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CONTENTS

	PAGE
ACCEPTANCE TESTING OF COAXIAL PAIRS FOR THE INLAND TRUNK NETWORK —R. E. Taylor, A.M.I.E.E., and R. J. Turner, B.Sc.(Eng.), A.M.I.E.E.	1
A NEW PORTABLE GENERATING SET FOR MANHOLE LIGHTING—B. C. Hill, B.Sc.(Eng.), A.M.I.E.E., and E. E. M. Smith, A.M.I.E.E.	7
INTRODUCTION TO ELECTRONIC EXCHANGES—TRUNKING AND SELECTION SYSTEMS—T. H. Flowers, M.B.E., B.Sc.(Eng.), M.I.E.E.	10
WHITEHALL GARDENS P.A.B.X.—F. T. Perkins	15
ALTERATIONS TO H.M.T.S. ARIEL'S CABLE PAYING-OUT GEAR	17
THE SINGLE-COMMUTATION DIRECT CURRENT SIGNALLING AND IMPULSING SYSTEM—S. Welch, M.Eng., A.M.I.E.E., and B. N. Horsfield, A.M.I.E.E.	18
THE NEW LONDON RADIO-TELEPHONY TERMINAL—C. W. Sowton, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E., and D. B. Balchin, B.Sc.(Eng.), A.M.I.E.E.	25
AN APPLICATION OF EQUALISER CURVES TO THE DESIGN OF TWO-TERMINAL NETWORKS—P. W. Seymour, A.M.I.E.E.	31
THE MANCHESTER-EDINBURGH TELEVISION RADIO RELAY SYSTEM	33
COMMONWEALTH TELECOMMUNICATIONS	35
NOTES AND COMMENTS	36
INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS	38
REGIONAL NOTES	39
JUNIOR SECTION NOTES	43
STAFF CHANGES	46
BOOK REVIEWS	24, 30, 32, 34, 45, 48

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THE INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS

Whitehall Gardens P.A.B.X.

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This article describes a recent Private Automatic Branch Exchange installation with ultimate capacity for 3,000 lines. Certain non-standard facilities have been provided to meet the requirements of the various Government Departments served by the exchange, and enquiry positions of novel design are fitted to suit the local conditions.

Introduction.

IN October 1950, the largest P.A.B.X. in the country was opened to serve various Ministries accommodated in the new block of Government offices in Whitehall Gardens, London, the exchange being situated on the ground floor of the building at its north-east end and on the Thames Embankment side. Apart from the special features of the equipment and its installation which are referred to later, interest arises from the historical associations of the site since, in Tudor times, it was occupied by the Palace of Whitehall.

During the excavations for the new building, several parts of the old Palace wall were uncovered, and it is known that the steps which originally led from the Palace to the river, together with an old riverside terrace, still lie below ground level; these will be uncovered and reconstructed in sunken gardens to be built facing the Embankment.

An interesting feature of the construction work was the moving of the Tudor wine cellar or crypt (built in Cardinal Wolsey's time), Parliament having decided that this, one of the few portions of the Palace still remaining, should be preserved as an ancient monument. The Crypt protruded over the building line on the Horse Guards Avenue side, and it was decided that it should be moved intact to a new location some 10 ft. to the west and lowered 18 ft. This could not be carried out as a direct move without an extremely complex operation. The operation was arranged, therefore, by mounting the crypt on rollers, moving it bodily on to a steel gantry, jacking down on this gantry, and then moving it back horizontally some 33 ft. to its final position.¹

General.

Proposals for the building of the new block of Government offices were first put forward in 1912, and the whole scheme was designed by Vincent Harris, O.B.E., R.A., F.R.I.B.A., but the first World War delayed the start of construction until 1936, while the second World War caused work to be suspended in 1940. When it was decided, in 1946, once more to proceed with the scheme, provision of a suitable P.A.B.X. to serve a number of Ministries had to be considered.

As the Post Office standard P.A.B.X. has been designed to cater for a total of 1,200 extensions only, the use of this type of equipment would have involved design work to extend the ultimate capacity to the 3,000 lines required. Additionally, the standard P.A.B.X. facilities do not include the control and timing of trunk and toll calls. It was decided, therefore, that in view of the time factor, the automatic equipment should be of the standard 2,000-type, non-director, with a sleeve control auto-manual switchboard equipped similarly to a group trunk exchange. This equipment does not, however, provide many of the facilities that are standard on modern P.A.B.X.s.

