Sept. 18, 1962 R. L. CLARK ET AL 3,054,872

ELECTRICAL CONTACTOR

Filed Nov. 28, 1958

3 Sheets-Sheet 1

Fig. 1.

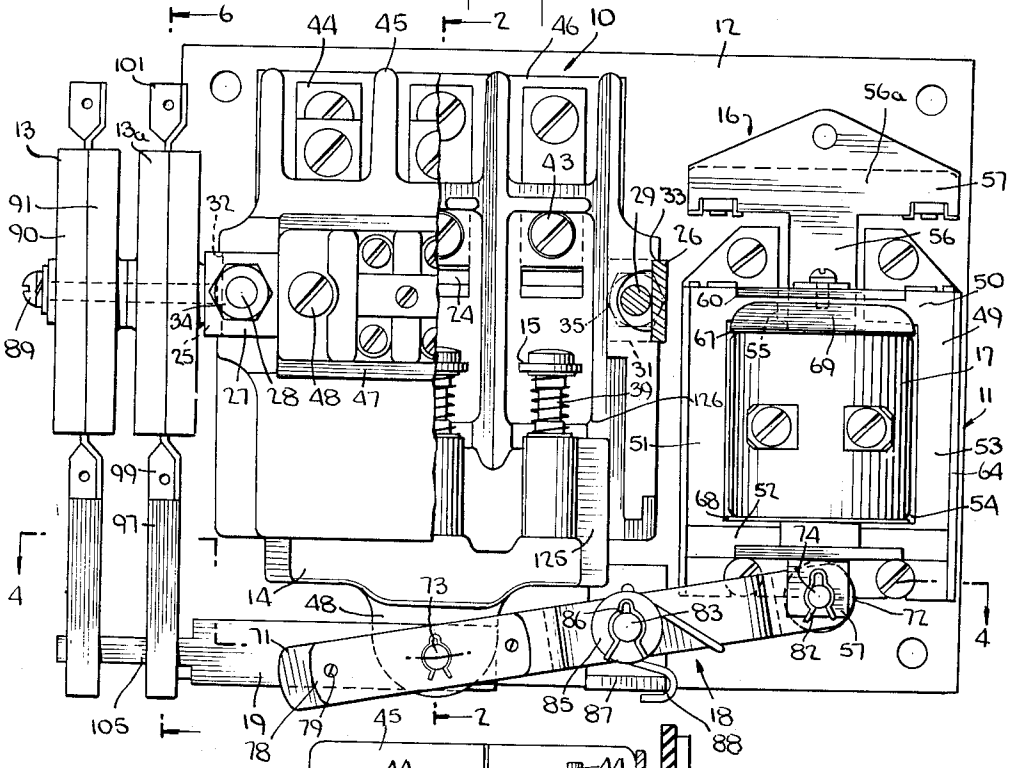


Fig. 2.

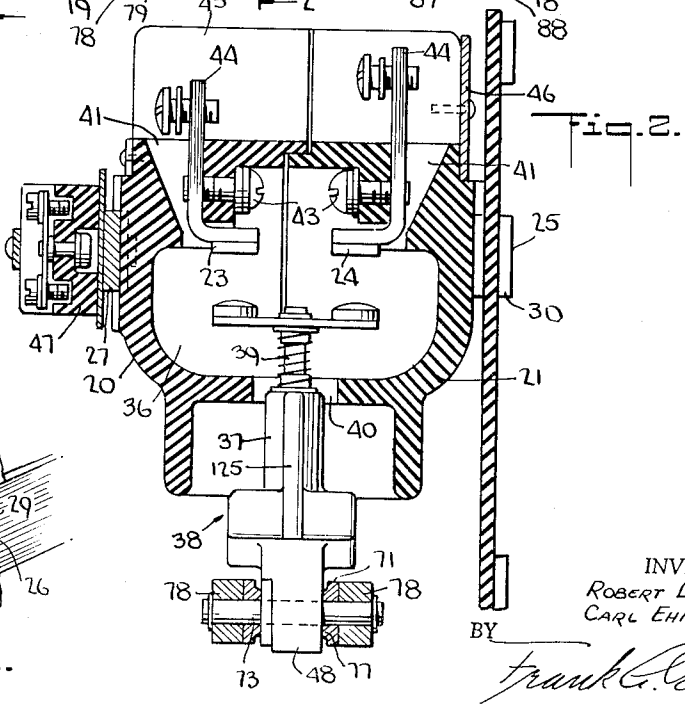
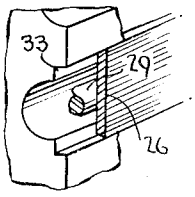


Fig. 3.



