

- [54] **DEVICE FOR REMOVABLY MOUNTING ELECTRICAL COMPONENT**
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- [52] U.S. Cl. **317/13 R, 317/40 A**
- [51] Int. Cl. **H02h 7/08**
- [58] Field of Search **317/13 R, 40 A; 339/258 F, 259 F**

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Attorney—Ostrolenk, Faber, Gerb & Soffen

[57] **ABSTRACT**

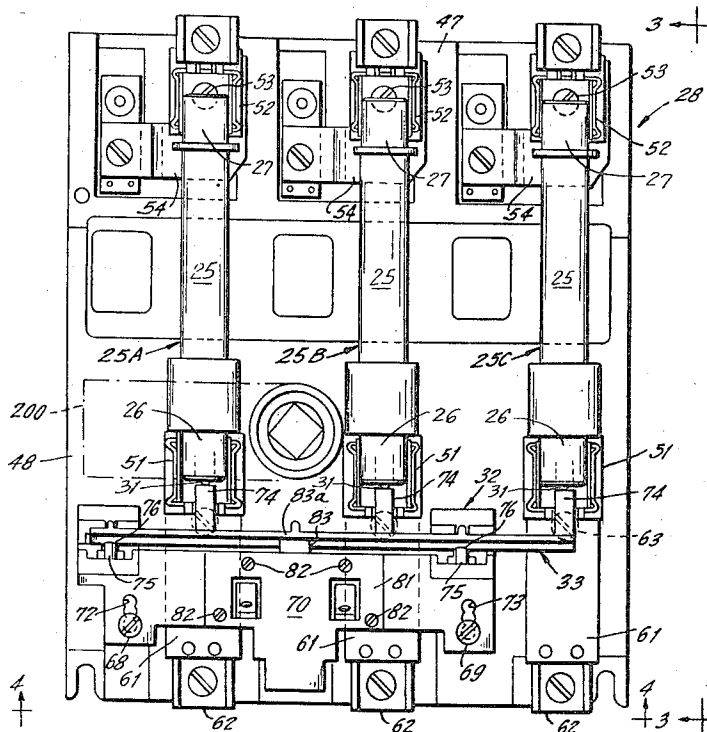
A motor controlling system, including a conventional

multipole electromagnetic contactor and associated overload relay means, is provided with motor short-circuit protector means in the form of fast-acting fused protector means connected in series with the heaters of the overload relay means and the motor windings. Under overload conditions below locked rotor current, referred to as running overloads, the overload relay means opens the actuating circuit for the contactor holding coil, and under severe fault conditions the fused protector means becomes active to limit let-through energy to a level that will not damage either the motor, contactor, overload relay means, or wiring to the motor.

The overload relay means is chosen from a family of overload relays in which each relay is adapted to protect a motor drawing a different full load current and the fused protector means is chosen from a family of fused protectors in which each protector is adapted to coordinate with a plurality of different relays from said family of overload relays.

Actuation or melting of a fused protector unit causes an ejector pin thereof to operate a common trip bar which, in turn, opens a switch in the coil circuit. This trip bar is part of an anti-single phasing unit that is selectively positionable with respect to the clips which mount the fused protector units, thereby cooperating with fused protector units of different sizes. These clips are provided with integral formations which serve a blocking or non-interchangeability function, thereby preventing oversized fused protector units from being mounted to the clips.

