Abstract

Mechanical interlock assembly for two or more electrical contactors in which the contactors each comprise a movable contact structure associated with electromagnetic means for actuating the movable contact structure for closing a circuit through the contactor; and a lever pivotally mounted between the contactors and having opposite end portions disposed in the path of movement of corresponding movable contact structures for holding one structure in a "closed-circuit" position and the other structure in an "open-circuit" position.
MECHANICAL INTERLOCK FOR ELECTRICAL CONTACTORS

BACKGROUND OF THE INVENTION

1. Field of the Invention
   This invention relates to mechanical interlocks for use in conjunction with two or more electrical contactors to prevent the contactors from being actuated simultaneously.

2. Description of the Prior Art
   The operation and control of reversible motors and multispeed motors usually include a contactor for each motor operation. A typical circuit includes, for example, a separate manual button for each contactor for the forward and reverse directions of a motor. As a result, actuation of the forward or reverse circuit includes an associated circuit for deactivating the other of the forward and reverse circuits. Notwithstanding such precautions, it sometimes occurs due to inadvertence or other reasons that both circuits, i.e., forward and reverse control buttons, are actuated simultaneously and thereby cause incorrect phase-to-phase line connections in the contactors. For that reason there is a need for a mechanical interlock disposed between the contactors to prevent incorrect phase-to-phase line connections.

Associated with the foregoing is a problem of adjusting a mechanical interlock on a back panel or control board between contactors of different size and/or manufacturers. As a result, there is a need for a mechanical interlock which is adjustable to any position suitable for operation between contactors of different sizes.

SUMMARY OF THE INVENTION

It has been found in accordance with this invention that the foregoing problems may be overcome by providing a mechanical interlock comprising a lever member which is substantially centrally pivotally mounted between a pair of contactors, each of which comprises a stationary contact structure, a movable contact structure, electromagnetic means for moving the movable contact structure between open and closed positions with respect to the stationary contact structure, the mechanical interlock being disposed so that the opposite end portions thereof are located in the path of travel of the movable contact structure of the contactors, whereby both contactors are prevented from being in the closed position simultaneously.

The advantage of the mechanical interlock of the present invention is that incorrect phase-to-phase line connections are prevented. In addition, a mechanical interlock is provided with adjustment means for compensating for irregularities in mounting surfaces, variations in mounting panels, in tolerances, and different size contactors.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a mechanical interlock disposed between a pair of three-pole contactors;
FIG. 2 is a vertical sectional view taken generally along the line II—II of FIG. 1;
FIG. 3 is a vertical sectional view taken on the line III—III of FIG. 1; and
FIG. 4 is a plan view showing the manner in which a mechanical interlock may be used in conjunction with three contactors.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Although the contactors described and shown herein are of the three-pole type, it is understood that other types of contactors may be used in conjunction with the mechanical interlock of this invention.

In FIGS. 1 and 2 an electric control system is generally indicated at 10 and it includes a mechanical interlock generally indicated at 12 and a pair of spaced contactors 14 and 16. The interlock 12 is disposed between the contactors 14, and 16, and the interlock and contactors are mounted on a base or mounting panel 18.

Generally, the interlock 12 is a lever comprising a pair of laterally spaced side brackets 20 and 22, a pair of generally U-shaped end brackets 24 and 26 each of which includes a pair of spaced end portions adapted to engage the contact carrier or carrier base at a pair of corresponding spaced locations or points, and mounting means including a pivot pin 28. The side brackets 20 and 22 have returned end portions at opposite ends which are secured to corresponding end brackets 24 and 26 by suitable means such as screws 30. The side brackets 20 and 22 are centrally mounted on the pivot pin 28 having end portions seated in the U-shaped mounting bracket 32 which is secured to the panel 18 in a suitable manner.

An adjusting bracket 34 (FIG. 3) is mounted within the bracket 32 and includes an intermediate portion 34a which is spaced above the intermediate portion 32a of the bracket 32. A pair of adjusting screws 36 are mounted on the intermediate portion 34a in order to adjust the vertical spacing between the portions 32a and 34a. The upright sides of the bracket 34 include opposed openings through which the pin 28 extends. Those openings are aligned with vertically extending slots 38 (FIG. 2) through which the pivot pin 28 also extends. The pin 28 is retained in place against lateral movement by retaining rings 40. When adjustments are made by the screws 36, the pin 28 moves vertically with the adjusting bracket 34 and within the slots 38 of the bracket 32. When the desired setting is established set screws 42 which extend through slots 44 are tightened in place to retain the relative positions of the brackets 32 and 34. A unique feature of the adjusting bracket 34 is the capability of adjustment of the interlock 12 to varying positions relative to the contact carrier base of the contactors 14 and 16. The proper position is obtained and maintained by the adjusting screws 36 having lock nuts 37.

