May 7, 1940. G. C. ARMSTRONG ET AL 2,200,070

ELECTRICAL CONTACTOR

Original Filed Aug. 28, 1936 2 Sheets-Sheet 1

Fig. 1

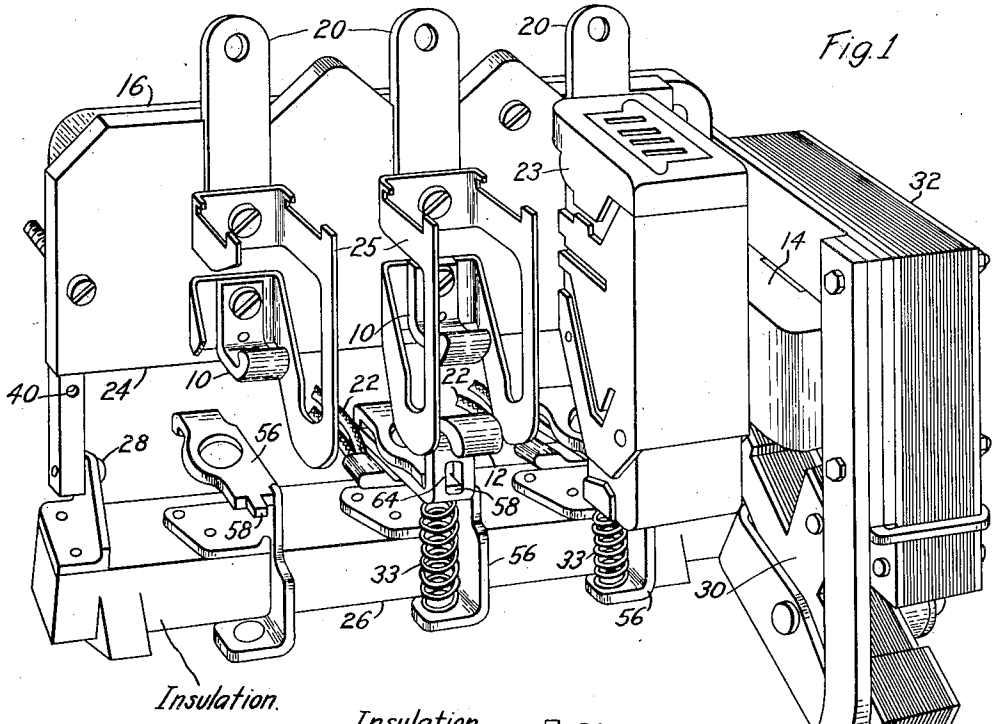
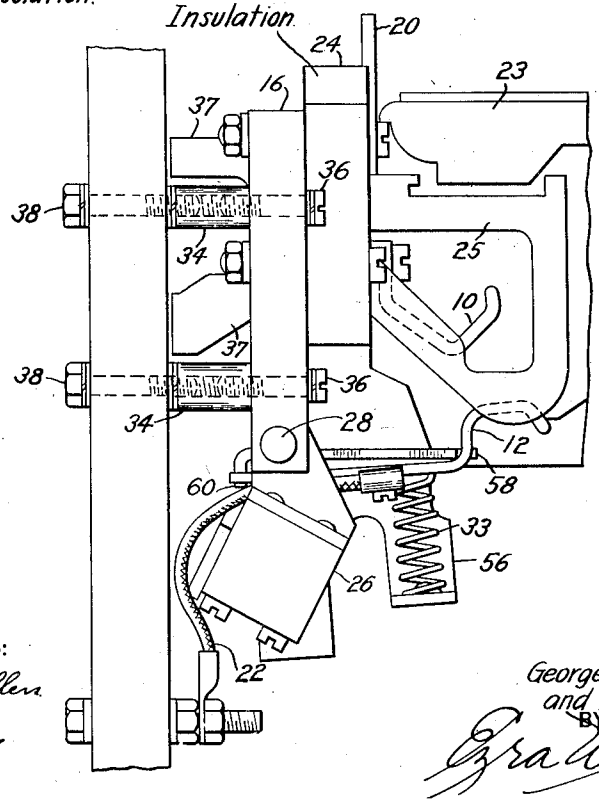


Fig. 2.



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Fig. 3.

