Feb. 20, 1968 J. D. VAN BENTHUYSEN 3,370,261

ELECTRICAL SWITCH AND COMBINATION ELECTRICAL RESISTOR AND SWITCH

Filed Jan. 4, 1965 3 Sheets-Sheet 1

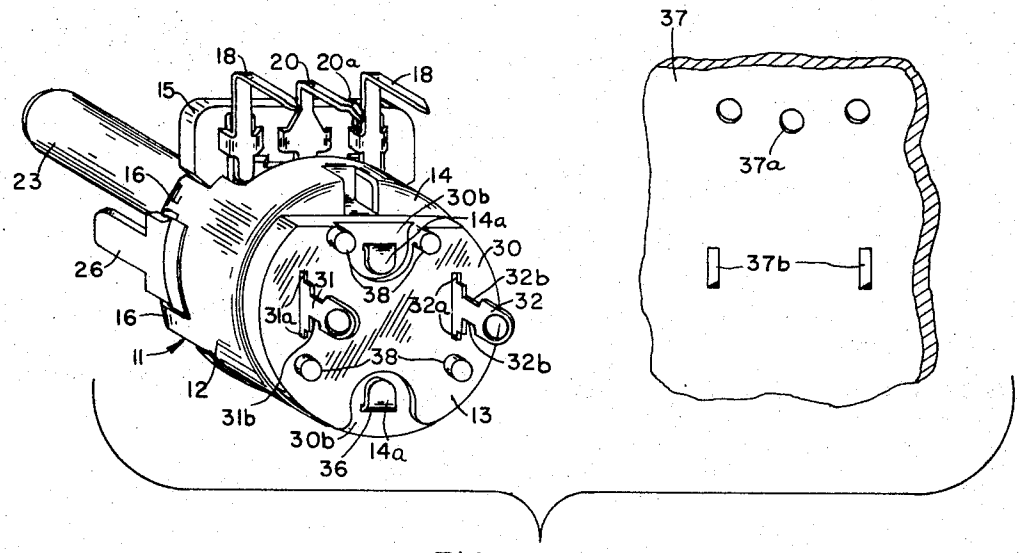

FIGURE 1.

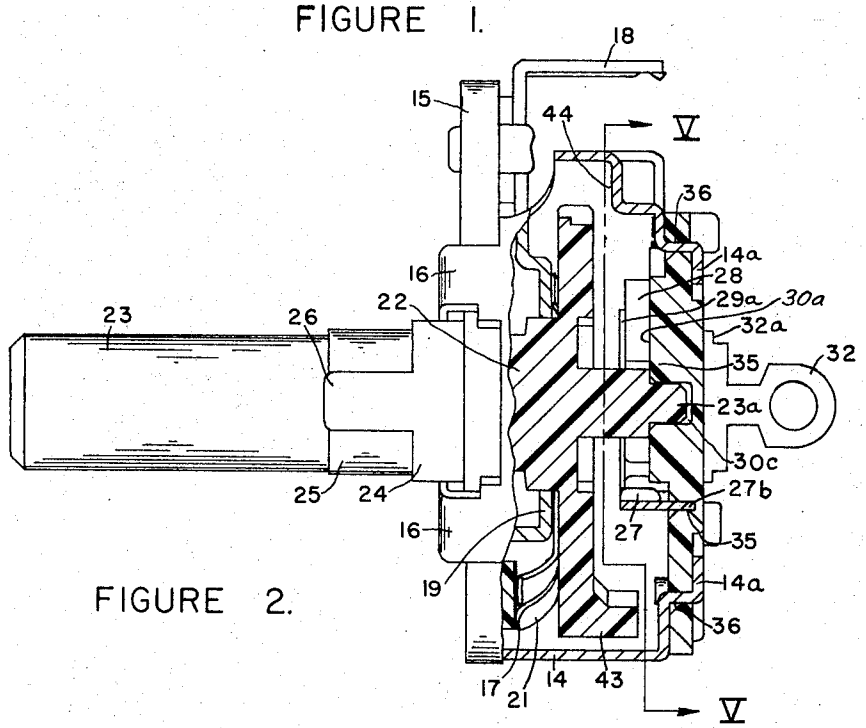

FIGURE 2.

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ELECTRICAL SWITCH AND COMBINATION ELECTRICAL RESISTOR AND SWITCH

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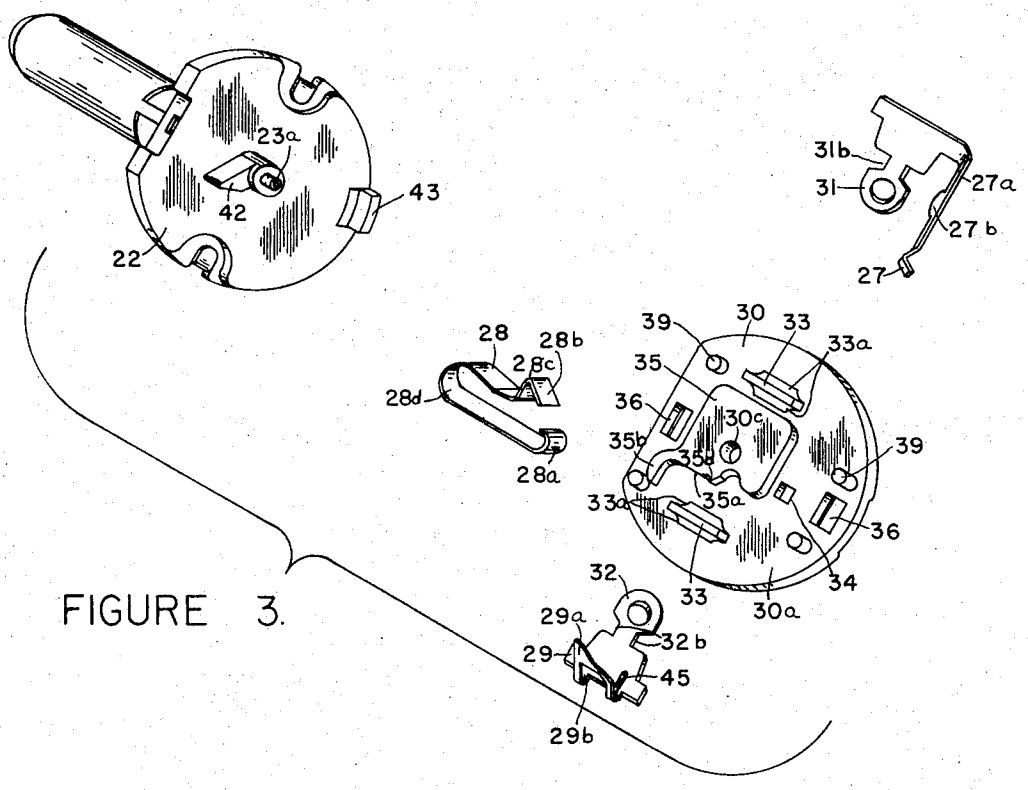

FIGURE 3.

