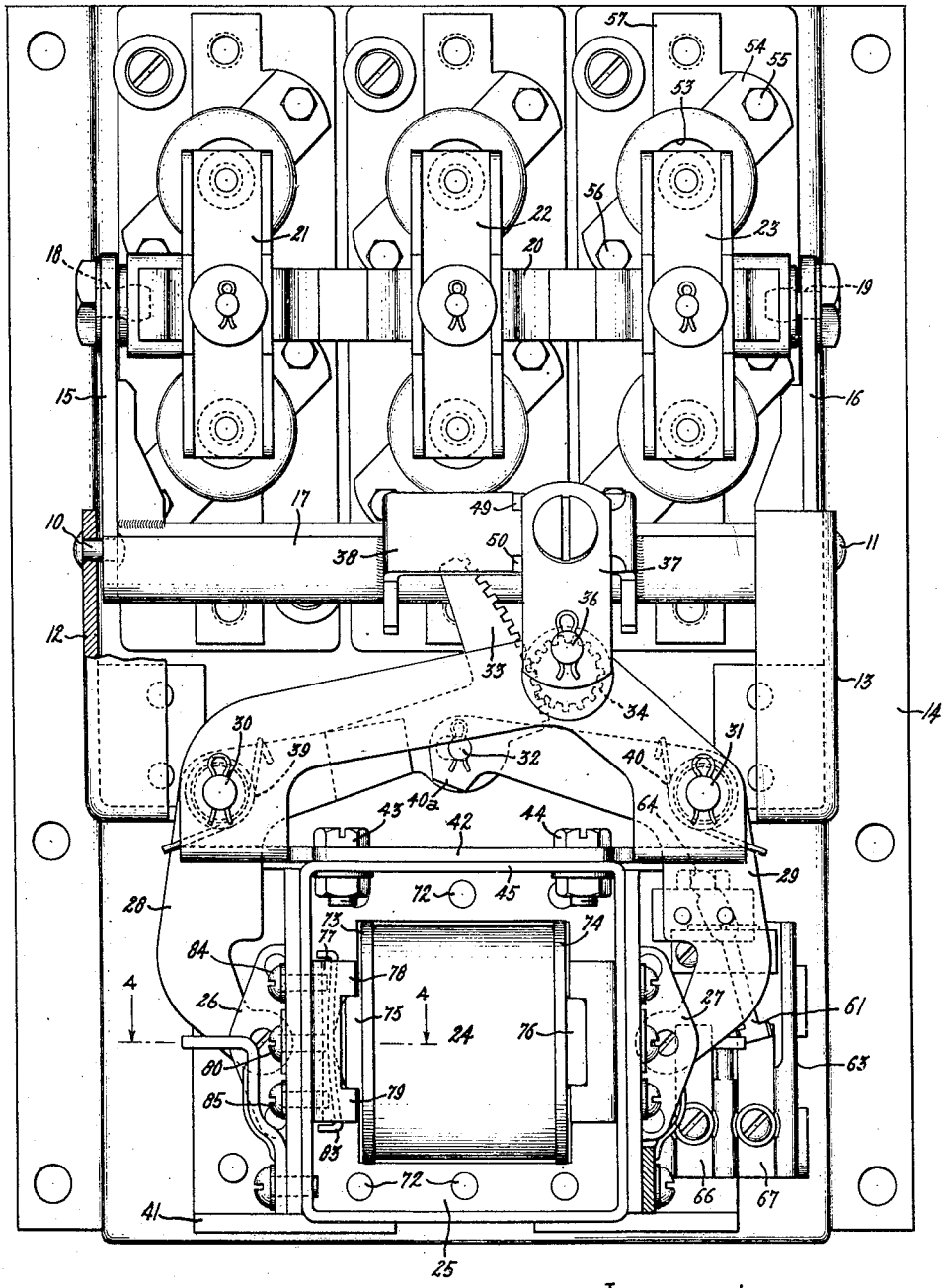
Jan. 1, 1946. A. G. ELMENDORF 2,392,134

ELECTRIC SWITCH

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Fig. 1.



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Fig. 2.

