May 14, 1957 C. R. CALLAWAY 2,792,469

MULTIPLE ELECTRICAL CONTACTOR

Filed Oct. 20, 1952 3 Sheets-Sheet 1

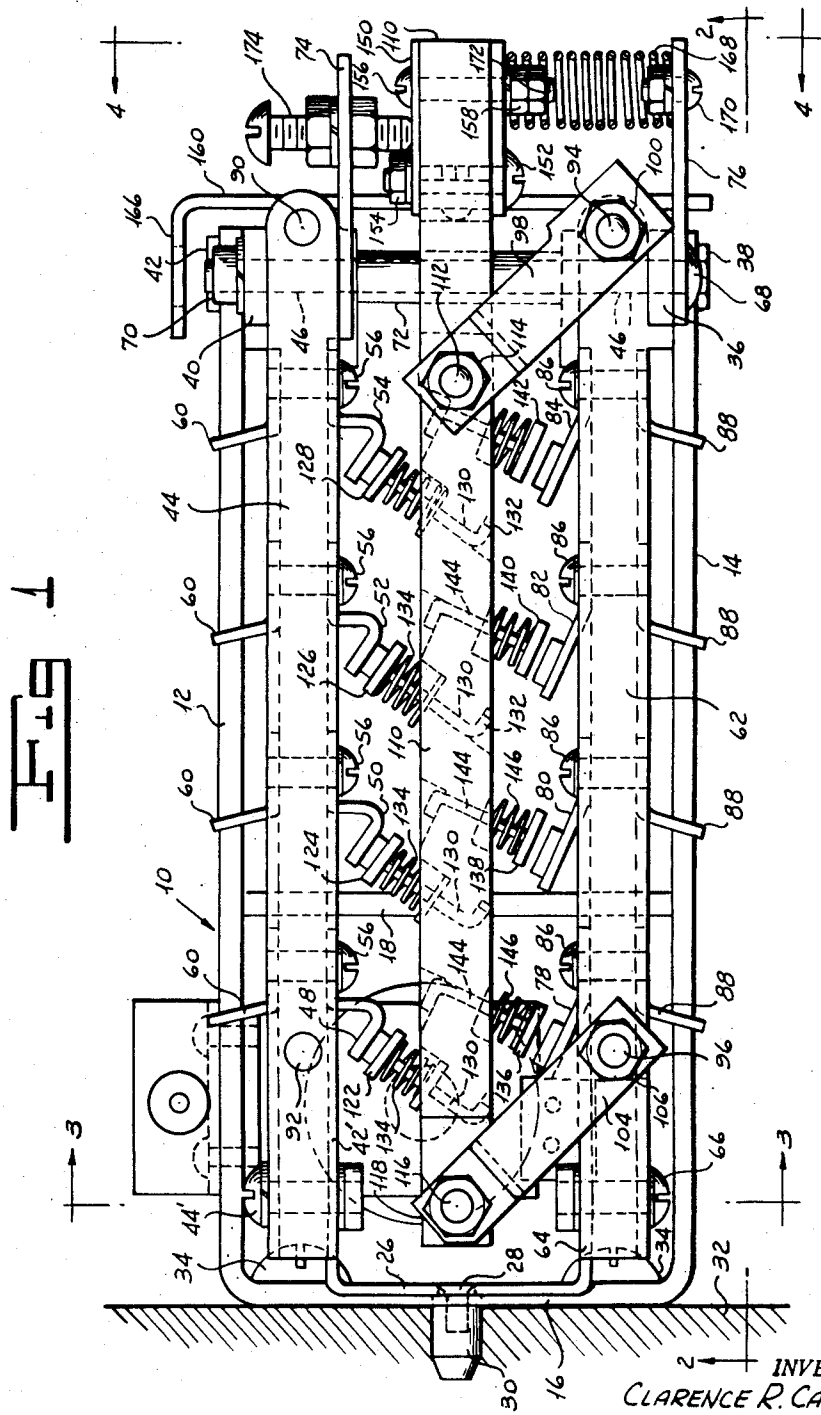


Fig. 1

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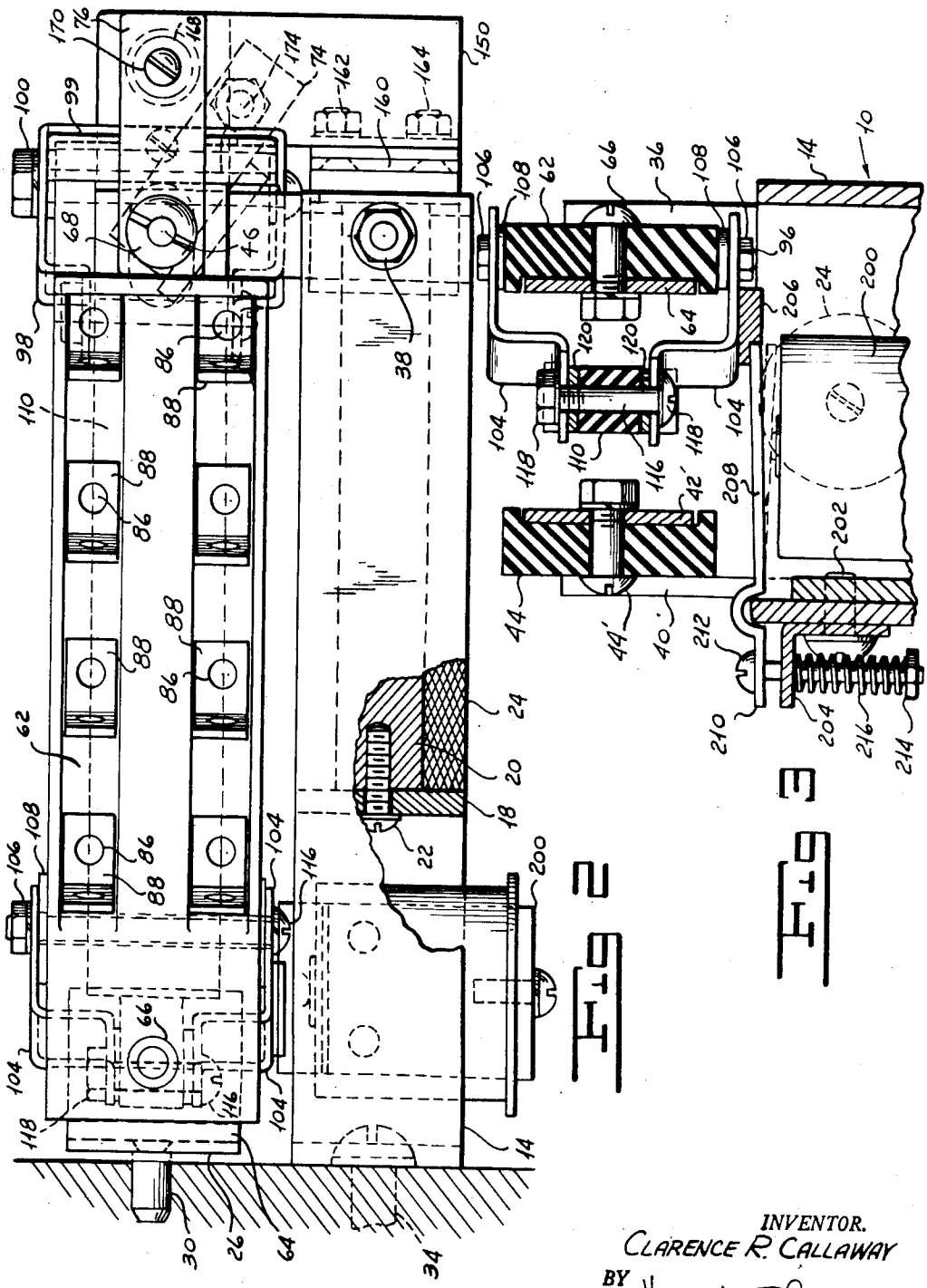


