April 22, 1958 D. F. MOYER 2,831,938

CIRCUIT BREAKER

Filed May 26, 1954 2 Sheets-Sheet 1

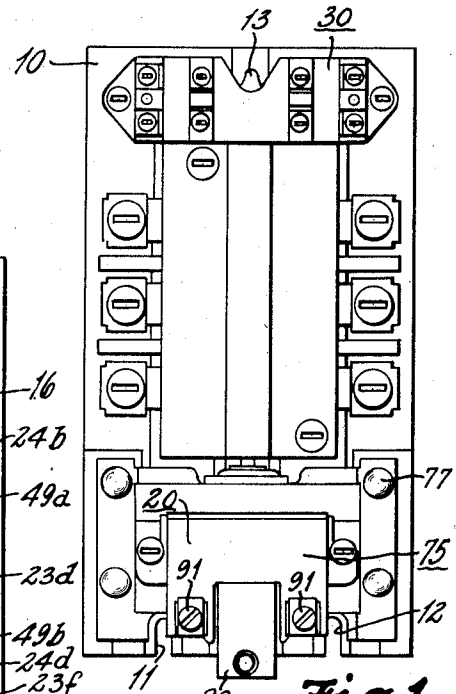


Fig. 1.

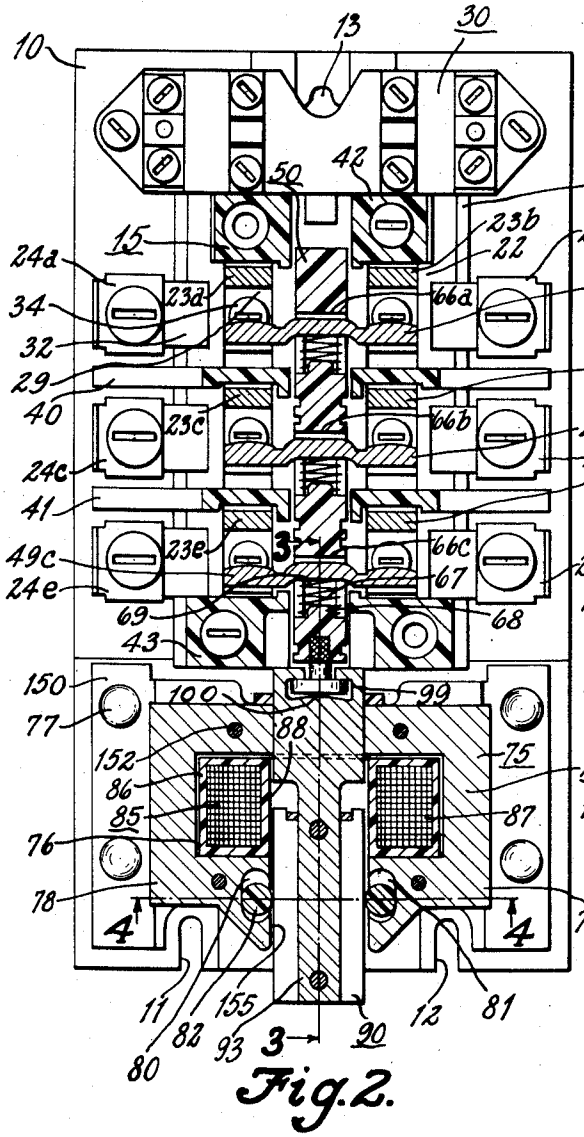


Fig. 2.

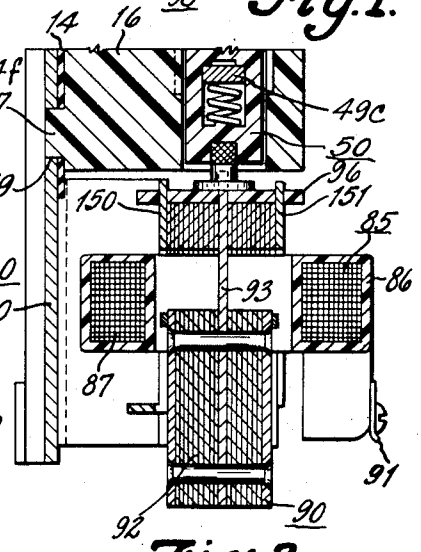


Fig. 3.

