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Rhodes

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[54] **TERMINAL BLOCK**

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[52] **U.S. Cl.** ..... **339/198 R,** 339/156 R

[51] **Int. Cl.** **H01r 9/00**

[58] **Field of Search** 339/198, 184, 183, 242, 339/272, 64, 65, 155, 156, 157, 47, 126, 192, 211, 248; 312/223

[56] **References Cited**

UNITED STATES PATENTS

445,751	2/1891	Hoffman	339/192 R
2,885,652	5/1959	Rowe	339/198 GA
3,086,191	4/1963	Olashaw	339/196
3,090,936	5/1963	Maltby	339/210
3,107,963	10/1963	Hansen	339/191
3,273,103	9/1966	Ericson	339/22
3,296,576	1/1967	Motten	339/176
3,320,572	5/1967	Schwartz	339/17

FOREIGN PATENTS OR APPLICATIONS

1,065,502	9/1959	Germany	339/198 GA
941,891	11/1963	Great Britain	339/198
1,023,038	3/1966	Great Britain	339/184 M

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Assistant Examiner—Robert A. Hafer
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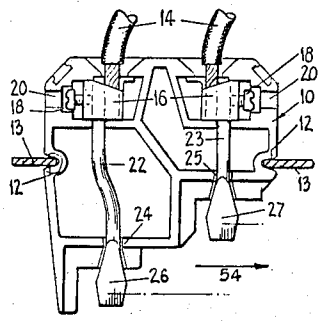
[57] **ABSTRACT**

Mating terminal blocks for mounting on the sides of sliding drawers and associated fixed walls to facilitate easy sliding connection or disconnection of the circuits in the sliding drawer. The contacts in the terminal blocks are staggered to facilitate mating engagement even though slight misalignments may exist and are of an especially compact configuration. They include grooves for easy mounting within simply shaped apertures.

15 Claims, 6 Drawing Figures



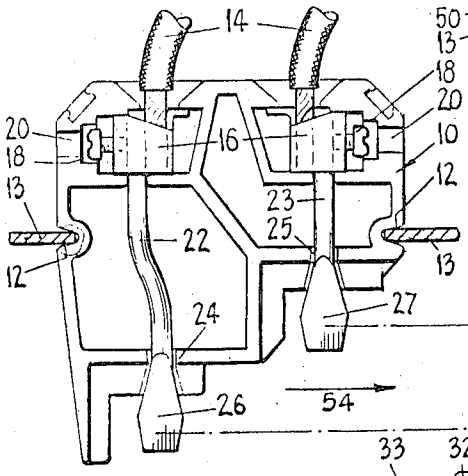


FIG. 1.

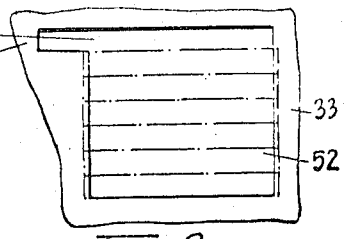


FIG. 3.

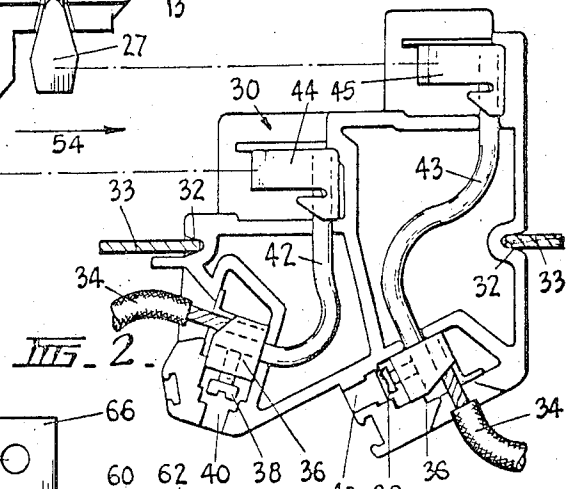


FIG. 2.

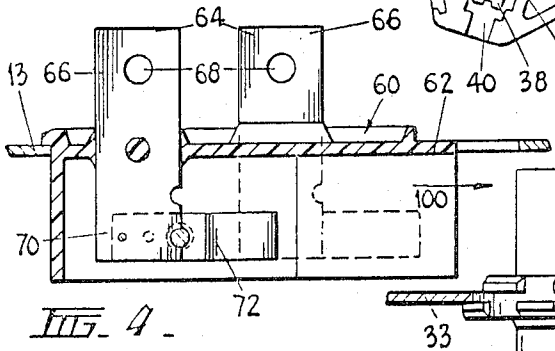
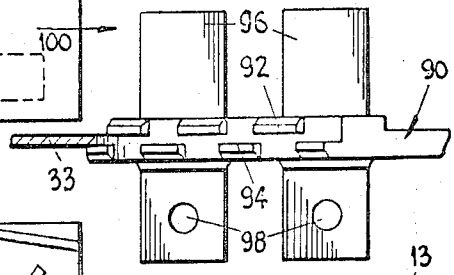


FIG. 4.

