PATENT SPECIFICATION

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DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Rack-Mounting Arrangements for Electrical apparatus

We, AUTOMATIC TELEPHONE & ELECTRIC COMPANY LIMITED, of Strowger Works, Liverpool 7, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to rack-mounting arrangements for electrical apparatus and although it will find application in automatic telephone exchange installations it is not necessarily limited thereto.

In automatic telephone exchange installations and the like, the well established practice is to mount switching and control apparatus, usually of an electromechanical nature, in laterally extending rows, or so-called shelves, between the upright members of a substantial main framework standing vertically upon the floor. In large exchanges involving many equipment racks, the racks are arranged in edge-to-edge relationship to form a suite and are often secured by means of tie-bars extending from the ceiling of the apparatus room. A plurality of such suites may be disposed in parallel manner with convenient alley-ways between them. Inter-rack and inter-suite cables are usually accommodated in over-head cable runways.

Two forms of equipment rack have been employed, viz: so-called single-sided and double-sided racks. The main merit of a single-sided rack, with its equipment arranged over one face, has hitherto been the accessibility which it gives to and for cabling and wiring at its rear face. On the other hand a double-sided rack has the obvious advantage that an increased amount of equipment can be mounted upon it, since both faces are employed for equipment mounting purposes. However, in the latter case the complexity of the mounting arrangements is increased since hingeing arrangements of one form or another have to be provided at one or both of the faces to provide a reasonable degree of accessibility to the internal cabling and wiring areas during manufacture, installation and maintenance.

In any type of telephone exchange installation or the like it is desirable that, during installation and normal service and also in the course of such processes as modifying or adding inter-rack and inter-suite cabling for extension or other purposes, the equipment should be as free as possible from the depositing of dust and other foreign matter, such as wire strippings and solder drips.

In recent years many proposals have been forthcoming and some have been put into practice, whereby racks are provided with dust covers or doors so that the whole of the contents are enclosed in a relatively dust-free environment under operational conditions. In these circumstances it may be considered that the provision of individual dust covers for the selector mechanisms, relay sets and the like may be dispensed with. However, those internal areas of the racks containing the switching and control apparatus, are still prone to the deposit of foreign matter during much of the installation period and during modifications to the cabling.

The object of the present invention is to provide improved rack-mounting arrangements for electrical apparatus, typically for use in telephone exchange installations. The invention envisages the provision of such arrangements having an elegant and modern appearance and which nevertheless are relatively simple and convenient in assembly and manufacture, which provide adequate protection of the electrical apparatus against breakage and the ingress of foreign matter at all stages whilst permitting ready access to the apparatus, and which simplify inter-rack and inter-suite cabling and wiring.

According to the present invention a mounting arrangement for electrical equipment com-

[*Price 4s. 6d.*]

prises a plurality of racks connected together in side-by-side relationship to form a suite with the side walls of each rack forming an equipment mounting zone therebetween, the side walls of the adjacent rack sides forming a vertical cable duct therebetween and openings in said rack side walls some of which are closed by terminal blocks whereby the wiring connections of electrical equipment mounted within each rack can be terminated at the electrical equipment side of the terminal blocks and external wiring connections for the electrical equipment can be arranged in the vertical cable ducts and terminated on the cable duct side of the terminal blocks.

According to a feature of the invention a mounting arrangement for electrical equipment comprises a plurality of equipment mounting zones in side-by-side relationship with side walls closing the sides of the equipment zones and forming vertical cable ducts between adjacent zones, top and bottom plates extending between the side walls of the zones to roof and floor said zones and cover plates or the like for closing the faces of each zone, the side walls of the equipment zones having openings therein which are closed by terminal blocks and the like where necessary by closure plates to effect a total enclosure of each equipment zone, and the arrangement being such that the wiring connections of electrical equipment mounted within each equipment zone can be terminated on the side of the terminal block presented to the equipment zone whereas the external wiring to the electrical equipment can be arranged within the vertical cable ducts and terminated on the cable duct side of said terminal blocks.