6 Claims, 14 Drawing Figures



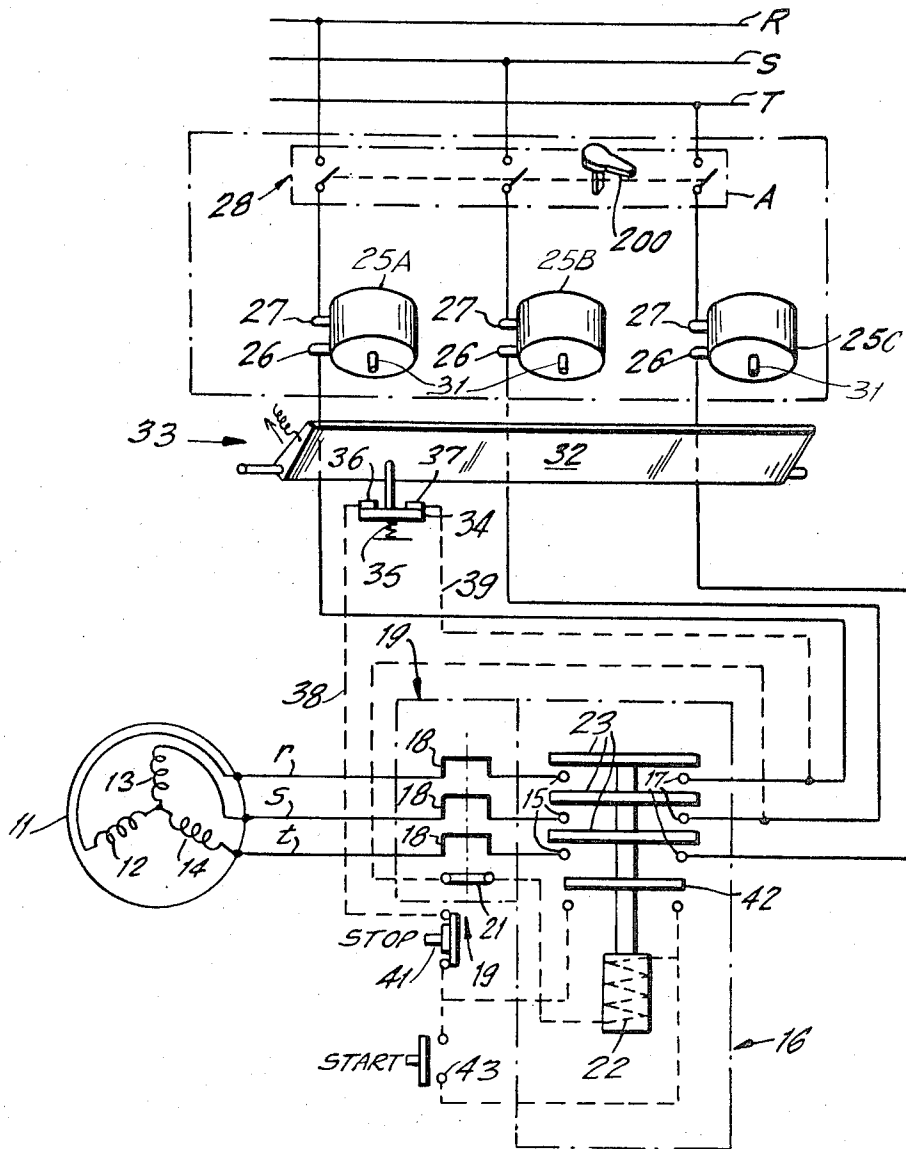


FIG. 1.

FIG. 2.