FIG. 2

FIG. 3

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Fig 4

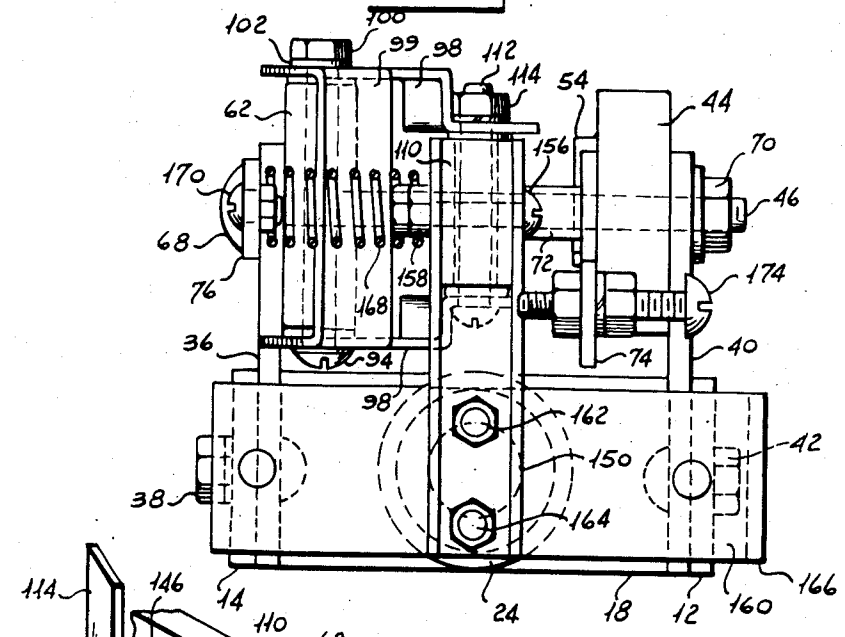
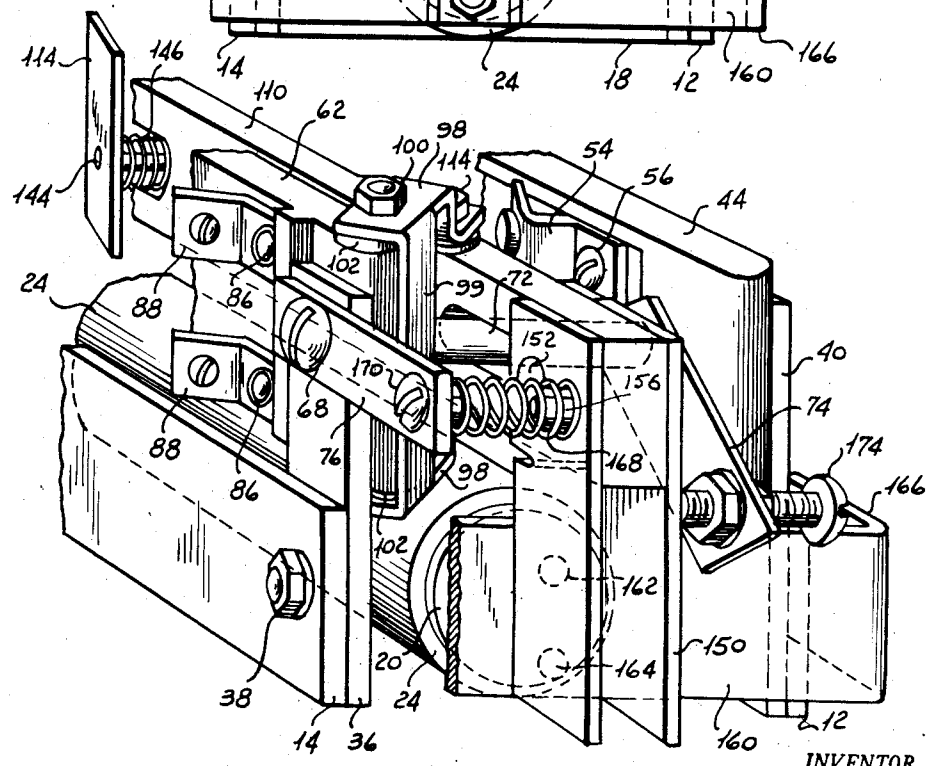


Fig 5



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MULTIPLE ELECTRICAL CONTACTOR

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Application October 20, 1952, Serial No. 315,669

9 Claims. (Cl. 200—104)

My invention relates to an improvement in multiple electrical contactors.

Electrical contactors having a large number of electrical contacts are known to the art. They are used for a variety of applications. For example, in the elevator art, push-button control circuits require a large number of relays. These are controlled by a series of multiple electrical contactors which are mounted upon a control panel. The multiple electrical contactors known to the art are comparatively large, cumbersome and expensive mechanisms. A control panel fitted with the multiple electrical contactors of the prior art occupies a large area. Frequently the contacts of the contactors of the prior art become corroded by arcing. Sometimes dust, dirt or grease lodges between the contacts, preventing electrical connection from being made.

One object of my invention is to provide an improved multiple electrical contactor which occupies a reduced space, whereby a large number of electrical contactors of my improved construction can be mounted on a comparatively small control panel.

