United States Patent

Raab

[15] **3,668,353**

[45] **June 6, 1972**

[54] ELECTRICAL SWITCHES WITH EXTERNAL RETURN SPRINGS

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[73] Assignee: **Indak Manufacturing Corp.,** Northbrook, Ill.

[22] Filed: **May 21, 1970**

[21] Appl. No.: **39,289**

[52] **U.S. Cl.** ..... **200/153 K,** 200/16 R, 74/523

[51] **Int. Cl.** **H01h 15/02**

[58] **Field of Search** ..... 200/16 R, 153 K; 74/523; 251/242, 243

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Primary Examiner—Robert K. Schaefer
Assistant Examiner—Robert A. Vanderhye
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[57] **ABSTRACT**

The present invention provides a new switch having a return spring which is mounted outside the casing in which the carriage and contactor are movable. An operating lever or other member extends into the casing to engage the carriage. Preferably, the spring is in the form of a torsion spring mounted on the pivot which supports the lever. In one embodiment, the spring has arms which extend into the casing through an opening therein, and then into a recess in the carriage. When the carriage is moved in opposite directions, it engages and moves the opposite arms of the spring. The opposite ends of the opening in the casing provide stops which are engageable with the arms to maintain initial stress in the spring. In another embodiment, the arms are engageable by tabs or other elements on the operating lever.

