United States Patent

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[54] **CELL CONSTRUCTION FOR MOTOR CONTROL CENTER FOR SEPARATE DISENGAGING OF TERMINAL BLOCKS AND BUS STABS**
14 Claims, 14 Drawing Figs.

[52] **U.S. Cl.** ..... **317/118,** 317/120, 339/258 R
[51] **Int. Cl.** **H02b 1/20**
[50] **Field of Search** ..... 317/118, 120; 339/22 B, 22 R, 125 R, 34, 258 R, 260, 261

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ABSTRACT: A cabinet for electrical controls of the like, typically a motor control center, having cubicals for slidingly receiving control units with conductors for engaging bus bars and terminal blocks for engaging mating terminal blocks in the cabinet. A sliding plate on the control unit carrying the control unit terminal block for manually engaging and disengaging the terminal blocks without requiring moving of the control unit. A terminal block design permitting a sliding installation of terminal blocks and a sliding installation of contacts within the terminals blocks. A hinged plate installation on the control unit for positioning push buttons and the like at the front of the cabinet. A pressure conductor stab for engaging bus bars behind the control unit cubicals.

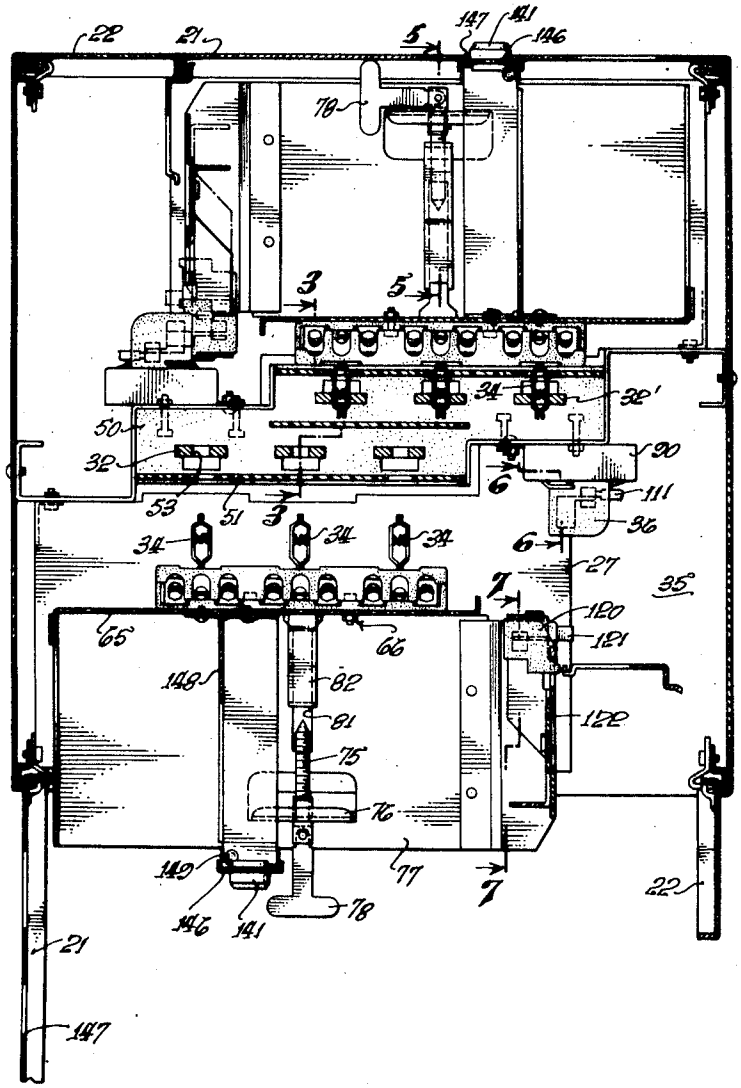


FIG. 1.

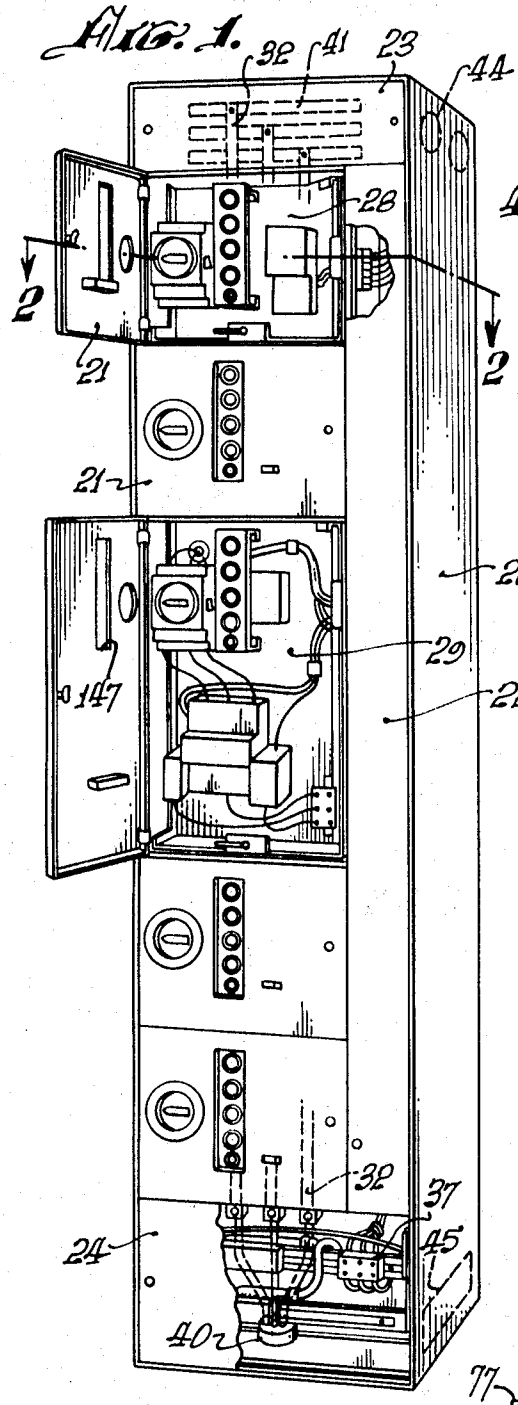


FIG. 3.