INVENTORS
ROBERT L. CLARK
CARL EHMANN

BY Frank G. Bower

ATTORNEY

Sept. 18, 1962 R. L. CLARK ET AL 3,054,872

ELECTRICAL CONTACTOR

Filed Nov. 28, 1958 3 Sheets-Sheet 2

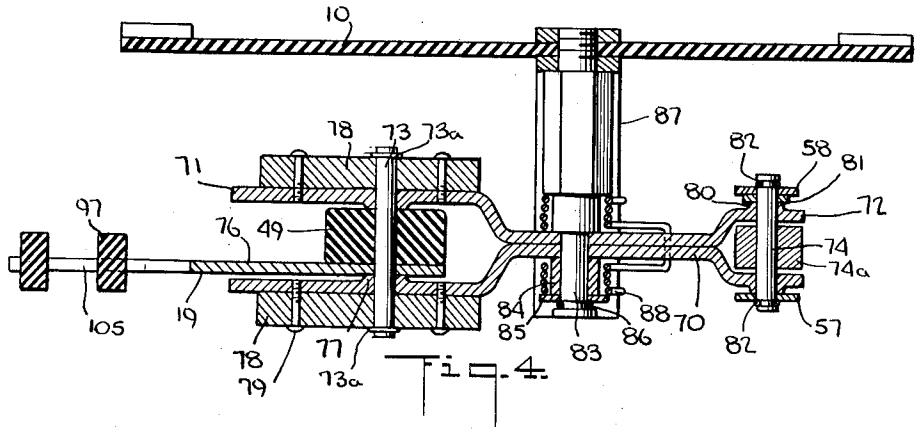


Fig. 4.

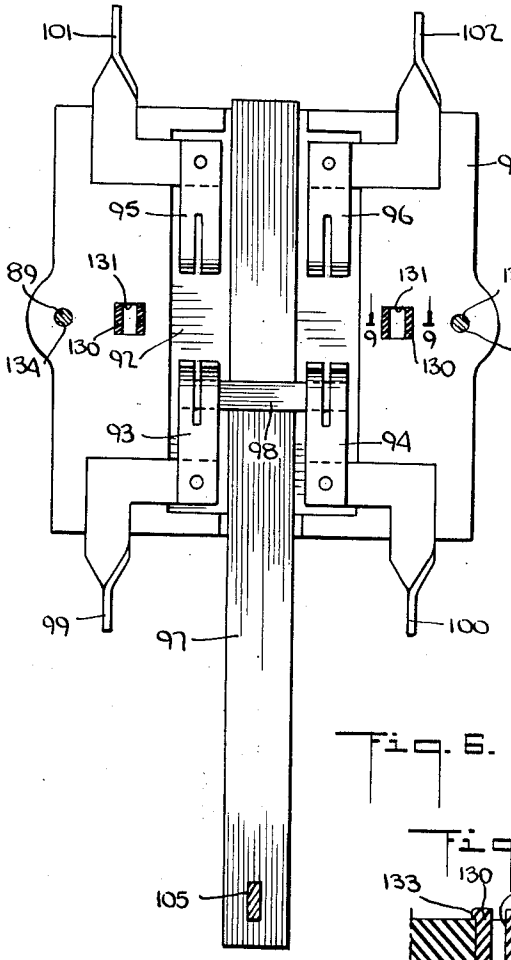


Fig. 6.

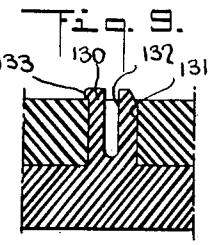


Fig. 9.