4 Claims, 30 Drawing Figures

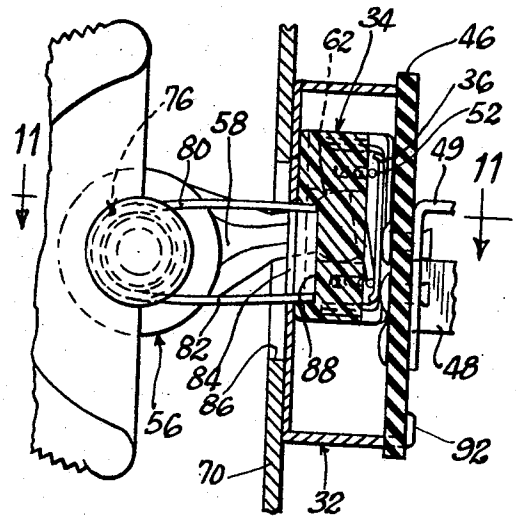


FIG. 3

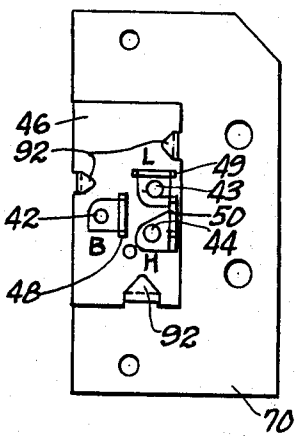


FIG. 1

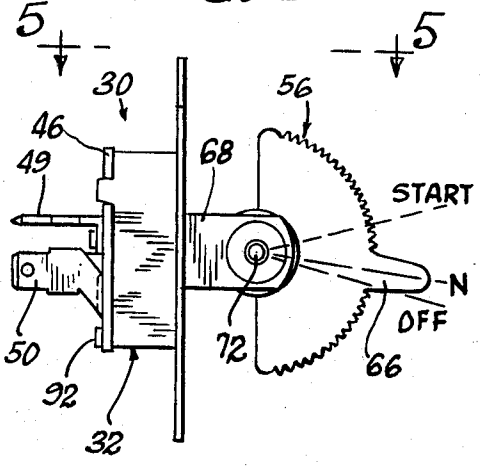


FIG. 2

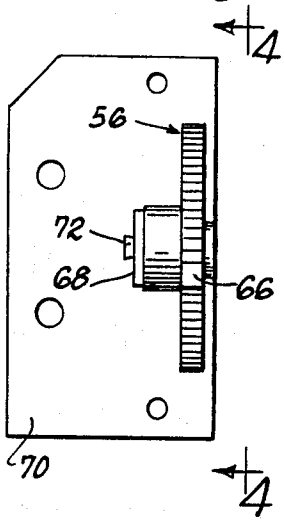


FIG. 4

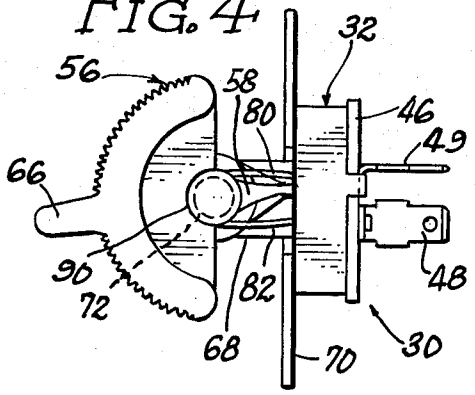


FIG. 5

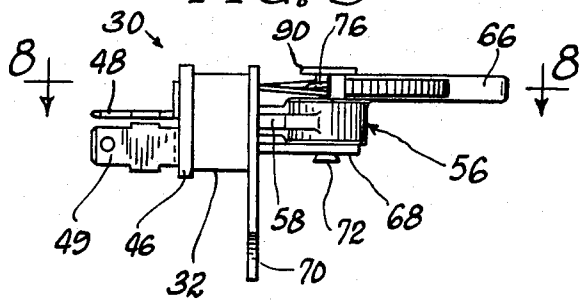


FIG. 6

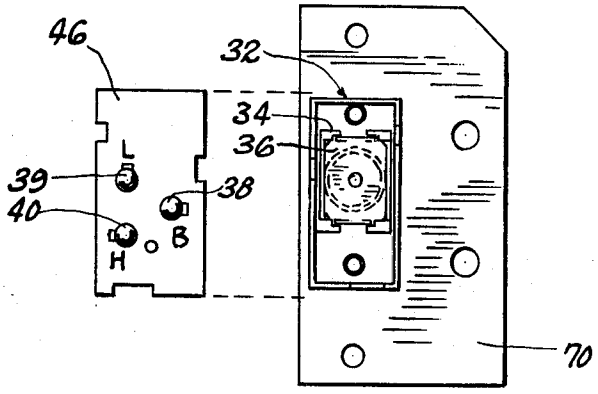
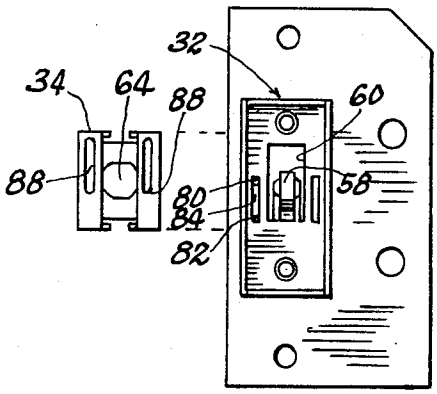


