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POST OFFICE
ENGINEERING DEPARTMENT

TECHNICAL PAMPHLETS FOR WORKMEN

Subject:

Distribution Cases, M.D.F., and I.D.F.

ENGINEER-IN-CHIEF'S OFFICE
1919

LIST OF

Technical Pamphlets for Workmen.

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DISTRIBUTION CASES, M.D.F. and I.D.F.

(D.18.)

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The following pamphlets in this series are of kindred interest:—

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DISTRIBUTION CASES, M.D.F. AND I.D.F.

DISTRIBUTION.

It is desirable that a large proportion of telephone plant shall be permanent in character. This has long been conformed to as far as Exchange plant and street cable systems are concerned, and in more recent years the practice has been extended to include the wiring of large buildings, groups of buildings, markets, etc. In the case, therefore, of Exchanges, Private Branch Exchanges, and the larger buildings, plant has been placed permanently in position ready to give service up to the limit of its capacity. Additional to this, however, some provision has to be made to meet conditions constantly changing. For instance, in a large exchange, subscribers are daily dropping out and others are taking up service. The business of a firm increases, necessitating additional exchange lines, and, generally, a change in the original telephone number to permit the use of a block of consecutive numbers. A subscriber may change his address and, if in the same area, may retain his old telephone number, but, as a consequence of the removal, he may be connected to the exchange *viâ* a cable running out in quite another direction.

These are a few of the changing conditions *external* to the exchange, but there are also varying factors *within* the exchange. The load upon an operator's position, *i.e.*, the total number of calls she has to handle at her busiest period, alters from time to time. Some positions become overloaded and have to be reduced, others become slack and, failing to provide an operator's average load, require to be augmented, thereby relieving an overloaded position. All these varying conditions are duly considered under and catered for by what is known as **Distribution.**

In exchanges distribution is given effect to through the agency of the Main Distribution Frame and the Intermediate Distribution Frame. In large buildings or groups of buildings a somewhat similar condition of change has to be provided for, but to a more limited extent. Here, permanent plant in the shape of main and branching cables is led to definite distributing points. The varying conditions to be met lie upon the inner side of these points. Tenants come and go, and, while telephone wiring is, as far as possible, left in situ, tenants are not equal users and the demand upon the service

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varies. Further, in modern steel frame buildings floors are, by the erection or demolition of slab partitions, speedily divided up into many small rooms and offices or a few large ones, so that over an extended period the building may sometimes have a considerable number of separate occupiers, at others relatively few : either condition may increase or lessen telephone density. The Distribution cases, upon which the branching cables previously referred to terminate, are the means by which these varying conditions are met.

MAIN DISTRIBUTION FRAMES.

A telephone exchange is placed as near to the centre of the area it serves as circumstances permit, and from it external cables radiate out to distributing points. In modern exchanges all such cables enter the building by way of a cable chamber, where, in general, they are divided up and jointed into smaller cables convenient for terminating upon the Main Frame located within the apparatus room. Each of these smaller cables is, as a rule, limited to suit the capacity of one vertical of the frame, and is led through a tube in the ceiling or floor of the apparatus room in alignment with the particular vertical it serves. Street cables enter the Exchange and are terminated upon the Main Frame without any consideration as to telephone numbers. This must necessarily be so. In the early days of an Exchange a large percentage of cable capacity will be spare and awaiting prospective subscribers. If a heavy percentage of such spare capacity was joined up direct to switchboard equipment in some order of telephone number, a considerable amount of costly plant would be idle, some of it for a lengthy period. Apart from this, the Post Office does an extensive business in the provision of Private Wires, *i.e.*, circuits working between two addresses under the direct control of the renter, but which, for cabling convenience, pass in and out of the Exchange building, generally *viâ* different cables, the cross connection being made through the medium of the Main Frame. Exchanges are linked up by means of junction cables terminating upon their respective Main Frames, which not only provide junction services between the two exchanges immediately concerned, but also furnish sections of longer junction services between distant Exchanges. Thus a junction circuit between A and D may pass through the main frames at B and C (intermediate exchanges). Further, quite a considerable number of cable pairs are utilized in supplying battery and machine ringing power to private

branch exchanges within the area, and always by way of the Main Frame. The fact that a certain proportion of spare cable capacity must be left available for subscribers removing within the area has already been noticed. The Main Distribution Frame, therefore, must at all times have a capacity greater than that possessed by the switchboard equipment.

There are several **types of M.D.F.** in use by the Department even at Exchanges of the same size, as the National Telephone Company's practice in this respect was not the same as that of the Post Office. The type fitted, however, depends mainly upon the capacity of the Exchange and whether it has been installed by the Post Office staff entirely, or by a contractor.

The National Telephone Company installed frames of the following sizes, which they kept in stock :—

(a) 120 Line Frame, 1 ft. 4 in. long x 1 ft. 3 in. deep x 7 ft. 1½ in. high.

(b) 250 Line Frame, 1 ft. 7½ in. long x 2 ft. 9 in. deep x 7 ft. 3¼ in. high.

(c) 500 Line Frame, 2 ft. 10 in. long x 2 ft. 9 in. deep x 7 ft. 3¼ in. high.

(d) 1,000 Line Frame, 5 ft. 0 in. long x 2 ft. 9 in. deep x 7 ft. 3¼ in. high.

Exchanges of larger size were usually installed by contractors, who fitted frames of a type that will be described later.

(a) The **120 Line frame** was designed to be fitted in the switchroom. It is enclosed in a walnut cabinet, stained and polished to match the sections. A slot in the roof is provided to admit the cables, and the cabinet can be opened at the front and back for inspection purposes. The upper half of the cabinet carries mounting irons for the protector and heat coil strips: in the lower portion test jacks are fitted. A shelf divides the two parts from each other; holes are cut in the shelf for the cross-connecting wires to be led from the protectors to the jacks.