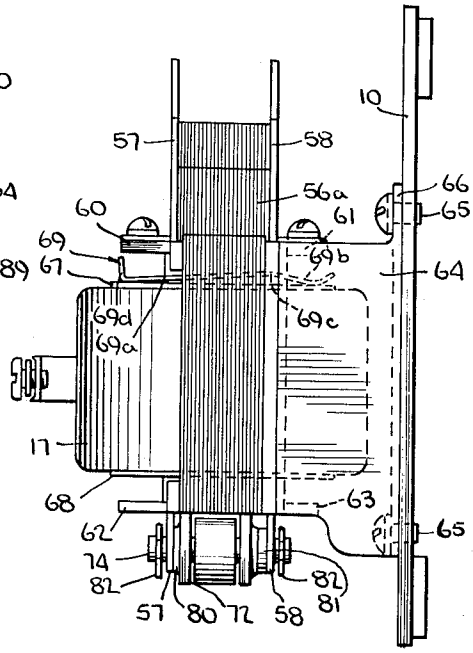


Fig. 5.

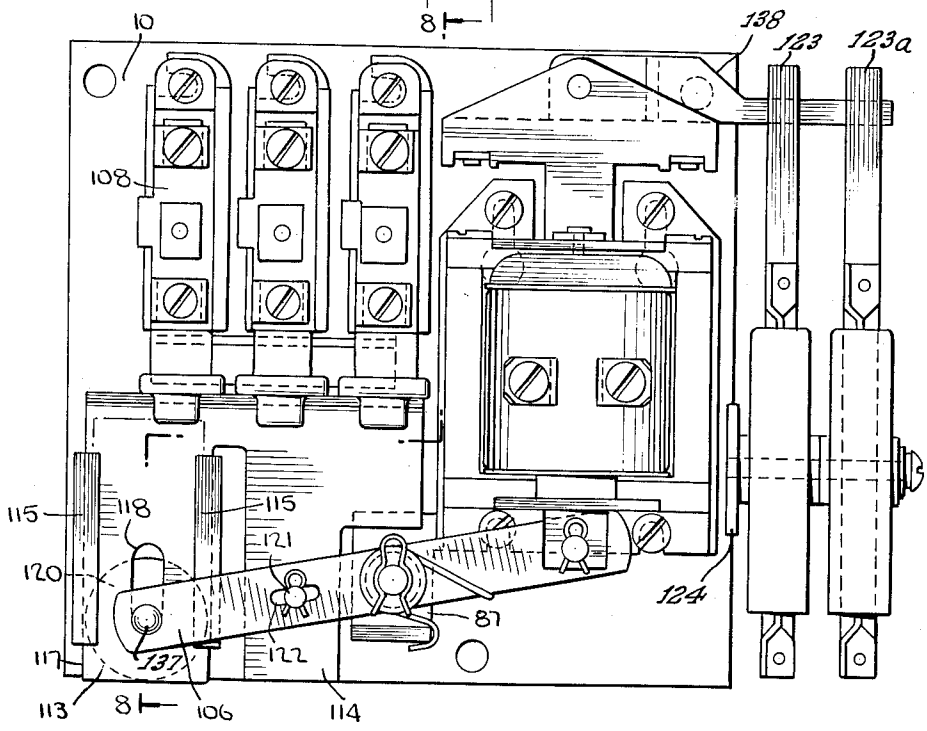
INVENTORS
ROBERT L. CLARK
CARL EHMANN
BY
Frank G. Bower
ATTORNEY

Sept. 18, 1962 R. L. CLARK ET AL 3,054,872

ELECTRICAL CONTACTOR

Filed Nov. 28, 1958 3 Sheets-Sheet 3

Fig. 7.



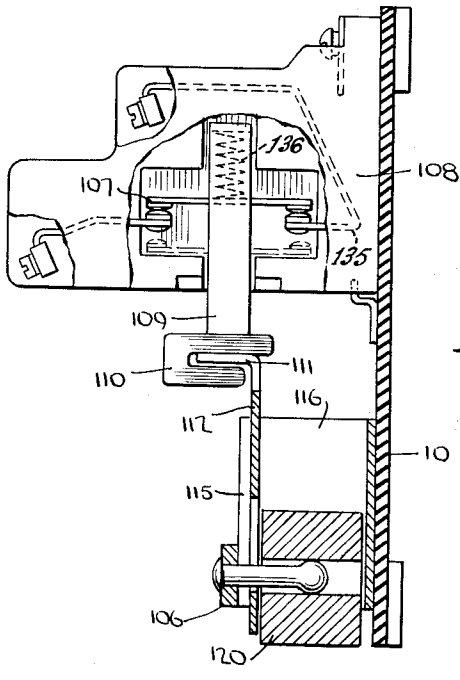


Fig. 8.