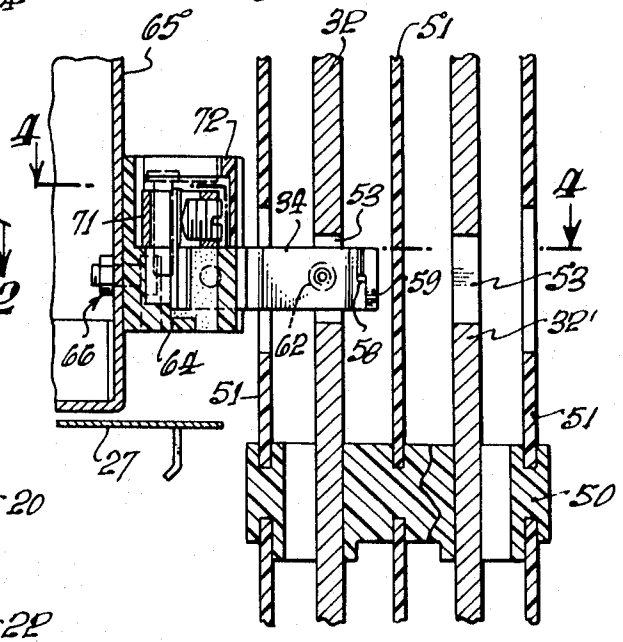


FIG. 4.

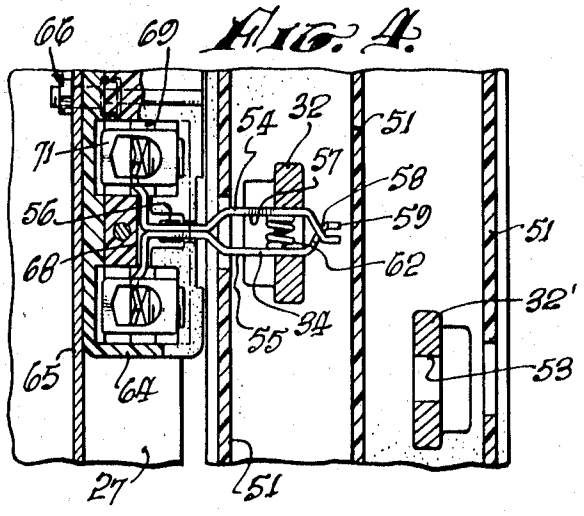


FIG. 5.

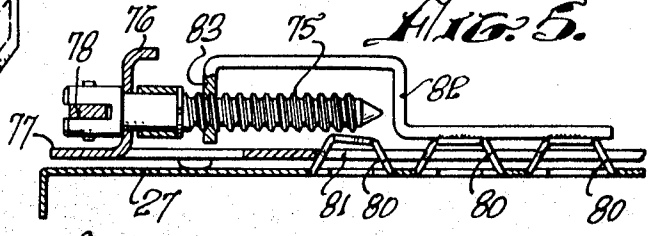


FIG. 13.

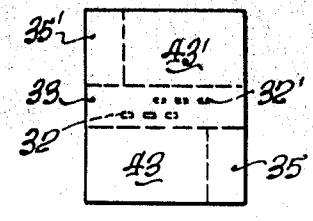
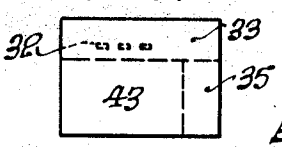
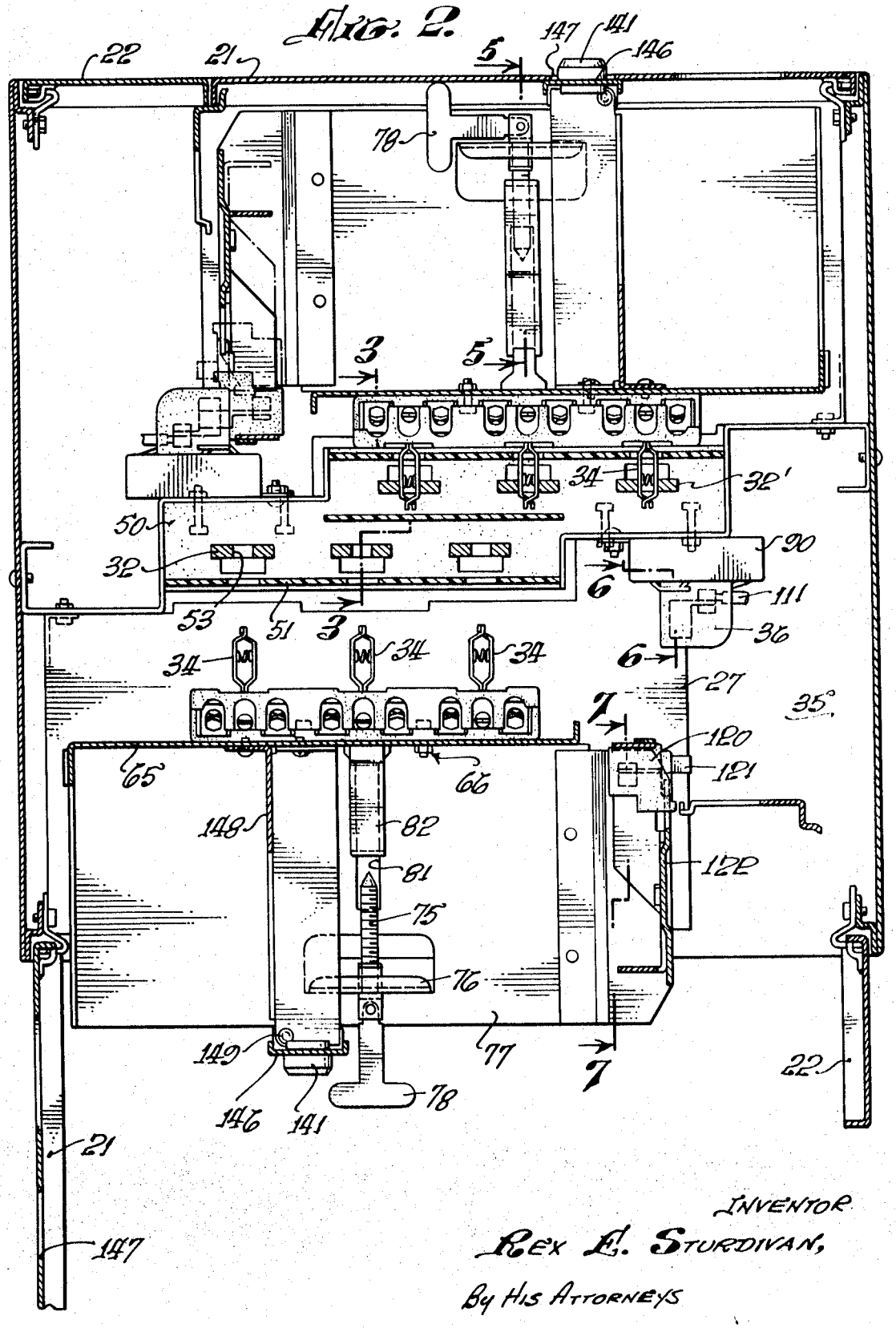


