March 8, 1966 W. N. SCHINK ETAL 3,239,615

KEY-OPERATED ELECTRICAL SWITCH WITH A MOVABLE INSULATOR HAVING DETENTS

Filed Dec. 3, 1962 2 Sheets-Sheet 1

FIG. 1

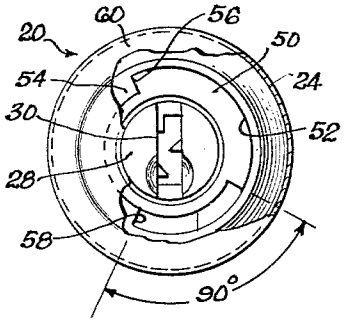


FIG. 2

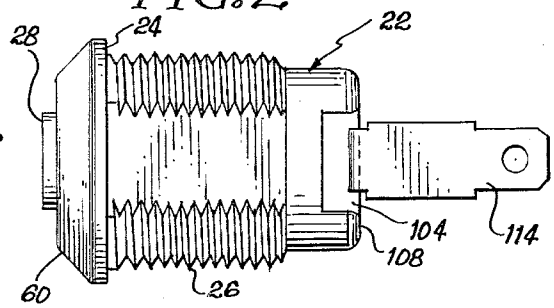


FIG. 3

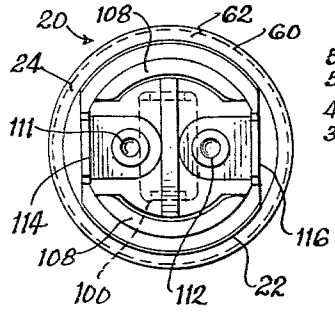


FIG. 4

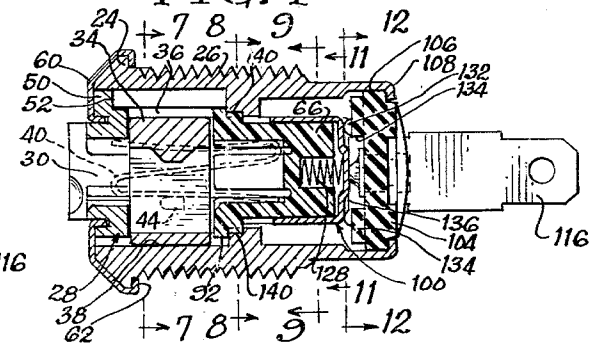


FIG. 5

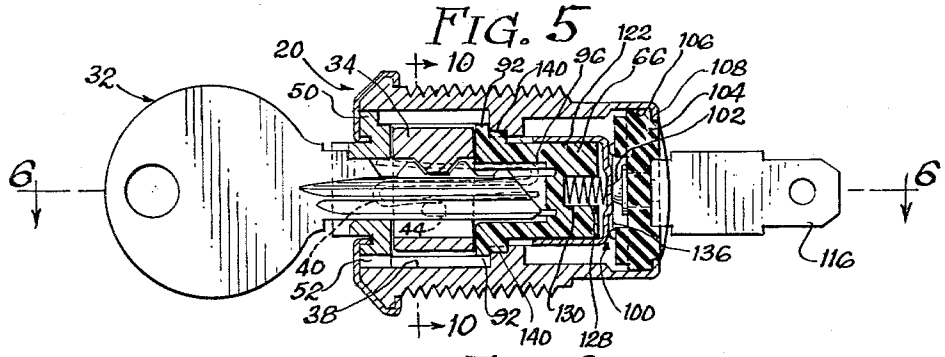
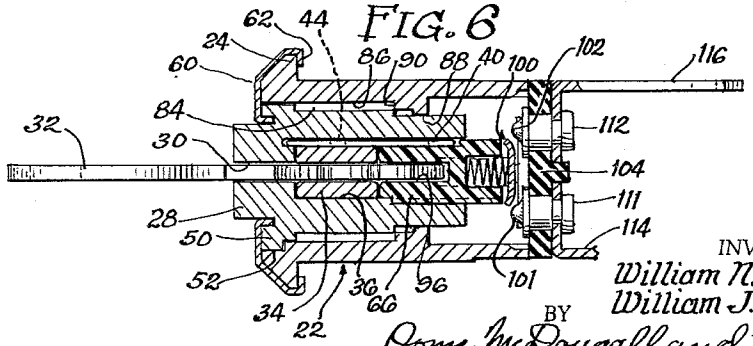


