Oct. 31, 1944. E. H. AYERS 2,361,808

ELECTROMAGNET

Filed Nov. 13, 1942

Fig. 1.

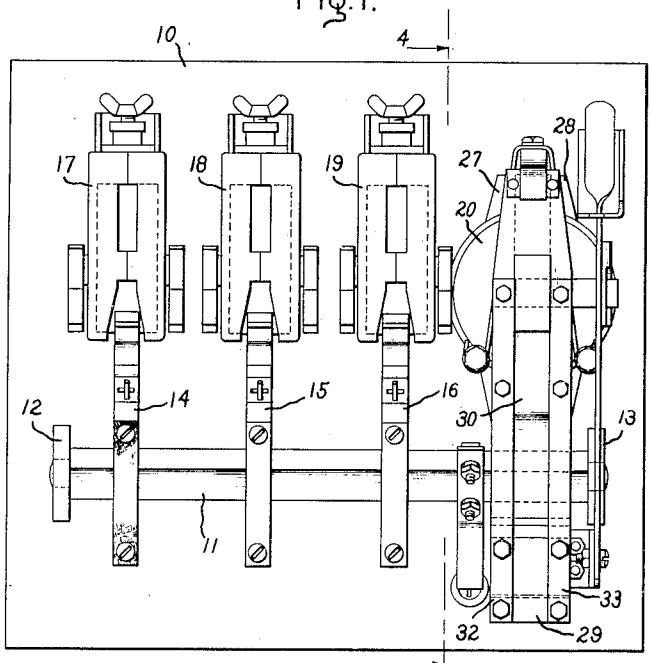


Fig. 2.

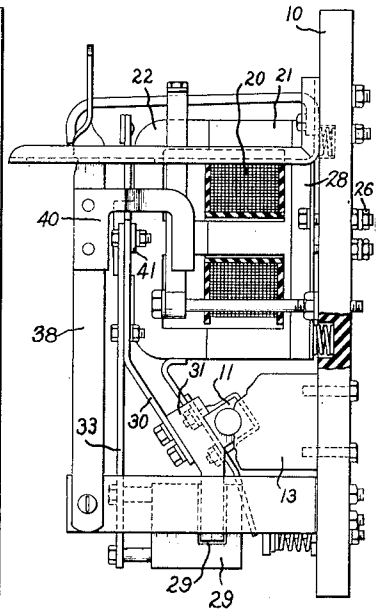


Fig. 3.

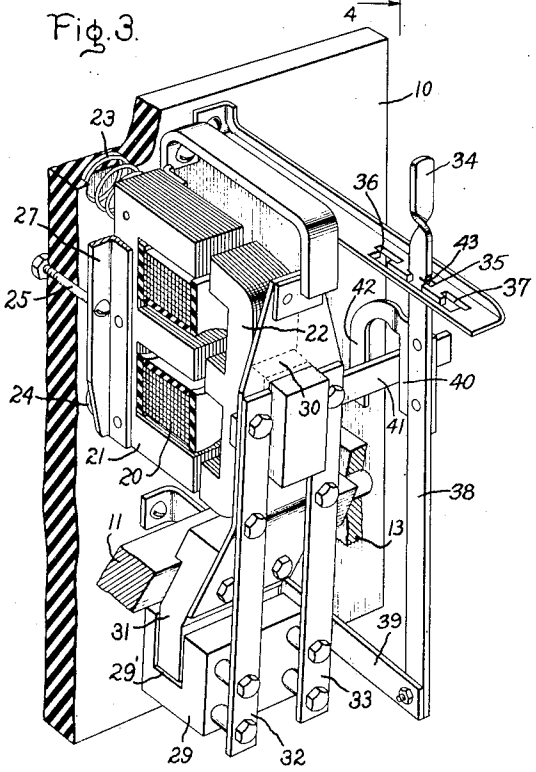
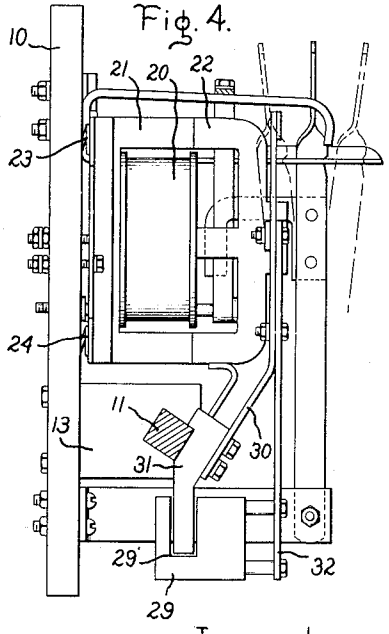


Fig. 4.