FIG. 14.



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FIG. 2.



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FIG. 6.

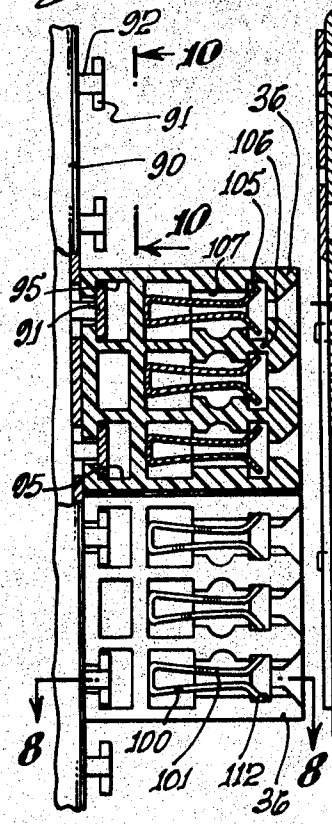


FIG. 7.

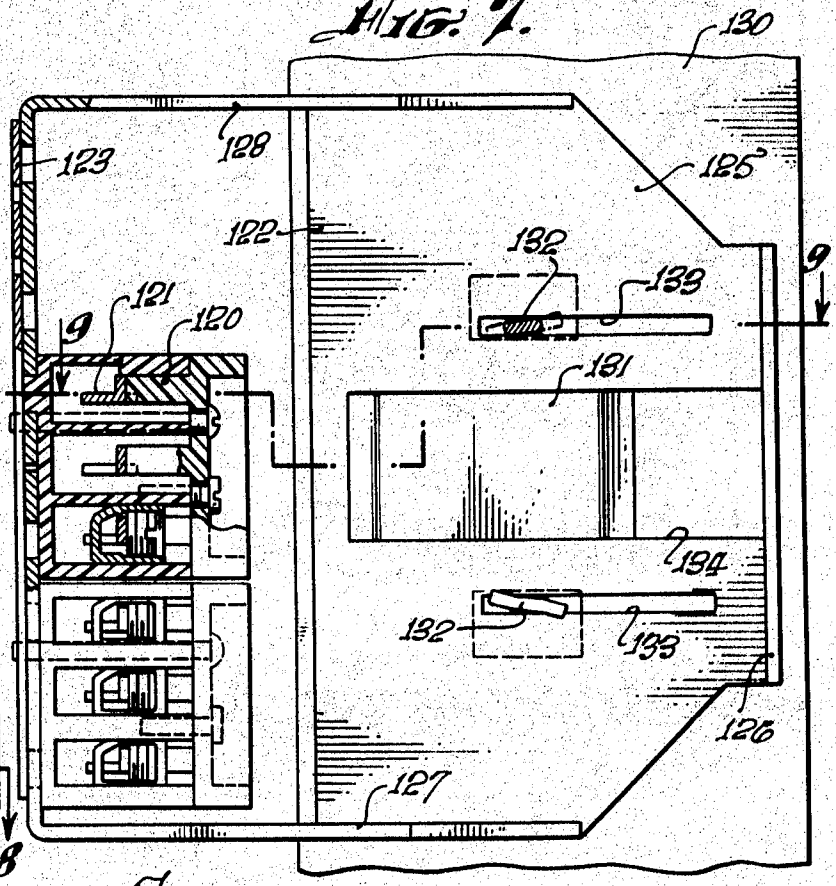


FIG. 10.

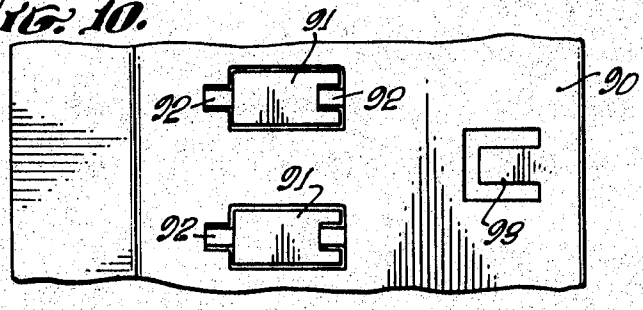
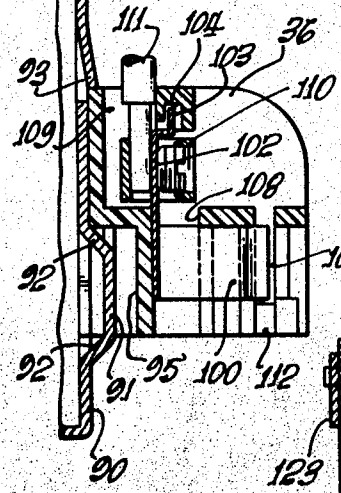


FIG. 8.



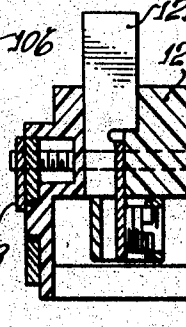
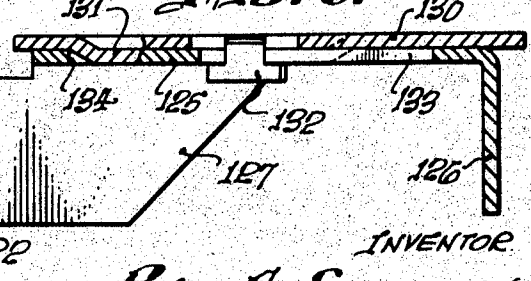


FIG. 9.