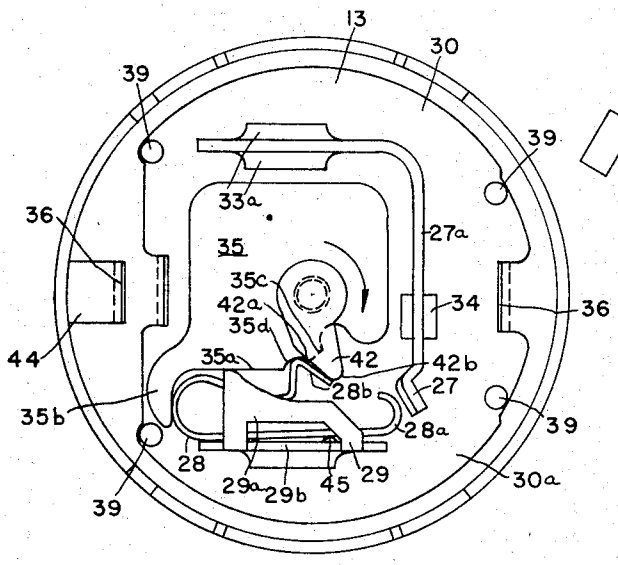

FIGURE 5A

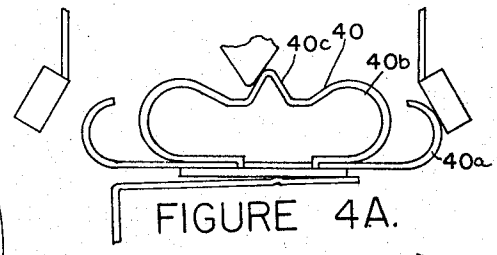

FIGURE 4A.

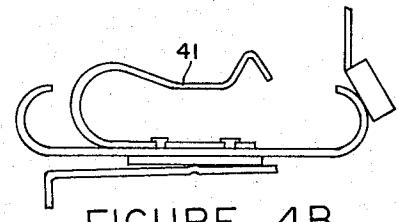

FIGURE 4B.

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ELECTRICAL SWITCH AND COMBINATION ELECTRICAL RESISTOR AND SWITCH

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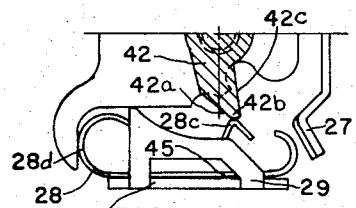