FIG. 7



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Attys

FIG. 8

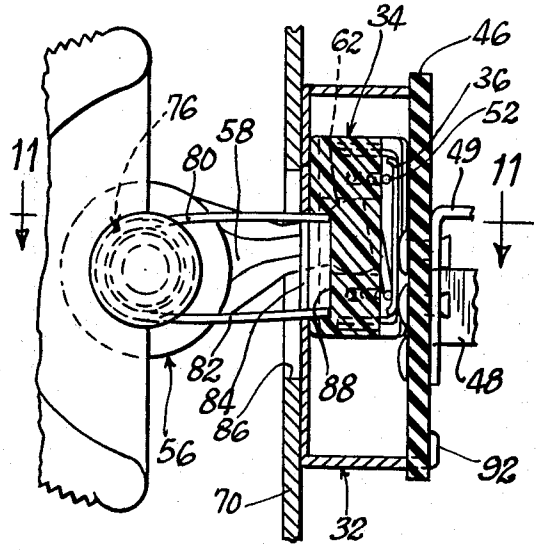


FIG. 11

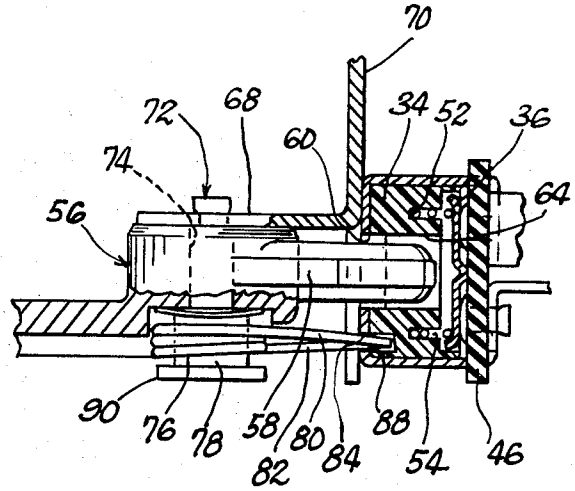


FIG. 9

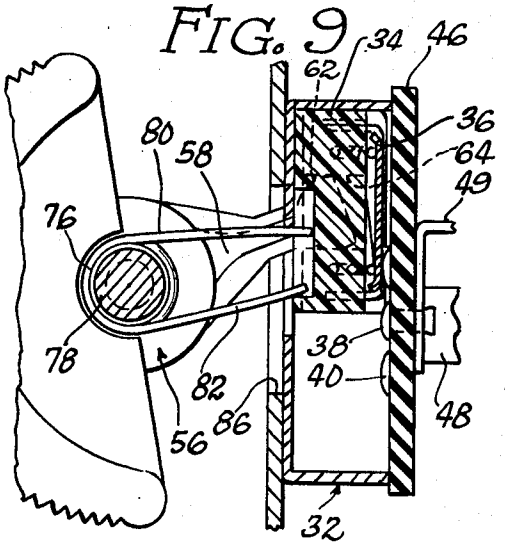


FIG. 12

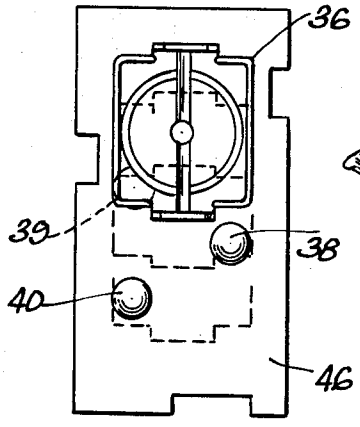


FIG. 13

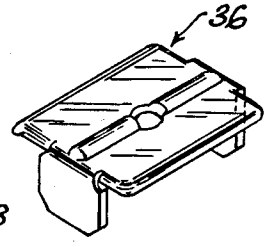


FIG. 10

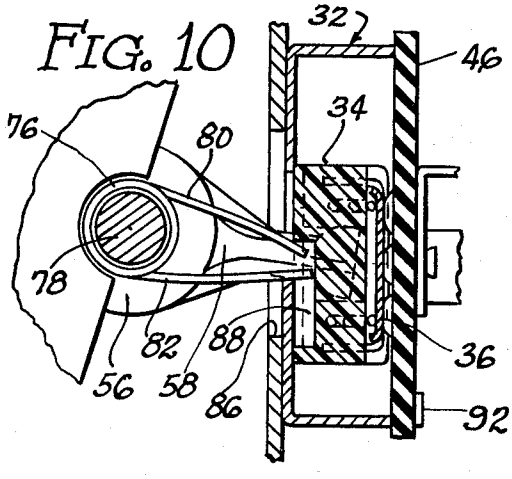


FIG. 14

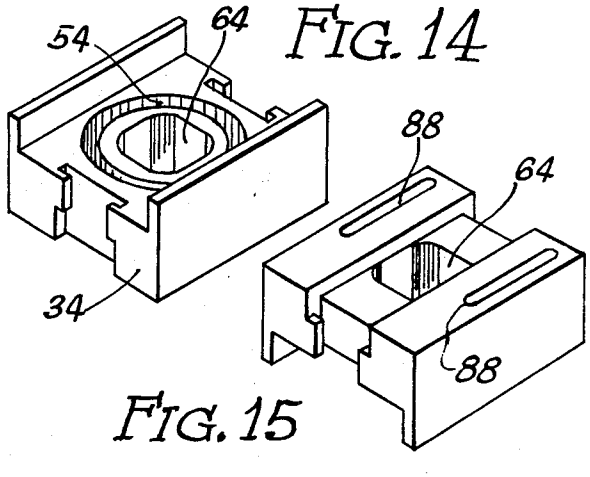


FIG. 15

FIG. 16

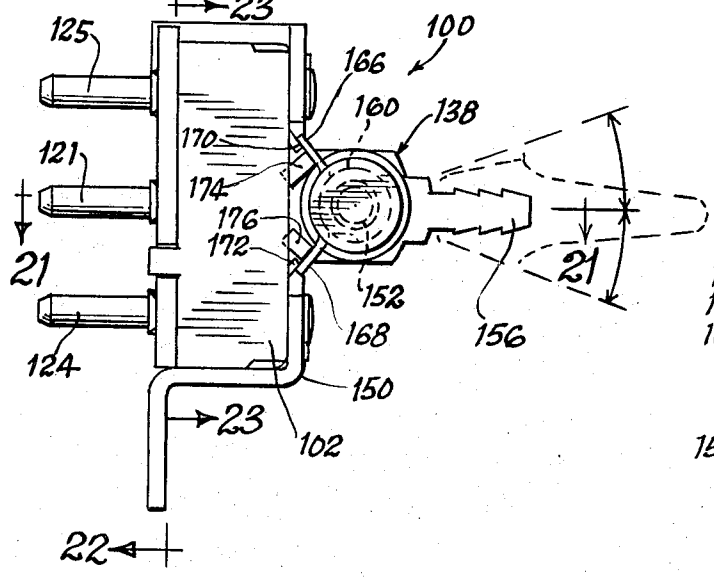