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Patented Oct. 31, 1944 2,361,808

UNITED STATES PATENT OFFICE

2,361,808

ELECTROMAGNET

Edgar H. Ayers, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York

Application November 13, 1942, Serial No. 465,409

8 Claims. (Cl. 175—336)

My invention relates to electric switches, more particularly to electromagnetically operated switches of the type ordinarily known as contactors, and has for its object simple and reliable means for preventing operation of the switch by shocks, and for latching the switch in either its open or closed circuit position.

In carrying out my invention in one form, I provide a resilient mounting for the magnet core member on the panel, which mounting provides in the event of shock for a limited amount of movement of the panel toward the magnet core, together with an inertia member or weight which is resiliently secured to the armature and located on the side of the pivot of the armature opposite the armature so as substantially to counterbalance the armature. In addition, I also provide a loose or lost motion connection between the armature and the inertia member consisting of a rigid arm secured to the armature which extends loosely into a slot in the inertia body.

With this arrangement, shocks in a direction tending to move the panel toward the magnet core are initially absorbed by the spring mounting, and any slight pivotal movement of the armature toward its unattracted position is damped by the inertia member so that the armature is quickly returned to its attracted position by the magnet coil and without opening of the switch contacts operated by the armature.

Shocks in the opposite direction with the armature in its attracted position have substantially no effect in producing pivotal movement of the armature toward its unattracted position because of the substantial balancing of the armature by the inertia member.

I also provide manually operated means for positively latching the switch in either its open or closed positions for providing normal freedom of movement of the armature for electromagnetic operation.

For a more complete understanding of my invention, reference should be had to the accompanying drawing, Fig. 1 of which is a front elevation view of an electromagnetically operated contactor embodying my invention; Fig. 2 is a side elevation view of the device shown in Fig. 1 looking at Fig. 1 from the right-hand toward the left-hand side; Fig. 3 is a fragmentary view in perspective of the device shown in Figs. 1 and 2 showing various details of construction; while Fig. 4 is a sectional view along the line 4—4 of Fig. 1 looking in the direction of the arrows.

Referring to the drawing, I have shown my invention in one form as applied to a conventional type of electro-magnetically operated switch or contactor. The device which is mounted on a panel 10 made of suitable electrically insulating material, such as slate, comprises a pivot shaft or rod 11 having its ends mounted in bearings 12 and 13. Mounted on this pivot 11 are three electric contact arms 14, 15 and 16 which cooperate with suitable stationary contacts secured to the panel 10. Suitable arc chutes 17, 18 and 19 are provided for the contacts. The shaft is biased as by gravity or by a suitable spring (not shown) to the position shown in Fig. 3 in which the switch contacts 14, 15 and 16 are in their open circuit positions. The shaft is moved from the open circuit position to its closed circuit position by means of an operating coil 20 provided with a stationary magnet core 21 and a movable armature 22 secured to the shaft 11.

It will be understood that a contactor of this type is affected by blows or shocks applied to the supporting panel 10 in a direction to cause rotation of the shaft 11 either from the closed circuit position to the open circuit position, or vice versa.

In accordance with my invention, I provide a resilient or spring mounting for the magnet core 21 on the panel 10. As shown, this mounting comprises helical springs 23 and 24 mounted between the magnet core and the panel whereby the magnet core is held resiliently in spaced relation with the panel. For supporting the weight of the magnet core, bolts 25 and 26 are provided passing through suitable holes in the panel and loosely through holes in flanges 27 and 28 on opposite sides of the magnet core. The nuts on these bolts are turned up so as to draw the magnet core toward the panel in suitable spaced relation with the panel and also to suitably adjust the force applied by the springs 23 and 24.

It will be observed that the springs 23 and 24 absorb movement of the panel in a direction toward the magnet core up to a predetermined amount before any appreciable movement of the magnet core is effected. It will be understood that such independent movement of the panel 10 is a very sudden movement caused by a shock such that the springs are compressed before the force transmitted by the springs to the magnet core has time to appreciably move the magnet core. This allowable independent movement of the panel permitted by the space between the

magnet core and the panel in a typical device was approximately ⅛ of an inch.

This absorption by the springs of the initial movement of the panel toward the magnet core prevents the transmission of the initial violence of the shock not only to the magnet core 21 but also to the armature 22 whereby movement of the armature from its attracted position to its unattracted position is prevented in response to the shock.

I also provide a weight or inertia member 29 for counterbalancing the armature about the axis of the shaft 11. Thus, as shown, the armature 22 is mounted on the end of a metal plate forming an arm 30 which has its other end secured to a rigid arm 31 and to the shaft 11 by suitable bolts. This rigid arm 31 extends downward to the side of the shaft 11 opposite the armature 22 and extends into a slot 29' in the weight 29, the slot being somewhat wider than the arm and the arm being positioned normally midway of the slot. The arm 31 and slot 29' thus form a loose or lost motion connection between the armature and inertia member. As shown, the weight 29 is mounted on two flexible spring metal supporting straps or arms 32 and 33 having their upper ends secured to the arm 30 at points adjacent the armature 22.