FIGURE 5B

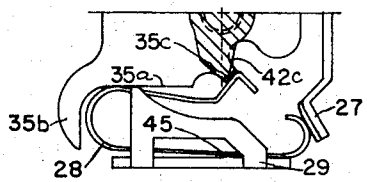

FIGURE 5C

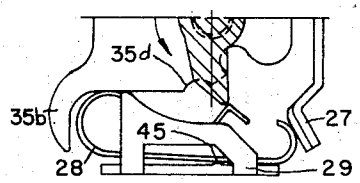

FIGURE 5D

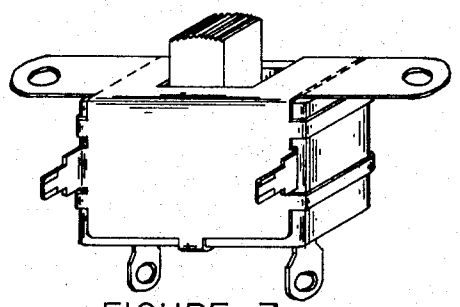
FIGURE 7

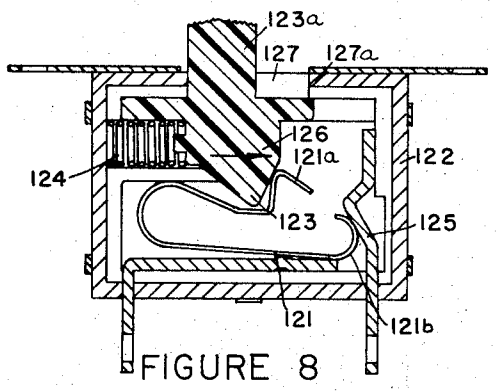

FIGURE 8

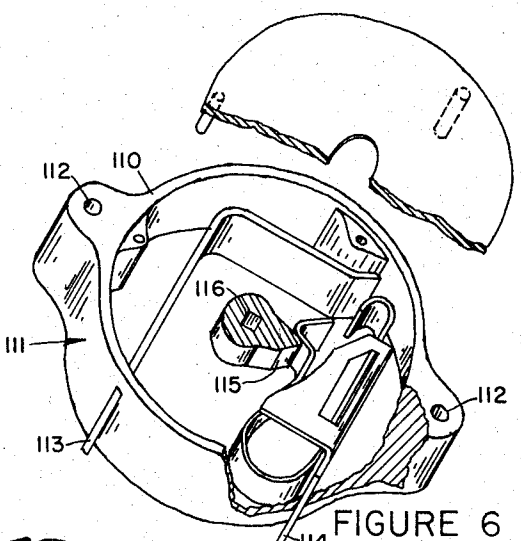

FIGURE 6

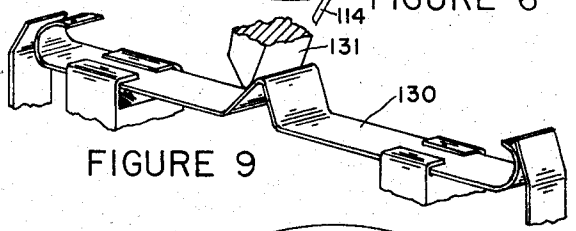

FIGURE 9

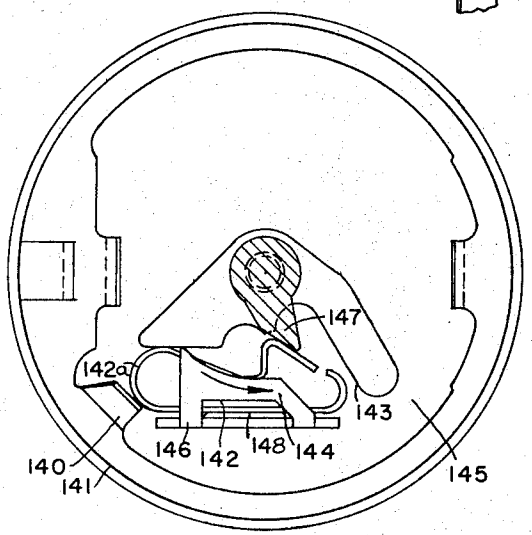

FIGURE 10

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3,370,261

ELECTRICAL SWITCH AND COMBINATION ELECTRICAL RESISTOR AND SWITCH

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Filed Jan. 4, 1965, Ser. No. 422,935
20 Claims. (Cl. 338—198)

ABSTRACT OF THE DISCLOSURE

A component such as an electrical switch having a guide means and an entire contactor supported by the guide means and slideable from a first position to a second position as a cam engages and shifts a cam follower connected to the contactor.

The present invention relates to electrical controls and, more particularly, to an electrical switch and to a combination variable resistance and electrical switch control.

The prior art is replete with various types of electrical switches including slide switches, snap action switches and over center switches, and variable resistance controls combined with such switches. It is to be understood that the term "electrical control" is used generically herein to designate devices for controlling the current or voltage in an electrical circuit and that an "electrical switch" as well as a "combination variable resistance and electrical switch control" are as usual species of "electrical controls." One of the important advantages of a snap action switch is that the switch is tease-proof, i.e., the contactor cannot be maintained in a neutral position by carefully controlling or manipulating the actuator in a center position of a two position switch thereby causing the contactor momentarily to engage and disengage the stationary contact. Such weakness in switch design generally occurs when the movement or rotation of the actuator is in the same direction as the intended movement of the contactor. Thus ideal snap action and over center switches currently available on the market for controlling energization of electronic circuits require a large number of parts including one or more springs, bearings, levers and the like to obtain the desired rapid make and break, that is, a snap action. Switch design, however, has not kept abreast of the demands of the changing electronic industry. It would, therefore, be desirable, to provide an ideal tease-proof snap action electrical switch employing a movable contactor of simplified construction wherein the switch actuator is moved in a direction opposite to the intended direction of the contactor to actuate the switch.

An electrical control of the combination type, namely a combination variable resistance and electrical switch control, generally comprises two housings connected in tandem. Such construction is preferable to facilitate assembly of and to avoid interference between the many parts of the control. For example, the stop member of the variable resistance control employed for limiting angular rotation of the contact wiping the resistance element is disposed in a different plane from the contacts of the switch to avoid interference with the actuating portion of the switch. It would, therefore, also be desirable to simplify a combination variable resistance and electrical switch control by eliminating a number of parts of the switch including the switch housing and fixedly securing an electrical switch to the rear of the variable resistance control housing.

Accordingly, it is an object of the present invention to provide a new and improved electrical control having the various desirable features set forth above.

An additional object of the present invention is to provide an electrical control with improved means for

mounting the control to a mounting panel to facilitate soldering of the control terminals into a circuit.

Another object of the present invention is to provide an improved electrical control having a slideable contactor shiftable by a cam connected to an actuator rotatable through a substantially greater angle than necessary for performing another function after the switch is energized or deenergized.

A further object of the present invention is to provide an improved electrical control employing detent means for maintaining the contactor in a first or second stable position.

A still further object of the present invention is to provide an improved electrical switch employing a contactor having a contact shoe secured to a cam follower movable to a labile neutral position before the contact shoe is sifted into or out of engagement with a stationary contact.

Still an additional object of the present invention resides in an electrical switch employing a U-shaped contactor having a contact shoe integral with one of the legs thereof and a cam follower integral with the other leg thereof.

Still another object of the present invention resides in a combination variable resistance and electrical switch control wherein the switch is mounted to and carried by the rear wall of the housing of the variable resistance control.

Yet an additional object of the present invention resides in a combination variable resistance and electrical switch control wherein the rear wall of the housing supporting the switch is provided with a plurality of depending feet for spacing the rear wall of the housing from a mounting panel.

Yet a further object of the present invention resides in an electrical switch wherein the stationary terminal is integral with an electrically conductive housing for grounding a circuit.

Still another object of the present invention resides in a tease-proof snap action switch provided with a contact shoe and having a cam movable in a direction for increasing the pressure of the contact shoe against a stationary contact until the cam follower is in a labile neutral position at which instant the contact shoe snaps in the opposite direction for rapidly breaking the circuit.

Still a further object of the present invention resides in the provision of an electrical switch employing a cam engageable with a slideable contactor and movable in a direction opposite to the intended direction of movement of the contactor.

Still a further object of the present invention resides in the provision of an electrical control having a snap action contactor slideably and pivotally mounted on a supporting member for producing a wiping action between the contacts.

Further objects and advantages of the present invention will become apparent as the following description proceeds, and the features of novelty characterizing the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Briefly, the present invention is concerned with an electrical control employing a contactor slideably shifted on a supporting member with a snap action to minimize arcing. The contactor comprises a contact shoe and a cam follower connected together by a resilient means. The contactor is slideably shifted in one direction only after the cam follower is moved through a labile neutral position by a cam or boss movable in a direction opposite to the one direction of the contactor in an interference path with a portion of the contactor. In one embodiment of the invention, the cam maintains the contactor in a stable position; otherwise a detent is integral with the

cam follower and a detent receiving indentation carried by the supporting member maintains the contactor in a stable position. The contactor is of spring material and preferably of U-shaped construction when minimum operating space is preferred and only one contact shoe is necessary. Guide means are carried by the supporting member for limiting lateral movement of the contactor when the cam follower is shifted to the labile neutral position by a rectilinearly movable or rotatable cam. In one of the preferred embodiments, the switch is combined with a variable resistance control, and such embodiment comprises a cylindrical housing provided with one or two apertured end walls. A first base closes one apertured end wall and a second base having a supporting surface for slideably supporting the contactor closes the other end wall of the housing, the second base being fixed to or integral with the housing. A rotor or driver rotatably supported in the housing is provided with means for wiping contact with a resistance element disposed in the housing and a cam or boss means integral with the driver is engageable with the cam follower for slideably shifting the contactor between a first and second stable position with a snap action. In still another embodiment, a stationary contact is integral with the housing.

