THE CONSTRUCTION, CABLING AND JUMPERING OF MAIN AND INTERMEDIATE DISTRIBUTION FRAMES

CONTENTS

INTRODUCTION

It is desirable that the majority of connexions between the various items of telephone and telegraph plant shall be of a permanent nature. Provision has to be made, however, to meet continually changing conditions, examples of which are as follows:-

(a) Provision and recovery of circuits to subscribers.
(b) Provision and recovery of circuits between exchanges.
(c) Change of telephone number without a change of location of an existing subscriber.
(d) Change of location without a change of telephone number of an existing subscriber.

In addition to these day to day changes, provision is required in the exchange whereby subscribers' lines can be rearranged from a location order to a numerical order, and then distributed evenly over the exchange calling equipment.

In telephone exchanges the necessary changes of connexions are carried out on one or two frames which are suitably equipped with connexion strips, protector units and fuse mountings. At telephone exchanges of the magneto type and C.B.S. type, the line circuit apparatus is such that the cross-connecting and rearranging of circuits is carried out on one frame, the Main Distribution Frame (M.D.F.). At C.B. and automatic exchanges other than certain types of U.A.X., the subscribers' and junction circuit arrangements are more complex and the necessary apparatus is mounted on racks. At these exchanges it is necessary to introduce a frame in addition to the M.D.F. from which to distribute the line wires to the various parts of the subscribers' and junction circuits. The frame is called the Intermediate Distribution Frame (I.D.F.).

The distribution frames described in this pamphlet are very heavy and occupy a considerable proportion of the floor space required for a telephone exchange. Changes of policy on the pattern of the equipment fitted to the frames, particularly the M.D.F., is likely to bring about a reduction in the size of the frames.

MAIN DISTRIBUTION FRAME

GENERAL

The M.D.F. in an exchange provides the following facilities:-

(a) A point, independent of the exchange equipment, at which all the wires in the external cables entering the exchange can be terminated. This arrangement is necessary because at any time a percentage of the cable capacity is spare awaiting new subscribers, and if such spare capacity was permanently connected to the exchange equipment, a considerable amount of costly plant would be idle. In addition to this a certain amount of the cable capacity is used for purposes other than subscribers' lines.

(b) A point at which, by means of cross-connexions called 'jumpers', the subscribers' lines can be rearranged from a cable pair order to a telephone number order, and the miscellaneous circuits can be connected to the appropriate apparatus. The rearrangement is necessary because if a subscribers' number was related to his location a severe restriction would be imposed on the flexibility of the exchange numbering scheme.

(c) A point where circuits can be cross-connected from one external cable to another. This arrangement allows the junction cables which run from one exchange to another to be used as sections of junction circuits between distant exchanges, thus a circuit from exchange A to exchange D may pass through the M.D.F.s at exchanges B and C. A subscriber's private circuit running to another telephone exchange area, or to a different part of the same area, can be routed in a similar fashion.

(d) A point at which the fuses, heat coils and protectors are inserted into the subscribers' lines and the appropriate junction circuits.

(e) A convenient point to intercept a circuit for fault location purposes.

(f) A point in an automatic exchange at which a faulty subscriber's line can be diverted from the normal calling equipment to a circuit which indicates to calling subscribers that the line is unobtainable.

(g) A point in pre-2000 type automatic exchanges at which the number unobtainable tone can be connected to unallotted numbers.

The side of the frame on which the external cables terminate is termed the 'line side' and the other side, on which the exchange numbering scheme terminates, is termed 'exchange side'.

CONSTRUCTION

The M.D.F. is a rigid mild steel framework, drawings of which are shown in Figs. 1 and 2 (appended). The base of the frame, which is embedded in concrete to floor level, consists of three longitudinal flat bars to which are fixed transverse angle irons at $6\frac{3}{4}$" centres. The length of the bars and the number of angle irons is governed by the circuit capacity of the frame.

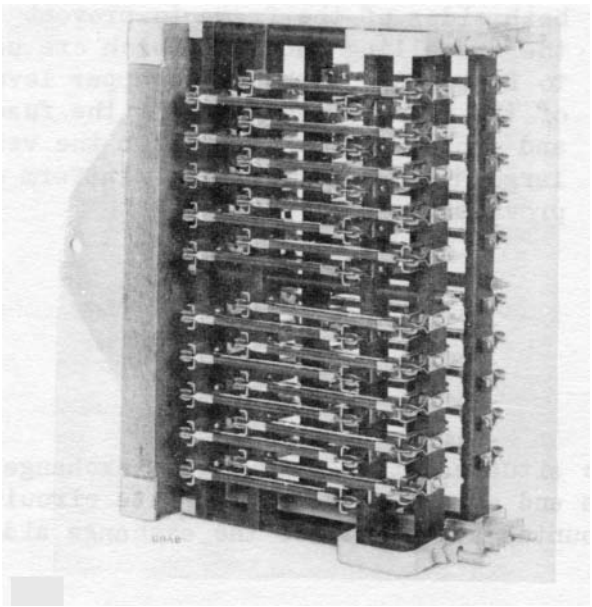
On an M.D.F. of standard height, eleven transverse members spaced as shown in Fig. 1, are fixed to each main vertical member. To preserve the general stability and alignment of the frame an additional vertical member is fitted between the top

and bottom transverse horizontals on the exchange side. Longitudinal horizontal stiffening bars, which also serve as fixings for the small jumper rings, are fitted on the line side as shown in Fig. 1. The small jumper rings are positioned midway between adjacent transverse horizontals. The dimensions Y and Z in Fig. 1, are governed by the number of vertical members in the frame and are as follows:-

No. of Verticals	Y	Z
Up to 40	1' - $2\frac{1}{8}$"	3' - $9\frac{3}{8}$"
41 and over	1' - $8\frac{1}{8}$"	4' - $3\frac{3}{8}$"

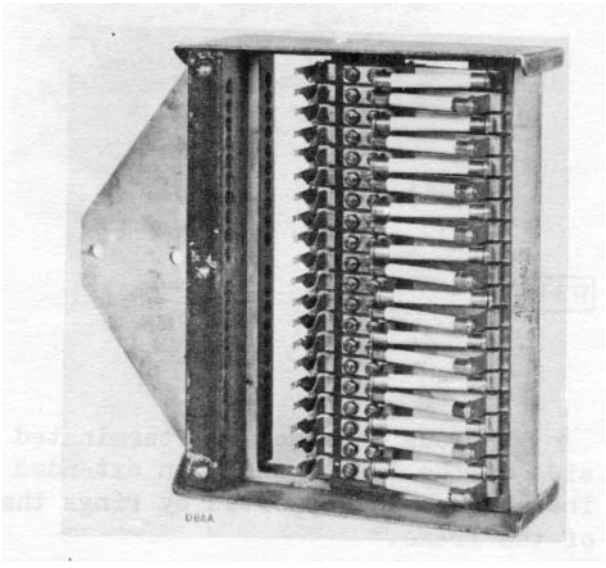
Large jumper rings, which act also as ties between adjacent main verticals, are fitted above each level of transverse horizontals. Additional ties between the verticals are provided by an angle iron and three bars, positioned as shown in Fig. 2. The protective vertical, Fig. 2, is necessary to provide a fixing for the large jumper ring of the adjacent regular vertical, and is always provided at the left-hand end of the frame when viewed from the line side. The protective vertical is provided with transverse horizontals only when it is situated at the growing end of the frame, i.e. the end to which extensions are fitted.

A fuse mounting having a capacity of 20 circuits can be fitted on each transverse horizontal on the line side of the M.D.F.; thus each vertical has a capacity of 220 line circuits. The standard type of fuse mounting is shown in Fig. 3, and an earlier type mounting, large numbers of which are still in use, is shown in Fig. 4.



R31349

Fig. 3

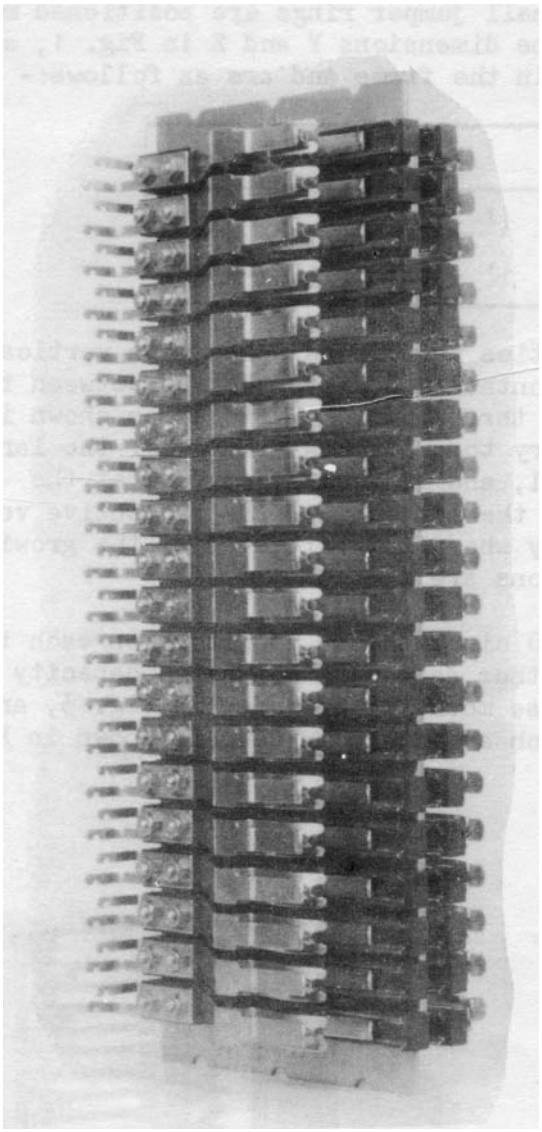


R31348

Fig. 4

The blocks of wood, termed fanning strips, at the rear of the fuse mountings are suitably drilled to provide guide ways for the wires and jumpers to the wiring tags of the mountings.

The protector mountings, Fig. 5, each having a capacity of 20 circuits, are fitted between the transverse horizontals on the exchange side of the frame. Consequently each vertical has a capacity of 200 circuits. The fanning strips are not an integral part of the protector unit, and are mounted on each side of the vertical member which is situated just behind the protector units. Three wood screws passing through holes in the vertical member, as shown in Fig. 2, are used as fixings for the two fanning strips associated with each protector unit. The positions of the test jacks and tone bar, mentioned later in this pamphlet, are also shown in Fig. 2. Each protector mounting is connected by means of a copper tape to a tinned copper earth wire which runs vertically behind the mountings. The earth wire from each vertical is connected to a copper bar which runs the full length of the frame. The main cable from the exchange earth system terminates on the copper bar, thus providing a low resistance path to earth from the protector units.



R34375

Fig. 5

The guard rail is provided on both sides of the frame to prevent the travelling ladders, which are used to facilitate work on the upper levels of the frame, from damaging the fuse and protector mountings. On the very large M.D.F.s a mezzanine platform is provided.

Various services are terminated on jacks situated at the top of the exchange side of the frame, and then extended by plugs and cords to the appropriate circuit. The cordage is supported by rings that are mounted at the top of the exchange side of the frame.

The M.D.F. in an automatic telephone exchange has a tone bar and/or a strip of test jacks fitted to certain of the fanning strips associated with the protector mountings. The tone bar provides a source of number unobtainable tone for circuits temporary out of service, and the test jack allows the busy condition to be applied to the associated circuit. At certain types of automatic exchange, a connexion strip is mounted below the lower transverse horizontal to provide a source of number unobtainable tone for unallocated telephone numbers.

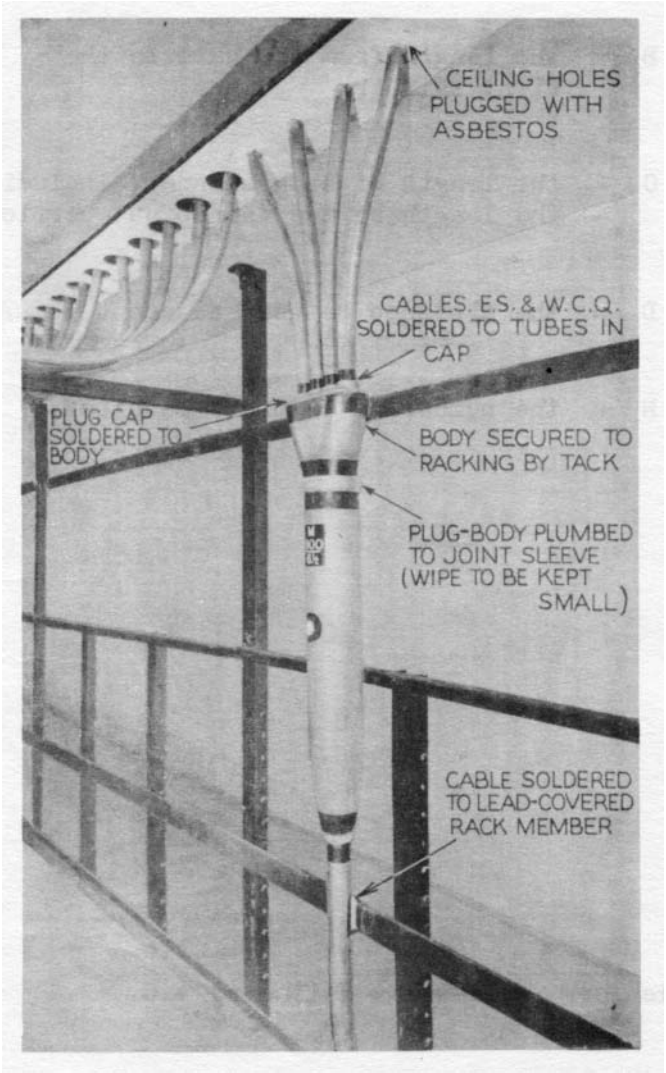
When connexion strips or fuse mountings are fitted on the exchange side of the frame, the transverse horizontal members concerned are reduced in length to keep the

equipment within the limit of the guard rail. This arrangement and the position of the vertical stiffening bar, together with the normal arrangement is shown in Fig. 6 (appended). Protector units and other types of mountings are not normally fitted on the same vertical.

CABLING

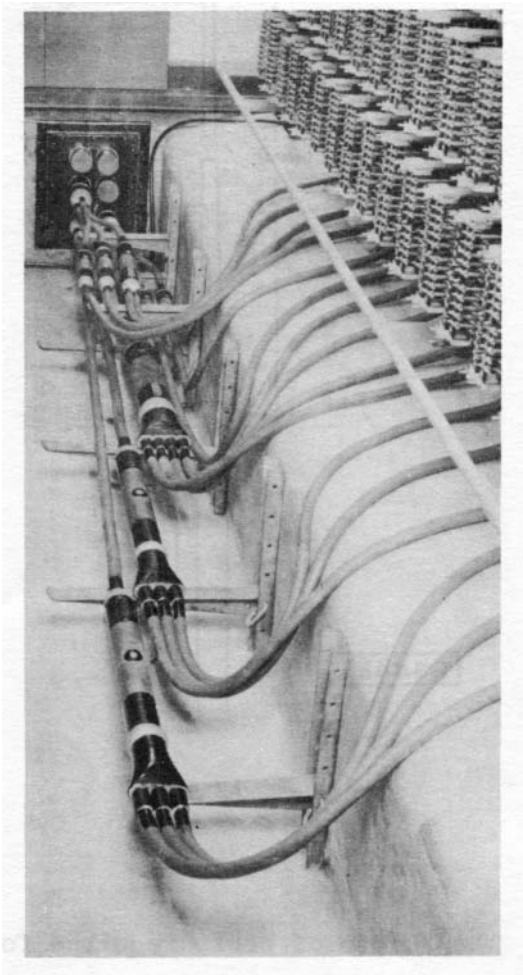
Line Side. Whenever possible the M.D.F. is situated on the ground floor of the building and is positioned directly above the chamber or trench into which the street cables enter the building. The lead covered street cables have paper insulated conductors and are of various sizes, and it is not practicable to terminate these cables directly on to the M.D.F.

