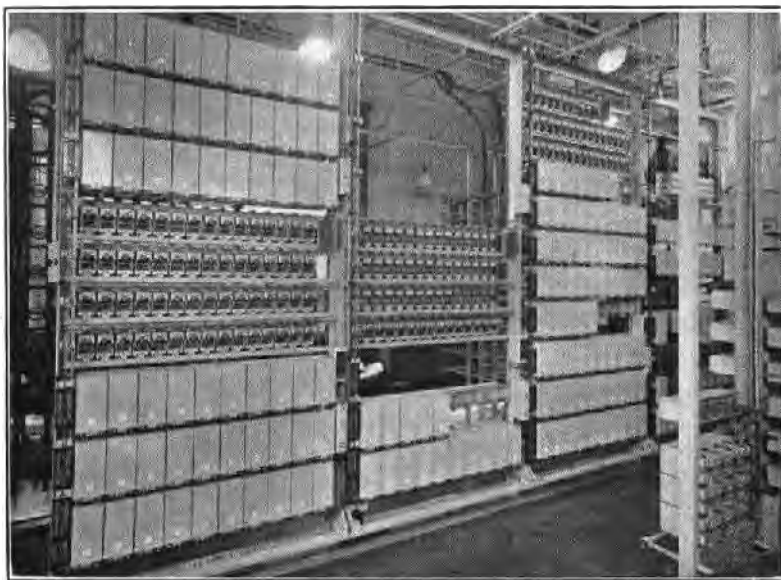


FIG. 5.—FRONT VIEW OF RACKS EQUIPPED WITH AUTOMATIC DISTRIBUTION EQUIPMENT.