For a better understanding of the present invention, reference may be had to the accompanying drawings wherein the same reference numerals have been applied to like parts and wherein:

FIGURE 1 is an isometric view of a combination variable resistance and electrical switch control adapted for mounting into a perforated panel;

FIGURE 2 is a sectional view of the control shown in FIGURE 1, a portion thereof being in section;

FIGURE 3 is an exploded view of the electrical switch of the control shown in FIGURE 1;

FIGURES 4A and 4B show additional embodiments of a contactor for the switch of the present invention;

FIGURE 5A is a sectional view taken along line V—V of FIGURE 2 showing the movable contactor disengaged from the stationary contact;

FIGURES 5B, 5C, and 5D are fragmentary sections of the view shown in FIGURE 5A showing the contactor in various positions;

FIGURE 6 is a perspective view of another embodiment of an electrical switch of the present invention with the cover removed and portions of the housing broken away to show the contactor;

FIGURE 7 is another embodiment of an electrical switch of the present invention wherein the actuating cam is rectilinearly movable and maintains the contactor in a first or second stable position;

FIGURE 8 is a sectional view of the electrical switch shown in FIGURE 7 of the drawings;

FIGURE 9 is another embodiment showing a modified contactor employed in a SPDT switch; and

FIGURE 10 is still another embodiment of an electrical switch of the present invention wherein the stationary contact is integral with an electrically conductive housing.

Referring now to the drawings, there is illustrated an electrical control generally indicated at **11** comprising a variable resistance control **12** having an electrical switch **13** secured thereto.

Considering first the variable resistance control **12**, it comprises a hollow cylindrical cover or housing **14** having apertured end walls. A base **15** of suitable electrically nonconductive material closes one of the end walls of the housing **14** and is fixedly secured to the housing with a plurality of ears **16** folded over the top surface of the base **15**. Means defining an arcuate resistance path **17**, e g., a carbon film resistance element, is suitably bonded or mechanically secured to the base **15** and the ends of the resistance path are connected to a pair of terminals **18**. When a not-shown arcuate wirewound resistance element is employed instead of the carbon film resistance element, it is insulatedly disposed in the housing **14** in a manner well known in the art. A collector ring **19** in fixed concentric relationship with respect to the resistance path **17** is provided with a center terminal **20**, and a contactor **21** electrically connects the resistance path **17** to the collector ring **19**.

A driver **22** integral with a shaft **23** extending through an opening provided in the base **15** is rotatably mounted in the housing **14** adjacent to the resistance path **17**. The contactor **21** is fixedly secured to one side of the driver **22** and, therefore, constrained to rotate therewith for wiping contact with the resistance path **17** and the collector ring **19**.

One of the means for mounting the electrical control **11** to a not-shown mounting panel with the shaft extending through an opening provided in the panel is of conventional construction and comprises a ground plate **24** generally provided with an extruded bushing **25** rotatably supporting the shaft **23**. A pair of mounting ears **26** extend forwardly of the ground plate, and the ends of the ears **26** are twisted after the ears are disposed in openings provided in the mounting panel for securing the control thereto.

As best illustrated in FIGURES 3 and 5 of the drawings, the electrical switch **13** comprises a stationary contact **27**, a slideable contactor **28**, and a guide arm **29** supporting the contactor **28** on a supporting member **30** of suitable electrically nonconductive material. A pair of terminals **31** and **32** integral with the stationary contact **27** and the giude arm **29** respectively extend through slots **33** in the supporting member **30** and are secured to the supporting member **30** by suitable means such as staking the edges **31***a* and **32***a* (see FIGURE 1) adjacent to the outer surface of the supporting member **30**. The sides **33***a* of the slots are beveled to facilitate insertion of the terminals **31** and **32** into the slots **33**. When it is preferable to dispose the terminals **31** and **32** in spaced parallel relationship to each other, a leg **27***a* connecting the stationary contact **27** to the terminal **31** is formed at an angle as shown in the drawings and, to restrict movement of the leg **27***a* and maintain the stationary contact **27** fixed with respect to the supporting member **30**, a tongue **27***b* (see FIGURES 2 and 3) depending from the leg **27***a* is wedged in a notch **34**. The guide arm **29** is provided with an end portion **29***a* spaced from and parallel to the inner surface **30***a* of the supporting member **30** for cagedly supporting and guiding the contactor **28** as it is shifted into and out of engagement with the stationary contact **27**. An elongated notch **29***b* is provided in the guide arm **29** to facilitate staking of the terminal **32** to the supporting member. The supporting member **30** is also provided with an inwardly extending section or platform **35**, a side of the platform forming a contactor retaining ridge or shoulder **35***a* in spaced relationship to the guide arm **29**. A stop member **35***b* cooperating with the shoulder **35***a* limits slideable movement of the contactor in one direction.

The supporting member **30** closes the other apertured end wall of the cylindrical housing **14** and is fixedly secured thereto and can be integral therewith. More specifically, a pair of tabs **14***a* extending rearwardly from the housing **14** and passing through a pair of slots **36** provided in the member **30** are folded over as shown in FIGURE 1 for securing the member **30** to the housing **14**. Preferably the slots **36** are provided in recessed portions **30***b* of the member **30** in order that the tabs **14***a* will not interfere with mounting of the control **11** to a mounting panel **37**. A plurality of rearwardly extending feet **38** integral with the member **30** space the control **11** from the mounting panel **37**. The supporting member **30** is also provided with a plurality of inwardly extending feet **39** (see FIGURES 3 and 5A) engaging the inner edge of the other apertured end wall of the housing **14** for facilitating alignment of the housing **14** with respect to the member **30**.