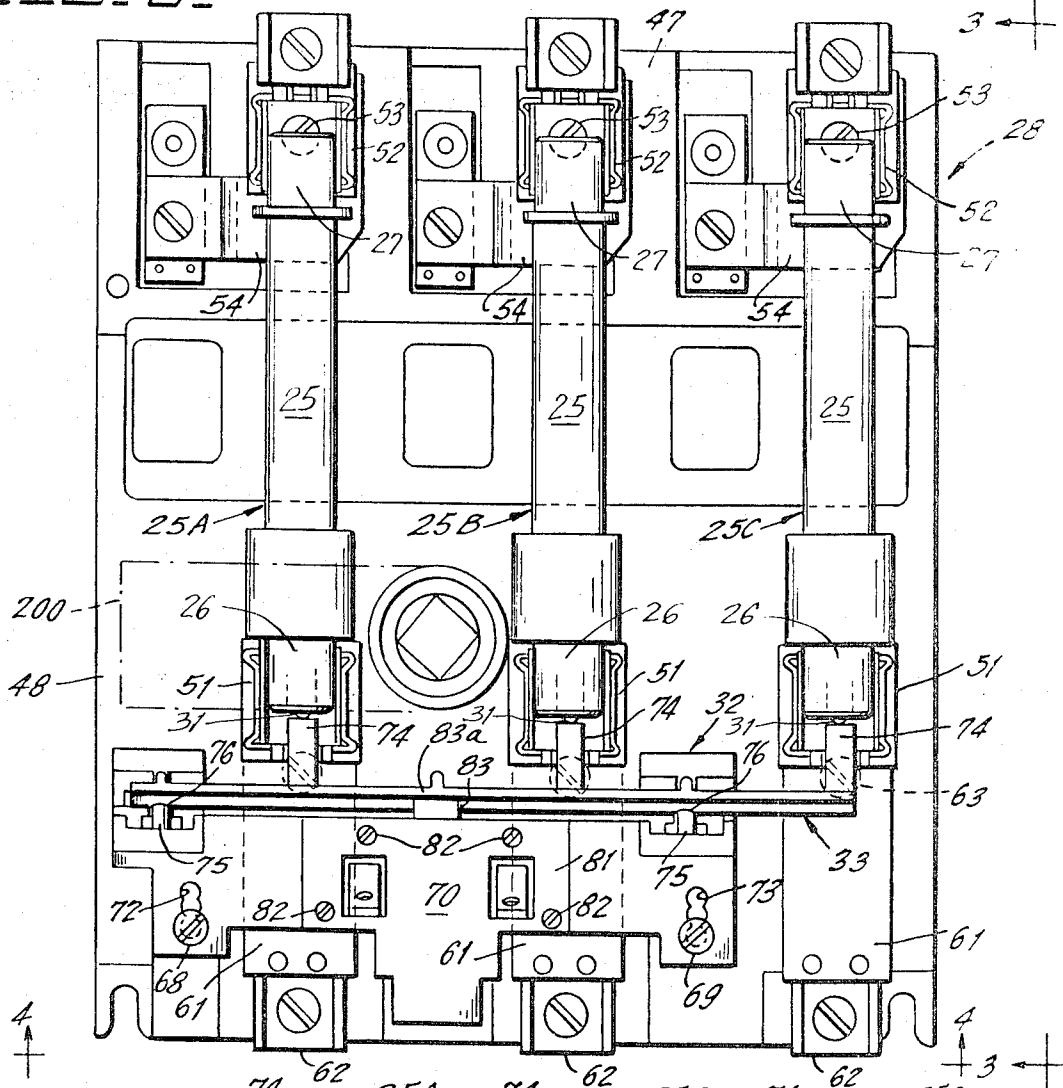


FIG. 4.

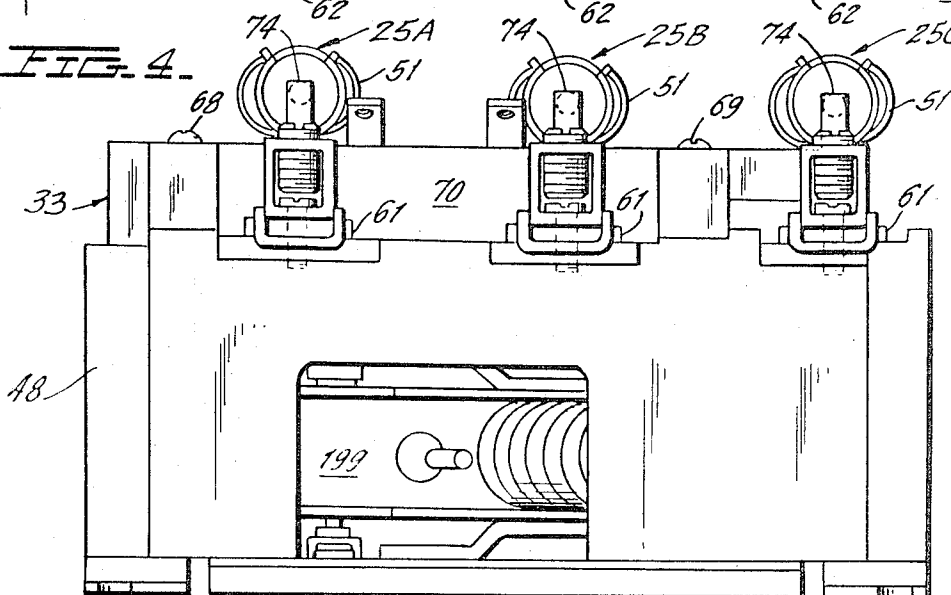


FIG. 3.