As shown more particularly in FIG. 2, the end brackets 24 and 26 extend to openings 45 in housings 46 of the contactors 14 and 16. Inasmuch as the contactors are set forth more particularly in the application of Ser. No. 853,271, filed Aug. 27, 1969, only the operative parts essential to the complete description of this invention are described herein. For brevity the contactors 14 and 16 are similar in construction and operation for which reason only the contactor 16 is described herein. As shown in FIGS. 1 and 2 the spaced end portions of the end brackets 24 and 26 are...
preferably provided with covers 24a and 26a, respectively, of dielectric material, such as nylon. The covers 24a and 26a serve primarily as resilient pads between the metal brackets 24 and 26 and the carrier base of the contactor to absorb the force of impact on the brackets. Moreover, spaced end portions are preferred over a single portion for better balancing between the interlock and the carrier base and for greater overall reliability.

The contactor 16 comprises a housing structure including the housing 46 and a base 48. The contactor also comprises a stationary contact structure 50, a movable control device 52, and an electromagnet 54. The housing 46 being composed of a dielectric material is a substantially rectangular body which is mounted on the base 48 and includes the openings 44 on opposite sides thereof (FIG. 2) through which the end brackets 26 extend.

The stationary contact structure 50 includes a pair of spaced contacts 56 and 58, similar mounting brackets 60 and 62, and conductors 64 and 66. The assembly of the contacts, mounting brackets, and conductors are secured together electrically and mounted fixedly on similar housing portions 68 in a suitable manner such as by screws 70. The conductors 64 and 66 extend in opposite directions through the housing 46 so that the external portions of the conductors are accessible for connection to a circuit for controlling, for example, a motor (not shown). For that purpose terminal connectors 72 are secured to the outer ends of the conductors 64 and 66 to enable connection of each pole unit in an electric circuit.

The movable control device 52 comprises a bridging contact member 74 having contacts 76 and 78, a dielectric or electrically insulating contact carrier 80, and a carrier base 82 which may be formed integrally with the carrier 80. The movable control device 52 is vertically movable between the upper position, as shown in FIG. 2, and a lower position in which the movable contacts 76 and 78 are in electrical contact with the stationary contacts 56 and 58. The movable control device 56 is retained in the upper position as shown in FIG. 2 by suitable means such as springs (not shown in the drawing) as shown in said application, see No. 853,271. The dielectric contact carrier 80 is disposed in a spacing between the conductors 64 and 66, the mounting brackets 60 and 62, and the stationary contacts 56 and 58.

As shown in FIG. 2, an upper end portion 84 of the dielectric contact carrier 80 extends through an opening 86 in the upper surface of the housing 46 to permit manual operation of the contactor and to serve as a guide for the movable control device 52.

In addition to the foregoing, the contactor 16 includes electromagnetic means for pulling or actuating the dielectric contact carrier 80 downwardly against the biasing springs which normally hold the carrier in the upper unactuated or open position. It is noted that although the electromagnetic means is actuated for closing a circuit through the contacts, it may be actuated or operated for the reverse function of opening a circuit and the unactuated position corresponding to a closed circuit. The electromagnetic means includes a stationary magnetic member 88 supported on the base 48 and a conducting coil 90 associated therewith, as well as a magnetic armature 92 which is secured within the carrier base 82 above the magnet member 88. The armature 92 is an inverted generally U-shaped, laminated member which is pulled magnetically to the stationary laminated magnetic member 88 when the coil 90 is energized. Thus, the movable control device 52 is pulled downwardly to bring the contacts 56, and 76, 58 and 78 into engagement. In the lowered position (as indicated by the broken line 94 of the carrier base 82) the right end of the interlock 12 is depressed to the broken line position 96 as viewed in FIG. 2. Manifestly, the left end of the interlock 12 is raised against the carrier base 82 of the contactor 14 to retain it in the upmost position and thereby prevent simultaneous closing of circuits through both contactors 14 and 16 in the event that an inadvertent attempt is made to actuate both contactors simultaneously, such as by manually pressing the control buttons at a control panel for actuating both conducting coils 90 in the contactors.

