

Ericsson

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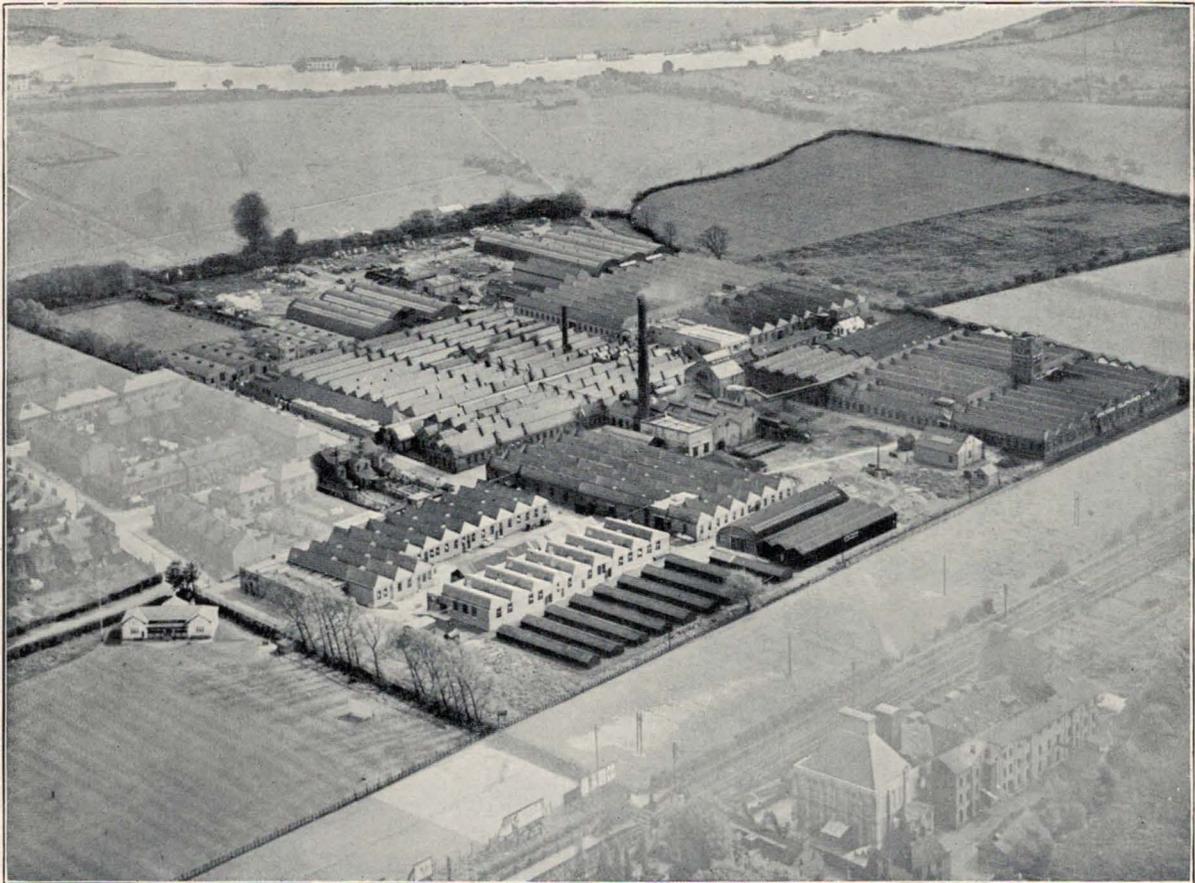


PRIVATE
AUTOMATIC EXCHANGES

Ericsson

PRIVATE AUTOMATIC EXCHANGES

Manufactured at



Telephone Works, Beeston, Nottingham

CONTRACTORS TO: The British Post Office, Admiralty, War Office, Crown Agents for the Colonies, India Office, Dominion Governments, London County Council, and the Principal Railway and Telephone Companies of the World

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PRIVATE AUTOMATIC EXCHANGES

FOREWORD

ERICSSON'S specialize almost entirely on Telephones and Telephone systems and have, by virtue of the extreme care and attention given to the smallest details of manufacture and construction, established a standard which is a proved guarantee of the efficiency, dependability and durability of their products.

When choosing an Automatic Telephone System for your establishment you cannot afford to overlook these facts.

It is being realized more fully every day that "time is money" and that rapid, efficient, dependable and durable switching of the various telephones in any establishment means increased profit and progress.

It is common knowledge that there are several automatic systems very much alike in operation and for that matter in the general appearance of the apparatus, but the test of time which proceeds ruthlessly and im-

partially is survived by the fit because it is fit to survive. So it is with the Ericsson Private Automatic Exchanges, the test of time has proved the fitness of our manufactures to survive.

The Automatic Telephone Switching Machine, as it may be termed, is considered one of the most notable contributions to science and it is, therefore, very essential that the manufacture of so highly perfected a machine should only be entrusted to those whose established reputation for quality of material, accuracy in production, attention to the smallest details and finish is beyond question.

Our business has been entirely built up on our reputation for supplying one quality—the best.

You should, therefore, investigate the application of an Ericsson Private Automatic Exchange to your establishment.



PRIVATE AUTOMATIC EXCHANGES

THE Ericsson Private Automatic Exchanges are based on well-known principles as applied all over the world to the design and functions of automatic equipment.

The P.A.X. 22/25 Line Equipment is limited to 22 or 25 lines and is non-extensible. This system is known as the Line Control System.

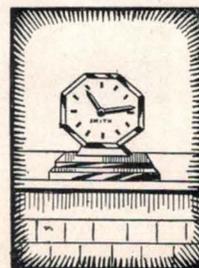
Three sizes of equipment are manufactured on the principles of the Register Controlled system, well known for the following characteristics:—Simplicity, reliability, speed and maintenance economy. Namely, P.A.X. 35, P.A.X. 50 and P.A.X. 50/400. The 35 and 50 line sizes are not extensible, while the 50/400 line size is made in 50-line units which can be extended by the addition of further 50-line units to serve a maximum of 400 lines. These three standardized equipments should, therefore, enable customers to specify the size most suitable for the ultimate requirements of their establishments.

The initial equipment of a P.A.X. 22 or 25 may be as low as ten lines and can be extended at any time to its full capacity, thus

the smallest business, or even a private house, may have the most up-to-date system of communication at a moderate cost. Similarly, the other sizes may be installed with equipments to suit immediate requirements and capable of extension when necessary, so that every business or organisation, whether small or large, is catered for.

