June 21, 1955 R. K. SHEWMON ET AL 2,711,448

CONTROL SWITCH

Filed Jan. 4, 1954 2 Sheets-Sheet 1

Fig. 1

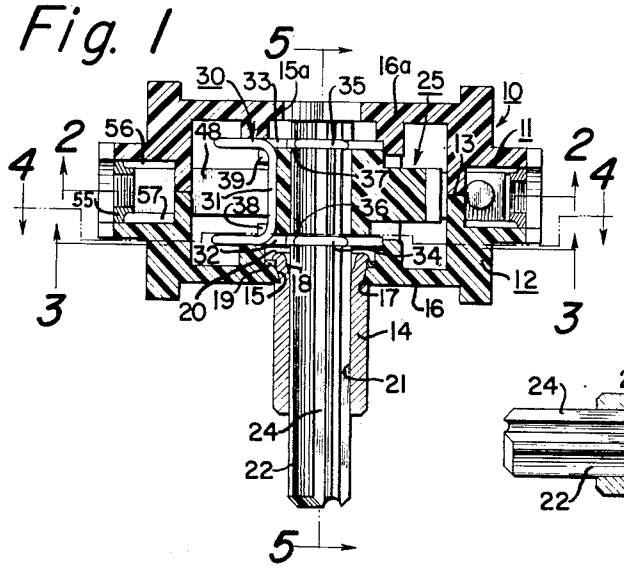
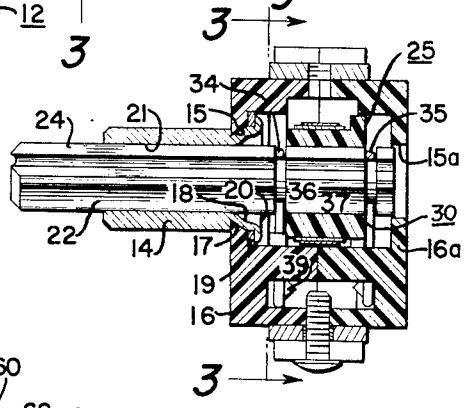


Fig. 5



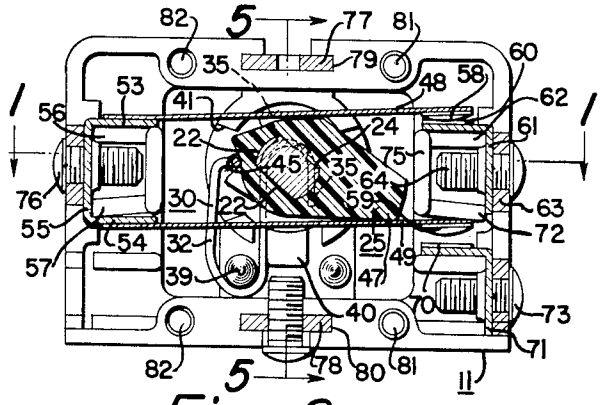
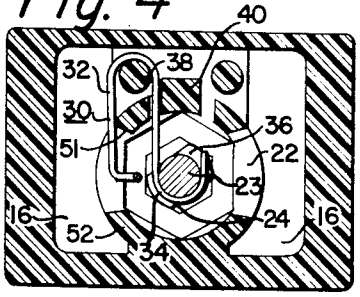


