United States Patent [19]

Rowley

[11] **3,792,219**

[45] **Feb. 12, 1974**

[54] **PUSHBUTTON SWITCH WITH COIL SPRING MOVABLE CONTENT WEDGINGLY ENGAGEABLE WITH STATIONARY HOUSING CONTACT**

[75] Inventor: **Paul M. Rowley,** Bexley, Ohio

[73] Assignee: **Robertshaw Controls Company,** Richmond, Va.

[22] Filed: **June 30, 1972**

[21] Appl. No.: **267,891**

[52] **U.S. Cl.** ..... **200/159 R,** 200/166 BA

[51] **Int. Cl.** **H01h 13/52,** H01h 1/18

[58] **Field of Search** ... 200/159 R, 166 BA, 153 M, 200/153 LA

[56] **References Cited**

UNITED STATES PATENTS

959,435	5/1910	Thomson	200/166 BA
2,444,552	7/1948	Brantingson	200/166 BA X
2,907,852	10/1959	Long et al.	200/159 R
1,859,981	5/1932	Norviel	200/159 R
2,572,335	10/1951	Hafke	200/159 R X
3,211,872	10/1965	Baer	200/166 BA X

FOREIGN PATENTS OR APPLICATIONS

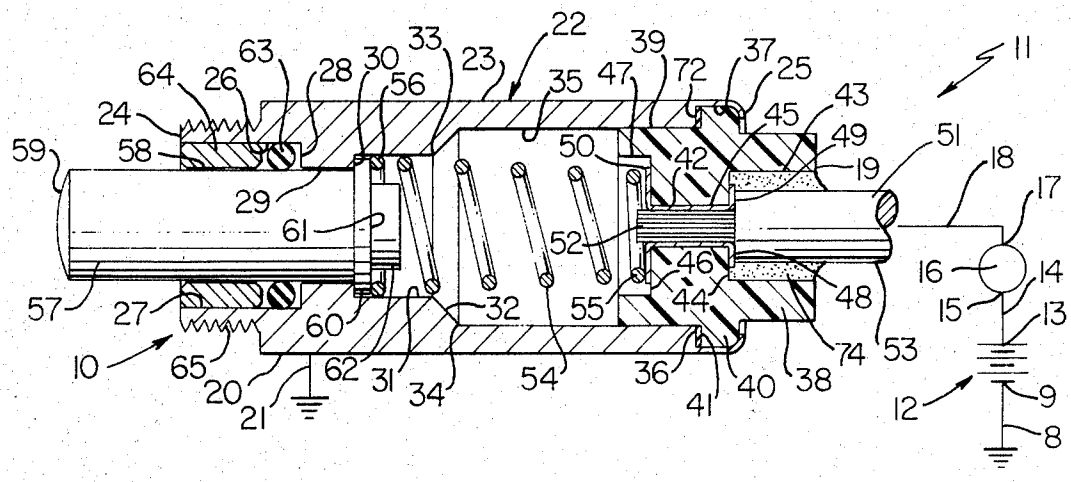
606,437	7/1960	Italy	200/159 R

Primary Examiner—Robert K. Schaefer
Assistant Examiner—Robert A. Vanderhye
Attorney, Agent, or Firm—James T. Candor

[57] **ABSTRACT**

An electrical switch construction having a housing and a movable plunger carried by the housing. A compression spring is carried by the housing and is engageable with the plunger, the spring when in one operative position being in wedged relation with the housing to provide an electrical circuit through the spring to the housing at the wedging engagement therebetween. The spring, housing and plunger are so constructed and arranged that when the plunger is moved to a certain position relative to the housing, the spring is moved out of its wedging relation with the housing to break the electrical circuit therethrough.