The principles governing the operation of these switchboards are identical and for each telephone instrument only two line wires are required. The construction of the apparatus is simple and accurate so that reliability is assured; in fact, the components are of exactly the same design and construction as those supplied by us to the British Post Office for public exchanges.

The various apparatus items are compactly and accessibly mounted on an iron rack of rigid construction and are protected at the front and rear with dust-proof covers. The non-extensible equipments are so arranged that they can be mounted close to a wall so that very little floor space is taken up.



THE 22 LINE P.A.X.

IN the following pages a description is given of register controlled P.A.X.'s, covering boards having capacities of 35 to 400 lines. Where the number of lines required is less than 20 it is found more economical to depart from the register control principle and for this reason the Ericsson Company have developed a board, which is particularly suitable for small installations, and is operated on straight-forward linefinder-connector principles.

The board provides for a maximum of 22 lines with three connecting relay sets, and employs 3,000 type relays and single motion switches (uniselectors) of approved British Post Office design. Ringing and tones are generated by a special relay group which is started and stopped automatically as re-

quired and is particularly economical in current consumption.

A 24 volt supply is required for operating the board and this may be derived from primary or secondary cells, or when an A.C. supply is available it may be operated from an eliminator. Wide voltage limits are possible and satisfactory operation is guaranteed between 20 and 30 volts.

Telephones of any pattern using B.P.O. standard dials giving 10 I.P.S. may be used and lines varying between 0-1,000 Ω loop resistance can be accommodated. When desired, long line equipment can be provided, so that lines having a greater resistance than 1,000 Ω may be connected. The minimum permissible wire to wire insulation for an extension line is 50,000 Ω .

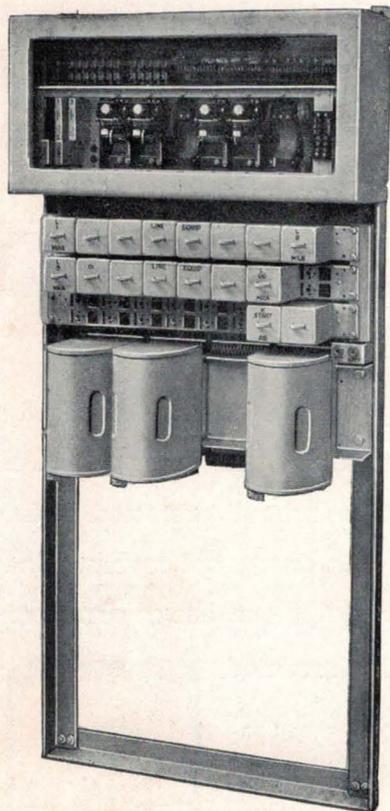


Fig. 1—The 22-line P.A.X.
with covers on

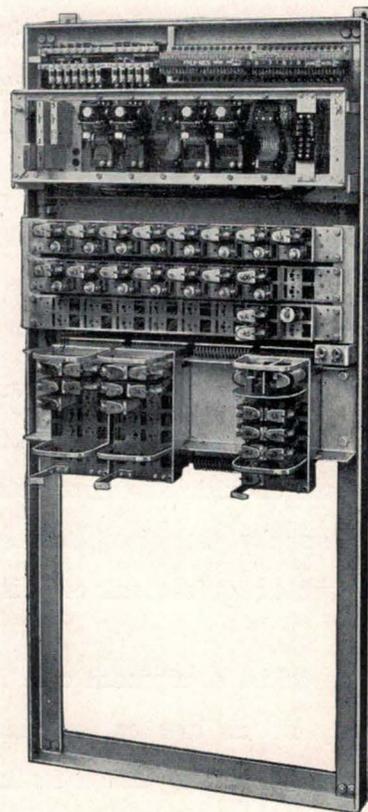


Fig. 2—The 22-line P.A.X.
With covers removed

EQUIPMENT AND LAYOUT OF BOARD.

Fig. 1 shows a view of a P.A.X. with covers in position, while Fig. 2 shows the same P.A.X. with covers removed. The board illustrated is equipped for 15 lines and two connecting circuits. It should be noted that wiring is always provided for the full capacity to enable additional equipment to be added with a minimum of trouble.

The total overall dimensions of the board are 4' 6" high by 2' 1" wide by 10" deep, and when desired it can be mounted close against the wall to save floor space, arrangements having been incorporated so that access to the wiring is possible from the front. This has been accomplished by arranging the equipment on hinged shelves which swing open for inspection purposes.

POWER PLANT.

(1) Using Primary Cells.

This arrangement is recommended only in cases where no electric supply is available. Twenty-three primary batteries are required having a capacity of 500 ampere hours.

(2) Using Secondary Cells.

This scheme is suitable where there is a D.C. supply. Two batteries of secondary cells each having a capacity of 20 ampere hours are required, either being suitable for operating the equipment for 2-3 days.

The charging current is provided by inserting suitable voltage dropping resistances in the mains leads.

(3) Operating direct from A.C. Mains.

This is the most satisfactory method and has many advantages, some of which are as follows:—

- (a) No charging plant is required.
- (b) No batteries are required.
- (c) The initial cost is lower.
- (d) The maintenance costs are reduced since the system is fully automatic and does not require any attention.
- (e) Considerably less space is required.

The equipment required for this method of operation is a battery eliminator which consists essentially of a transformer, a Westinghouse metal rectifier and "smoothing" equipment consisting of condensers and choke coils, etc. The transformer primary is tapped and can be used on supply voltages varying from 100-250 volts.

Full details of these and other eliminators are given on pages 11-13.

The following special facilities can be provided.

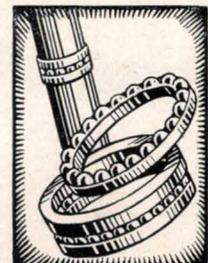
Round Call or Person Finder Facilities.

Automatic Conference Facilities.

Tie Line Working.