Any shock applied to the panel 10 in a direction perpendicular to the panel 10 or any component of a shock so directed is applied, of course, directly to the supporting bearings of the shaft 11 and thence to the shaft and to the armature 22 and weight 29. A shock directed toward the front of the panel, as seen in Fig. 1, and applied directly through the bolts 25 and 26 to the magnet core 21 thus moves the magnet core with the panel away from the armature 22. In other words, the armature 22, by reason of its inertia, tends to remain stationary and hence as the panel moves away pivots on the shaft 11 with respect to the panel. This is assuming, of course, that the armature is in its attracted position, the coil 20 being energized. However, the weight 29 has sufficient weight to counterbalance the armature 22 and the other parts connected to the shaft 11 so that these parts are substantially balanced about the axis of the shaft. Consequently, such a shock applied to the front of the panel 10 does not cause any relative rotation of the shaft because of the balanced parts.

When the shock is in the opposite direction, i. e., from the back toward the front, or from left to right as seen in Fig. 4, both the springs 23 and 24 and the weight 29 are required in the event of an extremely violent shock to prevent movement of the armature 22 to its unattracted position. Such a shock may, of course, be a secondary shock from one initially applied directly to the front of the panel. During the shock after substantial compression of the springs 23 and 24, the magnet core 21 and its armature are forced toward the right, as seen in Fig. 4. This, it will be understood, is a shock applied from the panel 10 through the springs to the magnet core, as distinguished from the shock applied from the panel to the supporting shaft 11. This latter shock applied to the shaft does not result in any substantial tendency for the armature to move to its unattracted position because of the fact that the armature is balanced by the weight 29 about the shaft.

The sudden blow of the shock applied to the armature 22, however, in a direction toward the right, as seen in Fig. 4, causes it to rotate in a clockwise direction on the shaft 11. After a slight clockwise rotation, the rigid arm 31 engages the left-hand wall of the slot 29' and is brought to rest together with the armature 22 by the inertia member 29. It will be understood that at this time the spring supporting straps 32 and 33 are flexed somewhat by the tendency of the weight 29 to remain stationary because of its inertia so that the armature moves slightly with relation to the inertia member. When the armature is thus brought to rest by the weight 29 after a very slight movement toward its unattracted position, it is quickly returned to its attracted position by the electromagnetic force of the magnet. This slight movement of the armature is not sufficient to disengage the movable contacts operated by the armature from their stationary contacts and, therefore, the circuits controlled by the switch remain closed throughout the shock.

Also, I have provided a handle 34 having three positions, a central or intermediate position in a notch 35, as shown in the drawing, in which the normal electromagnetic operation of the device is permitted, an inner extreme position in notch 36 in which the armature is manually latched in its attracted and hence closed circuit position, and a third outer extreme position in a notch 37 in which the armature is manually latched in its unattracted position. As shown, the handle is on the end of a spring arm having its lower end pivotally mounted on an arm 38 secured to the front of the panel on a bracket arm 39, the arm 38 extending substantially parallel with the panel in the central position shown. In its inner position in the notch 36 the stop member 40 carried by the handle engages the outer side of a laterally projecting stop arm 41 secured to the front side of the armature thereby to positively hold the armature in its attracted position. When the handle is in the outer notch 37, an inner stop member 42 carried by the handle engages the inner side of the stop 41 and thereby positively holds the armature in its unattracted position. The stops 40 and 42 are spaced apart far enough to provide for normal free movement of the armature and arm 41 between their attracted and unattracted positions when the handle is in the central notch 35 as shown in the drawing.

It will be understood that the arm 38 is sufficiently flexible laterally to allow the handle to be moved laterally out of one slot and into another. Preferably, as shown, the slots each have overhanging sides thereby to secure the handle against lateral displacement out of the slot. The handle is provided with a portion 43 of reduced width which freely moves between the overhanging sides of the slots. Furthermore, the arm 38 is bent toward the right, as seen in Fig. 1, so that its upper end is biased by the spring free of the arm 38 toward the right against the bottom or right-hand wall of the slot in which it happens to be.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electromagnet comprising a support, a magnet core member mounted on said support, an operating coil on said core member, an armature for said core member mounted for move-

ment toward and away from said core member, an inertia member mounted on said armature for movement with relation to said armature in response to a shock, and a lost motion connection between said armature and said inertia member whereby said inertia member damps movement of said armature in response to a shock.