FIG. 6



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FIG. 7

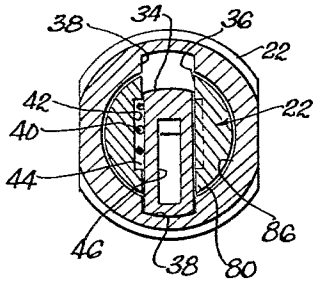


FIG. 8

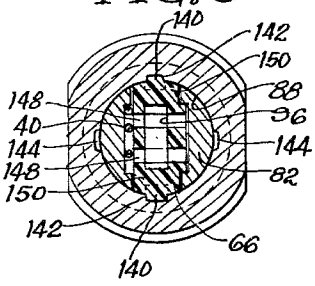


FIG. 9

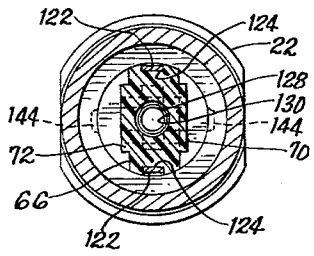


FIG. 10

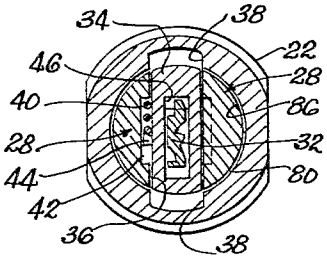


FIG. 11

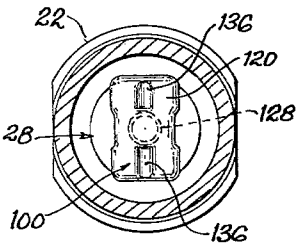


FIG. 12

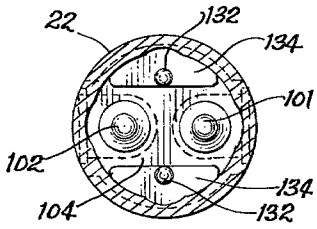


FIG. 13

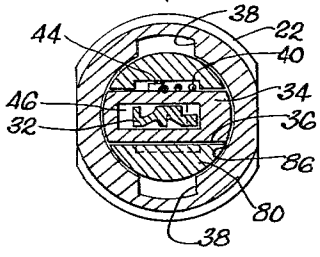


FIG. 14

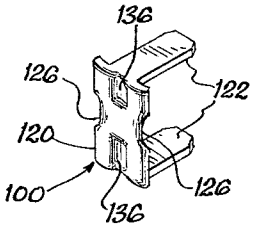


FIG. 15

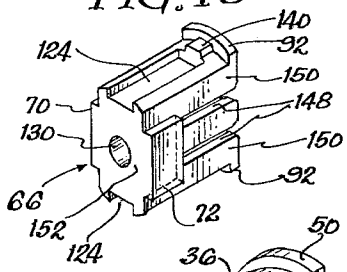


FIG. 16

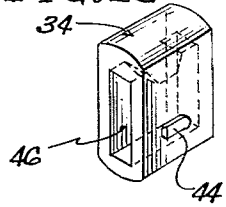


FIG. 17

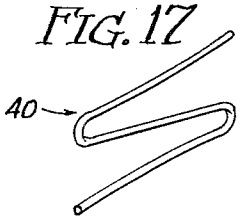
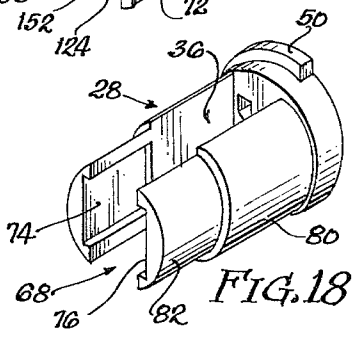