Loud Speaker Facilities,

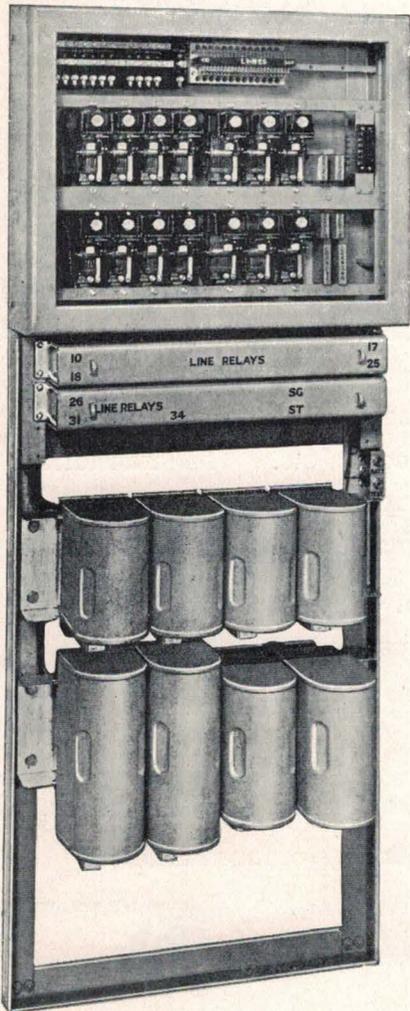
etc., etc.





REGISTER CONTROLLED P.A.X's

Three types of switchboards are manufactured, covering a range of from 35 lines to 400 lines or more. The two smaller boards are non-extensible and have a capacity for 35 lines and 50 lines respectively, inclusive of all services. These exchanges operate from 24 volt batteries, or where A.C. mains are available from battery eliminators specially designed for this purpose. The largest switchboard is built up in 50 line units to any capacity from 50 to 400 lines.



P.A.X. 35 front view with covers on

The equipments for producing the various tones and the interrupted ringing are composed of standard relays for the most part, and a pole changer. They are mounted on jacked-in units of conventional form and incorporated in the general design of a switchboard.

The illustrations of the boards show the compactness and accessibility of the apparatus, the pleasing symmetry of the equipment and the robust construction.

The various pieces of apparatus are protected at the front and rear with dust-proof covers. The non-extensible boards may be mounted close against a wall to save floor space.

The boards operate on the register control principle. The relays are of the P.O. 3,000 type, and the switches are of the Ericsson uniselector heavy duty types for 25 and 50 lines. The disposition and function of the various pieces of apparatus are described with reference to the views of the 35 line board.

In the top left-hand corner is the fuse panel, to which the battery or eliminator leads are connected. The fuses are capable of division into two groups to allow smoothed current to be applied to the transmission circuits when a battery eliminator is employed as the voltage source. To the right of this panel the connection block for the incoming subscribers lines is mounted. The external wiring from this block will consist of two wires for each instrument installed. Below this is mounted a gate on which all the uniselectors are fitted. This gate is pivoted on the left, and fastened on the right by two thumb screws. At the back of this gate a

sheet of metal is fixed to the rear of the framework to prevent the ingress of dust. The gate can be swung outwards to expose the switch multiple wiring. A glass fronted cover latched over this gate permits observation of the switches and protects them from dust. The first four switches from the left on the top and bottom rows are the line finders and connectors respectively of the four links and the next three are the finders, tens and units switches of the two registers.

The mounting plates below these switches contain the line relays, extra relays for preference subscribers and two start relays.

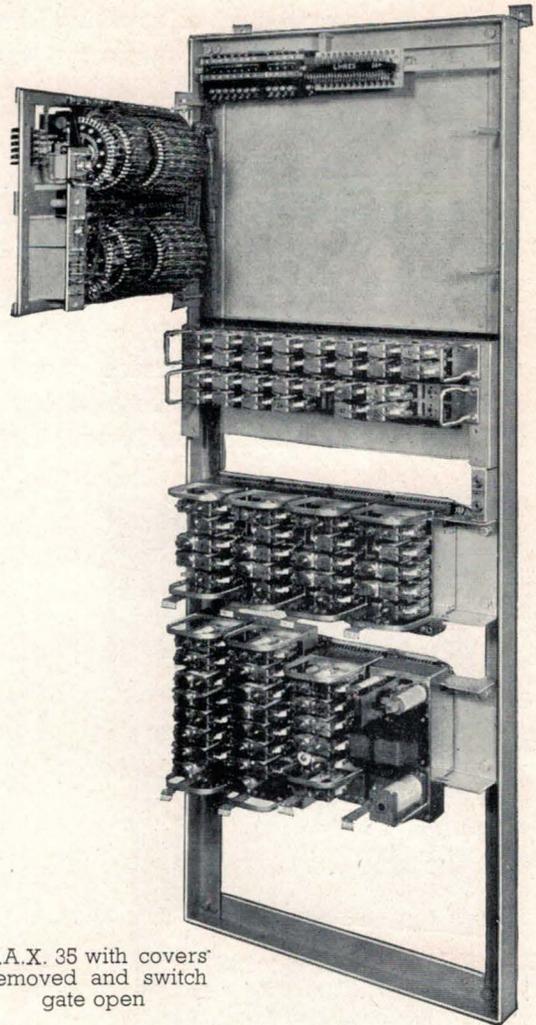
The equipments for the four links are mounted on jack-in units on the next row and the two registers and the ringing and tones sets on jack-in units along the bottom row.

The units of the large switchboard are completely enclosed in steel cabinets with detachable doors both front and rear.

The dimensions of the switchboards are as follows:—

Type.	Height		Width		Depth	
	ft.	ins.	ft.	ins.	ft.	ins.
P.A.X. 35	5	6	2	1		10
P.A.X. 50	5	6	2	6 $\frac{3}{4}$		10
P.A.X. 50/400 each section	5	9	2	6 $\frac{3}{8}$	1	6

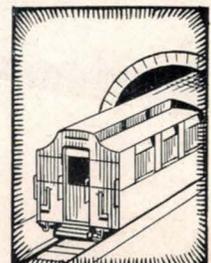
The 35 line board has two registers and a maximum capacity for four links; the 50-line board, two registers and six links; and the 50/400 board one or two registers, seven line finders and group selectors and six connectors per 50 line unit. In all cases the switchbanks with wiring are completed for these maximum figures but the switch



mechanisms and link relays on the jack-in equipment may be supplied to traffic requirements.

A straightforward numbering scheme is adopted in each case; for the 35 line board it is 10 to 44, for the 50 line board 10 to 59 and for the 50/400 board 100 to 499.