(b), (c) and (d) are identical in construction, (c) and (d) being multiples of (b). *The framework* is built up of vertical mild steel angles, which are bolted at top and bottom to flat mild steel bars. *The apparatus* is mounted on both sides of the rectangular framework, the sides of which are braced together by flat bars turned over at the ends and bolted, one side carrying

the protector and heat coil strips and designated the *line side*, and the other the test jacks forming the *exchange side*.

On the line side, a horizontal angle iron is bolted to the uprights at the top, a similar angle about 14 in. from the floor, and a flat bar midway between the two angles. These irons are drilled for the purpose of mounting the protector strips, which are fitted with 51 pairs of protectors and heat coils. On the 250 line frame, 2 strips are fitted on the upper portion and 3 strips below, the spacing between the strips being 4¾ in. On the middle bar, three distributing rings, 2½ in. diameter, are fitted, one above each protector strip on the lower bay.

On the exchange side, two horizontal angle irons are bolted to the uprights 1 ft. 9½ in. apart vertically. These irons carry wooden shelves, which are tenoned into wooden posts screwed to the steel uprights. The shelves support the test jacks, and are fitted with hardwood strips on front and back of the lower shelf and on the front of the upper. Behind the upper shelf a grooved hardwood strip is screwed to form a grid for leading through the cross-connecting wires.

Two wood rails, carried by brackets riveted to the tops of the vertical angle irons, are each used to form a grid made up of vulcanite tubes secured down the centre by brass screws to hardwood strips, one grid running behind the front of the line side, the other behind the front of the exchange side.

The cross-connecting wires, or "jumpers," are run from the protectors on the line side up through the rings (from the lower strips only), through the grid above, then across and down through the corresponding grid on the other side, through the grooves behind the upper jack shelf and on to the jacks. The cross-connecting, or "jumper," field provides the facility of arranging the lines in consecutive numbers on the switchboard. The line cables are terminated on the inner springs of the protection strips, and the twisted pairs, of which the jumpers consist on this type of frame, start from the outer springs of the protector, run over and are reassembled in definite order on the line sides of the test jack tags. Switchboard cables complete the wiring from the exchange tags of the jacks to the switchboard multiple jacks.

The ironwork is painted with three coats; the woodwork is stained walnut, sized twice, and given two coats of varnish.

No fuses are fitted on these frames.

$\frac{0}{480}$ FRAME.

This frame, which is the standard Departmental type for small exchanges, has accommodation for 240 pairs of wires, each wire being fitted with a fuse, a heat coil, and a lightning protector. It can be extended in either direction by adding stock frames. (See Figure 1.)

The frame has two sides, a line side carrying the fuses, and an exchange side carrying the protectors and heat coils.

The front of the line side consists of two vertical angle irons, (B), 6 ft. $4\frac{1}{4}$ ins. high and $6\frac{1}{2}$ ins. apart, to which the Fuse Mountings No. 4002 are screwed. Fifteen inches directly behind these irons are two more angle irons, (A), 6 ft. $9\frac{1}{4}$ ins. high, and also a flat end bar 8 ins. to the right, which is removed when the frame has to be extended. The pairs of vertical angle irons are braced from front to back by seven flat bars, spaced 11 ins. apart, and at the base by an angle iron. The flat bars extend $7\frac{3}{8}$ ins. behind the vertical angles (A), where they are screwed first to vertical flat bars (C), of the same height as (B), and to extension horizontal irons which are drilled and tapped on their sides for the fixing screws of the wooden fanning strips for the protectors, Protectors and Heat Coils 40 B, and for the protector mountings. One mounting comes vertically between two extension irons, and is held in position by the round-headed fixing screws engaging in the sides of the projecting bars. The fanning strips are secured to the extension irons immediately behind the protector mountings by brass clips. The extension

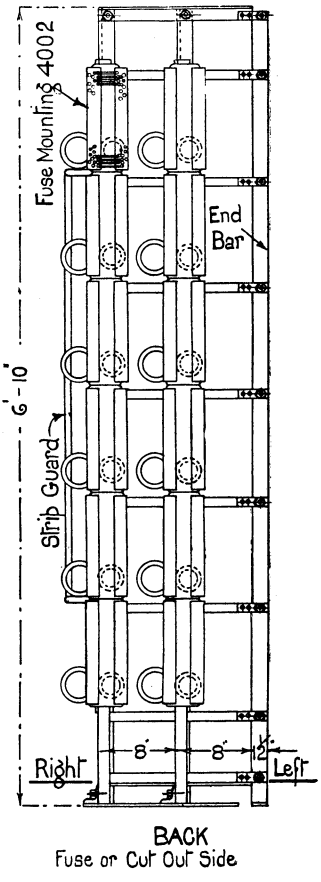

Fig. 1.

Technical Pamphlets for Workmen.—Amendments, **P.W.–D.18.** *January,* 1931.

Page 6. *Penultimate line. Amend* grips *to read* strips.