As illustrated and in a preferred form of the invention,

another means, in the alternative, is employed for mounting or holding the rear of the control **11** to the mounting panel **37**. Each of the terminals **31** and **32** preferably is provided with a pair of slots **31***b* and **32***b* respectively having a sufficient opening for engaging the mounting panel **37**, one side of each of the slots **31***b* and **32***b* preferably being at an angle to the supporting member to compensate for different thicknesses of mounting panel, and the center terminal **20** is provided with an offset portion or spring finger **20***a* engageable with the panel **37**. The perforation **37***a* in the panel **37** receiving the terminal **20** is spaced from the perforations **37***b* receiving the terminals **31** and **32** a distance less than the distance between the center terminal **20** and the terminals **31** and **32** for compressing the spring finger **20***a* of the center terminal **20** against the terminals **31** and **32** thereby engaging portions of the mounting panel **37** below the perforations **37***b* with the slots **31***b* and **32***b*. The mounting panel **37** supporting the control **11** and other not-shown printed circuits and controls can then be dip soldered in a simple and facile manner. The reduced cross section of each terminal resulting from the slots **31***b* and **32***b* also reduces the heat transfer from the ends of the terminals to the stationary contact and the guide arm during the soldering operation.

In one of the preferred forms of the present invention, the contactor **28** is of U-shaped construction having an arcuate contact shoe **28***a* integrally secured to one leg and a cam follower **28***b* integrally secured to the other leg of the contactor **28**. When the cam follower **28***b* is integral with the contact shoe **28***a*, it is preferable that the contactor **28** be of electrically conducting resilient spring material to permit flexing or movement of the cam follower **28***b* with respect to the contact shoe **28***a* or other leg of the contactor. The cam follower is preferably V-shaped, one leg of the V being connected to the one leg of the contactor. It is to be understood, however, that the contact shoe **28***a* need not be integral with the cam follower **28***b* and contactors **40** and **41** such as shown in FIGURES 4A or 4B can readily be employed when it is desirable to increase the current rating of the switch **13** or provide a SPDT switch. For example, the contact shoe **40***a* can be of a material having optimum current carrying properties and the spring **40***b* and cam follower **40***c* of a material having optimum spring characteristics. The spring **40***b* is fixedly secured to the contact shoe **40***a* in a suitable manner such as with rivets or spot welding.

For the purpose of shifting the contactor **28** slideably into and out of engagement with the stationary contact **27**, means in the form of a boss or a cam **42** movable in an interference path with the contactor and integral with the driver **22** is employed. Assuming that the switch **13** is in the off position, in other words, that the contact shoe **28***a* is not in intimate engagement with or biased against the stationary contact **27**, rotation of the cam **42** in a clockwise direction, as shown in FIGURE 5A of the drawings, causes the leading edge **42***a* of the cam **42** to force the cam follower **28***b* downwardly or toward the one leg of the contactor **28**, i.e., transversely of the contactor and, as the cam **42** continues to rotate in the clockwise direction, the apex or lobe **42***b* of the cam **42** eventually engages the apex **28***c* of the cam follower **28***b*, hereinafter such position being referred to as the labile neutral position (see FIGURE 5B). Due to the energy stored in the spring **28***d* of the contactor resulting from moving the cam follower **28***b* downwardly toward the one leg of the contactor **28** to the labile neutral position, the spring of the contactor **28** instantaneously urges the cam follower to the position shown in FIGURE 5C of the drawings. Thus the contactor **28** initially in a first stable position shifts to a second stable position with a snap action as the cam **42** moves from one side of the apex **28***c* of the cam follower **28***b* to the other side thereof. As best seen in FIGURES 5B and 5C of the drawings, the one leg of the cam follower is at a slight angle to the trailing edge **42***c* of the cam before the snap action occurs. It is essential that this slight angle exist, otherwise there would be no shifting of the contactor. The one leg of the cam follower functions as a wedge as it engages the trailing edge **42***c* of the cam causing rapid movement or ideal snap action of the contactor **28**. Moreover, it is essential in the switch **13** of the present invention that the cam **42** always move in a direction opposite to the intended direction of movement of the contactor when operation of the switch is desired; otherwise the contactor does not move through a critical or labile neutral position and the desirable rapid snap action is not obtained. The assembly of the contactor **28** and the guide arm **29** to the supporting member **30** is greatly facilitated since, if the cam **42** is initially on the wrong side of the contactor, the cam can readily be rotated to the proper side.

If the cam **42** continues to remain in the position shown in FIGURE 5C of the drawings, i.e., if further rotation of the cam **42** is halted, the inherent resiliency of the spring **28***d* of the contactor **28** due to partial compression of the legs thereof will continue to bias the contact shoe **28***a* against the stationary contact **27**. However, when the cam is integral with the driver of a variable resistance control **12** generally rotatable through a wide angle after the switch is closed, it is necessary that other means be provided for improving and increasing the combination between the variable resistance control **12** and the switch **13** and for maintaining the legs of the contactor **28** in a compressed position. To this end, the shoulder **35***a* formed by the raised platform **35** is provided with an abutment **35***c* for maintaining the cam follower **28***b* and the contact shoe **28***a* of the contactor **28** in the second stable position (see FIGURE 5C). The cam **42** can, therefore, continue to rotate in the clockwise position beyond the direction shown in FIGURE 5C of the drawings.

For the purpose of limiting rotation of the contact assembly **21** with respect to the arcuate resistance path **17**, the driver **22** is provided with a stop member **43** engageable with a stop **44** formed in the housing **14**. Because of the improved combination between the variable resistance control **12** and the switch **13**, the stop member **43** and the cam **42** are disposed in the same plane permitting a substantial reduction in the depth of the housing **14** of the electrical control **11**. In essence, an annular passageway extends around the inner edge of the housing (see FIGURES 2 and 5A) obstructed only by the stop **44**. The stationary contact **27**, the contactor **28**, and the guide arm **29** are disposed within the annular passageway. The performance of the control **11** is also improved since the driver **22** is provided with a stub shaft **23***a* journaled in a bearing **30***c* provided in the supporting member **30**. It is, therefore, obvious that the combination of a variable resistance control and electrical switch control **11** is improved by decreasing the number of elements, increasing the cooperation between the variable resistance control and the switch, and reducing the length of the control **11**. The stop member **43** carried by the driver **22** limiting rotation of the cam **42** to an angle less than 360° upon engagement with the stop **44** also prevents the cam **42** from engaging the cam follower from the wrong direction when the contact shoe **28***a* is biased against the stationary contact **27** thereby preventing the contactor **28** from moving to the disengaged position with an undesirable action. Thus, when the switch **13** is employed with an electrical component not having a stop, additional stop means is required to limit angular rotation of the cam.