The conductors of the street cables are formed into groups of 200 pairs and each group is jointed to a lead covered cable having enamelled, silk and wool covered conductors. The cable, termed E.S.W.Q., is then terminated on 10 fuse mountings, usually on the same vertical, on the M.D.F. The joints are made in the cable chamber and the E.S.W.Q. cable led to the bottom of the M.D.F. through metal pipes, Fig. 7, or in the cable trench as shown in Fig. 8.



R31347

Fig. 7

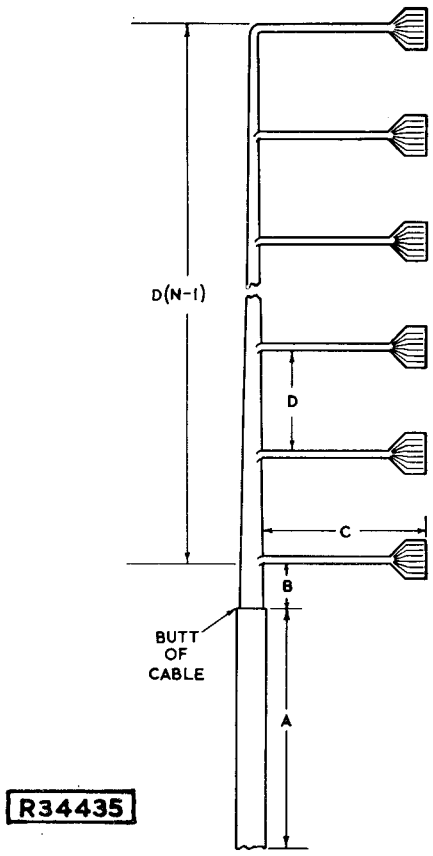


R34434

Fig. 8

When the M.D.F. is situated on an upper floor, the street cables are drawn into steel or earthenware pipes fixed to, or enclosed within, the wall of the building between the cable chamber and a trench adjacent to the frame. To economize in the length of terminating cable used, the joints between the street and terminating cables are made in the trench. The 'forms' of the terminating cables, a completed form for one vertical is shown in Fig. 9, can be prepared by either the single-forming or double-forming method. The double-forming method results in an economy in cable where a number of forms of the same length are to be prepared. Two similar forms with correctly dimensioned skinners are obtained from one length of cable without any wires cut to waste.

The length of cable required for a single form is, with reference to Fig. 9, determined as follows:-



A = the length of unstripped cable, including the length required for jointing to the street cable.

B = the length from the butt to the first skinner.

C = the length of each skinner, including the length of the fanned out portion.

D = the distance between adjacent skinners.

N = the number of skinners required.

Fig. 9

The length of cable required for a single form = $A + B + D(N - 1) + C$.

The length of cable required to make two forms by the double forming method, Fig. 10, is determined by the expression = 2A + 2B + 2C + D (N - 1).

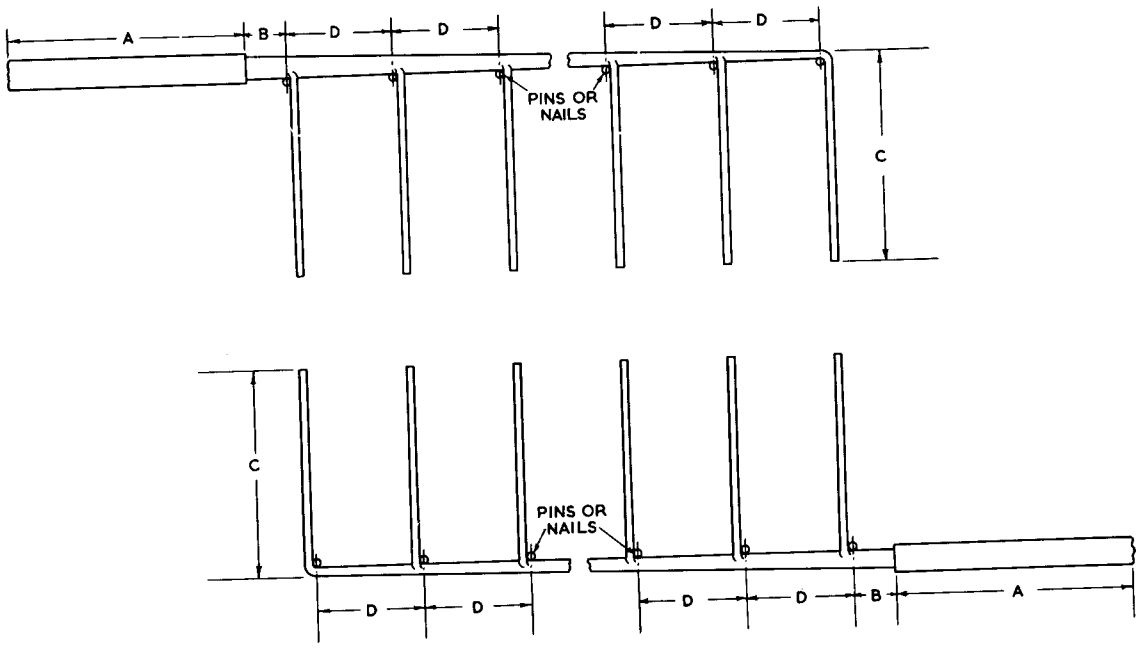


Fig. 10

The standard method used to make two forms is as follows.

A suitable length of cable is cut; length A, Fig. 10, is then measured from each end and the lead sheath removed between the two points so formed. A distance equal to B + C is measured from the butt of the lead sheath at one end of the cable, and the last 20 pairs of conductors in the outer layer of the cable are cut at this point. The cut pairs are then unwrapped back to the butt at each end. From the point of the first cut a further distance equal to D is measured and the group of 20 pairs, which are adjacent in the lay-up of the cable to the first group cut, are then cut and unwrapped back to the butts. This process is repeated until all the pairs in the cable are laid out as shown in Fig. 10. Each length of cable so obtained is clamped to a specially prepared forming board and the form suitably laced with twine.

The lead sheathed butt of the prepared terminating cable is passed through the appropriate pipe below the frame to the cable trench or cable chamber, ready for jointing to the street cable. The formed portion of the cable is positioned adjacent to the exchange side of the vertical angle iron, and on the left-hand side of the transverse horizontal members (when viewed from the exchange side. These transverse members are wrapped with tape at the points of contact with the cable form. At each level of the frame, the appropriate skinner is carried under the junction of the transverse horizontal member and the vertical angle iron (Fig. 12), and then along to the fuse mounting. The method of fanning out the conductors, protecting the skinner from the ironwork and securing the skinner is shown in Fig. 11. When the M.D.F. has 11 fuse-mountings at each vertical it is usual for the lower fuse mounting to be served by a terminating cable which runs horizontally between the verticals.

Street cables having polythene insulated conductors are terminated directly on the fuse mountings.

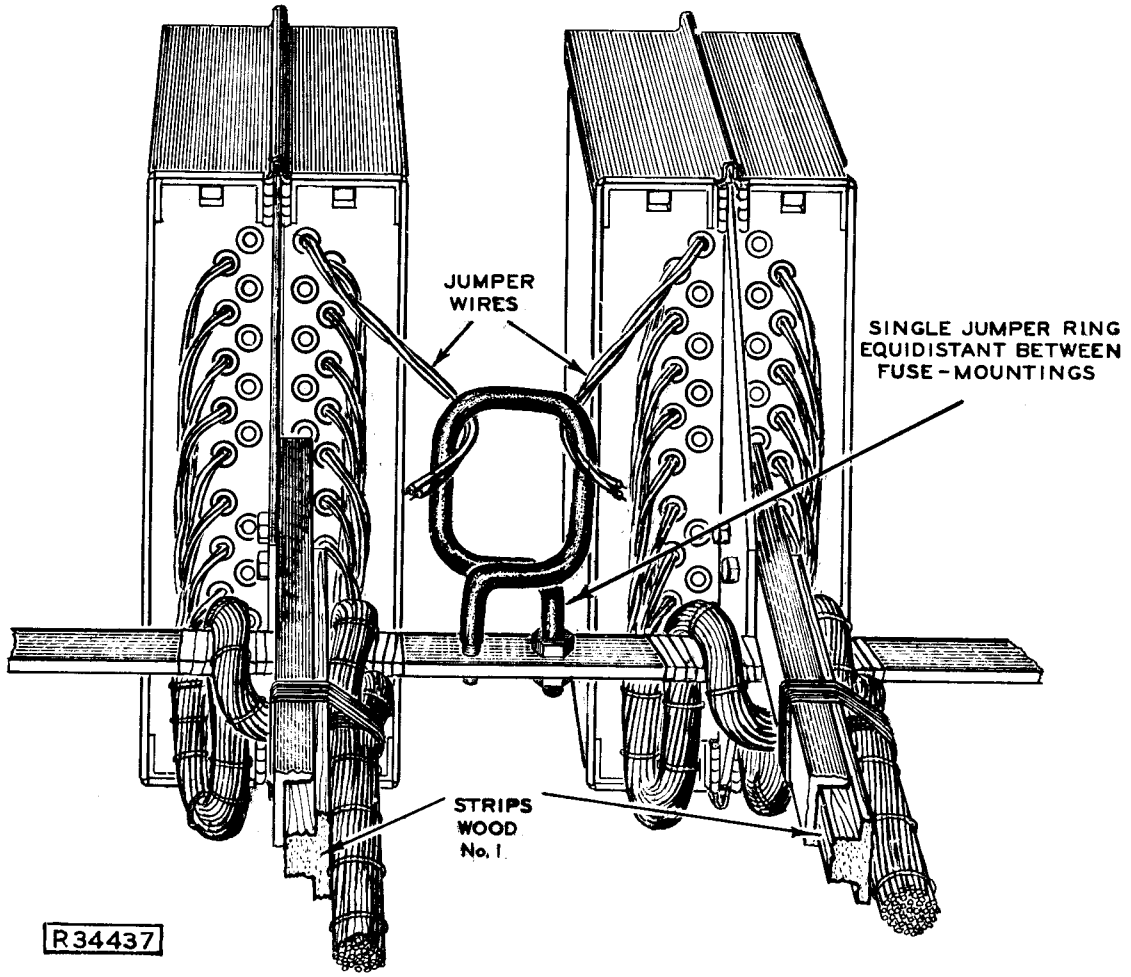


Fig. 11

Exchange Side. Before considering the cabling arrangements on the exchange side of the M.D.F., a brief description of the cable, termed switchboard cable, which is used to connect together the various stages of equipment will be given. The modern switchboard cable is sheathed with polyvinyl-chloride (P.V.C.) and has a core composed of $6\frac{1}{2}$ lb tinned copper conductors, each conductor being covered with P.V.C. which is coloured to suit the standard colour code arrangements. The cable is available in sizes to suit particular requirements, i.e. 41-wire cable contains 20 pairs and a single, 61-wire cable contains 20 triples and a single. The single wire is not provided on all sizes of cable and was not provided at all in certain earlier types of switchboard cable. In the text of this Pamphlet the single wire will be disregarded, but it is included in cable sizes given in certain of the figures. Details of switchboard cable is given in E.P. Draft Series GENERAL 3/7.

The twenty 2-wire circuits on each protector unit associated with subscribers' circuits on the M.D.F. are connected, by means of a switchboard cable, to a connexion strip mounted on the multiple side of the I.D.F. Thus 10 cables run from each fully equipped vertical on the M.D.F. to the corresponding vertical on

the I.D.F. The method of mounting the cables on each vertical of the M.D.F. is shown in Fig. 12. The conductors of the switchboard cable pass through the left-hand (when viewed from the front) holes in the fanning strips and terminate on the left-hand sets of soldering tags on the protector units.

The circuits on certain of the protector units associated with junctions are cabled with 40-wire cable to the Test Jack Frame (T.J.F.). This frame is made up of strips of jacks and the circuit arrangement is such that the junction circuits can easily be intercepted or marked with the busy condition for maintenance purposes. The remaining protector units associated with junction circuits are cabled directly to the multiple side of the I.D.F. with 40-wire cable. The method of mounting the cables on the M.D.F. is the same as that shown in Fig. 12.

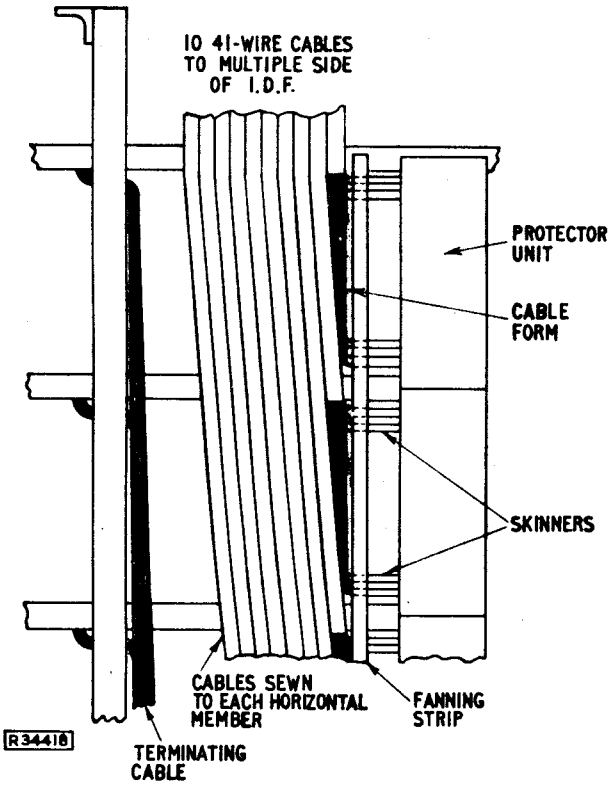


Fig. 12

The switchboard cables running between the distribution frames, and also those running between racks of equipment, are formed into blocks of rectangular cross section and supported by racking which is usually suspended from the ceiling. When the two distribution frames are situated parallel to each other, corresponding verticals are situated directly opposite to each other to effect an economy of cable. The cabling arrangements between the M.D.F. and the I.D.F. in a C.B. No. 1 exchange are shown in Fig. 13.

C.B. No.1. EXCHANGE

PRINCIPLES OF CABLING BETWEEN M.D.F., I.D.F., RELAY & METER RACKS. IT IS ASSUMED THAT THE M.D.F. & I.D.F. EACH ACCOMMODATES 200 CIRCUITS PER UPRIGHT.