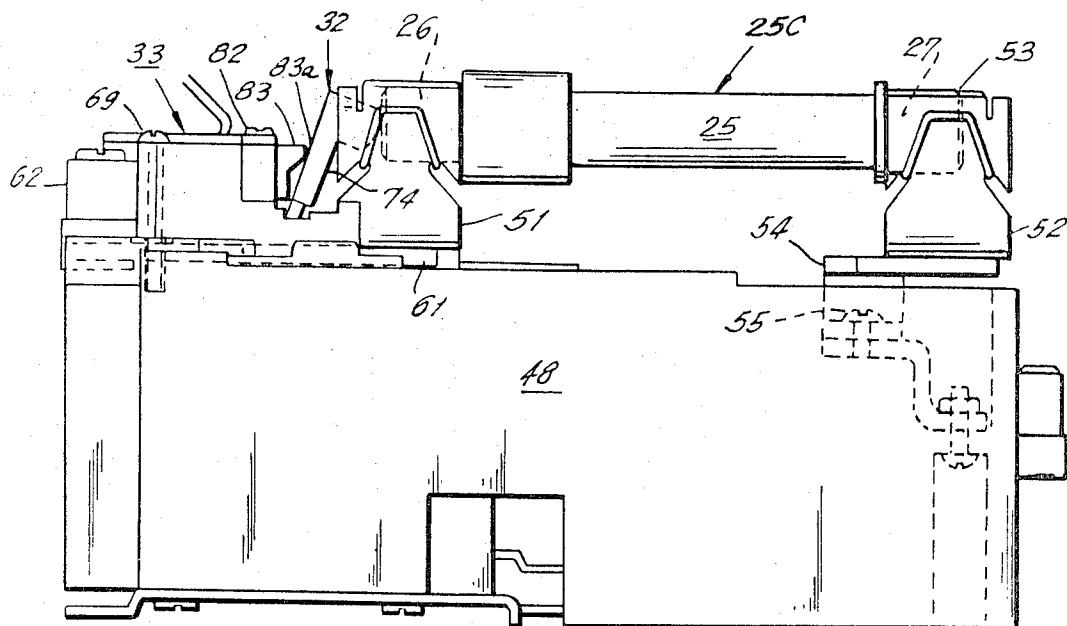


FIG. 5.

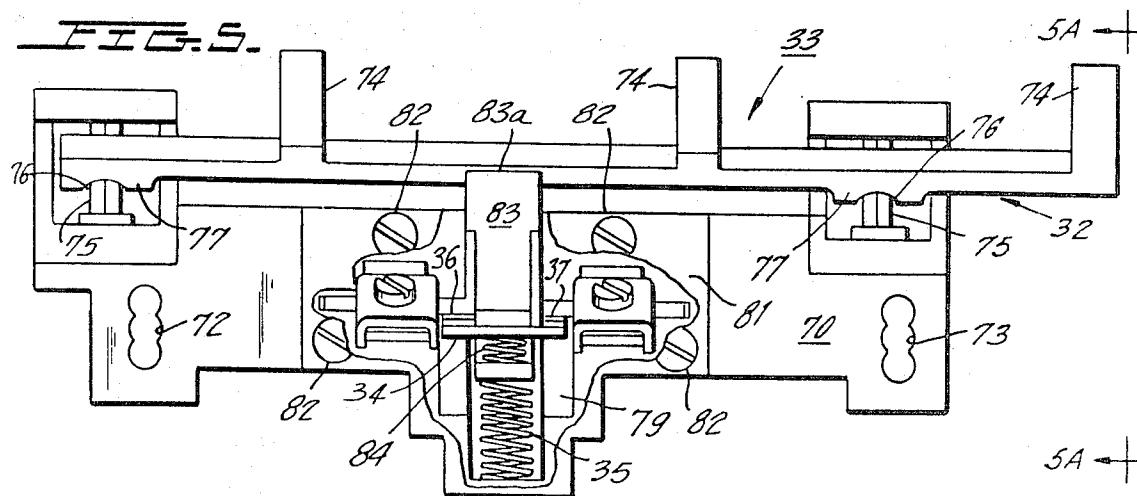


FIG. 5A.

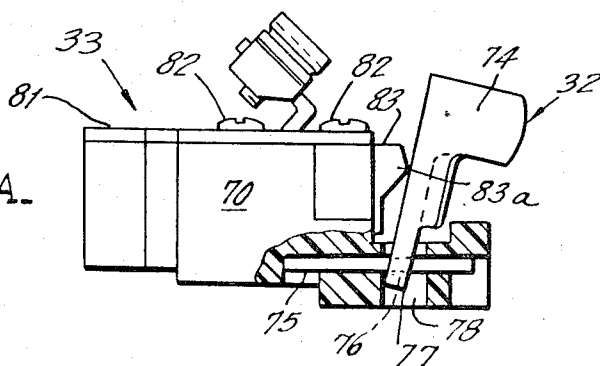


FIG. 6A.