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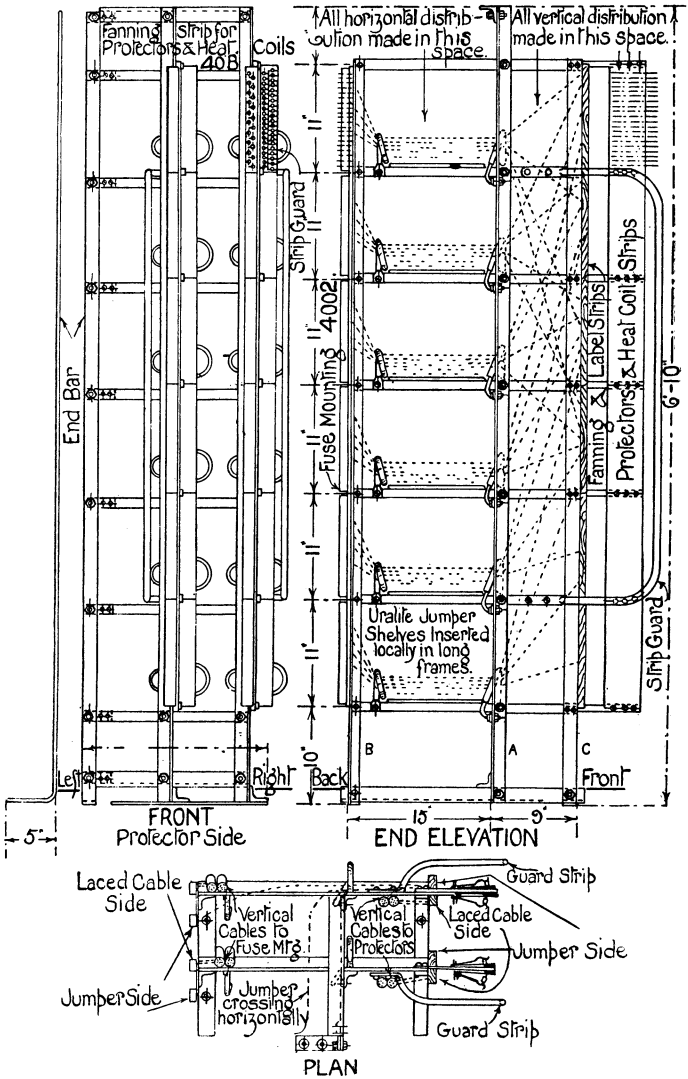

Fig. 1.

irons are also housed in the slots provided centrally at the top and bottom of the fanning strips. Lengthwise, the vertical angle irons (A) are braced together by flat bars, 11 ins. apart. A flat iron also connects the feet of the irons (B) and one the feet of irons (C); these form the base of the frame. The verticals are further stiffened by an angle iron, 2 ins. from the ground line, and one at the top of the frame, both bolted to the angle irons (A) and to the removable end bar.

The horizontal bars extending from back to front are fitted with jumper rings, one per fuse mounting space; the bars extending lengthwise carry the larger jumper rings which serve the protectors. Each vertical can carry six strips of 20 pairs of circuit apparatus. The frame is stocked unequipped, and the apparatus has to be requisitioned separately, and fitted to the verticals by means of the screws and clips which are issued with the frame.

The wiring scheme is as follows:—The incoming cables, Silk and Cotton Core of suitable size, are run either from the top or from the bottom, along and behind the left side of the verticals, looking from the line side of the frame, laced out and soldered to the tags on the fuse mountings. From the tags on the right side the jumper pairs from each strip are carried through the smaller ring fitted immediately behind it, back through the frame horizontally, through one of the larger rings, to be distributed vertically on the left side of the particular strip of protectors to which the circuit numbers are allocated. The pairs of wires are threaded through the holes in the fanning strip before being connected to the tags on the protectors. The switchboard cables are run vertically along the right side of the verticals, looking from the line side, laced out and soldered to the tags of protectors. These cables, as well as those on the line side, should be secured by stout twine lashings to the vertical irons. The ironwork should be served at the lashing points with insulating adhesive tape to protect the cables from abrasion. It should be noted that the cables terminate on the left side of the verticals and the jumpers on the right, to facilitate soldering operations on the latter.

To shield the protector and heat coil strips from passing traffic, a guard strip of Iron Tubing of flat U shape is fitted to the second and sixth horizontal irons on each side of the frame. The flat sides of the U's project a few inches beyond the carbons of the protectors.

The equipment required in addition to the Frame, Main Distribution, $\frac{O}{480}$, itself, includes the following items :—

1. End Bar.
2. Guards, Strip for M.D. Frames.
n Fuse mountings, No. 4002.
n Protector and H.C. 40 B.
n Strips, Fanning, 40 Line.

or

Fuse Mountings No. 4003 Protector and H.C. 200 A Strip, Fanning, 200 Line.

In extending an existing frame the end bar is removed and the first (A) vertical of the new frame is bolted in its place, the end bar in its turn being fitted in position on the new frame. The guard strip affected is also removed and fitted in its proper position on the end of the extended framework. When two or more frames are used as a single unit, uralite sheets are laid on the fore and aft horizontal bars to form an insulating shelf for the jumper wires.

Earthing strips of copper sheet about an inch wide should be fitted beneath the screw heads holding the protector strips on each vertical. A common earth wire of stranded copper is run below the protectors, and the copper strips should be bent over at one end and sweated on to the common earth. Care should be taken to see that the screw heads are clean and free from paint, and that good electrical contact is made between the iron of the frame and the earthing strips.

The ironwork is treated with two coats of lead-coloured paint.

The overall dimensions of the frame are, from front to back including guard strips, 2 ft. 10 ins.; length of a single unit, 1 ft. 9½ ins.; height, 6 ft. 9¾ ins.

LARGER FRAMES INSTALLED BY CONTRACTORS.

In the first Common Battery Exchanges installed in this country the Western Electric Company used a Main Distributing Frame that provided for horizontal distribution from the cables on the line side, and with vertical supports for the protective apparatus on the Exchange side. For this reason the line side is sometimes spoken of as the horizontal side of the frame, although the Department's more recent practice is to distribute vertically on both sides.

On these first frames, as fitted in London Central and City and in many ex-National Company's exchanges, the horizontal

side is formed by the flat iron bars, which are bolted horizontally in rows to the exchange side verticals, being fitted with shoes on their ends. To these shoes the connection strips are screwed horizontally, and when in position they form practically one continuous shelf or rows of shelves running along one side of the frame. The number of shelves depends upon the height of the test room and the size of the exchange.

The incoming Silk and Cotton Covered Cables are run along below the shelves, to which they are lashed at intervals, and are laced out and terminated on the tags on the lower side of the connection strips. The jumper wires are soldered to the tags on the upper side, and run horizontally on the shelves to distributing rings on the verticals on the other side. On several of the N.T. Company's exchanges no fuses were fitted, and the jumpers were soldered direct to the tags of the protector and heat coil strips. At the Department's exchanges fuses were fitted on both sides of the vertical in sets of 20 (Fuses No. 10/2—a fibre tube fuse in which the fuse wire is enclosed in soapstone to prevent metal splashing when the fuse is blown), and the jumpers were terminated on them. Short lengths of wire joined the exchange side of the fuses to the protector and heat coil strips.