To open the switch **13** or disengage the contact shoe **28***a* from the stationary contact **27**, it is necessary that the driver **22** be rotated in a counterclockwise direction until the cam is in the position shown in FIGURE 5C of the drawings. Further rotation of the cam in the counterclockwise direction of the drawings increases the pressure of the contact shoe **28***a* against the stationary contact **27** and, at the instant the cam follower passes the labile neu-

tral position (see FIGURE 5D), the contactor **28** shifts in the opposite direction away from the stationary contact to the first stable position. The stop **35***b* limits movement of the contactor **28** in the opposite direction.

In order to maintain the contactor in the first stable position, i.e., the off position of the switch, it is necessary that additional means for biasing the contactor be employed. In some controls the stop member **43** carried by the driver **22** can be properly located with respect to the stop **44** provided in the housing **14** to limit further rotation of the cam **42** in the counterclockwise direction beyond the position shown in FIGURE 5A of the drawings, and accordingly, the cam **42** will maintain the contactor **28** in the first stable position. Obviously, further rotation of the cam **42** in the counterclockwise direction will eliminate biasing of the contactor against the stop **35***b*, and inadvertent movement of the switch **13** can shift the contact shoe **38***a* into engagement with the stationary contact **27** without a snap action. Thus, additional means is provided for maintaining the contactor **28** in the first stable position when the cam **39** can be rotated in the counterclockwise direction beyond the position shown in FIGURE 5A of the drawings. The additional means comprises a detent receiving indentation **35***d* provided adjacent to the abutment **35***c* and the apex of the cam follower **28***b* functions as a detent when disposed in the indentation **35***d* maintaining the contactor **28** in the first stable position.

Preferably and in accord with the present invention, the guide arm **29** is provided with a fulcrum **45** normal to the major axis of the one leg of the contactor **28** for pivotally shifting or wiping the contact shoe **28***a* against the stationary contact **27**. The fulcrum **45** is disposed slightly forward of the center portion of the guide arm **29** for positioning the contactor at a small angle relative to the notch **29***b* when the contactor is in either of the stable positions. Due to the rapid movement or snap action of the contactor **28** from the first to the second stable position, the contactor does not pivot on the fulcrum **45** until after the contact shoe **28***a* engages the stationary contacts **27**. Thus the initial point of contact between the contact shoe **28***a* and the stationary contact **27** where arcing is most likely to occur is different from the final or stable point of contact. The contact shoe **28***a* is also preferably curved upwardly from the one leg of the contactor in order that the point of contact will not be on the slideable portion of the contactor **28** thereby assuring that the slideability of the contactor will not be affected by pitting of a portion of the contact shoe **28***a* due to arcing. The stationary contact **27** is preferably curved to raise or space the point of initial contact or arcing from the supporting surface **30***a* (see FIGURE 2).

In another embodiment of the present invention, as shown in FIGURE 6 of the drawings, the switch housing **110** is in the shape of a disc when it is desirable to secure a plurality of switches **111** together. The switch housing **110** is provided with a pair of spaced transverse openings **112** for receiving a pair of not-shown struts or tie rods permitting assembly of several switch housings **110** to each other or to a not-shown multiple contact rotary switch. The internal construction of the housing **110** supporting the switch parts is of similar construction to the switch shown in FIGURES 1–5 of the drawings except that the terminals **113** and **114** extend outwardly from the side of the housing **110** instead of the rear thereof and the cam **115** is provided with a square bore **116** or the like engageable with a suitable not-shown shaft.

In an additional embodiment of the present invention, as shown in FIGURES 7 and 8 of the drawings, a contactor **121** constructed in accord with the present invention and provided with a cam follower **121***a* and a contact shoe **121***b* is disposed in a housing **122** having a rectilinearly movable cam **123** carried by a switch actuator **123***a*. The cam **123** is biased against the cam follower **121***a* by a spring **124** maintaining the contact shoe **121***b* of the contactor **121** in engagement with a stationary contact **125** when the contactor is in one of the stable positions. The energy stored in the spring **124** is less than the energy required to shift the cam follower **121***a* downwardly thereby assuring a stable position for the cam **123** on either side of the cam follower **121***a*. It is, therefore, not necessary to provide an abutment or a detent receiving indentation respectively for maintaining the contactor biased against the stationary contact **125** or away therefrom. As the cam **123** is shifted longitudinally toward the cam follower in the direction of the arrow **126**, the cam follower **121***a* moves downwardly until disposed in a labile neutral position at which instant the contactor shifts in the opposite direction with a snap action. The cam continues to maintain the contactor in either of the stable positions since further movement of the cam is limited by the edge **127***a* of the slot **127**. A contactor **130** as shown in FIGURE 9 of the drawings, can also be employed with a rectilinearly movable or rotatable cam **131** thereby providing a SPDT switch. Two contactors **130** can be employed in parallel when a DPDT switch is desired.

In still another embodiment of the present invention as shown in FIGURE 10 of the drawings, a stationary contact **140** extends inwardly of a housing **141** and is integral therewith for engaging a contactor **142** when the contactor **142** is in the second stable position. Shoulder **143** provides another limit when the contactor **142** is shifted in the other direction shown by arrow **144**. Such switch construction is preferable whenever one side of a circuit is connected to ground as in electrical circuits for automobiles. Thus only five parts are necessary for obtaining optimum or ideal snap action of a contactor in a switch, namely the housing **141**, the contactor **142**, a supporting member **145**, a guide arm **146** and a cam **147**. Moreover, when the switch is connected in combination with another control such as a variable resistance control, additional parts can be eliminated, e.g., an additional cover for the variable resistance control is not necessary and the cam **147** becomes an integral part of a driver of the variable resistance control. When the spring **142***a* of the contactor **142** functions as the contact engaging portion of the contactor, it is preferable that a fulcrum be disposed on the other side of the center line of the guide arm **146** and, when the guide arm is employed in various embodiments, a pair of fulcrums can be formed on the guide arm or an elongated fulcrum **148** as shown in FIGURE 10 of the drawings can be employed.

