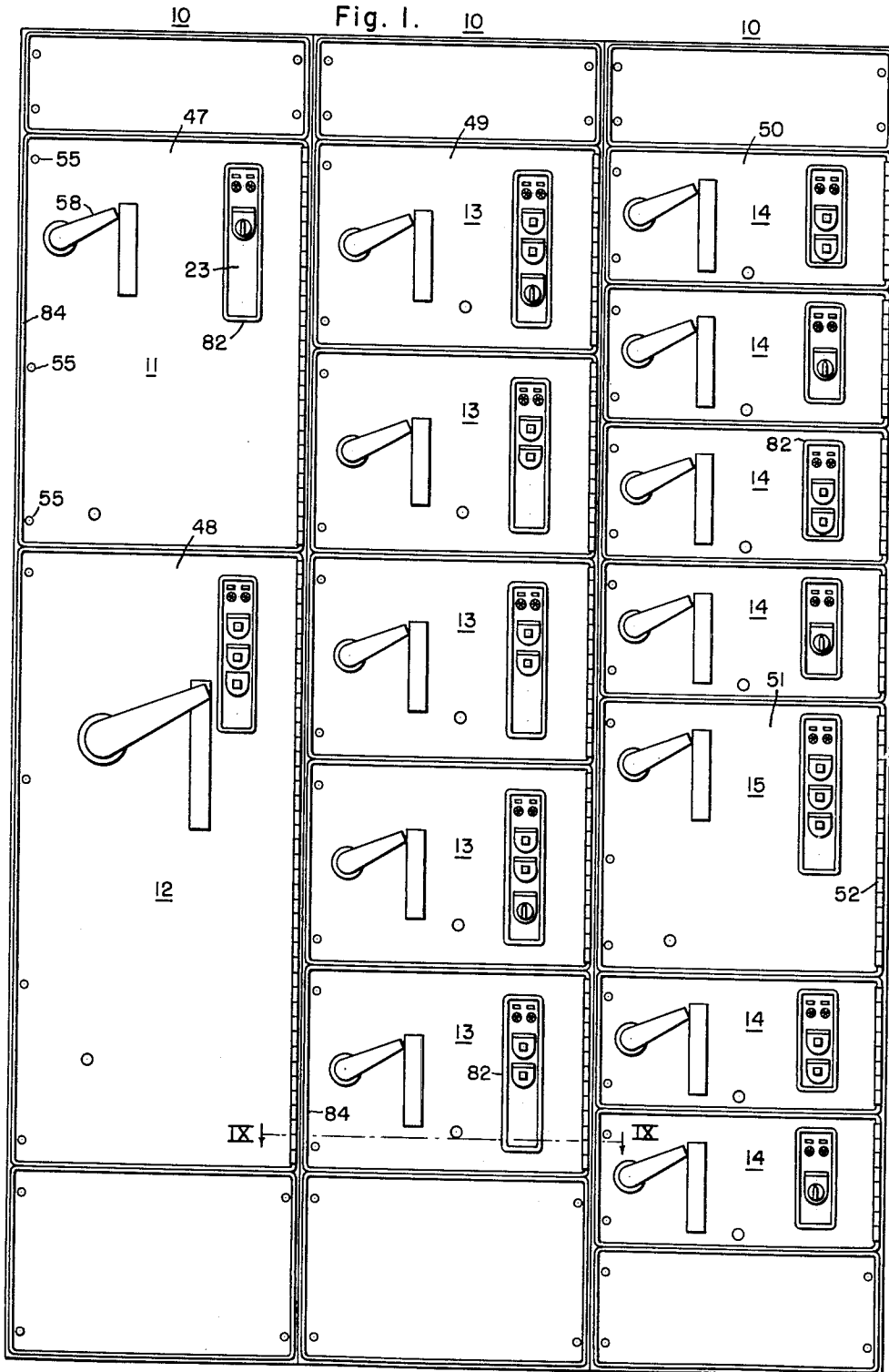


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Fig. 1. 10



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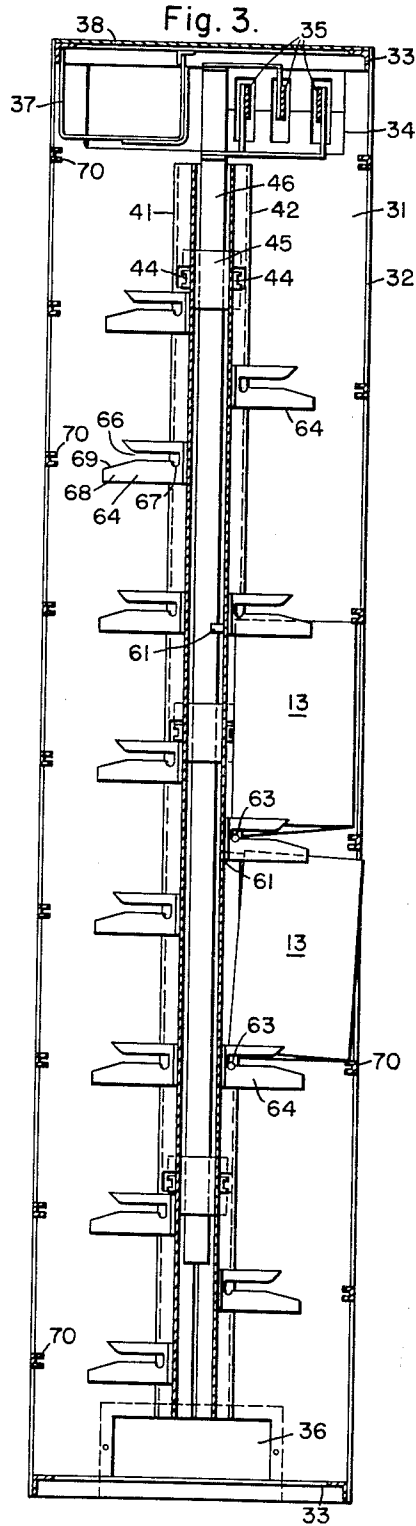
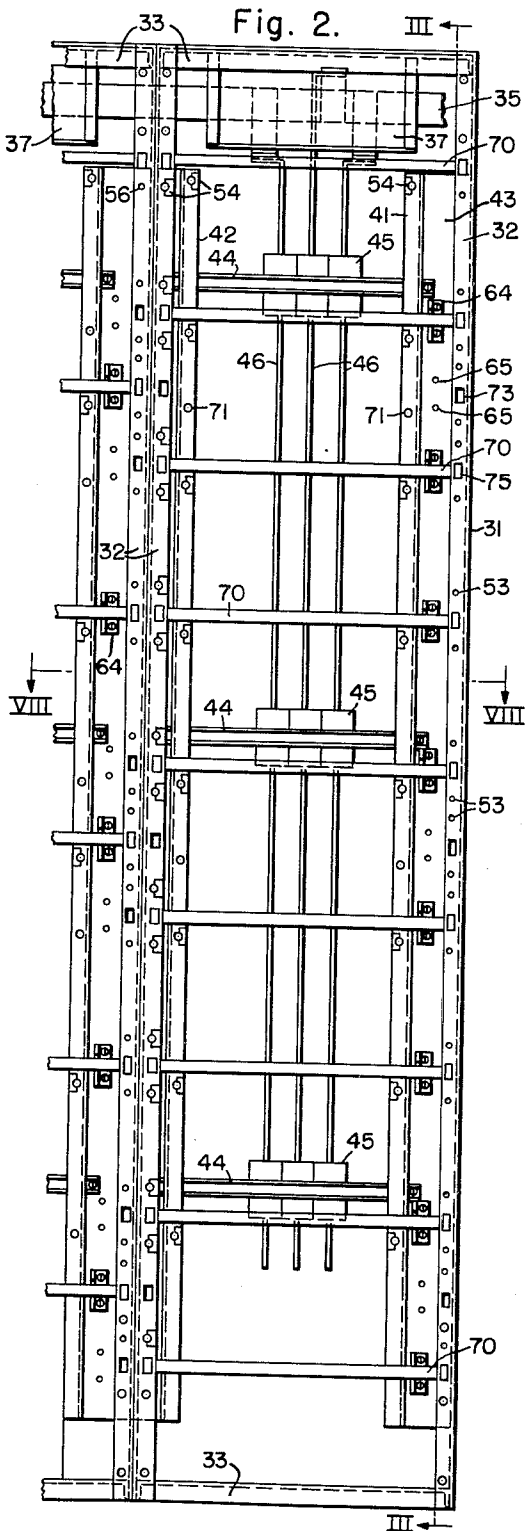