FIG. 18



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United States Patent Office 3,239,615 Patented Mar. 8, 1966

3,239,615

KEY-OPERATED ELECTRICAL SWITCH WITH A MOVABLE INSULATOR HAVING DETENTS

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Filed Dec. 3, 1962, Ser. No. 241,835
6 Claims. (Cl. 200—44)

This invention relates to electrical switches and pertains particularly to switches which are key operated. Such switches are commonly employed in the ignition circuits of internal combustion engines, and for many other purposes.

One object of the present invention is to provide a key-operated switch which is extremely compact and low in cost, yet is positive and dependable in operation.

A further object is to provide a new and improved switch having a movable insulator which not only carries the contactor of the switch but also provides integral detent elements which cooperate with grooves or other detent means on the case of the switch.

Another object is to provide a new and improved switch of the foregoing character in which the inherent resilience of the insulator is employed to bias the detent elements on the insulator into engagement with the detent recesses on the case.

A further object is to provide such a new and improved switch in which the insulator is effectively U-shaped, with a pair of longitudinal legs which are flexible and resilient for biasing the detent elements against the case.

It is another object to provide a new and improved switch of the foregoing character in which the legs are defined by longitudinal slots extending part way along the insulator.

A further object is to provide a new and improved switch in which the insulator engages and retains the tumbler or tumblers in the rotatable carriage of the switch.

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

FIG. 1 is a front elevational view of a key-operated electrical switch to be described as an illustrative embodiment of the present invention, certain parts of the switch being broken away for clarity of illustration.

FIG. 2 is a side elevational view of the switch.

FIG. 3 is a rear elevational view of the switch.

FIG. 4 is a central longitudinal section of the switch.

FIG. 5 is a view similar to FIG. 4 but showing the position of the switch after the operating key has been inserted.

FIG. 6 is a longitudinal section, taken generally along a line 6—6 in FIG. 5.

FIG. 7 is a cross section taken through the tumbler mechanism of the switch, generally along the line 7—7 in FIG. 4.

FIG. 8 is a cross section, taken generally along the line 8—8 in FIG. 4, and showing the detents on the insulator.

FIG. 9 is a cross-sectional view, taken generally along the line 9—9 in FIG. 4.

FIG. 10 is a section similar to FIG. 7 but showing the position of the switch after the operating key has been inserted, the view being taken generally along the line 10—10 in FIG. 5.

FIG. 11 is a sectional view looking forwardly, generally along the line 11—11 in FIG. 4.

FIG. 12 is a sectional view looking rearwardly, generally along the line 12—12 in FIG. 4.

FIG. 13 is a view similar to FIG. 10 but showing the position of the switch after the operating key has been rotated through approximately 90 degrees.

FIG. 14 is a perspective view showing the contactor of the switch.

FIG. 15 is a perspective view showing the movable insulator of the switch.

FIG. 16 is a perspective view showing the tumbler.

FIG. 17 is a perspective view showing the Z-shaped tumbler spring.

FIG. 18 is a perspective view showing the rotatable carriage of the switch.

As already indicated, the drawings illustrate a key-operated electrical switch 20 which is of the cylinder type, useful for automotive ignition switching and many other applications. Thus, the switch 20 comprises a generally cylindrical case 22 formed at its front end with a mounting flange 24. Behind the flange 24, the case 20 has a threaded outer portion 26 for receiving any suitable nut, not shown, whereby the switch may be mounted in a hole formed in a panel, bracket or the like.

