An electric control system characterized by a multipole control device and a fuse block, the control device having stationary and movable contact structures and electromagnetic means for moving the movable contact structure between operated and unoperated positions with respect to the stationary contact structure, the control device being enclosed within a housing having openings for access to the stationary contact structure; a fuse block mounted on the housing and comprising a conductor connected to one of the stationary contact structures, spaced clips for mounting a fuse block, one of which clips is connected to the conductor, and a terminal connected to the other of said clips. The electric control system also includes a crossbar having end portions extending through vertical slots in opposite sides of the housing and the portions of the housing forming the slots being seated in corresponding notches in said end portions of the crossbar whereby a pin for mounting an armature on the cross-bar is retained in place.

2 Claims, 6 Drawing Figures
ELECTROMAGNETIC CONTACTOR WITH FUSE BLOCK

BACKGROUND OF THE INVENTION

1. Field of the Invention
The invention relates generally to electric control devices and more particularly to such devices operated by electromagnetic means.

2. Description of the Prior Art
Electric control devices, such as contactors, are available in single or multipole types for various applications. In the past, when one pole of a multipole contactor required a fuse block in conjunction therewith for short circuit protection, the fuse block has been normally mounted on a panelboard. The disadvantage of that combination is that the fuse block reduces available space on the panelboard.

In addition, manufacturers of electromagnetic control devices are constantly endeavoring to provide a product that is more satisfactory to the consumer in various respects including lower cost, greater efficiency, quieter operation, and less maintenance. After a contactor has been used for an extended period of time it may require dismantling for maintenance or the like. After periods of such long use, the armature and magnet comprising the electromagnetic unit develop "mated" surfaces which upon reassembly should be remated to avoid any unnecessary noise or hum. For example, most prior known contactors comprise a crossbar which may be inserted in one position, or in a 180° oriented position, whereby mated surfaces of the armature and magnet are not remated upon reassembly. During subsequent operation, the contactor frequently emits an unpleasant hum.

SUMMARY OF THE INVENTION
It has been found in accordance with this invention that the foregoing problems may be overcome by providing an electromagnetic contactor comprising stationary and movable contact structures, electromagnetic means including an armature for moving the movable contact structure between open and closed positions with respect to the stationary contact structure, the electromagnetic means also including a crossbar on which the armature is mounted, a housing of electrically insulating material enclosing the stationary and movable contact structures which housing is provided with opening means for access to the stationary contact structure, a fuse block detachably mounted on the housing and comprising a conductor connected through one of the access openings to the stationary contact structure, the fuse block comprising a terminal and a pair of spaced clips for mounting a fuse, and a conductor being connected to one of the clips and a terminal being connected to the other of the clips. The contactor also includes openings in opposite walls of the housing through which opposite end portions of the crossbar extend, a mounting pin for mounting the armature on the crossbar and pin receiving grooves in the crossbar on each side of the armature, the extremities of the pin being disposed at the locations of the housing openings, the crossbar having notches at such locations for receiving the wall portions forming the openings and the wall portions forming the openings providing a shoulder in the opening for preventing any misorientation of the crossbar in the contactor.

The advantage of the electromagnetic contactor of this invention is that it provides for an exact reassembly of a pin retaining means for the crossbar into the contactor housing and at the same time maintains short circuit protection means in the form of a fuse block without reducing the area on a panelboard.

BRIEF DESCRIPTION OF THE DRAWINGS
FIG. 1 is a vertical sectional view of an electromagnetic contactor taken on the line I—I of FIG. 2;
FIG. 2 is an end view of the device shown in FIG. 1;
FIG. 3 is an elevational view taken on the line III—III of FIG. 2;
FIG. 4 is a fragmentary vertical sectional view taken on the line IV—IV of FIG. 1;
FIG. 5 is a horizontal sectional view taken on the line V—V of FIG. 2; and
FIG. 6 is a fragmentary vertical sectional view taken on the line VI—VI of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT
Although the contactor described and shown herein is of the three-pole type, it is understood that any other type of contactors may be used in conjunction with the device of this invention.

In FIGS. 1 and 2, an electric control device for the contactor is generally indicated at 10 and comprises a metallic base plate 12, a contact structure 14, and suitable means such as U-shaped spring clips 16 for securing the contact structure on the base plate. The contact structure 14 comprises a housing 18, a stationary contact structure 20, a movable contact structure 22, and an electromagnet 24. The housing 18, being composed of an electrically insulating material, is a substantially rectangular body which is mounted on the base plate 12 and includes openings 26 on opposite sides thereof through which terminals 28 of the stationary contact structure extend. The housing also includes a top surface 30 which includes spaced openings 32 one of which is shown in FIG. 1. The housing includes opposite side walls 34 and 36, each of which includes a horizontal projection 38 on which the intermediate portion of the spring clip 16 is seated. As shown in FIG. 2, a lower extremity of the spring clip includes upturned hook portions 40 which extend through openings provided therefor in the base plate 12. The housing also includes a vertical slot 42 in each of the side walls 34 and 36. As shown in FIG. 3, for the slot 42, each slot is wider at the lower end and narrower at the upper end due to a shoulder 44 provided by the peripheral portion of the side wall 36 forming the opening. The shoulders 44 for both slots are on the same side of the housing as shown in FIG. 5.

The stationary contact structure 20 includes a pair of spaced contacts 46 and 48 attached respectively to end portions of conductors 50 and 52, the other ends of which are provided with the terminals 28. The assembly of the contacts, conductors, and terminals is retained in place in the openings 20 of the housing in a suitable manner such as by screws 54. The conductors 50 and 52 extend in opposite directions through the housing 18 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, the terminals 28 are secured to the outer ends of the conductors as shown in FIG. 1 for the conductor 52 to enable connection of each pole unit in an electric circuit.