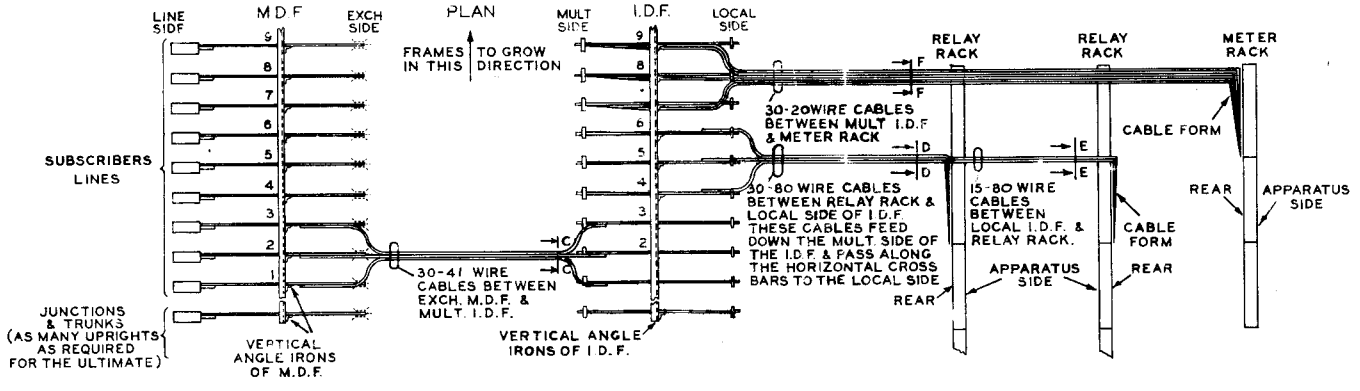


Fig. 13

INTERMEDIATE DISTRIBUTION FRAME

GENERAL

The I.D.F. provides the following facilities:-

(a) A point where, by means of a cross connexion, any subscriber's line can be connected to a calling circuit on any desired section of the exchange calling equipment. This arrangement allows for the easy rearrangement of circuits should the loading of the sections become uneven due to the provision and cessation of lines and the changing habits of telephone users.

(b) A point where the various types of circuits can be terminated, and then cross connected as required, to form suitable signalling circuits for incoming and outgoing lines to other exchanges. This arrangement introduces flexibility into the plant and provides convenient points in the circuit for fault location purposes.

(c) A point where, by means of cross connexions, junction circuits can be connected to the appropriate signalling circuits.

(d) A point in an automatic exchange where the various switching stages can be terminated and then cross connected as required.

(e) A point where miscellaneous circuits can be terminated and then cross connected to the appropriate line or equipment.

The side of the frame on which the subscribers lines terminate is termed the 'multiple side' and the other side, on which the exchange calling equipment terminates, is termed the 'local side'.

CONSTRUCTION

The framework of the I.D.F. follows the same general pattern as that of the M.D.F. Drawings of the multiple side, local side and a cross-section are shown in Figs. 14, 15 and 16 appended. The principal dimensions and sizes of material are indicated on the figures, and the dimensions X and Y are given in the following table.

No. of Verticals	X	Y
Up to 25	1' - 1"	2' - 6"
26 - 40	1' - 3"	2' - 8"
41 - 60	1' - 6"	2' - 11"
61 and over	1' - 8"	3' - 1"

The base of the frame is laid directly on the floor and, when the frame is completed, surrounded by a wooden curb of the order of 4 in high. The well formed by the curb is then filled with concrete.

Extensions to the frame are added to the 'growing end' and the verticals are numbered consecutively from the non-growing end. Suitable labels are affixed above the connexion strips associated with verticals 1, 5, 10 etc. on both sides of the frame. A protective vertical, necessary for the fixing of the large jumper ring associated with the adjacent working vertical, is provided at the left-hand end of the frame, as viewed from the local side. The protective vertical is not included in the numbering scheme and is fitted with horizontal members only when fitted at the growing end. On an I.D.F. of standard height, ten equally spaced transverse members are fixed to each main vertical member. A connexion strip having a capacity of 20 or 25 circuits can be fitted at the end of each member, thus each vertical has a capacity of 200 or 250 circuits.

The layout of the apparatus in certain telephone exchanges is such that additional I.D.F.s are necessary to save uneconomical cabling. The construction of these additional frames is similar to that already shown in Figs. 14, 15 and 16. The ironwork of all the I.D.F.s is connected to the exchange earth system.

CABLING

Subscribers' circuits. Each switchboard cable from the M.D.F. terminates on a connexion strip mounted on the multiple side of the I.D.F. The connexion strips are arranged so that the subscribers' numbers accommodated on a vertical on the M.D.F. appear on a corresponding vertical on the I.D.F.

In addition to the cable from the M.D.F., each connexion strip is served by a cable having a capacity of twenty 3-wire circuits from the switchboard or final selector multiples, and a cable having a capacity of twenty 1-wire circuits from the meters. In automatic exchanges using the standard method of metering, the cable from the meters usually has a capacity of twenty 2-wire circuits. The cables enter the frame from the top and are mounted on the left-hand side of the vertical (viewed from the multiple side) as shown in Fig. 17.

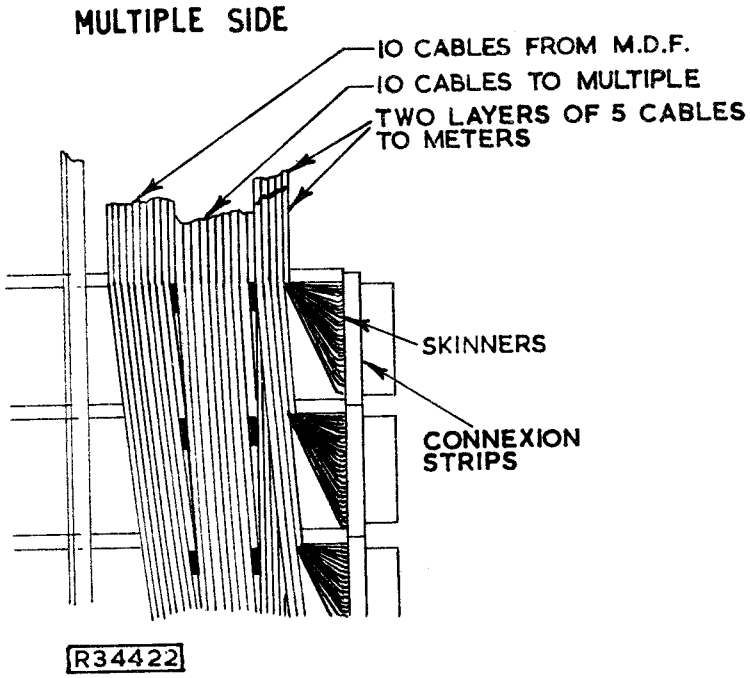


Fig. 17

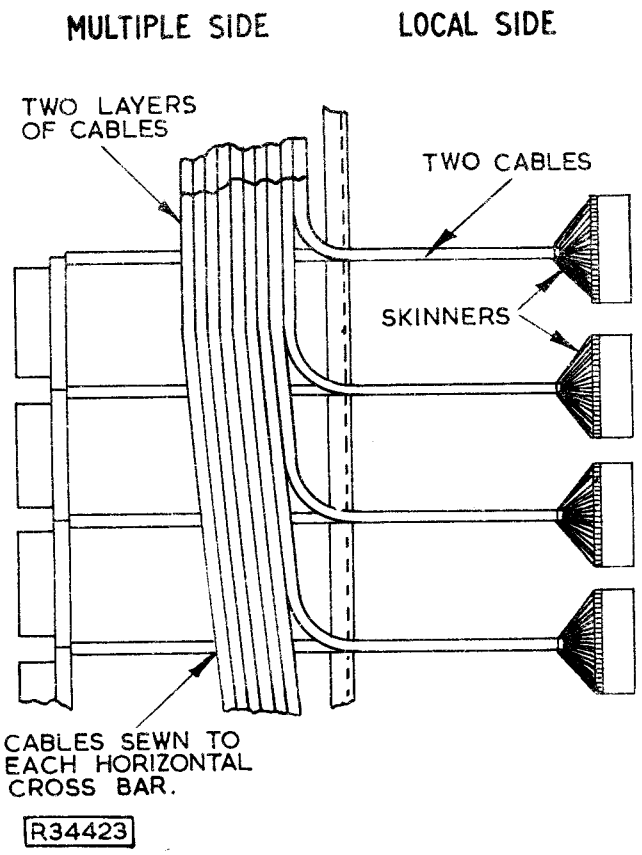


Fig. 18

Each connexion strip mounted on the local side of the I.D.F. is connected to 20 or 25 subscribers' calling circuits dependent on the type of calling circuits used. The cables which connect the calling circuits to the connexion strips are mounted on each vertical as shown in Fig. 18. This arrangement leaves the local side of the frame clear for the horizontal jumper field. The size and number of cables running from each connexion strip is dependent on the type of calling equipment used; typical circuits used in C.B. manual exchanges and automatic exchanges are shown in Figs. 19 and 20.

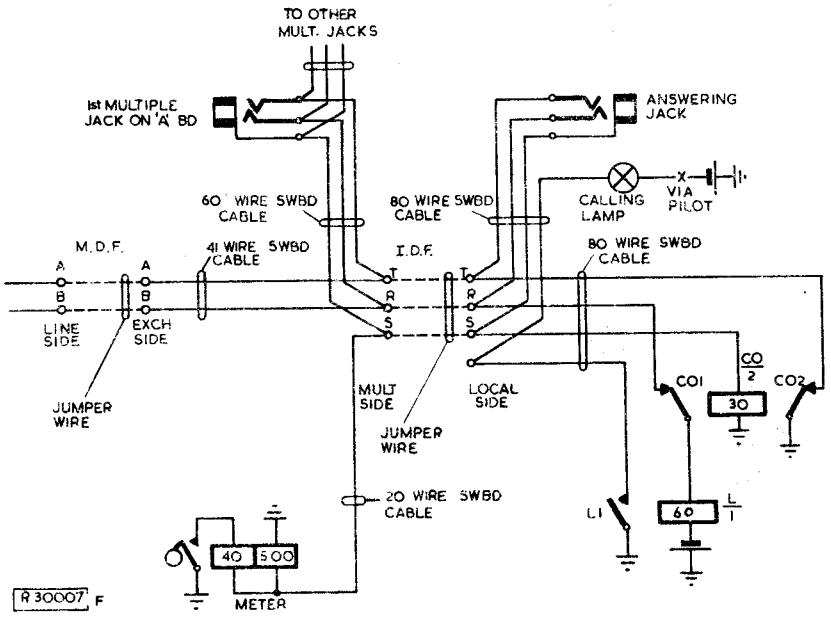


Fig. 19

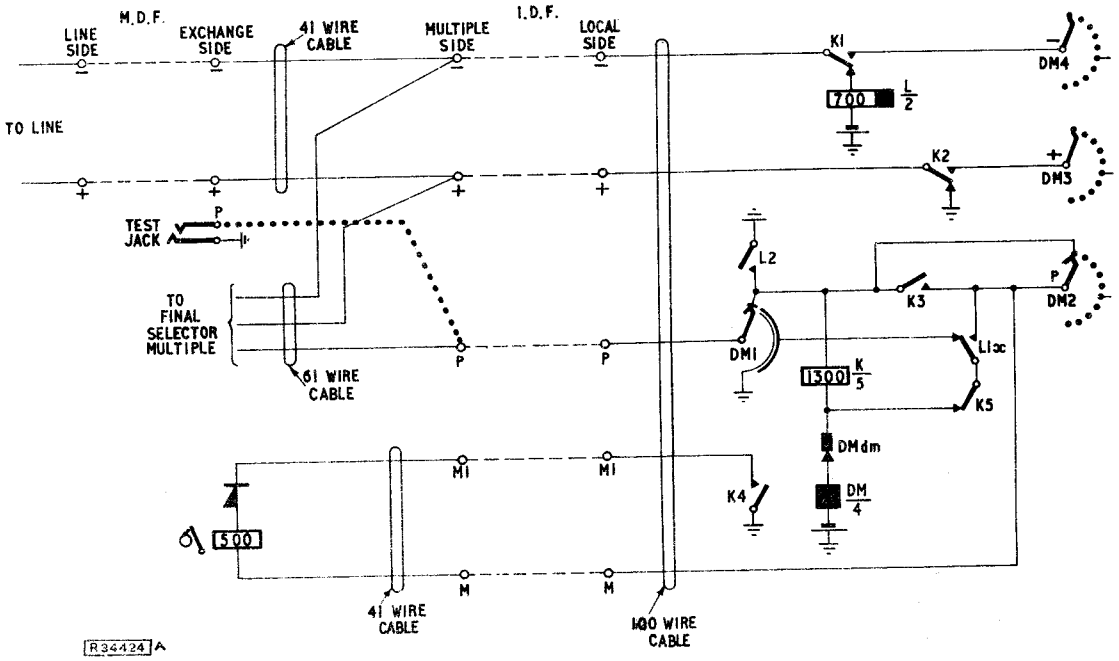


Fig. 20

In an automatic exchange there are three wires (-, + and P) for each circuit between the M.D.F. and I.D.F. when the circuit is one of a group of 100 allocated for P.B.X. subscribers. The P-wire of each circuit terminates on the appropriate test jack as shown by the dotted line in Fig. 20, and each cable between the M.D.F. and I.D.F. then has a capacity of twenty 3-wire circuits.

Junction circuits. Each strip of jacks on the T.J.F. is cabled with a 60-wire cable to a connexion strip mounted on the multiple side of the I.D.F. These connexion strips are considered as a separate group from those cabled directly from the M.D.F. and are mounted accordingly. In both cases the cables are mounted on the frame in the same manner as that shown in Fig. 18.

The relay-sets and selectors associated with the junction circuits are cabled to the I.D.F. in such a manner that the relevant side of each relay-set or selector is terminated on the local side of the frame. This arrangement facilitates cross-connexion to the particular junction circuit.

Although it is beyond the scope of this pamphlet to give detailed arrangements of the cabling of junction terminations, the trunking arrangements of two typical terminations are shown in Figs. 21 and 22.