FIG. 17

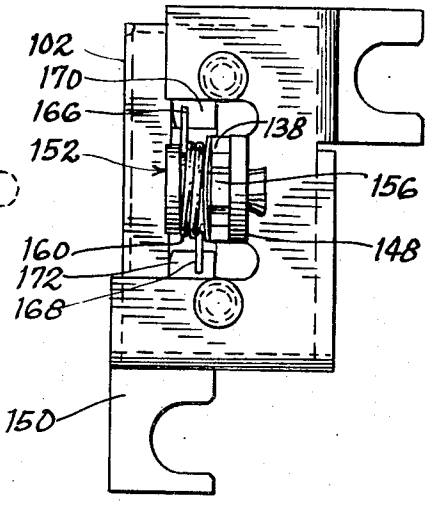


FIG. 18

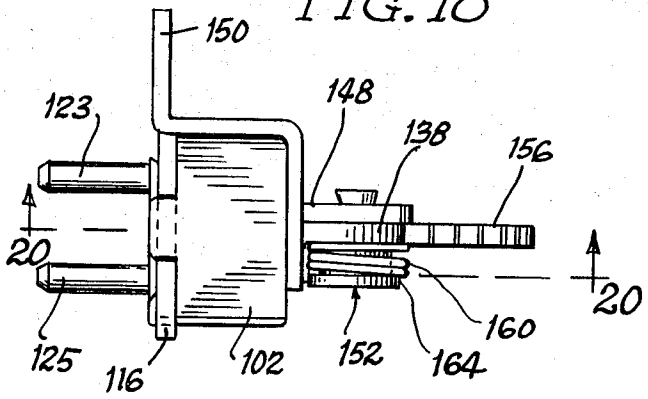


FIG. 19

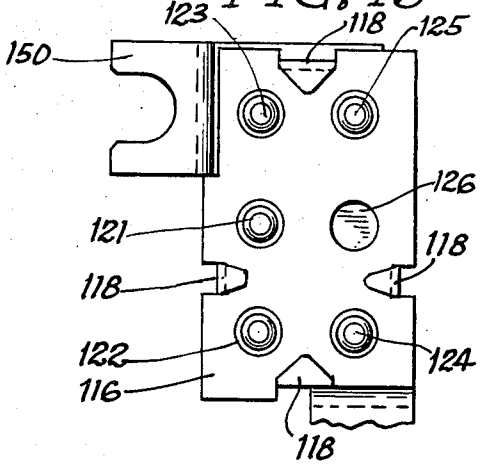


FIG. 20

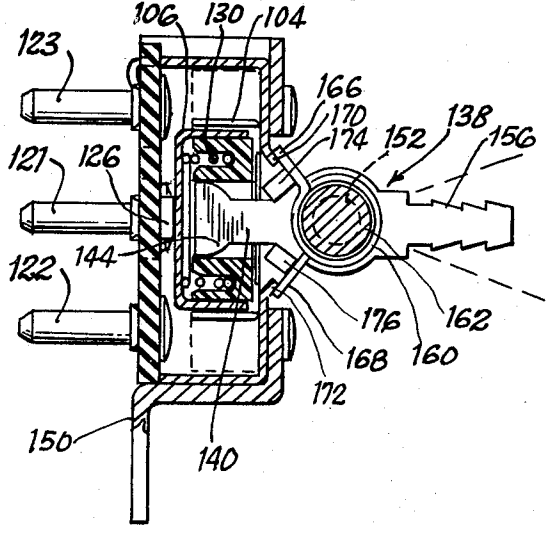


FIG. 21

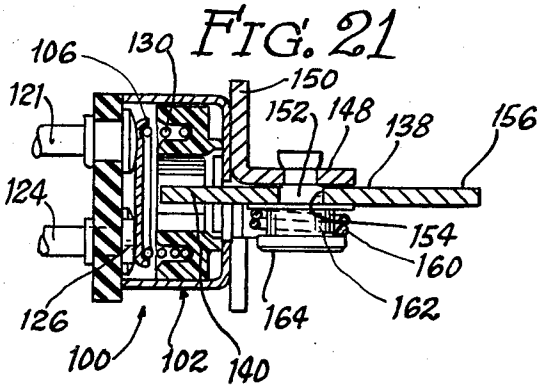


FIG. 22

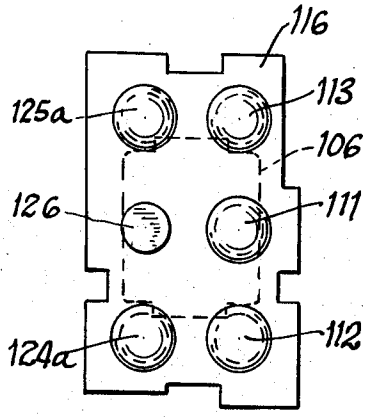


FIG. 23

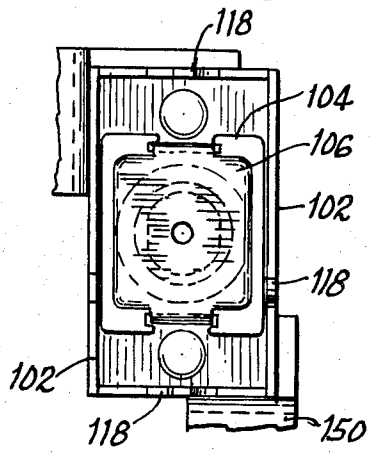


FIG. 24

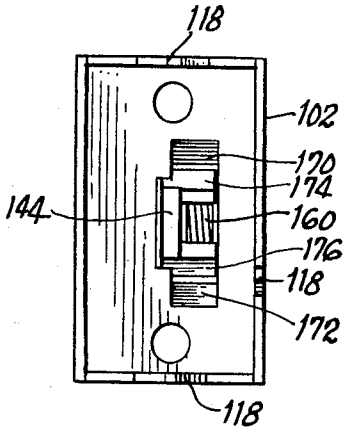
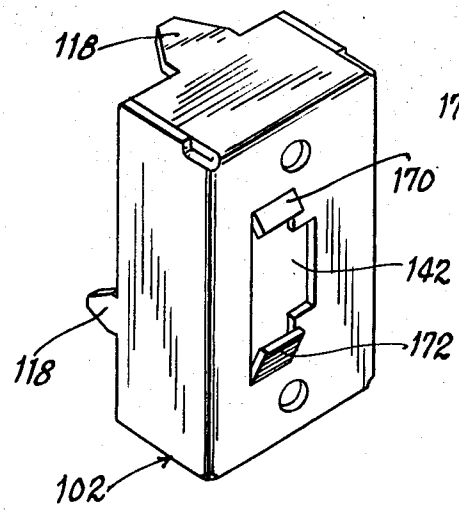


