

# PRIVATE AUTOMATIC EXCHANGE EQUIPMENTS. A NEW SERIES OF DESIGNS.

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### SYNOPSIS.

Tables are given of the equipment quantities and dimensions of the five basic new designs and of the auxiliary special services that can be provided. The general assembly and various design features are outlined. The circuit of the battery eliminator is given, also the numbering schemes, and various operational features are described. The article concludes with some notes on the special service facilities.

### INTRODUCTION.

Fig. 1 shows the five basic sizes of the recently developed series of private automatic exchange (P.A.X.) equipments, which are suitable for use both at home and abroad. The relays and automatic selective apparatus are of the British Post Office designs and, together with the wiring, have a semi-tropical finish.

A feature of special interest is that each of the five basic sizes is assembled as a completely self-contained metal-cased unit and includes a battery eliminator for operating direct off A.C. mains, no batteries being required. The battery eliminator is omitted where the supply mains are D.C. and duplicate batteries are used instead.

### EQUIPMENT QUANTITIES AND DIMENSIONS.

Table I gives the initial and maximum equipment quantities and the dimensions of the five basic sizes. The initial quantities of line

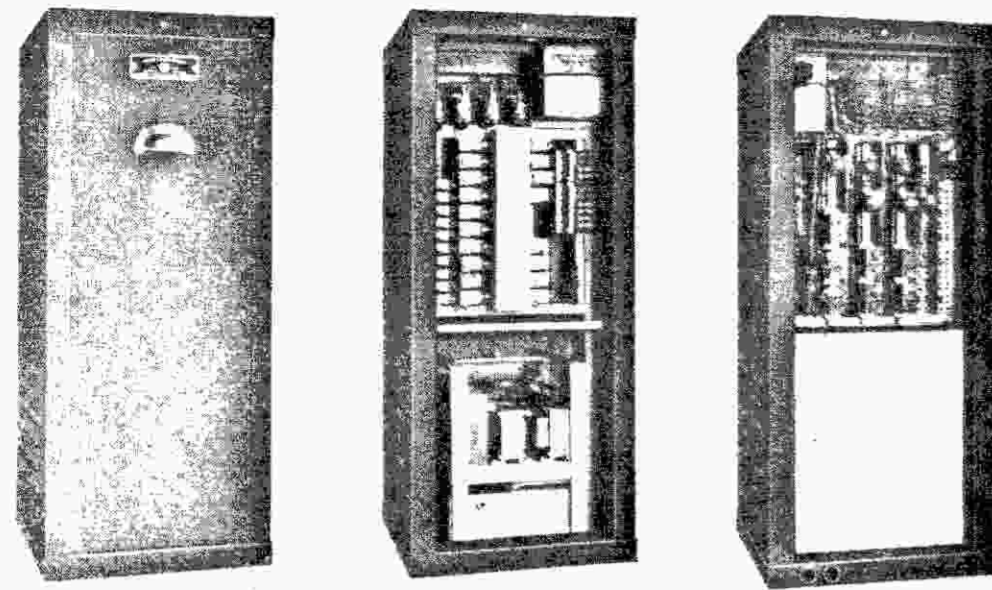
equipments and the connecting links can readily be increased in accordance with customers' orders, but not, of course, beyond the maximum capacity of any particular P.A.X. The line equipments are available in groups of 5 lines. Actually, the design is such that the additional items can be fitted at any time, convenient provision thus being made for any extensions that may be required later on.

### SPECIAL SERVICES EQUIPMENT.

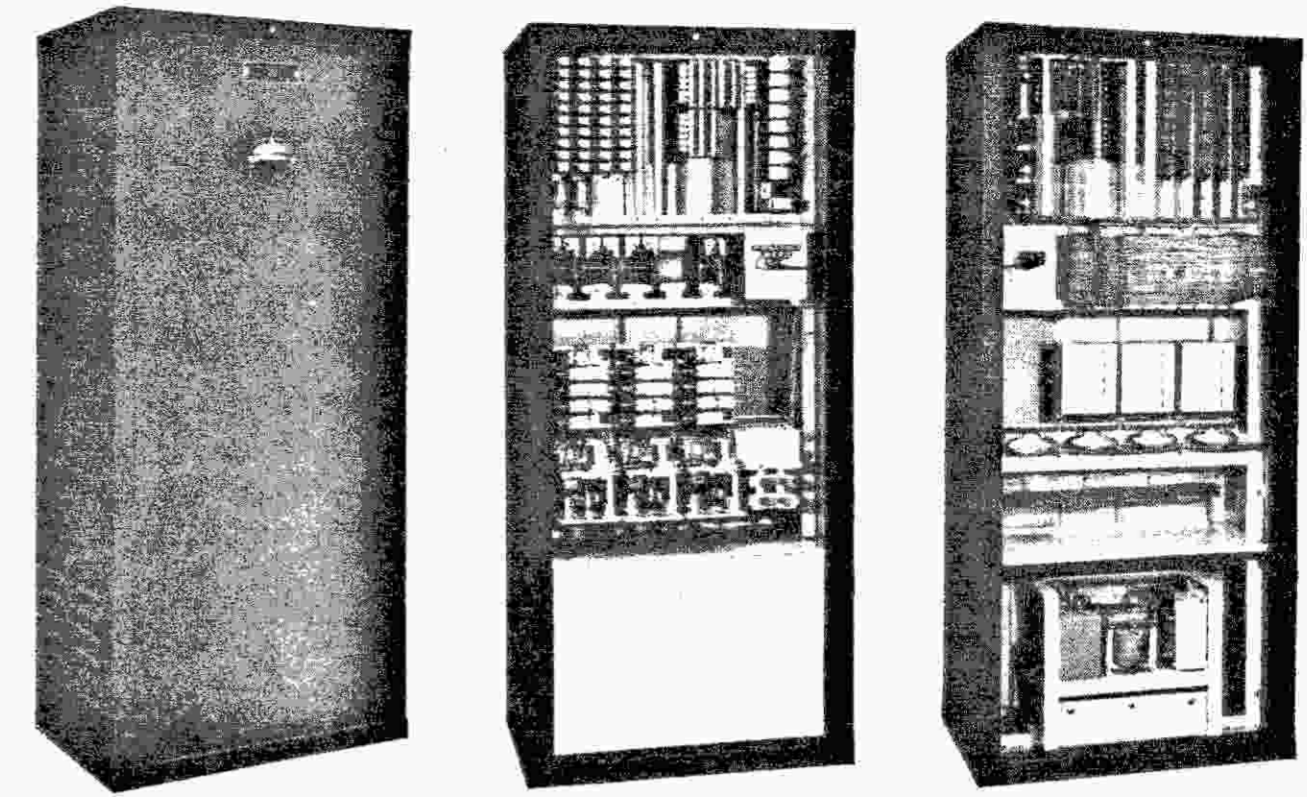
Provision is also made for a comprehensive and useful range of special services, any or all of which can readily be supplied initially or at any future date by the addition of various apparatus components. In the case of the 10, 25 and 50 lines P.A.X.'s, the special services apparatus is arranged to be accommodated, when required, in an extension at the top of the cabinet. On the 100 and 200 lines P.A.X.'s

TABLE I.

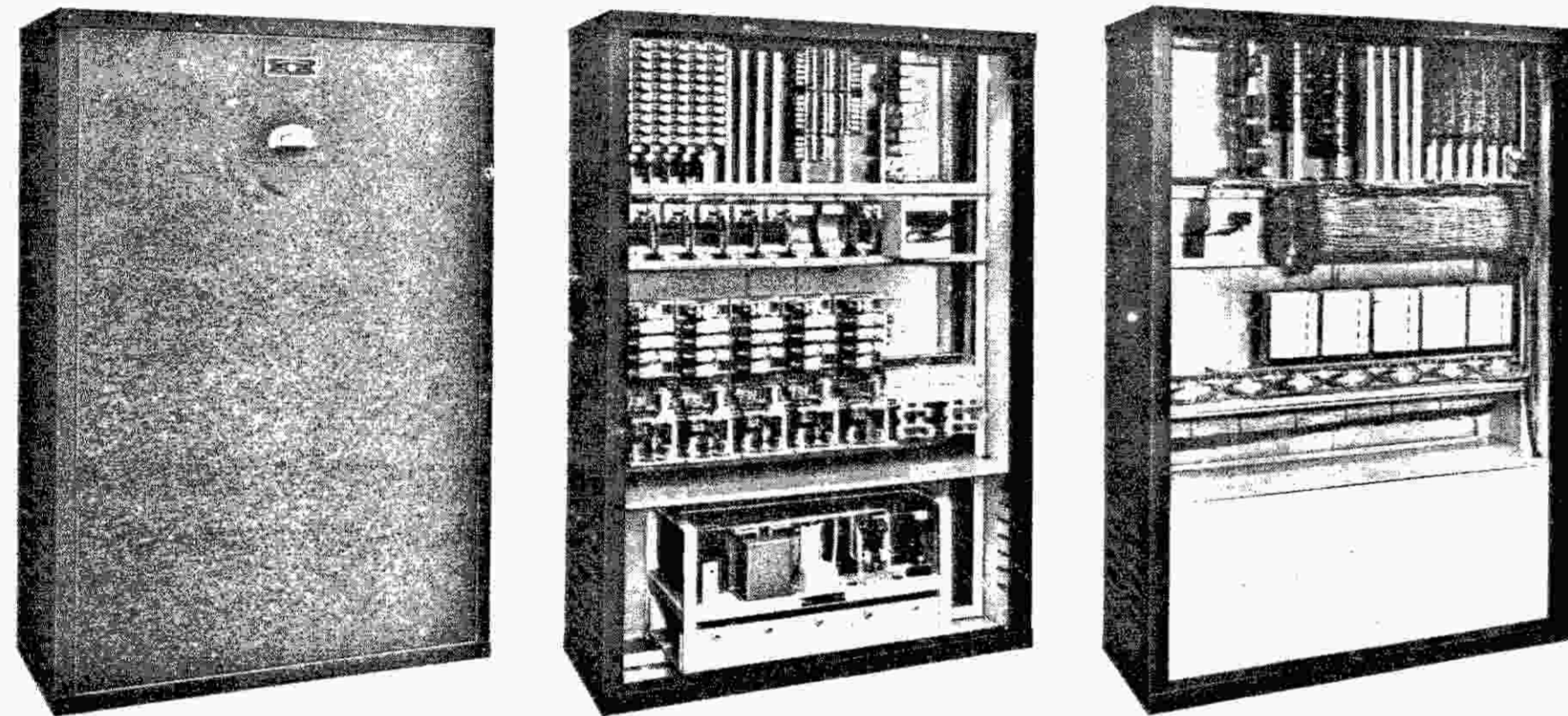
Type.	Initial Equipment.		Maximum Equipment.		Dimensions.						Special Services available. See Table II.
	Lines.	Con-necting Links.	Lines.	Con-necting Links.	Without top extension.			With top extension.			
					H.	W.	D.	H.	W.	D.	
10-2	10	2	10	2	3' 0"	1' 3"	1' 4"	4' 2"	1' 3"	1' 4"	I-6
25-4A	15	3	25	4	4' 6"	2' 0"	1' 4"	5' 8"	2' 0"	1' 4"	I-10
50-7A	30	5	50	7	4' 6"	4' 2"	1' 4"	5' 8"	4' 2"	1' 4"	I-10
100-10A	60	7	100	10	5' 6"	4' 6"	1' 4"	5' 6"	4' 6"	1' 4"	I-10
200-20A	60	7	200	20	5' 6"	4' 6"	1' 4"	5' 6"	4' 6"	1' 4"	I-10
					5' 6"	4' 6"	1' 4"	5' 6"	4' 6"	1' 4"	I-10