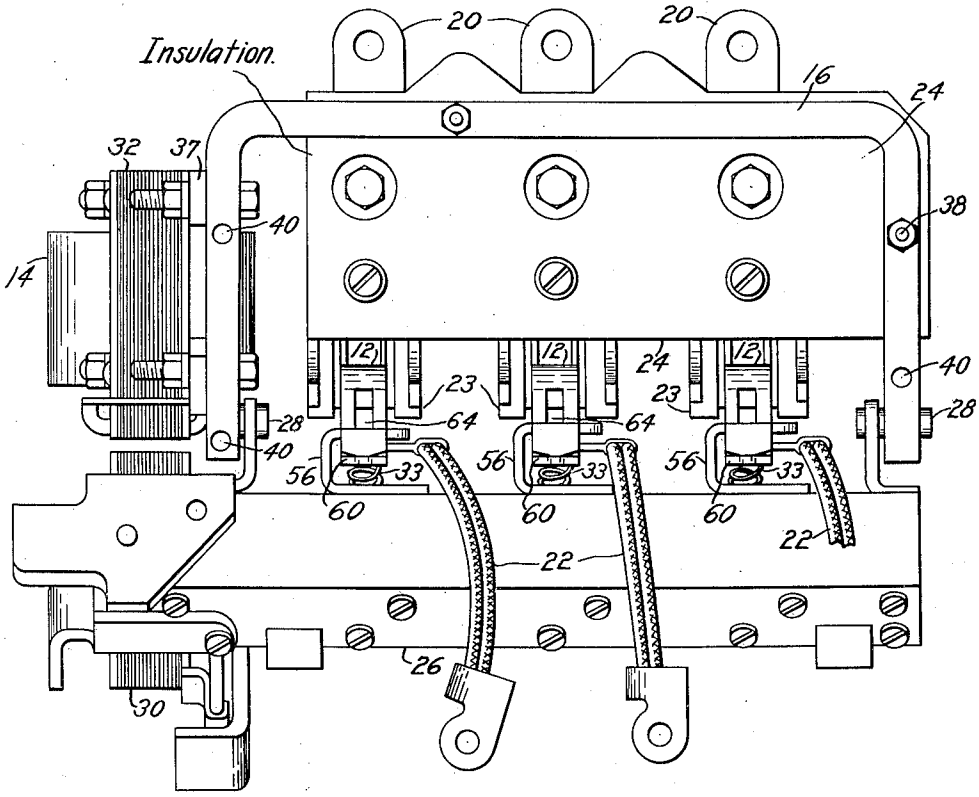


Fig. 4.

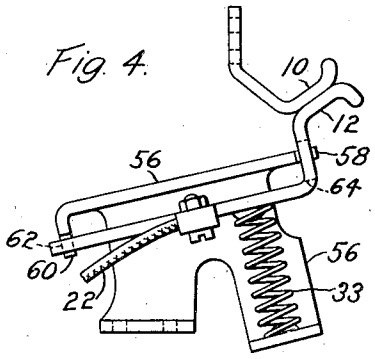


Fig. 5.

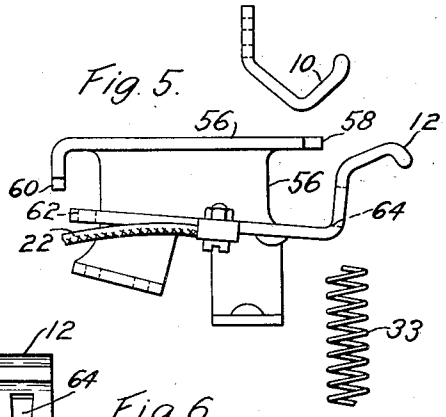
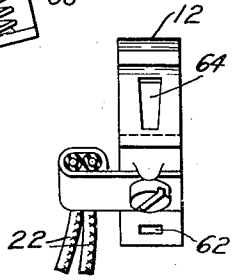


Fig. 6.



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2,200,070

UNITED STATES PATENT OFFICE

2,200,070

ELECTRICAL CONTACTOR

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Original application August 28, 1936, Serial No. 98,322, now Patent No. 2,157,843, dated May 9, 1939. Divided and this application August 6, 1937, Serial No. 157,652

10 Claims. (Cl. 200—147)

Our invention relates to magnetically-actuated switches or contactors, and it has particular relation to improvements in the design and construction of contactors adapted for use in alternating-current circuits.

This application is a division of our copending application, Serial No. 98,322 for Electrical contactors, filed August 28, 1936, now Patent No. 2,157,843, dated May 9, 1939, and assigned to the same assignee as this application.

An object of our invention is to provide a self-contained unit-constructed contactor which in multi-pole designs of high current rating may be completely assembled, adjusted and tested before being mounted upon a panel or other supporting structure.

Another object is to provide a mechanically rugged and compact construction wherein all parts of replaceable or adjustable character are accessible from the front of the mounting panel.

A further object is to provide a contactor of the type above described which is tilt and shock proof.