A generally cylindrical carriage 28 is rotatably mounted within the case 20. It will be seen that a longitudinal key slot 30 is formed in the carriage 28. A key 32 is adapted to be received in the slot 30.

The lock 20 may be provided with one or more tumblers adapted to prevent rotation of the carriage 28 until the proper key has been inserted into the slot 30. In this case, a single tumbler 34 is slidably mounted in a transverse tumbler opening or slot 36 formed in the rotatable carriage. When the key 32 is inserted, the ends of the tumbler are flush with the outside of the rotatable carriage 28. When the key is withdrawn, the tumbler 34 is moved into a locking groove or slot 38 formed in the case 22. As shown to advantage in FIG. 4, a Z-shaped tumbler spring 40, preferably made of spring wire, is connected between the rotatable carriage 28 and the tumbler to bias the tumbler along the tumbler slot 36 so that the tumbler tends to enter the locking slot 38. As shown to advantage in FIG. 10, the tumbler spring 40 is mounted in a recess 42 which is formed in the rotatable carriage on one side of the tumbler slot 36. The tumbler spring 40 is compressed between one side of the recess 42 and a tab or projection 44 on one side of the tumbler 34. The key 32 is adapted to be inserted through a slot 46 extending through the tumbler 34. Of course, the slot 46 is aligned with the key slot 30 in the carriage 28.

It will be seen from a comparison of FIGS. 10 and 13 that the carriage 28 is rotatable through approximately 90 degrees. Such rotation is limited by a segmental flange 50 (FIG. 1) formed on the front end of the carriage 28. The flange 50 is movable in a segmental groove 52 and is engageable with a segmental member 54 on the case 22. In the initial open position of the switch, one end of the segmental flange 50 engages a stop shoulder 56 at one end of the stationary member 54. When the rotatable carriage 28 has been turned through 90 degrees in a clockwise direction, the other end of the flange 50 engages a stop shoulder 58 on the other end of the stationary member 54.

In this case, the rotatable carriage 28 is retained within the case 22 by means of a sheet metal ring or collar 60 which covers the mounting flange 24 and the front end of the case 22. The collar 60 may be secured to the case 22 by means of a flange 62 which is bent or spun behind the mounting flange 24.

In the illustrated switch, an insulator 66 is slidably mounted in a slot 68 formed in the rear portion of the rotatable carriage 28. The insulator slot 68 may be a continuation of the slot 36 which receives the tumbler 34. The insulator 66 may be generally in the form of a

block and may be made of a suitable plastic or other insulating material.

As shown to advantage in FIG. 15, the sides of the insulator **66** may be formed with ribs or raised guides **70** and **72**. Grooves **74** and **76** may be formed in the rotatable carriage **28** on the sides of the slot **68** to receive the ribs **70** and **72** so as to prevent the insulator **66** from shifting laterally in the slot **68**, while providing for movement of the insulator **66** in the slot **68** in a direction parallel to the longitudinal axis of the carriage **28**. It will be seen that the front portion of the rib **72** is omitted or cut away to provide room for the Z-shaped tumbler spring **40**. The groove **76** in the rotatable carriage **28** may constitute an extension of the recess **42** for the tumbler spring **40**.

The tumbler slot **36** and the insulator slot **68** are formed in front and rear portions **80** and **82** of the rotatable carriage **28**. It will be seen that the rear portion **82** is reduced in diameter relative to the front portion **80**. The carriage **28** is rotatable in stepped bore **84** formed in the case **22**. The bore **84** has a front portion **86** of relatively large diameter in which the larger front portion **80** of the carriage **28** is received. The bore **84** also has a reduced rear portion **88** in which the reduced rear portion **82** of the carriage **28** is received. An annular shoulder **90** is formed between the front and rear portions **86** and **88** of the bore **84**. To engage the shoulder **90**, a pair of flanges **92** may be formed on the insulator **66**. The engagement of the flanges **92** with the shoulder **90** restrains the rearward movement of the insulator **66**.