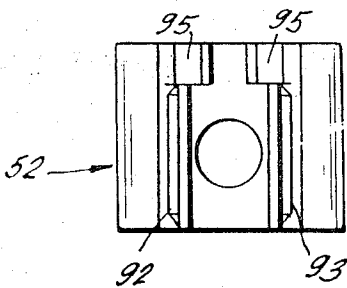


FIG. 9.

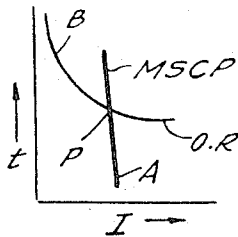


FIG. 6.

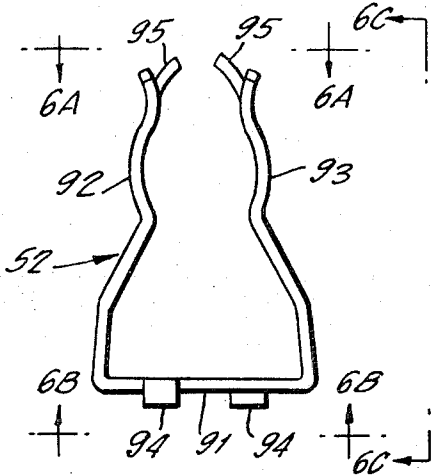


FIG. 6C.

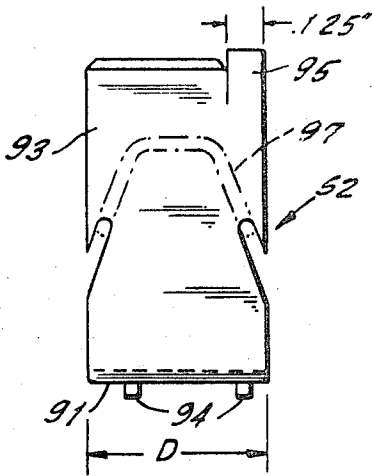


FIG. 6B.

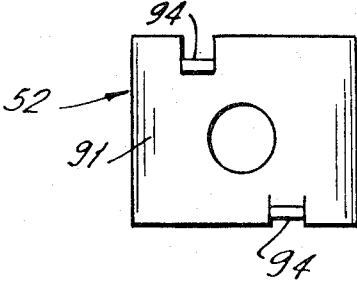


FIG. 6.

SIZE	A	B	C	D
MEN	1/2	3 7/8	7/8	5/8
OWP	5/8	4 1/8	1	3/4
RES	3/4	4 3/8	1 1/52	7/8

FIG. 7.

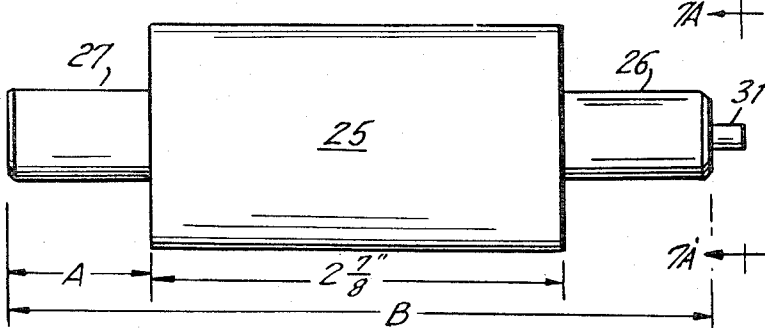
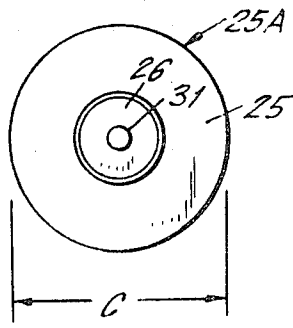


FIG. 7A.



DEVICE FOR REMOVABLY MOUNTING ELECTRICAL COMPONENT

This invention relates generally to motor controls in which there is coordination between overload relay means and a fused short-circuit protector so as to protect elements of the motor branch circuit under short-circuit conditions, and in particular this invention relates to a non-interchangeability means to prevent use of a short-circuit protector of excessive rating.

