United States Patent [19]

Bradshaw

[11] **3,790,729**

[45] **Feb. 5, 1974**

[54] **ELECTRIC SWITCH ASSEMBLIES WITH SPRING BIASED ROTATABLE KNOB ACTUATOR FOR GEAR SHIFT LEVER OR THE LIKE**

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[22] Filed: **Nov. 23, 1971**

[21] Appl. No.: **201,462**

[30] **Foreign Application Priority Data**

Nov. 27, 1970	Great Britain	56,558/70
Apr. 30, 1971	Great Britain	12,359/71
June 18, 1971	Great Britain	28,612/71

[52] **U.S. Cl.** ..... **200/61.88,** 200/11 J

[51] **Int. Cl.** **H01h 21/24,** H01h 9/06

[58] **Field of Search**. 200/11, 14, 42, 16 A, 44, 155, 200/157, 61.76, 61.78, 61.88, 61.28, 166 BA, 172

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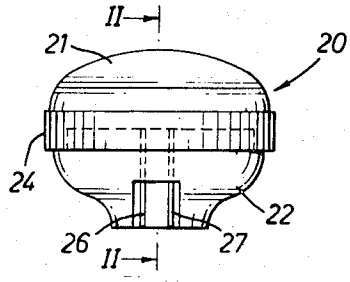
Primary Examiner—J. R. Scott

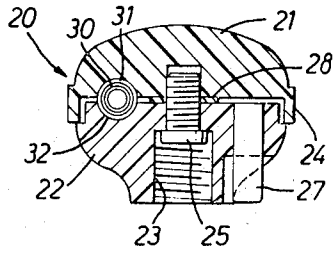
Attorney, Agent, or Firm—McGlew & Tuttle

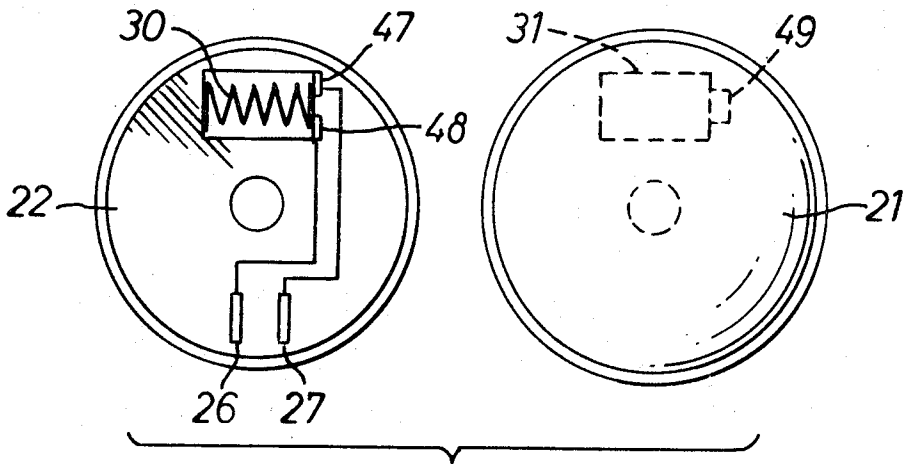
[57] **ABSTRACT**

An electric switch in the shape of a knob arranged for mounting on the end of a mechanical control lever, the knob being in two parts of which one is rotatable to perform an electrical switching function. The switch is preferably spring biassed to a 'normal' position by a compression spring lying between the two parts.