Fig. 2

Fig. 4



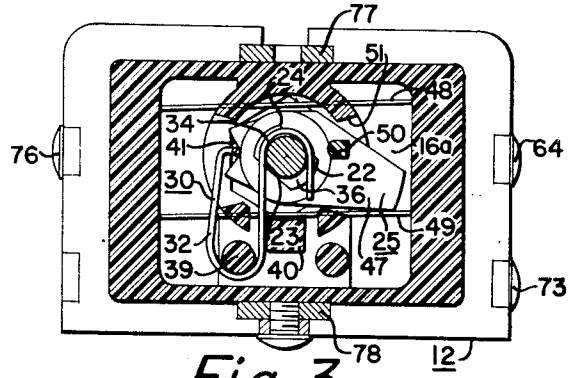


Fig. 3

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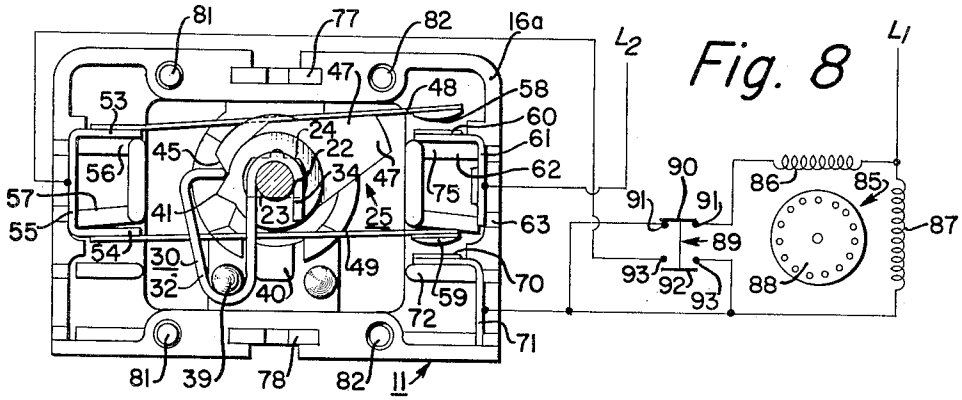


Fig. 8

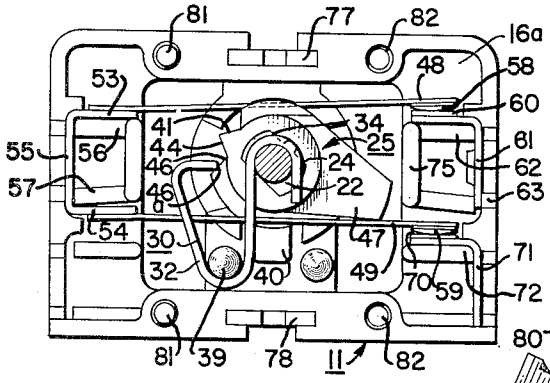


Fig. 9

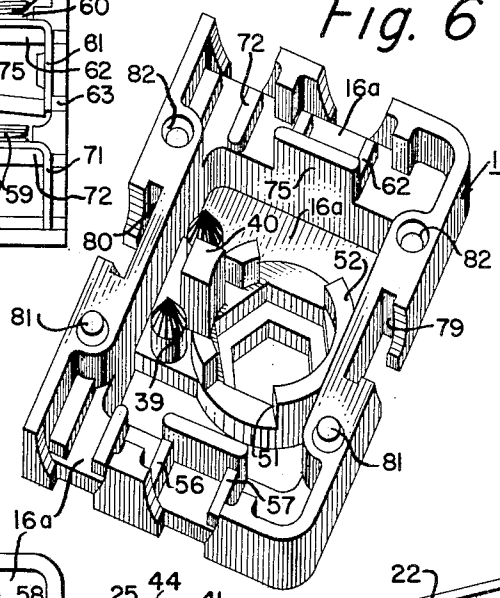
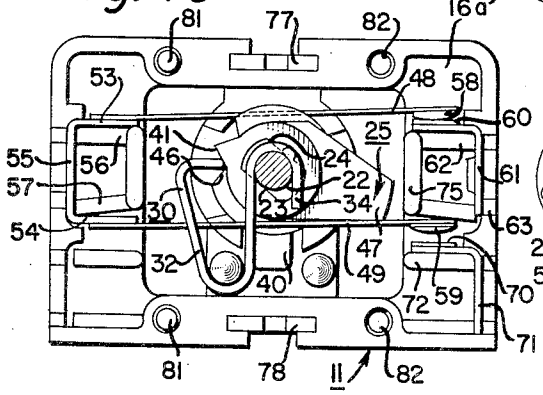


Fig. 6

Fig. 10



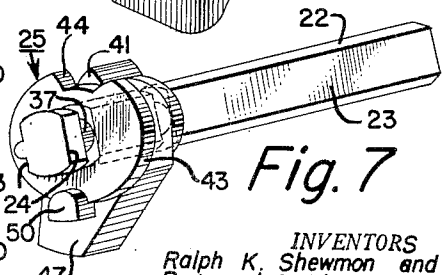


Fig. 7

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CONTROL SWITCH

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Application January 4, 1954, Serial No. 402,043

7 Claims. (Cl. 200—6)

This invention relates to an electrical switch particularly adapted for controlling the starting of electric motors.

An object of the invention is to provide a simplified and compact motor starting control switch wherein multiple electrical circuits are established to an electric motor to start the same and a single electric circuit is maintained during running of the motor, after starting.