Conventionally a motor is protected against electrical damage by an overload relay which is sometimes operated in combination with fuses. An example of this latter arrangement is disclosed in U. S. Pat. No. 2,965,809, issued Dec. 20, 1960, to W. S. Edsall for *Motor Starters*. At currents slightly higher than locked rotor current, the overload relay protects the motor branch circuit as long as the motor starter is self-protecting or the current is less than 13 times full load motor current, whichever is smaller. When bolted or arcing faults cause higher currents to flow through the branch circuits, very often the branch wire, overload relay, or contactor will be damaged if the branch circuit is not disconnected rapidly from the line.

The instant invention provides interrupting means in the form of fused elements designated as motor short-circuit protectors or MSCPs. These protectors are constructed for circuit interruption in a short period of time at currents higher than indicated above and are adapted to operate in coordination with conventional overload relays by limiting let-through energy in order to protect the heaters of the overload relays and other elements of motor branch circuits at all currents higher than the current at which the overload relays protect themselves. However, the overload relays are used to effect interruption at running overloads or at lesser fault conditions.

The overall quality or effectiveness of overcurrent protection within the entire motor branch circuit depends upon the result of the coordination or combined performance of the overload relays and the motor short-circuit protectors. The time-current characteristics of these two overcurrent devices must be properly related to achieve a proper degree of protection for the circuit components against overheating and mechanical damage due to fault currents, and at the same time nuisance tripping or unnecessary operation of the devices must be avoided.

Heretofore the responsibility of component selection to provide overcurrent protection for motor branch circuits has fallen to the ultimate user. Changes in existing circuit components, higher available fault current, the user's lack of knowledge concerning short-circuit current capability of motor branch circuit elements, and the introduction of new components have increased user's selection responsibilities beyond practical limits. Therefore, in accordance with the instant invention, this responsibility is assumed by the component manufacturer, who is more likely to have the ability to properly coordinate the circuit components.

The motor short-circuit protectors, preferably one for each leg of the circuit energizing the motor, are mounted to clips, resembling fuse clips, secured to one surface of a relatively shallow housing having a manually operable disconnect switch therein. Also mounted to the housing and selectively positionable thereon is an anti-single phasing device including a common tripper bar and a normally closed switch. Actuation of any

of the motor short-circuit protectors is effective to release a spring-biased pin thereof to operate the tripper bar which, in turn, operates the switch to open position to interrupt the holding circuit for the electromagnetic contactors.

The clips include spaced arms having integrally formed projections that act as a blocking or projection means which prevents utilization of improperly rated motor short-circuit protectors.

Accordingly, a primary object of this invention is to provide a novel motor control system.

Another object is to provide novel reject means for elements that mount the motor short-circuit protectors and other electrical elements.

Still another object is to provide integrally formed reject means for holders which mount motor short-circuit protectors.

These objects as well as other objects of this invention will become readily apparent after reading the following description of the accompanying drawings in which:

FIG. 1 is an electrical schematic of a motor control system constructed in accordance with teachings of the instant invention.

FIG. 2 is a plan view of the motor short-circuit protector and disconnect switch unit.

FIG. 3 is a side elevation of the unit of FIG. 2 looking in the direction of arrows 3—3 of FIG. 2.

FIG. 4 is an end view of the unit of FIG. 2 looking in the direction of arrows 4—4 of FIG. 2.

FIG. 5 is an enlarged plan view, partially sectioned, of the anti-single phasing unit.

FIG. 5A is a side elevation of the unit of FIG. 5 looking in the direction of arrows 5A—5A of FIG. 5.

FIG. 6 is a front elevation of one of the clips for mounting a motor short circuit protector unit.

FIGS. 6A, 6B and 6C are top, bottom and side elevations respectively of the clip of FIG. 6 looking in the direction of the respective pairs of arrows 6A—6A, 6B—6B, and 6C—6C of FIG. 6.

FIG. 7 is a side elevation of a blown motor short circuit protector unit.

FIG. 7A is an end view of the unit of FIG. 7 looking in the direction of arrows 7A—7A of FIG. 7.

FIG. 8 is a dimension chart correlating the structures of FIGS. 6C, 7 and 7A.

FIG. 9 is a graph of MSCP and overload relay tripping characteristics.