15 Claims, 13 Drawing Figures







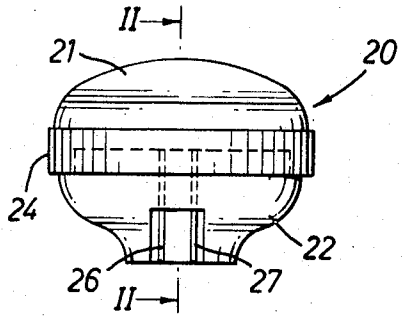


FIG. 1

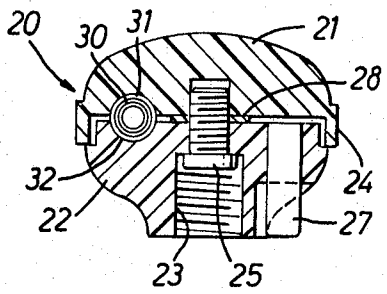


FIG. 2

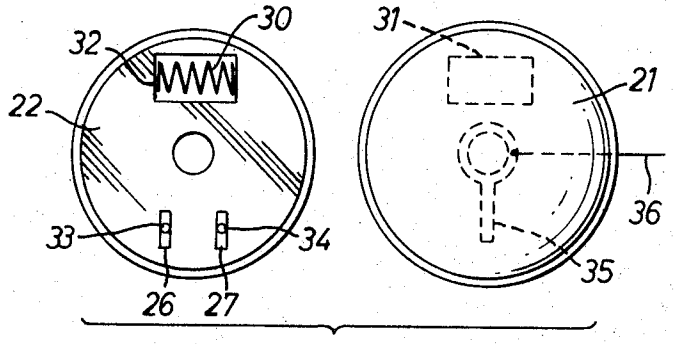


FIG. 3

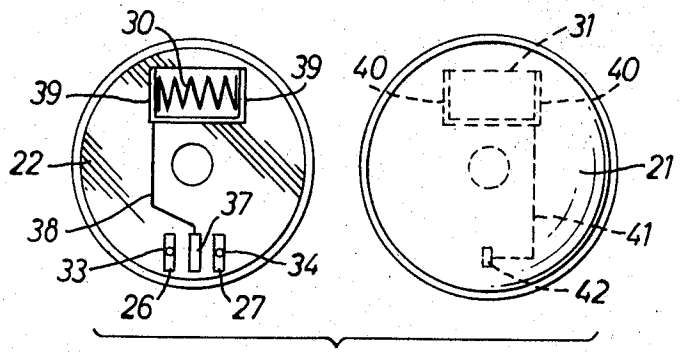


FIG. 4

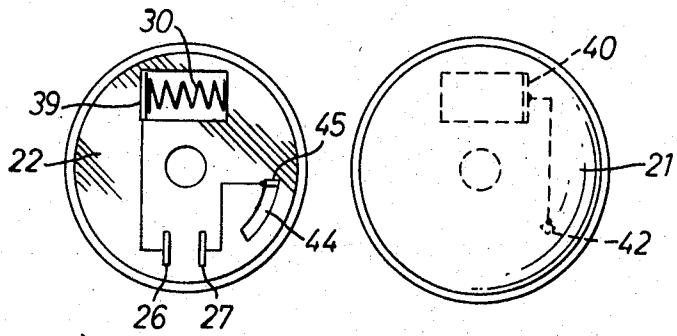


FIG. 5

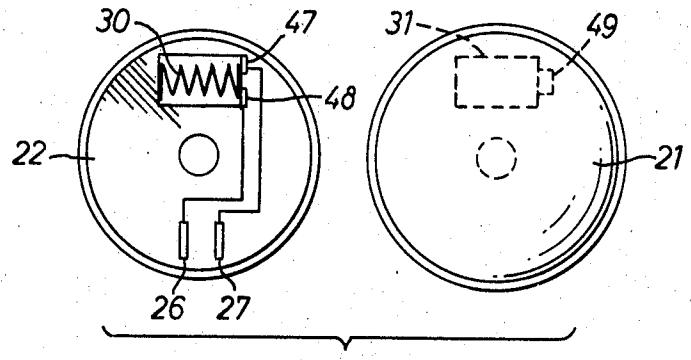


FIG. 6

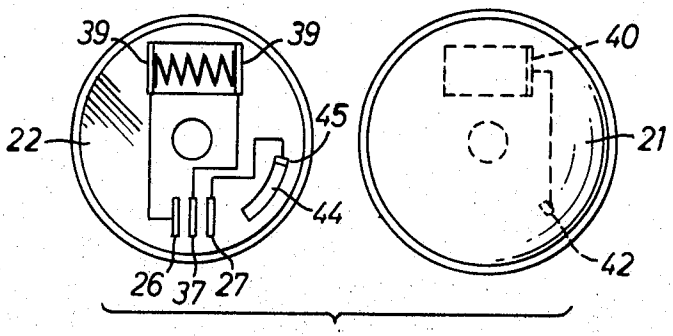


FIG. 7

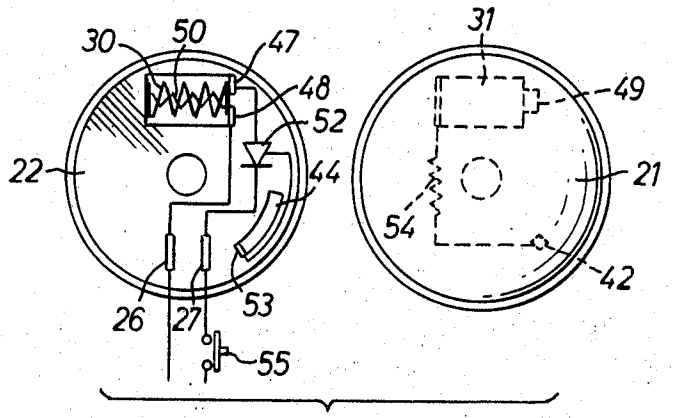


FIG. 8