The movable contact structure 22 comprises a bridging contact member 56 having contacts 58 and 60, an electrically insulating contact carrier 62, and a crossbar 64 which is preferably formed integrally with the contact carrier 62. As shown in FIG. 1, the upper end portion 62a of the contact carrier extends through the opening 32 in the top of the housing to permit manual operation of the contactor and to serve as a guide for the movable contact structure 22. The movable contact structure 22 is vertically movable between upper and lower positions in which the contacts 58 and 60 are in open and closed positions with the stationary contacts 46 and 48 respectively. The movable contact structure 22 is retained in the upper position as shown in FIG. 1 by suitable biasing means such as springs 66.

The electromagnet 24 pulls or actuates the movable contact structure 22 downwardly against the biasing springs 66 which normally hold the carrier in the upper un actuated or open position. It is noted that although the electromagnetic means or electromagnet 24 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 electromagnet 24 includes a stationary magnet 68 supported on the base plate 12, and a conducting coil 70 associated therewith, as well as a magnetic armature 72 which is mounted on the crossbar 64 above the magnet 68. The armature is a laminated member which is pulled magnetically to the stationary laminated magnet 68 when the coil 70 is energized. As shown in FIGS. 1 and 2, terminals 70a and 70b are provided on the external side of the housing for the coil 70. Thus, the movable contact structure 22 is pulled downwardly to bring the pairs of contacts 58, 46 and 60, 48 into engagement.

In some circuits, it is desirable to provide a fuse for protection of the contactor from short circuits. For that purpose, a fuse block 76 may be mounted on the top of the housing for selected pair of poles. As shown in FIGS. 1 and 2, the fuse block 76 is a rectangular member comprising a housing 76, clips 78 and 80 for mounting a fuse 82, and a terminal 84. A conductor 86 extends between the clip 80 and the terminal 84 and the clip 80 may be moved to a position 88 where a larger fuse 82 is necessary. The fuse block 72 includes a downturned conductor 90, the lower end of which includes an out-turned flange 92. The housing 76 being a box-like structure is provided with opposite side walls 94 and 96 in which aligned openings 98 are provided for the insertion of a suitable tool for inserting and removing the fuse 82 from the space clips 78 and 80. As shown in FIG. 4 for the clip 78, both clips are U-shaped members, the lower ends of which are secured to the base of the housing 76 by suitable means, such as a rivet 100 or a screw 102 for the clip 80. The upper end of the conductor 90 is secured by the rivet 100 to a clip 78. Similarly, the screw 102 secures the clip 80 to the conductor 86. In order to provide a more compact assembly it is noted that the axis of the fuse 82 is oriented in a plane parallel to the bridging contact member 56 and is perpendicular to the direction of movement of the movable contact structure 22.

The fuse block 76 is mounted in place on the top surface of the housing for which purpose it is provided with a hook 104 on the undersurface for engagement with the edge of the top portion through one of the openings 26 in the housing. In addition, when the fuse block 76 is used, the flange 92 of the conductor 90 is attached to the conductor 50 by the screw 54. Thus, the fuse block 76 is disposed between the contactor 10 and the line or load leads which are attached to either the terminal 28 or the terminal 82.

As shown in FIG. 5, opposite end portions of the crossbar 64 extend through the openings 42 in the side walls 34 and 36. It includes a notch 106 at one end and a notch 108 at the other end and the notches are adapted to receive the edge portions of the corresponding walls 34 and 36 which form the upper reduced portion of the slots 42. As a result of the notches 106 and 108 being on the same side (upper side, as viewed in FIG. 5), any attempt to insert the cross-bar 64 in a reversed position would be defeated by the shoulders 44 encountering the end portions of the crossbar. The specific configuration of the slots 42 including the shoulders 44 and a notch edge 110 serves another purpose of retaining the armature 72 substantially in place, as shown in FIG. 5.

More particularly, the armature 72 is mounted on an elongated pin 112 and is seated in an armature-receiving notch 114 in the cross bar 64. As shown in FIG. 6, the cross-bar is provided with an elongated groove 116, the center portion of which is interrupted by the notch 114 and the extremities of which terminate at the edges 118 of the side walls 34 and 36. Before the movable contact structure 22 is inserted into the housing 18 of the contactor, the armature 72 is pre-assembled in the crossbar by moving the end portion of the pin 112 into the laterally extending groove 116 through an open side 118 of the groove until the pin is substantially against the end wall 120 of the groove. In that position, the pin 112 is substantially in the longitudinal axis of the crossbar 64. In the assembled position of FIG. 5, the pin 112 is retained in the groove 116 and prevented from moving laterally therefrom towards the open side 118 by the edges 116 of the side walls 34 and 36. In addition, annular spacers 122 are mounted on the pin 112 between opposite sides of the armature 72 and of the notch 114.

In conclusion, the electromagnetic contactor of this invention provides a more efficient and less costly contactor than most contactors of prior construction.

What is claimed is:

1. An electric control system comprising a multipole control device and a fuse block, the control device comprising a stationary contact structure comprising spaced contact assemblies, and electromagnet including a magnetic armature, a 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, a housing enclosing the control device and composed of electrically insulating material, the housing having a top surface member with openings for access to the stationary contact structure, the fuse block having an undersurface and being mounted on the housing, means for detachably mounting the fuse on the housing and
comprising a hook on the undersurface and engageable with the top surface member through the openings and comprising a first conductor connected to one of the contact assemblies, the fuse block also comprising a terminal and a pair of spaced clips for mounting a fuse, the conductor being connected to one of the clips, and the terminal being connected to the other of the clips.

2. The electric control system of claim 1 in which the contact assemblies each comprise a terminal conductor, and in which the first conductor is detachably mounted on the terminal conductor.