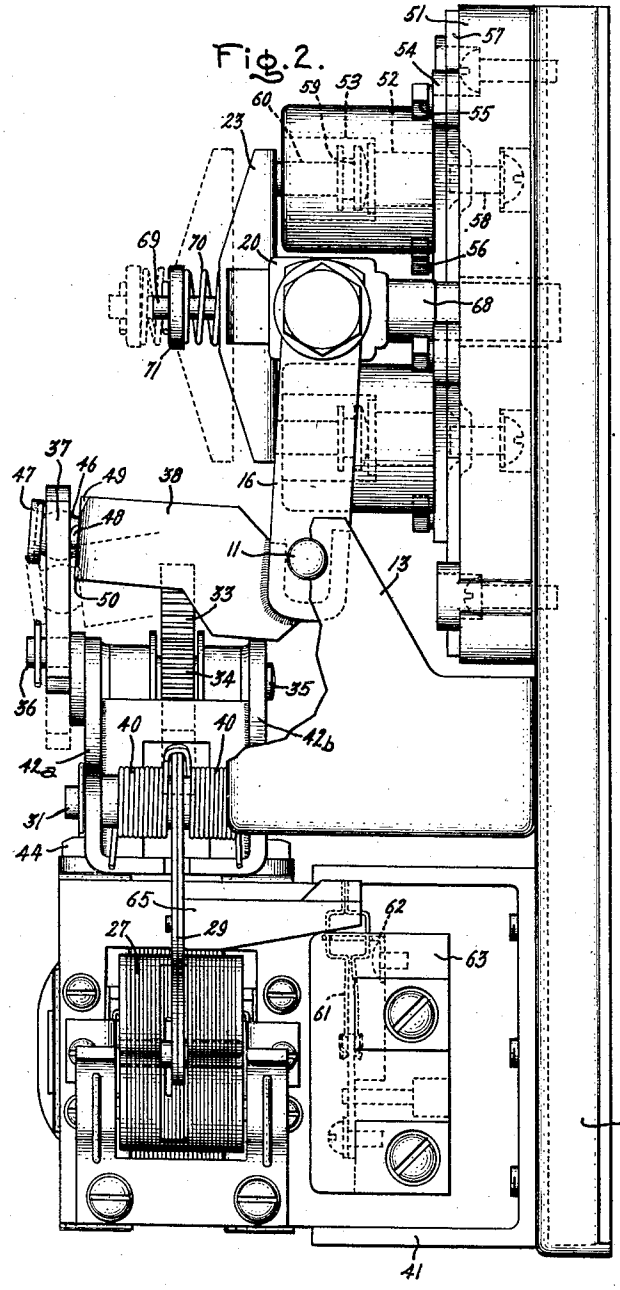


Fig. 3.

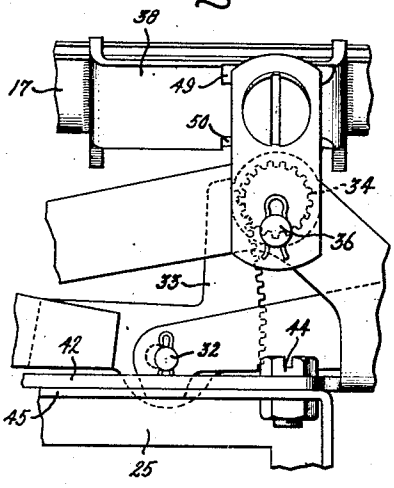
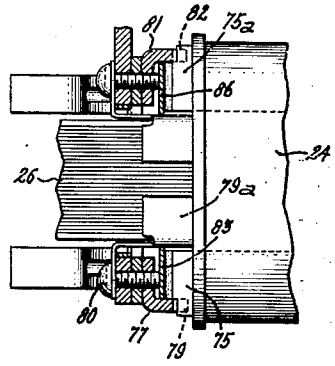


Fig. 4.



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UNITED STATES PATENT OFFICE

2,392,134

ELECTRIC SWITCH

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Application April 4, 1944, Serial No. 529,451

2 Claims. (Cl. 200—103)

My invention relates to electric switches, more particularly to electromagnetically operated electric switches of the type known as contactors, and has for its object a simple, reliable and shockproof operating mechanism for the switch.

In carrying out my invention in one form, I provide operating means for the switch comprising an electromagnet having two plunger type armatures extending into an operating coil from opposite sides, which armatures are mechanically connected together by means of bell cranks. Secured to the bell cranks is a gear segment which operates a second gear, this second gear turning a crank connected to the pivoted switch arm. The mechanism is so constructed and arranged that the crank is in a dead center position when the magnet is deenergized and energized, and the switch in its open and closed circuit positions whereby the switch is secured against shock in each position.