The standard Departmental frame is made up of a rigid iron structure, with its vertical members securely anchored in the concrete flooring of the test room. See Fig. 2. The framework consists of central angle irons, fitted $6\frac{3}{4}$ ins. apart vertically, with parallel bars 8 ins. behind on the protector side. These irons are bolted to angle irons, from about 2 ft. to 3 ft. long, laid back to front, which are in turn bolted to three flat iron bars running longitudinally along the frame. The combination of cross irons forms the foundation of the frame, which is embedded in $4\frac{1}{2}$ in. concrete floated over with cement. Channel irons commencing 1 ft. $4\frac{1}{4}$ ins. above the floor line, and duplicated every $11\frac{1}{16}$ ins. vertically, run from back to front, being bolted to the flat bars on the line side and to the central angles. These channel irons carry, on the line side, the protector and heat coil strips No. 40 B, one strip between each pair of irons, and on the exchange side, the fuse mountings No. 4001, one strip per bar. Jumper rings, one for each protector strip, are bolted through flat bars running lengthwise behind the angle irons, and are locked in position by the fore and aft channel irons bearing against the rising shanks of the rings and by the

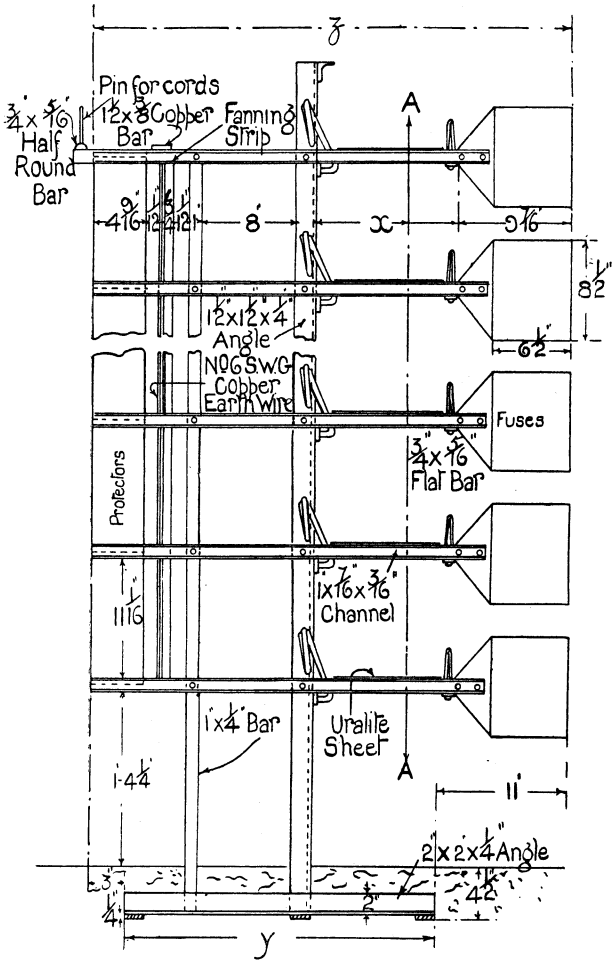

Fig. 2.

tips of the iron rings butting against the vertical angles. See Fig. 3. Behind each fuse mounting a smaller ring is bolted on

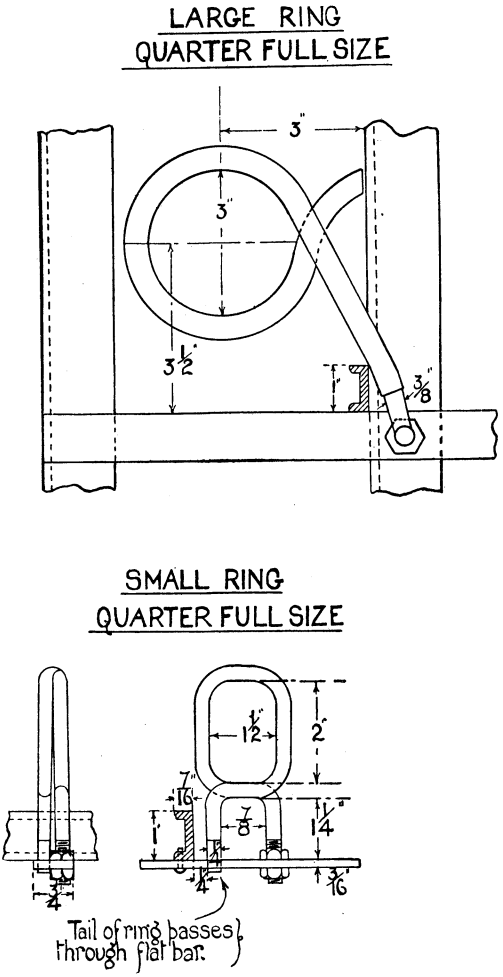

Fig. 3.

to a flat bar running lengthwise which is screwed to the channels. The framework is thus braced in two directions, by the fore and aft channels, and by the flat irons longitudinally.

Fanning strips are fitted between the channel irons on the protector side, and, immediately in front of each of these, runs a vertical copper earthing wire, No. 6 S.W.G., which is soldered above to the main earth copper bar of $1\frac{1}{2}$ in. x $\frac{3}{8}$ in. section (fitted along and above the highest channel irons), and secured by a thimble to one of the screws holding the protector strip in position.

Uralite sheets are laid on the channel irons behind the fuse mountings and form shelves for the horizontal jumpering between the rings.

The number of verticals and their height, which determines the number of mountings per vertical, depends upon the size of the exchange and the headroom. The overall depth of the frame varies from 3 ft. 4 in. for smaller exchanges to 4 ft. 1 in. for the largest. The ironwork is painted before leaving the shops and after erection.