It is another object of the invention to provide a control switch in accordance with the foregoing object wherein the switch provides for breaking of all electric circuits to the electric motor to stop the motor, and to prevent restarting of the motor until such time as the switch is manually operated.

Still another object of the invention is to provide an electric control switch in accordance with the foregoing objects that cooperates with a centrifugal switch in the electric motor in an electric circuit arrangement by which the motor will automatically stop when the speed of the motor drops below a predetermined value, and the motor cannot be restarted until the electric switch is manually operated, the electric switch providing for opening of all electric circuits to the electric motor until such time as the switch is manually operated for restarting of the motor.

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 transverse cross sectional view taken along line 1—1 of Figure 2.

Figure 2 is a cross sectional view taken along line 2—2 of Figure 1.

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

Figure 4 is a cross sectional view taken along line 4—4 of Figure 1.

Figure 5 is a cross sectional view taken along line 5—5 of Figure 1.

Figure 6 is a perspective elevational view of one-half of the housing for the switch mechanism.

Figure 7 is a perspective elevational view of the actuator for the switch mechanism.

Figure 8 is an elevational view of the switch mechanism shown in "off" position.

Figure 9 is an elevational view of the switch mechanism similar to Figure 8 by showing the device in motor starting position.

Figure 10 is an elevational view similar to Figures 8, 9 but illustrating the device in motor running position.

In this invention the electrical switch consists of a two part housing 10 comprising the housing part 11 and the housing part 12 that are positioned in engagement with one another along a parted line 13. The housing parts 11 and 12 are made of any suitable electrical insulating material as the several electric conducting parts are mounted upon the housing parts 11 and 12.

The housing part 12 carries a sleeve bearing 14 positioned within an opening 15 provided in the wall 16 of the housing part 12. The sleeve bearing 14 has a shoulder 17 engaging the wall 16 of the housing part 12 and a shank 18 that enters the opening 15 in the housing wall 16. A metal washer 19 is placed around the shank 18 of the sleeve bearing 14 and the inner end 20 of the sleeve bearing 14 is peened over upon the metal washer 19 to thereby hold the sleeve bearing 14 within the opening 15 in the housing wall 16.

The sleeve bearing 14 has an axial bore 21 that receives an actuating shaft 22 for rotation within the bore 21. The actuating shaft 22 is provided with parallel flat sides 23 and 24, an actuator cam 25 being positioned on one end of the actuating shaft 22 and within the housing 10. The flat sides 23 and 24 on the shaft 22 prevent relative rotation between the shaft 22 and the actuating cam 25.

The actuating cam 25 is retained in position on the end of the shaft 22 by means of a spring element 30.

The spring element 30 has a bar portion 31 from which there depends at each end thereof the hairpin or U shaped legs 32 and 33. The upper ends of each of the U shaped legs 32 and 33 terminate in reverse bend portions forming the hairpin return bend legs or U shaped portions 34 and 35. The spring element 30 thus comprises two substantially S shaped portions 32, 34 and 33, 35 that are disposed in parallel relation and joined by the bar portion 31.

The return bend portions 34 and 35 of the spring element 30 are positioned in annular grooves 36 and 37 provided in the actuating shaft 22 at each side of the cam actuator 25, thereby retaining the cam actuator 25 on the shaft 22, as retained by the hairpin loops 34 and 35.

The hairpin loops 32 and 33 extend around the bosses 38 and 39 provided on the walls 16 and 16*a* of the housing parts 12 and 11 respectively. The bosses 38 and 39 are each positioned adjacent a raised portion 40 provided on each of the housing parts 11 and 12 so that the hairpin loops 32 and 33 are retained between the raised portion 40 and the bosses 38 and 39.

The bar 31 of the spring element 30 engages the peripheral surface of the cam actuator 25 and cooperates with a cam shaped lug 41 to provide an over-center snap actuating mechanism for the cam actuator 25 to hold it in a first or off position of the device, as illustrated in Figure 8 or in a second or motor running position illustrated in Figure 10.

The cam actuator 25 has a radially extending peripheral flange 43 that is provided with a peripheral groove 44 that also engages the bar 31 of the spring element 30 to limit the movement of the cam actuator 25 relative to the bar 31 so that the bar 31 will rest in the retaining groove 45, as shown in Figure 8 or in the retaining groove 46, as shown in Figure 10.