For a more complete understanding of my invention, reference should be had to the accompanying drawings, Fig. 1 of which is a front elevation view, partly in section, of a contactor embodying my invention showing the parts in circuit closed position; Fig. 2 is a side elevation view of the device shown in Fig. 1; Fig. 3 is a fragmentary front elevation view showing part of the mechanism in its open circuit position; while Fig. 4 is a fragmentary sectional view taken along the line 4—4 of Fig. 1.

Referring to the drawings, I have shown my invention in one form as applied to a switch having an arm structure pivotally mounted on pins 10 and 11 secured to side supporting plates 12 and 13 which in turn are secured to a suitable metallic support or base 14. The switch arm structure comprises side links or arms 15 and 16 and having their lower ends mounted on the pivots 10 and 11 and, moreover, secured to each other by a cross bar 17. The upper ends of the bars 15 and 16 are connected by pivot pins 18 and 19 to a second cross bar 20 carrying bridging contact members 21, 22 and 23. Thus movement of the arm structure about the pivot axis formed by the pins 10 and 11 moves the bridging members between closed and open circuit positions with respect to stationary contacts mounted on the support 14.

For operating the switch arm structure, I have provided an electromagnet comprising an operating coil 24 mounted in a magnet frame 25 and provided with two plunger type armatures 26 and 27 extending toward each other into opposite ends of the coil and magnet frame. The plunger armatures are connected together to move in unison by means of two bell cranks 28 and 29 having their lower ends pivotally connected respectively to the armatures 26 and 27 and mounted on stationary pivots 30 and 31. At their other ends the two bell cranks are pivotally connected together by a movable pivot pin 32 carried by them.

A connection is provided between the bell cranks and the switch arm structure 15 and 16 by means of a gear segment 33 secured to the ends of the bell cranks adjacent the pivot 32. As shown, this gear segment forms part of an extension secured on the end of the bell crank 28, the gear segment being adjacent the pivot pin 32. It will be understood that the slot connection is provided between the ends of the bell cranks and the pivot pin 32, this slot preferably, as shown in the dotted lines, in the extension on the end of the bell crank 28. This gear segment 33 meshes with a small gear 34 mounted on a stationary shaft 35 and having on its end a crank pin 36. The crank in turn is connected by a link 37 to an arm 38 secured to a cross bar 17 and extending outwardly substantially at right angles with the arms 15 and 16.

By means of helical springs 39 and 40 mounted on the pivot pins 30 and 31, the two bell cranks 28 and 29 are biased respectively in clockwise and counterclockwise directions to move the switch arm structure to its open circuit position, i. e., counterclockwise, as viewed in Fig. 2, and the armatures 26 and 27 outward from the coil to their unattracted positions. In this position the bell cranks and armatures are brought to rest by the engagement of a stop projection 40a on the bell crank 29 with the supporting bracket 42.

As shown in Figs. 1 and 2, the switch arm is in its closed circuit position and the driving mechanism so arranged that the crank 36 is in a dead center position with respect to the link 37 at that time, i. e., the link 37 is substantially parallel with the crank. Thus the switch arm structure is held securely in its closed circuit position and is not affected by shocks since a shock force tending to move the switch arm to its open circuit position does not tend to rotate the shaft 35 because of the dead center position of the crank 36. Another feature making the device free from shocks when in the closed circuit position is the arrangement of the plunger armatures so that their inner ends inside of the coil engage each other in abutting relation when moved to their attracted positions. Likewise, as shown in Fig. 3, when the magnet coil 24 is deenergized by

means of a suitable switch (not shown), the biasing springs 39 and 40 move the bell cranks to the position shown and thereby move the gear segment 33 downward to its lowermost position in which the crank 36 is in its opposite dead center position with respect to Fig. 1. In other words, the gear 34 is rotated counterclockwise substantially 180 degrees. This movement downward of the crank 36 moves the arm 38 and the switch arm structure in a counterclockwise direction, as seen in Fig. 2, to its open circuit position.

Continuing with additional details of construction, the magnet is mounted on the supporting bracket 41 secured to the base 14, while the pivot pins 30 and 31 for the bell cranks are mounted in a supporting bracket 42 secured by bolts 43 and 44 to the upper side of the framework or flange 45 secured to each side of the magnet. This bracket has two upwardly extending side portions 42a and 42b which are substantially parallel. The pivots 30 and 31 extend through these side portions, and at their upper ends the side portions are provided with bearings for the shaft 35 which extends crosswise between them. The shaft 35 and the pivots 30, 31 and 32 are parallel with each other.