FIG. 6.



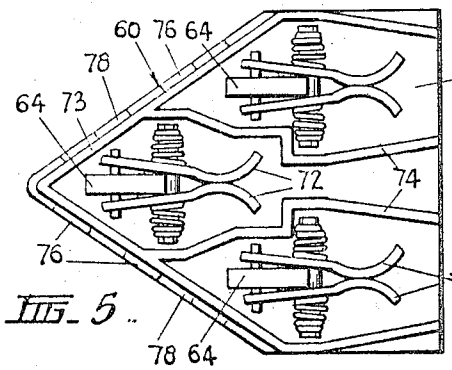


FIG. 5.

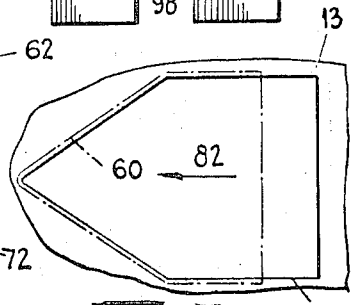


FIG. 7.

TERMINAL BLOCK

This invention relates to improved electrical connections, and more particularly to terminal blocks suitable for use in motor control systems.

With the advent of automation, many factories have found it necessary to install complex systems for controlling the electric motors which operate the various process machines. If not properly organized, the switch gear and associated equipment can occupy a major proportion of the factory area available.

Access to switch gear and control gear is also a problem. One solution has been to arrange control cabinets in front of sets of busbars, the cabinets containing sliding drawers in which the control equipment for a series of operations can be installed.

One system which is in use consists of a sliding-drawer cabinet in which each drawer is provided at its rear end with sets of contacts. One set of contacts forms a connection with three-phase busbars when the drawer is pushed in to its full extent, a second set of contacts feeds in process variables to the control equipment in the drawer, and a third set of contacts feeds three-phase power to an electric motor under the direction of the control equipment. Maintenance work can be carried out on the control equipment within the drawer simply by pulling the drawer out to make the equipment accessible.

The arrangement, nevertheless, has disadvantages in that all of the wiring is to the rear of the cabinet and the external connections are between the busbars and the cabinet.

It is an object of this invention to provide forms of terminal blocks which will enable installation and maintenance work on control equipment to be more readily carried out.

It is a further object of the invention to provide terminal blocks of a type which will permit sliding engagement of electrical contacts and which will permit some degree of misalignment between the mating parts to be tolerated.

Another object of the invention is to provide complementary terminal blocks, one of which is adapted to be mounted on the side of a sliding drawer, and the other on a fixed plate to enable circuits to be made and broken by sliding of the drawer.

A still further object of the invention is to provide terminal blocks for the above purposes which will occupy a minimal amount of space to permit the overall dimensions of sliding drawer control cabinets to be reduced.

According to one aspect of the invention there is provided a terminal block for sliding engagement with a complementary terminal block comprising an insulating casing formed between its ends and on opposite sides with a pair of grooves by means of which it may be mounted in a slot in a stationary or slidable plate, a pair of clamps located within one end of said casing and adapted to receive and retain the ends of a pair of wires, and a pair of contacts electrically connected to said clamps and projecting from the other end of said casing, one of said contacts being arranged to project beyond the line joining said grooves to a greater extent than the other of said contacts.

Preferably there is provided a pair of complementary terminal blocks as above defined, the contacts of one block taking the form of tags or the like and the contacts of the other taking the form of spring clips adapted to engage with said tags or the like.

According to another of its aspects, the invention provides a three-phase terminal block comprising an insulating casing having a base and side walls, a set of three spaced contacts moulded into said base and extending through both sides thereof into the interior of the casing and to the exterior of the casing, and one or more openings in one side of the casing to permit a complementary set of three-phase contacts to be connected to said first-mentioned contacts by relative sliding movement parallel to said base.

Preferably said first-mentioned contacts are located in a triangular arrangement and the end of said casing remote from the wall provided with an opening or openings is of tapered configuration having spaced projections for engagement with a complementarily shaped aperture in a support plate.

In order that the invention may be more readily understood, it will now be described by way of example with reference to a particular embodiment applied to motor control equipment in which sliding drawer cabinets are disposed in a position in front of a set of busbars.

