 AUXILIARY CONTACT INTERLOCK FOR ELECTROMAGNETIC CONTACTOR

Inventors: Edward L. Richards, Aliquippa; Stephen S. Dobrosielski, Beaver, both of Pa.


Filed: May 8, 1974

Appl. No.: 468,335

U.S. Cl. .................. 335/192; 335/193; 700/250
Int. Cl. ...................... H01h 3/00
Field of Search ............. 335/193, 196, 104, 192; 700/16 A, 243, 250, 251, 288, 146 R

REFERENCES CITED

UNITED STATES PATENTS
2,546,001 3/1951 Immel .................. 200/250 X
3,272,947 9/1966 Kobryner ............... 200/146 R X

Primary Examiner—G. Harris
Attorney, Agent, or Firm—L. P. Johns

The auxiliary contact interlock for use with an electromagnetic contactor having a crossbar which in the open position of the contactor is subject to unlimited vertical bouncing incurred by ambient vibration, characterized by stationary and movable contacts within a housing, a movable contact carrier supported on a rod mounted within the housing for longitudinal movement between open and closed contact positions, the rod being biased in one of the open and closed positions by a kickout spring, the end of the rod external of the housing being depressed against the kickout spring to said one of the open and closed positions when the crossbar is in the open contact position of the electromagnetic contactor, a loading spring mounted on the rod and adjacent to the contact carrier for holding the rod in said one position and a shock spring having a greater spring constant than the loading spring on the rod and end-to-end abutment with the loading spring for maintaining the contact in said one position so long as the rod is deflected against the kickout spring by the crossbar.

5 Claims, 2 Drawing Figures
AUXILIARY CONTACT INTERLOCK FOR ELECTROMAGNETIC CONTACTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention
This invention relates to auxiliary contact assemblies or interlocks associated with electromagnetic contactors.

2. Description of the Prior Art
Certain types of electromagnetic contactors and relays are particularly adapted for operation on board naval vessels. Examples of such contactors or relays are disclosed in U.S. Pat. Nos. 2,425,648 and 2,523,163. With electromagnetic devices on board naval vessels, it is necessary that certain electric circuits be undisturbed during shellfire. The shock of shellfire causes considerable impact and vibration which are transmitted to the electromagnetic devices. Under some circumstances where the contacts are in the open position it is desirable to maintain certain auxiliary circuits in the open and/or closed positions without interference from shocks incurred by shellfire.

SUMMARY OF THE INVENTION

Generally, it has been found in accordance with this invention that the foregoing problem may be satisfied by providing an auxiliary contact interlock for use with electromagnetic contactor having a crossbar which is in the open position of the contactor is disposed by gravity to a lower position; the interlock comprising a housing, stationary and movable contacts within the housing, a movable structure movable as a unit and comprising a bridging contact carrier and a rod supporting the carrier, the rod being mounted for longitudinal movement between open and closed contact positions in the housing, the rod being biased in one of the open and closed positions upon movement of the crossbar against the outer end of the rod, the carrier also comprising a loading spring and a shock spring both mounted on the rod and on the side of the carrier adjacent to the electromagnetic contactor, the loading spring being disposed on the rod and between said carrier and a spring backup member on the rod, the shock spring being disposed between the spring backup member and a spring stop member on the rod, the loading spring having a lower spring constant than the shock spring, and the spring backup member being sidely mounted on the rod but only toward the shock spring.

The advantage of the device of this invention is that the contacts of the auxiliary contact interlock are maintained in the desired open or closed position when an impact force is experienced due to shock or severe ambient vibrations.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical sectional view of an electromagnetic contactor and an associated auxiliary contact interlock; and
FIG. 2 is a vertical sectional view taken on the line II—II of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

An electromagnetic contactor generally indicated at 5 is mounted on a support base 7 and comprises an electromagnetic operating mechanism including a coil 9, a magnetic frame 11, a vertically movable operating member or armature 13, a crossbar 15 disposed at the lower end of the armature, a pair of stationary contacts 17, and a pair of movable contacts 19 mounted on the crossbar. Inasmuch as the contactor 5 is substantially disclosed in U.S. Pat. No. 2,523,163, an explanation of the manner in which the contactor operates is limited. Briefly, when the coil 9 is energized, the armature 13 moves upwardly in the coil to pull the crossbar 15 and the contacts 19 from the open position shown in FIG. 1 to a closed position with the stationary contacts 17 as generally indicated by the broken line positions of the movable contacts 19.

In addition to the contactor 5 an auxiliary contact interlock is provided at the lower end of the contactor. The contactor interlock 21 comprises a housing 23, means for opening and closing a circuit through the interlock including a movable contact carrier comprising a bridging contact carrier 25, and a plunger or rod 27 on which the contact carrier is mounted. In addition, the interlock 21 comprises a pair of movable contacts 29 and stationary contacts 31. Although the auxiliary contact interlock 21 is of a normally open construction, it is shown in the closed position because the contactor crossbar 15 is in its lowermost position and the upper end of the rod 27 is thereby depressed to the overtraveled closed contact position.

More particularly, the housing 23 is composed of three sections 33, 35 and 37 which are secured together by suitable means, such as nut and bolt assemblies 39. The housing sections 33—37 are composed of molded electrically insulating material and when assembled form an operating chamber 41 in which the operating parts including the contacts 29 and 31 are contained. The contact carrier 25 is slidably mounted on the rod 27 and is normally retained in the upper or open contact position by a loading spring 43. The contacts 29 are disposed at opposite ends of the contact carrier 25 and are aligned with the stationary contacts 31 which are disposed on separate conductors 45, 47 each of which is provided with a terminal (not shown in the drawing).