FIG. 25



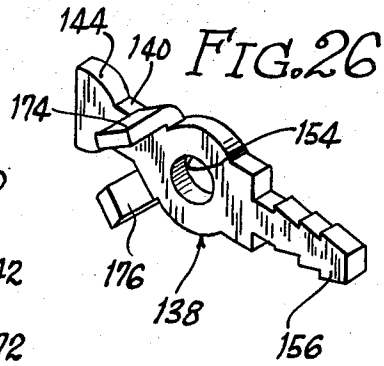


FIG. 26

FIG. 27

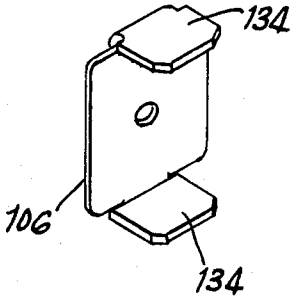


FIG. 28

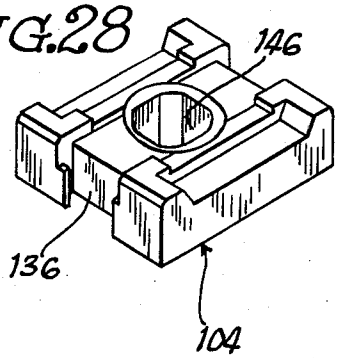


FIG. 29

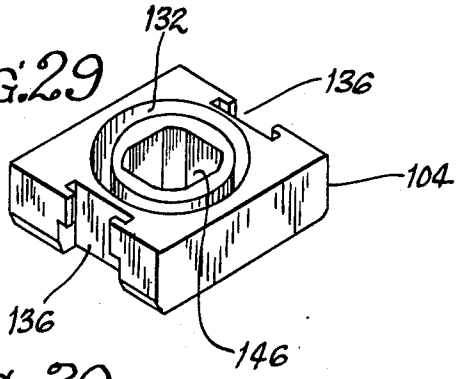
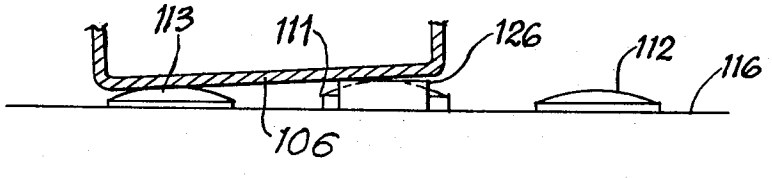


FIG. 30



ELECTRICAL SWITCHES WITH EXTERNAL RETURN SPRINGS

This invention relates to electrical switches which are especially well adapted for automotive service, but will find many other applications.

One object of the present invention is to provide new and improved switches of the spring return type.

A further object is to provide a new and improved electrical switch in which the return spring is mounted outside the casing in which the carriage and contactor are movable. In this way, the size of the return spring is not limited by the space in the casing. A strong and dependable return spring can be provided at very low cost. The same return spring, and the associated supporting components, can be employed with a wide variety of switches, having various contactor and contact arrangements. Moreover, any particular switch construction can readily be provided, either with or without the return spring.

Generally, the switch of the present invention comprises a casing in which an insulating carriage is movable. One or more contactors are mounted on the carriage and are engageable with fixed contacts. The present invention can be applied to switches with a wide variety of contactor and contact arrangements. The switch comprises an operating member disposed outside the casing and having a member extending into the casing to operate the carriage. Such operating member is preferably in the form of a lever pivoted on a bracket or the like on the outside of the casing. A return spring is disposed outside the casing, preferably in the form of torsion spring mounted on the pivot which supports the lever. The spring is engageable with at least one connecting element which is movable with the operating member and the carriage. In one embodiment, the torsion spring has arms which extend into the casing through an opening therein. The arms are engageable by the carriage when it is moved in opposite directions. Thus, the spring biases the carriage toward an initial position. Preferably, the ends of the opening in the carriage provide stops which are engageable with the arms of the spring to maintain an initial stress therein.

In another embodiment, the arms of the torsion spring are engageable by tabs or other elements on the operating lever. Here again, the arms of the spring are engageable with stops on the casing.

Further objects, advantages and features of the present invention will appear from the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a side elevational view of a switch to be described as an illustrative embodiment of the present invention.

FIGS. 2 and 3 are front and rear elevations of the switch.

FIG. 4 is an elevation of the switch viewed from the opposite side, as indicated by the line 4—4 in FIG. 2.

FIG. 5 is a top view of the switch.

FIG. 6 is a rear view with the contact board removed and positioned along side the switch.

FIG. 7 is a view similar to FIG. 6 but with the carriage removed.

FIG. 8 is a fragmentary section taken generally along the line 8—8 in FIG. 5, the switch being shown in its initial or neutral position.

FIG. 9 is a view similar to FIG. 8 but showing the switch with the carriage moved upwardly from its neutral position.

FIG. 10 is a view similar to FIG. 8 but showing the switch with the carriage moved downwardly from its neutral position.

FIG. 11 is a horizontal section, taken generally along the line 11—11 in FIG. 8.