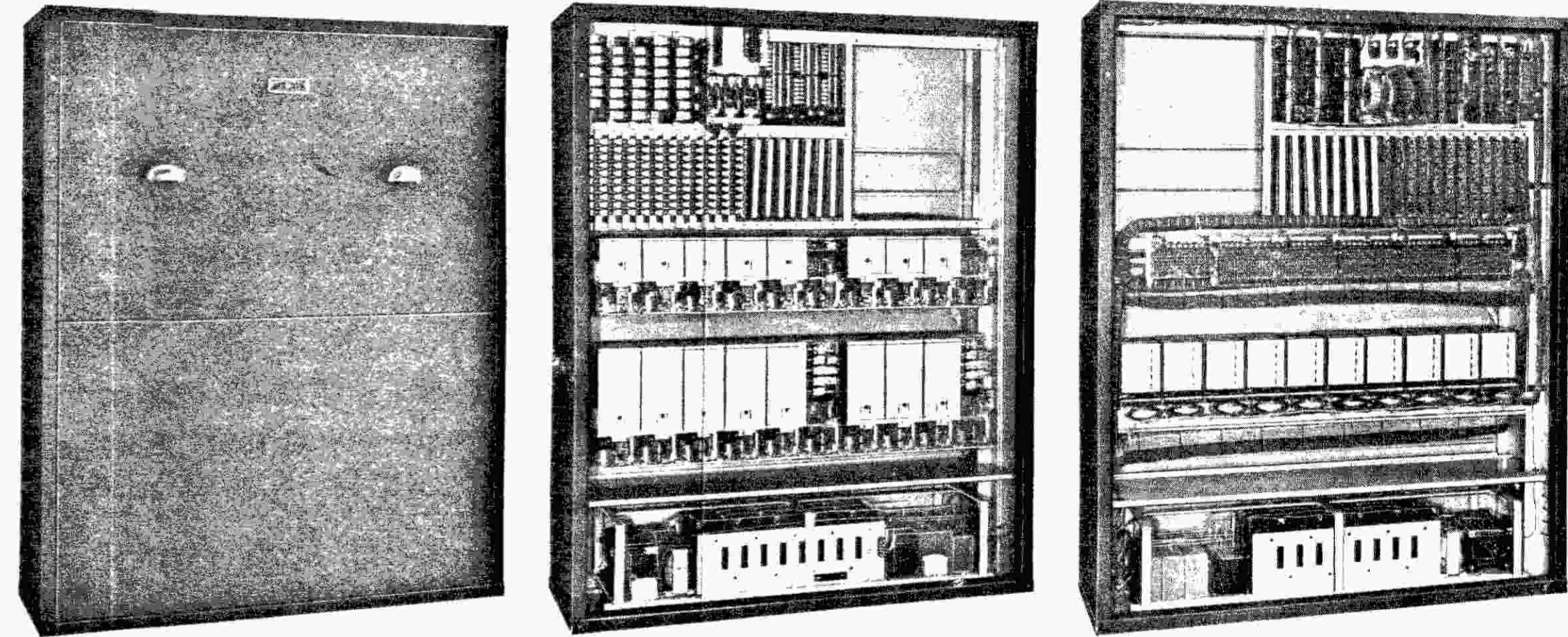
TYPE 10-2



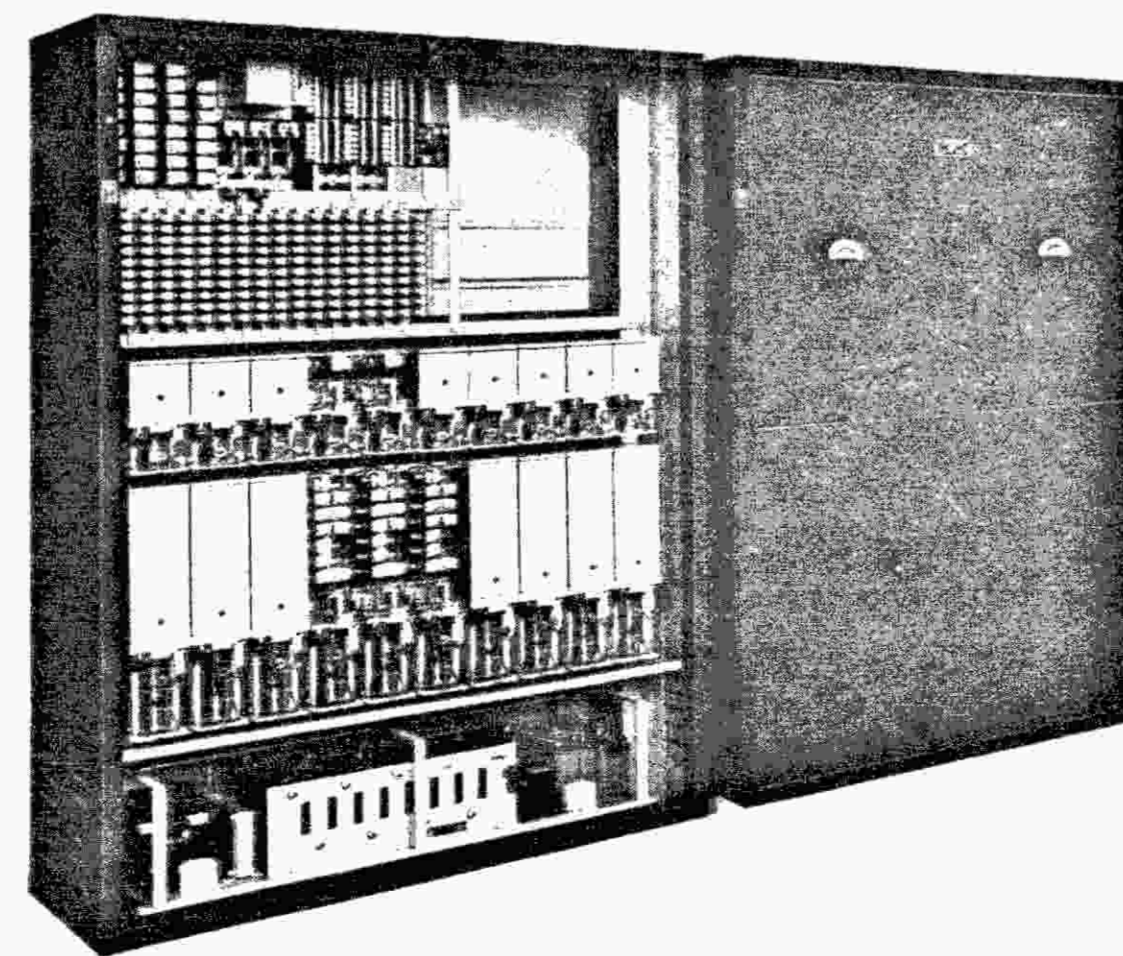
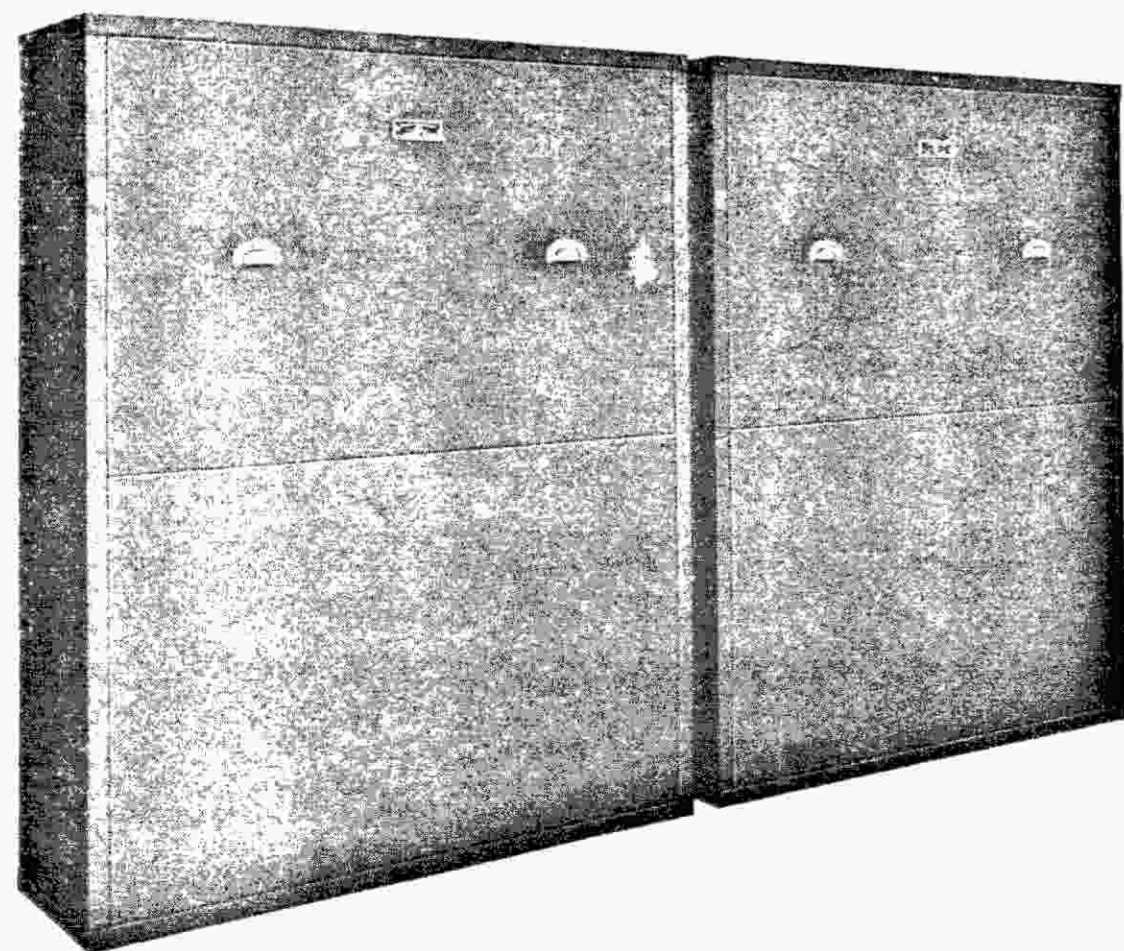
TYPE 25-4A