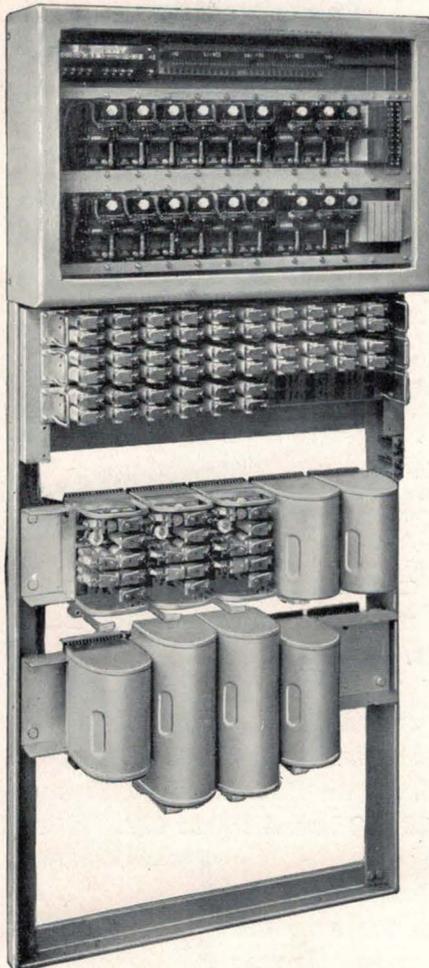
As already explained, the relays are of the standard P.O. 3,000 type. Among



the many technical points of this relay the outstanding features which recommend it for service and maintenance are the twin contact springs and the method of applying tension to the individual springs against a buffer block to ensure correct individual contact pressures.

In every case the relays on these switchboards operate to standard adjustment charts which preclude the use of "two-step" relays.

The voltage variations from a battery eliminator on varying load are greatly in excess of those of a secondary battery and to cover these variations the 24 volts boards



P.A.X. 50 front view with some covers removed

are designed to operate satisfactorily at a voltage varying between 20 and 30 volts and the larger boards between 40 and 60 volts.

The subscribers' instruments used in conjunction with these switchboards are of the standard type fitted with the P.O. dial, described and illustrated on page 15.

SPECIAL FACILITIES

Preference Facility. When a preference subscriber makes a call to an engaged line, a warning tone is first sent to the subscribers in communication and then the preference caller is introduced into the conversation. Should the preference caller desire to withdraw and allow the original conversation to proceed, he may do so by replacing his handset, but if his call is private he asks the wanted number to hang up. This causes the line to be released from the previous call, after which the preference call will automatically ring the wanted line and be connected under normal conditions when the ring is answered.

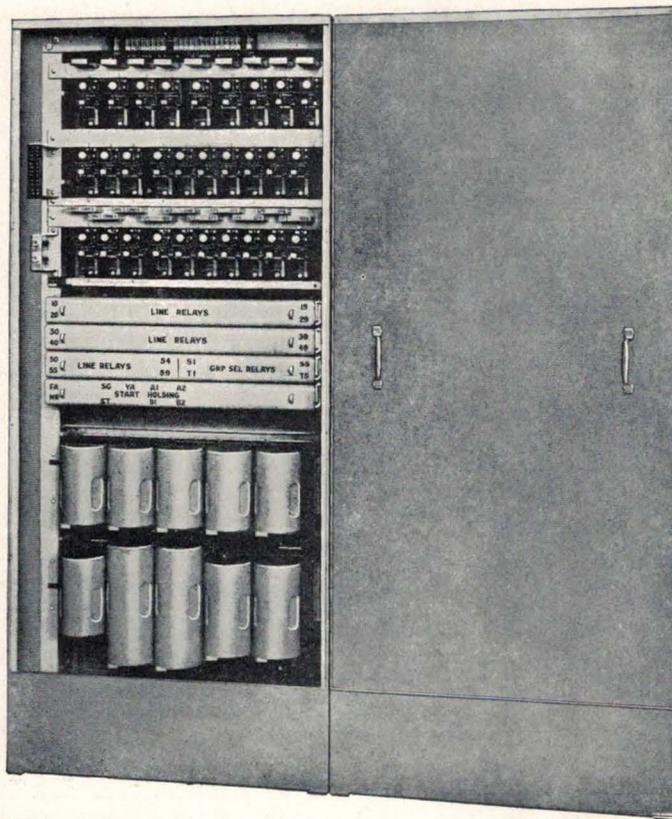
Loud-speaker equipment may be introduced in place of any normal instrument without modification to the switchboards, the busy tone introduced on the line when the distant end clears obviating the risk of omitting to restore the amplifier key. See page 16.

The circuit design of the connector permits dial impulses to be sent over the connector multiple to control the setting of switches. This feature allows facilities to be added which may be of primary importance to some administrations, such as Tie-Line, Round Call and Conference working. These types of calls are controlled by equipment units additional to the standard switchboards.



Tie-Line Working. A variety of tie-line circuits provide for automatic both-way working to other exchanges of various types. A tie-line relay set is designed to be connected to the multiple of a group selector stage on the larger exchanges and to the connector multiple on the small exchanges. If more than one tie-line is required, the call will automatically connect itself to the first

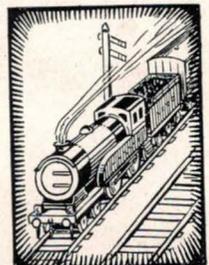
free tie-line of a group. The registers are wired up to make these junctions available by dialling a single digit. It is thus possible to have full automatic inter-communication between two P.A.X.'s of the types described, and furthermore the standard circuit is designed to allow manual supervision for tie-line working with any type of manual board.



PAX. 50/400 showing two sections lined up making a 100-line equipment

The Round Call or Person Finding facility supplies a means of rapid communication with a person who is within a building but not at his usual location. A number of persons holding important positions may be allocated round call numbers which will be

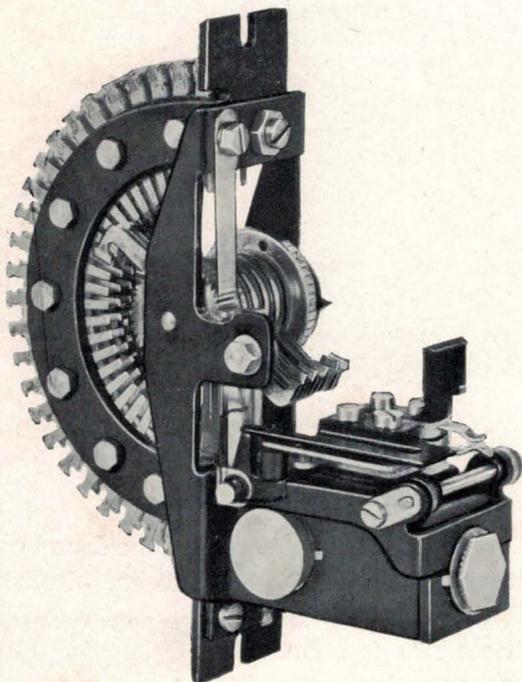
dialled when they are unable to be found on their normal telephone numbers. Round call numbers are usually restricted to ten, but this figure may be exceeded when necessary.



