3 + 10-Line Subscriber-Attended P.A.B.X.

Cat. No. PB2202

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Almost since its invention, the telephone has been universally recognised as an essential aid to business, a fact that is equally true of the small office as it is of the large manufacturing organisation. The telephone system must provide both intercommunication between the members of the staff and communication between the internal and the public exchange networks.

In the past this service was provided by a P.M.B.X. (private manual branch exchange), in which all the connexions, both internal and external, were completed by an operator This was succeeded by the P.A.B.X. (private automatic branch exchange), in which all internal calls could be set up automatically, but external calls were still established by an operator, via a switchboard.

Now the G.E.C. 3 + 10-line P.A.B.X. allows all calls, both internal and external, to be set up automatically by extensions. This results in a general increase in speed and efficiency, with a resultant economy in operating costs.

The exchange operates on the same principle and uses the same components as the public telephone exchange , thus the same high standard of reliability is ensured. In addition, "two-wire" lines are used to connect the extensions to the exchange resulting in the same speech transmission efficiency specified by Public Administrations.

Features

The 3 + 10-line exchange accommodates up to three lines to the public exchange and up to ten extensions. A switchboard operator is not required as incoming calls from the public exchange are dealt with by any one of up to four pre-determined Answering Extensions, whilst outgoing calls can be made direct from any extension. Both incoming and outgoing calls can be repeatedly transferred among the ten extensions. Communication between extensions is automatic, two such calls being possible simultaneously. In addition to the transfer facility public exchange calls may be held whilst an enquiry call is made to another extension, the user then having the choice of either returning to the public exchange call or transferring it to the second extension. The basic trunking diagram is shown in Fig. 1.

Priority facilities are included to allow selected extensions, *e.g.*, executives, to break into an established connexion with or without maintaining secrecy. This facility is also essential for the Answering Extensions to allow incoming public exchange calls to be completed as quickly as possible. Further facilities are given to Answering Extensions to allow them to forcibly release an internal connexion so that equipment may be made available for the completion of an incoming call.