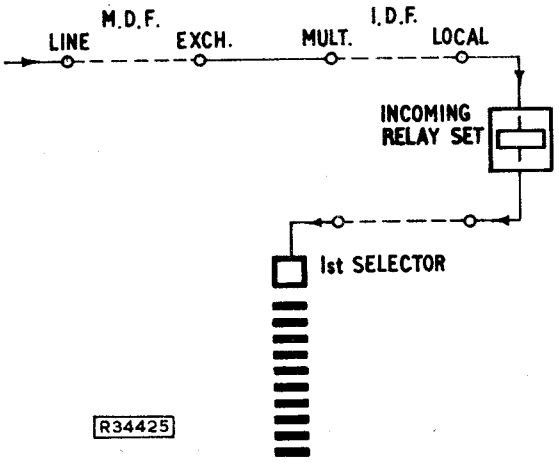


Fig. 21

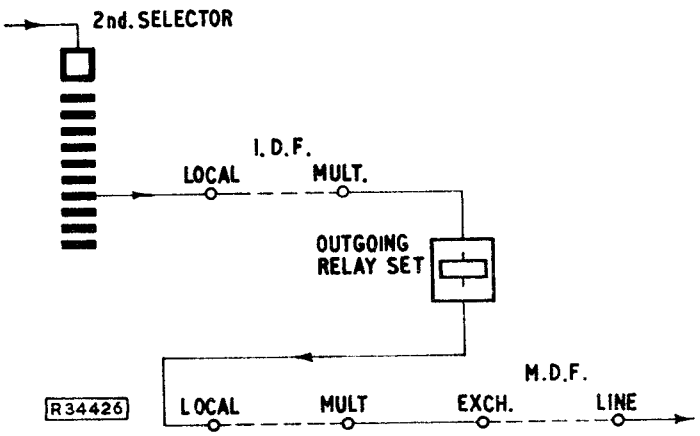


Fig. 22

Exchange equipment. In modern automatic exchanges certain of the switching stages are cabled to and from the I.D.F. This practice increases the size of the frame compared with the previous cabling arrangements, and if the ultimate length is expected to exceed 16-20 ft, the frame may be divided into two parts. The two frames so formed are referred to as the "Subscribers' I.D.F." and the "Equipment I.D.F.". While the Subscribers' I.D.F. must be near the M.D.F., considerable cabling economy may be effected by having the Equipment I.D.F. near to the racks of selectors. The cabling arrangements in a 4-digit non-director exchange are shown in Fig. 23.

In addition to the junction terminations and switching stages, the various circuits associated with services to subscribers are cabled to the appropriate sides of the I.D.F. and connected to subscribers circuits as and when necessary by means of jumpers.

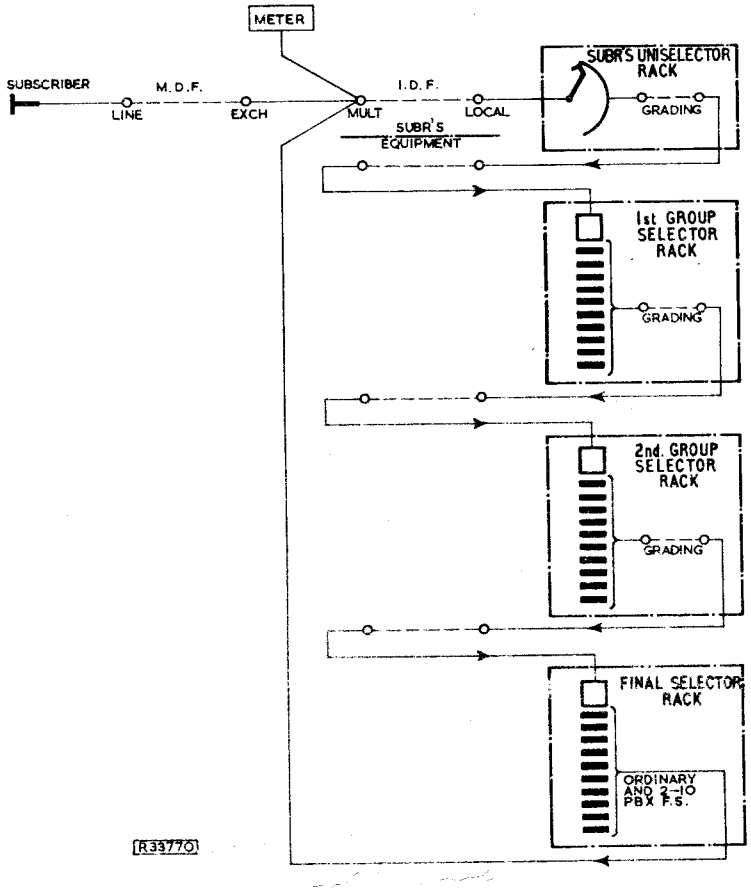


Fig. 23

COMBINED DISTRIBUTION FRAME

The combined distribution frame is an M.D.F. with an I.D.F. on top, as shown in Fig. 24 (appended), and is fitted in U.A.X.s No. 14 and some C.B. types of manual exchange.

On the line side of the M.D.F. portion five mountings are used on each vertical to accommodate 100 2-wire circuits. On the exchange side of the M.D.F. portion there are four protector mountings accommodating 80 circuits. Where the apparatus room has a clear height of 12 feet, the M.D.F. is increased to 120 circuits per vertical on the line side and 100 circuits per vertical on the exchange side.

The local and multiple sides of the I.D.F. each accommodate 80 circuits per vertical, or 100 circuits per vertical when the clear height of the apparatus room is 12 feet.

The cabling and facilities are similar to those for separate M and I.D.F.s, except that the connexions between the exchange side (M.D.F.) and multiple side (I.D.F.) do not leave the frame and may be bound together into a single form for each vertical as shown in the figure.

JUMPERING

GENERAL

A jumper is the general term given to a cross connexion on a distribution frame and it provides a cheap and speedy means of connecting circuits. In practice, jumpers having from 1 to 7 wires are used and are colour coded to prevent reversals. Examples of the codes used are as follows:-

M.D.F.	2 wire jumper	
	A - wire	Red
	B - wire	Red/Blue
I.D.F.	4 wire jumper	
	+ ve and T wires	White
	- ve and R wires	Red
	P and S wires	Green
	M and L wires	Red/Green
	5 wire jumper	
	+ ve wire	White
	- ve wire	Red
	P wire	Green
	M wire	Blue
	M1 wire	Red/Blue

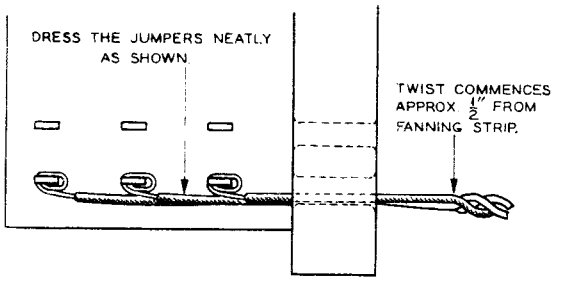
Each wire has a polyvinyl-chloride insulation covered with a lacquered coloured cotton braiding. Originally wire of $12\frac{1}{2}$ lb gauge was used on frames having an ultimate capacity exceeding 2000 circuits and $9\frac{1}{4}$ lb gauge where the ultimate capacity was 2000 circuits or less. Present practice is to use wire of $9\frac{1}{4}$ lb gauge on all frames.

The construction of the distribution frames is such that the jumpers form a horizontal field on the line side of the M.D.F. and the local side of the I.D.F., and a vertical field on the exchange side of the M.D.F. and the multiple side of the I.D.F.

JUMPER RUNNING

To facilitate the running of the jumpers at exchanges with more than 900 lines, the coil of jumper wire is accommodated on a 'vertical swift'. The essential components of a 'swift' are a conical wooden drum mounted on a circular wooden plate which is free to rotate on a vertical spindle. The spindle is fixed to a wooden stand, and the complete swift can be moved to any position along the length of the frames.

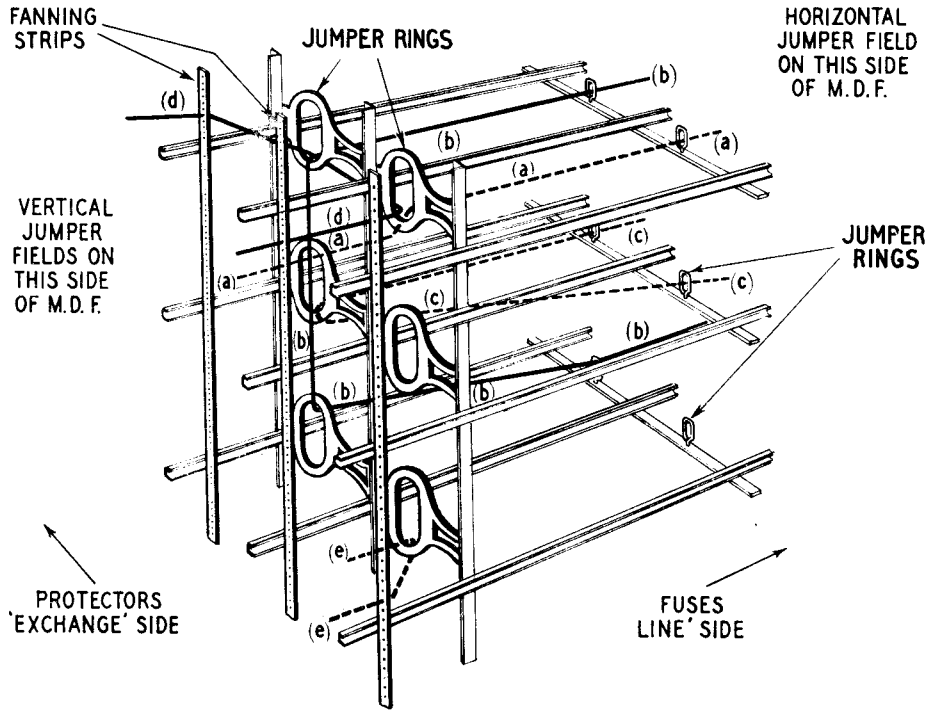
The majority of jumpers run from one side of the frame to the other, and when running such a jumper, the swift is placed on the horizontal jumper field side of the frame directly opposite the large jumper ring through which the jumper has to pass. The run is commenced by passing the end of the jumper through the large ring and then up or down the vertical field to the hole in the fanning strip associated with the circuit. This end of the jumper is now terminated, a typical termination is shown in Fig. 25. The wire running back to the swift is taken across the horizontal field to the other terminal point, cut, threaded through the small jumper ring and the fanning strip, and then terminated. The surplus wire is would back on the coil. When running a jumper, it is drawn just sufficiently taut to lay evenly in the jumper field. A tightly drawn jumper is difficult to trace, and when recovered often damages the insulation of other cross-connexions. The method of routing typical cross connexions on an M.D.F. is shown in Fig. 26, similar methods are used on the I.D.F.



JUMPER SIDE OF A CONNEXION STRIP MOUNTED VERTICALLY.

R34429

Fig. 25



R34427

Fig. 26

The jumper (a) is between terminating points on opposite sides of the frame. It passes from the line or local side terminating point, through the small jumper ring, across the horizontal field to the required vertical, through the large jumper ring and up or down the vertical field to the other terminating point.

The jumper (b) is between terminating points on the horizontal field side of the frame. It passes from one terminating point, through the small jumper ring and the nearest large jumper ring, up or down the vertical field to the required horizontal field, through the large jumper ring and thence to the other terminating point via the small jumper ring.

The jumper (c) is between terminating points on the same horizontal shelf and runs from one terminating point, through the small jumper ring and the nearest large jumper ring, then back across the horizontal field to the other terminating point via the small jumper ring.

The jumper (d) is between terminating points on different verticals of the frame; it passes from one terminating point, through the nearest large jumper ring, along the horizontal field, through the large jumper ring which gives access to the required vertical field and up or down the field to the other terminating point.

The jumper (e) is between terminating points on the same verticals of the frame; it passes from one terminating point through the large jumper ring and then up or down the vertical field to the other terminating point.

EXAMPLES OF TYPICAL M.D.F.s AND I.D.F.s

Photographs showing various aspects of the M.D.F. and I.D.F. are given in the following appended figures.

Fig. 27 This shows an M.D.F. equipped for 2,200 subscribers' lines and having an ultimate capacity of the order of 5000. The protector units at the distant end of the frame serve the junction and miscellaneous circuits. The drum mounted on the end of the frame is a method, not now in general use, of holding the coil of jumper wire.

Fig. 28 This view of the growing end of an M.D.F. shows the method of mounting the terminating cables and the copper earth wire for the protector units. When the bottom row of transverse horizontals on the line side are brought into service, the form of the terminating cable will be positioned along the length of the frame and below the transverse horizontals on the exchange side.

Fig. 29 On this M.D.F. both the line and exchange sides of the first regular vertical are equipped with connexion strips. As mentioned previously in this pamphlet, the exchange side transverse horizontals are cut back to prevent the connexion strips projecting beyond the guard rail. The protective vertical is not provided with transverse horizontal members.

Fig. 30 The method of mounting the switchboard cables on the multiple side of the I.D.F. is shown in this figure.

Fig. 31 This end view of the I.D.F. shows the wooden kerb at the base of the frame, and also the vertical and horizontal jumper fields. On this frame a wooden bar is fitted between the top and bottom unequipped transverse horizontals for protection purposes.

THE RACK M.D.F.

Changes of practice in the protective equipment provided in subscribers' lines has allowed for changes in the design of the main distribution frame. The new protection standard requires only a fuse and heat coil in each wire of a subscriber's line at the exchange. A combined fuse and heat coil, termed a delay-action fuse, Fig. 32, has been designed and is mounted in a fuse unit on the line side of the redesigned M.D.F. The heat coil and protector unit formerly fitted on the exchange side of the frame is replaced by a simple interception jack unit.

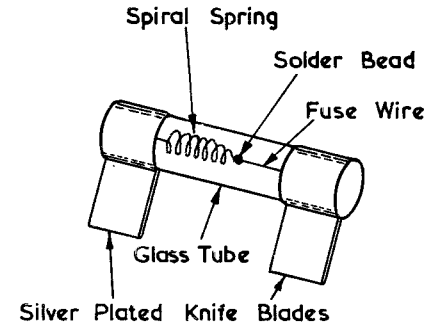
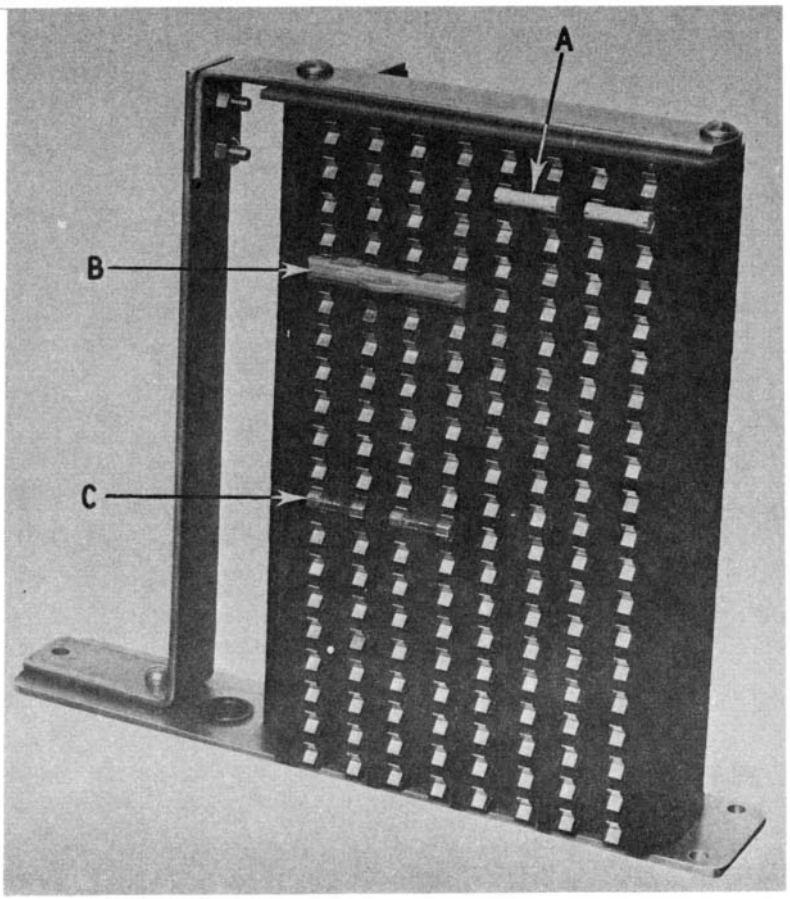