It is usual to fit one extra strip on each vertical on the line side of the frame for the purpose of terminating spare wires in the cables. At No. 1 C.B. exchanges, where the verticals carry as many as 200 circuits each, travelling ladders, running on rails above and on the floor, are provided for work to be carried out on the higher strips. Along the top of the frame on the line side a strip of 20 jacks is fitted at regular intervals, and on the protector side similar jacks are also mounted. The function of these jacks is to provide facilities for testing new subscribers' lines, to intercept circuits for traffic observation and for testing purposes generally. Clips, Test No. 12 complete, which include a length of 4-way cord and two switchboard plugs, or Plugs No. 211, for use on the protector side, and Clips, Test No. 2, for use on the fuse mountings, are supplied to split the circuit into external and internal halves and to test them independently.

INTERMEDIATE DISTRIBUTING FRAMES.

At small exchanges of the magneto and C.B.S. types, where each circuit to the switchboard is made up of two wires only, the cross-connecting and rearranging of circuits is carried out on the M.D.F. by means of jumpers running between the two sides.

At C.B. Exchanges, however, the circuit arrangements are much more complex, and the switch sections cannot contain the relays, meters and cord circuit apparatus required to provide the operating advantages such systems confer. It is necessary, therefore, to introduce an intermediate point to terminate the line pairs, and to distribute the wires from them to the various parts of the circuit. This point is also utilised to rearrange the circuits and to load up the operators' positions more or less uniformly. The terminating and distributing blocks are fitted

on an ironwork frame, or rack, which is called the Intermediate Distributing Frame or I.D.F. (Fig. 4.)

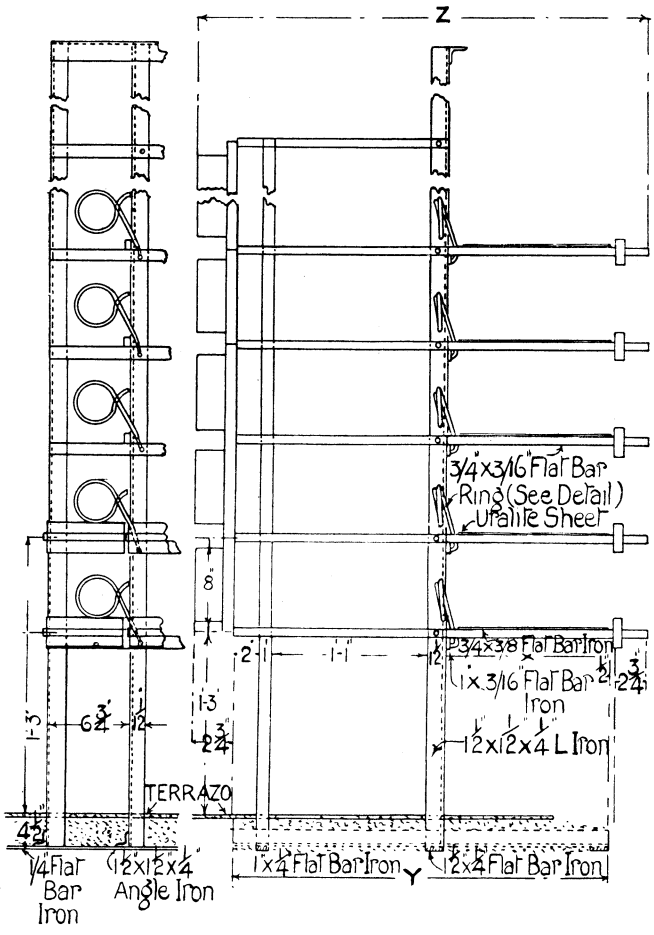

Fig. 4.

At No. 10 *Exchanges* the I.D.F. is combined with the M.D.F. and forms part of the same structure, the vertical members of the latter being made higher to carry the channel irons for the blocks which constitute the I.D.F. portion. Cross-connection strips are mounted on both sides of the frame in a similar manner to the fuse mountings and protector strips on the M.D.F. below, and the cabling is carried vertically up both sides in the same way. On the M.D.F. side of the I.D.F. portion, however, the strips are mounted horizontally on their supports to suit the cabling to the line relays. The main copper earthing bar runs below the bottom channel irons on this type of frame.

At No. 1 *Exchanges* the I.D.F. forms a separate structure—being combined sometimes with the relay and meter racks—but it is built up in exactly the same way, although the members are of smaller section. The assembly of cross-connection strips is identical with that on the combined frame.

Some variation has taken place in the wiring arrangements, but the following is now recognised as standard practice:—

On M.D.F. side are fitted 60-tag strips, 3 tags per circuit, and on the Exchange side 80-tags per circuit.

On M.D.F. side the cabling runs:—

	Tags.		
Tip	1	Cable to Protectors M.D.F.	Cable to Multiple Jacks.
Ring	2		
Sleeve	3	Cable to Meters	

On switchboard side the cabling runs:—

	Tags.	
Tip	1	(i) Cable to answering Jacks and Lamps.
Ring	2	
Sleeve	3	(ii) Cable to Line and Cut-Off Relays.
Lamp	4	

Three-wire jumpers run across the frame to connect the two halves of the circuit together. The three jumpers are threaded through the fanning holes in the cross-connection strips, run horizontally to the jumper ring on the required vertical, through the ring, and up, across or down to the fanning holes of the strip on the other side. The smaller rings used on the main frame are not fitted on the I.D.F. Uralite sheets are laid on the channel irons to form shelves for the horizontal jumpering.