FIG. 12 is an elevation showing the relationship between the contactor and the contact board, with the contactor in a position corresponding to FIG. 9.

FIG. 13 is a perspective view of the contactor.

FIGS. 14 and 15 are perspective views showing the rear and front sides of the carriage.

FIG. 16 is a side elevation of a modified switch to be described as another embodiment of the present invention.

FIGS. 17, 18 and 19 are front, top and rear views of the switches of FIG. 16.

FIG. 20 is a vertical section, taken generally along the broken line 20—20 in FIG. 18.

FIG. 21 is a horizontal section, taken generally along the line 21—21 in FIG. 16.

FIG. 22 is a front view of the contact board, shown detached from the switch, generally as indicated by the line 22—22 in FIG. 16.

FIG. 23 is a rear view of the switch with the contact board removed, generally as indicated by the line 23—23 in FIG. 16.

FIG. 24 is a view similar to FIG. 23 but with the carriage and contactor moved.

FIGS. 25, 26 and 27 are perspective views of the casing, operating lever and contactor for the switch of FIG. 16.

FIGS. 28 and 29 are perspective views of the front and rear sides of the carriage for the switch of FIG. 16.

FIG. 30 is a diagrammatic sectional view taken longitudinally through the contactor and showing the manner in which it tilts or rocks when it is moved from its neutral position.

As just indicated, FIGS. 1–15 illustrate an electrical switch 30 which is particularly well adapted for automotive service, but will find many other applications. The illustrated switch was designed particularly to control the rear window heater for an automobile. However, it will be understood that the invention is applicable to many types of switches.

The illustrated switch 30 comprises a casing 32, with a carriage 34 movable therein, as shown to best advantage in FIG. 8. The carriage 34 is preferably made of an insulating material, such as a suitable resilient plastic. One or more contactors are mounted on and movable with the carriage 34. In this case, there is a single contactor 36.

Various contact means may be provided for engagement by the contactor 36. As shown, three contact points 38, 39 and 40 are engageable by the contactor 36. The contact points 38, 39 and 40 are in the form of the spherically rounded heads of rivets 42,43 and 44, extending through corresponding opening in an insulating contactor or terminal board 46. Terminals 48, 49 and 50 are secured to the board 46 by the rivets 42, 43 and 44.

The switch 30 is preferably provided with spring means to press the contactor 36 against the contacts 38, 39 and 40. As shown, a coil spring 52 is connected between the carriage 34 and the contactor 36. The spring 52 is located in a circular recess 54 formed in the carriage 34. In the illustrated switch, the casing 32 is substantially rectangular, and the carriage 34 is slidable along the length of the casing. The contactor 36 is generally rectangular in shape. However, it will be understood that the manner in which the carriage is movable within the casing may be varied.

The switch 30 is provided with operating means for moving the carriage 34. As illustrated, such operating means take the form of a lever or other member 56, disposed outside the casing 34. The illustrated lever 56 has an arm 58 which extends into the casing 34 through a slot or other opening 60. The arm 58 has a rounded end portion 62 which is received in an opening 64, formed in the carriage 34. The lever 56 has a projecting portion 66 which serves as a handle.

The illustrated lever 56 is pivotally mounted on a bracket 68 extending forwardly from a mounting plate 70, which is riveted or otherwise secured to the casing 32. A pivot 72 extends through an opening 74 in the lever 56 and is riveted or otherwise secured to the bracket 68.

Spring means are provided to bias the carriage 34 and the lever 56 to a neutral or initial position, as shown in FIGS. 1 and 8. This position is designated N in FIG. 1. The lever 56 is swingable in one direction to a position designated START, and in the opposite direction to a position designated OFF. The corresponding positions of the carriage 34 are shown in FIGS. 9 and 10. Resilient resistance is afforded by the spring means to the movement of the carriage 34 and the lever 56 away from the neutral position.

Various return spring arrangements may be employed. As illustrated, the switch 30 comprises a torsion spring 76 disposed outside the casing 34. As illustrated, the spring 76 is

mounted on an enlarged portion 78 of the pivot 72. The spring 76 has arms 80 and 82 for engagement by connection elements on the carriage 34. Thus, the arms 80 and 82 extend into the casing 32 through a slot or other opening 84 therein. The mounting plate 70 has a cutout or opening 86 which exposes the slot 84, and also the slot 60.

The rear ends of the arms 80 and 82 are received in a recess or other opening 88 in the carriage 34. The ends of the slot 84 in the casing 32 act as stops for the spring arms 80 and 82, to locate the neutral position of the carriage 34 and the lever 56. Preferably the spring 76 is given an initial stress, which is maintained by the engagement of the spring arms 80 and 82 with the ends of the slot 84.

When the handle 66 is swung upwardly to the START position, as shown in FIG. 1, the carriage 34 is moved downwardly, as shown in FIG. 10. The upper end of the recess 88 in the carriage 34 pushes the spring arm 80 downwardly, so that the spring affords resilient resistance to the downward movement of the carriage.

When the handle 66 is swung downwardly to the OFF position, as shown in FIG. 1, the carriage 34 is moved upwardly, as shown in FIG. 9. The lower end of the recess 88 pushes the spring arm 82 upwardly, so that the spring 76 affords a resilient restoring force, tending to return the carriage 34 to its neutral position.