A still further obect is to improve the design and arrangement of the movable-contact parts which are employed in the above and other contactors.

Our invention, together with additional objects and advantages, will best be understood through the following description of a specific embodiment when taken in conjunction with the accompanying drawings in which:

Figure 1 is a perspective view of a contactor which incorporates the several improvements of our invention,

Fig. 2 is a view in side elevation of the device of Fig. 1 showing its adaptability for mounting upon and complete access from the front of a supporting panel,

Fig. 3 is a view in rear elevation of the device of Fig. 1, and

Figs. 4, 5 and 6 are views showing our improved design of moving contact assemblage.

The contactor which we have represented in the drawings as incorporating the several features of our invention is a three-pole device of the shaft-driven vertical-lift-type. As best shown by Figs. 1, 2 and 3, it comprises stationary contact members 10, cooperating movable members 12, an engagement-determining magnet 14—30—32 and a frame 16 in the form of a U-shaped bar of metal adapted to be mounted in the inverted position illustrated. The circuit to be controlled (not shown) is connected with the stationary contacts through lugs 20 and with the moving contacts through flexible shunts 22.

Associated with each set of contacts 10—12 is an arc box 23 supported by a blow-out coil 25. These boxes form a part of an improved arc-quenching equipment more completely shown and described by our copending application for Electrical contactors, Serial No. 98,324, filed August 28, 1936, now Patent No. 2,147,430, dated February 14, 1939. In order better to show the construction and arrangement of the device contact parts, the view of Fig. 1 illustrates only one of the three boxes 23 in position and shows only one of the three moving contact members 12 in place.

The U-shaped frame 16 is adapted to position the device contacts and magnet in full operative relation and to support the complete contactor from a mounting panel or other supporting structure 18 (Fig. 2). It supports the stationary contacts 10 from its upper portion by means of a slab 24 of insulating material. It supports the movable contacts 12 pivotally between the lower ends of its legs by means of bearing pins 28 and a shaft-bar 26 of insulating material carried thereby.

The frame 16 supports the stationary-core portion of the operating magnet 32 from the side of one of its downwardly extending legs. An extension of one end of the shaft bar 26 carries the armature or movable-core portion of the magnet 30. This magnet is of an improved E-core vertical-lift design more completely shown and described by our copending application for Electrical contactors, Serial No. 98,323, filed August 28, 1936, now Patent 2,157,844, dated May 9, 1939.

As long as the magnet winding 14 is deenergized, gravity holds the armature in the lowermost position illustrated in which the movable contacts 12 are separated from the stationary members 10. Energization of the winding 14 from any suitable circuit (also not shown) attracts the armature upwardly to rotate the bar 26 into the contact-engaging position, thereby completing the controlled circuit.

Springs 33 form a part of the connections between bar 26 and movable contacts 12. When energized the magnet rotates the bar somewhat beyond the point of initial contact engagement. This motion compresses the springs, providing the pressure of electrical contact and storing energy which, during the opening of the device increases the speed of separation of the contacts.

The deenergization of the magnet winding releases the armature 30. By action of gravity and

the force of springs 33, the armature is urged downwardly, causing the contacts 12 to separate from the contact members 10 with a rapidity and through a distance sufficient to interrupt the controlled-circuit current.

The form of construction just described offers a number of advantages. The support by frame 16 of all essential parts of the contactor in full operative relation permits the device to be completely assembled, adjusted and tested before being mounted on a panel. The single-piece frame 16 shown may, of course, be replaced by a multipiece form of construction. In either case this frame constitutes the backbone of the complete unit-assembled contactor. It is rigid, has no loose joints, and is not subject to distortion. The ends may, by a single operation during manufacture, be drilled and line-reamed to constitute the bearings which accommodate shaft-bar pins 28.

The attachment of the contactor to the panel is readily effected. One preferred manner employs tapped spacers, shown at 34 in Fig. 2, and cooperating bolts 36 and 38. The three bolts 36, which are inserted from the front of the panel, pass through holes 40 (Fig. 3) in the frame 16. Instead of using the spacers 34 at the magnet end of the contactor, separation of that end of the device from the mounting panel may be effected by a bracket 37 (Figs. 2 and 3). In that case the members 34 need serve only to interconnect bolts 36 and 38.

Our improved contactor is also adapted for mounting on a steel or other metal panel. The only changes required in the form of attachment illustrated are the provision of insulating bushings (not shown) for the circuit-connecting studs or terminals.

In our improved design all parts of replaceable or adjustable character are completely accessible from the front of the mounting panel. With the form of mounting shown in Fig. 2, the complete device may be removed and replaced by a duplicate unit without disturbing the rear of the panel. This minimizes the danger and inconvenience incident to work on the contactor, it being necessary to deenergize only the circuits of direct connection.