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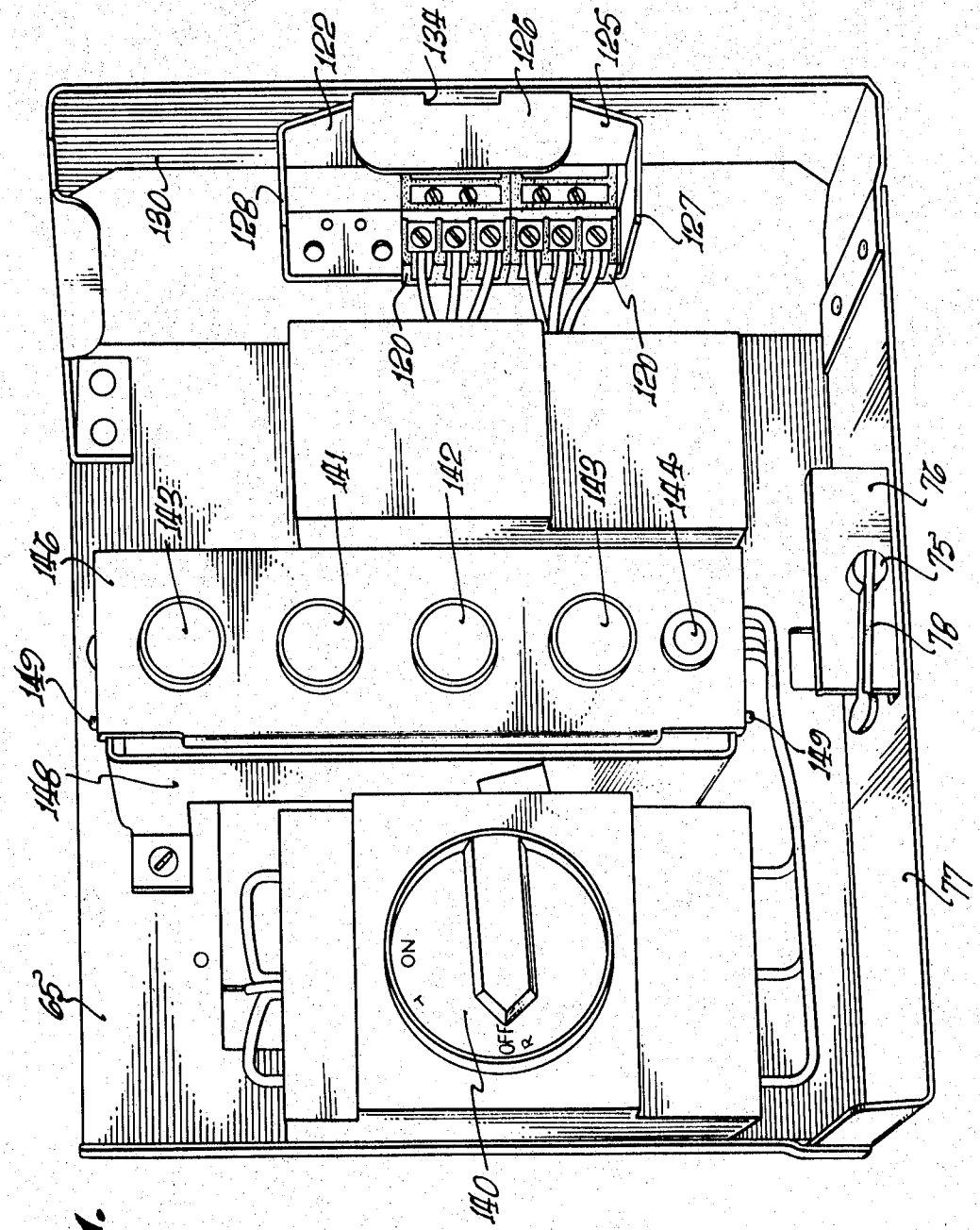


FIG. 11.

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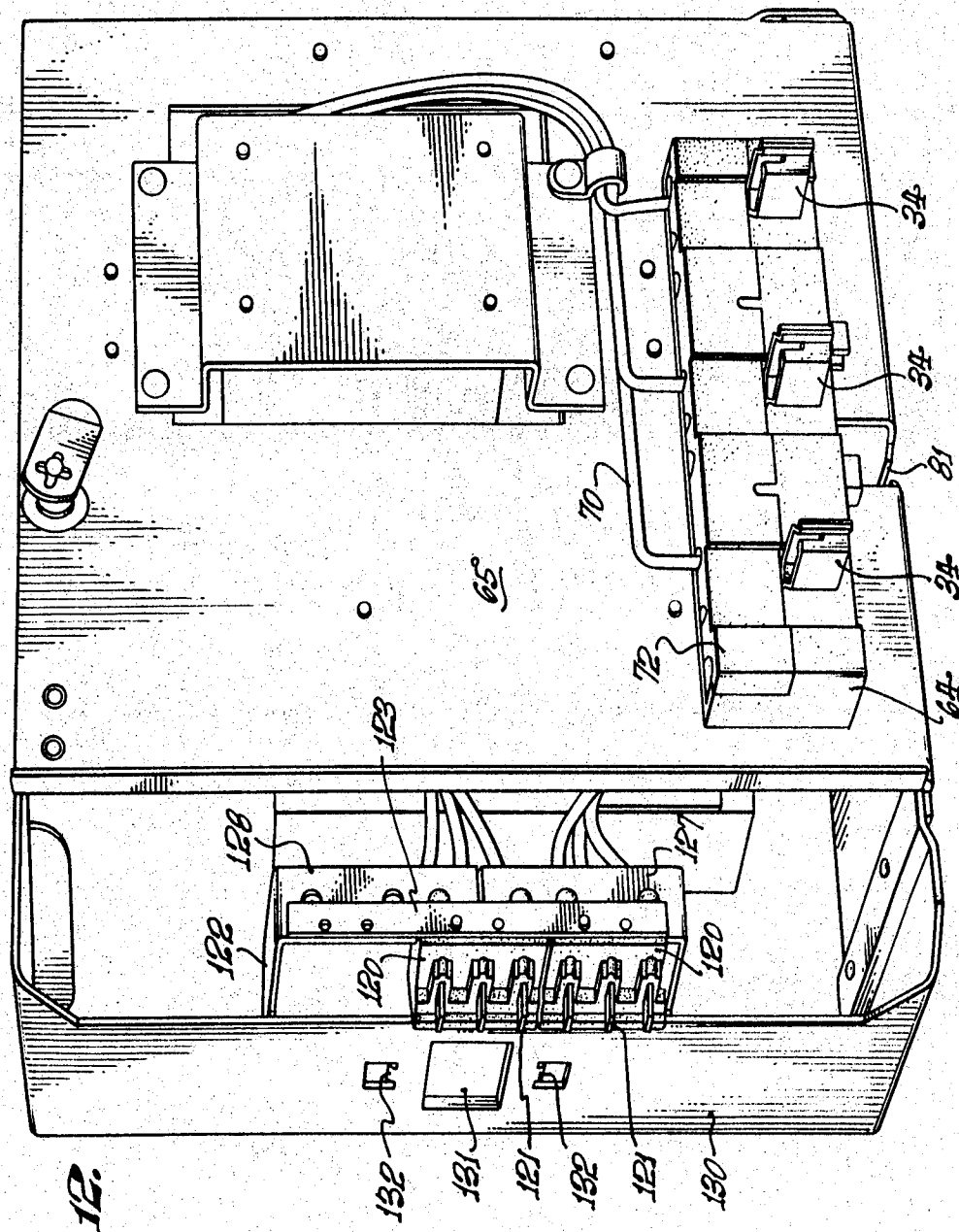