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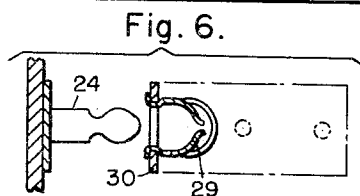
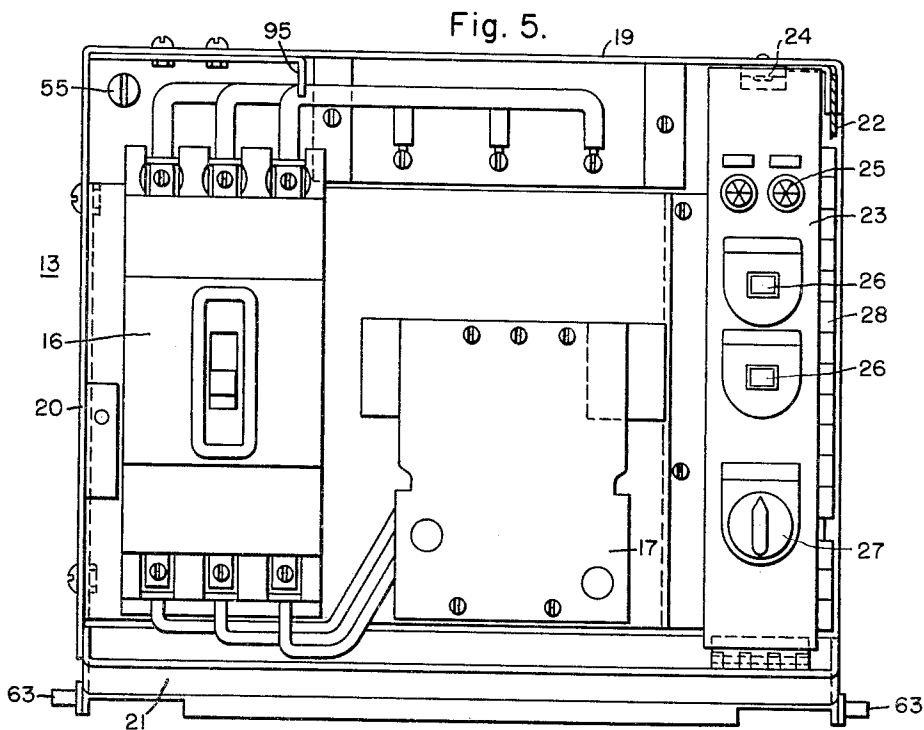
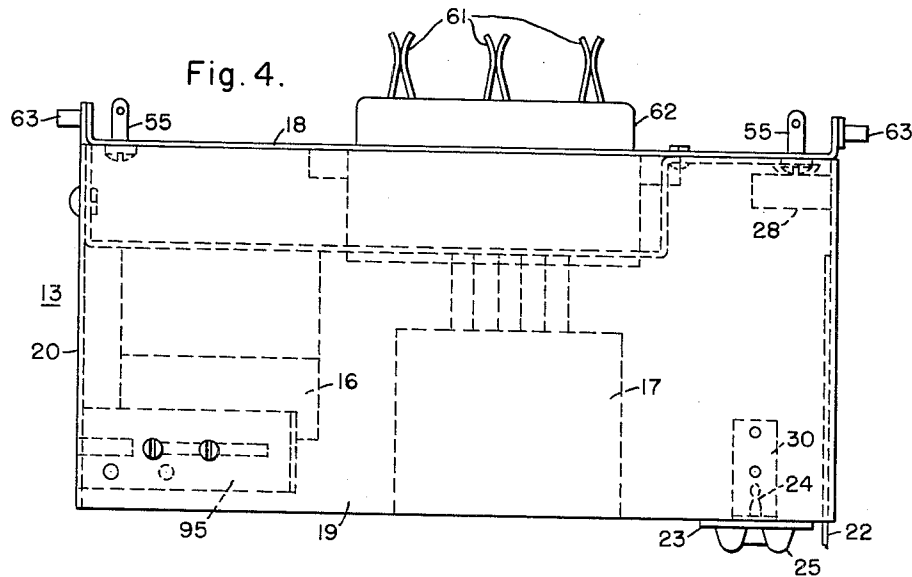
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Fig. 7.