Each drawer of the cabinets consists of a side plate arranged to slide in upper and lower tracks which are preferably lined with an antifriction material such as nylon or polytetrafluoroethylene. The remainder of the drawer is supported in cantilever fashion from the side plate and carries the electrical and/or electronic integers required for control of a motor. The rear of the drawer carries three spring-loaded contact clamps adapted to engage with a set of three-phase busbars when the drawer is pushed inwardly to its full extent. These contacts are connected into the circuits within the drawer.

On the side of the drawer opposite the support plate a set of contacts for control circuits and a set of three-phase contacts for the motor circuit are arranged for sliding engagement with complementary contacts on a fixed plate within the cabinet and preferably located adjacent the front of the cabinet.

It will be appreciated that a degree of clearance in the slide mechanism is required to prevent binding of the drawer. For this reason accurate alignment cannot be maintained between the mating fixed and moving sets of contacts. The terminal blocks to be hereinafter described permit correct engagement of mating contacts without accurate alignment.

FIG. **1** is a plan view of an exemplary control circuit terminal block adapted for mounting on a movable drawer or the like;

FIG. **2** is a plan view of another exemplary control circuit terminal block adapted for mounting on a fixed frame for mating engagement with the terminal block of FIG. **1**;

FIG. **3** is a side view of the preferred exemplary type of mounting slot for receiving the terminal blocks of FIGS. **1** and **2**;

FIG. **4** is a side view of an exemplary motor control circuit terminal block adapted for mounting on a movable drawer or the like;

FIG. **5** is a plan view of the terminal block shown in FIG. **4**;

FIG. **6** illustrates an exemplary terminal block adapted for mounting on a fixed frame for mating en-

gagement with the terminal block of FIGS. 4 and 5; and

FIG. 7 is a view of the preferred exemplary type of mounting slot for receiving the terminal blocks of FIGS. 4, 5 and 6.

For the control circuits the terminal blocks are preferably made up of units as illustrated in FIGS. 1 and 2 of the accompanying drawings. FIG. 1 is a plan view of the terminal block for attachment to the sliding drawer and consists of a moulded thermosetting plastic casing 10 having grooves 12 by means of which it is adapted to slide in a slot in the vertical side 13 of the drawer opposite that which is supported in tracks.

The section of casing 10 above the grooves 12 as shown in the drawing is located within the drawer, while the remainder of the casing is located externally of the drawer.

A pair of wires 14 are connected to the control circuits within the drawer and are held within casing 10 by means of clamps 16 having screws 18 which are readily accessible through moulded apertures 20 in the casing. A pair of conductors 22, 23 have one of their ends held within clamps 16 and have their other ends extending outwardly of the casing through apertures 24, 25. Conductors 22, 23 are preferably made from solid copper wire and have their free ends flattened to form tags 26, 27 respectively.

Conductor 22 is made longer than conductor 23 so that tag 26 projects further from side 13 of the drawer than tag 27. The relevant side of casing 10 is stepped to suit so that apertures 24, 25 provide support to resist displacement of the tags 26, 27.

The terminal block for mounting on a fixed part of the cabinet is illustrated in FIG. 2. Again there is provided a moulded thermosetting plastic casing 30 having a stepped configuration to match the stepped configuration of casing 10. Casing 30 is formed with a pair of grooves 32 by means of which it may be mounted in a slot in a fixed vertical plate 33 of the cabinet.

A pair of wires 34 are connected to external equipment adapted to feed process variables to the control circuits in the drawer. These wires are held in casing 30 by means of clamps 36 provided with screws 38 which are readily accessible through apertures 40 in the casing, the apertures being directed at an angle towards the front of the cabinet to further facilitate access.

A pair of conductors 42, 43 have one of their ends held in clamps 36 and have their other ends fitted with spring contacts 44, 45 adapted to engage with tags 26, 27 on conductors 22, 23. Preferably contacts 44, 45 are of the form described in our co-pending application filed on even date herewith.

Both casing 10 and casing 30 are provided with flat moulded covers (not shown).

The slots used in the side plate of the drawer and in the fixed plate f the cabinet for mounting the terminal blocks are preferably of the shape illustrated in FIG. 3 having a relatively broad upper section 50, of sufficient width and depth to admit the casings, and a somewhat narrow lower section 52 of sufficient width to span the distances between the inner extremities of the grooves 12 or 32 as appropriate.

It will be clear that any required number of terminal blocks can be installed simply by sliding them into the section 50, aligning the grooves 12 or 32 with the plate and sliding the casings 10 or 30 downwardly into the section 52. The length of section 52 is selected to accommodate the required number of casings.