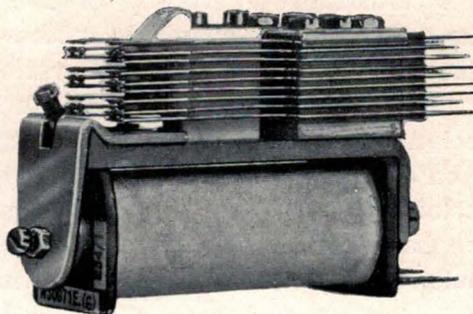
The process of a round call is as follows :

When a caller has been unsuccessful in finding the wanted round call subscriber at his normal telephone number he releases this connection and makes a new call by dialling the single digit allocated to the round call unit and then the round call number of the wanted line. This will immediately operate code calling equipments in various parts of the building. This code calling equipment may be of the type which sends out audible code signals or alternatively visible code signals with an audible tone to attract attention. The subscriber whose code is being transmitted is thus made aware that he is wanted and can quickly come into communication with the caller by dialling a specified digit from any convenient P.A.X. telephone in the vicinity.

Typical examples of the Two Main Pieces of Apparatus used.



Rotary Line Switch.



P.O. Type " 3,000 " Relay.

Conference Calling is a means of collecting a number of subscribers on the same speaking connection for purposes of discussion or instruction. Two types of equipment are available for this purpose; a manually operated and a dial operated system, the former being suitable for a P.A.X. with short lines and the latter for a P.A.X. having the subscribers spread over a larger area. Each subscriber given this facility has a special conference number in addition to the normal number and nine lines is a convenient maximum for this type of equipment.

Faulty Lines, etc. If a line is connected to a register for more than a predetermined time, a thermo-relay comes into operation and transfers this line from the register to a holding circuit, where it will be retained until the fault or loop is cleared. One of the normal numbers must be used for this holding circuit, this number being wired to a jack on the switchboard for use as a normal line when the maintenance engineer is in attendance,



THE ELIMINATION OF BATTERIES IN SMALL AUTOMATIC TELEPHONE EXCHANGE OPERATION

SINCE the inception of automatic telephone exchange switching, it has been one of the ideals of the telephone engineer to produce a complete equipment which could really be called automatic, in so far that, provided no apparatus fault occurs, it would give good service over an extended period, without receiving any manual attention whatsoever.

Up to a short time ago, this ideal, while possible technically, could not be realized fully in practice owing to the exacting demands on the power supply of automatic systems; the chief difficulty being to provide a maintenance free power source whose voltage would remain within the necessary close limits during heavy usage of the exchange.

In the past, the almost universal method of dealing with the problem under all conditions has been to provide accumulator batteries, which are charged from an external power supply—the regularity of charge and general battery condition being supervised by an attendant, or maintenance officer. This arrangement is perfectly satisfactory in the case of large exchanges, where a trained maintenance staff is always in attendance, and where a large reservoir of energy is required to maintain public service over a breakdown period of the charging power source, but in the case of the small private exchange, even when the battery is charged automatically, the lack of the necessary attention to maintain important conditions such as the acid level, etc., is a great drawback, and the need of an alternative scheme, in which all manual attention to any part of the exchange equipment can

be dispensed with entirely, has long been felt.

Recent years have seen, inter alia, the development of three very important factors which have at last enabled the telephone engineer to produce a power unit requiring even less maintenance than his own switching equipment. These factors are (a) the increase in the generation and distribution of alternating electric power, (b) the development of the maintenance-free metal-rectifier, and (c) the production on a commercial scale of reliable high-capacity electrolytic condensers.

The Ericsson Company are producing automatic exchanges for working directly on the power mains without the aid of batteries or rotating machinery, and judging by the great demand for this type of board, a very real contribution has been made to the already long list of merits of the small automatic exchange. The power units used with this equipment are referred to as battery eliminators, and incorporate Westinghouse metal rectifiers. In view of their extending use, no doubt a few comments on the salient features of our standardized equipment will be of value to all who are interested in this aspect of exchange power supply.

It has been found from experience that the greatest appeal of battery eliminators occurs in the case of small automatic exchanges of anything up to 50 lines capacity, accordingly we cater primarily for this equipment range.

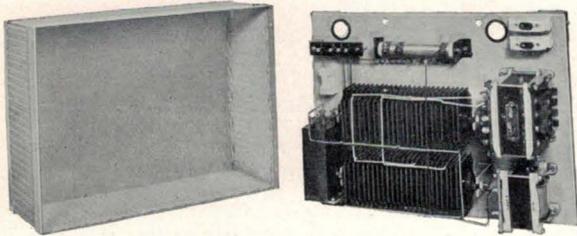
This popularity in the smaller sizes is due to the fact that exchanges served by





eliminators rely solely on the main power supply for their immediate source of energy, and any discontinuity in this supply will interrupt the telephone service, therefore, in the case of larger and more important equipments, a power supply incorpor-

Other frequencies can be dealt with but require special treatment resulting in a slight increase in cost. The output values quoted take into account a mains voltage variation of $\pm 6\%$.



Battery Eliminator for 22-line Exchanges

ating a reserve of power, e.g., an accumulator battery, is usually preferred. In some cases, however, the enthusiasm for a battery free exchange up to 100 lines capacity has been so great that an eliminator for this purpose, on 50 volt exchange equipments can also be supplied, see illustration. A complete list of our eliminator equipment is given below:—



Battery Eliminator for 100-lines Exchange

All the below-mentioned eliminators are capable of operating on the following mains voltages, at frequencies of from 40-100 cycles per second:—100, 110, 120, 200, 210, 220, 230, 240 and 250.