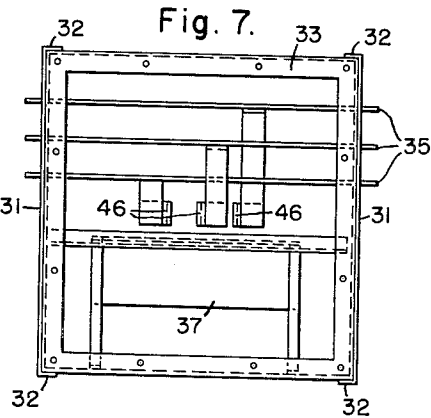


Fig. 8.

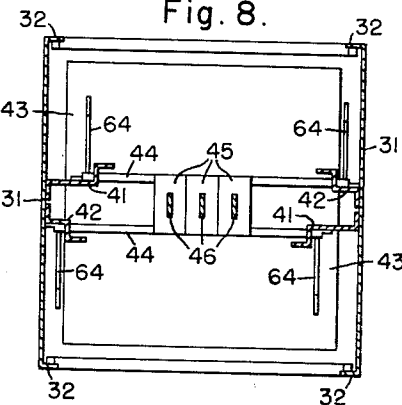


Fig. 9.

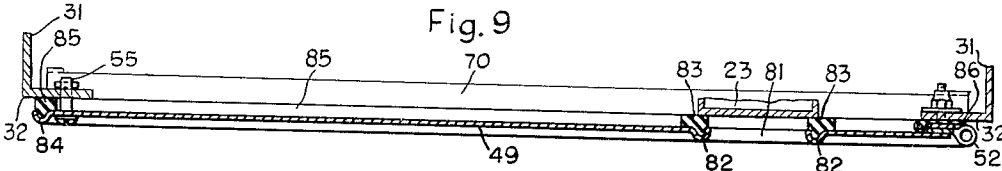


Fig. 10.