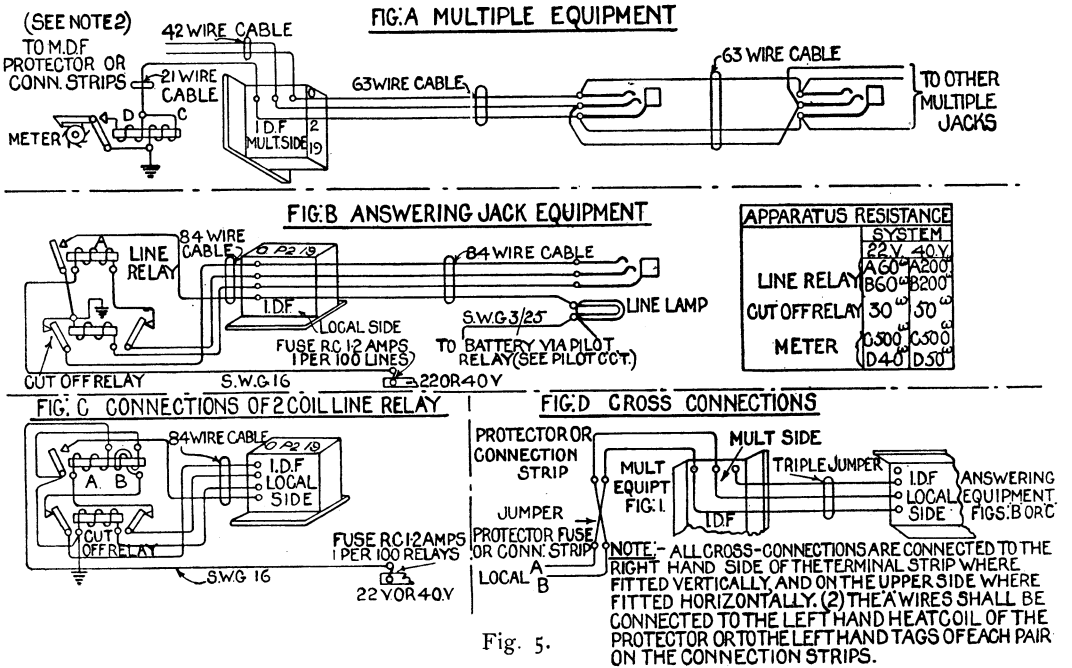

Fig. 5.

M.D.F.

Showing Cabling Scheme.

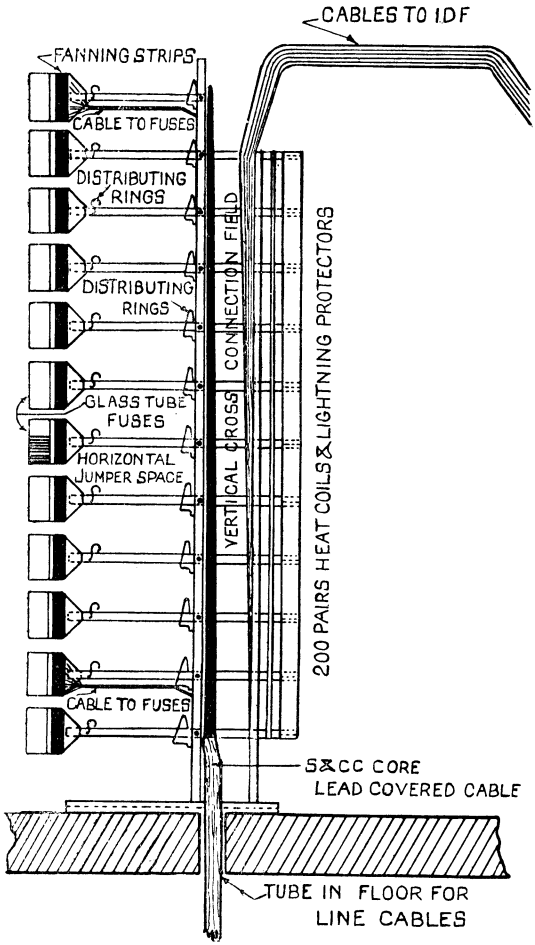

Fig. 6.

CABLING.

The methods made use of in cabling an Exchange Main Distributing Frame are shown in Fig. 6.

Line Cables.—As already mentioned a 200 pair/10 lead covered, silk and cotton core cable, beeswaxed, passes up through a floor tube at the foot of the vertical it serves. The lead sheathing is removed upwards from a point some 12 inches above the ending of the tube. It is the practice to secure a lead cap to the sheathing, immediately over the tube, in such a way as to permit of its falling over the open end, thereby sealing the aperture. The stripped portion of the cable is carried up the right hand or vertical section of the frame, the constituent wires being carefully laid up to preserve cable formation, and laced with twine immersed, prior to use, in molten wax. The tie at every turn of the lacing should be made with a self-binding knot, to prevent the lacing running back to the cable butt. The cable is lashed with lacing twine to the cross bars of the frame and so obtains a rigidity as firm as that of the structure itself. At each cross bar 20 pairs of wires are turned out from the rising cable and led away to the fuse mounting with which the bar terminates. These pairs are laid up and lapped with adhesive tape between the main cable and the fanning strip of the fuse mounting, in order to insulate them from the bar along which they run, to protect them in crossing the horizontal jumper field, and to form them into a convenient branching cable.

Main Frame and I.D.F. Cabling.—42-wire switchboard cables link up the arrester side of the Main Frame with the connection strips upon the multiple side of the I.D.F., as illustrated in Fig. 6. These cables enter the frame from the top, and pass downwards, dropping one cable at each cross bar where it terminates upon 20 combined arresters and heat coils in the case of the main frame, and upon a connection strip in that of the I.D.F. The 63-wire cables connecting the latter frame with the multiple jacks, and also the 84-wire cables running from its local side to the switchboard calling and answering equipments, and to the relay rack, are similarly dealt with. The following details may be taken as applying generally to both frames. The cables are secured by twine with neat ties to the cross bars. As the type of cables used is highly suscept-

ible to atmospheric moisture, that section of it which is stripped of its cover to allow of termination upon arresters or connection strips is immersed in molten beeswax at boiling point, and is left so immersed until all air bubbles have ceased to appear upon the surface of the wax. When taken out the wires are carefully wiped to remove all superfluous wax, and then laced out upon a cable forming or lacing board. A description of this board together with some notes as to how it is used are given in Technical Pamphlet D.17.