As previously indicated, the rectifying operation is performed by dry plate metal rectifiers which require no maintenance attention whatsoever, further, due both to the stability of this type of rectifier and to the light electrical loading our design imposes, an almost inexhaustible life is anticipated. Smoothing is effected by a low-pass filter of generous proportions, and accounts for the unusually silent background experienced during the conversation period. In order to make the best use of this filter equipment the output of the rectifier is divided into two parts, one of which is highly smoothed and feeds the speech circuits and any other delicate apparatus such as tone relays, the other is considerably less smoothed and is used in all cases where a high degree of smoothing would be of little or no value.

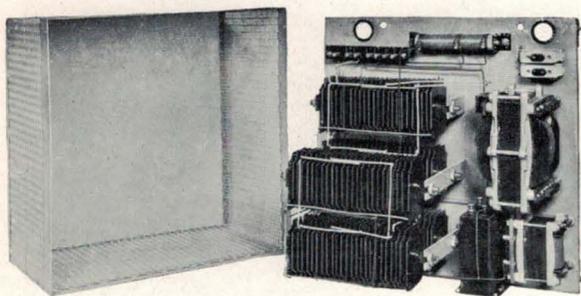
An output voltage control is incorporated on all recent designs, and ensures an almost constant voltage across the exchange bus bars, even when operating under heavily fluctuating load conditions.

Code.	Application.	Output.	Dimensions.
N.20447	Small direct switching exchanges up to 22 lines.	24 v—3.0 amp.	1' 7" x 1' 2" x 8"
N.20384A	Register exchanges up to 35 lines.	24 v—4.25 amp.	1' 6" x 1' 6" x 1' 0"
N.20385A	Register exchanges up to 50 lines.	24 v—5.5 amp.	1' 6" x 1' 6" x 1' 0"
N.20444	Register exchanges up to 100 lines.	50 v—7.5 amp.	1' 3" x 1' 0" x 5' 9"

This results in both the transmission and signalling tone levels remaining substantially constant also, a feature which is of particular value on busy exchanges.

The subject of isolation of the low tension circuits from the mains

voltages is obviously of particular importance on telephone equipments, and has, therefore, received very careful attention on these power units. The insulation of the step down transformer is maintained at an exceptionally high figure by insulating materials of great durability, and as a final precaution an earthed metallic screen is built into the transformer between the primary and secondary windings; this screen causes the main fuse to blow if the unearthed (and therefore dangerous) pole of the mains attempts to flash over to the



Battery Eliminator for 35-line Exchanges (i.e. with 3 units)
Battery Eliminator for 50-line Exchanges (i.e. with 5 units)

secondary circuit. Insulation tests are carried out at a voltage of 2,000 r.m.s. which is approximately 10 times the value of the maximum applied voltage occurring in practice. All high-tension terminals are bakelite covered to preclude the possibility of stray wire, etc., causing dangerous inter-connections.

When eliminator equipment is required for tropical use, or in locations where the ambient air temperature is likely to exceed 100° F., the electrical loading of the rectifiers is reduced appreciably, also special finishes

are provided throughout. It is important, therefore, when specifying for non-standard conditions of use, to ensure that the correct choice of equipment is made, and where any doubt is felt it is strongly advised that the assistance of our technical department should be obtained on the matter.

When installing eliminator equipment the following points should be given attention:—

- (a) Correct mounting position chosen in relation to the rectifiers and electrolytic condensers.
- (b) Location to be as dust free as possible, also fumes liable to cause corrosion must be avoided.
- (c) A ground clearance of at least 12" should always be provided.
- (d) The eliminator should be as near to the exchange as possible.

The correct mounting position occurs when the rectifiers are horizontal, and the electrolytic condensers are in a vertical position with the terminals at the top. This arrangement ensures the necessary circulation of cooling air to the rectifiers and must, therefore, be obtained always.

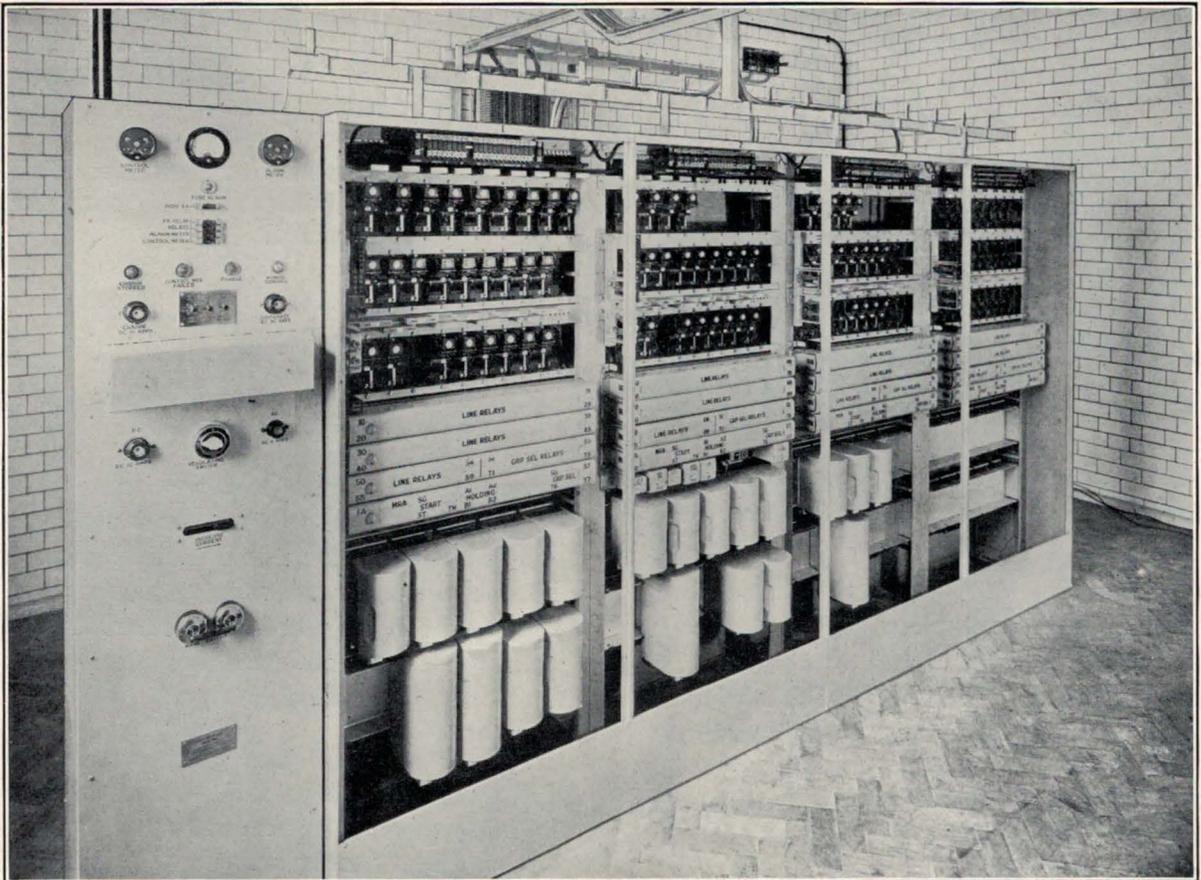
Air circulation is further promoted by the perforations in the all metal cover and by adequate ground clearance. Dust ingress due to these perforations is of no consequence other than to cause unsightliness.