In another embodiment of the invention, as shown in FIG. 4, a mechanical interlock may be used for more than two contactors. For example, three contactors 98, 100, and 102 may be used for actuating a reversible motor for an elevator. More particularly, the contactor 100 is used for operating the motor for lifting the elevator and contactor 102 is used for reversing the motor to lower the elevator. Both contactors 100 and 102 are conventionally used with alternating current. The contactor 98 is provided for dynamically jamming the motor with direct current in either the up or down direction as the elevator approaches a signalled stopping point or floor. For that purpose, a mechanical interlock generally indicated at 104 is provided. For simplicity of the parts of the interlock 104 that correspond to the interlock 12 (FIG. 2) are provided with identical reference numbers and additional parts are described where the interlock differs from the interlock 12. Thus, the interlock 104 includes an actuator bracket 106 which is attached to the right end of the side brackets 20 and 22 as viewed in FIG. 4. The actuator bracket 106 is an elongated member having end brackets 26 attached to opposite ends thereof for use in conjunction with the conductors 100 and 102. Like the end brackets 24 and 26 in FIG. 1, the end brackets in FIG. 4 are preferably U-shaped members composed of metal and are provided with dielectric sleeves 24a and 26a, respectively. Like the end brackets 24 and 26 in FIG. 1, the end brackets 24 and 26 in FIG. 4 extend into their corresponding contactors through similar openings in the housing wall and are disposed in the path of movement of the carrier bases 82 as shown in FIG. 2. Thus, when the contactor 98 is actuated, the left end of the interlock 104 is depressed and the right end including the end brackets 26 extending into the contactors 100 and 102 are raised to prevent actuation of current through these contactors.

In addition, an interlock 108 may be provided between the contactors 100 and 102 to prevent both from being actuated simultaneously. Structurally, the interlock 108 is similar to the interlocks 102 and 104 with the exception that the interlock 108 includes a pair of brackets 110 and 112 which is substantially shorter than the side brackets 20 and 22 because of the smaller spacing between the contactors 100 and 102.
than between the contactors 14 and 16. The brackets 110 and 112 are pivotally mounted on the pivot pin 28 which in turn is mounted on brackets 32 in a manner similar to that shown in FIG. 4. Opposite ends of the brackets 110 and 112 are disposed below the carrier bases 82 of the separate contactors 100 and 102. As a result, when the right end of the interlock 104 is down, one or the other of the contactors 100 and 102 is free to be actuated but not both.

In conclusion, the mechanical interlock of this invention prevents two or more contactors from being actuated in incorrect line connections simultaneously.

What I claim is:

1. An electric control system comprising at least two control devices and a mechanical interlock, each control device comprising a stationary contact structure, an electromagnet including a magnetic armature, magnetic core and a coil, a movable structure movable as a unit and comprising a movable contact structure, a movable contact carrier, and said magnetic armature, the magnetic armature being movable relative to the core to move the movable contact structure between an operated position and an unoperated position to control an electric circuit, the mechanical interlock being between the control devices and including a lever reciprocally movable between first and second positions and having one end portion cooperative with the movable structure of one control device for holding the movable contact structure of the other control device in its unoperated position in said first position of said movable member and having another end portion cooperative with the movable structure of the other control device for holding said movable contact structure of said one control device in unoperated position in said second position of said movable member, means for mounting the lever between the control devices and comprising an adjusting bracket and a pivot pin, the lever being mounted on the pivot pin, the pivot pin being mounted on the adjusting bracket, and the pivot pin being movable to varying positions in a line of travel substantially parallel to the lines of travel of the movable contact carriers.

2. The electric control system of claim 1 in which there are means for biasing each control device movable structure in the unoperated position.

3. The electric control system of claim 1 in which there are three control devices and two of which devices are grouped as a pair with an interlock therebetween and with a third device being spaced from the pair of devices with a second interlock disposed between the third device and at least one of the pair of devices.

4. The electric control system of claim 1 in which each end portion of the movable member is adapted to engage the contact carrier at two spaced locations.

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