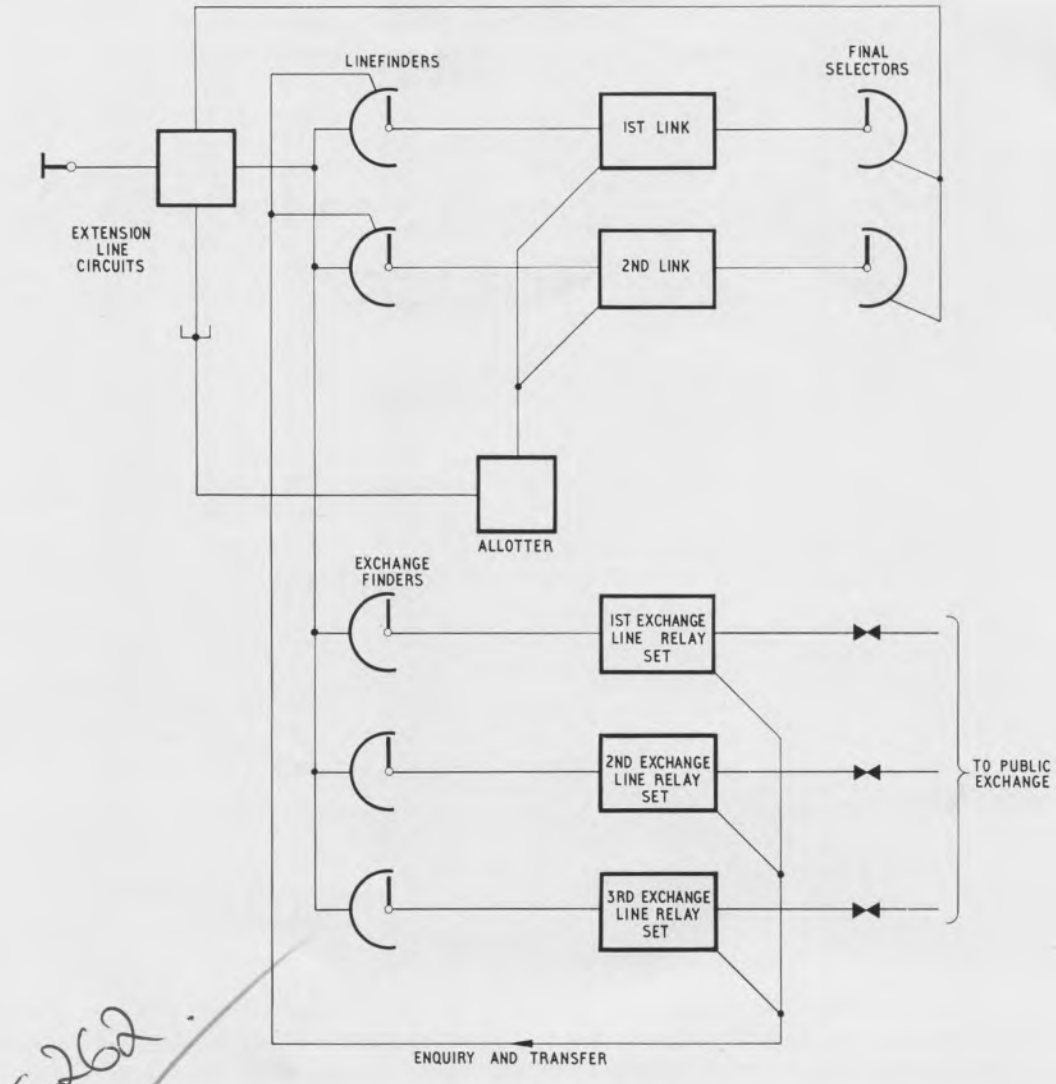

Fig. 1.—Basic trunking diagram.

Whether a particular extension is able to answer incoming calls or not is arranged by strappings made on the terminal block. In addition, other facilities can be given by simple strappings. In the main these straps connect marking signals to the appropriate line circuit. Hence extensions can be divided into a number of classes as indicated below.

Extensions with Executive Right of Way (Priority).

Extensions barred from making calls to the public exchange.

Extensions allowed to receive incoming calls from the public exchange by transfer from the Answering or any other extension.

Extensions not allowed to receive incoming calls.

Extensions allowed only certain types of outgoing public exchange calls. For example, it may be desired that an extension is allowed to originate an inexpensive local call but is not allowed to dial certain preselected routing codes on the public exchange to gain access to the more expensive trunk network.

These facilities are now described in more detail.

Operation

Extension-to-Extension Calls

Internal calls, extension to extension, are made simply by dialling two digits within the numbering range 01 to 00. (First digits other than "0" are reserved for any special services and facilities frequently required by users, typical of which are those given at the end of this article). During the setting up of such a call supervisory tones are returned to the caller as in normal telephone-exchange practice. The resulting connexion is absolutely secret, remaining so even under executive intrusion conditions, if so desired. The release of the connexion is under the control of the calling extension, the link circuit being made available for the next call immediately upon clear down.

Incoming Call from the Main Public Exchange (Fig. 2)

The P.A.B.X. is a subscriber on the main public exchange and is obtained by the public-exchange caller dialling its directory number. This incoming call is received at the P.A.B.X. and is signalled on separate bells, which are additional to those incorporated in the telephone instruments, and which are located at points convenient to the Answering Extensions. The call may be answered by any of the Answering Extensions by simply lifting the telephone handset. This action causes a mark to be applied to the exchange-finder bank, and a start signal to be applied to the particular exchange line circuit in use. The exchange finder hunts for the marked outlet and stops, so connecting the Answering Extension to the public-exchange caller when ringing has been tripped.

If the Answering Extension cannot deal with the call the advice of a third party may be obtained by advising the caller to "hold-on" whilst an enquiry call is made.

Enquiry Call (Fig. 3)

A momentary depression of the pushbutton on the Answering Extension's telephone will apply holding conditions to the incoming call and connect the Answering Extension to one of the two P.A.B.X. connecting links. Upon receipt of the link dial tone the Answering Extension dials the number of the party required.