All eliminators are externally finished in grey and chromium plate.





ERICSSON AUTOMATIC TELEPHONE INSTALLATION



Typical Suite of 4-50 Line Sections (200 lines)
complete with automatic charging panel.



NEW BAKELITE TELEPHONES

IN designing a modern telephone instrument several important points must be taken into consideration. It must have a high standard of electrical efficiency both in volume and purity of speech, a pleasing outward appearance combined with rigid construction and, for reasons of economy, simplicity in maintenance and adjustment. The most effective combination of these qualities has been the ultimate aim of the Ericsson Company, whose wide experience in this section of telephone engineering has resulted in the production of new bakelite table and wall telephones.



N.1002 H

This modern, distinctive and pleasing design incorporates a form of cradle or micro-telephone rest which is not readily damaged should the instrument get violently knocked or fall to the ground.

The whole of the interior apparatus which is mounted on a frame can be removed as a unit by undoing one screw and loosening two others, the base cover being first removed by undoing one screw only.

This wall instrument follows the design of the table set immediately above.

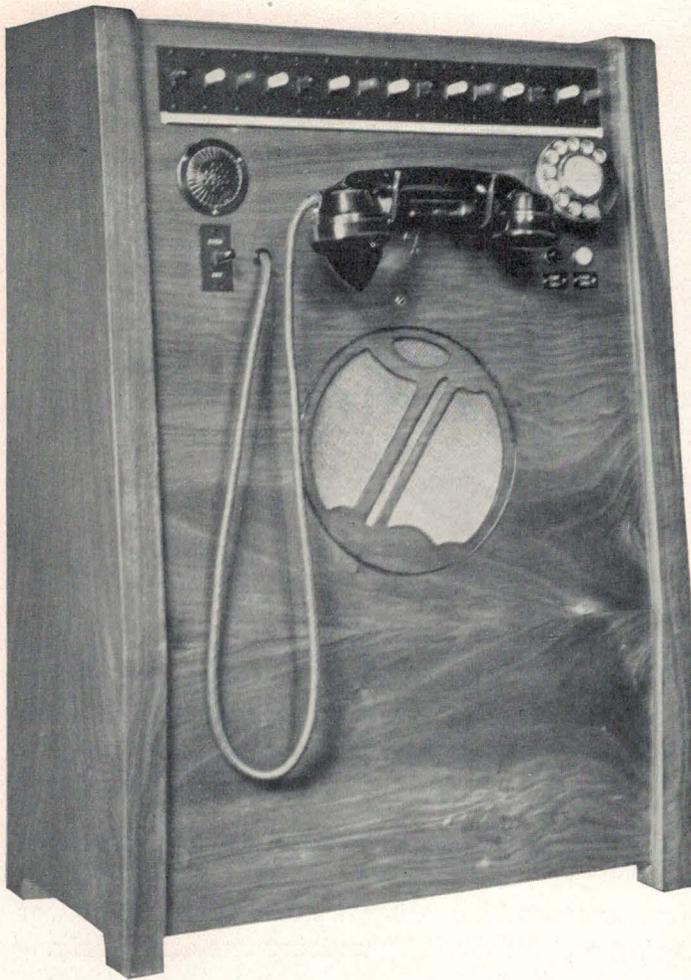
The case is hinged at the bottom to a metal back upon which are mounted the induction coil, ringer, switch, condenser and terminals. The whole interior is exposed by undoing one screw only, and the apparatus can be removed as a unit without taking the instrument from the wall.



N. 1070



EXECUTIVE'S CABINET



The Console Cabinet illustrated is designed for the busy executive who desires instant communication with his various departmental chiefs without the necessity of dialling. A call is originated by the "flick of a key," maximum 15 lines. A conference call is effected by depressing the desired number of keys and has automatic priority over engaged lines. Loudspeaker facilities are incorporated but the standard bakelite hand microphone is also fitted for private conference, thus cutting off the loudspeaker.

These Cabinets are made to order and may be of oak, walnut or mahogany to suit office furnishings.

LOUDSPEAKER EQUIPMENT

The loud speaker illustrated above has been specially designed to work on automatic telephone circuits. The operation is simple since it is only necessary for the user to turn the switch and dial the wanted number, or, in the case of an incoming call, to turn the switch only.

The equipment is self-contained, the amplifier being incorporated in the cabinet together with loud speaker and microphone. By using the hand-micro-telephone the loud speaker is automatically cut out of service for secret conversation.

The standard wood for the cabinet is Walnut, but any suitable woods could be used should it be desired to match existing surroundings.





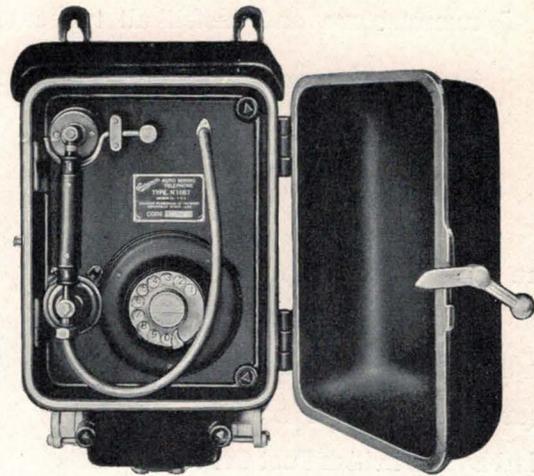
ERICSSON AUTOMATIC MINING TELEPHONE

THE development of the flameproof telephone had its inception in the desire of a large firm of chemical manufacturers to have a safe telephone service in all departments where a possible risk of inflammable vapours existed, yet for this service to be given via their central automatic exchange. When the first stages of experiment were commenced, a call for automatic instruments for the petroleum refining industry was received and this was shortly supplemented by the necessity of providing like communication in coal mines.