A further object of my invention is to provide a multiple electrical contactor in which the contacts wipe one another by sliding action during the making or breaking of contact, thereby maintaining contact surfaces clean so that good electrical contact can always be made.

Still a further object of my invention is to provide an improved electrical contactor in which any desired number of contacts may be made and broken within reasonable limits.

An additional object of my invention is to provide an improved multiple electrical contactor which is inexpensive to manufacture and simple to construct.

Other and further objects of my invention will appear from the following description.

In general, I provide a U-shaped magnet frame by which the contactor assembly is supported and through which it may be conveniently mounted upon a control panel. The magnet frame carries a pair of stationary contact bases formed of an appropriate insulating material. An electromagnet is carried by the magnet frame for magnetizing it. An appropriate number of electrical contact points are mounted upon the stationary contact bases. Positioned between the stationary contact bases, I provide a movable contact base which is carried by a parallel motion linkage. The movable contact base carries an L-shaped armature adapted to coact with and be attracted by the magnet formed by the frame and the electromagnetic winding. The movable contact base carries a plurality of movable contacts extending to both sides of the movable contact base, which is normally urged to one position by a spring. In this position a series of contacts are made while a series of contacts are open. Upon energization of the magnet winding, the movable contact base moves parallel to the stationary contact bases, breaking the contacts made through the action of the spring and closing the normally open contacts. The stationary contact members are disposed at an angle to the axis of the contactor. The arrangement is such that wiping contact occurs whenever the contacts are made or broken. The movable contacts are resiliently mounted, while the stationary contacts are rigidly mounted. This assists in this wiping action. A latch controlled by a solenoid is provided for latching the normally open contacts closed upon de-energization of the contactor winding.

In the accompanying drawings which form part of the instant specification and which are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views:

Figure 1 is the top plan view of an improved multiple electrical contactor containing one embodiment of my invention.

Figure 2 is the side elevation of the electrical contactor shown in Figure 1 viewed along the line 2—2 of Figure 1.

Figure 3 is a sectional view taken along the line 3—3 of Figure 1.

Figure 4 is an end elevation viewed along the line 4—4 of Figure 1.

Figure 5 is a fragmentary perspective view of the armature end of my improved multiple electrical contactor with parts broken away.

More particularly, referring now to the drawings, a U-shaped magnet frame, indicated generally by the reference numeral 10, is formed with a pair of legs 12 and 14 and a base portion 16. Intermediate the ends of the legs 12 and 14, I provide an integral cross flange 18 to which the core 20 of an electromagnet is secured by a screw 22, as can be seen by reference to Figure 2. A winding 24 is disposed about the core 20 and is adapted, when energized, to magnetize the legs 12 and 14. The magnetic circuit is such that, if the free end of the core 20 were the north pole, the ends of the legs 12 and 14 would be the south poles of what is the equivalent of a double horseshoe magnet having one leg in common.

The magnet frame 10 is secured to a base 32 by means of screws 34 which pass through the base portion 16 of the magnet frame 10. The base 32 may be the panel to which the contactor is secured, or it may be any other appropriate base or frame. The base 32 supports a U-shaped bracket 26 through a guide pin 30 to which the bracket 26 is fastened by means of screws 28. I secure a vertically-extending member 36 to the end of leg 14 by means of a bolt 38. In a similar manner, I secure a vertical member 40 to the end of leg 12 by means of bolt 42. One of the stationary contact bases 44 is supported by the member 40 and the leg 42' of the bracket 26. The rear end, that is, the end toward the base or panel 32, is attached to the leg 42' of the bracket 26 by bolt 44'. The other end of the stationary contact base 44 is supported by a bolt 46, as will be described more fully hereinafter. The stationary contact base 44 is made of any appropriate insulating material and carries a plurality of stationary contacts 48, 50, 52 and 54. These contacts are fastened by screws 56, which are threaded into members 60 to which electrical conductors are secured for electrical contact in any appropriate manner. The stationary contact base 44 has sufficient depth so that I may mount a pair of stationary contact members 48 for each position, one directly above the other, as can be seen by reference to Figures 2 and 5.