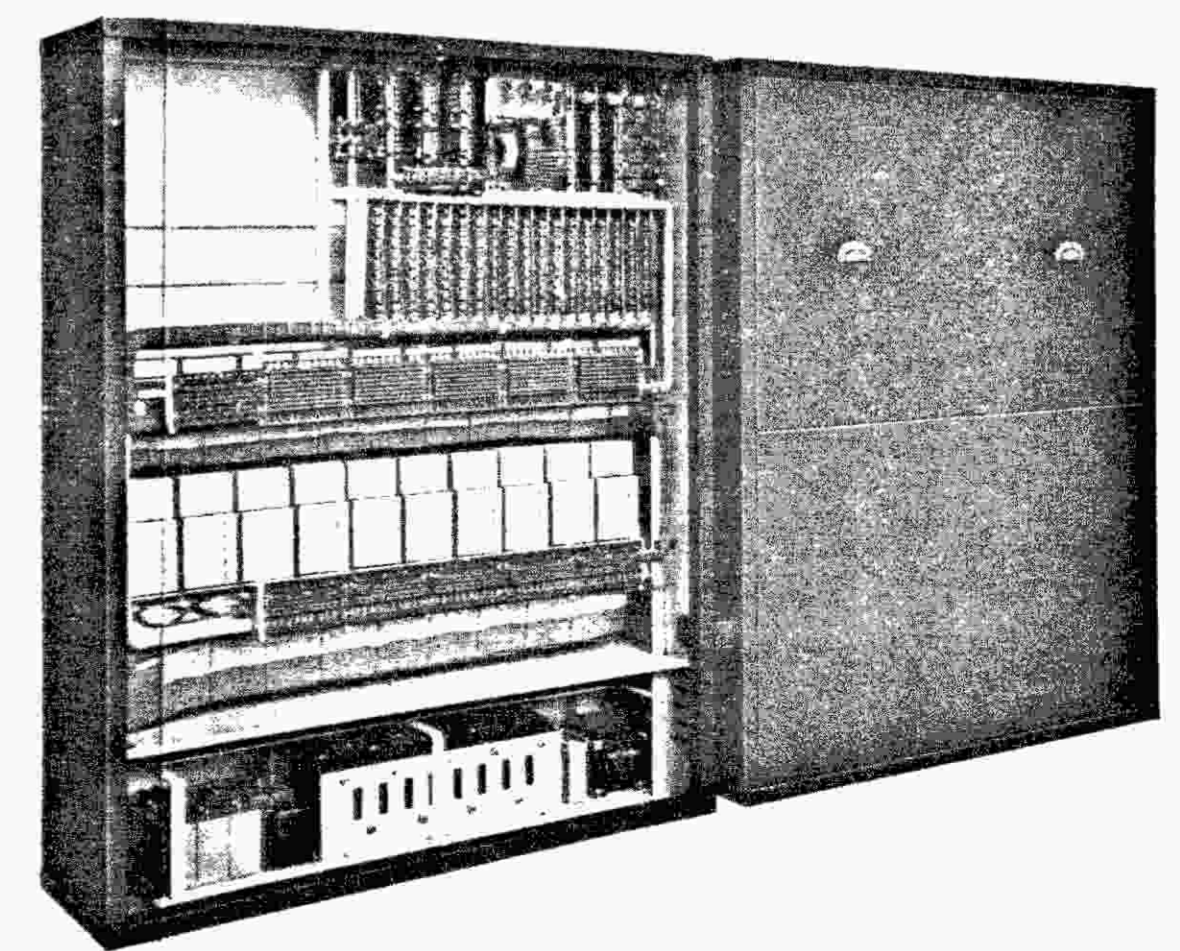
TYPE 50-7A



TYPE 100-10A



TYPE 200-20A



there is sufficient spare space within the cabinets to accommodate the special services components.

Fig. 2 shows the Type 25-4A P.A.X. fitted with the special services extension on the top of the cabinet.

Table II contains a list of the various special services and indicates which of these are available on each size of P.A.X.

**AUTOMATIC APPARATUS COMPONENTS.**

The automatic apparatus is composed of B.P.O. Type 600 and Type 3000 relays, B.P.O. type uniselectors and Type 32A (B.P.O. Type 2000) selectors. In the case of the Type 10-2 P.A.X., 12 point uniselectors are used as line finders and final selectors.

In all cases the P.A.X.'s are fully equipped with contact banks and wired for the ultimate capacity. The line and cut-off relays are strip mounted in groups of five pairs, as shown in Fig. 3. In the case of the Type 25-4A and Type 50-7A P.A.X.'s, the apparatus required to be fitted for an additional connecting link merely comprises a uniselector mechanism, with condenser and spark quench resistance, as line finder and a Type 32A final selector, as shown

in Fig. 4. For the Type 100-10A and Type 200-20A P.A.X.'s each additional connecting link merely requires the "jacking-in" of a Type 32A finder—see Fig. 5—and also a final selector. Any additional connecting links that

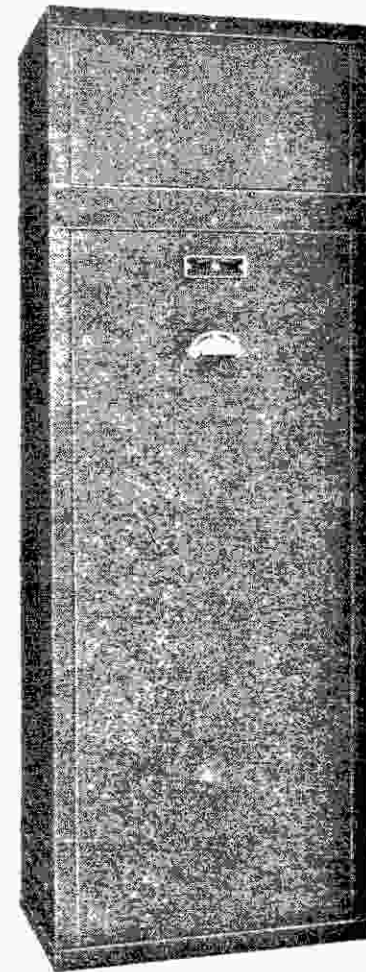


FIGURE 2

TABLE II.