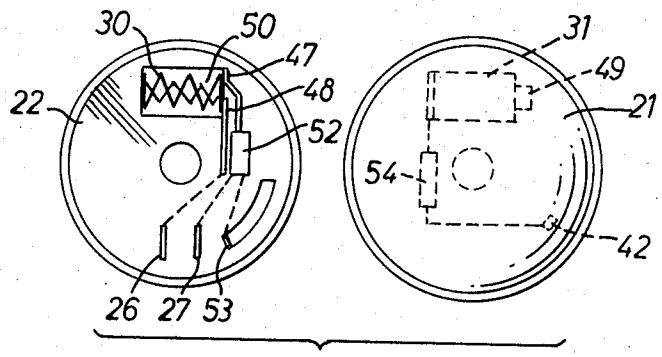


FIG. 9

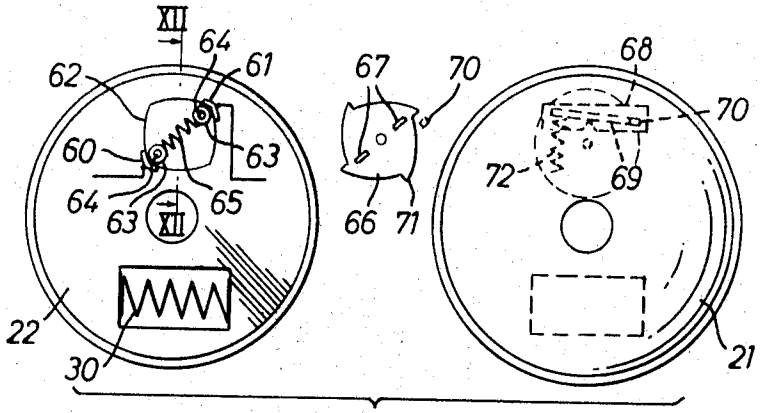


FIG. 10

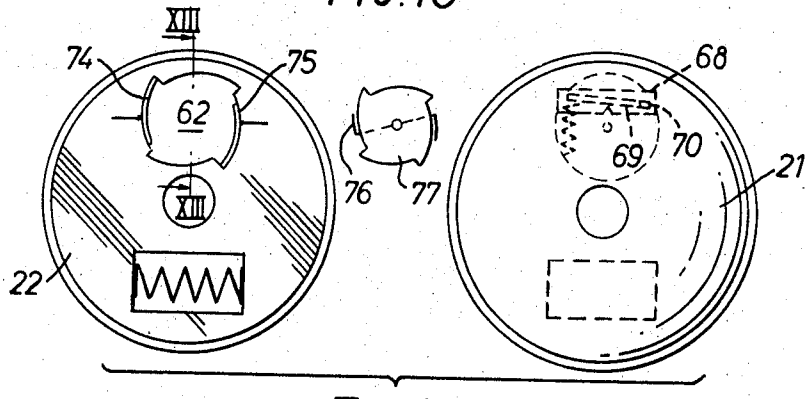


FIG. 11

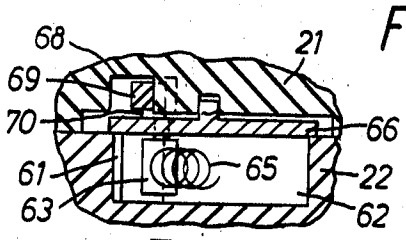


FIG. 12

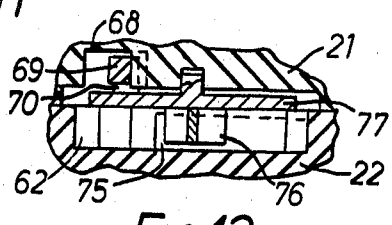


FIG. 13

ELECTRIC SWITCH ASSEMBLIES WITH SPRING BIASED ROTATABLE KNOB ACTUATOR FOR GEAR SHIFT LEVER OR THE LIKE

BACKGROUND OF THE INVENTION

This invention relates to electric switches.