INVENTORS
ROBERT L. CLARK
CARL EHMANN

BY Frank L. Bauer

ATTORNEY

United States Patent Office 3,054,872 Patented Sept. 18, 1962

3,054,872

ELECTRICAL CONTACTOR

Robert L. Clark, New City, and Carl Ehmann, Yonkers, N.Y., assignors to Ward Leonard Electric Co., Mount Vernon, N.Y., a corporation of New York

Filed Nov. 28, 1958, Ser. No. 776,805
3 Claims. (Cl. 200—104)

This invention relates to electromagnetically operated multipole contactors and is directed particularly to a balanced-type contactor having a multipole contact head actuated by the armature of an electromagnet.

An object of this invention is to provide an electromagnetically operated contactor that is balanced under dynamic conditions of mechanical shock of high intensity and under static conditions.

Another object of the invention is to provide a balanced multipole electromagnetic contactor that is light in weight and simple in its operative parts.

Another object of the invention is to provide a balanced multipole electromagnetic contactor that is easy to assemble and that is readily accessible for servicing.

Other and further objects and advantages of the invention will become apparent from the following description taken in connection with the drawings in which

FIG. 1 is a front view of a balanced multipole electromagnetic contactor with the contactor head illustrated in a fragmentary sectional view;

FIG. 2 is a sectional view of the contactor head taken along lines 2—2 of FIG. 1;

FIG. 3 is a fragmentary sectional view of the means for attaching the contact head to the panel;

FIG. 4 is a fragmentary sectional view of the linkage mechanism coupling the plunger of the contactor head and the electromagnet taken along lines 4—4 of FIG. 1;

FIG. 5 is a fragmentary side view of the electromagnet;

FIG. 6 is a sectional view of the maintaining contacts taken along lines 6—6 of FIG. 1;

FIG. 7 is a front view of another embodiment of the contactor with separate contact members and with the splitter-type contacts mounted on the opposite side of the electromagnet;

FIG. 8 illustrates a side view of the contact member and a sectional view of the actuating linkage; and

FIG. 9 illustrates the means for fastening the insulating members of the contact together.

In the embodiment illustrated in FIGS. 1 through 6 the contactor head **10** and the electromagnet **11** are mounted side by side on a panel or supporting means **12**. Splitter-type contacts **13** and **13***a* are fastened to the contactor head on the opposite side from the electromagnet. However, they could be fastened on either side. The contactor head **10** has a moving contact support **14** with movable bridge contacts **15** for engaging the fixed contacts **23** and **24** mounted in the contactor head. The electromagnet has a solenoid plunger **16** actuated by a coil **17**. The plunger **16** and the moving contact support **14** are coupled by an actuating linkage mechanism **18** pivotally mounted on the panel. The splitter-type contacts are actuated by an arm **19** mounted on the moving contact support **14**.

The contactor head **10** comprises two identical molded insulating pieces **20** and **21** formed and fitted together to carry three poles of the contactor. The molded pieces are securely held together and rigidly fastened to the panel by means of L-shaped brackets **25** and **26** and a cross strap **27**. The brackets have threaded members **28** and **29** extending from one end of a respective bracket and retainers or hooks **30** and **31** extending preferably normal to the bracket at the other end. The brackets are rectangular in cross section and extend through rectangular slots in the panel to position the retainers at the back of the panel. The brackets fit into rectangularly shaped grooves **32** and **33** in opposite sides of the contactor head to hold it in place on the panel. The cross strap **27** extends across the front of the contactor head fitting in rectangular slots at each side and fitting over the threaded members **28** and **29** of the brackets. The nuts **34** and **35** threaded on the brackets securely fasten the contactor head to the panel and hold the two molded pieces together. A terminal block **47**, when required, is mounted on the front strap by bolts **48** extending through the block and threaded in the openings in the strap. One of the molded pieces forms a front member and the other forms a rear member. When the two molded pieces are fitted together the contactor head has three separate chambers **36** in which the bridge contacts **15** move to engage the fixed contacts **23** and **24**. The bridge contacts are slideably mounted on pins **37** fastened in the cross arm **38** to form the moving contact support of the contactor. The pins **37** have shafts **39** with square cross sections to slideably carry the bridge contacts. Helical springs are positioned around the shafts to hold the contacts in engagement. The pins extend through openings **40** in the bottom of the chambers **36** and reciprocally move therethrough. Funnel-shaped passages **41** are provided in the upper wall of the chamber to receive the L-shaped fixed contacts **23** and **24** fastened to the contactor head by bolts **43**. The fixed contacts extend above the wall to form terminal portions **44** recessed by partitions **45** extending between the pairs of contacts and a strip **46** mounted on the rear surfaces of the partitions. The terminal portions are readily accesible through spaces between the top and front edges of the partitions. The plunger has ribs **125** at each end fitting in slots or grooves **126** in the contactor head. The slots and ribs guide the plunger in a linear movement. The cross arm of the plunger has a downwardly extending tongue **48** with flat parallel side surfaces and a bore extending through the tongue for coupling the plunger to the actuating linkage mechanism.