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CIRCUIT BREAKER

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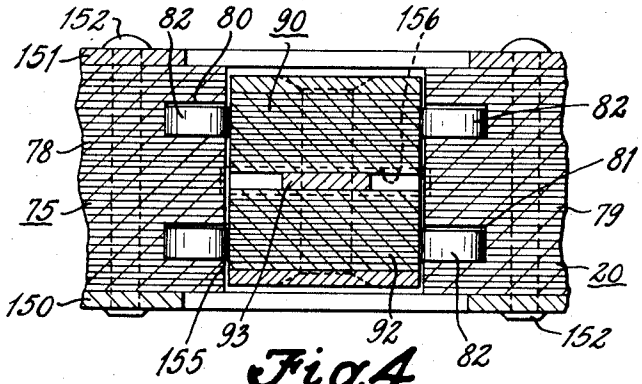


Fig. 4.

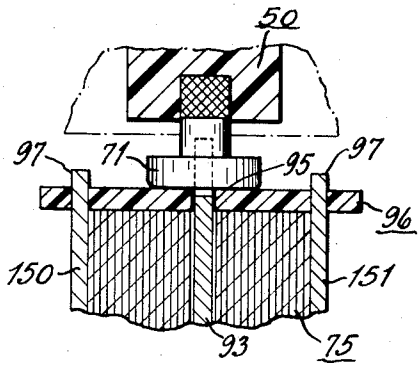


Fig. 6.

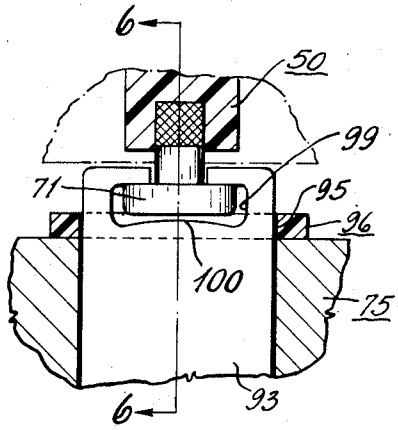


Fig. 5.

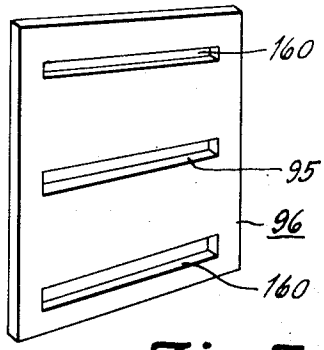


Fig. 7.

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United States Patent Office 2,831,938 Patented Apr. 22, 1958

2,831,938

CIRCUIT BREAKER

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Application May 26, 1954, Serial No. 432,485

4 Claims. (Cl. 200—104)

This invention relates to a motor starting controller.

An object of the invention is to provide an improved structural arrangement of a motor starting controller that is more compact and which provides for quick and easy disassembly of the several parts of the structure for replacement and repair when necessary.

Another object of the invention is to provide an electromagnetic device for a contactor in which the armature has freedom of movement but is guided axially by means of a guide plate and guide rollers that are preferably constructed of a solid ethylene polymer or nylon.

Still another object of the invention is to provide an electromagnetic device for a contactor in which the armature of the device is maintained in predetermined spaced relationship to the poles of the field piece of the electromagnetic device by means of rollers so as to effect a constant air gap between the armature and the poles throughout the life of the contactor.

A further object of the invention is to provide a magnetic motor starting controller wherein the movements of the armature of the electro-magnet and of the movable contact carrier of the contactor are linear movements linearly aligned to eliminate angularly directed forces on the contact carrier and thereby increase its freedom of movement.

Another object of the invention is to provide a motor starting controller wherein the contact carrier for the movable contacts of the controller is demountably attached to the armature of the electro-magnet in a manner to provide for disconnection of the contact carrier from the armature without in any way affecting the position of the armature relative to the electro-magnet coil, and to provide for removal of the armature from the electromagnet only after the contact carrier has been disengaged from the armature. Removal of the armature from the electro-magnet will also provide for disassembly of the magnet coil from the core of the electro-magnet.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the invention is clearly shown.

In the drawings:

Figure 1 is a plan view of a motor controller incorporating features of this invention.

Figure 2 is a transverse cross sectional view of the controller illustrated in Figure 1.

Figure 3 is a cross sectional view of a portion of the controller of Figure 2 and is taken along line 3—3 of Figure 2.

Figure 4 is a transverse cross sectional view of the electromagnetic actuating device taken along line 4—4 of Figure 2.

Figure 5 is an enlarged view of the connection between the electromagnetic device and the contact carrier of the controller.