In many mechanical applications, a lever is used to control a machine function, and the lever has a knob at its end. Normally, the knob is solid and immovable. A common example is the knob on a car gear lever.

Such a knob for mechanical control could, however, be advantageously employed to allow an operator to perform an additional, simultaneous, electrical control function. In the above example, the switching of an overdrive system for the gearbox.

SUMMARY OF THE INVENTION

It is the object of the invention to provide a suitable electric switch for the above purpose.

According to a first aspect of the invention, there is provided an electric switch comprising a housing, mounting means for attaching the housing to the free end of a rod or bar, and switch components within the housing, the housing being of bulbous shape and formed in at least two parts which are rotatable relative to each other about an axis substantially parallel with the centre axis of the free end of the bar or rod on which the switch is to be mounted, and means effecting interengagement of the components and the housing parts so that the relative rotation causes actuation of the switch components.

According to another aspect of the invention, there is provided a control knob having mounting means for attachment to the free end of a rod or bar, the knob being formed in two parts to form a housing, and switch components within the housing operable by relative rotary motion of the two parts about an axis lying parallel with the axis of the end of the rod or bar on which the knob is to be mounted.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention shall be clearly understood, a number of exemplary embodiments thereof will now be described with reference to the accompanying drawings, in which:

FIG. 1 shows an elevation of a switch according to the invention;

FIG. 2 shows a section on line II-II in FIG. 1;

FIG. 3 shows, in plan view and side-by-side, the two co-operable parts 21,22 of a simple form of two-way switch;

FIG. 4 shows similarly another form of two-way switch;

FIG. 5 shows similarly a switch with a single 'make' facility;

FIG. 6 shows similarly a switch with a single 'break' facility;

FIG. 7 shows similarly a switch in which a single movement both breaks one circuit and makes another;

FIG. 8 shows a diagrammatic view similar to FIGS. 3 to 7 of a switch embodying a thyristor;

FIG. 9 shows, in plan view and side-by-side, the two co-operable parts of a switch constructed in accordance with the diagrammatic view of FIG. 8;

FIG. 10 shows diagrammatically a switch of the push-push type;

FIG. 11 shows diagrammatically another switch of the push-push type;

FIG. 12 is a cross-section taken along the line XII — XII of FIG. 10; and

FIG. 13 is a cross-section taken along the line XIII—XIII of FIG. 11.

In FIGS. 3 to 11, the upper part 21 of the switch is shown on the right-hand side, and the lower part 22 of the switch is shown on the left-hand side.

So far as possible throughout the drawings, like reference numeral designate like parts.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 and 2 shows a switch on the form of a circular, bulbous knob 20 suitable for use as the knob of a vehicle gear lever. The knob is formed of an upper part 21 and a lower part 22, the plane of their division being perpendicular to the axis of a circular, threaded recess 23. This recess allows the knob to be screwed on the end of a rod or lever (not shown). The outer perimeter of the knob has a knurled rib 24 which also acts as a seal around the division between the two knob parts. The two parts are held together by a bolt 25 inserted through the recess 23. Two electrical terminals 26, 27 are moulded into the lower part 22. A third electrical connection may be made through the rod or lever to which the knob is attached by forming the recess 23 by means of a conductive metal bush, which in turn is contacted by the bolt 25.

A washer 28 lies between the upper and lower parts, and the two parts are relatively rotatable. The limits of this rotation are set by a coil spring 30 which lies under compression in two hemicylindrical recesses 31, 32 formed respectively in the upper and lower parts 21, 22. By this arrangement, the two parts are located, but they can be rotated relatively just so far in either direction as the spring 30 will allow as it is compressed.

These two figures do not illustrate the electrical contacts of the switch. The various forms which these may take, and the switching which may be performed will now be described with reference to other figures of the drawings.

A very simple form of two-way switch is illustrated in FIG. 3. A view of the switch when assembled would have the upper part 21 simply superimposed on the lower part. This convention is adopted for a number of the figures of the drawings.