Fig. 32

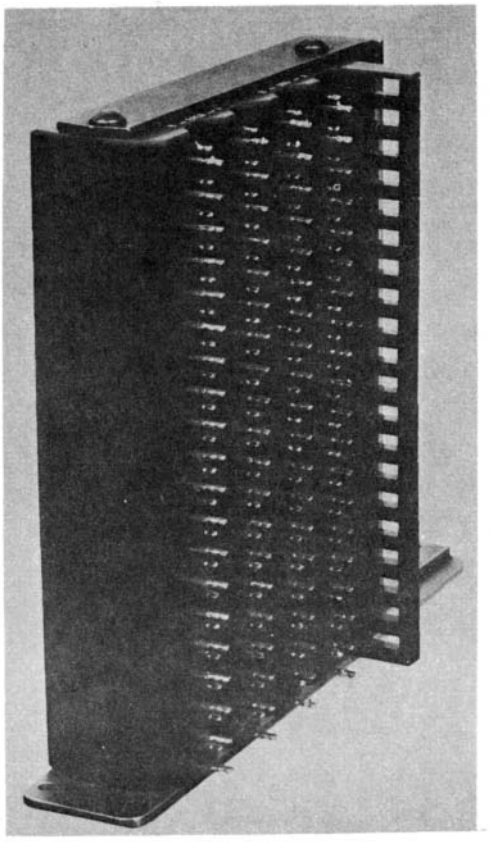
The delay-action fuse consists of a length of fuse wire, a bead of solder and a helical spring contained within a glass tube with metal end connexions as shown in Fig. 32. Most of the electrical resistance of the fuse is in the fuse wire which, with sufficient current flowing through it, develops enough heat to melt the solder. On the melting of the solder, the spring retracts and the fuse is open circuited. When large currents flow through the fuse, the fuse wire melts and so disconnects the circuit. The fuse has a rated current of 200 mA and blows within 5 to 300 seconds when carrying 350 mA.

The fuse unit on the M.D.F. for the delay-action fuses is shown in Figs. 33 and 34. The unit has a capacity for 80 fuses and is made up in a layer formation from twenty individual 2-circuit assemblies. The contact springs are of nickel-silver and provide a contact pressure of some 300 grammes on the fuse blades. The springs are held in position by the moulding which is a black nylon and bakelite composition of suitable mechanical strength and insulation resistance. The arrow C, Fig. 33 indicates two fuses fitted in the mounting, and arrow A indicates two dummy



R35903

Fig. 33



R35904

Fig. 34

fuses. The fuse covers, arrow B, are used on certain circuits, and clip over the fuses or dummy fuses. The covers are made from red polystyrene, and in addition to providing physical protection also act as markers to guard against inadvertent circuit interruption. The right-hand side of the mounting, showing the sets of tags on which the jumpers and cable pairs are terminated, is shown in Fig. 34.

The new M.D.F., termed a rack type M.D.F., has separate line-side and exchange-side ironwork units which are normally bolted together to form a complete frame unit. The separate ironwork units allow for the erection of the line-side and termination of the external cables prior to the installation of the exchange-side.

Also it is possible to extend the frame to accommodate any addition to the external cables by merely providing the line-side ironwork and fuse-units.

Each complete frame unit is suitable for fixing directly to the floor without the need for special footings, and is of standard height (10 ft $6\frac{1}{2}$ in) and 2 ft 3 in in length to allow for its installation in with suites of equipment. A unit consists of 4 verticals spaced at $6\frac{3}{4}$ in intervals and each vertical has a capacity for 400 circuits on both the exchange-side and line-side. A view of a unit from the line-side is shown in Fig. 35 (appended) and a view from the exchange-side in Fig. 36 (appended).

Each vertical on the exchange side has capacity for 8 test jack units for providing interception and test facilities. Each test jack unit is built up of 25 two-circuit units, thus providing for 50 circuits per unit and 400 circuits per vertical. The permanent wiring tags on each unit are designed for solderless connexions, that is wrapped terminations, and the unit is pivoted top and bottom so that it may be swung outwards to the right to facilitate terminating. When required, ordinary connexion strips can be fitted to the exchange-side as shown in Fig. 36; it should be noted that the special fixing bar which is required for the strips covers a half vertical and accommodates five connexion strips. The ironwork on the exchange-side is arranged to provide a vertical jumper field as on the older type frame.

The arrangements on the line-side of a rack type M.D.F. unit are shown clearly in Fig. 35. The ironwork forms 10 shelves on which are mounted the fuse unit mounting brackets at $6\frac{3}{4}$ in centres. When required a normal type connexion strip can be mounted at a fuse-unit position by means of a special bracket. New types of jumper 'rings', moulded in black nylon, are used on the frame, the single ring below the shelf, Fig. 35, provides for routing jumpers below the normal field to interception jacks immediately opposite, that is on the same vertical.

The framework is of a lighter gauge than that used on the older type frames, and to improve its rigidity webs are fitted at each shelf on the ends of the unit as shown in Figs. 35 and 36. An unusual feature of the frame is that the ironwork and panel below the bottom shelf on the line-side can be removed, therby allowing external cables to be laid along the floor from the point of entry to the particular vertical.

END

REFERENCES E.P. - Draft Series GENERAL 3/7

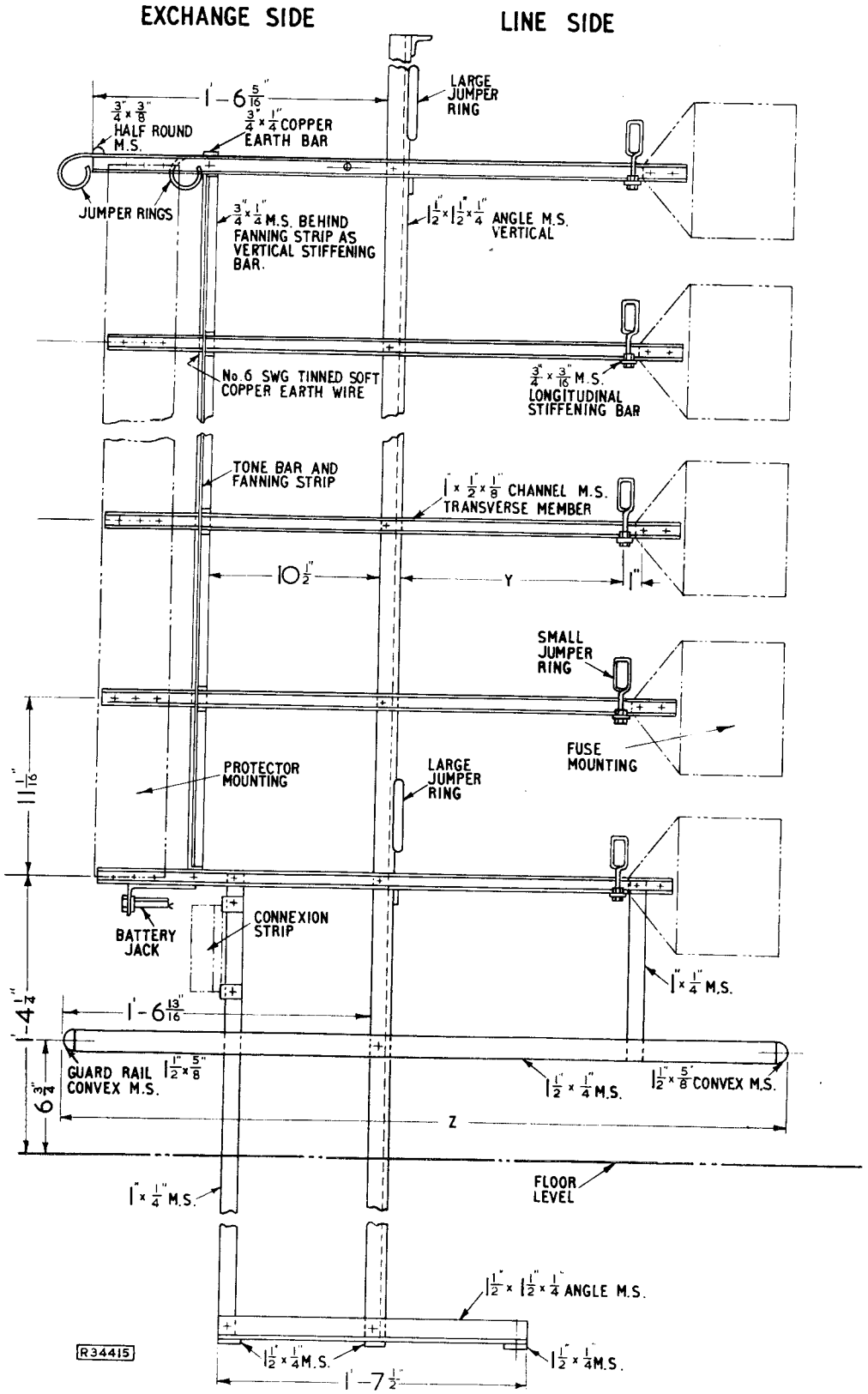
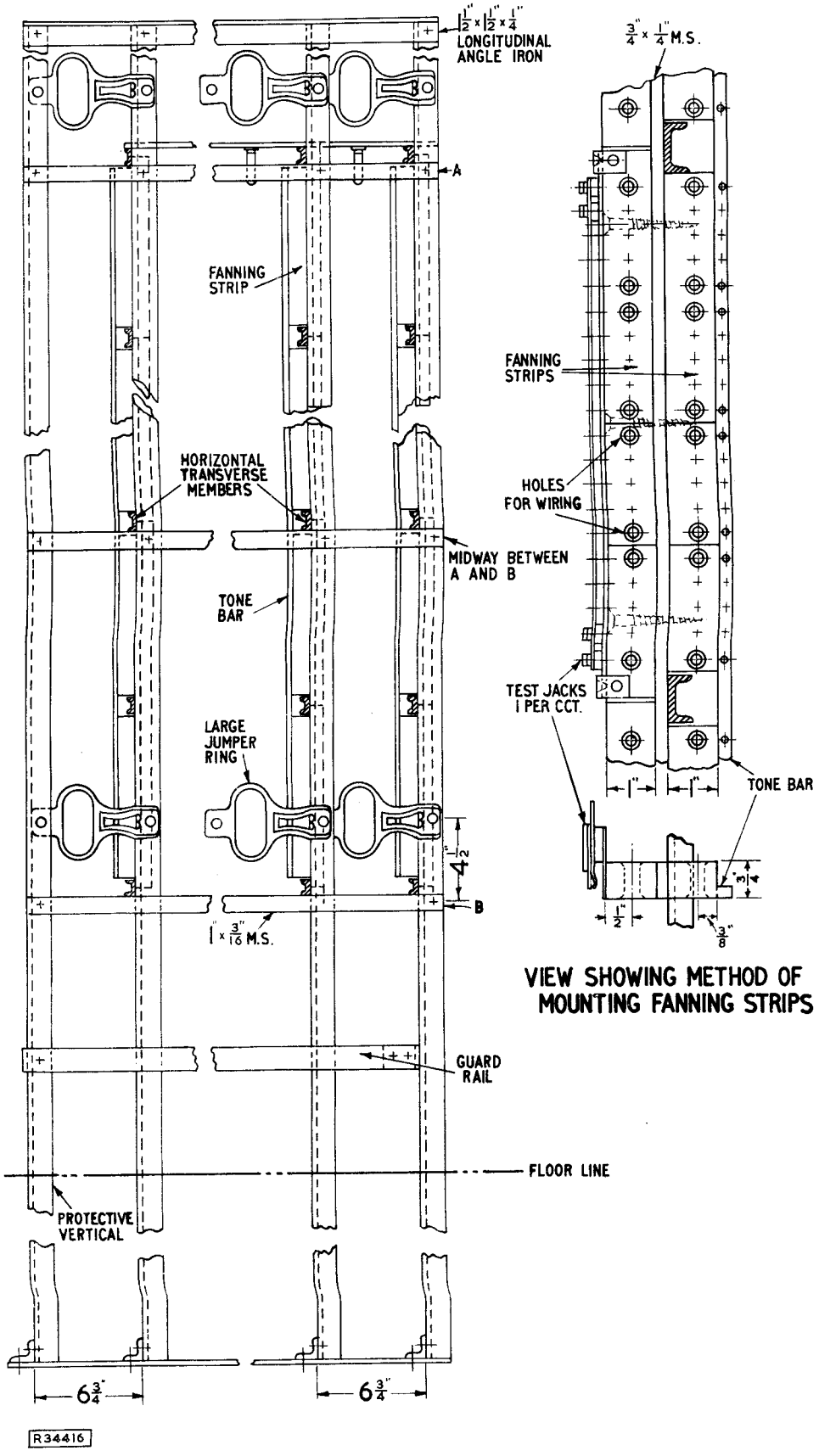

EXCHANGE SIDE
LINE SIDE
1'-6 5/16"
3/4" x 3/8" HALF ROUND M.S.
3/4" x 1/4" COPPER EARTH BAR
LARGE JUMPER RING
JUMPER RINGS
3/4" x 1/4" M.S. BEHIND FANNING STRIP AS VERTICAL STIFFENING BAR.
1/2" x 1/2" x 1/4" ANGLE M.S. VERTICAL
No.6 SWG TINNED SOFT COPPER EARTH WIRE
3/4" x 3/16" M.S. LONGITUDINAL STIFFENING BAR
TONE BAR AND FANNING STRIP
1" x 1/2" x 1/8" CHANNEL M.S. TRANSVERSE MEMBER
10 1/2"
Y
1"
SMALL JUMPER RING
FUSE MOUNTING
PROTECTOR MOUNTING
LARGE JUMPER RING
11 1/16"
BATTERY JACK
CONNEXION STRIP
1" x 1/4" M.S.
1'-4 1/4"
1'-6 13/16"
GUARD RAIL CONVEX M.S. 1/2" x 5/8"
1/2" x 1/4" M.S.
1/2" x 5/8" CONVEX M.S.
3/4"
Z
FLOOR LEVEL
1" x 1/4" M.S.
1/2" x 1/2" x 1/4" ANGLE M.S.
1/2" x 1/4" M.S.
1/2" x 1/4" M.S.
1'-7 1/2"
R34415