According to a further feature of the invention a mounting arrangement for electrical equipment comprises two horizontal cable ducts vertically spaced apart with vertical cable ducts extending therebetween and forming together with front and rear face walls a totally enclosed electrical equipment mounting zone between each adjacent pair of vertical ducts, the cable ducts being totally enclosed and the interiors of at least the vertical cable ducts being accessible by readily displaceable face cover plates or the like, at least one of the face walls of each equipment zone comprising one or more readily displaceable additional cover plates or the like giving access to the equipment zone said vertical ducts having openings in their side walls which are closed by terminal blocks and the like and where necessary by closure plates and the arrangement being such that the wiring connections of electrical equipment mounted within each equipment zone can be terminated on the electrical equipment side of the terminal blocks and external wiring for the electrical equipment can be arranged in the vertical ducts and terminated on the cable duct side of the terminal blocks.

According to a still further feature of the invention a mounting arrangement for electrical equipment comprises a plurality of vertical wall sections horizontally spaced and connected together to define alternate electrical equipment mounting zones and vertical cable ducts extending between front and rear face walls of the arrangement, the first and last of said wall sections each forming a side wall of end vertical cable ducts for the arrangement, continuous horizontal cable ducts above and beneath said wall sections which communicate with the vertical cable ducts, separate readily displaceable cover plates or the like, giving independent access to the equipment zones and to at least the vertical cable ducts, being included in said face walls.

The various features and details of the invention will readily be understood from the following description of one method of carrying it into effect which should be read in conjunction with the accompanying drawings comprising Figs. 1, 2 and 3. Of the drawings:—

Fig. 1 is a general view of two suites of racks in their completed form;

Figure 2 shows a section of the vertical cabling and wiring chamber or duct for two adjacent equipment racks; and

Fig. 3 discloses details of the basic skeletonised rack construction arrangements, in that the lower portion of one end (the so-called growing end) of a suite is illustrated.

All these drawings relate to a form of construction which *inter alia* is suitable for crossbar switch telephone exchanges of the kind described in British Patent No. 890,235, which are known as the "5005 Type" and which employ the so-called self-steering principle in the setting-up of connections.

Considering the two-suite equipment racking arrangement shown in Fig. 1, the suites 10 and 11 are substantially identical in appearance and from the point of view of equipment mounting capacity each suite may be considered as being equatable to five conventional double-sided racks. Thus five columns of equipment such as those designated 12, 13, 14, 15 and 16, each comprising ten so-called equipment shelves, are accommodated at, and accessible from, each face of the suite. The various shelves, such as 17, typically contain a crossbar switch and an allied group of electromagnetic relays together with ancillary devices and, in the normal working condition of the apparatus, the equipment-side, as distinct from the wiring-side, of each shelf is presented towards the outside of the suite. The front and rear faces of a suite are identical in external appearance and therefore the columns of equipment presented to the two faces are in corresponding positions. Accordingly, two columns of equipment, one relevant to each face, are normally in back-to-back relationship and occupy in a very efficient manner a zone extending directly from one

face of the suite to the other. The height and width of this equipment zone is more or less delineated on each face by the area ~~torally~~ embraced by a column of ten windows 18.

Each window comprises a pressed-metal frame and a sheet of transparent and unshatterable material such as polyvinychloride (p.v.c.). The inner surface of each window frame has a layer of synthetic compressible material affixed to it. When a window is in the closed position, as those which are represented in Fig. 1, the synthetic material is compressed against vertical side members and upper and lower cross-rails 19 of the rack structure to provide a good seal against the ingress of dust. Each window is provided with two spring-loaded catches 20 upon its upper edge and these are arranged to co-operate with a pair of corresponding devices 21, located upon the cross-rail 19 above, to retain the window closed. The lower edge of each window has two laterally extending pivot members 22 which are located in bearings also provided by the beforementioned devices 21 upon the cross-rail below. Thus an individual window may be opened by withdrawing the catches on the upper edge, allowing it to pivot about its lower edge, and in the fully open state that window will overlay the one immediately below. In order that a window may be fully detached if required, one of the lower pivots is spring-loaded to enable it to be withdrawn from the housing provided by the relevent device 21.