With arrangement described all of the control circuits can be connected by sliding the drawer inwardly in the direction of arrow 54 to engage tags 26, 27 in respective contacts 44, 45, and all of the control circuits can be disconnected simply by pulling out the drawer and disengaging the tags from contacts 44, 45.

The contacts for the electric motor to be operated by the direct circuits are preferably of the form illustrated in FIGS. 4 to 6.

FIGS. 4 and 5 illustrate a terminal block for attachment to the sliding drawer, while FIG. 6 illustrates the complementary terminal block for attachment to the fixed plate in the cabinet. The movable terminal block comprises a moulded thermosetting plastic casing 60 which has a base 62 through which three spaced copper conductors 64 project in both directions. The ends 66 of conductors 64 are located within the drawer and are provided with holes 68 by means of which they may be connected to the three-phase power supply derived from the busbars under the control of the control circuits.

The sections 70 of conductors 64 within the casing 60 are arranged to have spring clamps 72 connected to them. Within the casing conductors 64 are separated by integrally moulded walls 74 to prevent arcing and/or to enable the conductors to be placed more closely together.

The section of casing 60 to be located nearest to the front of the drawer is of tapered configuration (see FIG. 5) and its side walls 73 are provided with two sets of aligned projections 76, 78, the projections of set 76 being offset in relation to the projections of set 78 to facilitate moulding of the casing. The projections are similar to those illustrated in FIG. 6, from which the arrangement can be more clearly seen.

The spacing between the two sets of projections is equal to or slightly greater than the thickness of the side plate 13 of the drawer in which the contacts are to be mounted and it will be clear that, if an aperture of the configuration illustrated at 80 in FIG. 7 is made in the side plate of the drawer, casing 60 can be readily installed by inserting it into the aperture to align the space between projections 76, 78 with the plate 13 and then sliding the casing in the direction of arrow 82 to cause the projections to engage with the plate. Preferably a clamp or spacer is provided to retain casing 60 in the position indicated in dotted lines in FIG. 7.

FIG. 6 illustrates a suitable terminal block for use in conjunction with the terminal block of FIGS. 4 and 5. It comprises a moulded thermosetting plastic base 90 having a shape similar to the base 62 of casing 60 as seen in FIG. 5. It is provided with two sets of offset projections 92, 94, the sets of projections being spaced apart a distance equal to or slightly greater than the thickness of fixed plate 33 of the cabinet in which the terminal block is to be mounted.

Three conductors 96 are moulded into base 90 in the same orientation as conductors 64 of the complementary terminal block. The conductors extend through both sides of the base and at one end are formed with holes 98 by means of which they may be electrically connected to a motor.

The portions of conductors 96 on the opposite side of base 90 are adapted to engage with respective spring

clamps **72** when the drawer is pushed in the direction of arrow **100** in FIG. **4.**

FIGS. **4** and **6** are drawn with the two terminal blocks shown in the relative positions which they occupy when the drawer has been pulled out to some extent and the motor circuit has been broken.

The arrangements of terminal blocks described hereinabove are regarded as superior to those currently in use since they enable the wiring to be connected to locations which are readily accessible from the front of a control cabinet and permit the control circuits and the motor circuit to be readily made and broken merely by pushing in or pulling out a drawer. Access to the rear of the control cabinet does not therefore have to be provided and there is no necessity to release any wiring from terminal blocks to enable maintenance to be carried out. Additionally, the configuration of the blocks is such that only a minimal amount of space is required at the side of each drawer.

I claim:

1. In combination with a sliding drawer apparatus wherein electrical contact is provided between the drawer and a mating cabinet structure, a terminal block for sliding engagement with a similar but complementary terminal block in said mating cabinet structure, said first-mentioned terminal block comprising:

an insulating casing,

said insulated casing having a pair of grooves on opposite sides thereof mounting said terminal block in a slot in a plate on said sliding drawer,

a pair of clamps located within one end of said casing and adapted to receive and retain the ends of a pair of wires, and

a pair of contacts, each being electrically connected to a corresponding one of said clamps and projecting from the other end of said casing,

one of said contacts projecting beyond a line joining said grooves to a greater extent than the other of said contacts whereby the projecting contacts are staggered in a stepwise fashion along said other end of the casing.

2. Apparatus as claimed in claim **1** wherein said clamps are accessible from the opposite side of said plate to that on which said contacts are located.