Figure 6 is a cross sectional view taken along line 6—6 of Figure 5.

Figure 7 is an elevational view of the guide plate for the armature of the electromagnetic device.

In this invention the controller is of the type disclosed in my copending application S. N. 404,843, filed January 19, 1954, of which this application is a division and comprises a mounting plate **10** that supports the main contactor **15**. At the lower end of the contactor **15** there is provided an electro-magnet **20** for operating the contactor.

The contactor may also be provided with an auxiliary control which is the control switch **30** adapted for making and breaking circuit to auxiliary devices that need be electrically synchronized with the operation of the main motor starting control.

The mounting plate **10** has a plurality of screw slots **11**, **12** and **13** provided for receiving screw heads by which the plate **10** can be mounted on any suitable support. A sheet **14** of electrical insulating material is placed upon the upper face of the mounting plate **10** on which the terminal and contact base **16** is mounted.

The terminal base **16** has lugs **17** extending from the rear face of the base **16** that project into holes **19** provided in the mounting plate **10** whereby to accurately position the terminal base **16** upon the mounting plate **10**.

The terminal base **16** has a platform portion **22** on which the stationary contacts **23***a* to **23***f* inclusive are mounted. Each of the stationary contacts engages one of the line terminals **24***a* to **24***f* respectively.

A machine screw **34** extends through the leg **29** of the stationary contact into threaded engagement with the leg **32** of the terminal **24***a* whereby to retain the two elements together.

The stationary contact **23***a* can be removed from the line terminal **24***a* merely by removing the screw **34**, and this can be done without in any way affecting the position of the line terminal **24***a* with reference to the terminal base **16**.

The line terminals **24***a*, **24***c* and **24***e* are adapted to be connected with the three wires of a three phase wiring system. The line terminals **24***b*, **24***d* and **24***f* are linearly aligned with the line terminals **24***a*, **24***c* and **24***e* whereby the wires of the three phase wiring system may be connected straight through the terminal base for simplification of wiring.

The terminal base **16** has partition wall sections **40** and **41** that separate the line terminal set **24***c*—**24***d* from the line terminal sets **24***a*—**24***b* and **24***e*—**24***f* thereby compartmenting the line terminal sets and their cooperating stationary contacts one from the other. The end walls **42** and **43** provide closure walls for confining the terminal sets **24***a*—**24***b* and **24***e*—**24***f*. The partition walls **40** and **41** extend substantially above the level of the contacts **23***a*—**23***f* and substantially above the level of the contacts **23***a* to **23***f* to make it more difficult to directly engage the live contacts and terminals by an operator when replacing one of the contacts or disassembling the contactor.

The stationary contact sets **23***a*—**23***b*, **23***c*—**23***d* and **23***e*—**23***f* are bridged by the movable contacts **49***a*, **49***b* and **49***c* respectively whereby to conduct current between the respective line terminals on opposite sides of the terminal base **16**.

The movable contact bars **49***a*, **49***b* and **49***c* are supported in a contact carrier or switch actuator **50** that has linear movement only to move the movable contacts into and out of engagement with the cooperating stationary contacts.

The contact bars **49***a*, **49***b*, and **49***c* are each removably supported in the carrier or actuator **50** in openings **66***a*, **66***b*, and **66***c* respectively. Each of the contact bars is retained in its respective opening by means of a light compression spring **67** that has one end thereof resting upon a projection **68** at one end of the respective opening. The opposite end of the spring **67** engages a recessed por-

tion 69 on the respective contact bars whereby to hold the contacts in position in the carrier 50. The spring 67 allows for engagement of the contact bars with both of its cooperating stationary contacts with like pressure even though they may not be at exactly the same planar level.

The lower end of the carrier 50 is provided with a T head fitting 71 for connection to the armature of the electro-magnet 20.

The electro-magnet 20 for operating the contact carrier 50 comprises a substantially C-shaped core or field piece 75 composed of a plurality of C-shaped laminations retained between the mounting plates 150 and 151 by the rivets 152. The field piece 75 is secured to the plate 10 by means of rivets 77. The C-shaped field piece or core 75 has opposing legs 78 and 79 providing a mouth opening 155 that receives the armature 90. The central laminations of the field piece 75 are divided to provide a slot 156. The legs 78 and 79 are each provided with recesses 80 and 81 respectively that receive the rollers 82 made of a solid ethylene polymer, or nylon. The rollers 82 maintain uniform the air gap between the ends of the legs 78 and 79 and the armature 90 at all times during operation of the device. The rollers are arranged in pairs on opposite sides of the armature to resist rotation of the armature on its axis and provide minimum resistance to reciprocal linear movement of the armature since the recesses 80 and 81 are elongated parallel with the axis of movement of the armature to permit them to roll between the armature 90 and the walls of the recesses 80 and 81.