It may be mentioned at this juncture, that in the particular example each shelf of equipment, involving typically a cross bar switch and relays housed in a frame, is pivotally mounted (about its lower front edge) with respect to rigid uprights of the rack structure. In addition to the pivoting arrangements, articulated arms (not shown) are provided and extend between the sides of the shelf frame and said rigid uprights. The function of these arms is to provide two limit positions of stable equilibrium for the shelf, the first being when the shelf is in its normal vertical working position, and the second being when it is pivoted outwardly through the window space to a substantially horizontal position where it permits access to the wiring side of the equipment.

Still considering the general external arrangements represented in Fig. 1, it is observed that a sectionalised so-called "kicking-strip" 23, mainly of wood, is provided around the base of each suite. The sections of the kicking-strip are attached to cover-plates such as 24 and 25, extending to the base of the suite and which are of formed sheet metal. The cover-plates are secured to the internal framework and add to the rigidity of the whole structure. Cover-plates of a similar nature, such as 26 and 27, each fitted with part of the kicking-strip, are also provided towards the foot of each near-end section (Fig. 1) of each suite. Each of the said near-end sections extending the width of each suite, incorporate supervisory equipment and the like for the relevant suite. The left-hand end of each suite, which does not involve such an equipment section, is also provided with corresponding cover-plates of a somewhat different configuration as will be seen from Fig. 3.

However, the various cover-plates mentioned above, define an enclosed channel, along the base of each suite, for use as a cable duct embracing the whole of the rack suite.

Various other cover-plates of the suites, such as 28 and those constituting the side-walls of the installers cable trough (with its internal runway structure) which forms the whole of the upper extremity of each suite surmounting the equipment zones, are also permanently attached to the internal structure. It may be pointed out that the cable troughs, which are fitted with groups of alarm lamps 29 at suitable points, would be closed on the upper faces by readily detachable covers to form dust-free ducts. The cable-troughs which are joined at suitable positions by inter-suite ducts, such as 30, also have upper detachable covers.

Reverting again to the consideration of the main faces of the rack suite, it will be noted that the equipment zones are effectively spaced apart, and moreover the end supervisory section is likewise spaced. Each of the intervening areas, on both sides of the suite, superficially comprise three doors such as 31, separated by metal lateral members 32 and 33 which are permanently secured to vertical members of the internal framework structure. The lateral members 32 each carry a pair of battery supply jacks 41.

The doors 31, which have recessed handles such as 34, are provided with bearing pins to enable them to be pivoted outwardly along one vertical edge, and accordingly the members 32 and 33, the cover-plates 24 and the like and also the relevant parts of the upper cable trough are provided with appropriate housings for the bearing pins. The latter are spring-loaded to enable them to be withdrawn sufficiently to permit complete removal of a door. In practice two pairs of bearing housings are provided for each door so that if need be a door may be turned over and pivoted from the right of the aperture instead of the left.

Any column of doors, such as 31, and a similar column of doors in the corresponding position on the other side of the suite give access to a vertical cabling and wiring duct which runs into the previously mentioned ducts extending along the base and top of the rack suite.

It is now convenient to allude briefly to some features of the right-hand end-sections of the suites. As already mentioned each of these serves to mount general supervisory and control equipment appertaining to the suite. The typical end face has two detachable metal

cover-plates 35 and 36, and other smaller cover-plates, such as 37 and 38, which may be permanently fixed to the internal structure. The inside faces of the detachable cover-plates have adherent strips of synthetic resilient material towards the edges so that, when the cover-plates are in position with the material abutting the internal structure, the ingress of dust to the functional equipment areas is impeded. When the cover-plates 35 and 36 are removed, access may be obtained to such functional equipment as relays mounted on plates which are hinged upon the internal structure to permit access to their wiring sides.

Each typical end-section (near end only) also incorporates a recessed container 39 for main supply fuses and a flush-mounted control panel 40 incorporating, for example, key and lamp strips, tone-supply jacks and the like. The control panel is hingeable outwardly along its lower edge so that access may be gained to its inner face.