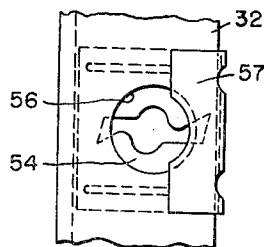


Fig. 11.

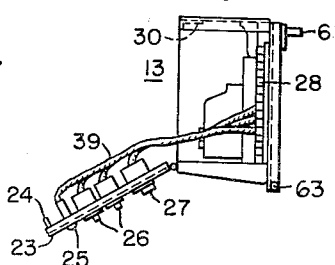


Fig. 12.

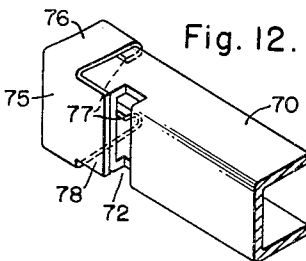


Fig. 13.

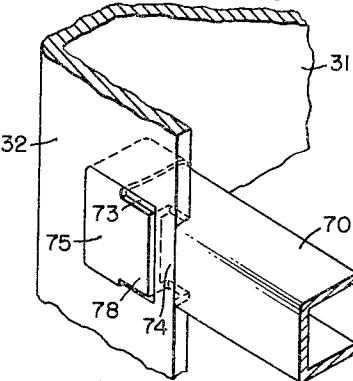
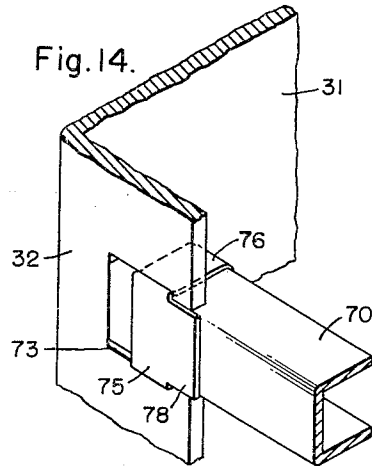


Fig. 14.



2,997,629
SWITCHBOARD

Jerome C. Wolski, Chicago, Ill., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Filed Dec. 24, 1956, Ser. No. 630,263
7 Claims. (Cl. 317-120)

My invention relates generally to switchboards and, more particularly, to enclosed switchboards or control centers of the type described in Patent No. 2,719,251, issued September 27, 1955, to P. V. Stewart and assigned to Westinghouse Electric Corporation.

Switchboards of the type described in the aforesaid patent are utilized for housing control apparatus, such as motor starter units. Since most industrial plants have motors of different ratings, it is necessary to provide starter units of correspondingly different sizes for the motors. Therefore, it is desirable that the switchboard housing units be so constructed that starter units of different sizes may be installed in each housing section or cell. The structure described in the aforesaid patent is such that starter units 14" high or multiples of 14" may be installed in each housing section.

An object of my invention is to provide a control center housing structure in which starter units of two different base dimensions or multiples of the two base dimensions may be installed in each section or cell.

Another object of my invention is to increase the structural strength of a switchboard housing structure.

A further object of my invention is to better exclude foreign matter from inside a switchboard housing structure.

Still another object of my invention is to facilitate the making of electrical connections to motor starter units removably mounted in a switchboard or control center housing structure.

A still further object of my invention is to increase the safety of a control center housing having a plurality of control units removably mounted in the housing.

Another object of my invention is to provide a control panel which is so mounted on a control unit that control apparatus mounted on the panel is accessible through an opening in the door for the space in which the control unit is mounted.

A further object of my invention is to so wire the control apparatus on the control panel to terminal blocks on the control unit that the panel may be moved for inspection of the apparatus without disconnecting the wires.

Other objects of my invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with one embodiment of my invention, the supporting members for the removable control units in each section of a control center or switchboard are so disposed that the units may be either 14" high or 9 1/4" high or multiples of those dimensions, thereby permitting units of different sizes to be utilized in the control center. The doors of the housing are provided with formed recesses at their edges to increase their strength and to hold gasket material for sealing around the doors. Each control unit may have a hinged panel thereon accessible through an opening in the door for the space in which the unit is mounted. Push buttons and indicating lights are mounted on the hinged panel to make them more accessible for wiring and maintenance.