Fig. 1



VIEW SHOWING METHOD OF MOUNTING FANNING STRIPS

Fig. 2

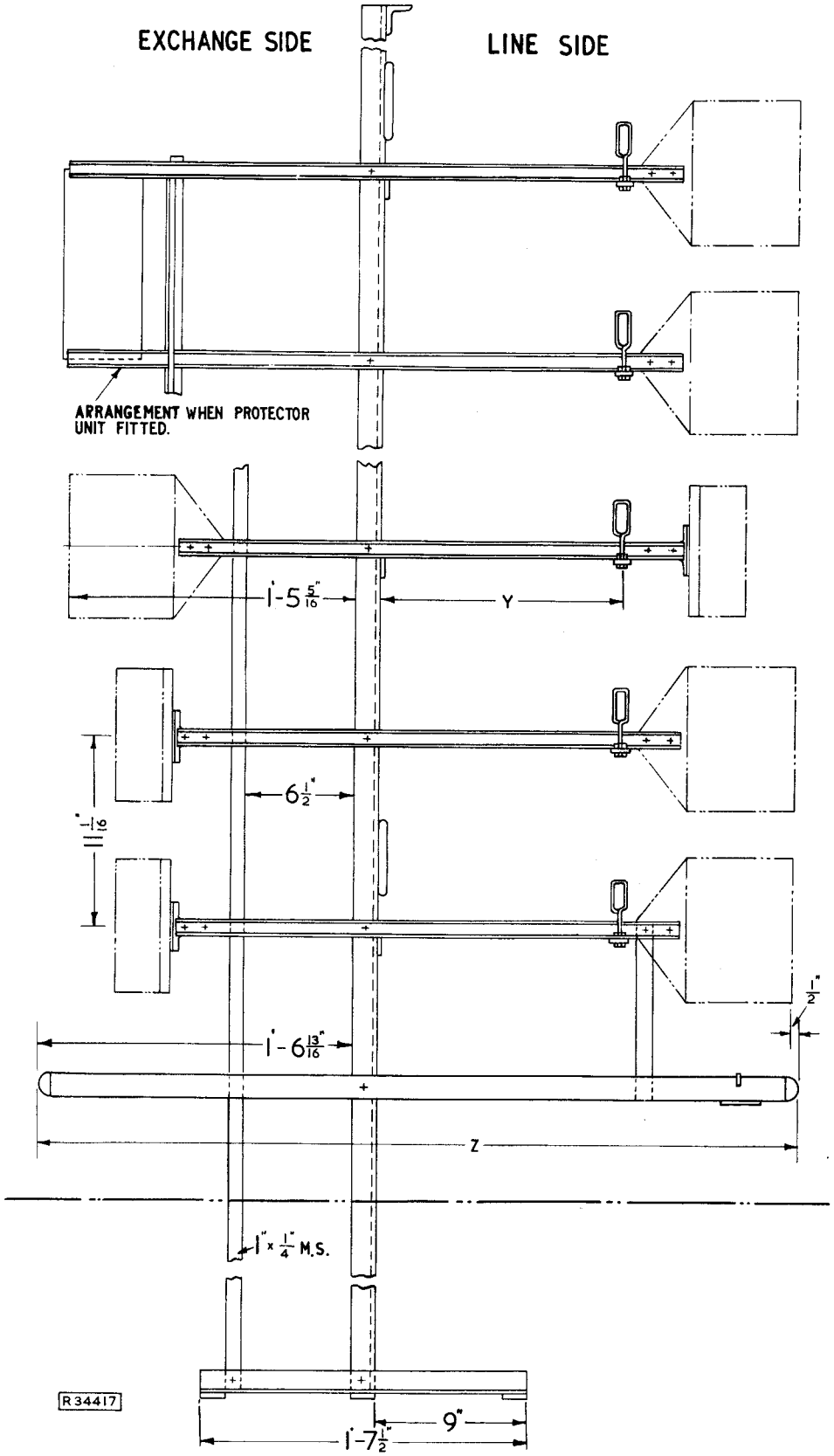
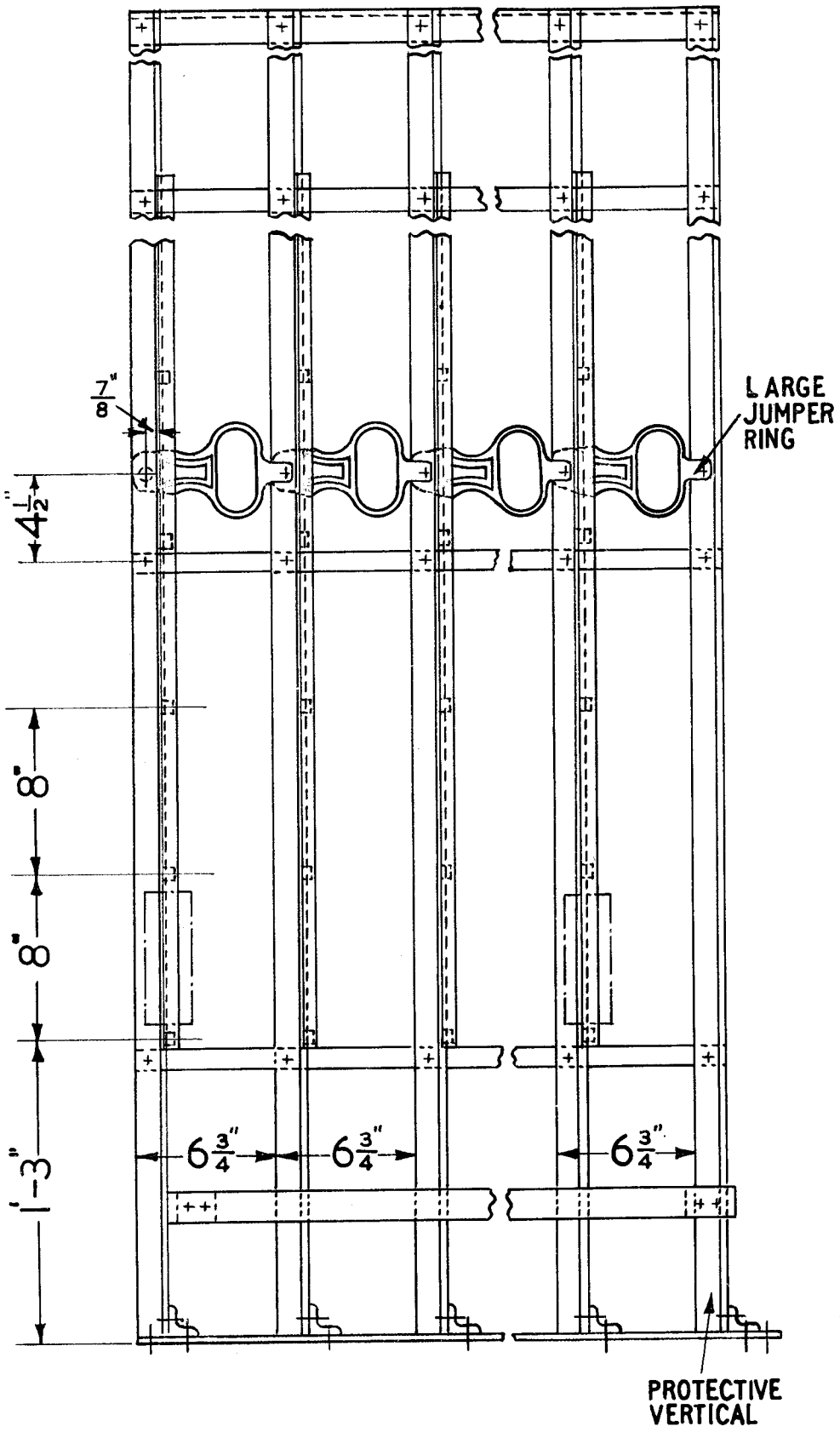

EXCHANGE SIDE
LINE SIDE
ARRANGEMENT WHEN PROTECTOR UNIT FITTED.
1'-5 5/16"
Y
6 1/2"
1 1/16"
1'-6 13/16"
1/2"
Z
1" x 1/4" M.S.
9"
1'-7 1/2"
R 34417

Fig. 6



MULTIPLE SIDE

Fig. 14

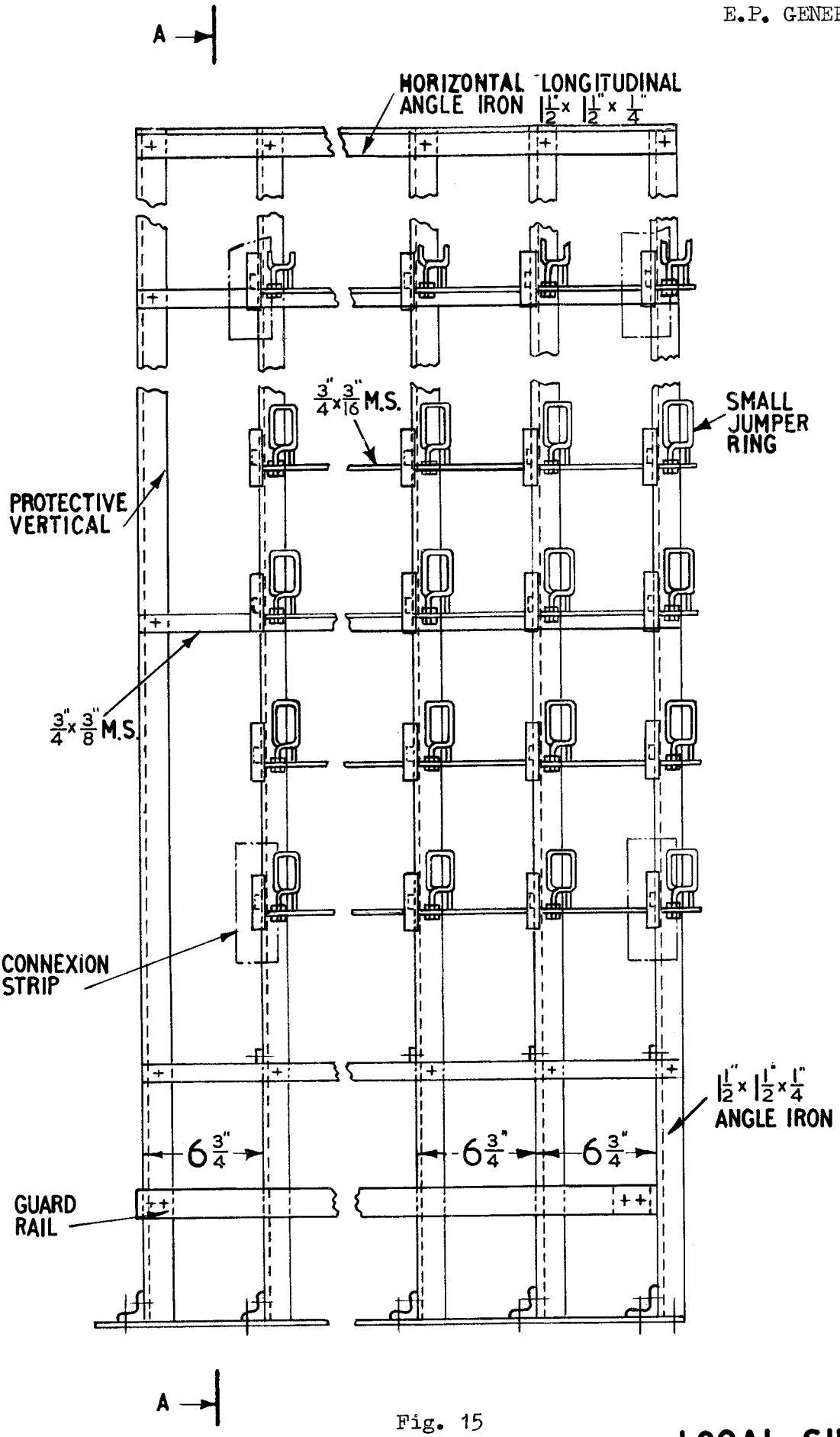


Fig. 15

R34420

LOCAL SIDE

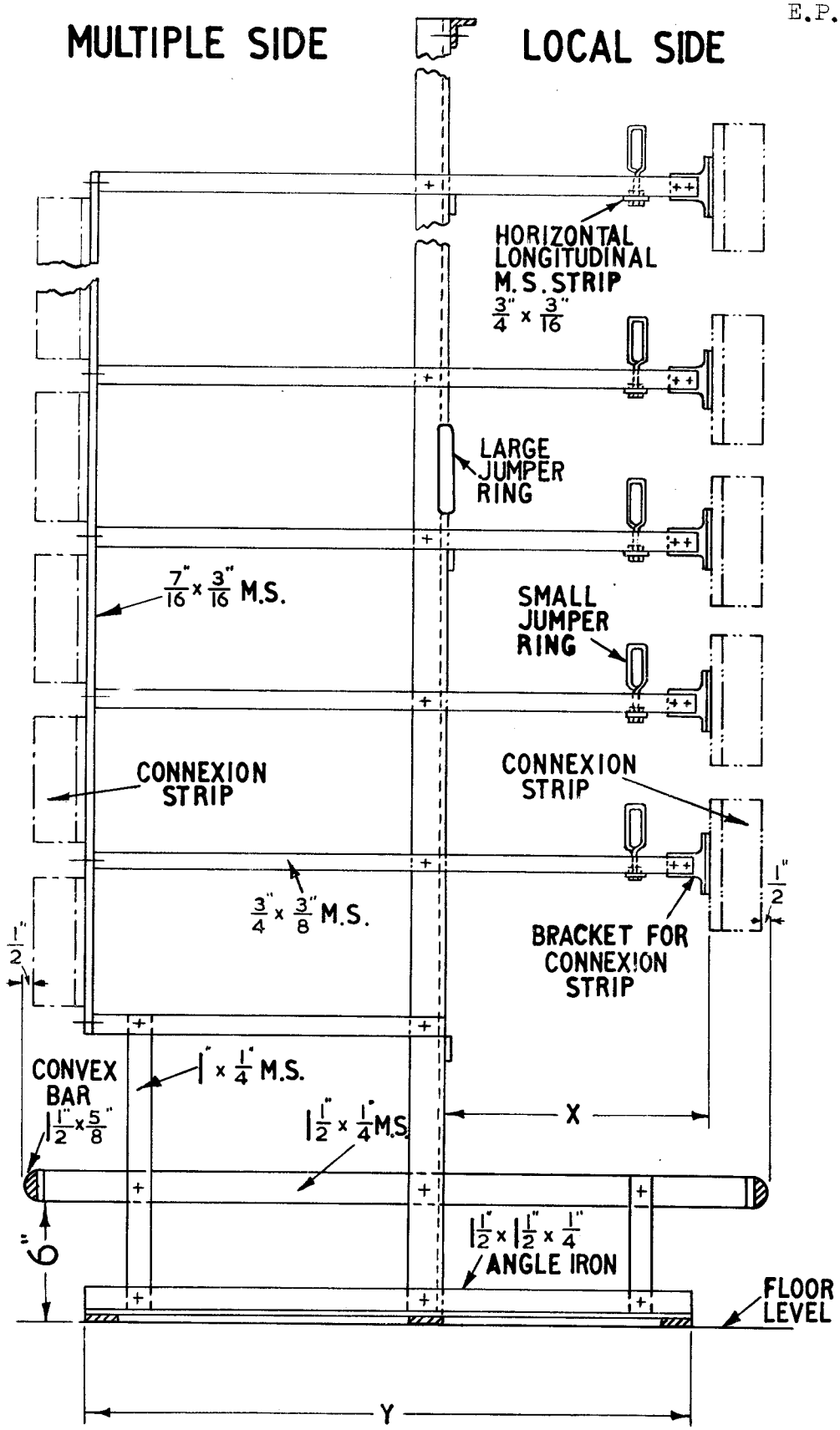

MULTIPLE SIDE
LOCAL SIDE
HORIZONTAL LONGITUDINAL M.S. STRIP 3/4" x 3/16"
LARGE JUMPER RING
7/16" x 3/16" M.S.
SMALL JUMPER RING
CONNEXION STRIP
CONNEXION STRIP
3/4" x 3/8" M.S.
1/2"
BRACKET FOR CONNEXION STRIP
1/2"
CONVEX BAR 1/2" x 5/8"
1" x 1/4" M.S.
1/2" x 1/4" M.S.
X
6"
1/2" x 1/2" x 1/4" ANGLE IRON
FLOOR LEVEL
Y
R34421
SECTION AA