Now referring to the Figures and more particularly to FIG. 1. Three phase motor 11 includes wye connected motor windings 12, 13, 14 connected through lines *r*, *s*, *t* and individual heaters 18 to individual load terminals 15 of electromagnetic contact 16 having three movable contacts 23. Heaters 18 are part of three phase overload relay 19 of a type described in U. S. Pat. No. 3,288,964 issued Nov. 29, 1966, to J. B. Cataldo et al. for a *Spring Trip Multi-Phase Overload Relay Having a U-Shaped Bimetal with a Pivot Pin at Its Web Portion*. In a manner well known to the art, when any of the heaters 18 becomes sufficiently heated, bimetal means (not shown) is effective to open normally closed contact means 21 and in so doing opens the energizing circuit for coil 22, deenergizing the latter so that main bridging contacts 23 become disengaged from their respective load and line contacts 15 and 17.

Contacts 17 are connected through other sections of conductors *r*, *s*, *t*, to load terminals 26 of the respective

motor short circuit protector units (hereinafter "MSCP") 25A, 25B, 25C whose respective line terminals 27 are connected through an individual pole of three-phase disconnect switch 28 to the respective energizing line R, S, and T. Each MSCP is of a construction illustrated in the copending applications (CS-253) Ser. No. 98,423 filed Dec. 15, 1970 and assigned to the Chase-Shawmut Company, a subsidiary of the assignee of the instant invention. In particular, each MSCP 25A, 25B, 25C includes a fusible element (not shown) having a rupturing characteristic indicated by curve A in FIG. 9, which upon rupturing releases striker pin 31 for engagement with common trip bar 32 of anti-single phasing unit 33.

Unit 33 also includes bridging contact 34, biased by spring 35 toward engagement with stationary contacts 36, 37 that are connected through lines 38, 39, respectively, to stop switch 41 and line *r* respectively. Thus, switch 34, 36, 37 is in the energizing circuit for contactor operating coil 22, such circuit also including normally closed stop switch 41 and holding contact 42, the latter being operated to closed position by energization of coil 22. Normally open start switch 43 parallels holding switch 42.

Disconnect switch 28 is generally of the type described in U. S. Pat. No. 3,349,208 issued Oct. 24, 1967 to J. B. Cataldo et al. for a Toggle Lever Actuated Manually Operated Circuit Controller, and includes molded main housing part 47 which encloses the disconnect switch contacts and operating mechanism 199 controlled by handle 200. Upper surface 48 of housing 47 supports three pairs of spaced clips 51, 52 for mounting the respective MSCPs 25A, 25B, 25C. In particular, the clip 52 for MSCP 25A is mounted by screw 53 to the raised leg of strap 54 whose lower leg is connected by screw 55 to the load terminal of disconnect switch 28.

The other clip 51 for MSCP 25A is mounted to the upper surface of strap 61 at one end of the latter with load terminal wire grip 62 being at the other end of strap 61. Screw 63 secures strap 61 to upper surface 48 of switch housing 47. Screws 68, 69 extending through a selected section of three section apertures 72, 73, respectively, in molded insulating base 70 of anti-single phasing unit 33, secure unit 33 to housing surface 48 in an operative position such that MSCP striker pins 31, when ejected, engage radially upward extending ears 74 of trip bar 32 to pivot the latter in a counterclockwise direction with respect to FIG. 5A. Roll pins 75, extending through elongated aperture 76 in ears 77 of trip bar 32 as well as through cavity 78 in base 70, provide a pivotal mounting for trip bar 32.

Switch contacts 34, 36, 37 are mounted within base cavity 79 having insulating cover sheet 81 mounted by four screws 82 to base 70. Operator 83 is provided with a cut-out portion through which bridging contact 34 extends and within which another contact pressure spring 84 is mounted. The force of spring 35 acting on plunger 83 is transmitted through spring 84 to bias contact 34 toward closed position. Spring 35 biases nose 83a of plunger 83 outside of cavity 79 into engagement with trip bar 32 in the midregion thereof, thereby urging trip bar 32 in a clockwise direction with respect to FIG. 5A.

MSCP 25A (FIGS. 7 and 7A), of a different rating than the MSCPs of FIG. 3 but in the same family, is provided with cylindrical body 25 having axially ex-

tending cylindrical terminals 26, 27 at opposite ends thereof. Striker pin 31 is also axially located, and prior to tripping of MSCP 25 pin 31 is retained within terminal 26.