FIG. 12.

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CELL CONSTRUCTION FOR MOTOR CONTROL CENTER FOR SEPARATE DISENGAGING OF TERMINAL BLOCKS AND BUS STABS

This invention relates to a cabinet for electrical controls and the like, typically electrical motor controls, and is sometimes known as a motor control center because the control equipment for a plurality of motors is at one location.

By way of example, a motor control center will comprise an upright cabinet or housing having line side conductors in the form of bus bars running vertically through the cabinet. A plurality of plug-in motor control units are mounted in the cabinet, one above the other, and make connection to the bus bars. Output or load conductors from each control unit and control conductors from each control unit are also contained in the cabinet. The load and control conductors run to one or more terminal boards within the housing, and means are provided for connecting line side conductors to the bus bars and load side and control conductors to the terminal boards.

A typical cabinet will have fixed sides with front and rear openings, with a stack of motor control units positioned one above the other and designed for sliding insertion and removal. The rear portion of the cabinet may be a duplicate of the front portion, providing two stacks of motor control units in a single cabinet with the bus bars in the center. Alternatively, the cabinet may provide for a stack of control units at the front only, with the rear being blank or having a single removable panel. The cabinets normally have a separate door for each motor control unit, permitting insertion and removal of a control unit without disturbing other units of the cabinet.

A bus bar in a motor control center typically may be in the order of three-eighths of an inch thick and 2 inches wide, with a generally rectangular opening therein for receiving a stab type contact from the motor control unit, with the stab being pushed into and pulled out of the bus bar opening as the control unit is inserted into and removed from the cabinet. The quality of the electrical connection between the control unit and the bus bar is dependent upon the design and operation of the stab contact and a variety of structures have been utilized. It is an object of the present invention to provide a new and improved bus bar contact for the motor control unit which provides relatively easy insertion and removal while also providing a high-pressure and low-resistance engagement during operation.

In the conventional control center, the load side and control terminals of the control unit are engaged and disengaged at the same time as the line side stabs. However, it has been found desirable to provide for engagement and disengagement of the load and control conductors without requiring moving of the control unit itself within the cubical of the cabinet. Accordingly, it is an object of the present invention to provide a new and improved control unit mounting for the load side and control terminal blocks providing ready manual sliding engagement and disengagement of the units.

While each motor control center is custom designed to provide a specific arrangement of specific control units for specific motors, it is highly desirable to have as many parts as possible of standard design. This is particularly true of the metal and structural components and of the insulators, while the relays, switches, wiring and the like will usually vary from cabinet to cabinet. It is an object of the present invention to provide a standard terminal block for the load side and control conductors and a standard sheet metal support for the terminal blocks, wherein one or more terminal blocks as desired may be slidably installed and latches in place with a simple metal bending operation. A further object is to provide such terminal blocks and electrical contacts for sliding installation therein which contacts require only a manual compression for installation.

While each motor control unit is positioned within its cubical and totally enclosed within the cabinet, the manually operable control devices such as push buttons, are designed to be manually accessible from the exterior without requiring opening of doors or the like. In conventional units, the switches are mounted on the door of the cabinet and require flexible wiring for connection to the cubical and require attachment to the door and removal from the door as the control unit is inserted and removed. It is an object of the present invention to provide a new and improved motor control unit wherein the control buttons are mounted directly on the control unit on a hinged plate structure providing ready access for wiring and positioning the switches at the front of the cabinet.

Other objects, advantages, features and results will more fully appear in the course of the following description. The drawings merely show and the description merely describes a preferred embodiment of the present invention which is given by way of illustration or example.

In the drawings:

FIG. 1 is an isometric view of a motor control center incorporating a preferred embodiment of the present invention;

FIG. 2 is an enlarged sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged partial sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a partial sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is an enlarged partial sectional view taken along the line 5—5 of FIG. 2;

FIG. 6 and 7 are enlarged partial sectional views taken along the lines 6—6 and 7—7, respectively of FIG. 2;

FIGS. 8 and 9 are partial sectional views taken along the lines 8—8 and 9—9 of FIGS. 6 and 7, respectively;

FIG. 10 is a partial view taken along the line 10—10 of FIG. 6;

FIG. 11 is a front isometric view of a typical motor control unit;

FIG. 12 is a rear isometric view of the control unit of FIG. 11;

FIG. 13 is a diagrammatic top view of the cabinet of FIG. 1 showing the dual cabinet arrangement; and

FIG. 14 is a view similar to that of FIG. 13 showing a single cabinet arrangement.