The external return spring 76 provides a switch construction which is particularly easy to assemble. The spring 76 and the lever 56 are mounted on the pivot 72. The arms 80 and 82 of the spring 76 are pressed together and inserted through the slot 84 in the casing 32. The pivot 72 is then riveted to the bracket 68. It will be seen that the pivot 72 has a head or flange 90 which retains the spring 76 on the enlarged portion 78 of the pivot. The spring 76 does not engage the bracket 68 or the lever 56 so that these components do not need to be adapted or modified to accommodate the spring.

The carriage 34 may simply be inserted into the casing 32, in such a manner that the ends of the arms 80 and 82 will be received in the recess 88. The spring 52, contactor 36, and terminal board 46 are then added to complete the assembly. The terminal board 46 may be secured to the casing 32 in any suitable manner. As shown the casing 32 is formed with tabs 92 which are bent behind the terminal board 46 to secure it in place.

The arrangement of the return spring 76 has the additional advantage that a large and sturdy spring may be employed, without any limitation due to the size of the casing 32. The strength and the construction of the spring 76 can be varied to suit different switch designs, without making any change in the casing 32 or the carriage 34. Moreover, the same spring construction can be used for many different switch designs, involving variations in the carriage 34, or in the contactor 36 and the associated contact points.

FIG. 12 shows the contactor 36 in its OFF position, in which the contactor engages only the contact point 39, and thus does not complete any circuit. The neutral position of the contactor 36 is indicated in broken lines. In this position, the contactor engages the contact points 38 and 39. The circuit thus established can be employed as the holding circuit for a relay or for any other desired purpose. The START position of the contactor 36 is also indicated in broken lines. In this position, the contactor engages the contact points 38 and 40. The connection thus established can be employed to energize the relay, or for any other desired purpose.

FIGS. 16–29 illustrate a modified switch 100 having a casing 102. A carriage 104 is movable in the casing 102. As shown to best advantage in FIG. 23, a contactor 106 is mounted on and movable with the carriage 104.

As shown in FIG. 22, the switch 100 is provided with contact means comprising three contact points 111—113, mounted on an insulating terminal board 116 which closes the rear side of the casing 102. As before, tabs 118 are provided to secure the board 116 to the casing 102. The contact points 111–113 have portions which extend through corresponding holes in the insulating board 116 and are connected to or formed integrally with terminals pins 121–123, shown to best advantage in FIG. 19. The board 116 also carries two pilot or locating pins 124 and 125, connected to rivet heads 124a and 125a which are thinner than the contact points 111-113 and thus are not engaged by the contactor 106 in any of the three operating positions thereof. It will be seen from FIG. 22 that the board 116 is provided with an insulating boss or dummy point in the form of a semiperforation 126, generally opposite the central contact 111. As shown to best advantage in FIG. 30, the end contacts 112 and 113 are thinner or lower than the central contact 111. The boss or dummy contact 126 corresponds generally in height to the central contact 111 and is relatively large in diameter.

A coil spring 130 is employed to press the contactor 106 rearwardly against the contact points 111–113. The spring 132 is seated in an annular recess, formed in the carriage 104. It will be seen that the contactor 104 is formed with tabs 134 which are slidable in slots 136 formed in the carriage 104.

The operating member for the switch 100 is in the form of a lever 138 having an arm 140 which extends rearwardly into the casing 102 through an opening 142. The arm 140 has a rounded rear end portion 144 which is received in an opening 146 formed in the carriage 104.

The lever 138 is pivotally mounted in front of the switch 100 on an arm 148 projecting forwardly on a mounting bracket 150, which is riveted or otherwise secured to the casing 102. As shown to best advantage in FIG. 21, the switch 100 includes a pivot 152 which extends through an opening 154 in the lever 138 and is riveted or otherwise secured to the arm 148. The lever 138 has a forwardly projecting arm 156 which is adapted to be swung vertically to operate the switch. A suitable knob or the like can be mounted on the arm 156.

As indicated in FIG. 20, the operating arm 156 of the lever 138 is initially in an intermediate or neutral position and is adapted to be swung upwardly and downwardly to displaced positions. A return spring arrangement is provided to bias the lever 138 of the carriage 104 to the neutral position. Various spring means may be employed but the illustrated switch 100 utilizes a torsion spring 160, preferably mounted around an enlarged portion 162 of the pivot 152. As shown, the enlarged portion 162 has a head or flange 164 which retains the spring thereon.

The illustrated torsion spring 160 has arms 166 and 168 which project rearwardly and are engageable with stops 170 and 172 on the casing 102. The stops 170 and 172 may assume various forms, but are illustrated as ears bent forwardly at an inclined angle. The stops 170 and 172 are at the opposite ends of the opening 142 in the front of the casing 102. Preferably, the spring 160 is initially stressed, so that the arms 166 and 168 are pressed rearwardly against the stops.

The arms 166 and 168 of the spring 160 are engageable by connecting elements which are movable with the carriage 104 and the lever 138. In this case, such connecting elements take the form of tabs or ears 174 and 176, projecting laterally from the lever 138.