The cam actuator 25 has an actuating finger 47 extending radially of the actuator that is adapted to engage a contact carrying arm 48 or a contact carrying arm 49 to actuate the same. At each side of the actuating finger 47 there is provided a boss 50 that rides in the arcuate slot 51 provided in an annular sleeve 52 extending around the opening 15 in the housing wall 16 and the corresponding opening 15*a* in the housing wall 16*a*. The arcuate slot 51 provides a limit stop engaged by the bosses or protrusion 50 to limit the degree of rotation of the cam actuator 25 relative to the housing 10, and thus limit the actuating movement of the contact carrying arms 48 and 49.

The contact carrying arms 48 and 49 are secured to the legs 53 and 54 of a U-shaped contact carrying member 55 positioned within the housing 10. The U-shaped carrying member 55 has the legs 53 and 54 positioned

adjacent the shoulder ledges 56 and 57 on the housing walls 16a, shown in Figures 2 and 8, whereby to accurately position the contact carrying arms 48 and 49 within the interior of the housing 10. The contact carrier 55 threadedly receives a screw 76 to retain the carrier 55 in position in the housing 10 against the end wall 77 and to provide for connection of an electric wire to the carrier 55.

The arm 48 carries a contact 58 while the arm 49 carries a contact 59. The contact 58 on the arm 48 is adapted for engagement with a stationary contact 60 carried on a contact carrier 61. The contact carrier 61 is substantially L-shaped in cross section and has one leg thereof engaging a shoulder ledge 62 on the wall 16a of the housing 10, as illustrated in Figure 2, the other leg of the contact carrier 61 engaging the end wall 63 of the housing 10. A screw 64 is threadedly received in the contact carrier 61 to retain the same in position in the housing 10 and provide for fastening of an electric wire to the contact carrier 61.

The contact 59 on the movable arm 49 engages a contact 70 supported on a contact carrier 71 that is L-shaped in cross section like contact carrier 61. The contact carrier 71 has one leg thereof engaging a shoulder ledge 72 while the other leg engages the end wall 63 of the housing 10 whereby to position the carrier 71 within the housing. A screw 73 is threadedly received in the contact carrier 71 to hold it in position in the housing and provide means for fastening an electric wire to the contact carrier 71.

Between the movable arms 48 and 49 there is provided a raised boss 75 that is engaged by the movable contact 49, as illustrated in Figures 2 and 8, to limit the upward movement of the arm 49 relative to the contact 70.

The movable contact carrying arm 48 is a leaf spring member that is spring biased normally to contact closed position while the contact carrying arm 49 is a leaf spring member that is spring biased to open position, as illustrated in Figures 2 and 8.

The housing parts 11 and 12 are secured together by retaining members 77 and 78 that may have their opposite ends flared to secure the housing parts together, the retaining members 77 and 78 being placed in transverse slots 79 and 80 provided in the housing parts.

Each of the housing parts 11 and 12 has bosses 81 that are adapted to fit into corresponding recesses 82 in the opposite housing part whereby to locate the housing parts accurately relative to each other.

Each of the housing parts 11 and 12 are of identical construction, one of which housing parts is illustrated in Figure 6 to more clearly show the respective ledges and stop members heretofore referred to. It will be noted that the housing part 11, illustrated in Figure 6 is identical end for end from the median point thereof. Thus a second housing part can be placed upon the housing part 11 with the several ledges and stops heretofore described aligning in their relative transverse positions between the housing parts. Thus a single mold form is used for manufacturing both housing parts of the housing 10.

The electric switch of this invention is particularly adapted for use with an electric motor having a starting winding and a running winding with a centrifugal switch positioned within the motor and responsive to motor speed to control the opening of the starting winding. Such a motor is diagrammatically illustrated in Figure 8 wherein the motor 85 includes the starting winding 86, the running winding 87 and an armature 88. A centrifugal switch 89 operated in response to motor speed has the contact arm 90 normally closing upon the contacts 91 when the motor operates below a predetermined speed, the contact arm 92 maintaining open circuit through the contacts 93.

The electric control switch of this invention is in a normal off position when the actuator 25 has the actuator finger 47 engaging the contact arm 48 to retain it in contact "open" position, as illustrated in Figure 8. At this time the spring element 30 has the bar 31 engaging the recess 45 to retain the actuating finger 47 in the position shown in Figure 8 to hold the contact arm 48 in "open" position, the contact arm 48 being normally spring biased to "closed" position. At this time the centrifugal switch 89 is in the position illustrated in Figure 8 with contacts 91 "closed" and contacts 93 "open."