In order to provide for freedom of movement, a bearing pin 46 having a spherical surface is provided on the outer end of the arm 38 for the upper end of the link 37. This is required because of the fact that the crank 36 is mounted on a shaft 35 whose axis is perpendicular to the axis 10, 11 of the arm 38. Limited lateral freedom of movement is provided for the link 37 between an outer flange 47 on the bearing 46 and a projection 48 on the end of the arm 38 adjacent the bearing 46. As seen in Fig. 1, the arm 38 is a substantially U-shaped strap having its ends suitably connected as by welding to the cross bar 17. At points adjacent the link 37 the upper and lower edges of the strap 38 are cut away, as indicated by the reference numerals 49 and 50, to provide the required freedom of movement laterally for the link 37.

The stationary contacts are mounted on a plate or base 51 made of electrically insulating material, which base is in turn secured to the support 14 by suitable bolts. As shown, three pairs of stationary contacts are provided with which cooperate respectively the bridging members 21, 22 and 23. Each pair, as shown in Fig. 2, consists of a stationary contact 52 mounted in the bottom of a cup 53 of heat refractory electrically insulating material. The stationary contact 52 is suitably electrically secured as by welding to a cross conducting plate 54 at the bottom, as seen in Fig. 1, which plate is in turn secured mechanically and electrically by screws 55 and 56 to a terminal conducting plate 57. This terminal plate 57 is in turn secured to the insulating base 51 by a screw 58. A similar construction is provided for the other stationary contacts. Electrical connections for each pair of stationary contacts are made with the connection strap 57.

The movable contacts 59 are secured on the ends of rods or bars 60, the other ends of which are secured to the respective bridging members, the rods 60 being long enough to extend downward to the bottom of the insulating cup 53 and bring the movable contact into engagement with the stationary contact when the switch arm is moved to its closed circuit position.

An interlock switch is provided adjacent the magnet frame 25 and operated by the bell crank 29. This interlock switch consists of a switch arm 61 consisting of two leaves pivoted on a bracket 62 secured to an insulating support 63. The upper end of the switch arm extends into an aperture 64 (Fig. 1) in a bracket 65 made of electrically insulating material secured in turn to the bell crank 29. Thus, as the bell crank moves about its pivot 31, the switch arm 61 is moved about its pivot between the upper ends of two conducting plates 66 and 67 to which electrical connections may be made. As shown in Fig. 1, the switch arm is in contact only with the upper end of the strap 67, and therefore the two straps are electrically disconnected from each other. When the bell crank 29 moves counterclockwise, as seen in Fig. 1, about its pivot 31, the switch arm 61 is moved clockwise about its pivot so that its lower end extends between the upper ends of the two straps 66 and 67 and closes a circuit between them.

A guide plunger 68 is secured at each end of the movable cross bar 20. Each guide plunger 68 extends through an opening provided for it in the insulating plate 51 and is slidably movable in this opening. These guide plungers provide for rectilinear movement of the bridging members 21, 22 and 23 toward and away from their stationary contacts. As previously pointed out, the cross bar 20 carrying the bridging members is connected by pivots 18 and 19 to the side arms 15 and 16. Each bridging member is provided with a central aperture through which extends a pin 69 secured to the cross bar 20. The bridging member is biased against the cross bar by a helical spring 70 encircling the pin 69 and having its outer end in engagement with a flanged washer 71 on the outer end of the pin 69. The spring 70 yields somewhat upon engagement of the contacts and thereby assures a predetermined contact pressure.

It will be observed that I have provided a very compact and efficient operating mechanism. This mechanism comprises a coil mounted on the support with its center line substantially parallel with the support, and pivots 10 and 11 for the switch arm 38 defining a pivot axis parallel with the support. On the other hand, the shaft 35 is mounted for movement about an axis lying in the plane of movement of the switch arm 38 and substantially perpendicular to the support. By means of the link 37 and the spherical bearing 46, I connect the switch arm 38 with the crank pin 36 for movement of the switch arm 38 by the crank pin.

I also provide simple and reliable means for securing the coil 24 in place in the magnet frame 25. The magnet frame is rectangular in shape. In fact, it is substantially square as shown and includes two U-shaped core members, upper and lower members as seen in Fig. 1, which form upper and lower magnetic paths between the ends of the plunger armatures 26 and 27. The upper and lower U-shaped core members are clamped between metal plates, only one of which is shown in Fig. 1, by means of suitable rivets 72 extending through them, each of these clamping plates being provided with a supporting flange 45. On the ends of the coils are plates 73 and 74 made of a molded electrically insulating material on each of which is provided a pair of spaced projections extending outwardly axially of the coil. Only one of these projections for each plate is shown in Fig. 1, this being the projection 75 for the plate 73 and the projection 76 for the plate 74. The other projection for each of the plates 73 and 74 is behind the one shown in Fig. 1 in spaced relation therewith and on the

opposite side of the magnet core, the projection 75a being shown in Fig. 4. Thus the pair of projections at each end of the coil embrace the two clamping plates of the magnet core at that point and hold the coil in position in the rectangular opening of the magnet, i. e., against movement in a direction transverse to the axis of the coil.