It will be apparent from FIGS. 4–6 that the rear side of the tumbler is slidably engaged with the front side of the insulator **66**. Thus, the insulator **66** retains the tumbler **34** in the tumbler slot **36** against rearward movement, while permitting movement of the tumbler **34** in a direction transverse to the longitudinal axis of the carriage **28**.

The front portion of the insulator **66** may be formed with a key slot **96** which is adapted to receive the end portion of the key **32**. The key slot **96** in the insulator is aligned with the similar slot **46** in the tumbler **34**. The illustrated slot **96** extends only part way through the insulator **66**.

One important purpose of the insulator **66** is to support a movable contactor **100** which is adapted to engage a plurality of contacts or points **101** and **102** mounted on an insulating terminal board or wall **104**. It will be seen from FIGS. 4 and 5 that the insulating board **104** closes the rear end of the case. An enlarged counter bore or recess **106** may be formed in the rear portion of the case **22** to receive the board **104**. In this case, the board **104** is retained by a flange **108** which is turned or bent inwardly from the case **22** behind the board **104**.

The contacts **101** and **102** may be formed on the front ends of rivets **111** and **112** extending through the terminal board **104**. Suitable terminals **114** and **116** may be connected to the rivets **111** and **112**. It will be seen that the contact points **101** and **102** project forwardly beyond the front surface of the terminal board **104**, for engagement by the contactor **100**.

The illustrated contactor **100**, as shown to advantage in FIG. 14, comprises a generally rectangular bar portion **120** formed with a pair of legs **122** extending perpendicular to the ends of the bar portion **120**. In this case, grooves **124** are formed in the narrower sides of the insulator **66** for slidably receiving the legs **122**, so as to guide the contactor **100** for movement along the longitudinal axis of the rotatable carriage **28**. The bar portion **120** of the contractor **100** may be perpendicular to the rotary axis of the rotatable carriage **28**.

Initially, the contactor **100** is out of engagement with the contact points **101** and **102**. The initial direction of the bar portion **120** is perpendicular to a line extending between the contact points **101** and **102**. The bar portion **120** is formed with a pair of notches **126** to avoid initial engagement between the contactor and the contact points **101** and **102**.

The illustrated contactor **100** is biased rearwardly by a spring **128** which is preferably of the coiled compression type and is disposed between the insulator **66** and the bar portion **120** of the contactor **100**. In this case, the spring **128** is mounted in a bore or recess **130** formed in the rear end of the insulator **66**. In addition to biasing the contactor **100** rearwardly, the spring **128** biases the insulator **66** forwardly so as to maintain the insulator in slidable engagement with the tumbler **34**.

In its initial position, shown in FIG. 11, the contactor **100** engages a pair of projections or knobs **132** which are formed on the front side of the insulating bore **104**. The knobs **132** are formed on bosses or steps **134** which project forwardly from the front surface of the terminal board **104** on which the contact points **101** and **102** are mounted. The knobs **132** and the steps **134** prevent the contactor **100** from engaging the contact points **101** and **102** until the contactor has been rotated through approximately 90 degrees to bring the bar portion **120** of the contactor **101** into alignment with the contact points.

The rear surface of the contactor **100** is formed with a pair of grooves or recesses **136** for receiving the contact points **101** and **102**. The grooves **136** are also adapted to receive the knobs **132** when the comtactor is in its initial position.

In accordance with one feature of the present invention, the insulator **66** is arranged to serve as a detent member, in addition to providing an insulating support for the contactor **100**. Thus, one or more detent projections **140** are formed on the insulator **66**, preferably adjacent the flanges **92**. The detent projections **140** extend radially beyond the narrower sides of the insulator **66**. Two sets of detent notches or grooves **142** and **144** are formed in the inside of the case **22** to receive the detent projections **140**. The detent recesses **142** and **144** may be formed in the reduced bore **88** just behind the shoulder **90**. In this case, the detent projections **140** are received in the detent grooves **142** when the insulator **66** is in its initial position, as shown in FIG. 8. When the carriage **28** and the insulator **66** have been rotated through 90 degrees, the detent projections **140** are received in the grooves **144**.