The initial equipment comprises 2,200 auto. and 100 manual calling equipments, 3,000 multiple, 15 "A" positions, 14 "B" positions, 4 dummy and unequipped

positions, 400 dialling, 20 auto. and 70 generator signalling tie lines and an 8-position enquiry table.

The building is designed throughout for offices and physical difficulties, due to low ceiling heights, were encountered therefore in accommodating the automatic equipment. The general heating arrangements for the building comprise a network of copper tubes concealed in the ceilings, and as this was considered to be unsuitable for apparatus rooms, floor radiators were specially installed.

The clear height under beams varies from 10 ft. 7 in. to 10 ft. 8 in., and as 10 ft. 6½ in. racks were necessary to provide the required capacity within the accommodation allocated, the overhead 1-in. twin bars securing the racks had to be sunk into the plaster in several places; moreover, normal practice of cabling over the top of the racks could not be followed and large runways had to be installed at 9 ft. 1½ in. from the floor, suspended by subsidiary girders along the gangways. The presence of these runways precluded the use of standard main battery bus-bars located in the gangways above the racks and to overcome this difficulty it was decided to use the feeder fuse board method of distribution.

The auto-manual switchboard (Fig. 1) is of a modern

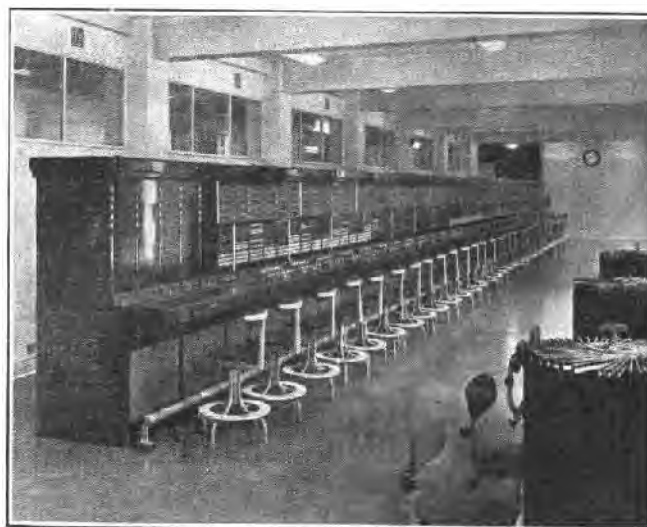


FIG. 1.—THE AUTO-MANUAL SWITCHBOARD.

design of the sleeve control type incorporating improvements such as cord fastener units, and with battery jacks located above the kicking panels and rear equipment layouts. A rear cable-shelf specially designed for the extension multiple is also included.

The "A" positions are each equipped with 14 cord circuits, 4 of which include chargeable-time clocks and handle all originating traffic on a "single-channel" basis, i.e. "0" is dialled for Assistance, Trunk or Toll calls. The "B" positions are equipped with 15 cord circuits and handle all incoming traffic including tie line "0" level circuits.

In other respects the exchange is generally similar in construction to a non-director exchange and includes separate subscribers' and equipment I.D.F.s and graded group selector racks.

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¹ "Government Offices, Whitehall Gardens. The Special problem of the re-siting of an Historic Building." *Institution of Civil Engineers*, Paper No. 5765.

Facilities.

Standard circuits are used as far as possible, but departures were necessary to a degree, and it is therefore proposed to explain the facilities which are special to this exchange.

It was not considered desirable to give the exchange a name and code to allow dialling direct to extension on incoming traffic from the public network; therefore, a group of incoming exchange lines from an 11-and-over final selector unit at an adjacent public exchange was provided for each Ministry, as for any other P.B.X. These lines appear in the answering multiple of the auto-manual board at Whitehall Gardens P.A.B.X., and are lamped over the "B" positions.

A multiple of all the extensions is provided on this switchboard, with stile bar numbering similar to C.B. exchange practice, to give direct access by the operators for incoming traffic, thus avoiding dialling through the manual board selectors for each call and saving time and provision of positions. This multiple involved a relay set for each extension line and as the calling equipments are 700 less than the multiple, the relay set provision is based on the calling equipments in the interest of economy and to avoid extravagant cabling and jumpering. The multiple-access relay sets are terminated on the same connection strips as the subscribers' unselector circuits, using 6×20 strips with the tags arranged for open wire straps for fault localising. This was made possible by dispensing with the usual M and M1 terminations as subscribers' meters are not fitted.