For a better understanding of the nature and objects of the invention, reference may be had to the following detailed description, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a view in front elevation of a switch-

board housing structure embodying the principal features of the invention;

FIG. 2 is a view in front elevation of a portion of the structure shown in FIG. 1, parts of the structure being removed for clearness;

FIG. 3 is a view in section taken along the line III-III in FIG. 2;

FIG. 4 is an enlarged view in plan of one of the control apparatus units utilized in the switchboard;

FIG. 5 is an enlarged view in front elevation of the control unit shown in FIG. 4;

FIG. 6 is an enlarged detail view of a fastener for a hinged panel on the control unit;

FIG. 7 is a view in plan of the structure shown in FIG. 2;

FIG. 8 is a view in section taken along the line VIII-VIII in FIG. 2;

FIG. 9 is an enlarged view in section of one of the doors taken along the line IX-IX in FIG. 1;

FIG. 10 is an enlarged detailed view of a portion of a fastening device utilized in the switchboard structure;

FIG. 11 is a reduced view inside elevation of one of the control units utilized in the switchboard; and

FIGS. 12, 13 and 14 are enlarged views, in perspective, showing the manner of installing and retaining a support bar in the switchboard.

Referring to the drawings, and particularly to FIG. 1, the switchboard structure shown therein comprises a plurality of housing sections 10 which are disposed in side-by-side relation. The housing sections are preferably of uniform height, depth, and width, and may be used singly or in groups as shown. In order to simplify the drawings only three housing sections have been illustrated. It will be understood that as many sections as desired may be provided.

As shown in FIG. 1, two apparatus units 11 and 12 are removably mounted in the left-hand housing section 10. Five apparatus units 13 are mounted in the middle section. Six apparatus units 14 and one unit 15 are mounted in the right-hand housing section. As shown in FIGS. 4 and 5, the particular apparatus units illustrated in the present drawings are motor starter units, each unit comprising a circuit interrupter 16 and a motor starting device 17 of a type suitable for controlling the operation of an electric motor.

The apparatus units 13 are all of the same height, for example, 14". The apparatus unit 11 is 28" in height and the apparatus unit 12 is 42" in height. Thus, the heights of the apparatus units 11 and 12 are multiples of the height of the apparatus units 13. The apparatus units 14 are 9 1/4" in height and the apparatus unit 15 is 18 3/4" in height. Thus, the height of the unit 15 is a multiple of the height of a unit 14. Furthermore, the heights of the units are such that three of the units 14 may be installed in the space required for two of the units 13 or one of the units 11.

Accordingly, by providing apparatus units of two basic heights and multiples of these two heights, a greater flexibility in the size and mounting arrangement of the units is obtained than can be obtained when only one basic height is utilized. Furthermore, the dimensions of the units are such that units of either basic height may be installed in the switchboard housing sections by making only a slight change in the space available at the bottom of the housing section as shown in the right-hand section in FIG. 1.

As shown in FIGS 4 and 5, each apparatus unit comprises a rear wall 18, a top wall 19, a side wall 20 and a bottom wall 21. A removable side wall or baffle plate 22 may be utilized at the other side of the apparatus unit. The baffle plate 22 may be provided with a plurality of perforations or openings or it may be a grill made from

heavy wire screen to provide for proper ventilation of the apparatus and at the same time prevent ignited or ionized gases from circulating between units.

As also shown in FIGS. 4 and 5 a movably mounted plate or panel 23 is provided at the front of each apparatus unit near the right-hand side. The panel 23 may be hinged to the apparatus unit at the bottom and fastened at the top by means of a quickly detachable fastener, such as a tongue 24 which engages a spring clip 29 mounted in angle member 30 attached to the top wall 19. Control apparatus, such as indicating lights 25, push buttons 26, and a selector switch 27 may be mounted on the panel 23. Terminal blocks 28 are mounted in the apparatus unit behind the panel 23. Thus, the wiring connections to the apparatus mounted on the panel 23 may be readily made by connecting terminals on the terminal blocks to the apparatus on the panel. Furthermore, since the panel 23 is hinged at one end, it may be swung outwardly to permit inspection and maintenance of the apparatus installed on the panel. As will be described more fully hereinafter, the door for the space for each apparatus unit is provided with an opening through which the apparatus installed on the panel 23 is accessible.

As shown in FIG. 11, the wires 39 between the terminal blocks and the control panel are of sufficient length to permit the panel to swing outwardly without disconnecting the wires. Thus, the apparatus on the control panel is made available for inspection and maintenance without it being necessary to remove any screws. Also, the control apparatus remains connected to the control unit for testing.

As shown most clearly in FIGS. 7 and 8, each housing section comprises two spaced side sheets 31 having their vertical edges turned in to form flanges 32. The side sheets 31 are held in spaced relation by rectangular frames 33 which are disposed at the top and the bottom of each housing section. Each frame 33 is preferably composed of angle members disposed inside the intumed edges 32 of the side sheets 31 and secured to the side sheets. In this manner, each housing section is a self-supporting unit.