I also provide a metal positioning member 77, Fig. 1, provided with projections 78 and 79 which embrace the projection 75 on that end of the coil. This member has an L-shaped cross section, as shown in Fig. 4. It is secured to the frame 45 together with a plunger guide 79a by means of a screw 80 extending through the frame and extending through a tapped hole in the center of the member 77. Thus the projections 78 and 79 engage opposite sides of the projection 75 on the coil and secure the projection between them. An oppositely disposed member 81 (Fig. 4), identical in construction with the member 77, cooperates with the projection 75a on the opposite side of the coil. Furthermore, the projections 75 and 75a are provided each with a portion extending under the member 77 or 81. In other words, the projections extend toward the left hand as seen in Fig. 4 under the members 77 and 81 so that the members 77 and 81 secure the coil against movement transversely of its axis in an upward or downward direction as seen in Fig. 4. Thus the members 77 and 81 secure the coil against movement transversely of its axis.

I have also provided a resilient connection for securing the coil comprising a spring strip 83 (Figs. 1 and 4) which extends parallel with the member 77. Screws 84 and 85 extend through the frame and bear on opposite ends of the spring 83 whereby the center of the spring is forced against the rounded end of the projection 75, as shown in Fig. 1. Thus the coil is resiliently pressed toward the right hand, as viewed in Fig. 1. A similar strip spring 86 (Fig. 4) is provided on the opposite side of the magnet frame at the left-hand end. On the right-hand end of the coil no spring strips are provided although two forked securing members similar to the members 77 and 81 are provided, the construction being the same as previously described for the opposite end of the coil. Thus the coil is secured against severe shocks.

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 electric switch comprising a support, a magnet coil mounted on said support with its axis substantially parallel with said support, a lever provided with a pivot on said support having its axis substantially perpendicular to said support, an armature for said coil mounted on said lever, a gear segment secured to said lever, a shaft mounted on said support in substantial perpendicular relation with said support, a gear on said shaft meshing with said gear segment, a crank pin on said shaft extending substantially parallel with said shaft, a switch arm mounted on said support for movement on a pivot substantially parallel with said support, said switch arm moving in a plane passing through the axis of said shaft, a bearing pin on said switch arm extending lengthwise of said switch arm and having a partly spherical bearing surface, a link having one end connected to said crank pin for pivotal movement on said crank pin and having its other end connected to said spherical bearing surface for operation of said switch arm about its pivot when said crank pin is turned by said shaft, spring means for biasing said lever and said armature to their unattracted positions with said crank pin in one dead center position, said coil when energized turning said crank pin to its opposite dead center position, and switch means operated by said switch arm.

2. An electric switch comprising a support, two bell crank levers mounted on spaced apart stationary pivots secured to said support with first arms of said levers extending toward each other and second arms of said levers in substantially parallel relation with each other, said pivots being parallel with each other and substantially perpendicular to said support, a loose pivotal connection between said first arms whereby said bell cranks are caused to move in unison about said pivots, a magnet coil mounted on said support between said second arms with its center line substantially parallel with said support, a pair of plunger armatures extending into opposite ends of said coil connected respectively to said second arms, a gear segment secured to one of said first arms at a point adjacent said pivotal connection between said first arms, a shaft mounted on said support in substantial perpendicular relation with said support, a gear on said shaft meshing with said gear segment, a crank pin on said shaft extending substantially parallel with said shaft, a switch arm mounted on said support for movement on a pivot substantially parallel with said support, said switch arm moving in a plane passing through the axis of said shaft, a bearing pin on said switch arm extending lengthwise of said switch arm and having a partly spherical bearing surface, a link having one end connected to said crank pin for pivotal movement on said crank pin and having its other end connected to said spherical bearing surface for operation of said switch arm about its pivot axis when said crank pin is turned by said shaft, spring means for biasing said bell crank levers and said armatures to their unattracted positions with said crank pin in one dead center position, said coil when energized turning said crank pin to its opposite dead center position, and switch means operated by said switch arm.

ANDREW G. ELMENDORF.