To start the electric motor the actuator 25 is rotated in a clockwise direction, as viewed in Figure 8, to the position illustrated in Figure 9 wherein the spring biased contact arm 48 closes its contact 58 upon contact 60 and the actuator finger 47 urges the contact arm 49 downwardly to close contact 59 upon contact 70. In this position the bar 31 of the spring element 30 engages the cam shaped edge 46a of the recess 46 tending to urge the actuator 25 in a counterclockwise direction, but which is prevented from doing so so long as the operator manually retains control of the actuator 25 to hold the finger 47 against the contact arm 49 with contact 59 closed upon contact 70.

Positioning of the electrical control switch in the manner illustrated in Figure 9 provides current to both the running winding and the starting winding of the electric motor 85 until the centrifugal switch 89 is actuated by the electric motor at a predetermined speed to open contacts 91 and close contacts 93. At this time electric circuit will be broken through the starting winding 86 of the motor but circuit will be maintained through the running winding 87 through the now closed contacts 93 and the closed contacts 58, 60 of the electric switch.

When the operator manually releases the actuator 25 the spring element 30 will cause counterclockwise rotation of the actuator 25 until the bar 31 rests in the recess 46, as illustrated in Figure 10, whereupon contact 59 opens from contact 70, but contact 58 remains closed upon contact 60 to retain electric circuit to the running winding 87 of the electric motor.

In the event the electric motor should have its speed reduced below the value at which the centrifugal switch 89 was closed originally, the centrifugal switch will open and thereby break circuit to the running winding 87 of the electric motor through the now open contacts 93. Thus, the electric motor cannot restart accidentally when the overload that caused the reduced motor speed is suddenly removed. The operator must manually operate the actuator 25 in a clockwise rotation to again close contact 59 upon contact 70 to restart the motor as initially.

To stop the motor, the operator will manually rotate the cam actuator 25 in a counterclockwise rotation whereby the finger 47 of the actuator will open contact 59 from contact 60 and thereby break circuit to the electric motor. The actuator 25 will be held in the position now established, as illustrated in Figure 8 by the spring element 30 having the bar 31 engaging the recess 45 in the actuator 25.

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. An electric switch, comprising, an insulating housing, a pair of stationary contacts mounted on said housing in spaced axial relation, a first contact arm within said housing engageable with one of said stationary contacts and spring biased to closed position, a second contact arm within said housing engageable with the second of said stationary contacts and spring biased to open position, a rotatable actuator between said contact arms having a protrusion engageable with said arms alternately upon alternate rotation of the actuator, said actuator having a first position operatively ineffective on said second arm and operatively effective on said first arm to hold said first arm in open position with said second arm in spring

biased open position and having a second position operatively ineffective on either of said arms with said first arm in spring biased closed position and said second arm in spring biased open position and having a third manually held position operatively effective on said second arm to hold said second arm in closed position with said first arm spring biased to closed position, said actuator effecting automatic effecting automatic return from said third to said second position upon removal of manual retention on the actuator.

2. An electric switch, comprising, an insulating housing, a pair of stationary contacts mounted on said housing in spaced axial relation, a first contact arm within said housing engageable with one of said stationary contacts and spring biased to closed position, a second contact arm within said housing engageable with the second of said stationary contacts and spring biased to open position, a rotatable actuator between said contact arms having a protrusion engageable with said arms alternately upon alternate rotation of the actuator, said actuator having a first position operatively ineffective on said second arm and operatively effective on said first arm to hold said first arm in open position with said second arm in spring biased open position and having a second position operatively ineffective on either of said arms with said first arm in spring biased closed position and said second arm in spring biased open position and having a third manually held position operatively effective on said second arm to hold said second arm in closed position with said first arm spring biased to closed position, said actuator effecting automatic return from said third to said second position upon removal of manual retention on the actuator, and detent means engaging said actuator to retain the same selectively in said first or said second position.