Reference will now be made particularly to Fig. 2 which illustrates a portion of the face of the rack suite, with one of the middle row doors 31 open to display a part of the vertical cable duct between two rack equipment zones. In this view, the rear of the recessed handle 34 of the door can be seen and moreover the horizontal limbs of the spring-loaded bearing pins 56 and 57 of the doors are shown. If it is required to detach the door completely, said limbs would be drawn together slightly to disengage the bearing pins from the housing in the lateral members 32 and 33.

The sides of the door aperture comprises substantial U-section steel members, such as 58, forming part of the skeleton of the rack structure and extending from the base of the suite to the upper cable duct. The previously-mentioned cross-rails 19 are secured to the vertical members 58.

The side-walls 50 and 51 of the vertical cabling and wiring duct, which are formed from sheet steel and have a substantially W-shaped cross-section, each extend from the upper boundary of the lower cable duct to the lower boundary of the upper duct, and perform the important function of separating the vertical duct from the previously-mentioned equipment zones. The re-entrant central portion of W-form of the side walls is appreciably smaller in depth than the width of the outer limbs thereof, as will be brought out clearly when Fig. 3 is referred to later. The side extremities of the outer limbs of each side wall are secured by screws, at fairly close intervals, to the inside faces of vertical members such as 58 in corresponding positions on opposite sides of the suite. With the two side-walls of a duct in position, with their re-entrant portions in line, one face of each side-wall, making an angle of approximately 45 degrees with the front face of the suite, is easily accessible through the open door. A similar state of affairs would apply at the other side of the rack-suite. The gap between the opposing side-walls, together with the central re-entrant portions of the side walls in this vicinity, provide a convenient vertically-extending central space for cables 55 comprising installer's and inter-shelf cables.

The side-walls are provided with two rectangular cut-outs which are clearly illustrated in Fig. 3, corresponding to each equipment shelf. The lower cut-out of each pair accommodates a close-fitting tag-block 52 with double-ended tags, and the tag-ends emerging from one face extend into the relevant equipment zones whereas those corresponding tag-ends of the other face extend, as shown, into the vertical duct. In some cases the upper cut-out of each pair accommodates a close-fitting fuse mounting 53. Other upper cut-outs, which are not used, are filled by suitable closure plates. When the tagblocks, fuse mountings and closure plates are mounted in the side-walls of the various vertical cable ducts, the ingress of dust and other foreign matter to the equipment zones from or by way of said ducts is virtually eliminated.

It may be mentioned that each shelf equipment, incorporating typically (as already mentioned) a crossbar switch and electromagnetic relays, is served for example by two tagblocks such as 52 one in each of the vertical cable ducts bounding the relevant equipment zone. Thus each shelf would be connected over two relatively flexible cable tails (permitting hingeing of the shelf as described) to the tag-ends on the inner faces of the appropriate tagblocks individually. The installer's cables and local inter-shelf wiring within the vertical duct are terminated as required on the readily accessible tag-ends presented within the duct.

It should be mentioned that the cabling illustrated, some of which may be inter-rack or inter-suite cabling extending by way of the upper cable duct, is only typical, and other cables would extend to tagblocks of the lower equipment shelves. Moreover other cables may extend upwardly from the lower duct. Battery supply busbars (not shown in Fig. 2) are also accommodated in the vertical ducts, and these would be connected to main busbars extending through either the lower or upper horizontal duct.

With further regard to the vertical cabling ducts, it is pointed out that adequate access is provided to the tagblocks to enable wiring connections to be made by so-called gun wrapping techniques.

It should also be understood that a vertical cable duct arrangement, identical with that just described, is provided intermediate the right-hand equipment zone and the adjacent end-section of each suite so that the said equipment zone and the equipment within the end

section are effectively separated from that duct in respect of the ingress of dust and other particles.