In FIG. 3, electrical connections are made to the terminals 26, 27, which form contacts 33, 34 inside the switch. A third connection 36 is made through the centre of the switch to a radial conducting arm 35. In the 'normal' position, in which the relative positions of the upper and lower parts are determined only by the spring 30, the arm 35 lies midway between the contacts 33, 34. If the upper part 21 is now rotated clockwise, arm 35 touches contact 33, thus making one circuit. If alternatively the upper part is rotated anti-clockwise, arm 35 touches contact 34, making a second circuit.

An alternative way of achieving two-way switching is shown in FIG. 4. In this case the third connection is made to a third terminal 37 lying between terminals 26 and 27. This is connected internally, by means of a conductor 38 moulded into the lower part 22, to contacts 39 at both ends of the recess 32. Corresponding contacts 40 in recess 31 lead via a conductor 41 moulded in the upper part 21 to a contact pin 42 pro-

jecting downwardly from the latter. When assembled, the spring **30** completes the connection from terminal **37** to pin **42.**

In the normal position, the pin **42** lies midway between contacts **33, 34.** Rotation of the upper part causes contact between pin **42** and either contact **33** or **34** to make one of two circuits.

In FIG. **5,** terminals **26** and **27** do not themselves have contacts. Terminal **26** is connected internally to a contact **39** in recess **32.** At the opposite end of recess **31** is a contact **40,** with an internal connection to pin **42.** The latter projects downwardly into an arcuate recess **44.** This has a contact **45** connected internally to terminal **27.**

In the normal position, pin **42** projects freely into recess **44.** Anti-clockwise rotation of the upper part **21** will make contact between pin **42** and contact **45,** thus making a circuit.

FIG. **6** illustrates a simple break-only switch. In this case the upper part **21** has no internal connections. The two terminals **26,27** of the lower part **22** have internal connections to two spaced contacts **47, 48** at the right-hand end of recess **32.** With the switch in the normal position, these two contacts are connected by spring **30** which bears against both simultaneously. When the upper part **21** is rotated anti-clockwise, the right hand end of its recess **31** causes the spring **30** to be lifted away from the contacts **47, 48,** thus breaking the circuit as soon as the part **21** is rotated.

In a modified version, a second compression spring (not shown) is positioned within the spring **30.** A hemicylindrical recess **49** of a width suitable to receive the second spring is included as an extension of the recess **31.**

In the normal position, both springs now contact the contacts **47, 48.** When the part **21** is turned the spring **30** is compressed, but the second spring is not, because the recess **49** slides over it. Thus the contact is not broken immediately. Only when the part **21** has turned sufficiently for the end surface of the recess **49** to contact and compress the second spring does the switch open. Thus the switch cannot be operated accidentally.

FIG. **7** shows a slightly more complex switch in which rotation anti-clockwise of part **21** causes one circuit to be broken and, shortly after, another circuit to be made. As can be seen, a third terminal **37** is connected via an internal conductor to contact **39** in recess **32,** through the spring **30** to a further contact **39** and back via an internal conductor to terminal **26.** In the normal position, this circuit is complete, but is broken as soon as the part **21** is rotated anti-clockwise.

The upper part **21** has a contact **40** at the right hand end of recess **31,** connected by an internal conductor to a contact pin **42.** This pin remains in contact with the spring **30,** and thus electrically connected to terminal **26,** as the part **21** is turned. When pin **42** reaches contact **45** in recess **44,** a circuit is completed between terminals **26** and **27.**

FIG. **8** illustrates, with the same diagrammatic convention, an on-off switch according to the invention which employs a thyristor to form effectively a self-holding relay. The mechanical features of the switch have all been described previously. Contacts **47, 48** are normally closed by springs **30, 50,** and an additional recess **49** is provided. Terminal **26,** which is the live side of the circuit to be controlled, is connected directly to contact **48;** contact **47** is connected through a thyristor **52** to terminal **27.** A contact **53** in recess **44** is connected to the firing terminal of the thyristor. In the upper part **21,** a pin **42** is connected via a limiting resistor **54** to contact **40** in recess **31.** A main switch **55** lies in the connection to terminal **27.**

The operation will now be described. The on-operation is effected by rotating the upper part **21** clockwise. This brings pin **42,** which is live through resistor **54,** spring **50,** contact **48** and terminal **26,** into contact with contact **53.** This fires the thyristor **52,** which completes the circuit through terminal **26** and contacts **48, 47** back to terminal **27.** Even when the upper part **21** is released, the circuit remains complete.