No.	Type of Special Service.	Type of P.A.X.				
		10-2	25-4A	50-7A	100-10A	200-20A
1	Secretarial ... ..	X	X	X	X	X
2	Key-calling ... ..	X	X	X	X	X
3	Conference key-calling ... ..	X	X	X	X	X
4	Priority ... ..	X	X	X	X	X
5	Tie-line ... ..	X	X	X	X	X
6	Fuse alarm ... ..	X	X	X	Always fitted	Always fitted
7	Release alarm ... ..	—	X	X	"	"
8	Code call using morse signals ... ..	—	X	X	X	X
9	Code call using coloured light signals ... ..	—	X	X	X	X
10	Fire alarm ... ..	—	X	X	X	X

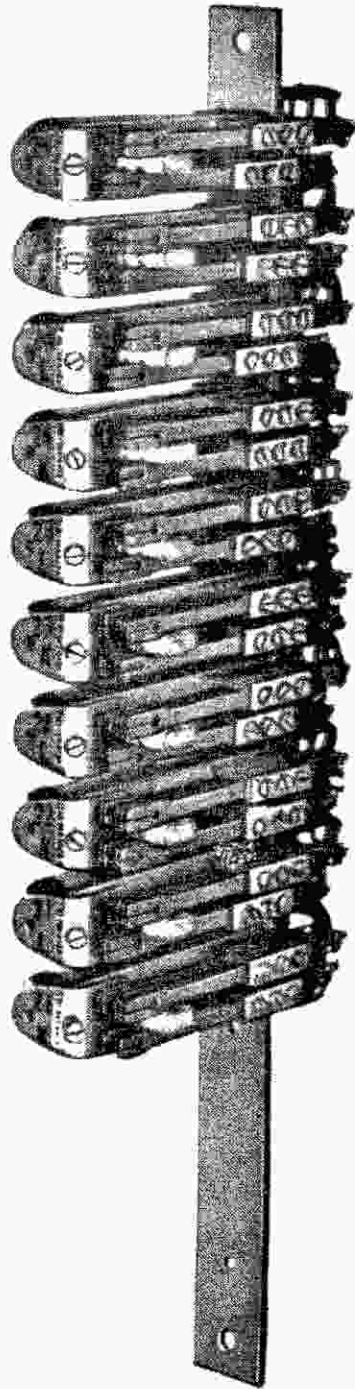


FIGURE 3

may be required can therefore be fitted very readily.

The ringing and tone apparatus is of the vibratory type and provides tones very similar to those standardised by the British Post Office, including dial tone, ring-back tone and busy tone. The ringing and tone apparatus comprises B.P.O. Type 3000 relays and vibrators and a transformer and choking coil unit.

GENERAL ASSEMBLY.

The equipment is assembled on an iron framework and enclosed in a metal cabinet, the disposition of the various components in the case of the Type 25-4A P.A.X. being as shown in Fig. 6. The same general arrangement is followed for the other sizes. The automatic apparatus and the battery eliminators are

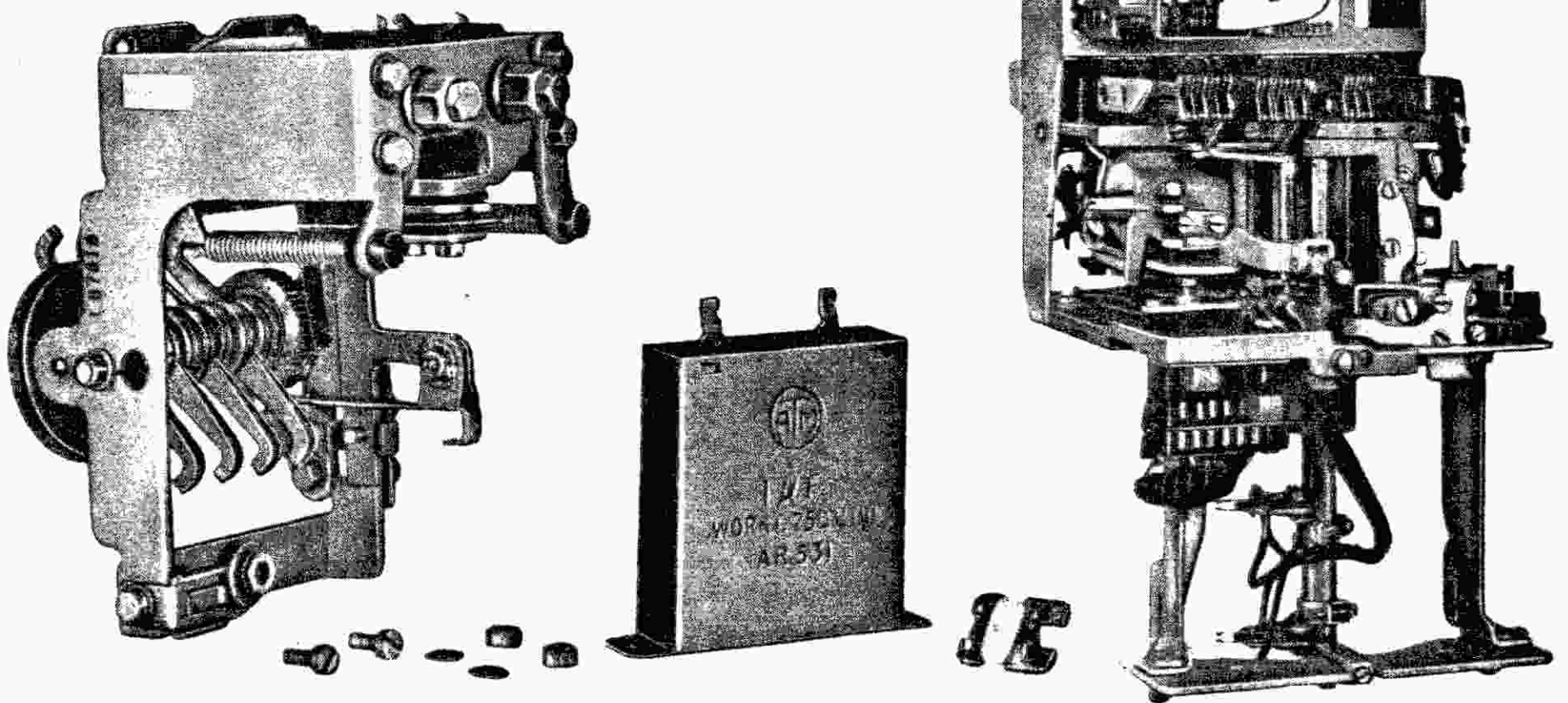


FIGURE 4

contained in top and bottom sections of the metal cabinets which have been specially designed to exclude all dust and foreign matter.

#### METAL CABINET DESIGN.

The metal cabinets comprise nine parts in the cases of Types 10-2, 25-4A and 50-7A P.A.X.'s as shown in Fig. 7. As the Types 100-10A and 200-20A P.A.X.'s have two-part front and rear panels, the cabinets for these have a total of eleven parts.

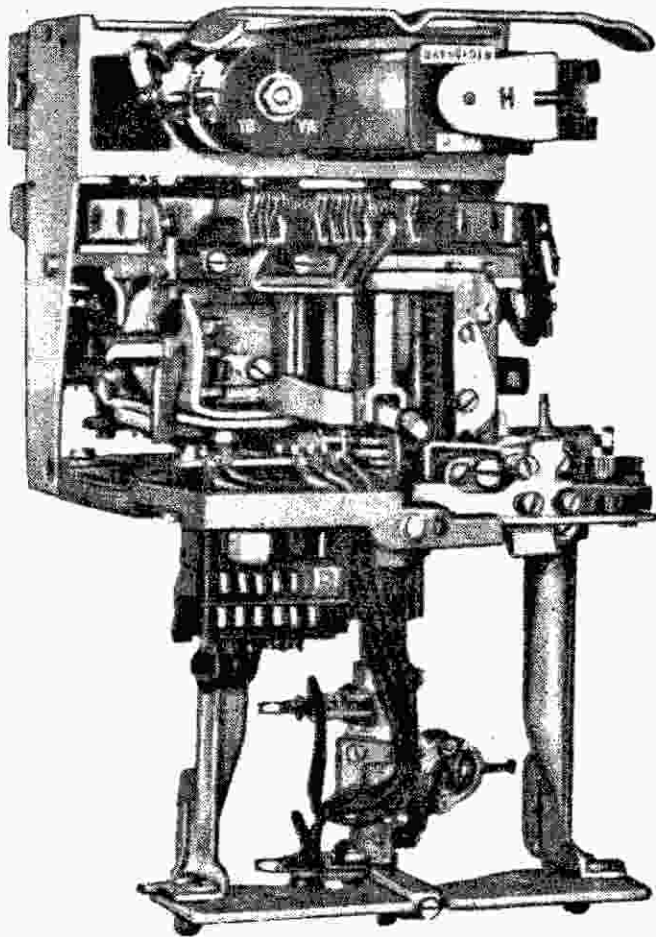


FIGURE 5

The front and rear panels are removable and their edges are tapered to correspond with a similar formation of the top, bottom and sides of the cabinet. Each of these panels is fitted with a lock, the tongue of which registers in a tapered slot as shown in Fig. 8a. These arrangements ensure that, when the panels are locked in position, the tapered surfaces are brought into close relationship, thus effectively excluding dust or foreign matter. The action of locking also secures the aprons in position, as shown in Fig. 8b.

The intersection panel and aprons effectively separate the automatic apparatus and the battery eliminator, whilst the louvres in the side provide for the free ventilation of the eliminator section.

The outer surfaces of the metal cabinets are finished in crystalline black and have chromium plated fittings.

#### MOUNTING OF SPECIAL SERVICES APPARATUS.

As previously mentioned, the special services apparatus for the three smaller P.A.X.'s is arranged to be accommodated in an extension at the top of the cabinet. In these cases the apparatus is assembled as a unit on a small iron framework, which is arranged to be bolted to the top member of the main framework of the P.A.X., as shown in Fig. 9. The top of the cabinet is, of course, first removed and is replaced by a metal band and two side pieces, which are bolted to the extension framework. The top of the cabinet fits on the top of the extension framework and fits closely on to the two sides. The top extension has also two panels, each being fitted with a lock. The whole of the special services apparatus is thus completely enclosed.