The construction of the insulator **66** is such that the inherent resilience of the insulator is employed to bias the detent projections **140** outwardly for reception in the detent grooves **142** and **144**. To this end, the insulator **66** is preferably formed with a pair of slots **148** extending part way along the longitudinal dimension of of the insulator. The slots **148** effectively divide the insulator **66** into a pair of legs **150** extending longitudinally from a connecting portion **152** at the rear end of the insulator **66**. The slots **148** are formed in the front portion of the insulator **66**. It will be noted that the legs **150** and the connecting portion **152** form a generally U-shaped structure. The provision of the slots **148** enables the legs **150** to flex inwardly and outwardly to a considerable extent so as to provide for the movement of the detent projections **140** out of the detent notches **142** and **144**. The resilience of the legs **150** and the connecting portion **152** biases the detent projections **140** outwardly so that they tend to be retained in the detent notches **142** and **144**.

When the insulator **66** is in its initial position, as shown in FIG. 8, the detent projections **140** are received in the detent notches **142**. When the insulator **66** is rotated along with the carriage **28**, the insulator **66** must be turned with sufficient force to flex the legs **150** inwardly, so as to permit the detent projections **140** to move out of the detent notches **142**. After the carriage **28** and the insulator **66** have been rotated through approximately 90 degrees, the detent projections **140** snap into the other set of detent recesses **144**. It is advantageous to make the insulator **66** from a resilient wear-resistant plastic such as nylon or Delrin.

It will be recognized that the electrical switch of the present invention is very ingenious and compact in its construction. It is also effective and dependable in operation. The detent action of the insulator considerably reduces the cost and complexity of the switch.

Various modifications, alternative constructions and equivalents may be employed without departing from the true spirit and scope of the invention, as exemplified in the foregoing description and defined in the following claims.

We claim:

1. In an electrical switch,
the combination comprising a case having a bore therein,
a carriage rotatably mounted in said bore,
an insulator having body means mounted on said carriage,
a contactor mounted on said insulator,
contact means disposed in said case for engaging said contactor,
flexible resilient longitudinal leg means formed in one piece with said insulator,
first detent means on said leg means,
and second detent means on said case for engaging said first detent means,
said leg means resiliently biasing said first detent means into operative engagement with said second detent means,
said insulator having longitudinal slot means formed therein between said body means and said leg means of said insulator and extending from one end thereof part way along said insulator toward the opposite end thereof.

2. In an electrical switch,
the combination comprising a case having a bore therein,
a carriage rotatably mounted in said bore,
an insulator having body means mounted on said carriage,
a contactor mounted on said insulator,
contact means disposed in said case for engaging said contactor,
a plurality of flexible resilient longitudinal leg means formed in one piece with said insulator,
a plurality of first detent means on said leg means,
and a plurality of second detent means on said case for engaging said first detent means,
said leg means resiliently biasing said first detent means into operative engagement with said second detent means,
said insulator having longitudinal slot means formed therein between said body means and said leg means of said insulator and extending from one end thereof part way along said insulator toward the opposite end thereof.

3. In an electrical switch,
the combination comprising a case having a bore therein,
a carriage rotatably mounted in said bore,
said carriage having a transverse insulator slot therein,
an insulator having body means slidably mounted in said insulator slot,
a contactor mounted on said insulator,
contact means disposed in said case for engaging said contactor,
a pair of flexible resilient longitudinal leg means formed in one piece with said insulator,
a pair of first detent means on said leg means,
and a pair of second detent means on said case for engaging said first detent means,
said leg means resiliently biasing said first detent means into operative engagement with said second detent means,
said insulator having longitudinal slot means formed therein between said body means and said leg means of said insulator and extending from one end thereof part way along said insulator toward the opposite end thereof.