RUNNING JUMPERS.

The *jumper* or *cross-connecting* wire fills a very important place in the economy of a telephone exchange owing to the cheap and speedy manner with which it connects up points upon opposite sides of the M.D.F. or the I.D.F. It thus permits practically the rest of the Exchange plant to be laid down upon permanent lines, while allowing all the changing conditions to be met.

The wire used is of the flameproof type, 12½, and is supplied as a single, one pair, triple and two pairs. To facilitate running out, the wire coil is placed upon a Swift in smaller exchanges, but in large exchanges an iron drum or reel of special construction is permanently fixed at each end of the two frames. In a vertical line with the drum an insulated ring is bolted to each cross bar, with its loop downwards, and these serve as guides when jumpers are run. Jumper wiring runs horizontally in the left hand section of the frame, vertically in that of the right. The free end of the wire is taken from the drum through the guide ring serving the horizontal section in which the fuse mounting or the connection strip to be joined up is located, and so by way of the small jumper ring at the end of the cross bar, and the fanning strip, to the relative soldering tags upon the right-hand side of the fuse mounting or the strip. The ends are stripped of their covering, the exposed wires carefully cleaned, made off, and secured with solder.

Technical Pamphlets for Workmen.—Amendments,
P.W.-D.18. *January,* 1931.

Page 19. *Line* 9. *After* Technical Pamphlet D.17 *add* Cable S. & C.C. has now been abandoned in favour of Cable E.S. & W.C. for all new work.

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One end of the jumper is now terminated. The wire running back to the drum is next taken to the opposite side of the frame, to the point at which the required vertical meets the horizontal run, is measured off, cut, passed through the large jumper ring and led up or down the vertical run to the allotted arrester or connection strip. Any surplus wire run out is wound back upon the drum, and the guide ring utilised left free for future service. It is essential that the jumper length between the large and small rings referred to should be held taut diagonally across the jumper field, in order that other rings may not be blocked.

The withdrawal of a disused jumper wire, consequent upon the recovery of a circuit, or its diversion to another part of the frame inaccessible to the jumper length hitherto in use, is an operation requiring considerable care. In the course of time jumper runs become congested, and a lack of care in the withdrawal may result in serious damage to the insulating cover of adjacent wires. A certain percentage (varying with the length, type and condition of the frame) of recovered jumpers should be capable of re-use. Each length on withdrawal is examined for insulation damage, tested for continuity, measured, coiled up, its length marked and stored to be re-run as occasion demands.

FRAME M.D. $\frac{40n}{320}$.

P.W.—D.18.

Page 20 and 21. *Delete all paragraphs under FRAME M.D.* $\frac{40n}{320}$ *and insert :—*

Frames M.D. $\frac{40n}{320}$ and $\frac{0}{240}$.

The $\frac{40n}{320}$ frame, which was designed in the first instance for use in connection with large private branch exchange installations, where the majority of the lines are internal and where space is limited, is a structure suitable for fitting against the wall of the switchroom. It has been used at small public exchanges and is mentioned here for that reason. The design has, however, been recast and the frame is now superseded by the $\frac{0}{240}$ type which allows for greater flexibility and is more adaptable for installations either at a large private branch exchange or in a small public exchange.

The $\frac{0}{240}$ type has been designed to provide a frame that can be utilised for terminating and cross-connecting all classes of circuits—internal lines not requiring protection, lines with fuses only, and lines fully protected with fuses, heat coils and protectors.

It is a wall fitting type and consists of two verticals, each capable of accommodating on the front six strips, which may be all fuse mountings or all protectors and heat coils with fanning strips, or all connection strips, or a mixed combination of any of the three. The apparatus strips are not supplied with the frame unless specially called for, but all the fitting details for these items are supplied fixed in position, with the exception of the metal screws for securing the connection strips to the fixing clips and the wood screws for securing the fanning strips to their clips, which are supplied tied to the clips on which they are to be used. The full equipment of jumper rings and earth wire thimbles is supplied fitted in position on the frame.

The frame is suitable for extending in either direction, and four bolts and nuts required for this purpose are supplied fitted in the bolt holes drilled in the bent ends on the right of the four main long horizontal bars. Distribution is carried out on the front; the position of the jumper rings renders it possible for the cross-connecting wires to be run without touching the metal work of the frame. The ironwork is served with two coats of best French grey paint before issue; the inner sides of the screws fixing the protectors in position and the bolts and nuts securing the earth wire thimbles, and also the surfaces facing these attachments are left bright and clean in order to secure good electrical contact.

The front vertical bars are of flat iron made up in eleven inch lengths which are tapped on the front to take fuse mountings, and have clear holes through them transversely for fixing clips to which connection strips can be screwed. When it is necessary to fit protectors and heat coils, the requisite number of lengths of the front bars are removed, and the protector strips and fanning strips are fitted between any two of the horizontal members which run from back to front every eleven inches. These horizontal members are tapped on the sides near the front for the fixing screws which secure the protector strips in position, and are also fitted with brass clips to which the fanning strips are attached.

When used at a public exchange, the *lower* portion of the frame is reserved for the line cables and the *upper* portion for the switchboard cables. The same arrangement applies generally for P.B.X.'s, although naturally the apparatus fitted may vary to meet the requirements.

DISTRIBUTION CASES.

These are wooden cases fitted with terminal strips.

A list of them with dimensioned sketch of general arrangement is given in Fig. 7.

They are used for distribution only, protection from lightning and power circuits not being afforded by them, and their use is confined to Private Branch Exchanges where a main distributing frame is not required or cannot be fitted, and to the wiring of buildings serving several subscribers.

The 10-wire size included in the list is not standard; it was proposed for special cases, but a "Block Terminal" will be used instead.

The 480-wire size is being abandoned in favour of either a "main distributing frame," or two or more "distribution cases" of a smaller size.