#### BATTERY ELIMINATORS.

Fig. 10 shows the circuit of the battery eliminators, which provide for maximum outputs of 1, 3, 5 and 8 amperes, the output voltage being automatically controlled within the limits of 45-53. Mains voltages of from 100 to 250 volts are provided for by means of suitable tappings.

There are two separate output supplies, one being specially smoothed for transmission feeding circuits and the other, less smoothed, for operating purposes. Ammeter links are provided and enable a portable ammeter to be inserted whilst the P.A.X. is in operation without causing any interruption of the service.

#### NUMBERING SCHEMES AND OPERATIONAL FEATURES.

##### (a) Type 10-2 P.A.X.

Designed for single digit operation, 0-9, the circuit arrangements are composed of three sections, namely, the line equipment, the connecting link equipment and the tone equipment.

The second connecting link is automatically made available during the time that the first link is engaged.

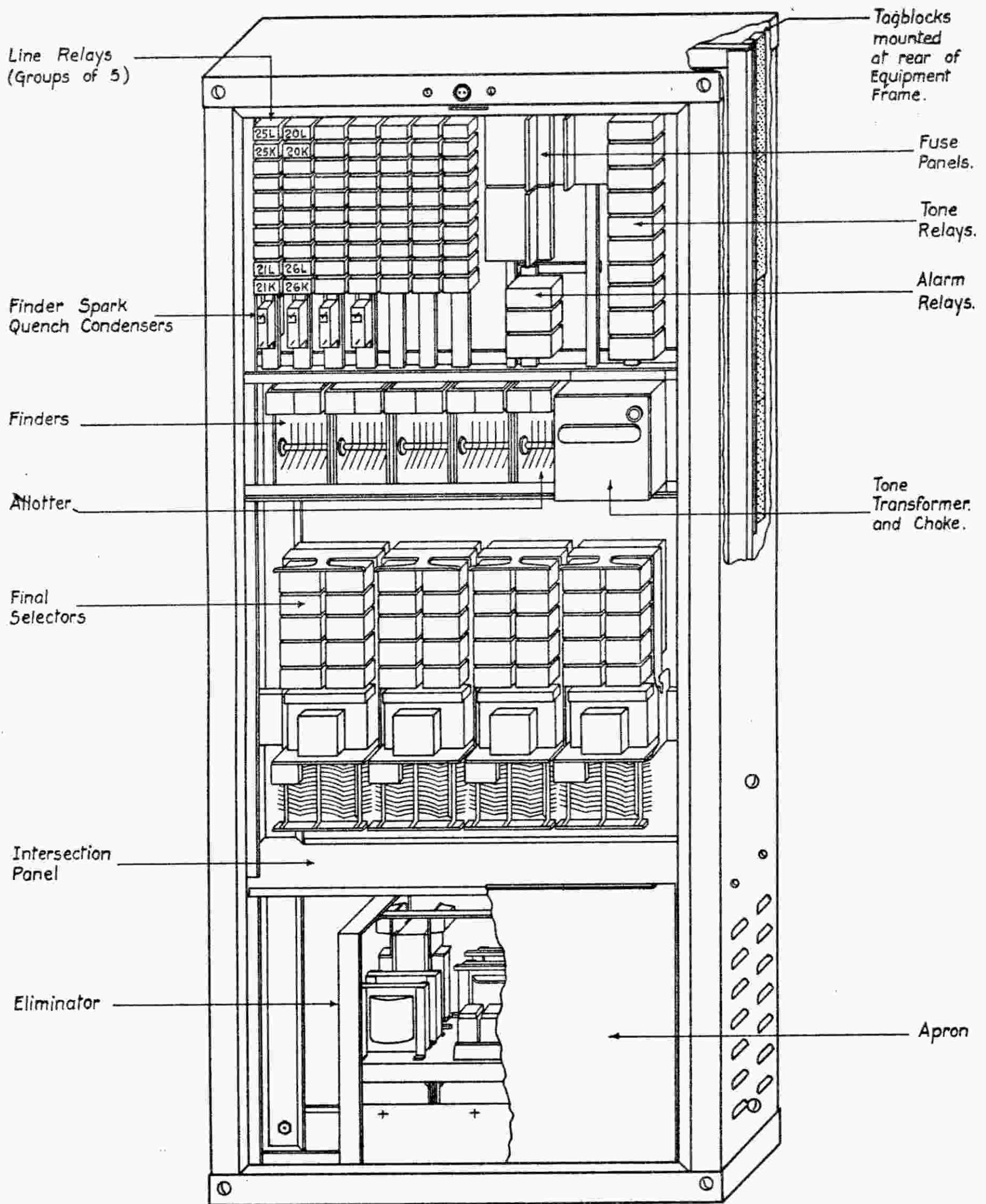


FIGURE 6

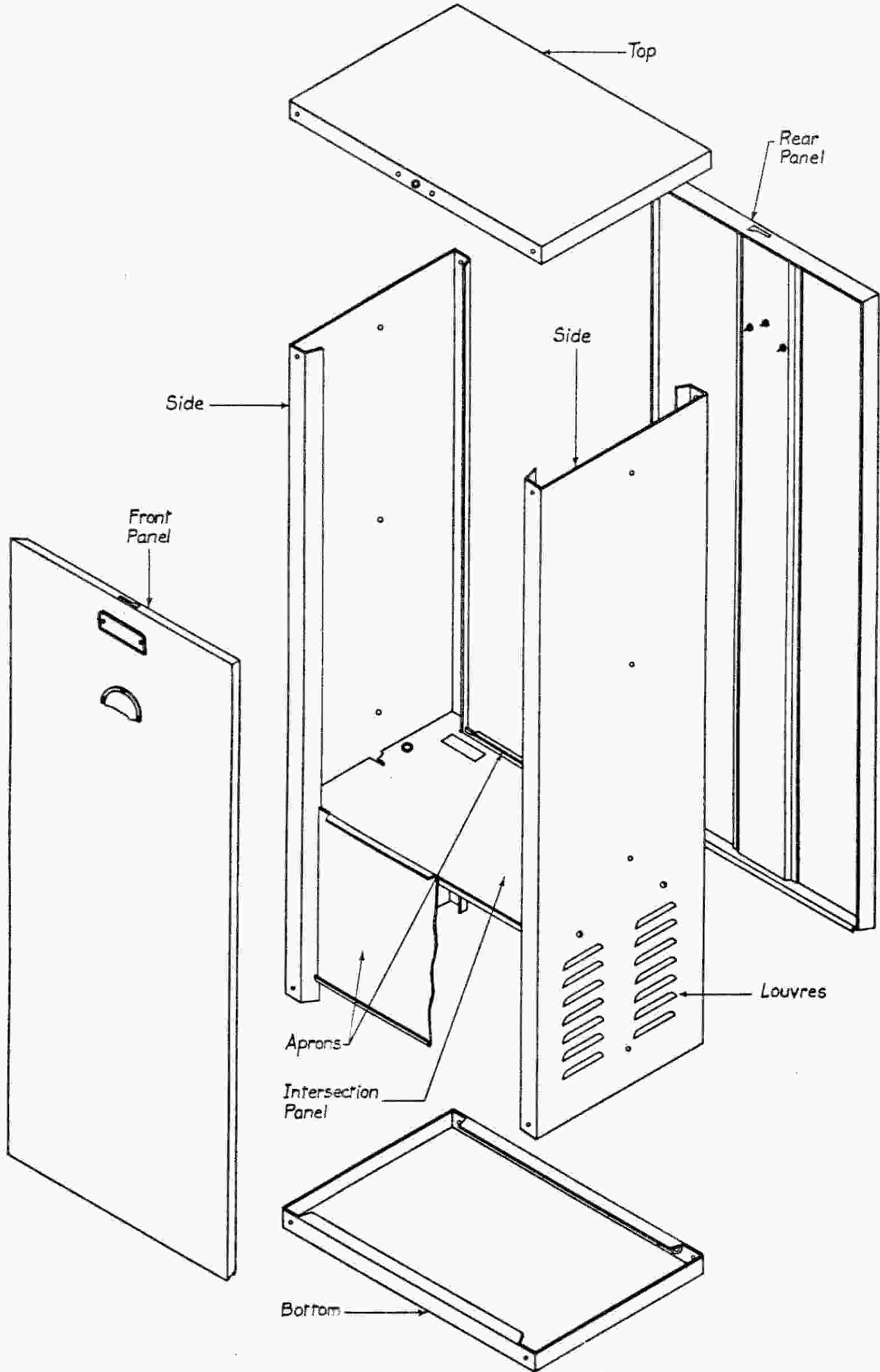


FIGURE 7

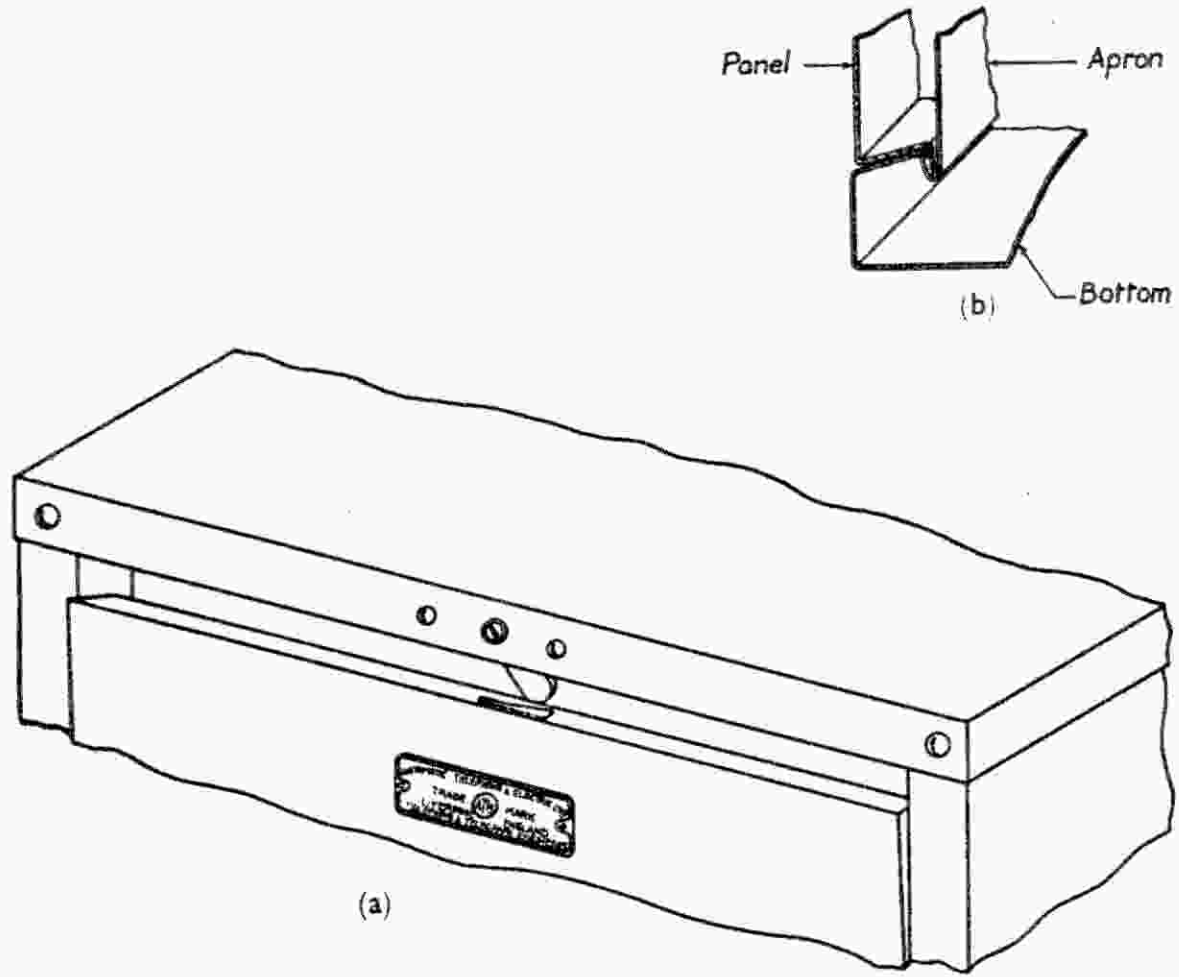


FIGURE 8

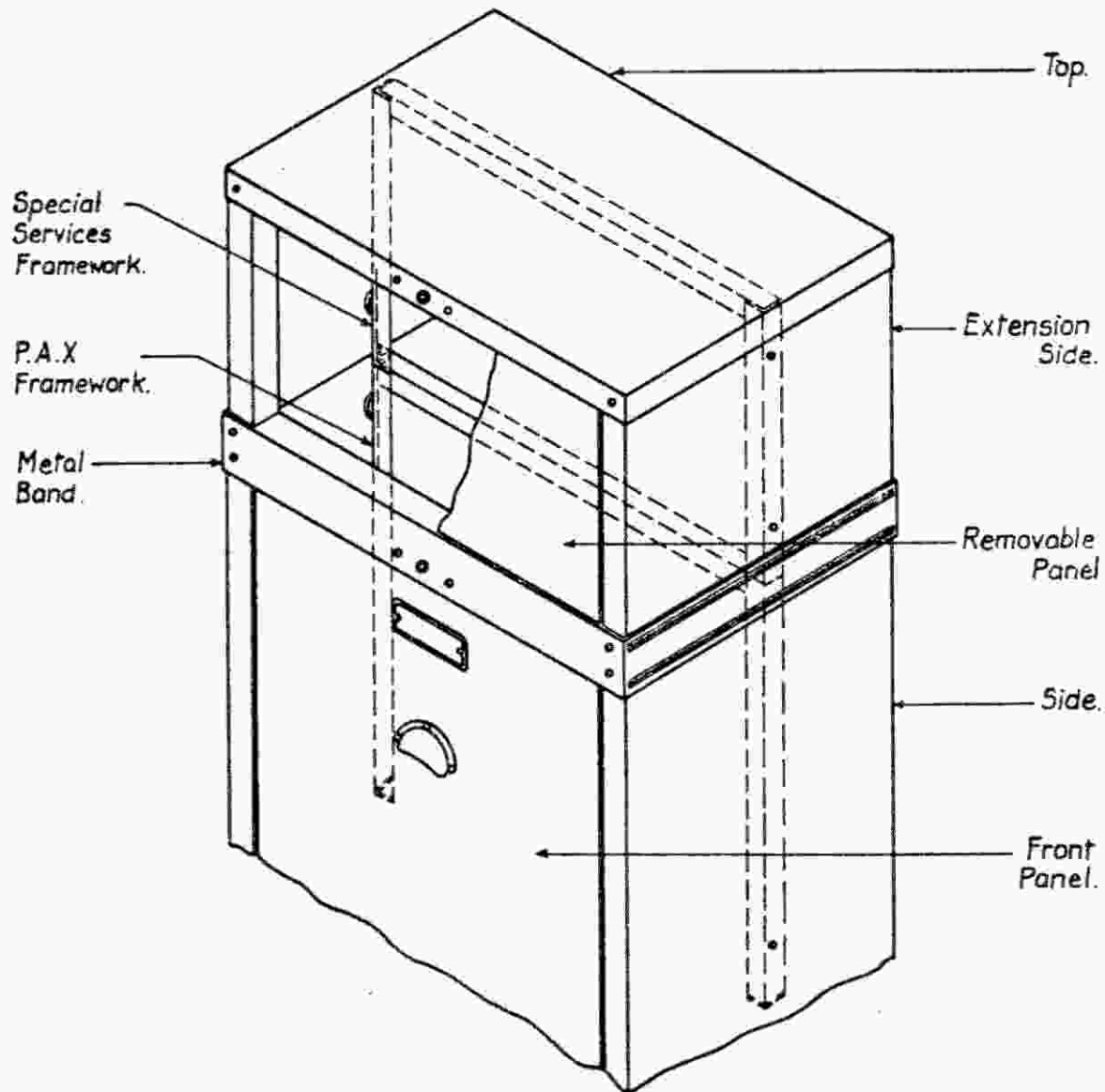


FIGURE 9



In the event of the fuse of a link being blown, the particular link is automatically "busied" out of service.

The two line-finders are relay-driven, a single relay serving both line finders in turn.

(b) *Type 25-4A and Type 50-7A P.A.X.'s.*

The numbering schemes for these two P.A.X.'s are as follows :—

Type 25-4A	20-39	} 60 and 69 reserved for code-call service.
	41-45	
Type 50-7A	20-69	

Tie-line service can be given over one or more groups of tie-lines by means of either one or two additional digits.

(c) *Type 100-10A and Type 200-20A P.A.X.'s Numbering Schemes.*

Type 100-10A	01-99	} 80 and 89 reserved for code call.
Type 200-20A	200-299	
	300-399	} 280 and 289 reserved for code call.

The line finders on both of these P.A.X.'s embody the Type 32A (B.P.O. Type 2000)