As regards the left-hand end, or so-called-growing end, of each suite, this is not provided with an equipment-carrying end-section and it therefore suffices to introduce an end duct approximately half the width of the others which nevertheless extends the height of the suite, and from face to face thereof, to join the lower and upper cable ducts. Thus the last equipment zone of the suit is provided with one W-shaped side-wall upon which the necessary tagblocks, fuseholders and closure plates are mounted. Pairs of detachable doors, equal in height to the doors 31 but of different configuration, are provided to complete the enclosure of the end duct in a manner which will be deduced later from Fig. 3.

Fig. 3 which shows internal details of the lower left-hand portion of the suite illustrated in Fig. 1, will now be described and it may be noted that the general principles of construction apply throughout the suite. The particular portion illustrated in Fig. 3 would accommodate six hingeable equipment shelves, and from the illustration the general configurations of the extreme left-hand duct of the suite, a typical intermediate vertical duct and the lower common duct can be visualised.

In the illustration six U-section vertical members 58 of steel serve to define the corners of an equipment zone and the corners of the vertical cable duct to the right. The left-hand front pair of vertical members 58 are linked together at their lower ends by a steel L-shaped lateral member such as 64 and the corresponding pair of rear vertical members are linked in a similar manner by member 65, corresponding pairs of vertical members are linked together throughout the suite. Similar arrangements (not shown) would be provided at the top end of the structure immediately below the upper cable duct. Within the limits of the vertical cable duct, steel bracing members such as 76 are secured to the lower ends of vertical members 58 on both sides of the structure, and similar bracing arrangements would be provided at the upper extremities of said vertical members.

Corresponding vertical members at the front and rear of the structure are secured together at intervals by steel U-section bracing members, such as 66, and by intermediate steel strip members 67. Each of the side walls 60, 61 and 62 of the vertical cable ducts is secured to vertical members 58 in corresponding positions of both sides of the structure, the side walls being provided, as already described with pairs of cut-outs 63 corresponding to each shelf equipment position. As regards the vertical duct which is shown to the right of the drawing and which is typical of all the intermediately positioned ducts of the complete suite, pairs of small metal tie-bars 73 are provided at vertically spaced intervals to link the opposing side-walls. These pairs of tiebars, although adding to the rigidity of the structure, are primarily intended to assist in the location of the cables within the duct. The partly visible U-shaped members such as 77, secured at intervals to the extreme left-hand side-wall 60, also serve as cable guides in the end cable duct.

The framework of the equipment zone is completed by the steel cross-rails 19 extending between, and secured by screws to, appropriate vertical members 58. These cross-rails besides imparting rigidity to the structure are provide with devices such as 21 which are for use in conjunction with the shelf-position windows as already mentioned.

It is to be noted that the typical equipment area is provided with a floor of sheet steel comprising a rectangular portion 74 and two end portions such as 75, the latter portions being arranged to fit snugly into the W-configuration of the duct side-walls 60 and 61 respectively and are preferably welded thereto. The portion 74 is secured by screws to the lower cross-rails 19 and the end portions 75. It is important to note that the floor of the equipment zone will separate that zone from the lower cable duct when the structure is fully equipped. Moreover it should be understood that components corresponding to 74 and 75 would be utilised in a similar manner at the top of the equipment zone to provide separation from the upper cable duct.

U-shaped bearing housings such as 68 and 69 are secured to opposing faces of the vertical members 58 on the basis of one pair for each shelf equipment portion. Each pair of housings 68 and 69 is adapted to take the bearing pins of a shelf equipment frame so that the bearings of said frame are lowered into the housings. The frame may be hinged about these bearings after the manner already described.

The cable duct at the left-hand end of Fig. 3 will now be discussed briefly. A lower cover-plate 70 of symmetrical shape, corresponding in height to the beforementioned cover-plates 25 and 24, and having chamfered corners is secured to the vertical members 58 towards the end of the suite. The cover-plate 70 is faced with a section of the beforementioned kicking-strip 23 which is therefore continuous around the foot of the suite. A metal rail 71 at the same height as the cross rail 32, and similar in plan view to cover-plate 70, has its ends affixed to the two vertical members. A bracing member 72 of formed sheet steel has its ends secured at the mid-positions of cover-plate 70 and rail 71. The aperture provided at each side of member 72 would eventually be closed by a readily detachable door arranged to be pivotally mounted adjacent member 71 in bearings included in cover plate 70 and rail

71. Six such doors would be provided at the end of the complete suite, and accordingly another rail, such as 71 and two other members such as 72 would be utilised in corresponding positions above, the upper extremity of the topmost member 72 being secured to a fixed and suitably shaped cover plate (not illustrated) which effectively closes the end of the upper cable duct.