As shown most clearly in FIG. 3, rectangular openings 34 may be provided at the top of each side sheet 31 for horizontally disposed bus bars 35 which extend between housing sections. The bottom of each side sheet 31 may be notched at 36 to permit the bus bars or cables to be located at the bottom of the housing if desired. As shown in FIG. 3, a trough 37 may be attached to the top frame 33 to support cross panel wires and cables. A top cover plate 38 is provided for each housing section.

As shown most clearly in FIG. 8, two vertically disposed adapters or vertical support members 41 and 42 are secured to each side sheet 31. Each adapter is substantially of a Z-shape in cross-section with an additional leg or flange disposed parallel to the main leg of the Z. The adapters 41 and 42 are similar in construction, with the exception that the main leg of the Z of the adapter 41 is longer than the main leg of the adapter 42. The adapters act as spaced vertically extending supporting members on which the apparatus units are removably mounted as hereinafter described.

Thus, as shown in FIG. 8, by mounting the adapters 41 on the right-hand side sheet as viewed from the door at the front and the rear, respectively, of each housing section, the apparatus units which are supported by the adapters are offset to the left, thereby providing a vertical wiring gutter 43 between the side sheet and the right-hand sides of the apparatus units. In this manner, wires may extend substantially the full height of the housing in the wiring gutters 43 and may be readily connected to the terminal blocks 28 on the apparatus units.

As shown in FIGS. 2, 3 and 8, channel-shaped horizontally disposed support members 44 extend between

the adapters or vertical support members on the opposite side sheets and are secured to the adapters. Insulating bus support members 45, which are attached to the horizontal support members 44, are provided for supporting the vertically disposed bus bars 46 in each housing section. The vertical bus bars 46 may be connected to the horizontal bus bars 35 at the top of the housing.

As shown in FIG. 1, doors 47, 48, 49, 50 and 51 are provided for the spaces containing the apparatus units 11, 12, 13, 14 and 15, respectively. The doors are approximately the same height as the apparatus unit installed in the space behind each door. Thus, each door may be either approximately 14" high or a multiple of 14", or 9 1/2" high or a multiple of 9 1/2" high. Each door is mounted on the intumed flange 32 of one side sheet 31 by means of a full length hinge 52. The hinges may be secured to the side sheets by bolts inserted through openings 53 in the flange 32 of the side sheet. These hinge supporting openings 53 are so spaced that doors either 14" or 9 1/2" high, or multiples of these dimensions, may be readily attached to the housing in each possible position where a door could be placed when various combinations of the doors of different dimensions are used.

The doors are fastened to the flange 32 of the other side sheet for each housing by means of captive fasteners 54 (FIG. 10) which are of the cam type. Captive studs 55 (FIG. 9) are rotatably mounted in the doors. The studs 55 are rotated through an angle of 90° after being inserted into the fasteners 54 to secure the door in the closed position. Round openings 56 are provided in the flange 32 of the side sheet for the studs 55 on the doors. The fasteners 54 are retained on the flange 32 at the desired openings by spring clips 57 which slip over the edge of the flange 32 as shown in FIG. 10. The openings 56 are so spaced that the fasteners for the doors may be located properly in accordance with the height of each door when different combinations of doors of each dimension are used. As shown in FIG. 1, each door is provided with a handle 58 for operating the circuit interrupter mounted in the apparatus unit behind the door. The breaker mechanism may be operated by means of the handle 58 in a manner known in the art.

As shown most clearly in FIGS. 3 and 8, apparatus units may be mounted in the front and the rear of each housing section. As explained hereinbefore the apparatus units may be of a size suitable for controlling a motor or other apparatus of a predetermined rating. As shown in FIG. 4, each apparatus unit is provided with three electrical connectors 61 of the stab type which are mounted on a supporting member 62 at the rear of the apparatus unit. The connectors 61 are disposed to frictionally engage the vertical bus bars 46 when the apparatus unit is fully inserted into the operating position in the housing.

Where the apparatus units are disposed back-to-back in the housing as shown, each set of bus bars 46 supplies power to apparatus units at the front and the rear of the housing, thereby reducing the amount of copper required for making the electrical connections to a relatively large number of apparatus units. Furthermore, the bus bars are substantially enclosed and protected by the adapters 41 and 42 and the apparatus units when they are inserted in the housing, thereby preventing accidental contact with the bus bars.

In order to facilitate the installation of the apparatus units in the housing, each apparatus unit is provided with oppositely disposed side pivot pins 63 at the two rear lower corners of the unit. The pins 63 may be inserted into slotted and notched guide rails 64 secured to the vertical supporting members 41 and 42 at spaced intervals corresponding to the height of the apparatus unit to be installed in any given space. The vertical supporting members 41 and 42 are provided with openings 65 for receiving bolts for attaching the guide rails 64

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which act as mounting means for the apparatus units. The openings 65 are so spaced that the guide rails may be attached at the proper locations for the installation of apparatus units of any of the sizes previously mentioned.