The tabs 174 and 176 are arranged so that the lever 138 is located initially in its neutral position. When the operating arm 156 of the lever 138 is swung downwardly, the tab 174 moves the spring arm 166 away from the stop 170. Thus, the spring 160 exerts a force on the tab 174, tending to restore the lever 138 and the carriage 104 to the neutral position. When the lever arm 156 is swung upwardly, the tab 176 moves the spring arm 168 away from the stop 172, so that the lever 138 is restored to its neutral position by the spring 160 when the lever arm 146 is released.

When the contactor 106 is in its neutral or intermediate position, it engages the contact point 111 and the semiperforation 126 as indicated in FIG. 22. Due to its large size and flat top surface, the semiperforation 126 has a stabilizing or leveling action upon the contactor 106, so that it squarely engages the semiperforation and the central contact 111. When the contactor 106 is moved downwardly, it engages the contact

points **111** and **112**, and the semiperforation **126**. Upon upward movement of the contactor **106**, it engages the contact points **111** and **113**, and the semiperforation **126**. The present invention may be employed with various other arrangements involving one or more contactors and two or more contact points.

FIG. **30** shows the manner in which the contactor **106** tilts or rocks as it is moved away from its neutral position. This tilting action insures that the contactor **106** will solidly engage the contacts **111**, **112**, and **113**. As the contactor **106** is moved against the contact **113**, the spring **130** causes the contactor **106** to tilt about the edge of the semiperforation **126** as clearly shown in FIG. **30**. This tilting action is due to the fact that the end contacts **112** and **113** are lower than the central contact **111**. The contactor **106** has three points of engagement: with the contacts **111** and **113**, and with the edge of the semiperforation **126**, as shown in FIG. **30**. A similar tilting action takes place when the contactor **106** is moved from its neutral position toward the contact **112**. While the illustrated boss or dummy point **126** takes the form of a semiperforation mode of insulating material, it can be in other forms, made of either insulating or conductive material.

Here again, the switch is unusually easy to assemble. The spring **160** and the lever **138** are assembled on the pivot **152** with the spring arms **166** and **168** against the tabs **174** and **176**. The pivot **152** is then riveted to the bracket arm **148**. It is an easy matter to insert the carriage **104**, the spring **130** and the contactor **106** into the casing **102**. The terminal board **116** is then mounted on the rear of the casing.

The arrangement of the external return spring makes it easy to use a strong and dependable spring, without any size limitation due to the dimensions of the casing **102**. The same spring arrangement can be provided for various switches, utilizing different arrangements of the contactor and the points. On the other hand, the spring arrangement can be hanged without affecting the internal construction of the switch. With the construction of the present invention, the return spring can be provided at extremely low cost. In each of the illustrated switches, the return spring does not engage the mounting bracket, so that the bracket does not need to be modified or adapted to accommodate the spring.

In the illustrated switches, the carriage and the operating lever are movable in both directions from the neutral position. However, the invention is also applicable to switches in which the lever and carriage are movable in only one direction from the initial position.

Various other modifications, alternative constructions and equivalents may be employed, as will be evident by those skilled in the art.

I claim:

1. An electrical switch comprising a casing,
a carriage movable in said casing,
a supporting member connected to the outside of said casing,
an operating member in the form of a lever having pivot means mounting said lever on said supporting member,
said lever being movable relative to said casing and having an element extending into said casing and engageable with said carriage for moving said carriage,
contactor means mounted on and movable with said carriage,
contact means supported by said casing for engagement by said contactor means, and
a torsion spring disposed outside said casing and mounted along the axis of said pivot means,
said torsion spring having first and second arms extending into said casing and engageable with said carriage for biasing said carriage against movement in opposite directions.

2. A switch according to claim **1**,
in which said casing is formed with an opening through which said arms extend into said casing,
said casing having stop elements at the ends of said opening and engageable with said arms of said spring for maintaining initial stress in said spring.

3. An electrical switch,
comprising a casing,
a carriage movable in said casing,
contactor means mounted on and movable with said carriage,
contact means supported by said casing for engagement by said contactor means,
a supporting member connected to the outside of said casing,
an operating lever extending into said casing for moving said carriage,
pivot means connecting said lever to said supporting member,
a spring mounted on said supporting member, and
two connecting elements on said carriage and movable therewith and engageable with opposite end portions of said spring whereby said carriage is biased against movement in opposite directions,
said casing having stop elements engageable with the opposite end portions of said spring.

4. An electrical switch,
comprising a casing,
a carriage movable in said casing,
contactor means mounted on and movable with said carriage,
contact means supported by said casing for engagement by said contactor means,
a supporting member connected to the outside of said casing,
an operating lever extending into said casing for moving said carriage,
pivot means connecting said lever to said supporting member,
a torsion spring mounted along the axis of said pivot means and having two end portions in the form of arms, and
two connecting elements on said carriage and movable therewith and engageable with said arms of said spring whereby said carriage is biased against movement in opposite directions.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,668,353 Dated June 6, 1972

Inventor(s) Andrew F. Raab

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 35, "hanged" should read --changed--.

Signed and sealed this 26th day of September 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

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