A magnet coil 85 that comprises the electrical insulating shell 86 and a magnet coil 87 is placed within the opening 76 of the core 75 in a manner that the axis of the armature opening 88 through the coil and case assembly is normal to the axis of the opening 76 in the core 75. This provides an opening through the electro-magnet assembly that receives the armature 90. Electric current is conducted to the operating coil 87 through terminals 91.

The armature 90 comprises a laminated body 92 that has a non-magnetic extension member 93 projecting from the upper end thereof. The member 93 extends through the slot 156 in the core 75 and through a slot 95 in the guide plate 96 made of a solid ethylene polymer or nylon mounted on the core 75 by means of the tabs 97 extending from the outer frame members 150 and 151 of the core 75 through the openings 160 in the guide plate, the plate being a press fit on the tabs 97.

The free end of the extension 93 on the armature 90 has a T-slot 99 that engages the T-head 71 on the contact carrier 50 whereby the armature 90 is suspended from the carrier 50 when the controller is in its normal vertical position. The lower wall 100 of the T-slot 99 in the armature extension 93 has a convex curvature whereby to provide for point contact of the armature extension 93 with the lower end of the T-head 71 to maintain as nearly as possible linear actuation of the armature relative to the carrier.

The armature 90 passing through the core slot 155 engages the nylon rollers 82 which maintain accurate spacing of the walls of the armature relative to the walls of the core slot. This establishes and maintains throughout the life of the controller a positively dimensioned air gap between the armature and the core.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In an electromagnetically operated switch, a plurality of substantially C-shaped laminations assembled to form a substantially C-shaped field piece, certain of the laminations being divided to provide a slot in the field piece opposite to the mouth opening thereof, a linearly guided armature movable in the mouth opening of the field piece and having a non-magnetic extension projecting through said slot, said extension having a slot therein extending inwardly from the end edge of the extension terminating in a transversely extending enlarged opening having a convex wall facing said slot, a coil on the field piece for actuating the armature in the field piece, and a linearly guided switch actuator disposed for linear movement with said armature, said actuator having a projection extending therefrom provided with an enlarged head having a surface engageable with said convex wall, said projection and head being positioned in said slot and opening to provide for freedom of movement of said head transversely of said extension in all directions to eliminate binding therebetween because of axial misalignment and to effect connection between said armature and said actuator with said convex wall engaging said surface on said head to provide substantial point contact therebetween for linear driving movement of said actuator by linear movement of armature irrespective of axial misalignment between said actuator and said armature.

2. An electromagnetically operated switch in accordance with claim 1 in which the slot and opening in the extension on the armature is substantially a T-slot with the convex wall facing the stem of the T-slot and the projection on the switch actuator is substantially a T-shaped member disposed within the aforesaid T-shaped slots with opposite surfaces of the cross member of the T-shaped projection engaging corresponding opposite surfaces of the T-shaped slot one of which is the convex surface of the T-shaped slot.

3. An electromagnetically operated switch in accordance with claim 1 in which the extension on the armature is not substantially thicker than one of the laminations of the field piece with the slot and opening in the extension being substantially a T-slot with the convex wall facing the stem of the T-slot and the projection on the actuator is substantially a T-shaped member disposed within a T-shaped slot with opposite surfaces of the cross member of the T-shaped projection engaging corresponding opposite surfaces of the T-shaped slot one of which is the convex surface of the T-shaped slot whereby to effect substantial line contact between the extension and the projection to effect freedom of linear alignment one with the other.

4. In an electromagnetically operated switch, a linearly guided switch actuator, an electromagnet including a linearly guided armature movable linearly with linear movement of said switch actuator, said armature comprising a plurality of relatively thin lamina one of which projects beyond the others at one end of the armature, said projecting lamina having in the projecting end thereof a substantially T-shaped slot with a convex wall facing the stem of the T-shaped slot, said switch actuator having a projection extending from one end thereof in the form of a substantially T-shaped head, said head being disposed in said slot with opposite surfaces of the cross member of the T-shaped head engaging corresponding opposite surfaces of the T-shaped slot one of which is the convex surface of the T-shaped slot.

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