The motor control center of FIG. 1 includes a cabinet or housing 20 with a plurality of hinged doors 21 positioned one above the other and another door 22 opposite the doors 21. A removable panel 23 may be positioned at the upper end of the cabinet and another removable panel 24 may be positioned at the lower end of the cabinet.

Shelves 27 are carried within the cabinet dividing the space behind the doors 21 into separate cubicals for slidingly receiving motor control units and two such units 28, 29 are illustrated in FIG. 1. A typical motor control unit is shown in FIGS. 11 and 12. Line side bus bars 32, 32′ are disposed vertically in the space 33 behind the control units and the control units are connected to the bus bars by stab terminals or connectors 34. The load side wiring and the control wiring are disposed in the space 35 behind the door 22, running between terminal boards 36 adjacent the control units and terminal boards 37 disposed in the space behind the panel 24.

The line cables may enter the cabinet through the bottom, with a line conduit 40 terminating within the cabinet with the individual line cables connected to corresponding bus 32. Alternatively, the line cable may enter through the upper portion of the cabinet and be connected to horizontal bus 41 which in turn are connected to the vertical bus 32. The horizontal bus provide for interconnection between cabinets which are mounted side by side. The vertical bus 32 are in the space 33 behind the control unit cubical space 43 and the space 35. Two sets of motor control units may be mounted back to back in a single cabinet as illustrated in FIGS. 1 and 13, with both sets of bus 32, 32′ in the central space 33 and with the spaces 35′, 43′ corresponding to the spaces 35, 43, respectively. Alternatively, a single stack of motor control units may be utilized with the cabinet configuration of FIG. 14.

The exterior wires for the load conductors and control conductors may enter the cabinet in any conventional manner, through the bottom, top, the back, or either side as desired. Typical entry openings are indicated at 44 and 45.

The bus bars 32, 32' are positioned in insulator blocks 50 and are separated from each other and enclosed within insulator plates 51 which rest in grooves in the insulator blocks 50. The bus bar supports and the stab terminals or conductors 34 which engage the bus bars are best seen in FIGS. 2, 3, 4 and 12. A generally rectangular opening 53 is provided in the bus bar for receiving the stab 34. Each stab 34 comprises two metal strips 54, 55 joined together at one point as by a rivet 56. The strips 54, 55 are bent away from each other to provide a gap therebetween at 57, with the ends of the strips having interengaging notches 58 and tabs 59. A spring 62 is positioned between the strips 54, 55 in the gap 57, urging the tabs 59 into engagement with each other, as seen in FIG. 12 and in the lower three terminals in FIG. 2.

The three stab terminals 34 of a three-phase motor control unit are carried in an insulator block 64 mounted on a back plate 65 of the control unit by bolts and nuts 66. The ends of the strips 54, 55 opposite the tabs 59 are bent away from each other to form a generally T-configuration and is positioned in a T-slot 68 in the insulator block 64, as best seen in FIG. 4. Openings 69 are provided at opposite ends of the T-slot for receiving a wire 70 and a lug 71 for attaching the wire to the strip forming the stab. Another insulator block 72 is fastened to the block 64 for holding the stabs 34 in place and covering the exposed end of the conductor 70 and the lug 71.

The stab terminal 34 and the opening 53 in the bus bar are dimensioned so that the width of the stab across the strips 54, 55 is greater than the width of the opening 53, when the tabs 59 are in engagement. In the lower portion of FIG. 2, a motor control unit 75 is partly slid into the cubical, with the stab terminals 34 in line with the openings 53 of the bus bars 32. As the control unit 75 is pushed further into the cabinet, the tabs 59 of the stab 34 enter the openings 53, guiding the main portion of the stabs into the openings. As the stabs move into the openings, the springs 62 are compressed and the tabs 59 are separated, as seen in FIG. 4 and in the upper portion of FIG. 2. This construction provides for ease of insertion of the stab terminals while also providing positive spring loading of the contact surfaces between the stabs and the bus bars after the control unit has been inserted.

A screw 75 is mounted in a flange 76 formed in the bottom plate 77 of the control unit and may be rotated by a pivoting handle 78 (FIGS. 5 and 2). Raised guide sections 80 in the cabinet shelf 27 ride in a slot 81 in the bottom plate 77 of the control unit for guiding the control unit. A bracket 82 is carried on some of the raised sections 80 and has an internally threaded opening in the outer end 83 for receiving the screw 75. The screw 75 engages the threaded opening at about the time the stab conductors 34 enter the bus bar openings and manual rotation of the handle 78 provides a mechanical advantage for forcing the stabs into the openings. The screw 75 is operated in the reverse direction to withdraw the stabs from the bus bars.

In the embodiment illustrated, two of the terminal blocks 36 are utilized, each providing for three conductors. One terminal block provides the load side power for the three-phase supply and the other terminal block provides three control conductors. The terminal blocks are identical and only one will be described in detail. A terminal plate 90 is mounted in the cabinet at each cubical and serves as a mounting plate for a plurality of the terminal blocks 36 (FIGS. 2, 6, 8 and 9). Plate portions 91 are supported as posts 92 parallel to and spaced from the main plate 90. The plate portions 91 may be provided in a variety of ways and preferably are formed integral with the plate 90 by lancing. A tab 93 is also formed in the plate 90, as by punching out a U-shaped opening around the tab 93. In the embodiment illustrated, a tab 93 is provided for each pair of plate portions 91.

Each of the terminal blocks 36 is provided with a pair of T-shaped grooves 95 open at one end and closed at the other, as seen in FIGS. 6 and 8. A terminal block 36 is installed by resting it on the plate 90 and sliding it from right to left as seen in FIG. 10, bringing the plate portions 91 into the grooves 95. When the closed end of the grooves 95 engage the plate portions 91, as shown in FIG. 8, the tab 93 is bent upward to the position of FIG. 8 and the terminal block is now fixed in position. If desired, the terminal block can be removed by bending the tab 93 back to the in line position and sliding the block off of the plate portions 91.