As shown in FIG. 3, each guide rail 64 has a slot 66 therein which terminates in a notch 67 at the rear of the slot 66. A lower portion 68 of the guide rail, which extends forwardly beyond an upper portion, has a slightly inclined surface 69 as shown in FIG. 3.

As described in more detail in the aforesaid patent, an apparatus unit may be installed in the housing by resting the pivot pins 63 on the inclined surfaces 69 of two oppositely disposed guide rails or mounting members for that unit and pushing inwardly on the unit to cause the pins to enter the slots 66 and drop into the notches 67 at the rear of the slots. After the pins 63 are in the notches 67 the upper part of the unit is pushed inwardly to cause the stab connectors 61 to engage the bus bars 46.

The unit may be retained in the operating position by means of cam fasteners 54 similar to the fasteners provided for the doors of the structure. As shown in FIGS. 4 and 5, a captive stud 55 is provided near each upper corner of an apparatus unit for insertion into fasteners 54 secured to the vertical support members 41 and 42. As shown in FIG. 2, round openings 71 are provided in the vertical support members for the insertion of the captive studs 55 on the apparatus unit. The openings 71 are spaced at intervals corresponding to the basic heights of the apparatus units. The fasteners 54 may be installed at the openings 71 which are spaced properly for the apparatus units to be installed.

As shown most clearly in FIGS. 2 and 3, horizontally disposed support bars 70 are provided between each apparatus unit and also at the top of the upper unit and at the bottom of the lower unit of each housing section. As shown in FIG. 12, each support bar 70 is of a channel-shape. A notch 72 is provided in each bar 70 near each end. As shown in FIG. 13, an opening 73 is provided in the intumed flange 32 of the side sheet 31. The notch 72 is of such a dimension that a portion 74 of the flange 32 between the opening 73 and the edge of the flange can enter the notch 72, thereby permitting the base of the channel-shaped bar 70 to be flush with the outer face of the flange 32 when the bar 70 is installed in position.

The bar 70 is retained in position by a generally U-shaped clip 75 which is installed on the end of the bar in the manner shown in FIG. 12. The clip 75 has two arms 76 each of which has an intumed flange 77 thereon. The flanges 77 engage the edges of the channel-shaped bar 70 when the clip is installed on the bar. After the clip is placed on the end of the bar it is inserted in the opening 73 as shown in FIG. 13. The clip is then slid along the bar 70 which is retained in position by a projection 78 on the clip 75 which engages the portion 74 of the flange 32. As shown in FIG. 2 the openings 73 are so spaced that apparatus units of the different sizes previously mentioned may be installed in each housing section.

The bars 70 may be removed from the structure, or they may be omitted from the structure, in order to facilitate the installation of the wires in the wiring gutters 43 previously mentioned. After the wires are installed, the bars 70 may be inserted in the proper openings 73 between the apparatus units. The bars 70 are retained in position by the clips 75, as previously explained. As shown in FIG. 3, a bar 70 supports the front of each apparatus unit when it is tilted outwardly to disconnect the stab connectors 61 from the bus bars 46 thereby deenergizing the apparatus in the unit. The apparatus unit may be latched or locked in the disconnected position by latch means 95 shown in FIGS. 4 and 5 and described in more detail in the aforesaid patent.

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As shown in FIG. 9, each door is provided with an opening 81 in front of the panel 23 on the apparatus unit mounted in the space behind the door. As previously stated, the opening 81 provides access to the apparatus installed on the panel 23.

As shown in FIGS. 1 and 9, a substantially semi-circular combined rib and recess 82 is formed around the edges of the opening 81. A gasket 83, which may be composed of a resilient material such as rubber or a synthetic compound, is secured in the recess 82. The gasket 83 has a rib on one side fitting in the recess 82 and is flat on the opposite side to engage the panel 23, thereby sealing the opening around the panel to prevent foreign matter from entering the apparatus unit.

Likewise, a substantially semi-circular rib and recess 84 is provided at the top, one side and the bottom edges of the door. A gasket 85 having the same shape in cross-section as the gasket 83 is secured in the recess 84. This gasket is pressed against the support bars 70 and the flange 32 of the side sheet 31 when the door is closed to seal the opening around the door. As also shown in FIG. 9, a gasket 86 is provided underneath the hinge 52 for the door to seal the hinge side of the door. The formed ribs and recesses 82 and 84 strengthen the door mechanically as well as retaining the gaskets in place.

From the foregoing description, it is apparent that I have provided a switchboard or control center construction which makes it possible to install control apparatus units of various sizes and ratings. Furthermore, the apparatus units may be interchanged after the original installation. The present switchboard has an improved appearance as compared with prior structures. The wiring for the apparatus units may be more readily installed and inspection and maintenance of the apparatus in the units is facilitated. The strength of the structure is increased without increasing the weight or gauge of the metal utilized in the structure and better protection against the entrance of foreign matter into the housing is afforded.