The other stationary contact base 62 is similar in construction to the stationary contact base 44. Its base end is secured to the leg 64 of the bracket 26 by means of a bolt 66. The bolt 45 runs completely transversely of the assembly, there being a bolthead 68 at one end of the bolt and a nut 70 at the other end of the bolt. A sleeve 72 is disposed about the bolt between the stationary contact bases 44 and 62. When the nut 70 is tightened,

the ends of the stationary contact bases 44 and 62 will be supported by the bolt 46, which runs therethrough, and will be positioned by clamping pressure by the respective vertical members 36 and 40 and the abutting ends of the sleeve 72. Carried by the stationary contact base 44, I provide a plate 74, as can be seen by reference to Figure 1. The plate 74 is clamped between the stationary contact base 44 and the end of sleeve 72. I position an arm 76 about the bolt 46. This member is clamped between the bolthead 68 and the vertical member 36. It will be seen therefore, that upon the tightening of the nut 70, the end of the stationary contact member 44 and the end of the plate 74 through which the bolt 46 passes will be clamped between the upper end of the vertical member 40 and the end of the sleeve 72. At the same time the end of the stationary contact base 62 will be clamped between the vertical member 36 and the other end of the sleeve 72. A similar clamping action clamping the end of the arm 76 between the bolthead 68 and the vertical member 36 will also occur at the same time.

The stationary contact base 62 carries contacts 78, 80, 82 and 84, which are secured by screws 86 to members 88 which are analogous to the members 60 of the stationary contact base 44. It is understood that there is a pair of contacts for each position, one of the contacts being disposed directly above the other. The contact base 62 is made of an appropriate insulating material, the screws 86, the contact members 78, 80, 82 and 84 and the terminal members 88 being formed of conducting metal. It will be noted that the stationary contact base 44 is provided with a vertically extending bore 90 and a vertically extending bore 92. The bores 90 and 92 of the base 44 are not employed, though the corresponding bores formed in the stationary contact base 62 are used to position hinge pins. A hinge pin 94 is positioned in the bore in contact base 62 corresponding to bore 90 and a hinge pin 96 is positioned in the bore in stationary contact base 62, which corresponds to the bore 92 of stationary contact base 44. A pair of hinge arms 98 are provided. One end of each of the hinge arms 98 is secured to the stationary contact base 62 by a nut 100 which threadedly engages the hinge pin 94, as can readily be seen by reference to Figure 5. A washer 102 is positioned between the surface of the stationary contact base 62 and the hinge arms 98, there being two hinge arms, one above and one below the stationary contact base 62. These hinge arms are connected by a metal strip 99 to give rigidity to the assembly. In a similar manner I pivotally secure a pair of hinge arms 104 to the hinge pin 96 by nuts 106 and provide washers 108 between the surface of the stationary contact base 62 and the ends of the hinge arms 104, as can readily be seen by reference to Figure 3.

I provide a movable contact base 110 which is supported by the two pairs of hinge arms 98 and 104. The other ends of hinge arms 98 are pivotally secured to a hinge pin 112 by means of nuts 114, the hinge pin 112 being carried in a bore formed in the movable contact base 110. This contact base is made of appropriate insulating material. The movable contact base 110 is formed with another bore in which I position a hinge pin 116 to which the ends of arms 104 are pivotally secured by means of nuts 118, there being washers 120 disposed between the upper and lower surfaces of the movable contact base 110 and the ends of arms 104. The distance between hinge pins 116 and 112 is equal to the distance between hinge pin 96 and hinge pin 94. The distance between hinge pin 116 and hinge pin 96 is equal to the distance between hinge pin 112 and hinge pin 94. This last equality is achieved by making the length of the hinge arms 98 equal to the length of hinge arms 104. Accordingly, the hinge arms 104 and 98 will maintain the movable contact base 110 parallel to the stationary contact base 62 throughout the movement of the movable contact base 110. The stationary contact base 44 is positioned to be parallel to the stationary contact base 62.

The movable contact base carries a plurality of movable contact plates 122, 124, 126 and 128. In the position shown in Figure 1, plate 122 bridges the pair of contacts 48, plate 124 bridges the pair of stationary contacts 50, plate 126 bridges the pair of stationary contacts 52 and plate 128 bridges the pair of stationary contacts 54. Each of the plates 122, 124, 126 and 128 is mounted upon a respective rod 130. The end of each rod 130 is provided with a hooked portion 132 adapted to seat against the lateral surface of the movable contact base 110. A spring 134 is provided to urge each movable contact plate outwardly to seat the hooked end 132 against the surface of the movable contact base 110. In an analogous manner, the movable contact base 110 carries a plurality of vertical contact plates 136, 138, 140 and 142. The plate 136 is adapted to bridge the pair of stationary contacts 78. Similarly, the plates 138, 140 and 142 are adapted to bridge the respective stationary contacts 80, 82 and 84. Each of the contact plates 136, 138, 140 and 142 is carried by a rod 144 in a manner analogous to the carrying of plates 122, 124, 126 and 128 by the rods 130. Likewise, springs 146 analogous to springs 134 are provided.