The conductor within the terminal block 36 is a generally T-shaped piece of resilient metal with arms 100, 101 and a body 102. The arms 100, 101 are bent into a generally U-configuration with outwardly flared ends, as seen in FIG. 6. The body 102 preferably has a stepped end 103 for positioning in a groove 104 in the terminal block 36. Opposed grooves 105, 106 are provided in the terminal block 36 at the upper end of a zone 107 which receives the arms 100, 101, with the body 102 passing through an opening 108 into a zone 109. The body 102 is passed through a lug 110 having a screw for clamping the body to a conductor 111. The grooves 105, 106 are at least partly closed at the outer or lower end as viewed in FIG. 8.

The conductor is easily inserted into the terminal block. The body 102 is passed through the opening 108 and through the lug 110. The arms 100, 101 are manually pinched together so that the flared ends can enter the opening 112 and the arms are then released, permitting the ends to expand into the grooves 105, 106 as the end 103 enters the groove 104. The conductor is now completely retained within the terminal block without requiring any connectors or retainers of any type.

Terminal blocks 120 are mounted on the motor control unit and include stab conductors 121 for engaging the U-shaped conductors of the terminal blocks 36. In the embodiment illustrated, two terminal blocks 120 are fixed to a sliding bracket 122 by screws and a screw plate 123 (FIGS. 7, 9, 11 and 12). The sliding bracket 122 has a flat section 125, a turned up handle 126, and turned up arms 127, 128 which are bent toward each other at their ends for carrying the terminal blocks 120.

The sliding bracket 122 is carried on a side plate 130 of the motor control unit, with a raised section 131 of the side plate 130 riding in a groove 134 of the bracket 122 to provide guiding and alignment for sliding the bracket 122 with respect to the plate 130. Two T-shaped tabs 132 are bent upward from the plate 130 and ride in slots 133 of the bracket 122, with the arms of the tabs 132 twisted as seen in FIG. 7 to serve as retainers for the sliding bracket. With this arrangement, the bracket 122 may be manually moved relative to the control unit between a retracted position of FIGS. 7 and 9 and the lower portion of FIG. 2, and an engaged position shown in solid lines in the upper portion of FIG. 2 (the retracted position being shown in phantom lines in the upper portion of FIG. 2).

With this construction, the motor control unit can be inserted into a cubical with the stab terminals 34 engaging the bus bars 32, while the sliding bracket 122 remains in the retracted position, with the terminal blocks 102, 36 unengaged. The bracket 122 may then be manually pushed inward, engaging the terminal blocks and the load side and control conductors. Subsequently at any time, the bracket 122 may be manually pulled out, opening the circuit to the load and control conductors, without requiring movement of the control unit. This simple sliding engagement and disengagement provides for separate connection and disconnection of the line side and load side conductors.

Referring to FIG. 11, a typical motor control unit will have a main disconnect switch 140, motor start and stop buttons 141, 142, signal lights 143, and a fuse 144. An opening may be provided in the door 21 for access to the main disconnect 140, and in the embodiment illustrated, the push bottom switches 141, 142, the lights 143 and the fuse 144 are mounted on a plate 146 and another opening is provided in the door for access to these components. The plate 146 desirably is larger than the opening 147 in the door and is disposed so as to be just inside the door to substantially close the opening and position the switches in the plane of the front of the cabinet, such as is seen in the upper portion of FIG. 2.

Plate **146** is mounted on a bracket **148** supported on the backwall **65** of the control unit by a hinge construction indicated generally at **149**. With this arrangement, the plate **146** is normally in the plane of the front of the cabinet, but is readily pivoted to a position perpendicular to the plane of the front of the cabinet providing access to the back side of the plate **146** for wiring the components carried on the plate. By having the components **141–144** mounted on a plate carried on the control unit, the conventional arrangement of mounting the components on the cabinet door is avoided. This arrangement eliminates the necessity of flexible wiring between the control unit and the cabinet door and the necessity of removing the components from the cabinet door when the control unit is to be removed from the cabinet.

Thus it is seen that the control unit and the cabinet with cubicals for receiving the control units meet the objects of the present invention. Although an exemplary embodiment of the invention has been disclosed and discussed, it will be understood that other applications of the invention are possible and that the embodiment disclosed may be subjected to various changes, modifications and substitutions without necessarily departing from the spirit of the invention.

I claim:

1. In a cabinet having means defining a plurality of cubicals, a plurality of bus bars mounted adjacent said cubicals, a plurality of bus bars mounted adjacent said cubicals, a plurality of first terminal blocks mounted adjacent said cubicals, and a plurality of control units, each slidable into and out of a cubical along a first axis, each of said control units having a plurality of first conductors engaging said bus bars and a second terminal block engaging a first terminal block, the improvement comprising:

a plate member mounted in a control unit and slidable relative to said control unit parallel to said first axis; and

means mounting the control unit second terminal block on said plate member, with said plate member being manually slidable a distance to engage and disengage the second terminal block with a first terminal block without moving the control unit in the cubical.

2. A structure as defined in claim **1** in which said plate member includes means defining three slots parallel to said first axis, and

the control unit includes a plate portion in sliding engagement with one side of said plate member, said plate portion having a first projecting guide element disposed in one of said slots and second and third projecting retainer elements passing through the others of said slots and engaging the opposite side of said plate member.

3. A structure as defined in claim **2** in which said projecting guide and retainer elements are formed integral with said plate portion of the control unit.

4. A structure as defined in claim **2** in which the first terminal block includes a generally U-shaped spring contact and the second terminal block includes a projecting stab, with the sliding movement of said plate member moving said stab into and out of said contact.

5. A structure as defined in claim **1** in which a control unit includes a control plate carrying a control switch, and

support means for positioning said control plate generally in the plane of the front of the cabinet, said support means and control plate including hinge means for rotation of said control plate from the planar position to a position generally perpendicular to said plane.

6. A structure as defined in claim **5** in which said bus bars include generally rectangular openings for receiving said first conductors and each of said first conductors comprise:

first and second strips joined in side by side relation at a first point, separated by a gap at a second point, and having interengaging notches and tabs at a third point, with said second point intermediate said first and third points, and

a spring positioned between said strips at said gap urging said strips apart at said gap and together at said tabs, with the distance across said strips at said gap when said tabs are engaged being greater than the width of said bus bar openings providing a push fit for a first conductor in a bus bar opening.