The circuit can be broken by rotating part **21** anti-clockwise, breaking the connection between contacts **47, 48.** The second spring **50** and recess **49** ensures that this is only effected by a deliberate action. The circuit cannot be re-made without re-firing the thyristor.

This form of switch has a particularly valuable application in the field of motor vehicles, as control for a 'Laycock' overdrive system. The on-off switch described forms the driver's control and simultaneously the knob of the gear lever, upon which his hand must be in any event. The switch **55** in the circuit is the override switch which operates when a gear is selected for which the overdrive is not operative.

FIG. **9** shows a plan view of the lower part **22** and of the upper part **21** of the switch. The conductors are shown dotted as cast-in the two parts.

FIG. **10** illustrates a 'push-push' switch i.e. in which successive operations (rotations) in the same direction cause on and off actions. The diagrammatic convention previously used is again adopted. The two parts **21, 22** are held in a normal position by spring **30.** Two electrical contacts **60, 61** lie in the opposite corners of a generally square recess **62** which has concave side faces. Two metal roller contacts **63,** each with a projecting stub axle **64,** are held spaced apart by a spring **65,** and take up positions at opposite corners of the recess **62.** A separate pawl member **66** overlies the recess, and the axles **64** project into slits **67** in the member. The member is toothed around its outside to form a ratchet surface.

The upper part **21** has an elongate recess **68** in which lies a bar **69.** This has a downwardly projecting peg **70** at one end which can engage the ratchet teeth **71** of the member **66.** The other end is acted on by a spring **72** which urges the peg **70** radially inwards. In the normal position the peg lies at point **70'** relative to member **66.** Upon anti-clockwise movement of the part **21,** the peg pulls the member **66** round with it, thus also swinging the two roller contacts **63** round until they lie across the opposite diagonal of recess **62.** When part **21** is released it returns to its normal position, the peg **70** sliding over the face of member **66** until it falls behind the next ratchet tooth **71.** A second operation repeats the process to bring the roller contacts with their spring back to their original diagonal position. By these means, the circuit through contacts **60, 61** is first broken and then remade.

In an alternative form, a single roller may be used to make contact between two contacts lying one above the other in a single corner of the recess. Pairs of contacts might be placed in each corner, and then a roller or ball at the other end of the spring would need to be non-conductive.

FIG. 11 shows another form of 'push-push' switch, somewhat similar to FIG. 10. In this case, the recess 62 is itself formed in the shape of a ratchet member, and has contacts 74, 75 on opposite faces. Contact between them is made by a shaped spring contact member 76 on the underside of a pawl member 77. Rotation of the latter causes contact to be made or broken between contacts 74, 75. The rotation is produced by an arrangement on the upper part 21 precisely similar to that in FIG. 10.

Apart from the various designs of switch just described, many alternative versions may be devised in which operation may be, for example, clockwise instead of anticlockwise, or which may incorporate additional contacts. Moreover, instead of a biassed arrangement as described using spring 30, the switches may be provided with a click-stop arrangement to positively locate the two parts in two, three, or even more relative positions. A sprung wheel or ball might be suitable for this.

Further, the switch might be divided again to allow a further 'layer' of contacts to be introduced.

Although most conveniently the switch is screwed onto a bar or rod, it is feasible to include instead a clamping arrangment by means of which it may grip the rod.

In addition, the two parts of the housing may be held together by a snap connection, e.g. formed of nylon. The housing in general may be made of any suitable mouldable material.

It will be understood that the above description of the present invention is susceptible to various modification changes and adaptations.

What is claimed is:

1. An electric switch comprising a housing in the shape of a bulbous knob and formed of at least two parts, means mounting said parts for rotation relative to one another about an axis, means for attaching the housing to one free end of a rod-like control lever with said axis co-axial therewith, switch contacts, means positioning said contacts within said housing, a first and a second elongate recess of semicircular cross-section provided complementarily in said parts to form a cylindrical cavity, and coiled compression spring means within said cavity operable between the cavity ends for biassing the two housing parts into a normal relative position.

2. A switch as defined in claim 1, wherein said spring means forms an electrical connection between said switch contacts.

3. A switch as defined in claim 2, wherein said switch contacts are disposed at opposite ends of said cavity in said two parts of said housing, and said spring means forms an electrical connection between said contacts in said normal relative position of said housing parts.