The dial assembly is interesting in that the finger plate is independent of the dialling mechanism. Thus the safety of the enclosure does not depend on the light bearing shaft but the movement is transmitted from finger plate to mechanism by a clutch-shaft of generous proportions, coupled with a locking device which prevents damage to the dial mechanism by over-rapid dialling. Between the mechanism and the front casting carrying the flame-proof bearing a gauze is inserted as a diffuser to prevent a cone of pressure being exerted upon the bearing in the event of ignition. While this is a refinement and not an essential, it provides an additional factor of safety of particular value where hydrogen mixtures and chloroform, ether or kindred vapours are encountered. The back cover is of massive proportions and forms a spigot joint on the front housing.

The receiver switch enclosure and the terminal chamber follow the proved design of the Ericsson flameproof magneto telephones.

The isolating switch is connected directly to the lines incoming at the terminal chamber



Auto Mining Telephone with door open
N. 1087

and is operated by the inner door. Opening the inner door $\frac{1}{8}$ " cuts off all connection between the lines and the internal wiring, thus any necessary examination can be conducted with safety. The switch is housed in a substantial flameproof enclosure and the contact springs and their tensioning are so arranged that in the unlikely event of any mechanical breakage the instrument is automatically disconnected. Further to protect the switch an overdrive is provided to take up any surplus movement after fitting.

The instrument has been tested for flameproofness by the Mines Department and is certified for both Group I—Firedamp (methane) and Group II, Petroleum and Acetone Vapours, by Certificate No. FLP. 853 of 21st October 1936.

It will naturally be appreciated that a similar instrument can be provided for working to a C.B. System.



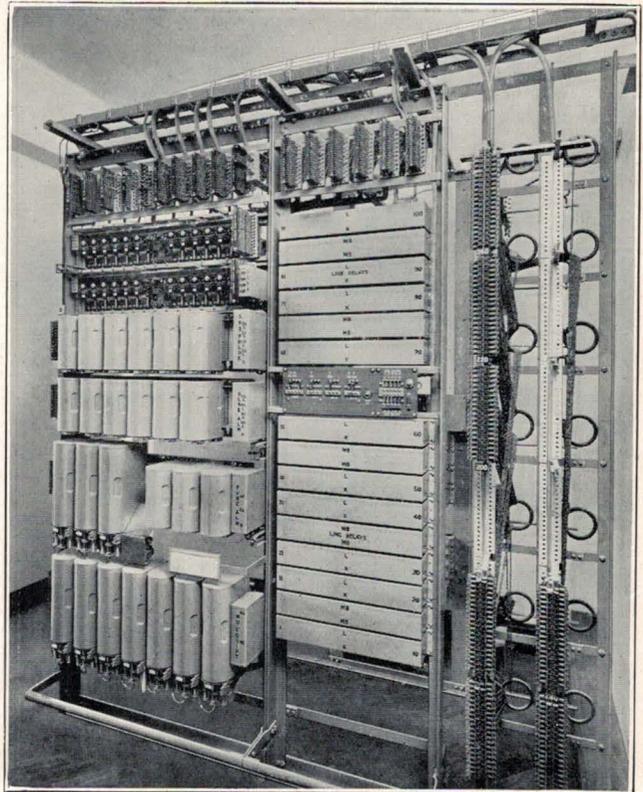
PABX. EQUIPMENTS

WHERE facilities for connections to the public exchange system are required, we manufacture and install all types and sizes of Private Automatic Branch Exchange Equipments, and invite customers to send us their enquiries, when we shall be glad to advise and quote.

The equipment comprises main frame, auto unit, miscellaneous apparatus rack, ringing panel and attendant's manual board. The power equipment is supplied by the British Post Office, together with instruments and line wiring. The exchange illustrated is initially equipped to serve 100 extension lines, and all exchange calls may be routed via the attendant's board or by direct dialling.

A typical auto unit is illustrated on this page. The switching equipment provides for a maximum of 12 simultaneous conversations between extensions. Calls to or from the public exchange are made without holding switching equipment. A cross-connecting field between the line relays and connector multiple is provided on the rack for traffic reasons.

The manual board is of the floor pattern type with a capacity for 100 extension lines, 10 exchange lines



A Private Automatic Branch Exchange for 100 lines and 12 cord circuits, the initial equipment being 90, 4 and 9 of these circuits respectively. Provision for night switching has been made on all exchange lines.

The line finders used are 50-outlet uniselectors and the connectors are two-motion switches of the 200-outlet type. All relays are the British



Post Office (B.P.O.) "3000" type, incorporating twin contacts.

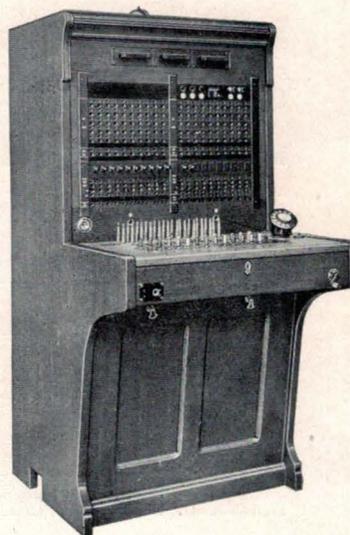
Alarm signals are provided to indicate:—

- (a) When a connector is taken into service and held for an excessive period before the call is proceeded with (permanent loops, etc.), the circuit conditions are such that the switching equipment is released after a period of 30-60 seconds and the calling signal on the manual board associated with the extension glows. The extension lamp provides the alarm signal in this case.
- (b) Blown fuses.
- (c) Whenever a fault occurs which results in the permanent energisation of a release magnet. This alarm is re-

tarded for a period no longer than 18 seconds.

- (d) Ringing current failure, indicating a fault on the ringing dynamotor.

All the above alarms are extended to the attendant's manual board.



A PABX. Manual Switchboard





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