The use of moving parts adapted for vertical lift results in a device which is substantially shock and tilt proof. The construction minimizes the tendency of severe jars or tilts through large angles to change the position of the movable contacts 12 relative to the stationary contacts 10.

Our invention also contemplates improvements in moving contact assemblages for circuit controlling devices. In our preferred construction, the moving contact member 12 is supported from the shaft bar 26 through the medium of a bracket 56. This bracket is of a comparatively heavy and rugged construction and is provided with a pair of extensions 58 and 60 which project at substantially right angles in the manner shown. The end of the body portion of the moving contact member 12 has an opening 62 into which the projection 60 may be fitted while the front portion of the contact member body is provided with a slot 64 adapted to accommodate the projection 58. To impart a small sliding movement to the engaging surfaces of contacts 12 and 10, the point 60 of movable-member pivot is slightly displaced (see Fig. 2) from the bearing pin 28 about which the movable assemblage rotates.

In assembling the combination (see Fig. 5), the projection 58 is first engaged with slot 64 and opening 62 is then aligned with projection 60. Next the compression spring 33 is placed in position. It serves to hold parts 12 and 56 in operative relation without the aid of screws, bolts or clips. The arrangement thus allows the parts readily to be assembled or replaced.

The contact member 12 is preferably of copper and the bracket 56 of steel or other wear-resisting material. As wear takes place during use, the comparatively long length of these parts prevents any substantial change in contact alignment. This allows the contacts to be used much longer than otherwise. Also practically no wear is sustained by the hard-metal bracket 56. Replacement of the copper contact members thus restores the assemblage to its original condition.

In order to increase the speed of contact separation and to prevent wear along the sides of slot 64 of the copper member 12, this slot is made wider at the top than at the bottom. Projection 58 occupies the lower and narrower portion of the slot when the contactor is in the open position shown in Figs. 1 and 3. As the magnet rotates shaft bar 26 into the contact-engaged position, the face of member 12 first strikes that of cooperating contact member 10. This centralizes the moving member. As further movement, resulting in compression of the spring 33, advances projection 58 upwardly along the length of the slot (see Figs. 4 and 5), the widening dimension causes a complete separation which eliminates wear of the slot side.

This elimination of drag also allows the moving shaft-bar brackets 56 to accelerate at maximum speed during the opening operation. The sudden impact of hammer blow finally imparted to contacts 12 separates them from stationary members 10 in the minimum of time. Such quick separation prolongs contact life and increases rupturing capacity.

The moving contact parts are further so designed that, during the opening operation the projection 58 strikes the member 12 substantially at its center of percussion about the stationary end of the contact. This further insures maximum speed of separation and eliminates chattering by imparting to the contact 12 at the moment of separation from the contact 10 a speed in excess of the speed of the bracket 56.

The presence of the slot 64 in the particular position shown also accomplishes an electrical function. In order that the arc quenching apparatus 23 may function most effectively, it is desirable that the blow-out coil 25 urge the arc into the box interior in a substantially central position. However, the contact members 10 and 12 may, in separating, initiate the arc at practically any point along their line of contact or width.

When the portion of member 12 which carries the slot 64 is solid as in prior art constructions, an initiation of the arc at one side of the contact center results in a direction into the arc box toward that side. Instead of tending to bring the arc back into the desired center, the tendency is to cause it to depart further from the center. This is due to magnetic interactions resulting from unequal current distribution through the moving contact body.

By placing the slot 64 in the position shown, however, a very beneficial compensating action results. An arc started at the side of the contacts tends to be restored toward the center of the arc box interior. Here again the explanation is magnetic interaction.

The presence of the slot requires that the total current divide through the two parallel paths around the slot. The distribution between these

two paths varies with the point at which the arc is drawn. If this point is at the center, the distribution is uniform. If at one side, a major portion of the current flows through the path at that side since that path is shorter in effective length than is the other.

The magnetic interactions resulting under these conditions strongly tend to restore the arc, in its movement away from the contacts, to a path approaching the center of the arc box 23. In practice, this effect is found greatly to increase the efficiency of arc extinction.

Although we have shown and described certain specific embodiments of our invention, we are fully aware that many modifications thereof are possible. Our invention therefore, is not to be restricted except insofar as is necessitated in the prior art and by the scope of the appended claims.