The electromagnet unit **11** comprises an electromagnetic coil **17**, an armature **16** and a laminated core **49**. The core is rectangular in shape and has four legs **50**, **51**, **52** and **53** forming a space **54** for receiving the electromagnetic coil. The upper leg **50** has an opening **55** across the width of the leg dividing it into two magnetic portions. The armature has a laminated structure with a center leg **56** passing through the opening between the two portions of the upper leg and with a cross piece **56***a* lateral to the center leg to form a magnetic linking path between the two portions. The lower end of the center leg is spaced from the lower leg when in a non-energized position. On energization of the coil the center leg is drawn downward to close the gap between the end of the center leg and the core and to bring the cross arm **56** into contact with the portions of the upper leg. One opposite sides of the laminated armature structure are T-shaped straps **57** and **58**. The center legs of the straps are longer than the center legs of the laminated structure and extend on opposite sides of the lower leg to link with the actuating linkage mechanism.

The laminated core **49** is fastened together by upper mounting brackets **60** and **61** and lower mounting brackets **62** and **63**. The rear upper and lower brackets **61** and **63** are fastened to a U-shaped mounting member **64** spacing the electromagnetic from the panel and rigidly fastening it to the panel. The mounting member **64** is fastened to the panel by bolts **65** passing through the flanges **66**. The coil **17** is retained in position by means of the insulating members **67** and **68** positioned in the top and bottom of the coil, respectively, and by a spring wedge **69** fitting between the upper leg **50** of the core and

the insulaing piece 67 to securely retain the electromagnetic coil in the core without vibration or movement. The spring wedge 69 is made of annealed spring steel and has a U-shape with legs 69*a* and 69*b* extending on opposite sides of the armature. The legs of the spring wedge are curved with the center portion 69*c* pressing against the legs of the core and the ends against the insulating piece. The front edge 69*d* is turned to form a portion generally normal to the wedge to stiffen the center leg and provide a means for easily inserting and securing the wedge.

The actuating linkage mechanism 18 comprises a lever 70 formed from two pieces of flat metal bent to join at an intermediate portion and to diverge at the ends to form end forked portions 71 and 72. The lever is pivotally mounted by pivotal mounting means secured to the panel and extending through the intermediate portion of the lever. The forked portion 71 fits around the tongue 49 on the cross arm of the plunger and is pivotally fastened thereto by the pin 73. The other forked portion 72 fits between the straps 57 and 58 of the armature and is pivotally fastened by the pin 74.

The tongue 49 of the plunger cross arm has a cut-out portion extending longitudinally to the cross arm and transversely to its movement. The arm 19 actuating the splitter contacts 13 and 13*a* fits into this cut-out portion and is held in place by the bosses 77 on the forked portion of the lever. Balancing weights 78 are secured on opposite sides of the lever by rivets 79. The pin 73 extends through the balancing weights and is held in place by the cotters 73*a*. The balancing weights are distributed equally in weight around the pivot. The other forked portion 72 has outside bosses 80 for spacing the straps 57 and 58. A spacing washer 81 is fitted between one side of the fork and one of the center legs. The pin is held in place by the cotter pins 82 snapped on the ends. As illustrated in FIGS. 1, 4 and 5 the movement of the actuating mechanism is limited in the non-engaged condition by the cylindrical roller-type stop 74*a* mounted on the pin 74 between the ends of the straps 57 and 58.