3. Apparatus as claimed in claim **1** wherein said clamps include clamping screws, the axes of which are arranged at an angle to the plane of said plate so that said plate is part of a cabinet or a drawer of a cabinet in which said terminal block is mounted and the axes of the screws are directed at an angle towards the front of said cabinet to facilitate access.

4. A three-phase terminal block comprising:

an insulating casing having a base and side walls,

a set of three spaced contacts moulded into said base and extending through both sides thereof into the interior of the casing and to the exterior of the casing,

said side walls including spaced projections for engagement with the edges of an aperture in a support plate and

one or more openings in one side of the casing to permit a complementary set of three-phase contacts to be connected to said first-mentioned contacts by relative sliding movement parallel to said base.

5. A terminal block as claimed in claim **4** wherein said contacts are separated by integrally moulded walls of said casing to prevent arcing.

6. A terminal block as claimed in claim **4** wherein said contacts are provided with spring clamps adapted to engage with complementary contacts.

7. A three-phase terminal block comprising:

an insulating casing having a base and side walls,

a set of three spaced contacts moulded into said base and extending through both sides thereof into the interior of the casing and to the exterior of the casing, and

one or more openings in one side wall of the casing to permit a complementary set of three-phase contacts to be connected to said first-mentioned contacts by relative sliding movement parallel to said base,

said first-mentioned contacts being located in a triangular arrangement, and

the end of said casing remote from the said side wall which is provided with an opening or openings being of a tapered configuration and having spaced projections thereon for engagement with a complementarily shaped aperture in a support plate.

8. In combination with a sliding drawer apparatus wherein electrical contact is provided between the drawer and a mating cabinet structure, a terminal block for permitting sliding engagement and disengagement of a plurality of electrical contacts disposed along the side of a fixed or movable plate, said terminal block comprising:

an insulating casing having first and second ends and side walls,

mounting means disposed on said side walls intermediate said first and second ends securing said insulating casing within an aperture of said plate,

at least two wire receiving means associated with said first end of said casing,

at least two sliding contact means associated with said second end of said casing, and

conductor means extending between said first and second ends and connecting respectively corresponding ones of said wire receiving means and said sliding contact means,

said two sliding contact means being displaced with respect to one another along said second end in the direction of intended sliding movement along said plate.

9. Apparatus as in claim **8** wherein said mounting means comprises a groove formed to engage edges of said aperture.

10. Apparatus as in claim **8** wherein said mounting means comprises spaced projections formed to engage edges of said aperture.

11. Apparatus as in claim **8** wherein said two sliding contacts are also displaced with respect to one another in a direction substantially perpendicular to said direction of intended sliding movement.

12. Apparatus as in claim **11** wherein said direction substantially perpendicular is also substantially perpendicular to the plane of said plate whereby the sliding contact means project in a staggered stepwise fashion along said second end of said casing.

13. Apparatus as in claim **12** wherein said second end is shaped in a similar stepwise fashion with each of said sliding contacts projecting through a supporting aperture in a corresponding step of said second end.

14. A pair of terminal blocks adapted for sliding engagement with each other, each of said terminal blocks comprising:

an insulating casing having a pair of grooves on opposite sides thereof to permit mounting in a slot in a stationary or slidable plate,

a pair of clamps located within one end of each of said casings and adapted to receive and retain the ends of a respective pair of wires, and

a pair of contacts, each being electrically connected to a corresponding one of said clamps and projecting from the other end of said casing,

one of said contacts projecting beyond a line joining said grooves to a greater extent than the other of said contacts whereby the projecting contacts are staggered in a stepwise fashion along said other end of the casing,

the contacts of a first one of said blocks being in the form of tags or the like, and

the contacts of a second one of said blocks being in the form of spring clips adapted to engage with said tags or the like.

15. A terminal block for permitting sliding engagement and disengagement of a plurality of electrical contacts disposed along the side of a fixed or movable plate, said terminal block comprising:

an insulating casing having first and second ends and side walls,

mounting means disposed on said side walls intermediate said first and second ends for securing said insulating casing within an aperture of said plate,

at least two wire receiving means associated with said first end of said casing,

at least two sliding contact means associated with said second end of said casing, and

conductor means extending between said first and second ends and connecting respectively corresponding ones of said wire receiving means and said sliding contact means,

said two sliding contact means being displaced with respect to one another along said second end in the direction of intended sliding movement along said plate,

said two sliding contacts also being displaced with respect to one another in a direction substantially perpendicular to said direction of intended sliding movement wherein said direction substantially perpendicular is also substantially parallel to the plane of said plate whereby each of said sliding contacts is disposed at substantially the same distance from the plane of said plate although displaced in the direction of intended sliding movement parallel to said plate.

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