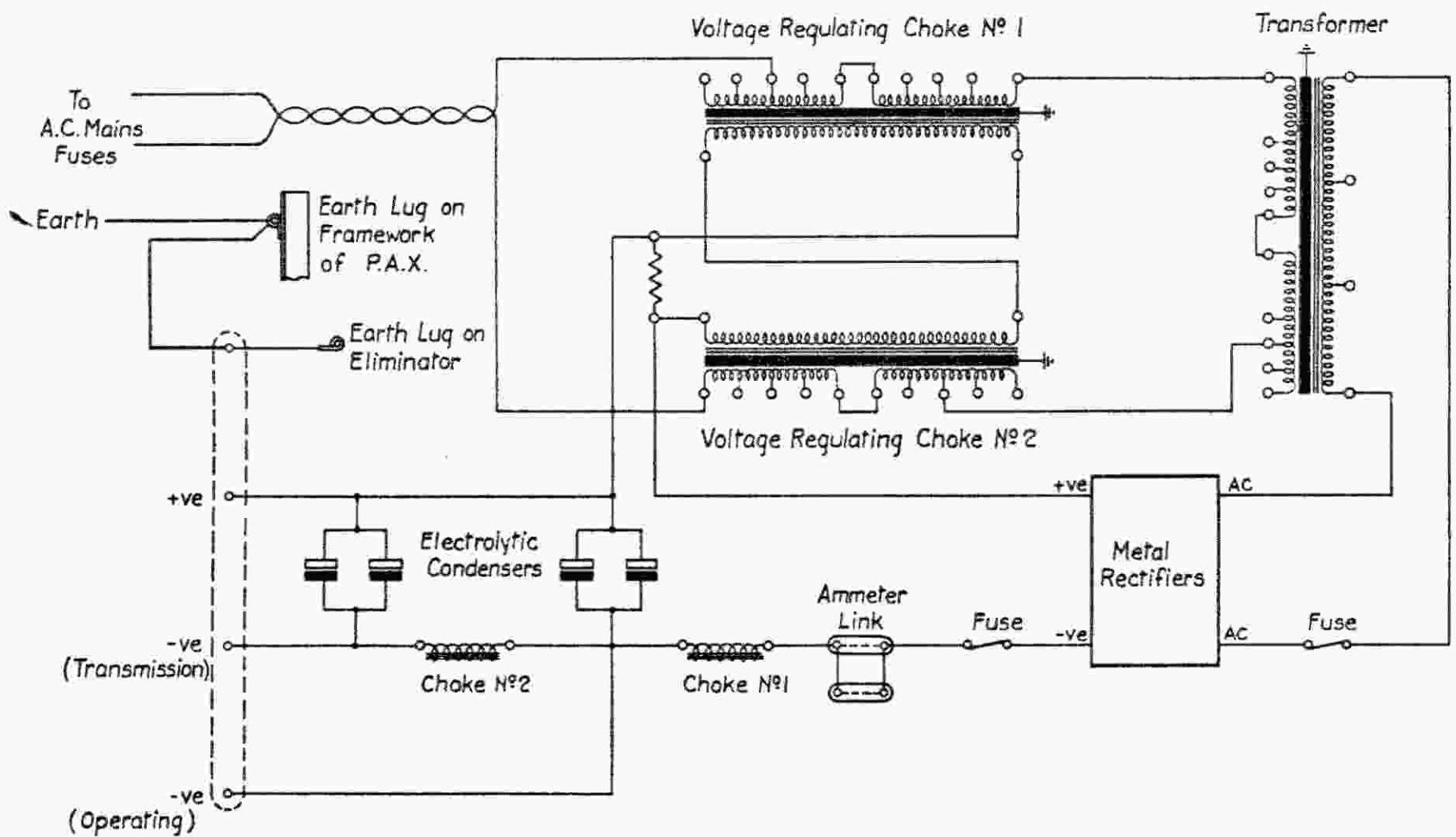


FIGURE 10

The line finders are preselected in turn by means of an allotter, which automatically steps forward as each call is switched through and continues to step until a free line finder is seized in readiness for the next call. The circuit arrangements are such that, in the event of the fuse serving the operating supply to a connecting link being blown, the associated line finder is "busied" and is accordingly passed over by the allotter. Should all the connecting links be simultaneously engaged, continuous rotation of the allotter is automatically prevented.

selector mechanism and have 100 points. The final selectors on the Type 100-10A have 100 points, whereas on the Type 200-20A the final selectors are of the digit absorbing wiper-switching type.

The allotters function in the same manner as described above, with the exception that, unless both the operating and transmission supply fuses on any connecting link are intact, the associated line finder is automatically "busied" and is thus passed over by the allotter, when hunting.

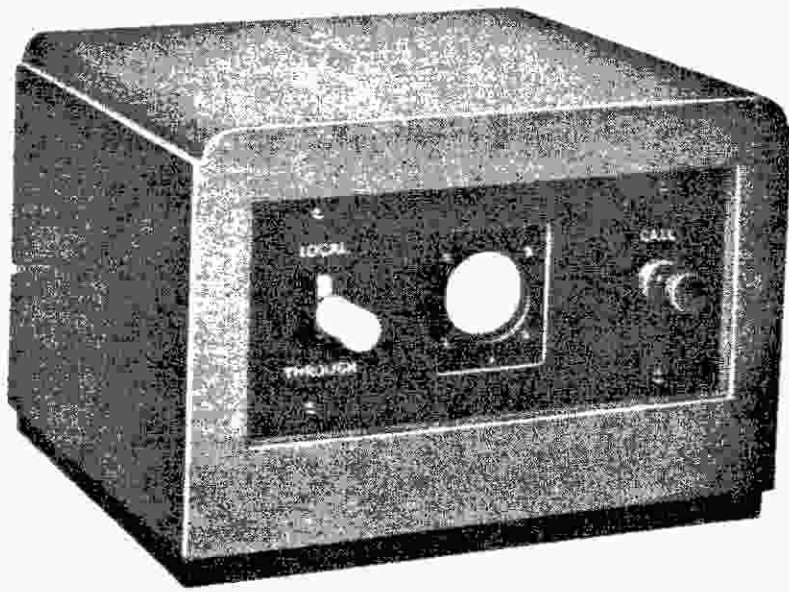


FIGURE 11

Various alarm signals are provided for on both of these P.A.X.'s as follows :—

	Delay.
Fuse Alarm ... ..	Nil
Line Finder Alarm ... ..	9 seconds
Release Alarm ... ..	12 ,,
Called Subscriber held alarm (C.S.H.) ... ..	25 ,,

These alarms are indicated both visually and audibly. The line finder alarm and the C.S.H. alarm are each indicated by a lamp having a white opal cap, and the fuse alarm and release alarm are indicated by lamps having red and green caps respectively.

The alarm lamps are accommodated on a small panel adjacent to the fuse panels inside the cabinet. This panel also accommodates a two-way telephone type key and a push key. The former key, when actuated in one direction or the other, is for the purpose of routing the line finders on either the 1st or 9th levels. The push key is for cancelling the alarm bell, which commences to ring immediately any alarm signal is given.

NOTES ON SPECIAL SERVICES.

The special service facilities available with this new series of P.A.X.'s provide important additional means for improving the convenience and efficiency of inter-departmental communications between the staff and personnel of offices, works, factories, hospitals, institutions, etc. The following notes may therefore be of interest.

(a) Secretarial Service.

The secretary's cabinet is shown in Fig. 11 and contains an eyeball indicator, a buzzer, a push key and a switching key. Fig. 12 shows the general wiring arrangements.

Normally, all incoming calls for the principal will be received at the secretary's telephone, the switching key being normal. The secretary, upon ascertaining that an incoming call is for the principal, operates the switching key to the local position and also momentarily operates the push key to actuate the principal's calling buzzer. When the principal replies, the secretary is able to offer the call without the calling party being able to overhear. If the principal accepts the call, the secretary changes the switching over from the local position to the through position, thus connecting the calling party with the principal.

When "through," the eyeball indicator on the secretary's cabinet operates so long as the principal is on the line, but releases when the principal replaces his hand-combination. "Through" calls are usually fully secret, i.e.,

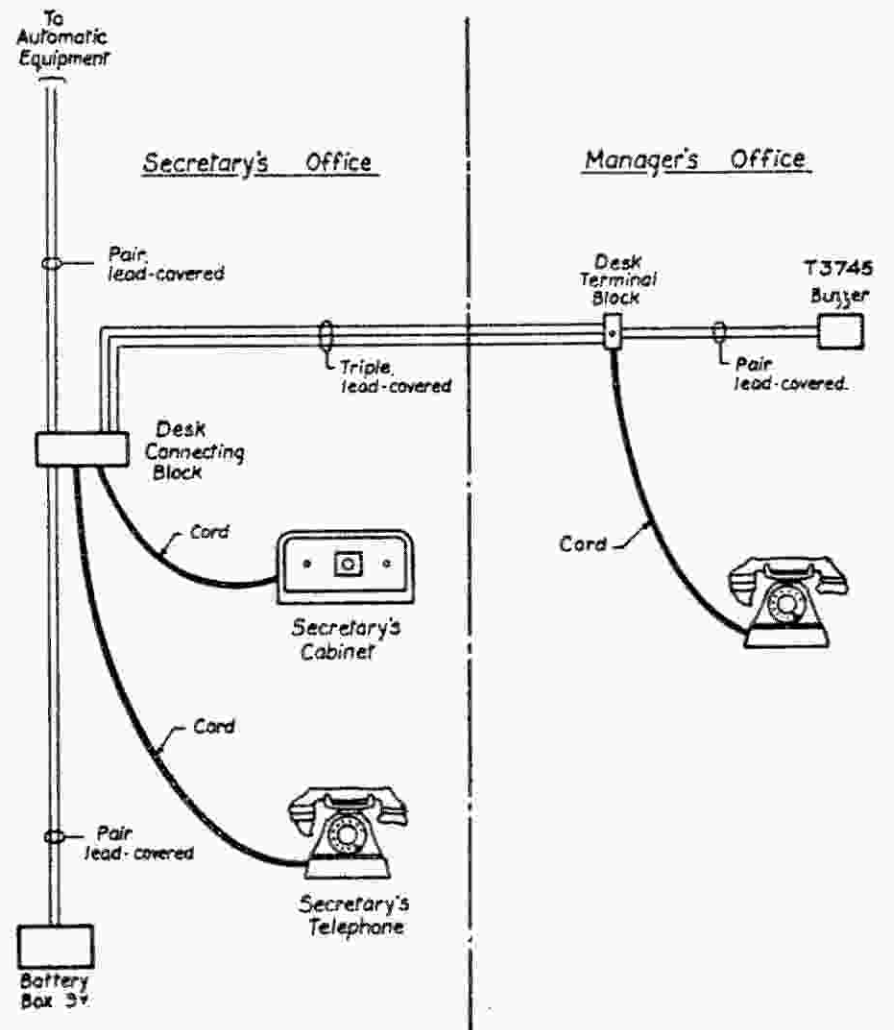


FIGURE 12

the secretary is unable to listen-in. When desired, however, the facility of permitting the secretary to listen-in on "through" connections can readily be provided by simply adding two short strapping connections inside the secretary's cabinet. When the principal desires to speak to the secretary or to make an exchange call, he merely raises his hand-combination and this actuates the buzzer in the secretary's office. Conversation is immediately established by the secretary operating the switching key to the local position. A call from the principal to the exchange can then be set-up by the principal himself, after requesting the secretary to operate the switching key to the "through" position. Alternatively, the required call can be set up by the secretary and subsequently transferred to the principal.

During the time that the secretary's telephone is unattended, the switching key would be left operated in the "through" position, thus ensuring that any incoming calls are directed to the principal's telephone.