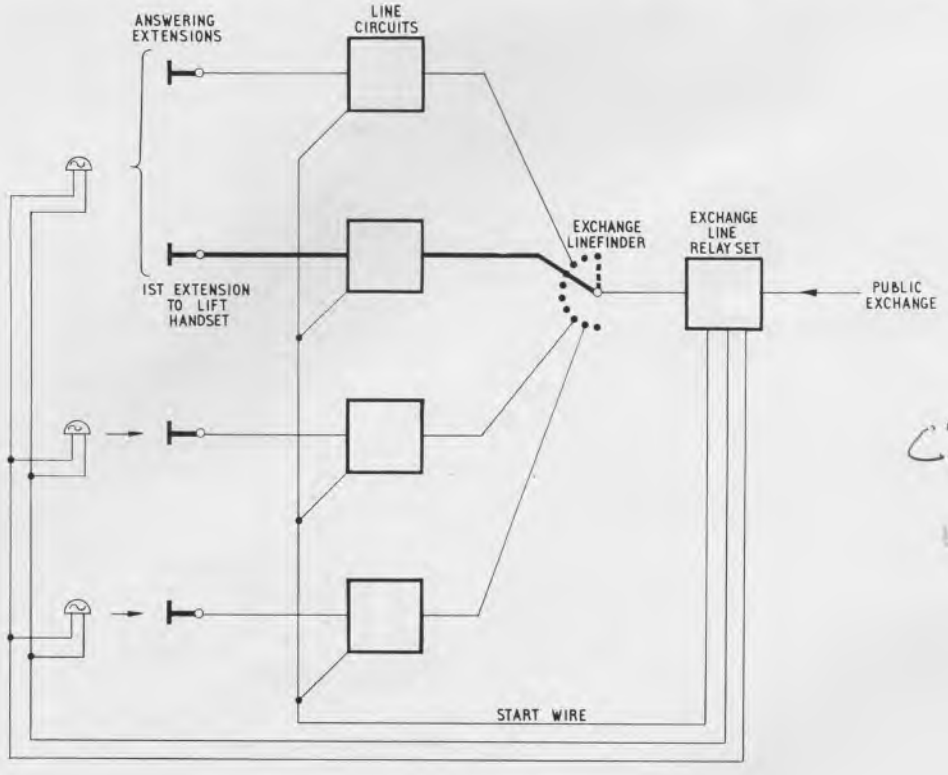

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Fig. 2.—Incoming-call circuit.

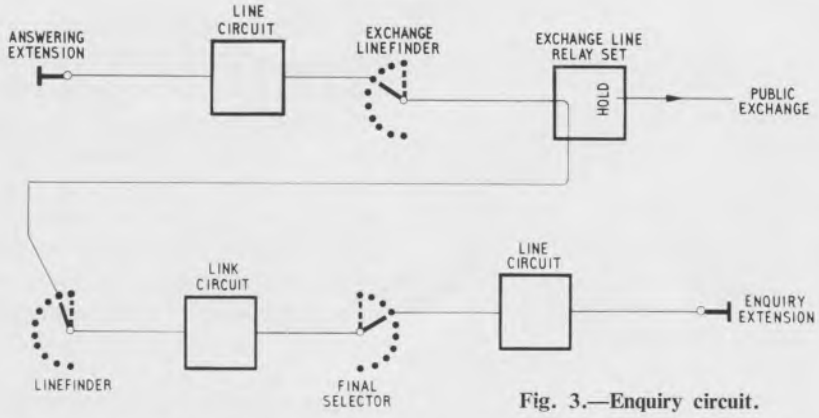

Fig. 3.—Enquiry circuit.

(During this conversation a ticker tone may be heard. This does not interfere with the conversation but indicates that the particular extension is one of those that cannot have incoming calls transferred to it. Absence of this tone indicates that subsequent transfer is possible). When the enquiry call is finished, a second momentary depression of the pushbutton reconnects the Answering Extension to the incoming call. Enquiry calls can be made at any time during an incoming or an outgoing public exchange call.

Transfer (Fig. 4)

If an incoming call requires transfer to another extension, the Answering Extension dials the required extension's number as described under "Enquiry Call" Absence of a ticker tone indicates that the called extension is one allowed to receive a public-exchange call. The Answering Extension is now in a position to offer the public exchange call to the second extension and, if this is accepted, transfer is effected by the Answering Extension replacing the handset. This clearing down by the Answering Extension causes the exchange linefinder involved to self drive for the second extension.