Fig. 16

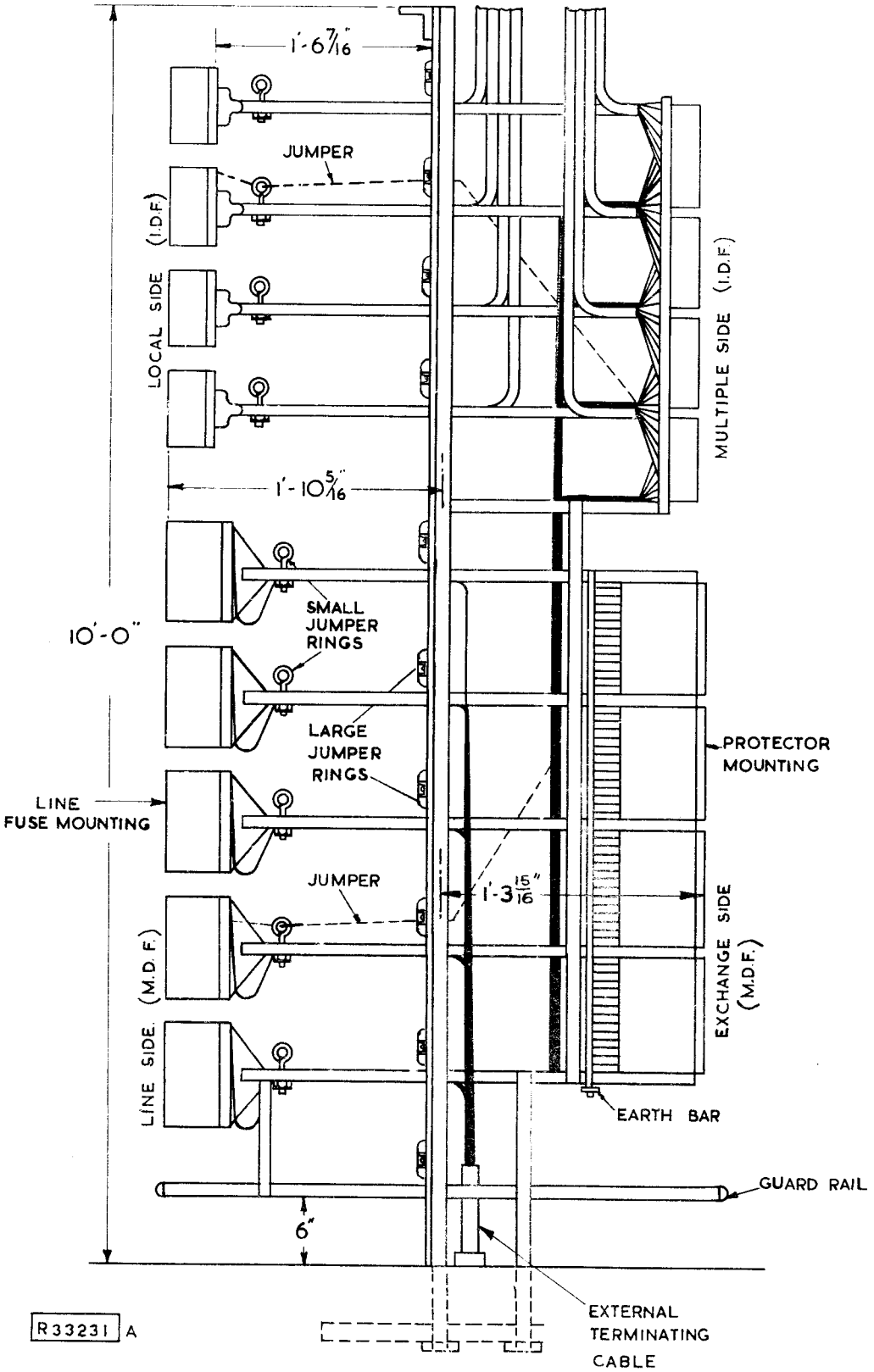
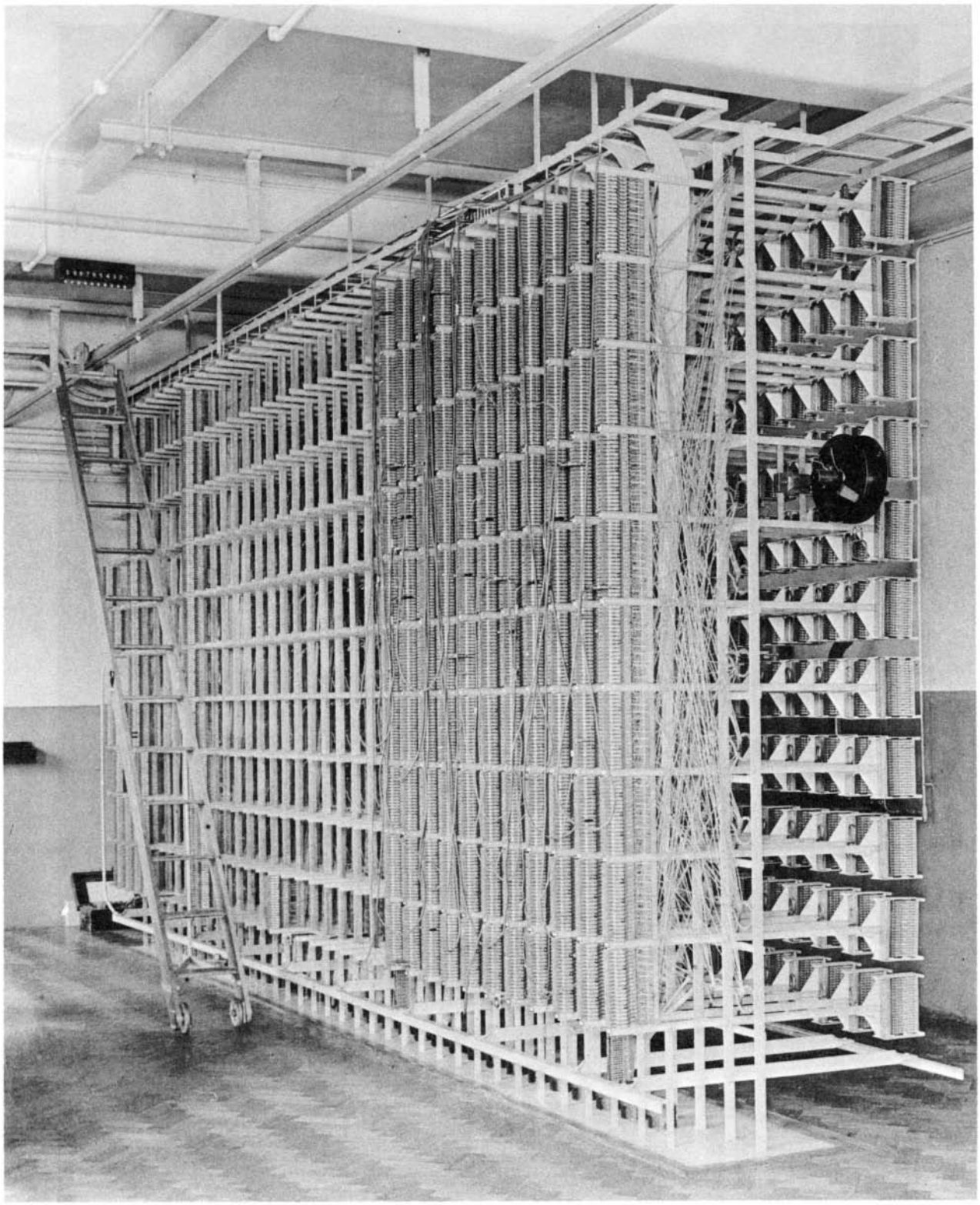
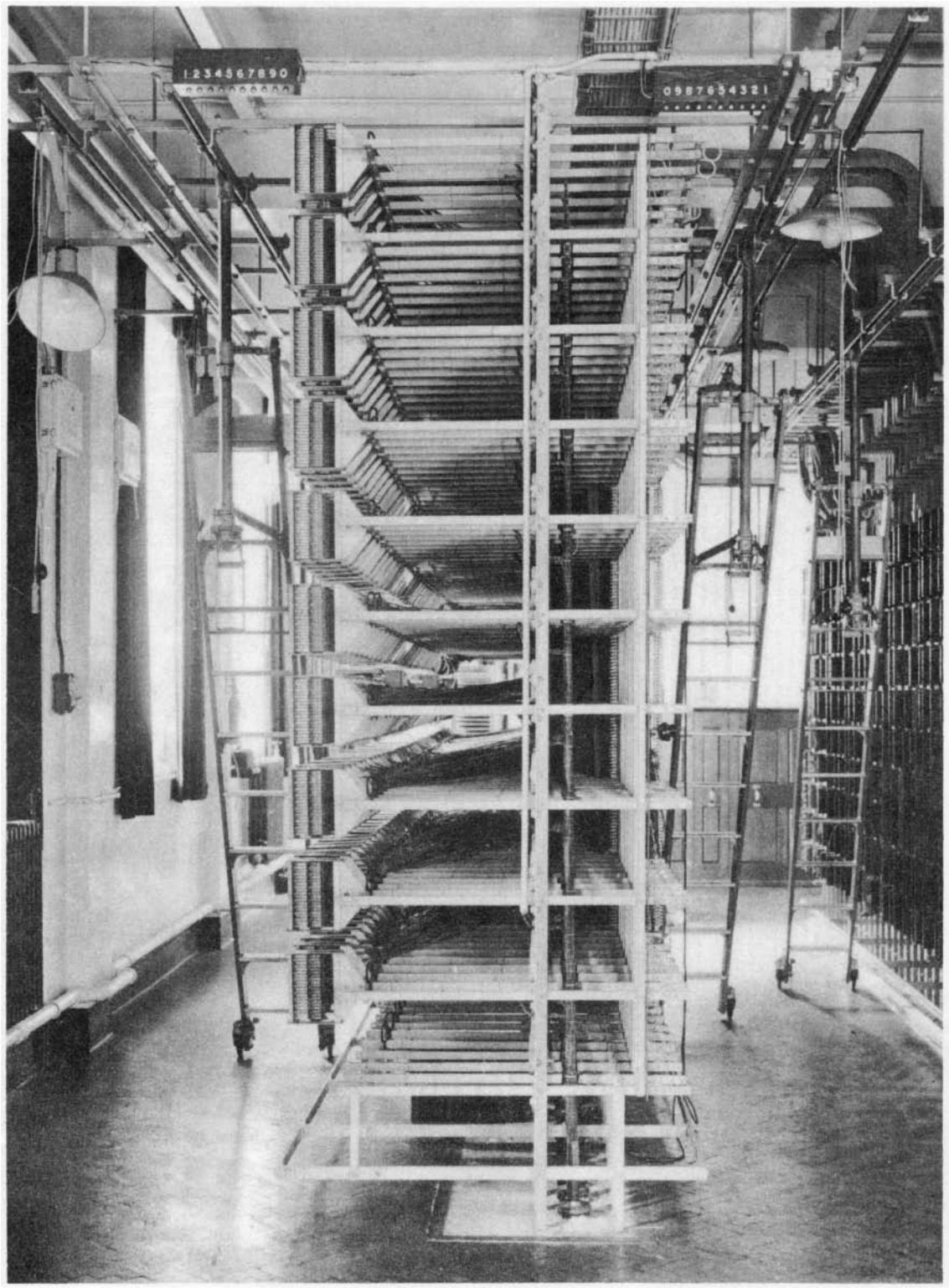

1'-6 7/16"
JUMPER
LOCAL SIDE (I.D.F.)
MULTIPLE SIDE (I.D.F.)
1'-10 5/16"
10'-0"
SMALL JUMPER RINGS
LARGE JUMPER RINGS
PROTECTOR MOUNTING
LINE FUSE MOUNTING
JUMPER
1'-3 15/16"
LINE SIDE (M.D.F.)
EXCHANGE SIDE (M.D.F.)
EARTH BAR
GUARD RAIL
6"
EXTERNAL TERMINATING CABLE
R33231 A