7. A structure as defined in claim **1** in which said bus bars include generally rectangular openings for receiving said first conductors and each of said first conductors comprise:

first and second strips joined in side by side relation at a first point, separated by a gap at a second point, and having interengaging notches and tabs at a third point, with said second point intermediate said first and third points, and

a spring positioned between said strips at said gap urging said strips apart at said gap and together at said tabs, with the distance across said strips at said gap when said tabs are engaged being greater than the width of said bus bar openings providing a push fit for a first conductor in a bush bar opening.

8. In a cabinet having means defining a plurality of cubicals, a plurality of bus bars mounted adjacent said cubicals, a plurality of first terminal blocks mounted adjacent said cubicals, and a plurality of control units, each slidable into and out of a cubical along a first axis, each of said control units having a plurality of first conductors engaging said bus bars and having a second terminal block engaging a first terminal block, with said bus bars including generally rectangular openings receiving said first conductors, the improvement wherein each of said first conductors comprises:

first and second strips joined in side by side relation at a first point, separated by a gap at a second point, and having interengaging notches and tabs at a third point, with said second point intermediate said first and third points, and

a spring positioned between said strips at said gap urging said strips apart at said gap and together at said tabs, with the distance across said strips at said gap when said tabs are engaged being greater than the width of said bus bar openings providing a push fit for a first conductor in a bus bar opening;

said first and second strips of each of said first conductors including a right angle flange adjacent the first point providing a T-configuration, and

said control unit including a first insulator block having a T-shaped opening for receiving a first conductor with the first point and flanges therein and with the second and third points projecting therefrom, and a second insulator block affixed to said first insulator block covering the junction of the T and the first point and providing wire access openings to each of said flanges.

9. In a cabinet having means defining a plurality of cubicals, a plurality of bus bars mounted adjacent said cubicals, a plurality of first terminal blocks mounted adjacent said cubicals, and a plurality of control units, each slidable into and out of a cubical along a first axis, each of said control units having a plurality of first conductors engaging said bus bars and having a second terminal block engaging a first terminal block, the improvement wherein

the cabinet includes a first terminal block mounting plate having a retainer plate supported above and generally parallel to the surface of the block mounting plate on at least one post, and having a tab bendable outward from said surface, and

one of the first terminal blocks includes an insulator block having a surface slidable along said block mounting plate at said tab and having a T shaped slot open at one end receiving said retainer plate and closed at the other end engaging said retainer plate as a stop, with said tab engaging said insulator block in stopping relation for maintaining said insulator block on said retainer plate.

10. A structure as defined in claim **9** including a contact mounted in said first insulator block, said contact comprising a generally T shaped piece of metal with the arms of the T bent to form a U-shaped stab receptacle with outwardly flared ends,

said insulator block having first and second contacting zones with said stab receptacle in the first zone and with the body of the T passing from the first zone to the second zone into a slot in said first insulator block, and

a screw lug positioned in said second zone about said contact,

said first zone including stop members engaging said flared ends maintaining said contact in said first zone.

11. A structure as defined in claim 9 in which said bus bars include generally rectangular openings for receiving said first conductors and each of said first conductors comprises:

first and second strips jointed in side by side relation at a first point, separated by a gap at a second point, and having interengaging notches and tabs at a third point, and with said second point intermediate said first and third points, and

a spring positioned between said strips at said gap urging said strips apart at said gap and together at said tabs, with the distance across said strips at said gap when said tabs are engaged being greater than the width of said bus bar openings providing a push fit for a first conductor in a bus bar opening.

12. A structure as defined in claim 1 wherein

the cabinet includes a first terminal block mounting plate having a retainer plate supported above and generally parallel to the surface of the block mounting plate on at least one post, and having a tab bendable outward from said surface, and

one of the said first terminal blocks includes an insulator block having a surface slidable along said block mounting plate at said tab and having a T shaped slot open at one end receiving said retainer plate and closed at the other end engaging said retainer plate as a stop, with said tab engaging said insulator block in stopping relation for maintaining said insulator block on said retainer plate.

13. A structure as defined in claim 12 including a contact mounted in said first insulator block, said contact comprising a generally T shaped piece of metal with the arms of the T bent to form a U-shaped stab receptacle with outwardly flared ends,

said first insulator blocking having first and second contacting zones with said stab receptacle in said first zone and with the body of the T passing from the first zone to the second zone into a slot in said first insulator block, and

a screw lug positioned in said second zone about said contact,

said first zone including stop members engaging said flared ends maintaining said contact in said first zone.

14. In a cabinet having means defining a plurality of cubicals, a plurality of bus bars mounted adjacent said cubicals, a plurality of first terminal blocks mounted adjacent said cubicals, and a plurality of control units, each slidable into and out of a cubical along a first axis, each of said control units having a plurality of first conductors engaging said bus bars and a second terminal block engaging a first terminal block, wherein one of the first terminal blocks includes a first insulator block, the improvement comprising:

a contact mounted in said first insulator block, said contact having a generally T shaped piece of metal with the arms of the T bent to form a U-shaped stab receptacle with outwardly flared ends,

said first insulator block having first and second contacting zones separated by an insulating barrier with an opening therethrough, with said stab receptacle in the first zone and with the body of the T passing through said opening from the first zone to the second zone into a slot in said first insulator block, and

a screw lug positioned in said second zone about said contact,

said first zone including stop members engaging said flared ends maintaining said contact in said first zone.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,626,253 Dated December 7, 1971

Inventor(s) REX E. STURDIVAN

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Abstract, line 1, "of" should be --or--;

Column 1, line 66, "latches" should be --latched--;

Column 2, line 25, "FIG." should be --FIGS.--;

Column 3, line 63, "as" should be --on--;

Column 4, line 55, "102" should be --120--;
line 68, "bottom" should be --button--;

Column 5, lines 25-26 (Claim 1), after "cubicals", delete --a plurality of bus bars mounted adjacent said cubicals,-- (second occurrance);

Column 6, line 15 (Claim 7), "bush" should be --bus--;

Column 7, line 8 (Claim 11), "jointed" should be --joined--;
line 10 (Claim 11), after "point,", delete --and--;

Column 8, line 3 (Claim 13), "blocking" should be --block--;
and
line 4 (Claim 13), "said" (second occurrance) should be --the--.

Signed and sealed this 6th day of June 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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