Since numerous changes may be made in the above-described construction, and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In a switchboard structure, in combination, a pair of oppositely disposed spaced side sheets having intumed vertical edges, frame means for tying the side sheets together, guide members supported by the side sheets, apparatus units removably mounted on the guide members, a door disposed in front of each apparatus unit, said doors being hinged to the vertical edge on one side sheet and closing against the vertical edge on the other side sheet, horizontal bars disposed between said apparatus units, clip means for removably attaching said bars to said side sheets, a substantially semi-circular integrally formed rib and recess encircling one end and two sides and the corners between said end and sides of each door at the edge of the door, and resilient material secured in said recess and extending beyond the recess to be compressed against the vertical edge on one side sheet and two of said bars when the door is closed.

2. In a switchboard structure, in combination, a pair of oppositely disposed spaced side sheets having intumed vertical edges, frame means for tying the side sheets together, mounting members supported by the side sheets, apparatus units removably mounted on the mounting members, a door disposed in front of each apparatus unit, said doors being hinged to the vertical edge on one side sheet and closing against the vertical edge on the other side sheet, horizontal bars disposed between said apparatus units, an opening in the intumed edge of each side sheet for each bar, clips slidably disposed in said openings for engaging the bar, a notch near each end of

the bar for permitting a portion of the bar between the notch and the end of the bar to enter the opening in the side sheet, a substantially semi-circular formed rib and recess extending along the edge of the door at two sides and one end of the door, said rib and recess extending around the corners between said end and sides, and resilient material secured in said recess and extending beyond the recess to be compressed against the vertical edge on one side sheet and two of said bars when the door is closed.

3. In a switchboard structure, in combination, a pair of oppositely disposed spaced side sheets, frame means for tying the side sheets together, guide members supported by the side sheets, apparatus units removably mounted on the guide members, a plate hinged on the front of each apparatus unit, control apparatus mounted on said plate, a hinged door disposed in front of each apparatus unit, each door having an opening therein exposing the control apparatus on the plate behind the opening, said door being openable without moving the plate, an integrally formed rib and recess around the opening in the door, said recess being on the inner side of the door, and resilient material disposed in said recess and compressed against said plate when the door is closed.

4. In a switchboard structure, in combination, a pair of oppositely disposed spaced side sheets having intumed vertical edges, frame means for tying the side sheets together, apparatus units removably disposed between said side sheets, channel-shaped bars disposed between said apparatus units for supporting the units, an opening in the intumed edge of each side sheet for each bar, a generally U-shaped clip slidably disposed on each end of each bar, each clip being disposed in one of said openings and having arms thereon engaging the edges of the channel-shaped bar, a notch near each end of the bar for permitting a portion of the bar and the clip to enter the opening in the side sheet, and a projection on the clip engaging the side sheet to retain the bar in position when the clip is moved longitudinally of the bar.

5. In a switchboard structure, in combination, a pair of oppositely disposed spaced side sheets, frame means for tying the side sheets together, mounting members supported by the side sheets, apparatus units removably mounted on the mounting member, a control panel hinged on the front of each apparatus unit, control apparatus mounted on said panel, wires connected to the apparatus on the panel, said wires being of sufficient length to permit the panel to swing outwardly without disconnecting the wires, a hinged door disposed in front of each apparatus unit, each door having an opening therein exposing said panel and making the control ap-

paratus on the panel behind the opening accessible from in front of the door, and the door being openable without moving the panel.

6. In a switchboard structure, in combination, a pair of spaced vertically disposed side members, mounting members supported by the side members, apparatus units removably mounted on the mounting members, a control panel hinged on the front of each apparatus unit, control apparatus mounted on said panel, a terminal block mounted on each apparatus unit behind said control panel, wires connecting the terminal block on a unit to the control apparatus on the panel on said unit, said wires being of sufficient length to permit the panel to swing outwardly without disconnecting the wires, a hinged door disposed in front of each apparatus unit, each door having an opening therein exposing said panel and making the control apparatus on the panel behind the opening accessible from in front of the door, and the door being openable without moving the panel.

7. A switchboard structure comprising, a pair of oppositely disposed spaced side sheets having vertical edges, frame means for tying the side sheets together, guide members supported by the side sheets, apparatus units removably mounted on the guide members, a door disposed in front of each apparatus unit, said doors being hinged to the vertical edge on one side sheet and closing against the vertical edge on the other side sheet, horizontal bars disposed between said apparatus units, a substantially semi-circular integrally formed rib and recess encircling one end and two sides and the corners between said end and sides of each door at the edge of the door, said recess being on the inner side of the rib, and resilient material secured in said recess and extending inwardly beyond the recess to be compressed against the vertical edge on one side sheet and two of said bars when the door is closed.

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