4. A switch as defined in claim 2, wherein said switch contacts are disposed at opposite ends of said cavity in one part of said housing, and said spring means forms an electrical connection between said contacts in said normal relative position of said housing parts.

5. A switch as defined in claim 2, wherein two switch contacts are disposed at one end of said cavity, and said spring means forms an electrical connection between said contacts in said normal relative position of said housing parts.

6. A switch as defined in claim 2, wherein said compression spring means comprises a first coil spring and a second, smaller diameter, coil spring disposed within said first coil spring, both said springs making said connection between said switch contacts and wherein one of said recesses has a longitudinal extension dimensioned to accommodate said smaller diameter coil spring but not said larger diameter coil spring whereby relative rotation of the housing parts in one direction away from their said normal relative position is initially resisted by said first coil and only subsequently and additionally resisted by said smaller coil spring, said connection being meanwhile maintained by said second coil spring.

7. A switch as defined in claim 1, comprising a contact in one part of said housing, a conductive pin in the other part of said housing, and means mounting said pin to project towards said one housing part for engagement with said contact.

8. A switch as defined in claim 7, comprising an arcuate recess in said one housing part and means mounting said pin-engageable contact in said arcuate recess.

9. A switch as defined in claim 1, comprising in said housing a thyristor having a main conductive circuit and a firing circuit, and means electrically coupling said circuits to said contacts for maintaining said main circuit normally closed, said coupling means being cooperative with said contacts positioning means for rendering said main circuit open upon relative rotation of said housing parts in one direction and said firing circuit open upon relative rotation of said housing parts in another direction opposite to said one direction.

10. A switch as defined in claim 1 actuable by relative rotation of said parts away from said normal relative position and automatically returnable thereto by said spring means, wherein said contacts positioning mean comprises a device bearing one of said contacts rotatable relative to another of said contacts fixed within said housing, said switch comprising a ratchet mechanism in one of said housing parts, a peg in the other of said housing parts and projecting towards said one housing part for operating said ratchet mechanism, and means operably connecting said contact device to said ratchet mechanism for imparting continuing stepwise angular displacement of said contact device in response to successive switch actuations.

11. An electric switch comprising a housing forming a bulbous knob having an axis of symmetry, attachment means for attaching said switch to one free end of a rod-like control lever with said axis extending therealong, first and second housing parts forming said housing and having respectively first and second surfaces each defining an elongate recess of semi-circular transverse section, means mounting said housing parts for angular displacement relative to one another about said axis with said first and second surfaces facing and closely adjacent one another to dispose said recesses and complementarily to one another for defining a cylindrical cavity, contact elements at at least one end of said cavity, and electrically conductive coiled compression spring means within said cavity for urging said housing parts against said angular displacement into a normal relative position in which said spring means electrically interconnects said contact elements.

12. An electric switch comprising a housing forming a bulbous knob having an axis of symmetry, attachment means for attaching said switch to one free end of a rod-like control lever with said axis extending therealong, first and second housing parts forming said hous-

ing and having respectively first and second surfaces each defining an elongate recess of semi-circular transverse section, means mounting said housing parts for angular displacement relative to one another about said axis with said first and second surfaces facing and closely adjacent one another to dispose said recesses complementarily to one another for defining a cylindrical cavity, contact elements at at least one end of said cavity, and electrically conductive coiled compression spring means within said cavity for urging said housing parts against said angular displacement into a normal relative position in which said spring means electrically interconnects said contact elements, said spring means comprising a first coil spring having a first diametral dimension, and a second coil spring having a second diametral dimension less than said first diametral dimension disposed within said first coil spring, both said first and second coil springs engaging said contact elements when said housing parts are in their said normal relative position, and wherein, at said one end of said cavity, one of said recesses is provided with an extension of transverse dimension less than said first diametral dimension for accommodating said second coil spring and enabling the latter to electrically interconnect said contact elements until a predetermined angular displacement of said housing parts from said normal relative position is exceeded.

13. A switch as defined in claim **12,** wherein said contact elements are disposed at opposite ends of said cavity in said two parts of said housing.

14. A switch as defined in claim **12,** wherein said contact elements are disposed at opposite ends of said cavity in one part of said housing.

15. A switch as defined in claim **12,** wherein two said contact elements are disposed at one end of said cavity.

* * * * *