Member 150 is clamped to the end of the movable contact base 110 by means of a bolt 152 and a nut 154 and bolt 156 and nut 158. The lower end of the member 150 is bolted to an armature 160 by bolts 162 and 164. The armature 160 is provided with an L-shaped extension 166, as can readily be seen by reference to Figures 1 and 5. The armature 160 is adapted to be attracted whenever the winding 24 is energized. The armature will move to shorten the air gap to reduce the path of the magnetic flux in the magnetic circuit of the magnet frame and its energized core. A spring 168 has one end positioned by a bolt 170 carried by the arm 76. The other end of the spring 168 is positioned by the end 172 of the bolt 156. The spring 168, it will be seen, will bias the movable contact base 110 to move upwardly as viewed in Figure 1. This motion carries the armature 160 away from the ends of the magnet frame. The upward motion of the movable contact base 110 is limited by a stop screw 174, which is carried by the plate 74. The position of the stop screw 174 is so adjusted that good contact is made between the stationary contact pairs 48, 50, 52 and 54 and the movable contact plates 122, 124, 126 and 128, respectively. The adjustment is such that the springs 134 will be slightly compressed. It will be noted that, owing to the fact that the movement of each point on the movable contact base 110 is along the locus of a circle whose radius is the length of the hinge members 98 and 104, in making contact there will be a wiping action. That is, after the contact plates have been seated, there will be a lateral component of motion, the springs compressing to permit this. This lateral component of motion wipes the contact surfaces owing to the relative lateral movement between them. The same action occurs when the movable contact member moves to break circuits through the contacts.

When the winding 24 is energized, the armature 160 will be attracted to the magnet frame. The armature is attached to the movable contact base 110 and will accordingly take part in its motion. Any point upon the armature will describe a portion of a circle. The attraction of the armature 160 will cause the movable contact base 110 to move to the left and downwardly as viewed in Figure 1. This motion will be against the action of spring 168. When the armature 160 seats against the ends of legs 12 and 14 of the magnet frame 10, we have reached the limit of motion. When this limit is reached, the contacts theretofore made will be broken, and contact plates 136, 138, 140 and 142 will have made contact with respective pairs of stationary

contacts 78, 80, 82 and 84. In the making of the contacts, the wiping action heretofore described will occur, and the springs 146 will compress to permit this.

It is to be understood that, while I have shown four pairs of stationary contacts on each of the two stationary contact bases, any appropriate number of pairs of contacts may be employed by the simple expedient of making the assembly longer. In a similar fashion, a smaller number than four pairs of contacts may be employed if desired.

In the construction thus far described, a number of circuits are normally closed and a number of circuits are normally open. Upon the energization of the contactor, the normally closed circuits are opened and the normally open circuits are closed. When the winding is de-energized, the spring 168 will open the normally open switches and close the normally closed switches.

In some applications it is desirable to maintain the normally open circuits in closed condition after the de-energization of the actuating winding of the contactor.

Referring now to Figure 3, I mount an electromagnet 200 upon the magnet frame, securing the electromagnet to the leg 12 of the frame 10 by means of a screw 202 which also secures a bracket 204 to the leg 12. The lower hinge 104 carries a stop lug 206. An armature 208 is rockably mounted on the upper edge of leg 12. The armature 208 is formed with a projecting end 210 through which a bolt 212 passes. The bolt passes downwardly through an opening in the bracket 204. The end of the bolt is provided with a nut 214 between which and the bracket 204 I position a spring 216. The spring normally urges the end of the armature 208 upwardly to its full line position. In this position the end of the armature is adapted to contact the stop lug 206 and latch the movable contact base 110 in its position against the action of spring 168. Whenever the electromagnet 200 is energized, the armature 208 will be brought downwardly to its dotted line position, as shown in Figure 3, against the action of spring 216, to permit the spring 168 to return the movable contact base 110 to the position shown in Figure 1. In the construction shown, therefore, if the winding of electromagnet 200 is de-energized, the following action will occur:

Upon the energization of the winding 24, the movable contact base 110 will be moved downwardly and to the left against the action of spring 168, and the movable armature will automatically be latched in this position. To release the movable armature and to break the circuit thus maintained by the latching armature 208, it will be necessary to energize the winding 200.