From all the foregoing description it will now be appreciated that a fully enclosed equipment-mounting arrangement is provided which gives adequate accessibility to all parts of the interior. Moreover each equipment zone accommodating twenty shelves of equipment, ten at each side of the suite, is a separate compartment adequately sealed against ingress of dust and other particles, both from the exterior of the suite or from the various cable ducts, even when the latter are opened while necessary work is in progress therein. Also the suite end-sections carrying supervisory equipment are provided with dust-free zones for the functional equipment.

It will be appreciated that many modifications in the apparatus described are possible without departing from the scope of the invention. For example, the flexible cable tails emanating from each shelf of equipment may each be terminated on a multi-point connector adapted to be plugged into the rear of a modified type of tagblock (replacing tagblock 52) mounted in the side-wall of a cable duct. According to this method all the vertical cable ducts, comprising essentially (in the case of all intermediate position ducts) four vertical members 58 suitably braced together, two side-walls fitted with tagblocks, fuse holders and closure-plates and the relevant doors are assembled as a complete entity and all necessary inter-shelf cabling and wiring appropriate to the twenty shelves served by the duct, as distinct from incoming and outgoing installer's cables, would be fitted and connected. The suite end-section, for the supervisory and like equipment, would be assembled. The cable-duct for the growing end of the suite, and including two braced vertical members 58, a side-wall fitted with tagblocks, fuse holders and closure plates together with other necessary components, such as doors would be assembled and the local inter-shelf wiring completed. All the above assembly and wiring operations would be factory processes as distinct from installation processes.

These relatively compact assemblies would be sent to the installation side together with a quantity of previously-mentioned cross-rails 19, equipment-position windows, lower and upper plates such as 74, for the equipment zones, and such lower cover plates, with kicking-strips, and the like, as are not included in the before-mentioned assemblies. Components of the upper cable runway would also be supplied.

On site, the vertical ducts would be mounted upon the floor in predetermined spacial relationship and then linked together by the cross-rails 19, and the aforesaid plates 74 fitted. The building of the skeleton of the suite then proceeds in any suitable order. At some suitable stage, the end supervisory section is fitted, and plug-in electrical connections are established between the equipment thereof and the appropriate duct tagblocks. The shelves of equipment are installed from the faces of the suite, the relevant multi-point connectors terminating the cable tails being plugged into the rear of the appropriate duct tagblocks, whereupon the windows are fitted to complete the enclosure of the functional equipment in dust-free environment. When all these assembly operations, and others of a minor nature, have been completed the installer's cables may be run in and wired.

The advantages accruing from this method of manufacture assembly and installation are firstly, that local inter-shelf wiring, hitherto undertaken by the installer, can be effected under factory conditions, and secondly that space-consuming rack assemblies, which generally would be unequipped, are not transported to site as such but are in effect assembled in a simple manner by attachment of the appropriate cross-rails and so on, by the installer.

WHAT WE CLAIM IS:—

1. A mounting arrangement for electrical equipment and comprising a plurality of racks connected together in side-by-side relationship to form a suite with the side walls of each rack forming an equipment mounting zone therebetween, the side walls of the adjacent rack sides forming a vertical cable duct therebetween and openings in said rack side walls some of which are closed by terminal blocks whereby the wiring connections of electrical equipment mounted within each rack can be terminated at the electrical equipment side of the terminal blocks and external wiring connections for the electrical equipment can be arranged in the vertical cable ducts and terminated on the cable duct side of the terminal blocks.