The dialling tie lines between this and other P.A.B.X.s and P.M.B.X.s could not be arranged with dialling codes from selector levels owing to the large number of groups, and it was decided, therefore, to use 2-10 and 11-and-over final selectors, according to the size of the groups, with 3-digit dialling codes. The majority of the lines are equipped for both-way working, using subscribers' uniselectors, but where line resistances are in excess of the standard for unselector working, they are arranged on a unidirectional basis with the incoming lines connected to 1st selectors. Equipment is also provided for tie lines with resistances outside dialling limits to be worked manually using auto. or generator signalling. Facilities are available on the manual board for operators to obtain direct access in the outgoing junction multiple on most of the tie lines. Local extensions have access to all the dialling tie lines.

A group of 100 manual extensions is also provided, with facilities for manual working to and from the switchboard and connection to final selectors if automatic working is required for incoming traffic. Where automatic working is not required, N.U. tone is connected to the final selector number.

Originating calls from extensions to the London area are obtained by dialling "9" which routes the caller from the 1st selector level, via an auto-auto relay set, to a barred-trunk unselector at the public exchange. Excess fee calls are obtained by dialling "0" and the P.A.B.X. operator extends the callers to the public exchange by full facility exchange lines which appear in the outgoing junction multiple.

Trunk and toll calls are obtained by dialling "0" and the Whitehall Gardens operators have complete control of timing as in a trunk exchange, with direct channels to London Trunk and Toll exchanges.

The numbering scheme is, 2000-2999; 6000-7999, the trunking diagram being given in Fig. 2.

Enquiry Tables.

The requirements for enquiry traffic are such that a monitor's desk as used in non-director exchanges is inadequate, drum files being necessary to contain the very

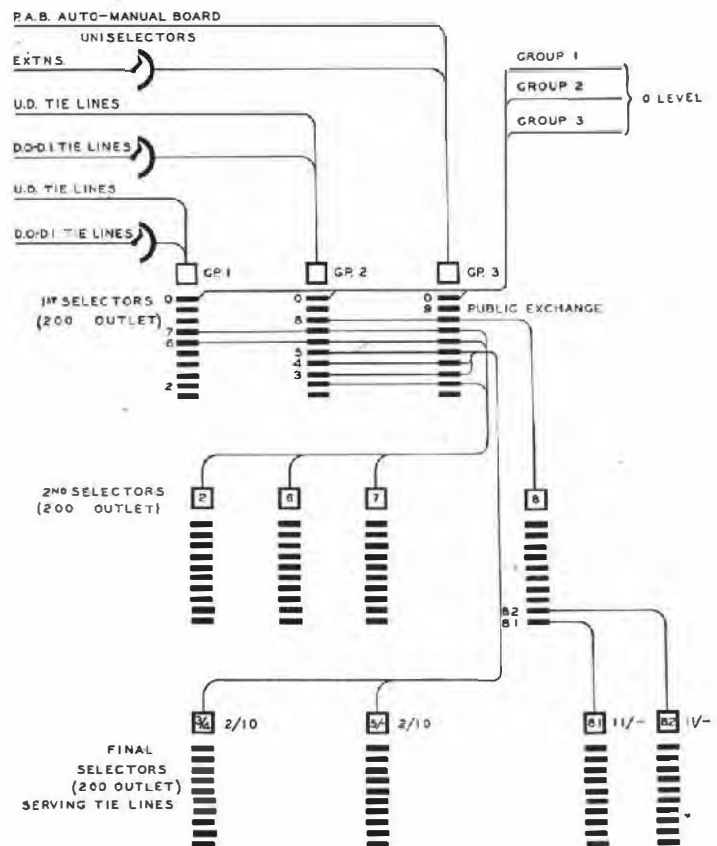


FIG. 2.—TRUNKING DIAGRAM OF WHITEHALL GARDENS P.A.B.X.

large number of entries for each of the Ministries. In the absence of a suitable standard, the Engineering Department agreed to the tables being designed to suit the local conditions and two 4-position, double-sided, cordless tables are provided to accommodate up to six drum files and directory and card compartments. (See Fig. 3.)