We claim as our invention:

1. In a device comprising stationary and movable contact members, the combination of a rotatively movable supporting and actuating bracket for the movable member having two extensions spaced radially with respect to the axis of rotation and projecting in planes at about right angles to each other, a body portion for the movable member having openings adapted to accommodate said extensions, and a compression spring adjacent one end of the body portion adapted to hold said parts in operative relation and to determine the pressure of contact engagement.

2. In a device comprising stationary and movable contact members, the combination of a rotatively movable supporting and actuating bracket for the movable member having two extensions spaced radially with respect to the axis of rotative movement and projecting in planes at about right angles to each other, said movable member having a slot near its contact-making end adapted to accommodate one of said extensions and an opening in the opposite end adapted to accommodate the other, and a compression spring adjacent one end of the body portion adapted to hold said parts in operative relation and to absorb all slack in the lost-motion connection of which said slot forms a part.

3. In a device comprising stationary and movable contact members and an actuating bracket for the movable member, the combination of a projection from said bracket, a movable-member body portion having a slot adapted to accommodate said projection, said slot being narrower at one end than at the other, and resilient means adapted to bias said projection toward the narrow end of said slot and to allow it to move toward the wide end when the movable member has been brought into engagement with the stationary contact member.

4. In a circuit-controlling device, the combination of a movable contact member provided with a slot narrower at one end than at the other, an actuating member carrying a projection which engages said slot, and resilient means interconnecting said members adapted to bias said projection toward the narrow end of said slot.

5. In a device comprising stationary and movable contact members, the combination of a supporting and actuating bracket for the movable member having two spaced extensions projecting at about right angles, a body portion for the movable member having openings adapted to accommodate said extensions, and a compression spring adapted to hold said parts in operative relation and to determine the pressure of contact engagement, the bracket and movable contact member being so proportioned and arranged that, after a slight motion of the bracket in a direction to separate the contact members, it strikes the movable contact member substantially at its center of percussion to effect separation of the contacts.

6. In a device comprising stationary and movable contact members, the combination of a supporting and actuating bracket for the movable member for hingedly supporting one end of the movable member and provided with an extension, a body portion for the movable member having an opening adjacent the contacting end for slidably accommodating said extension, and a compression spring adapted to hold said parts in operative relation and to determine the pressure of contact engagement, the opening in said movable member permitting a predetermined movement of the bracket in a contact separating direction prior to separation thereof from the stationary contact members, the position of said opening in said movable member being substantially at the center of percussion of the movable contact member about its hinged end to effect a rapid separation of the contact members upon receiving an impact from the bracket.

7. In a device comprising stationary and movable contact members, the combination of a supporting and actuating bracket for hingedly supporting the movable member and adapted to engage said movable member at a point corresponding substantially to its center of percussion about its hinged point, and a compression spring adapted to hold said parts in operative relation and to determine the pressure of contact engagement, said movable member being biased against the pressure of said spring upon engagement with said stationary member to separate the part of the movable contact member corresponding to its center of percussion from engagement with the cooperating portion of the bracket to preset the movable contact member for rapid separation from the stationary contact member upon an impact from the bracket at its center of percussion.

8. In a circuit controlling device comprising stationary and movable contact members, in combination, a rotatively movable supporting member, a bracket mounted thereon for carrying the movable contact member and having two spaced extensions adjacent the outer and inner ends thereof, the inner projection extending substantially in the direction of motion of movement about the axis of rotative movement of the device and the outer projection extending outwardly therefrom, a body portion for the movable member having openings adapted to receive said extensions, and a compression spring adjacent the outer end of the body member for holding said bracket and body member in operative relation and for determining the pressure of contact engagement.

9. In a circuit controlling device comprising stationary and movable contact members, in combination, a rotatively movable supporting member, a bracket mounted thereon for carrying the movable contact member and having two spaced extensions adjacent the outer and inner ends thereof, the inner projection extending substantially in the direction of motion of movement about the axis of rotative movement of the device and the outer projection extending outwardly therefrom, a body portion for the movable

member having an opening at its inner end adapted to receive the inner extension from the bracket to form a fulcrum of movement with respect to the bracket and an upturned outer end having an opening adapted to receive the other extension from the bracket, and a compression spring adjacent the outer end of the body member for holding said bracket and body member in operative relation and for determining the pressure of contact engagement.

10. In a circuit controlling device comprising stationary and movable contact members, in combination, a supporting and actuating bracket for the movable member for hingedly supporting one end of the movable member and provided with an extension, a body portion for the movable member having an upturned outer end provided with a slot therein for slidably accommodating said extension, said slot being narrower at one end than the other, and resilient means adapted to bias said extension toward the narrow end of said slot and to allow it to move toward the wide end when the movable member has been brought into engagement with the stationary contact member.

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