2. A mounting arrangement for electrical equipment and comprising a plurality of equipment mounting zones in side-by-side relationship with side walls closing the sides of the equipment zones and forming vertical cable ducts between adjacent zones, top and bottom plates extending between the side walls of the zones to roof and floor said zones and cover plates or the like for closing the faces of each zone, the side walls of the equipment zones having openings therein which are closed by terminal blocks and the like and where necessary by closure plates to effect a total enclosure of each equipment zone and the arrangement being such that the wiring connections of electrical equipment mounted within each equipment zone can be terminated on the side

71. Six such doors would be provided at the end of the complete suite, and accordingly another rail, such as 71 and two other members such as 72 would be utilised in corresponding positions above, the upper extremity of the topmost member 72 being secured to a fixed and suitably shaped cover plate (not illustrated) which effectively closes the end of the upper cable duct.

From all the foregoing description it will now be appreciated that a fully enclosed equipment-mounting arrangement is provided which gives adequate accessibility to all parts of the interior. Moreover each equipment zone accommodating twenty shelves of equipment, ten at each side of the suite, is a separate compartment adequately sealed against ingress of dust and other particles, both from the exterior of the suite or from the various cable ducts, even when the latter are opened while necessary work is in progress therein. Also the suite end-sections carrying supervisory equipment are provided with dust-free zones for the functional equipment.

It will be appreciated that many modifications in the apparatus described are possible without departing from the scope of the invention. For example, the flexible cable tails emanating from each shelf of equipment may each be terminated on a multi-point connector adapted to be plugged into the rear of a modified type of tagblock (replacing tagblock 52) mounted in the side-wall of a cable duct. According to this method all the vertical cable ducts, comprising essentially (in the case of all intermediate position ducts) four vertical members 58 suitably braced together, two side-walls fitted with tagblocks, fuse holders and closure-plates and the relevant doors are assembled as a complete entity and all necessary inter-shelf cabling and wiring appropriate to the twenty shelves served by the duct, as distinct from incoming and outgoing installer's cables, would be fitted and connected. The suite end-section, for the supervisory and like equipment, would be assembled. The cable-duct for the growing end of the suite, and including two braced vertical members 58, a side-wall fitted with tagblocks, fuse holders and closure plates together with other necessary components, such as doors would be assembled and the local inter-shelf wiring completed. All the above assembly and wiring operations would be factory processes as distinct from installation processes.

These relatively compact assemblies would be sent to the installation side together with a quantity of previously-mentioned cross-rails 19, equipment-position windows, lower and upper plates such as 74, for the equipment zones, and such lower cover plates, with kicking-strips, and the like, as are not included in the before-mentioned assemblies. Components of the upper cable runway would also be supplied.

On site, the vertical ducts would be mounted upon the floor in predetermined spacial relationship and then linked together by the cross-rails 19, and the aforesaid plates 74 fitted. The building of the skeleton of the suite then proceeds in any suitable order. At some suitable stage, the end supervisory section is fitted, and plug-in electrical connections are established between the equipment thereof and the appropriate duct tagblocks. The shelves of equipment are installed from the faces of the suite, the relevant multi-point connectors terminating the cable tails being plugged into the rear of the appropriate duct tagblocks, whereupon the windows are fitted to complete the enclosure of the functional equipment in dust-free environment. When all these assembly operations, and others of a minor nature, have been completed the installer's cables may be run in and wired.

The advantages accruing from this method of manufacture assembly and installation are firstly, that local inter-shelf wiring, hitherto undertaken by the installer, can be effected under factory conditions, and secondly that space-consuming rack assemblies, which generally would be unequipped, are not transported to site as such but are in effect assembled in a simple manner by attachment of the appropriate cross-rails and so on, by the installer.

WHAT WE CLAIM IS:—

1. A mounting arrangement for electrical equipment and comprising a plurality of racks connected together in side-by-side relationship to form a suite with the side walls of each rack forming an equipment mounting zone therebetween, the side walls of the adjacent rack sides forming a vertical cable duct therebetween and openings in said rack side walls some of which are closed by terminal blocks whereby the wiring connections of electrical equipment mounted within each rack can be terminated at the electrical equipment side of the terminal blocks and external wiring connections for the electrical equipment can be arranged in the vertical cable ducts and terminated on the cable duct side of the terminal blocks.