The pivotal mounting means has a shaft 83 fastened to the panel. The shaft 83 has a shoulder against which the intermediate portion of the lever is held by the collar 84, washer 85 and snap cotter pin 86. The shoulder positions and centers the lever in relation to the armature and cross piece. An L-shaped member 87 is fastened to the panel 10 and extends parallel to the shaft to form a means for holding the torsion spring 88 loaded against the lever. The spring is formed into two helical halves positioned on opposite sides of the central portion and connected by a portion positioned underneath the lever. The ends of the spring are caught on the piece. The spring 88 engages the lever on the opposite side of the shaft 83 from the contactor head.

The balancing weights balance the weight of the steel armature so that the weight distribution on the opposite sides of the stud is equal. The torsion spring biases the contactor in the open position. Thus, in this embodiment the armature and the plunger are positioned on opposite sides of the pivot and the dynamic members are balanced by balancing weights. A shock applied to the contactor in the line of movement of the plunger and the armature will not affect the position of these dynamic members. A downward force tending to move the plunger into the closed position or retain it in the closed position will have the effect of tending to accelerate the armature to move the plunger into the open position. With the balance about the pivot, these forces are cancelled and the plunger remains in position when a shock is applied.

The splitter-type contacts 13 and 13*a* are fastened by bolts 89 threaded into the mounting bracket 25 of the contact head. The contact units comprise identical insulating members 90 and 91 forming an internal chamber 92 in which the split contacts 93, 94, 95 and 96 are fastened to the insulating member. The insulating members are fastened together to form the housing for the contacts by means of the resilient projection 130 and the rectangular opening 131. The projection has a longitudinal slot 132 permitting flexure of the ends of the projection. A knob 133 is provided on one side of the projection to catch the projection in the opening and holes 134 are provided for receiving the bolts 89 to secure the housing to the bracket. A rectangular shaft 97 extends through the chamber 92 and between the insulating members by means of openings in opposite sides of the insulating members. The contacts 93 and 94 are positioned on opposite sides of the shaft to receive the contact bar 98 when the main contacts are open, and the contacts 95 and 96 are positioned on opposite sides of the bar to receive the contact bar when the main contacts are closed. The split contacts are respectively connected to the external terminals 99, 100, 101 and 102 fitting in suitable channels in the insulating members. The rectangular shaft 97 is made of an insulating material and has a linear movement parallel to the movement of the plunger. The shafts are operated together by arm 19 to move in unison. The arm 19 engages both of the shafts by a tab 105 fitting into the slot in the shafts. The contacts are connected to the terminals of the starting button (not shown) so that when the plunger is raised in an engaging position, the shorting bar is raised to bridge the shorting contacts. On application of a physical shock to the contactor, the shorting bar remains in engagement with the contacts and maintains the energization of the unit. When the plunger is in a disengaged position any physical shock applied to the contactor will prevent the energization of the coil due to the balancing action of the dynamic members. The splitter-type contact maintains closure on application of a force due to the bayonet-type construction. On a longitudinally applied force the shorting bar remains in engagement with the contacts for a considerable portion of the stroke so that any movement produced by a jarring action as a result of physical shock will not produce a disconnection of the contact bar from the splitter contacts.

In another embodiment illustrated in FIGS. 7 and 8 the electromagnet is the same as in the embodiment of FIGS. 1 through 6. The actauting lever 106 is a single metal strip. The pivotal mounting of the member is identical to that in the previous embodiment. The contacts 107 of the switch are mounted in separate individual contact mountings 108 similar to those described in the co-pending application Serial No. 741,347 filed June 11, 1958, by John Scheib, Jr. Each of these contacts has a light plastic plunger 109 with a U-shaped connecting portion 110 engaging the flange 111 of the actuating member 112. The plunger 109 is guided in a linear movement by the mounting 108. The contacts 107 are movable over a short distance in the direction of movement of the plunger and resiliently held against the fixed contacts 135 by a spring 136. The actuating member 112 comprises a flat portion having two vertically extending strips 113 and 114. One strip 114 is pivotally connected to the actuating lever 106 and the other strip 113 fits in guides 115 formed by brackets 116 mounted on the panel 10. The guides 115 are lateral flanges engaging and holding the strip to move the actuating member in linear movement in a given plane. A slot 118 is provided in the strip through which a rivet 137 extends to pivotally connect a balance weight 120 to the end of the actuating lever. The balance weight is cylindrical in shape and has an axial bore 127. The rivet 137 extends into the bore and has a rounded or a ball shaped end 128 rockably supporting the balance weight between the actuating member 112 and the bracket 116. The balance weight balances the armature of the electromagnet. The slot 118 is wider than the diameter of the pin to accommodate the lateral movement of the pin in its motion about the center of the pivot. The pin 121 con-

necting the actuating lever to the actuating plate has a transverse slot **122** to permit relative movement between the pin and the actuating plate. The balance weight and the actuating plate and the plungers of the individual contacts balance the weight of the armature of the electromagnet so that any force applied to the unit will be cancelled out through the actuating lever.