While there has been illustrated and described what is at present considered to be a preferred embodiment of the present invention, and several modifications thereof, it will be appreciated that numerous changes and modifications are likely to occur to those skilled in the art, and it is intended in the appended claims to cover all those changes and modifications which fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a switch, the combination of an electrically nonconductive supporting member, a terminal having a stationary contact carried by the supporting member, a second terminal fixed to the supporting member, a movable spring contactor supported by the second terminal, first means for limiting the amount of movement of the contactor away from the stationary contact, said movable spring contactor including means integral with the contactor for establishing a conductive path between the stationary contact and the second terminal, second means for maintaining the movable spring contactor in a first position biased against the stationary contact, a resilient cam follower integral with the movable spring contactor, and a cam movable in an interference path with the cam follower thereby to compress the cam follower to a labile neutral position as the cam moves into engagement therewith, said movable spring contactor rapidly moving with

a snap action in a direction opposite to the direction of movement of the cam.

2. An electrical switch comprising an electrically nonconductive supporting member, a pair of terminals mounted in the supporting member in spaced relationship to each other, a movable contactor, guide means integral with one of the terminals for guiding the contactor from a first position to a second position, resilient means including a cam follower integral with the movable contactor, and a cam movable in an interference path with the cam follower thereby to compress the cam follower to a labile neutral position as the cam moves into engagement therewith, said movable contactor rapidly moving with a snap action in a direction opposite to the direction of movement of the cam.

3. In an electrical switch, the combination of a housing, a pair of terminals disposed in the housing in spaced relationship to each other, a stationary contact connected to one of the terminals, a movable contactor, the other terminal supporting the movable contactor and electrically connected therewith while the movable contactor is in or out of engagement with the stationary contact, resilient means integral with the movable contactor, and cam means engageable with a portion of the resilient means and movable in an interference path with the movable contactor, the cam means initially compressively moving the resilient means to a labile neutral position before movement of the contactor occurs, continued movement of the cam means releasing the resilient means whereby the movable contactor rapidly moves with a snap action in a direction opposite to the direction of movement of the cam means, and means for maintaining the movable contactor in a position out of engagement with the stationary contact, said means comprising an indentation for receiving said resilient means only when the movable contactor is out of engagement with the stationary contact.

4. An electrical switch comprising a housing provided with an electrically nonconductive supporting surface, a stationary contact disposed adjacent to the surface of the housing, a movable contactor mounted in the housing and movable from a first position where the contactor engages the stationary contact to a second position, means for maintaining the movable contactor in one of the positions, a detent integral with the movable contactor and engageable with said means, and a cam movable in a direction opposite to the direction of movement of the contactor for moving the contactor from the first position to the second position after the contactor is biased to a labile neutral position.

5. An electrical switch comprising a housing, a stationary contact disposed in the housing, a contactor slideably mounted in the housing, said contactor comprising a detent, a contact shoe, and a resilient portion connecting the detent to the contact portion, the housing being provided with an indentation for receiving the detent, and a cam movable in a direction opposite to the intended direction of movement of the contactor for moving the contactor from a first position where the contactor engages the stationary contact to a second position and for shifting the detent into and out of the indentation.

6. An electrical switch comprising an electrically nonconductive supporting member, a pair of terminals mounted on the supporting member in spaced relationship to each other, a movable spring contactor, detent receiving means for maintaining the movable spring contactor in a first stable position and for limiting movement of the movable spring contactor from the first stable position to a second position, a resilient detent connected to the contactor, and engageable with the detent receiving means for retention thereby, a cam having surfaces in an interference path with the resilient detent for shifting the detent into and out of engagement with the detent receiving means, and a cam driver integral with the cam, displacement of the cam driver causing one of the surfaces of the cam to engage with and compressively displace the resilient detent to a labile neutral position storing energy therein, the stored energy being released rapidly when the lobe of the cam passes the resilient detent, the movable spring contactor rapidly moving with a snap action motion in a direction opposite to the direction of movement of the cam when the lobe of the cam passes the resilient detent.

7. In an electrical switch, the combination of a supporting surface, conductive means disposed in fixed relationship to the supporting surface, a stationary contact, a contactor movably supported for limited movement on the conductive means while the contactor is in or out of engagement with the stationary contact, a resilient cam follower integral with the contactor, a displaceable driver supported for movement relative to the supporting surface, and a cam carried by and displaced with the driver, the cam having surfaces in an interference path with the resilient cam follower, displacement of the driver causing one of the surfaces of the cam to engage with and compressively displace the resilient cam follower thereby to move the resilient cam follower to a labile neutral position and store energy therein, said stored energy being released with a snap action motion when the cam passes the center of the resilient cam follower in one direction, the contactor rapidly moving with a snap action in a direction opposite to the direction of movement of the cam.

8. The device of claim 7 wherein the stationary contact engageable by the contactor is mounted adjacent to the supporting surface, and a fulcrum is carried by the conductive means for pivotally moving the contactor when slideably shifted from one position to another.

9. An electrical switch comprising an electrically conductive cylindrical housing having an apertured end wall, an electrically nonconductive supporting member closing one of the end walls of the cylindrical housing, a stationary contact integral with the cylindrical housing, a slideable contactor, a guide terminal carried by the supporting member, a platform mounted on the supporting member defining a contactor retaining portion engageable with the contactor and cooperating with the guide terminal for limiting transverse and longitudinal movement of the contactor, the contactor being in engagement with the guide terminal while the contactor is in or out of engagement with the stationary contact, a detent connected to the contactor, a detent receiving indentation cooperating with the contactor retaining portion, and a cam for moving the detent into and out of the detent receiving indentation thereby moving the contactor into and out of engagement with the stationary contact.

10. In an electrical switch, the combination of a cylindrical housing having an apertured wall, an electrically nonconductive supporting member fixedly secured to the housing and closing the wall, a pair of terminals mounted in the supporting member in spaced relationship to each other, a stationary contact connected to one of the terminals, supporting means provided on the other terminal, a movable contactor on the supporting means for movement into or out of engagement with the stationary contact, retaining means for maintaining the movable contactor in a first position out of engagement with the stationary contact, said retaining means limiting movement of the movable contactor in one direction, the stationary contact limiting movement of the movable contactor in the opposite direction, a resilient cam follower integral with the movable contactor, and a cam for engaging and compressively displacing said resilient cam follower integral with the movable contactor and storing energy therein, said stored energy being released with a snap action motion thereby to snap the movable contactor into or out of engagement with the stationary contact.