It will be seen that I have accomplished the objects of my invention. I have provided a multiple electrical contactor of improved construction which can be conveniently and expeditiously mounted upon a panel and occupy a minimum of panel space. It will be noted that the base of the assembly occupies a much smaller area than either the plan view or the side elevation. A comparatively small panel can therefore be employed to mount a comparatively large number of multiple contactors. This is important, for example, and advantageous in elevator practice where panel space is limited. Any desired number of circuits can be made and broken by means of my multiple electrical contactor. The contacts of my multiple contactor automatically provide wiping contact during each making and breaking of the respective circuits. A large number of circuits can be made and broken simultaneously.

There are essentially only two moving parts, namely, the movable contact base and its associated contacts and armatures, and the two hinge assemblies. It is to be noted, furthermore, that the provision of the spring-mounted movable contact plates not only permits wiping contact in combination with the movement of parts provided, but also cushions the seating of the movable contact base in both limits of motion. This prevents pounding out of stops or of the magnet frame and makes for a relatively quiet operation.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is therefore to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is:

1. In a multiple electrical contactor, a pair of stationary contact support members, means for mounting the members in separated parallel position, pairs of spaced electric contacts carried by each of the stationary members, a movable member parallel to said stationary members, means for mounting the movable member between the stationary members for motion simultaneously parallel therewith and transverse thereof, bridging contact means carried by the movable member on opposite sides thereof for coaction with respective pairs of electric contacts carried by the stationary members, biasing means normally urging the movable member to bring the bridging contact means on one side thereof to close the spaced contacts carried by one of the stationary members and electromagnetic means for moving the movable member against the action of the biasing means to bring the bridging contact means on the other side of the movable member to close the pairs of spaced contacts carried by the other of said stationary members.

2. In a multiple electrical contactor, a pair of stationary contact bases formed of insulating material, means mounting the stationary contact bases in separated parallel position, a movable contact base formed of insulating material and parallel to said stationary contact bases, means mounting the movable contact base between the stationary contact bases for motion simultaneously parallel therewith and transverse thereof, pairs of contact members carried by each of the stationary contact bases, a plurality of bridging contact members carried on opposite sides of the movable contact base for coaction with respective pairs of stationary contact members, biasing means normally urging the movable contact base to bring the bridging contact members on one side of the movable contact base into engagement with the respective pairs of contact members on one of the stationary contact bases and electromagnetic means for moving the movable contact base against the action of the biasing means to bring the bridging contact members on the other side of the movable contact base into engagement with the respective pairs of contact members carried by the other of said stationary contact bases.

3. A multiple electrical contactor as in claim 2 in which each of said movable bridging contacts is adapted to bridge a pair of stationary contacts in a plane substantially normal to the direction of movement of said movable member.

4. A multiple electrical contactor as in claim 2 in which each of said bridging contacts carried by the movable contact base is resiliently mounted.

5. A multiple electrical contactor as in claim 2 in which each of said bridging contact members carried by the movable contact base is resiliently mounted and means for guiding the contact members for movement along a line extending at an acute angle with the longitudinal axis of the movable contact base.

6. A multiple electrical contactor as in claim 2 in which said means for mounting the stationary contact bases comprise a U-shaped frame, a panel and means mounting the frame on the panel at the base of the frame.

7. A multiple electrical contactor as in claim 2 in which said means mounting the movable contact base includes a pair of links of equal length, means for pivo-

tally securing one end of each link to one of the stationary contact bases and means for securing the other ends of the links to the movable contact base in parallel motion linkage.

8. A multiple electrical contactor as in claim 2 in which said means mounting the stationary contact bases includes a U-shaped frame of magnetic material and said electromagnetic means comprising a core carried by said frame a winding positioned upon said core and an armature carried by the movable contact base adjacent the end of the frame, said U-shaped frame forming a part of the magnetic path for said winding.

9. A multiple electrical contactor as in claim 2 including in combination a latch, means for mounting the latch for maintaining the movable contact base in position to close circuits through said second mentioned group of stationary contacts against the action of said biasing means and electromagnetic means for releasing said latch.

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