(b) *Key-calling Service.*

This is a particularly convenient service for a general manager or senior official, since, without dialling it enables immediate connection to be made with the line of any one of several subordinates. It is immaterial whether or not the required line is engaged; immediate connection is made in either case.

The keys for this service are compactly assembled in a small cabinet as shown in Fig. 13, the wiring arrangements being as shown in

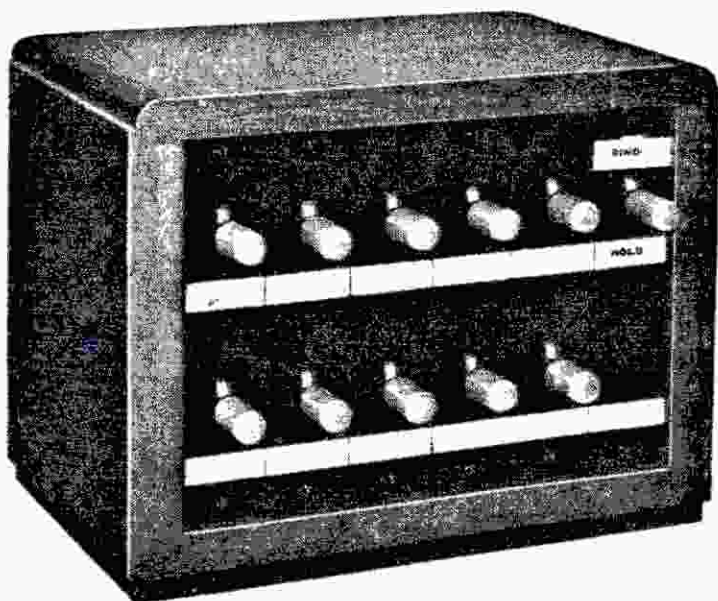
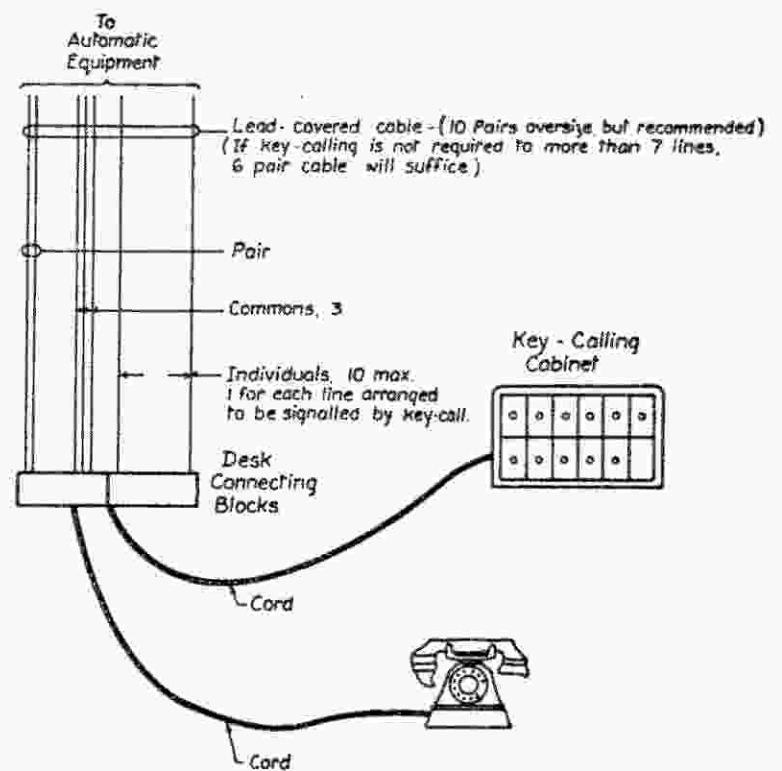


FIGURE 13



Examples

<u>No. of lines arranged to be signalled by key-call.</u>	<u>Pairs</u>	<u>Commons</u>	<u>Individuals</u>	<u>Minimum Wires reqd.</u>
5	1	3	5	10
7	1	3	7	12
9	1	3	9	14

FIGURE 14

Fig. 14. This cabinet provides for key-calling to a maximum of ten different lines. The eleventh key is for ringing purposes and also for holding purposes as explained in the following paragraph.

(c) *Conference Key-calling.*

This is an extension of the above simple key-calling facility and enables a conference by telephone to be established rapidly by merely actuating some or all of the keys and then momentarily operating the common ringing key.

By means of the hold key the convener of the conference can withdraw his telephone for the purpose of dialling any non-conference line, whilst still leaving the conference intact. Restoration of the hold key gives immediate re-access to the conference. The general manager or convener of the conference can disconnect any line from the conference by merely restoring the appropriate key.

(d) *Priority Service.*

This service enables a number of senior officials to have the privilege of securing immediate connection with any other telephone instrument, even if this happens to be engaged

when dialled. The additional wiring required for the key-calling facility is not necessary for priority service.

(e) *Tie-line Service.*

Tie-line service enables two or more P.A.X.'s in different localities to be operated together as a single unit, all the telephone instruments having full access to one another.

(f) *Code Call using Morse Signals.*

This is a particularly useful service for works and organisations having many departments, since it enables telephonic communication to be established rapidly with any senior official whose exact whereabouts are not known. The system operates by morse code signals, which are usually produced both visually and audibly by means of lamps and bells or hooters. In all there are 22 code call numbers and corresponding code call signals, one of which is assigned to each senior official. The code call numbers include a prefix of either two or three digits, according to the size of the P.A.X., followed by the digits individual to each official.

When, then, a code call number is dialled, the corresponding morse signals are caused to be given in all the main departments. The required party is put into immediate communication with the calling party by simply proceeding to the nearest telephone instrument and dialling the recognised two or three digit common reply number.

(g) *Code Call using Coloured Light Signals.*

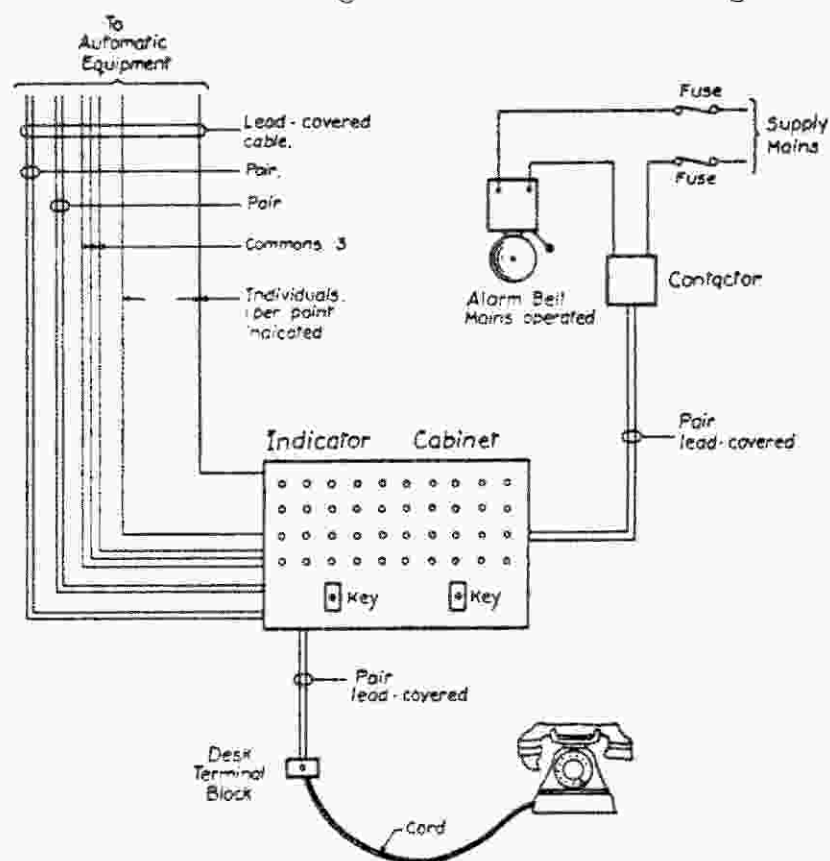
This is generally similar to (f) except that groups of five differently coloured lamps are arranged to be illuminated in any one of twenty-two combinations, in place of the morse code signals. The coloured lamps are intermittently flashed at regular intervals and a bell can, of course, be used to give an audible signal as well. The signals are initiated and replied to in precisely the same manner as described above for (f).

(h) *Fire Alarm Service.*

Fig. 15 shows the general wiring arrangements of the fire alarm special service and includes a multi-core cable between the automatic equipment and the indicator cabinet installed at some central point. The cabinet usually contains an indicator or a lamp for each telephone line. In order to give a fire alarm signal, an assigned

fire alarm number, followed by the digit "0", is dialled from the nearest telephone. The fire alarm hooter or bell is then sounded and the indicator or lamp corresponding to the telephone line from which the alarm was given is operated.

The fire alarm signals, when once actuated, cannot be cancelled except by means of a reset key at the indicator cabinet. This ensures that the caller need not necessarily wait to speak to the central indicating station after dialling.



Type of P.A.X.	Size of lead-covered cable from automatic equipment	Maximum number of points indicated.	Pairs	Commons	Individuals	Minimum Wires reqd
25 - 4A	35 above	38	2	4	48	57
50 - 7A	35 above	196	2	6	98	108

FIGURE 15

This system can also be further extended to give "group" indications, i.e., the particular building, floor or area from which the fire alarm was given.

(i) *Other Special Services.*

The available special services are not necessarily limited to those described above since the flexibility of the P.A.X. design also makes possible the provision of the following :—

- (a) Patrol watchman's service.
- (b) Party-line working.
- (c) Revertive calling between parties on the same line.
- (d) Automatic special selective ringing by executives.