2. A mounting arrangement for electrical equipment and comprising a plurality of equipment mounting zones in side-by-side relationship with side walls closing the sides of the equipment zones and forming vertical cable ducts between adjacent zones, top and bottom plates extending between the side walls of the zones to roof and floor said zones and cover plates or the like for closing the faces of each zone, the side walls of the equipment zones having openings therein which are closed by terminal blocks and the like and where necessary by closure plates to effect a total enclosure of each equipment zone and the arrangement being such that the wiring connections of electrical equipment mounted within each equipment zone can be terminated on the side

of the terminal block presented to the equipment zone whereas the external wiring to the electrical equipment can be arranged within the vertical cable ducts and terminated on the cable duct side of said terminal blocks.

3. A mounting arrangement for electrical equipment and comprising two horizontal cable ducts vertically spaced apart with vertical cable ducts extending therebetween and forming together with front and rear face walls a totally enclosed electrical equipment mounting zone between each adjacent pair of vertical ducts, the cable ducts being totally enclosed and the interiors of at least the vertical cable ducts being accessible by readily displaceable face cover plates or the like, at least one of the face walls of each equipment zone comprising one or more readily displaceable additional cover plates or the like giving access to the equipment zone, said vertical ducts having openings in their side walls which are closed by terminal blocks and the like and where necessary by closure plates and the arrangement being such that the wiring connections of electrical equipment mounted within each equipment zone can be terminated on the electrical equipment side of the terminal blocks and external wiring for the electrical equipment can be arranged in the vertical ducts and terminated on the cable duct side of the terminal blocks.

4. A mounting arrangement for electrical equipment and comprising a plurality of vertical wall sections horizontally spaced and connected together to define alternative electrical equipment mounting zones and vertical cable ducts extending between front and rear face walls of the arrangement, the first and last of said wall sections each forming a side wall of end vertical cable ducts for the arrangement, continuous horizontal cable ducts above and beneath said wall sections which communicate with the vertical cable ducts, separate readily replaceable cover plates or the like, giving independent access to the equipment zones and to at least the vertical cable ducts, being included in said face walls.

5. A mounting arrangement as claimed in claim 2, 3 or 4 in which all said cover plates are detachable and/or hingeable outwardly.

6. A mounting arrangement as claimed in claim 1, 2, 3, 4 or 5 in which said side walls are of sheet metal formed to a W-shaped cross-section with the outer limbs directed towards the equipment mounting zones and said openings are formed in said outer limbs, the spaces bounded by the re-entrant portions of said walls being adapted to contain electrical cables.

7. A mounting arrangement as claimed in claim 1, 2, 3, 4, 5 or 6 in which a supervisory section is constructed on one end of the arrangement with a vertical cable duct between said section and the equipment zone adjacent thereto and cover plates are provided for completing a vertical cable duct on the other end of the arrangement.

8. A mounting arrangement as claimed in claim 1, 2, 3, 4, 5, 6 or 7 in which each equipment mounting zone presents a plurality of shelf spaces arranged one above the other and each shelf space is adapted to house a shelf of electrical equipment, the equipment being hingedly connected to the arrangement so as to be pivotally displaceable into and out of the shelf spaces.

9. A mounting arrangement as claimed in claim 8 in which each shelf space is adapted to house a shelf of electrical equipment adjacent one zone face and pivotally displaceable about an axis adjacent said zone face and a second shelf of electrical equipment adjacent the opposite zone face and pivotally displaceable about its adjacent zone face, each shelf space thereby being capable of housing two shelves of electrical equipment in back-to-back relationship which are accessible from opposite faces of the arrangement.

10. A mounting arrangement as claimed in claim 8 or 9 in which each equipment zone face of each shelf space is closed by a hinged window and a resilient sealing member is interposed between each hinged window and the arrangement so as to form a dust seal therebetween when the window is in a closed position.

11. A mounting arrangement substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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