Since terminal clips 51, 52 have identical constructions, only one of these clips, clip 52, will be described in detail. With particular reference to FIGS. 6-6C, clip 52 is constructed of resilient conducting material and is of generally U-shape having web 91 interconnecting arms or jaws 92, 93 which engage MSCP terminal 27 therebetween. Outwardly extending ears 94 of web 91 are received by recesses in strap 54 to prevent rotation of clip 52. The edges of jaws 92, 93 remote from clip 51 are each provided with an integrally formed inward projection 95 which is operatively positioned to block proper mounting of an MSCP unit that is of excessive rating, thereby forming a one-way rejection or non-interchangeability means. Formed wire spring 97 urges jaws 92, 93 toward one another into firm electrical and mechanical engagement with MSCP terminal 27. As seen by studying the chart of FIG. 8 in relation to FIGS. 6C, 7 and 7A, MSCP 25 is one size unit in a family of three MSCPs, each having a 2-7/8 inch long cylindrical body but having different length terminals 26, 27. The electrical ratings are also different, with sizes R and S having I^2t ratings greater than the I^2t ratings of sizes M and N and less than the I^2t ratings of sizes R and S. Non-interchangeability formations 95 of clip 52 are operatively positioned to block mounting of those members of this MSCP family that are of excessive rating. For example, if combination motor starter 16, 19, 25, 28 is constructed so that the largest MSCP to be used is sizes O and P, then the distance between non-interchangeability formations 95 of clips 51, 52 is greater than 4-1/8 inches but less than 4-3/8 inches. With such a construction, clips 51, 52 will accept MSCP sizes M and N but will reject sizes R and S.

Reference is made to FIG. 9 which shows a steep current versus melting time characteristic of the MSCP in log-log scale. In particular, the crossover point P between the MSCPs melting characteristic A and the overload relay tripping characteristic B is chosen so that the MSCP will operate to cause opening of the operator coil circuit under severe overload conditions. In order to protect overload relay heaters 18 and motor 11, and to prevent nuisance blowing of the MSCP, crossover point P is generally in the range from 5.5 to 13 times full load current of motor 11 depending upon the current up to which overload relay 19 is self-protecting. For running overload conditions and currents under crossover point P of the two characteristics A and B, opening of the circuit for energizing coil 22 is caused by the operation of overload relay means 19.

Thus, it is seen that the instant invention provides a novel motor controlling system which utilizes motor short-circuit protectors mounted in ferrule engaging clips having integrally formed blocking formations constituting a non-interchangeability means.

Although there has been described a preferred embodiment of this novel invention, many variations and modifications will now be apparent to those skilled in the art. Therefore, this invention is to be limited not by the specific disclosure herein but only by the appending claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows.

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1. Mounting means for removably connecting a motor short circuit protector (MSCP) in a motor starter circuit, with this MSCP being from a family consisting of at least three MSCPs each having a different let-through energy rating, each having the same length cylindrical body and the same diameter axially extending cylindrical terminals at each end, with body diameter and terminal length in the family being graduated so that they are greatest for the MSCP of highest rating and least for the MSCP of lowest rating; said mounting means including first and second clips engaging the cylindrical terminals of an MSCP, said clips being spaced apart by the same distance regardless of the highest rated MSCP said spring clips are constructed to receive; at least one of said clips at the end thereof remote from the other of said clips having a blocking means operatively positioned to permit normal mounting of those MSCPs in said family having ratings below a predetermined let-through energy rating and block mounting of those MSCPs in said family having ratings above said predetermined let-through rating.

2. Mounting means as set forth in claim 1 in which each of said clips includes a pair of spaced jaws; said blocking means including inward projections on said jaws of at least one of said clips and formed integrally therewith.

3. Mounting means as set forth in claim 2 in which each of the clips is generally U-shaped with a web section

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tion connecting a pair of spaced arms constituting said jaws, said web being at one end of said arms and said projections being at the other end of said arms.

4. Mounting means as set forth in claim 3 in which the projections of one of said clips are at the end thereof remote from the other of said clips.

5. Mounting means as set forth in claim 2 in which both of said clips have inward projections on said jaws formed integrally therewith and operatively positioned to reject predetermined devices exceeding said predetermined specifications from being operatively mounted to said clips; for each of said clips the inward projections thereof being at the end thereof remote from the other of said clips; said clips being positioned with the spacing between the projections of said first clip and the projections of said second clip being greater than the overall lengths of those electrical devices of no greater than said predetermined specifications and being less than the overall lengths of those electrical devices exceeding said predetermined specifications.

6. Mounting means as set forth in claim 5 in which each of the clips is generally U-shaped with a web section connecting a pair of spaced arms constituting said jaws, said web being at one end of said arms and said projections being at the other end of said arms.

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