11. The electric switch of claim 10 wherein said retaining means includes a detent receiving indentation disposed to receive the resilient cam follower and thereby maintain the movable contactor in a first position, and an abutment

cooperating with the resilient cam follower for maintaining the movable contactor in a second position.

12. An electrical switch comprising a housing, a terminal provided with a stationary contact fixedly secured to the housing, a contactor having a pair of resiliently connected legs slideably mounted in the housing, a guide arm longitudinally guiding and limiting movement of the contactor, terminals connected to the stationary contact and to the guide arm, a contact shoe integral with the one leg of the contactor, a cam follower integral with the other leg of the contactor and movable from a first position to a second position with respect to the one leg, and a cam movable in a direction opposite to the intended direction of movement of the contactor for shifting the cam follower from the first position to the second position before the contact shoe is slideably shifted into engagement with the stationary contact.

13. In an electrical control, the combination of a cylindrical housing having apertured end walls, a base closing one of the end walls fixedly secured to the housing, means defining a resistance path and a conductive path carried by the base, a supporting member closing the other end wall fixedly secured to the housing, a driver disposed in the housing between the base and the supporting member, rotatable means supporting the driver in the housing, means carried by the driver for wiping contact with the first mentioned means, a movable contactor, means for limiting movement of the contactor, a resilient cam follower integral with the contactor, a terminal disposed in the housing and supporting the movable contactor, and a cam carried by the driver for engaging and compressively displacing the cam follower and storing energy in the movable contactor, said stored energy being released with a snap action motion whereby the movable contactor rapidly moves in a direction opposite to the direction of movement of the cam.

14. The control of claim 13, wherein a stop member is carried by the driver and extends from the same side of the driver as the cam and a stop disposed in the housing limits angular rotation of the driver when engaged by the stop member.

15. The control of claim 13, wherein a plurality of feet extend inwardly of the supporting member and cooperate with the housing for aligning the supporting member with the housing.

16. In a component, the combination of a contactor supporting member, a contactor slideably supported for limited movement on the contactor supporting member, resilient means including a cam follower integral with the contactor, and means for sliding the contactor along the supporting member, the means for sliding the contactor comprising a cam having surfaces in an interference path with the cam follower, displacement of the cam causing one of the surfaces of the cam to engage with and compress the resilient means to a labile neutral position, said contactor rapidly moving with a snap action motion in a direction opposite to the direction of movement of the cam as the cam follower is moved through the labile neutral position.

17. In a control, means providing a contact surface, a movable contactor having a portion thereof adapted for sliding movement across the contact surface, a resilient cam follower forming an integral part of the movable contactor, and a cam having surfaces in an interference path with the cam follower and operably engageable with the cam follower, displacement of the cam causing one of the surfaces of the cam to engage with and compress the resilient cam follower to a labile neutral position, said contactor rapidly moving with a snap action motion in a direction opposite to the direction of movement of the cam as the resilient cam follower moves beyond the labile neutral position.

18. A snap switch comprising a housing having open ends, insulating means closing said open ends of said housing, a control shaft rotatably journaled in said housing and projecting through one of the insulating means, a rotor in said housing and carried by and displaced with said shaft, a plurality of terminal means carried by another one of said insulating means, groove means within said housing, one of said terminal means being predeterminately spaced from the other terminal means, displaceable spring means supported on one of said terminal means, a section of said spring means normally interfitting with said groove means so that said spring means is compressively retained thereby, and boss means carried by and displaced with said rotor, said boss means having surfaces and an apex in an interference path with said section of said spring means, displacement of said shaft causing one of said surfaces of said boss means to engage with and compressively displace said spring means storing energy therein, the stored energy being released with a snap action motion when the apex of said boss means passes said section of said spring means thereby displacing said spring means so that said section of said spring means disengages said groove means and said spring means is guided by said boss means to a position substantially between said terminal means thereby allowing said spring means to engage with said terminal means and be compressively retained against said terminal means.

19. A switch comprising a housing having open ends, insulating means closing said open ends of said housing, a control shaft rotatably journaled in said insulating means and projecting through one of said insulating means, a rotor in said housing and carried by and displaced with said shaft, a plurality of terminal means carried by another one of said insulating means, groove means within said housing, one of said terminal means being predeterminately spaced from the other of said terminal means, displaceable spring means supported on one of the terminal means and a section of said spring means normally interfitting with said groove means so that said spring means is compressively retained by the groove means, and boss means carried by and displaced with said rotor, said boss means having surfaces in an interference path with said section of said spring means, displacement of said shaft causing one of said surfaces of said boss means to engage with and compressively displace said spring means storing energy therein, the stored energy being released with a snap action motion when the apex of said boss means passes said section of said spring means thereby displacing said spring means so that said section of said spring means disengages said groove means and said spring means is guided by said boss means to a position substantially between said terminal means thereby allowing said spring means to engage with said terminal means and be compressively retained against said terminal means, said rotor carrying wiper nib means wipably engageable with resistance means carried by said one insulating means, said wiper nib means being displaced on said resistance means by displacement of said shaft thereby varying the resistance of said resistance means.

20. A two-position switch comprising a housing having open ends, means closing said open ends of said housing, a control shaft rotatably journaled in the housing, a rotor in said housing carried by and displaced with said shaft, a plurality of terminal means carried by one of said means closing said open ends of the housing, a displaceable spring contactor supported by one of said plurality of terminal means for moving into and out of engagement with another of said plurality of terminal means for making and breaking an electrical connection therebetween, said displaceable spring contactor movable through a labile neutral position while being moved into and out of engagement with said another of said plurality of terminal means, energy being stored in the displaceable spring contactor while in the labile neutral position, means within the housing including a detent groove for compressively retaining the displaceable spring contactor out of engagement with said another of said terminal means, and boss means carried by and displaced with said rotor, said boss means

having surfaces in an interference path with said displaceable spring contactor for shifting the displaceable spring contactor through the labile neutral position, displacement of said shaft causing one of said surfaces of said boss means to engage with and compressively displace said spring contactor to the labile neutral position storing energy therein, said stored energy being released with a snap action when said boss means passes said displaceable spring contactor to release the displaceable spring contactor from the labile neutral position, the displaceable spring contactor rapidly moving with a snap action in a direction opposite to the direction of movement of the boss means when the displaceable spring contactor is released from the labile neutral position, whereby the displaceable spring contactor may alternately compressively engage said terminal means and said detent groove.

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