During the above enquiry and transfer processes busy conditions may be met either because a local P.A.B.X. link is not available or because the required extension is already engaged.

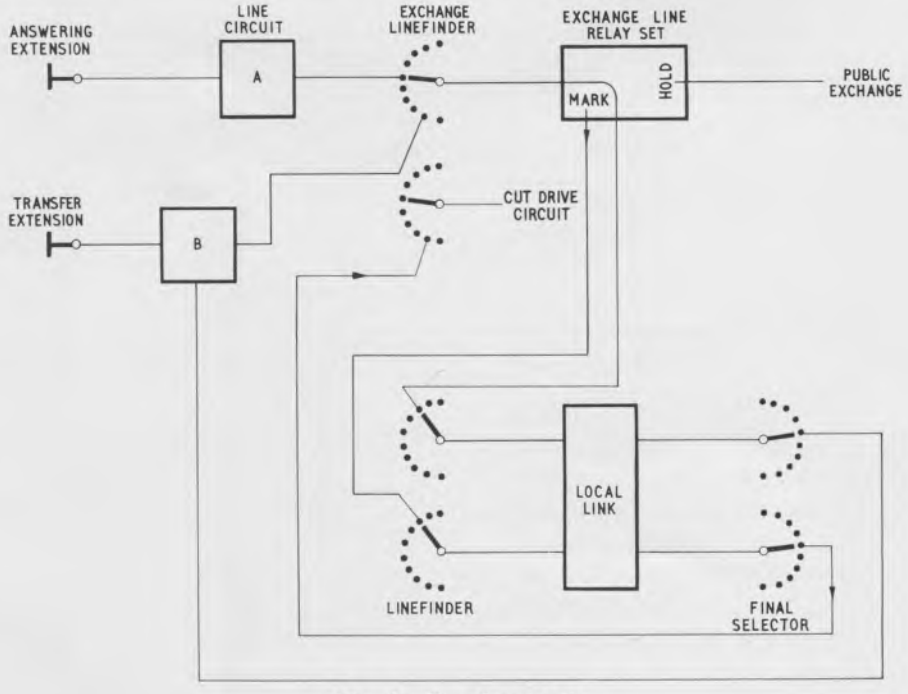

Fig. 4.—Transfer circuit.

Both Links Busy

If both P.A.B.X. connecting links are engaged when an Answering Extension attempts to transfer a call or initiate an enquiry call, the local link dialling tone will not be received when the pushbutton is depressed. Continued operation of the pushbutton will, if one of the links is engaged on an internal call, cause a distinctive tone to be superimposed on the conversation warning the conversing parties that the link is required for a public-exchange call and that their handsets should be restored. After a short interval, if the warning has been ignored, the link will be forcibly released automatically to allow the public exchange call to be connected.

(a) One arrangement of straps will ensure that the Answering Extension cannot hear any of the conversation taking place, the conversing parties being warned by a distinctive tone injected upon their conversation indicating to them that one of them is required to answer an incoming exchange-line call. Upon hearing this tone both extensions should replace their handsets whereupon, without further action on the part of the Answering Extension, the wanted extension will be re-rung.

(b) The alternative condition to (a) above allows the Answering Extension to join in on the existing conversation and offer the call to the required extension. With this form of intrusion a warning tone is injected on to the existing conversation to indicate that the call is no longer strictly private and secret.