FIG. 3.—ENQUIRY TABLES WITH DRUM FILES.

Double-sided sloping panels are fitted in the centre of each table with capacity for 11 keys on each side. The circuits to and from the manual board are arranged for enquiries for each Ministry to be dealt with by separate operators and this is achieved by terminating two groups of circuits incoming from the manual board multiplied on positions 1, 4, 6 and 7 and 2, 3, 5 and 8; the drum files

for each Ministry are located in a manner to suit the circuits. The arrangement also allows for concentration on position No. 1 with coupling between positions Nos. 1 and 2.

Power Plant and Distribution.

Power is supplied by two batteries of open-type lead-acid cells, each of 1,100 ampere-hour capacity, and two mercury arc rectifiers, each with an output of 50 amps. at 50 V, operating as a parallel battery automatic power plant. Space is available for the provision of a third rectifier to meet ultimate load requirements. Standard ringing and tone supplies are obtained from 75-watt inductor tone generators.

The power distribution is by twin bus-bars from the power board to the first feeder fuse board, from which the main negative feed is continued to the second feeder fuse board by two 61/-103 V.I.R. cables in parallel. The groups of racks are served by smaller V.I.R. cables from group fuses mounted on the D.F.B.s.

The feeder fuse boards (Fig. 4) are each designed to accommodate 7 group fuses and, to preserve standard arrangements as far as possible, each group is equipped with a 125 amp. regular and stand-by fuse with separate alarm lamps for each group, identical to 2000-type group fuse panels, but in this case, centralised on feeder fuse boards.

The battery positive connection is continued over all the racks by 2 in. $\times$ $\frac{1}{2}$ in. copper bar laid flat and bolted to the tops of the racks thereby also serving as the earth connection for each suite of racks.

Conclusion.

The contract for the manufacture and installation of the exchange was placed in June 1948, with Standard Telephones & Cables, Ltd., the work being completed in September 1950, and the exchange brought into service on the 16th October 1950.

In conclusion, the author desires to express his thanks

to Standard Telephones & Cables, Ltd., for supplying photographs of the installation.

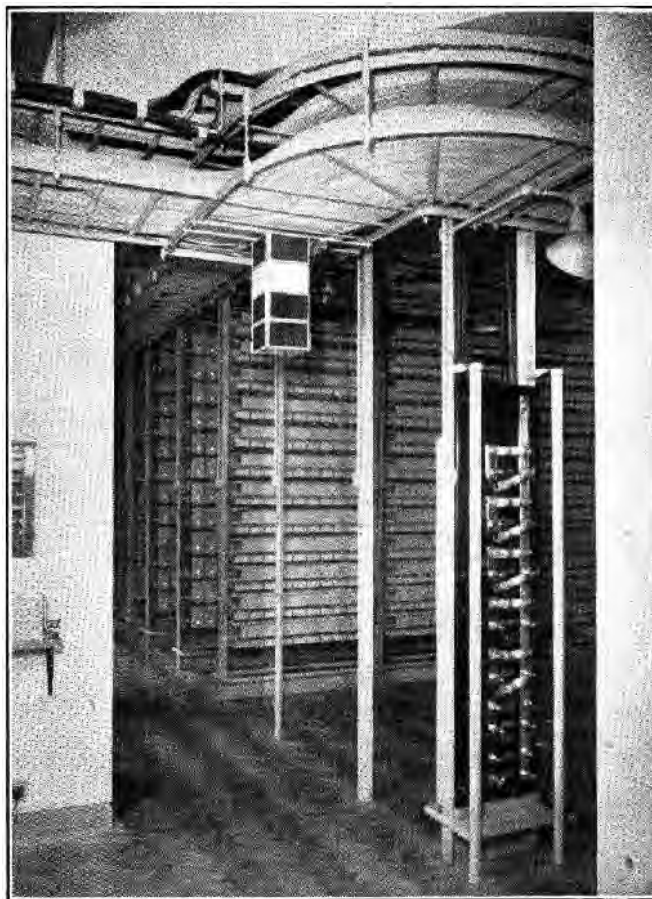


FIG. 4.—VIEW OF APPARATUS ROOM SHOWING FEEDER FUSE BOARD, CABLE RUNWAY AND RELAY SET RACKS.