The rod 27 extends through an aperture 49 in the upper side of the housing section 33 and is an elongated flat member vertically movable through the aperture and through a bearing 51 which is seated in the lower housing section 37. The bearing 51 includes a bore in which a bearing 53 is movably mounted which bearing 53 is secured to the lower end portion of the rod 27.

In addition to the movable contacts 29, auxiliary contacts 55 of resilient material are disposed adjacent to the movable contacts and are preferably end portions of an elongated conductor 57 which extends across the top of the contact carrier to which the conductor is secured by suitable means such as rivets 59. The auxiliary contacts 55 engage the conductors 45 and 47 against which the auxiliary contacts 55 are held tightly in place due to the flexibility of the material of which the contacts are composed.

As shown in FIGS. 1 and 2 in accordance with this invention, the rod 27 includes a window or opening 61 in which a shock spring 63 is disposed with its upper end seated against the upper end of the opening and with its lower end seated against a backup plate 65 which, when the shock spring is fully extended, is seated against the lower end of the opening. In addition to the shock spring 63 a loading spring 67 is disposed between the contact carrier 25 and the plate 65. Prefer-
ably, however, a backup plate 69 is slidably mounted on the rod 27 and adjacent to the backup plate 65. The loading spring 67 preferably surrounds the rod 27 and has a lower spring constant than the shock spring 63; that is, the shock spring requires a greater force to compress than does the loading spring 67.

In operation in accordance with this invention when the crossbar 15 of the contactor 5 drops to the open position as shown in FIG. 1 it pushes the rod 27 downwardly and moves the contacts 29 from the normally open (broken line) position to the closed position with the stationary contacts 31. As the rod 27 is moved downwardly the backup plate 65 moves into contact with the backup plate 69 and continued travel of the rod causes the loading spring 67 as well as the kickout spring 43 to be compressed as shown in FIG. 1. When contacts 29 press on stationary contacts 31 to complete the circuit, movement of carrier 25 is arrested. Continued downward travel of rod 27 bottoms out spring 67 and over-travel compression of spring 63 results. The length of over-travel of the spring 63 and the spring 67 compression is greater than the possible upward movement of the crossbar before its travel is stopped by the contactor shock latches when the equipment is subjected to the effects of shock.

In the event of an unusual shock or vibration being transmitted to the contactor 5 and the interlock 21 to cause the contactor crossbar to rise its latch arrested position, the carrier 25 cannot raise to open contact 29 from 31 because only the spring 63 overtravel is dissipated; but compression of spring 67 is mostly retained to continue pressure on carrier 25. More particularly, if the crossbar 25 moves fractionally upwardly, even a sufficient distance to momentarily separate the movable contacts 29 from the stationary contacts 31, the auxiliary contacts 55 remain in contact with their conductors 45 and 47. However more importantly, due to the pressure applied by the shock spring 63 against the backup plates 65, 69, very little, if any, movement of the contact carrier 25 actually occurs. Indeed, sufficient pressure is applied by the shock spring 63 and the loading spring 67 to overcome any pressure to separate the contacts 29, 31. It is noted that the kickout spring 43 has a lower spring constant than either the shock spring 63 or the loading spring 67 and is effective to raise the contacts to the open position only under normal conditions where operation of the contactor coil draws up the armature and crossbar to a height sufficient to relieve all pressure from the rod 27. Movement upward of the contactor crossbar to that height is prevented by the contactor shock latches which arrest and stop the upward movement of the armature and its connected crossbar when the assembly has experienced shock.

Accordingly the device of this invention provides a multipoint loaded interlock which is adapted for maintaining normally open or normally closed interlocks in closed and open positions, respectively, notwithstanding ambient forces or vibrations applied.

What is claimed is:
1. A shock-responsive device comprising an electromagnetic contactor and an auxiliary contact interlock, the electromagnetic contactor comprising a first pair of movable and stationary contacts, electromagnetic means for closing the contacts and comprising a first crossbar, the first crossbar being biased to an open-contact position, the first crossbar being subject to fluctuations in response to shock forces on its axis of travel between the open and closed positions of the contacts when the first crossbar is in the open-contact position, the auxiliary contact interlock comprising a housing, a movable contact carrier and a second pair of movable and stationary contacts within the housing, the movable contact carrier comprising a bridging contact carrier and a rod supporting said carrier, said carrier comprising a second crossbar and the second pair of movable contacts on the second crossbar, the second crossbar being mounted on the rod, the rod being mounted for longitudinal movement between open and closed contact positions in the housing, the rod being biased in the open position, said carrier also comprising a loading spring and a shock spring both mounted on the rod and on the side of said carrier adjacent to the electromagnetic contactor, the loading spring being disposed on the rod and between said carrier and a spring backup member on the rod, the shock spring being disposed between the spring backup member and a spring stop member on the rod, the loading spring having a lower spring constant than the shock spring, and the spring backup member being slidably mounted on the rod toward the shock spring.
2. The shock-responsive device of claim 1 in which the loading spring and the shock spring are in end-to-end abutment.
3. The shock-responsive device of claim 1 in which the spring backup member is disposed between the loading spring and the shock spring.
4. The shock-responsive device of claim 3 in which the rod includes an opening, and the shock spring is disposed in the opening.
5. The shock-responsive device of claim 4 in which the spring is disposed in the opening adjacent to the loading spring.

* * * * *