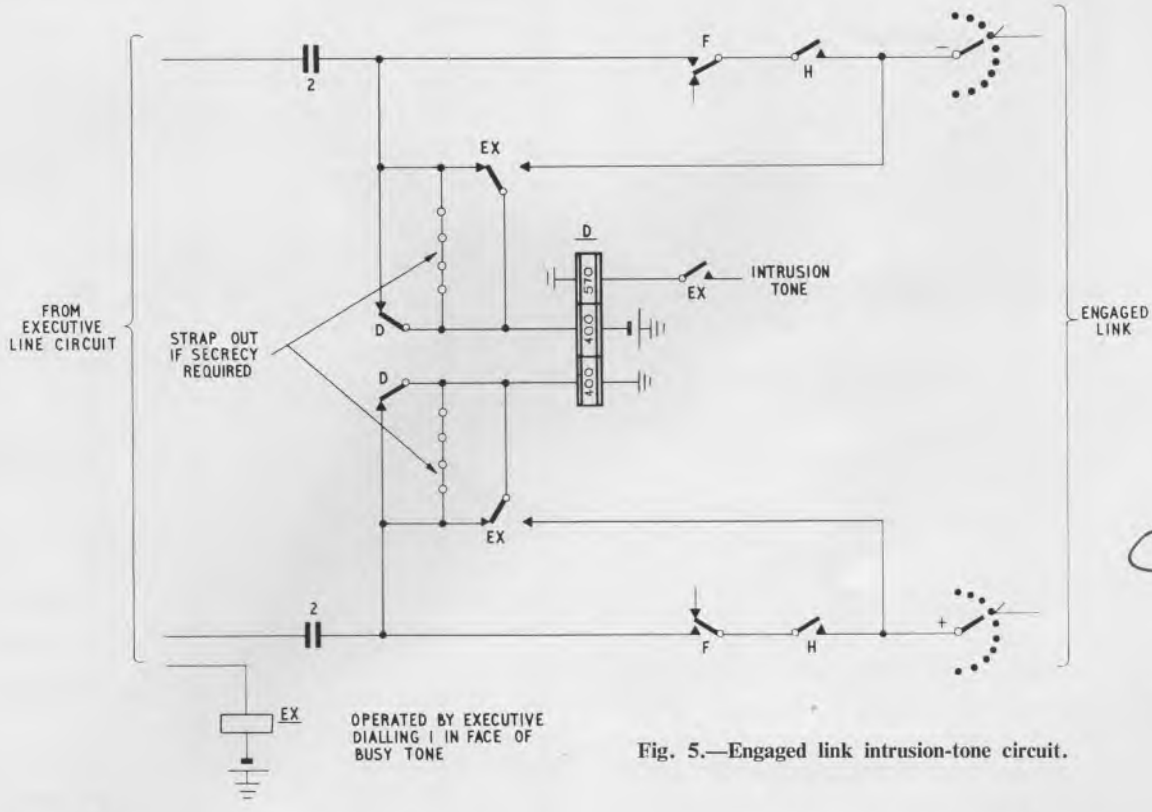

Fig. 5.—Engaged link intrusion-tone circuit.

Wanted Extensions Busy (Fig. 5)

If, when dealing with a public exchange line call, an Answering Extension receives busy tone because the wanted extension is already engaged, the dialling of an extra digit "1" allows the Answering Extension to break-in on to the existing conversation. A strapping arrangement is provided on the P.A.B.X. enabling this break-in to be achieved two ways

It has been mentioned previously that during an enquiry or transfer process, a special tone may be heard

Fig. 6.—3 + 10-line P.A.B.X. with cabinet removed.

to indicate to the Answering Extension that the other extension involved is not permitted to receive an outside call. Although it may be argued that the Answering Extension will very soon become familiar with which extensions can receive outside calls and which cannot, the tone has been provided to warn other extensions, ones who do not normally answer incoming calls, that the extension is barred. The transfer facility is repeatable so that the extension attempting transfer is not necessarily an Answering Extension. Any attempt to override this tone to effect a barred transfer results in the transferring extension being re-rung. In this way it is ensured that the public exchange caller is not left completely disconnected.

Outgoing Calls to the Public Exchange

It has already been stated that whether an extension has this facility or not is entirely at the discretion of the organisation owning the P.A.B.X. equipment. Those extensions with this facility originate outgoing calls to the public exchange simply by lifting the telephone handset and operating a pushbutton. This action is effective even when both of the P.A.B.X. connecting links are already engaged by other extensions on internal calls, and results in the receipt of public-exchange dial tone if the exchange is automatic, or the operator answering if the exchange is manual.

From the list of facilities given earlier it will be seen that an extension may be allowed to take incoming exchange-line calls yet be barred from originating outgoing ones. The P.A.B.X., therefore, contains special circuits to prevent such an extension originating outgoing calls by hanging on after the public exchange caller has cleared when the public exchange is a first or calling-party release system.