The splitter-type contacts **123** and **123***a* (FIG. 7) are mounted to a flange **124** secured to the panel and are actuated by an arm **138** fastened to one of the side plates of the armature. The arm **138** is S-shaped with a fastening portion secured to the side plate and a portion bent out of alignment with the fastening portion and centered on the armature. This latter portion engages slots in the arms of the splitter contacts. The structure of the splitter contacts **123** and **123***a* may be similar to the contacts **13** and **13***a*.

Various modifications and changes may be made in the foregoing invention without departing from the invention as set forth in the appended claims.

We claim:

1. A mounting for electrical contacts comprising a panel, a contact head having a first and second insulating pieces solely mounted by the same single means to said panel, a plurality of pairs of contacts, said first piece supporting one contact of each pair of contacts, said second piece supporting the other contact of each pair of contacts, said first piece engaging said panel, said second piece fitting on said first piece, said first and second pieces having grooves on each side thereof for positioning said contacts carried by said second piece at a specified level with the contacts of said first piece, two brackets, each of said brackets having means for securing said brackets to said panel and a strap portion fitting in a respective groove, a strap member extending across said second insulating piece and coupled to said brackets to hold said brackets against the sides of said insulating pieces to form with said brackets the means for securely fastening said second piece to said first piece and said first piece to said panel to hold said contacts of said second piece at a specified level with the contacts of said first piece and permit inspection of said contacts.

2. An electrical contactor comprising a panel, an insulating contact head mounted on said panel, said head having fixed contacts and a plunger movably mounted therein in a linear movement, contacts mounted on said plunger movable in and out of engagement with said fixed contacts, an electromagnet mounted on said panel and having an armature with a linear movement generally parallel to said plunger, a lever, means for pivotally mounting said lever on said panel between the lines of movement of said plunger and said armature, an actuating plate coupling said lever and said contact plunger, said actuating plate having two strips, said first strip being pivotally connected to said lever, a bracket slideably guiding said second strip to move said actuating plate in a plane, and a counterbalance mounted in said guiding bracket to balance the weights of the dynamic members.

3. An electrical contactor comprising a panel, an electromagnet having a T-shaped armature with a linear movement, an insulating contact head having a plurality of pairs of fixed contacts aligned in a plane normal to the movement of said armature, said electromagnet and said contact head being separately mounted on said panel, said contact head having grooves on each side extending longitudinal to the movement of said armature, a plunger movably mounted within said contact head and having ribs fitting in said grooves to guide said plunger in a linear movement parallel to said armature, said plunger having movable contacts aligned in a plane normal to the movement of said plunger, an exterior lever having yoke portions at each end, a shaft mounted on said panel and extending normal to said panel and through an intermediate portion of said lever to pivotally mount said lever on said panel, a spacer on said shaft to position said lever from said panel and in alignment with said plunger and armature, said plunger and armature each having extensions fitting in said yoke portions with the plunger extension adapted for connection to auxiliary contact means, pins extending through a respective extension and yoke portions to pivotally connect said lever to said plunger and armature on opposite sides of said shaft, counterbalance means on the yoke portion coupled to said plunger to balance the dynamic components and coil spring means formed around said shaft and engaging the lever to force said armature out of said electromagnet on deenergiaztion.

References Cited in the file of this patent

UNITED STATES PATENTS

2,394,090	McFarland	Feb. 5, 1946
2,475,331	Lowndes	July 5, 1949
2,523,774	Moran	Sept. 26, 1950
2,561,450	Russell	July 24, 1951
2,589,167	Van Valkenburg et al.	Mar. 11, 1952
2,675,443	Wyckoff	Apr. 13, 1954
2,719,890	Schleicher	Oct. 4, 1955
2,924,685	Burch	Feb. 9, 1960

FOREIGN PATENTS

349,498	Great Britain	May 24, 1930
710,452	Great Britain	June 9, 1954