4. In a key operated electrical switch,
the combination comprising a casing having a bore therein,
a carriage rotatably mounted in said bore,
said carriage having a forwardly opening key slot therein,
a tumbler slot extending transversely in said carriage and intersecting said key slot,
a tumbler slidably mounted in said tumbler slot,
a spring biasing said tumbler in one direction in said tumbler slot,
a transverse insulator slot formed in said carriage behind said tumbler slot,
an insulator having body means slidably received in said insulator slot,
a contactor mounted on the rear portion of said insulator,
a terminal board mounted in the rear end of said casing,
a plurality of contacts mounted on said terminal board for engagement by said contactor,
a spring disposed between said insulator and said contactor and biasing said contactor for engagement with said contacts,
a pair of flexible resilient longitudinal leg means formed in one piece with said insulator,
a first pair of detent means on said leg means,
and a second pair of corresponding detent means on said casing for engaging said first detent means,
said leg means resiliently biasing said first detent means into operative engagement with said second detent means,
said insulator having a pair of spaced longitudinal slots formed therein between said leg means on said body means of said insulator and extending from one end thereof part way along said insulator toward the opposite end thereof.

5. In a key operated electrical switch,
the combination comprising a case having a bore therein,
a carriage rotatably mounted in said bore,
said bore having a larger front portion and a relatively smaller rear portion,
said carriage having a larger front portion received in said front portion of said bore,
said carriage having a reduced rear portion received in said smaller rear portion of said bore,
a longitudinal key slot extending through said carriage,
a transverse slot formed in said carriage,
said transverse slot having a front portion intersecting with said key slot and extending through said larger front portion of said carriage,
a tumber slidably received in said front portion of said transvserse slot,
said transverse slot having a rear portion formed in the rear portion of said carriage,
an insulator mounted in said rear portion of said transverse slot,
the front of said insulator being slidably engaged with the rear of said tumbler,
a flange on the front portion of said insulator and received in the larger front portion of said bore for retaining said insulator and said tumber in said transverse slot in said carriage,
a plurality of stationary contacts disposed in said casing behind said insulator,
a contactor mounted on said insulator for sliding movement in a front to rear direction,
said contactor being engageable with said contacts,
a spring disposed between said contactor and said insulator for biasing said contactor rearwardly while biasing said insulator forwardly,

a plurality of flexible resilient longitudinal leg means formed in one piece with said insulator,
a plurality of first detent means on said leg means,
and a plurality of second detent means on said case for engaging said first detent means,
said leg means resiliently biasing said first detent means into operative engagement with said second detent means,
said insulator having longitudinal slot means formed therein between said body means and said leg means of said insulator and extending from one end thereof part way along said insulator toward the opposite end thereof.

6. In a key operated electrical switch,
the combination comprising a case having a bore therein,
a carriage rotatably mounted in said bore,
said bore having a larger front portion and a relatively smaller rear portion,
said case having a shoulder between said larger front portion and said smaller rear portion of said bore,
said carriage having a larger front portion received in said front portion of said bore,
said carriage having a reduced rear portion received in said smaller rear portion of said bore,
a longitudinal key slot extending through said carriage,
said carriage having a transverse slot therein,
said transverse slot having a front portion intersecting with said key slot and extending through said larger front portion of said carriage,

a tumbler slidably received in said front portion of said transverse slot,
said transverse slot having a rear portion formed in and extending through the rear portion of said carriage,
an insulator mounted in said rear portion of said transverse slot,
the front of said insulator being slidably engaged with the rear of said tumbler,
flange means on the front portion of said insulator and received in the larger front portion of said bore and against said shoulder for retaining said insulator and said tumbler in said transverse slot in said carriage,
a plurality of contacts disposed in said case behind said insulator,
and a contactor mounted on said insulator for engaging said contacts.

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ROBERT K. SCHAEFER, *Examiner.*