Case, Distribution, 20-wire, is a wooden case fitted with 40 terminals, in 2 rows of 20. The 20-wire part of the title refers to the number of wires in the main cable or the sum of the number of wires in the main cables that have to be distributed to subscribers' instruments by means of other smaller cables.

The terminals are of the screw and soldering tag type. The permanent connections, *i.e.*, the main cables and the subscribers' cables, are connected to the soldering side of the tags.

Cross connections or jumper wires between the two sets of cables are connected to the screw side of the tags on the respective strips. The jumper wires pass through "Rings, jumper," to the top of the case and back (as shown in the diagram).

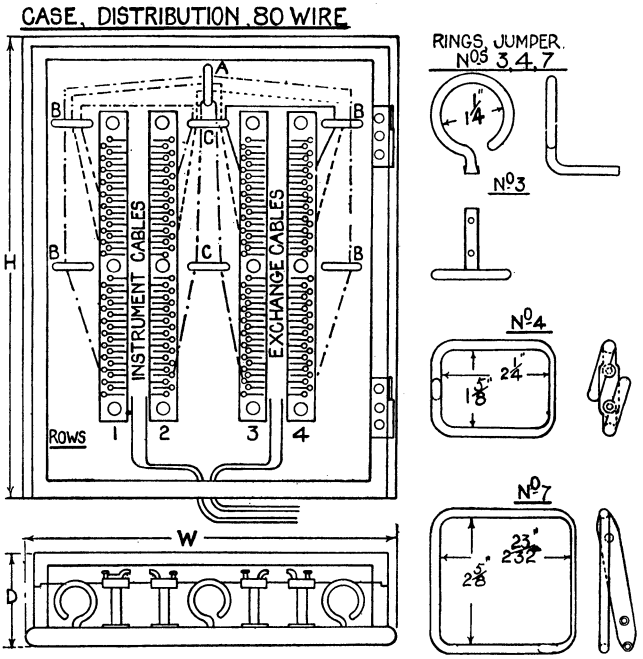
The terminal strips for these cases are made in three sizes, viz. :—

Strip Conn. No. 2 20 screw tag terminals.
Strip Conn. No. 45 40 screw tag terminals.
Strip Conn. No. 3 80 screw tag terminals.

The details of the "Rings, jumper," used are given in Fig. 7.

The cases for 20, 40 and 80 wire and some for 160 wire are fitted with hinged covers, and the covers can be lifted off the hinge pins, which point upwards, taking the jumpering end of the case as the top of the case.

In the older type of cases small labels, one for each pair



CASE DISTRIBUTION NO OF WIRE (AS UNDER)	SIZE W.	SIZE H.	SIZE D.	STRIP CONNECTION NO OF ROWS	STRIP CONNECTION QTY	STRIP CONNECTION TITLE NO	RINGS, JUMPER A QTY	RINGS, JUMPER A TITLE NO.	RINGS, JUMPER B QTY	RINGS, JUMPER B TITLE NO.	RINGS, JUMPER C QTY	RINGS, JUMPER C TITLE NO.	LABELS QTY	LABELS TITLE NO.
10 WIRE (MARK 234)	5	11 3/4	3 3/8	1	1	NO2	-	-	-	-	-	-	1	122A
20 WIRE	10 7/8	9 1/2	3 3/4	2	2	NO2	1	NO3	-	-	-	-	20	NO27
20 WIRE (MARK 234)	9 1/4	13 1/8	3 5/8	2	2	NO2	1	NO3	-	-	-	-	1	122B
40 WIRE	10 7/8	17	3 3/4	2	4	NO2	2	NO3	-	-	-	-	40	NO27
40 WIRE (MARK 234)	15 1/8	13 1/8	3 5/8	4	4	NO2	4	NO3	2	NO3	1	NO3	1	122C
80 WIRE	12 1/2	27	5 1/4	2	2	NO3	-	-	-	-	4	NO3	80	NO27
80 WIRE (MARK 234)	15 1/2	19 3/4	3 7/8	4	4	NO4S	4	NO3	4	NO3	2	NO3	1	122D
160 WIRE *	15 5/8	33 1/8	6	4	4	NO3	1	NO7	8	NO3	4	NO4	160	NO21
160 WIRE (MARK 234)	16 1/8	33 1/8	5 7/8	4	4	NO3	2	NO3	8	NO3	4	NO3	1	122E
240 WIRE *	21 5/8	33 1/8	6	6	6	NO3	2	NO7	8	NO3	8	NO4	240	NO21
480 WIRE *	39 5/8	33 1/8	6	12	12	NO3	5	NO7	8	NO3	20	NO4	480	NO21

* IN THESE ITEMS THE DOORS ARE NOT HINGED BUT LIFT OFF

Fig. 7.

of terminals, were used. In later cases these small labels are replaced by ruled enamelled iron tablets suitable for pencil writing and for easy erasure of pencil marks. The erasure can be made either by a moist rag or by ordinary indiarubber. One label of this type is used for each size of distribution case. The vertical columns in the labels correspond to terminal pairs on the terminal strips in each. The 20, 40 and 80 wire sizes of case are issued with the cable opening already made in the lower end of the case.

For the larger sizes the cable openings are required to be made locally to suit the local requirements.

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LIST OF

Technical Pamphlets for Workmen.

(*Continued.*)

GROUP E.

1. Automatic Telephone Systems.

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2. Subscribers' Apparatus C.B.S.
3. Subscribers' Apparatus Magneto.
4. Private Branch Exchange—C.B.
5. Private Branch Exchange—C.B. Multiple, No. 9.
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7. House Telephones.
8. Wiring of Subscribers' Premises.

GROUP G.

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2. Power Plant for Telegraph and Telephone Purposes.
3. Maintenance of Power Plant for Telegraph and Telephone Purposes.
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9. Electrolytic Action on Cable Sheaths, etc.
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1. Submarine Cables.

GROUP K.

1. Electric Lighting.
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