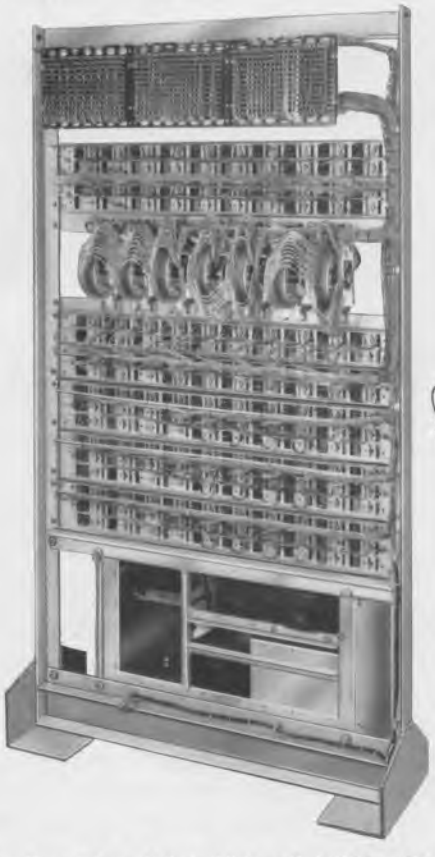

Fig. 7.—Rear view of 3 + 10-line P.A.B.X. with cabinet removed.

If it is required that only certain types of public exchange call are made, extra auxiliary relays and switches must be added to the P.A.B.X. This route-restriction equipment then monitors digits dialled into the public exchange and when a barred code is dialled immediately breaks down the call and returns a number-unobtainable tone to the calling extension. All calls are monitored by the route-discriminating equipment even those dialled by extensions allowed to have such calls. In this case barring does not take place but any subsequent transfer of that call can be rendered impossible, thus preventing unauthorised extensions obtaining trunk calls with the aid of a second extension.

In addition to the basic facilities already described, special facilities can be provided to suit individual requirements. These include

Tie Lines
Up to two tie lines can be provided between the P.A.B.X. and another private telephone exchange.

Staff Location
Staff can be located by a system of lamps or bells. A special locating number is dialled followed by a personal code number.

Conference and Dictation Circuits
These enable a conference or dictation to take place by telephone while the participants remain at their desks.

Secretary's Service
A G.E.C. Switching Telephone may be provided so that a secretary may filter calls to an executive. The executive would have a G.E.C. Extension Telephone.

Equipment

The automatic equipment comprises standard components, approved by Overseas Public Administrations, mounted in a compact form in a sheet-metal dust-proof cabinet. The cabinet has lift-off doors front and rear for ease of access to the equipment. It has been arranged that this equipment can be supplied minus the cabinet where the installation does not warrant dust-proofing. The dimensions when supplied as a free standing open rack are 4ft 6 $\frac{3}{16}$ ins × 2ft 5$\frac{3}{4}$ins × 1ft 6ins (137·4 × 74·3 × 45·7 cms) increasing to 4ft 11 $\frac{11}{32}$ins × 2ft 5 $\frac{13}{32}$ins × 1ft 3$\frac{1}{2}$ins (150·7 × 75 × 39·4 cms) when the cabinet is added. Individual equipment covers are

Fig. 8. 3 + 10-line P.A.B.X. cabinet.

fitted on both open rack and cabinet types so that maintenance can take place on certain items of equipment without subjecting the remainder of the equipment to accidental damage or ingress of dirt.

Figure 6 shows the layout of the equipment with the rear view shown in Figure 7. It will be noted that the terminal block upon which all wiring is carried out is at the top of the rack at a convenient working height. The power unit mounted in the base of the equipment operates from the public mains supply. If the public mains supply is unreliable, it can be arranged that secondary cells are used instead of the power unit, the space normally occupied by the power unit being used to house the ring and tone equipment then needed.

When operating from the public mains supply, circuits are included to cover the case of mains supply failure. Under such circumstances certain preselected extensions are connected automatically direct to the public exchange where they become normal subscribers for the duration of the failure. This arrangement prevents the complete isolation of the user from the outside world under mains fail conditions.