2. An electromagnet comprising a support, a magnet core member mounted on said support, an operating coil on said core member, an armature for said core member, an arm supporting said armature for pivotal movement about a predetermined pivot toward and away from said core member respectively to attracted and unattracted positions, a flexible member on said armature extending to the side of said pivot opposite said armature, an inertia member mounted on said flexible member on the side of said pivot opposite said armature thereby to balance substantially said armature about said pivot, a rigid member secured to said armature and mounted for movement on said pivot, and a connection between said rigid member and said inertia member providing for limited freedom of movement of said rigid member with respect to said inertia member.

3. An electromagnet comprising a support, a magnet core member mounted on said support, an operating coil on said core member, an armature for said core member pivotally mounted for movement about a predetermined pivot toward and away from said core member, resilient arm means connected to said armature extending to the side of said pivot opposite said armature, an inertia member mounted on said arm means and substantially balancing said armature about said pivot, said inertia member being provided with a slot, and a rigid member secured to said armature extending loosely into said slot and spaced from at least one wall of said slot whereby said inertia member damps pivotal movement of said armature in response to a shock.

4. An electromagnet comprising a support, a magnet core member, a resilient mounting for said core member on said support thereby to provide for movement of said support independently of said core member in response to a shock, an operating coil on said core member, an armature for said core member mounted for movement toward and away from said core member, an inertia member resiliently mounted on said armature, and a lost motion connection between said armature and said inertia member whereby said inertia member cooperates with said spring mounting to damp movement of said armature away from said core member in response to a shock.

5. An electromagnet comprising a support, a magnet core member, resilient means connecting said core member to said support thereby to provide for movement of the support independently of said core member in response to a shock, an operating coil on said core member, an armature for said core member, a pivot support for said armature, an inertia member, a spring arm mounting said inertia member on said armature, a rigid arm secured to said armature, and a connection between said rigid arm and said inertia member providing limited freedom of movement of said inertia member with respect to said rigid arm.

6. An electromagnet comprising a panel support, a magnet core member, resilient means connecting said core member to said panel thereby to provide for movement of the panel toward said core member independently of said core member in response to a shock applied to said panel after which said panel moves said core member, an operating coil on said core member, an armature for said core member on the opposite side of said core member from said panel, an arm supporting said armature for pivotal movement about a predetermined pivot toward and away from said core member respectively to attracted and unattracted positions whereby said movement of said core member by said panel in response to a shock moves said armature away from said core member, a flexible arm on said armature extending to the side of said pivot opposite said armature, an inertia member mounted on said flexible arm, a rigid member secured to said armature, and a connection between said rigid member and said inertia member providing for limited freedom of movement of said inertia member with respect to said rigid member whereby said inertia member damps said movement of said armature away from said core member in response to a shock.

7. An electromagnet comprising a panel support, a magnet core member, means mounting said core member on said panel for limited movement toward and away from said panel, spring means for normally holding said core member in a predetermined spaced relation with said panel thereby to provide for a predetermined limited movement of said panel toward said core member independently of said core member in response to a shock applied to said panel after which said panel moves said core member, said core member being provided with a plurality of core legs extending away from said panel and terminating in pole faces substantially parallel with said panel, an operating coil on said core member, an armature for said core member, means mounting said armature for movement toward said pole faces to an attracted position and away from said pole faces to an unattracted position whereby said movement of said core member by said panel in response to a shock moves said armature away from said pole faces, a spring arm secured to said armature and extending to the side of said shaft opposite said armature, and an inertia member mounted on said spring arm for damping said movement of said armature away from said pole faces in response to a shock thereby cooperating with said spring means to prevent substantial movement of said armature toward said unattracted position in response to a shock.

8. An electromagnet comprising a panel support, a magnet core member, means mounting said core member on said panel for limited movement toward and away from said panel, spring means for normally holding said core member in a predetermined spaced relation with said panel thereby to provide for a predetermined limited movement of said panel toward said core member independently of said core member in response to a shock applied to said panel after which said panel moves said core member, said core member being provided with a plurality of core legs extending away from said panel and terminating in pole faces substantially parallel with said panel, an operating coil on said core member, an armature for said core member, an operating shaft supporting said armature for pivotal movement toward said core member to an attracted position in engagement with said pole faces and away from said core member to an unattracted position whereby said movement of said

core member by said panel in response to a shock moves said armature away from said pole faces, a spring arm secured to said armature and extending to the side of said shaft opposite said armature, an inertia member mounted on said spring arm and substantially balancing said armature about said pivot shaft, said inertia member being provided with a slot, and a rigid arm secured to said shaft extending toward said inertia member into said slot so as normally to be in spaced relation with at least one wall of said slot and engaging said wall to damp said movement of said armature away from said pole faces in response to a shock applied to said panel.

EDGAR H. AYERS.