3. An electric switch, comprising, an insulating housing, a pair of stationary contacts mounted on said housing in spaced axial relation, a first contact arm within said housing engageable with one of said stationary contacts and spring biased to closed position, a second contact arm within said housing engageable with the second of said stationary contacts and spring biased to open position, a rotatable actuator between said contact arms having a protrusion engageable with said arms alternately upon alternate rotation of the actuator, said actuator having a first position operatively ineffective on said second arm and operatively effective on said first arm to hold said first arm in open position with said second arm in spring biased open position and having a second position operatively ineffective on either of said arms with said first arm in spring biased closed position and said second arm in spring biased open position and having a third manually held position operatively effective on said second arm to hold said second arm in closed position with said first arm spring biased to closed position, said actuator effecting automatic return from said third to said second position upon removal of manual retention on the actuator, and detent means engaging said actuator to retain the same selectively in said first or said second position and resiliently movable relative to said actuator when said actuator is in said second position to permit said actuator to assume said third position.

4. An electric switch, comprising, an insulating housing, a pair of stationary contacts mounted on said housing in spaced axial relation, a first contact arm within said housing engageable with one of said stationary contacts and spring biased to closed position, a second contact arm within said housing engageable with the second of said stationary contacts and spring biased to open position, a rotatable actuator between said contact arms having a protrusion engageable with said arms alternately upon alternate rotation of the actuator, said actuator having a first position operatively ineffective on said second arm and operatively effective on said first arm to

hold said first arm in open position with said second arm in spring biased open position and having a second position operatively ineffective on either of said arms with said first arm in spring biased closed position and said second arm in spring biased open position and having a third manually held position operatively effective on said second arm to hold said second arm in closed position with said first arm spring biased to closed position, said actuator effecting automatic return from said third to said second position upon removal of manual retention on the actuator, and detent means engaging said actuator to retain the same selectively in said first or said second position and resiliently movable relative to said actuator when said actuator is in said second position to permit said actuator to assume said third position and thereafter return said actuator to second position upon removal of manual retention of the actuator in said third position.

5. An electric switch, comprising, an insulating housing, a pair of stationary contacts mounted on said housing in spaced axial relation, a first contact arm comprising a leaf spring mounted at one end on said housing and having a contact on the opposite end engageable with one of said stationary contacts and spring biased to closed position, a second contact arm parallel to the first arm and spaced therefrom and comprising a leaf spring mounted at one end on said housing comparable to the mounting end of the first arm and having a contact on the opposite end engageable with the other stationary contact and spring biased to open position, a rotatable actuator between said arms having an actuating finger alternately engageable with said arms upon alternate rotation of the actuator, and detent means engaging said actuator and cooperating therewith to retain said actuator in either of two selected positions in one of which said finger engages said first arm to retain the same in open contact position and in the second of which said finger is out of operating engagement with either arm whereby said first arm is in spring biased contact closed position and said second arm is in spring biased contact open position, said detent being resiliently movable relative to said actuator to permit manual rotation thereof into a manually retained third position in which said finger engages said second arm to maintain the same in contact closed position so long as so manually retained, said detent effecting movement of said finger from said third position to said second position upon manual release of said actuator.

6. An electric switch, comprising, an insulating housing, a pair of stationary contacts mounted on said housing in spaced axial relation, a first contact arm comprising a leaf spring mounted at one end on said housing and having a contact on the opposite end engageable with one of said stationary contacts and spring biased to closed position, a second contact arm parallel to the first arm and spaced therefrom and comprising a leaf spring mounted at one end on said housing comparable to the mounting end of the first arm and having a contact on the opposite end engageable with the other stationary contact and spring biased to open position, a rotatable actuator between said arms having an actuating finger alternately engageable with said arms upon alternate rotation of the actuator, the shaft journaled in said housing supporting said actuator and for rotating the same, and detent means cooperating with said actuator to retain the actuator in either of two selected positions in one of which said finger engages said first arm to retain the same in open contact position and in the second of which said finger is out of operating engagement with either arm whereby said first arm is in contact closed position and said second arm is in contact open position, said detent means including a pair of substantially S-shaped spring members disposed in parallel relation and joined at one end with a bar portion, said bar portion being positionable on opposite sides of a protrusion on

said actuator for selective retention of said actuator in either of said two selected positions, one looped end of the S-shaped spring members being positioned over said shaft and the other looped end of said spring members being positioned over stationary abutments on said housing to retain said spring members against rotation on said shaft with said bar portion in engagement with said actuator for effecting the said positioning of the actuator.

7. An electric switch structure in accordance with claim 6 wherein the first mentioned loop ends of the

spring means are positioned in annular recesses in the shaft on opposite sides of the actuator carried on the shaft to retain the actuator on the shaft.

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