Fig. 24



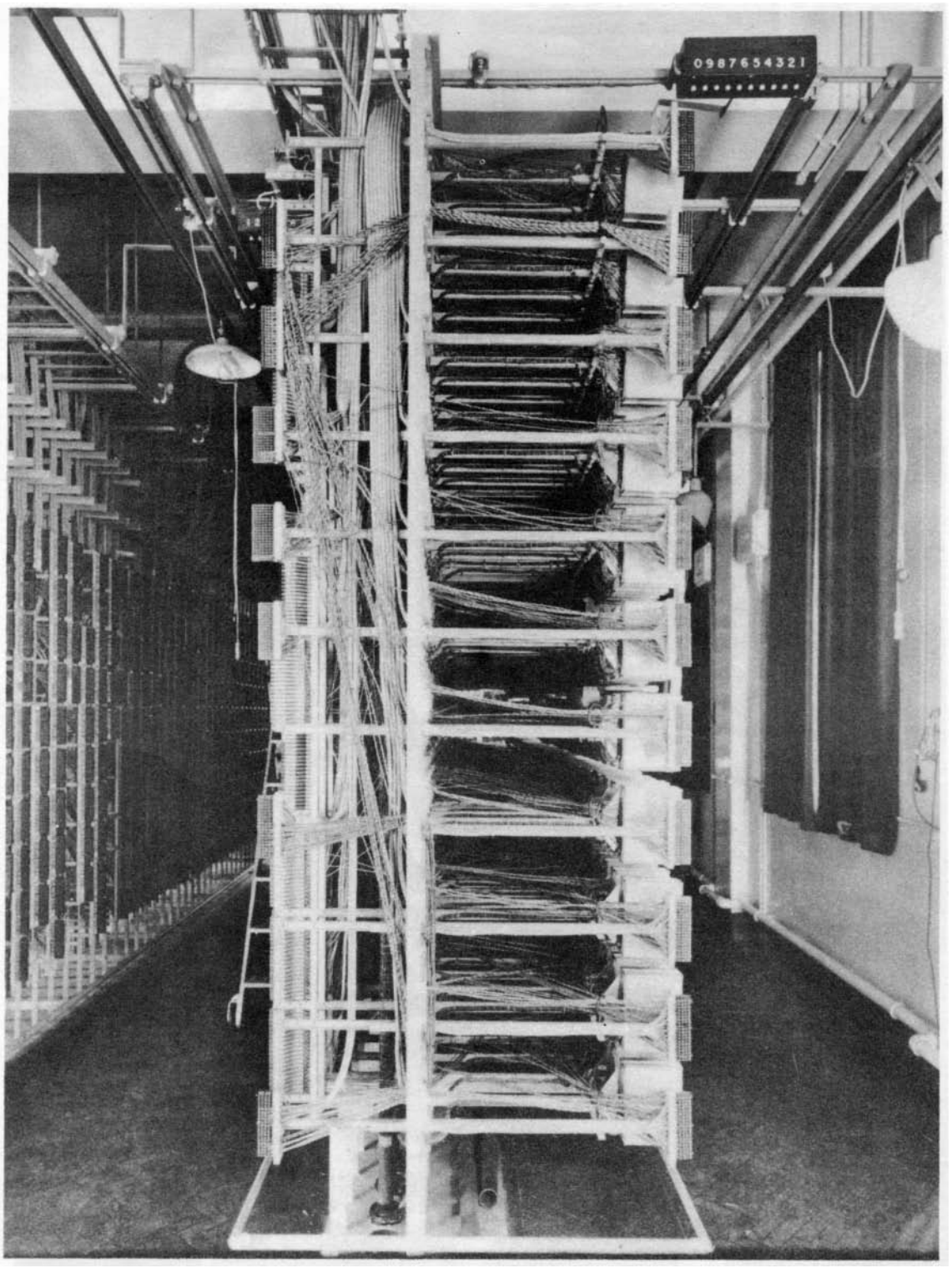
R34428

Fig. 27



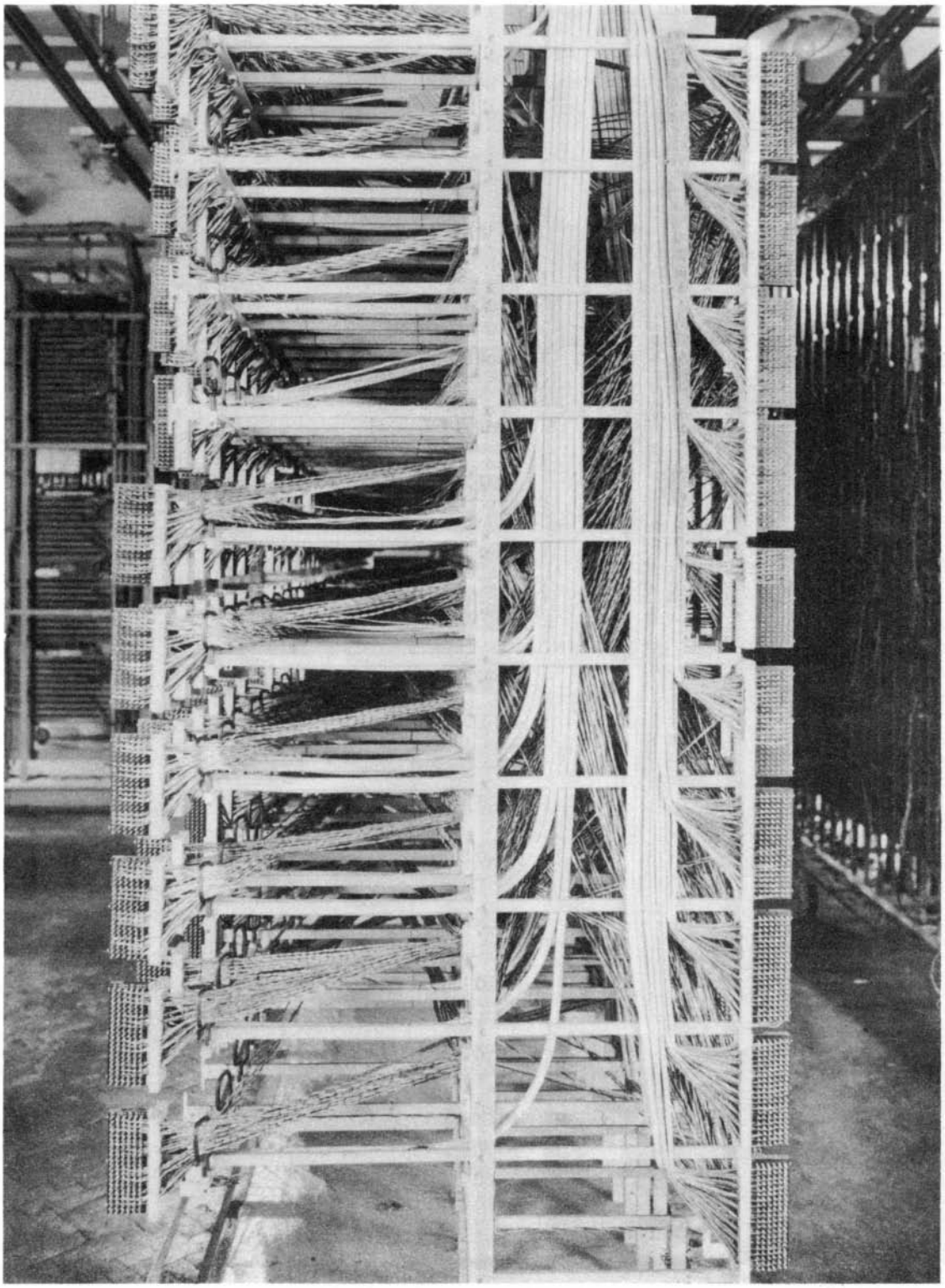
R34430

Fig. 28



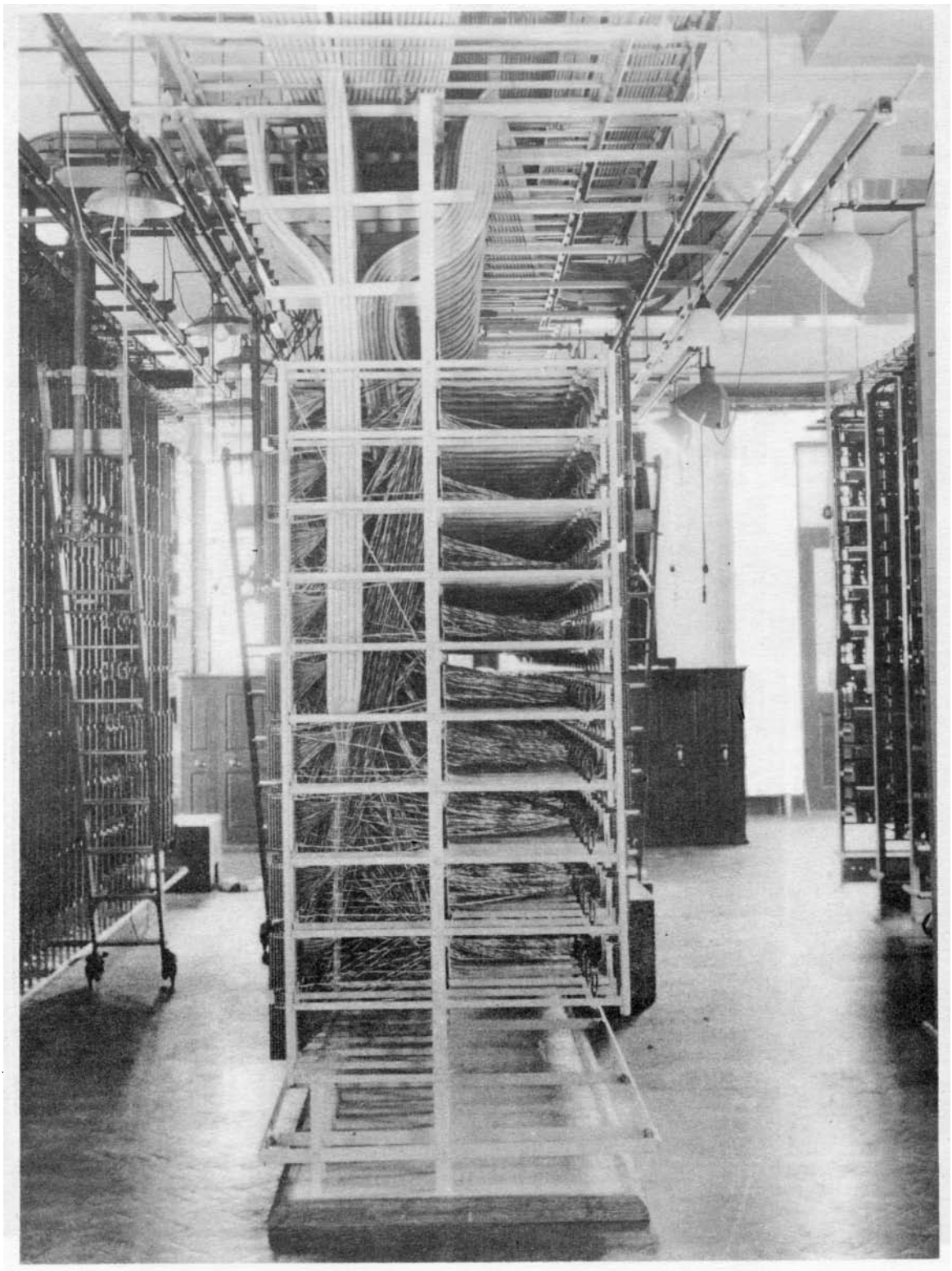
R34431

Fig. 29



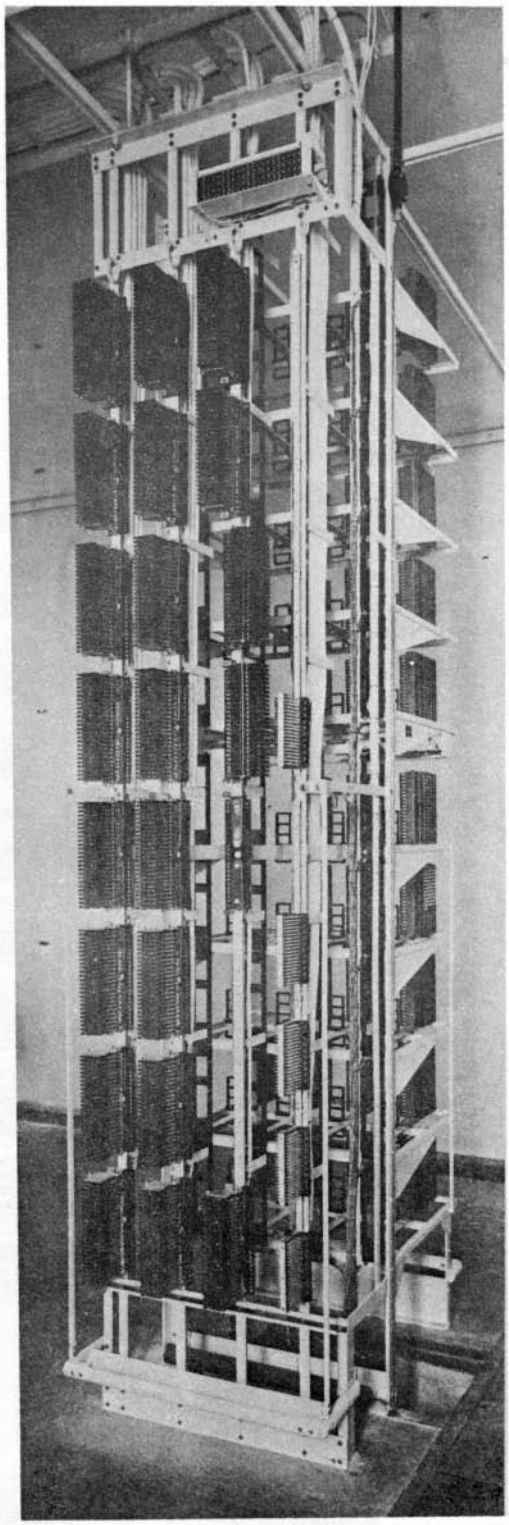
R34432

Fig. 30



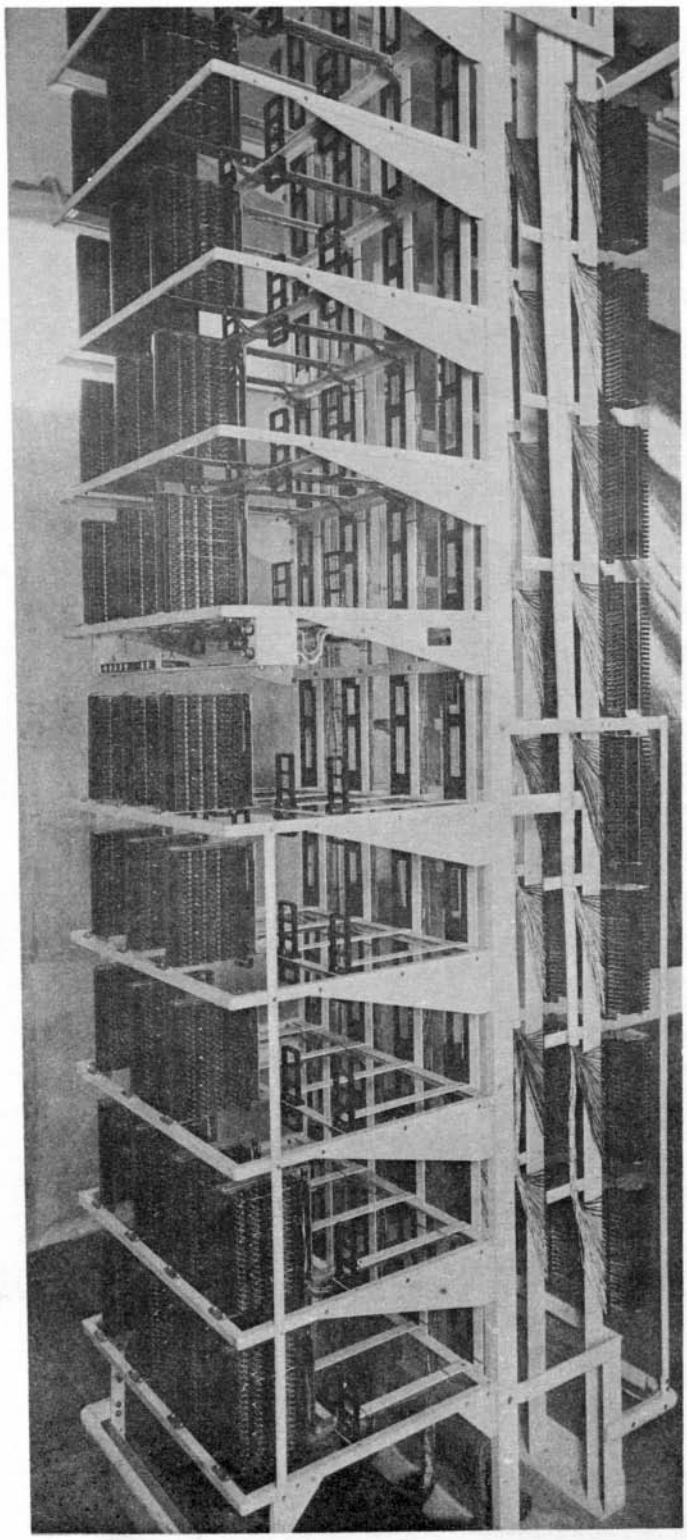
R34433

Fig. 31



R35929

Fig. 35



R35930

Fig. 36