20 Claims, 3 Drawing Figures



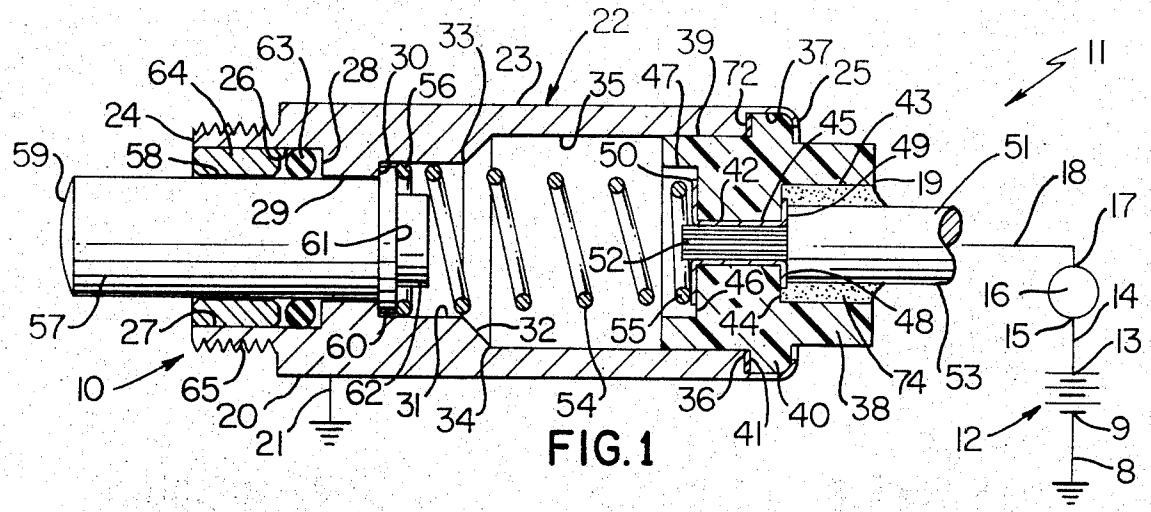


FIG. 1

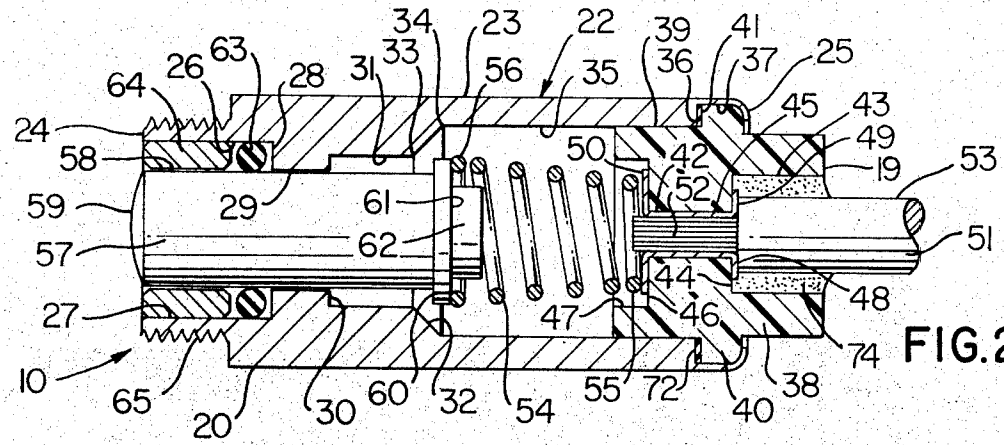


FIG. 2

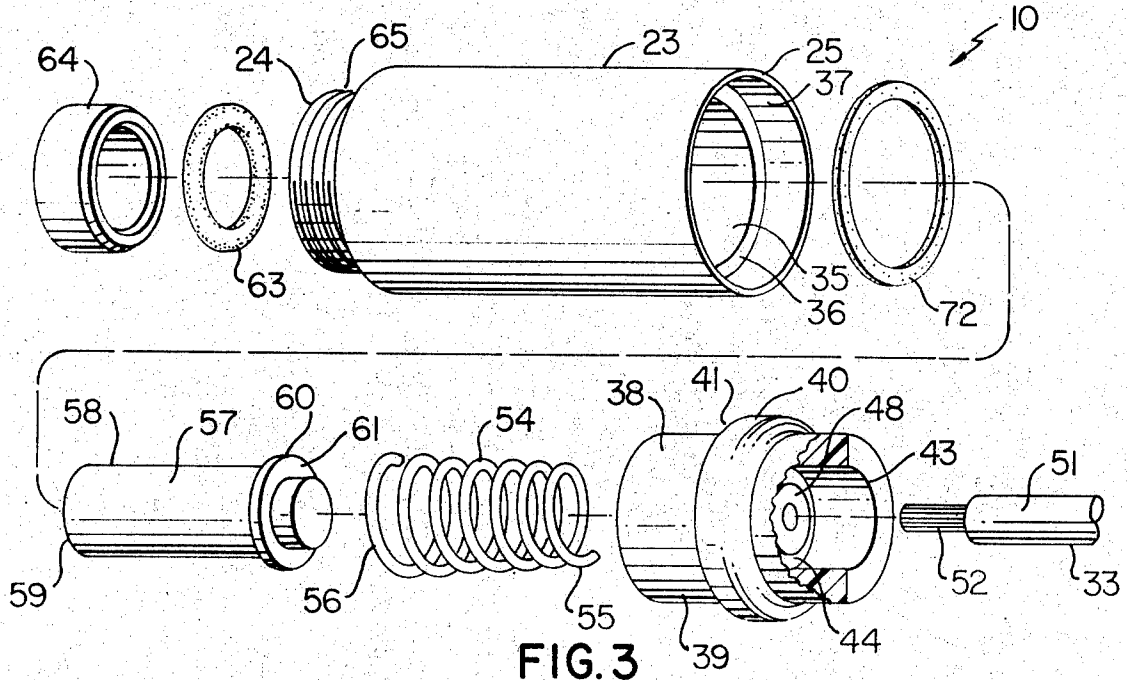


FIG. 3

PUSHBUTTON SWITCH WITH COIL SPRING MOVABLE CONTENT WEDGINGLY ENGAGEABLE WITH STATIONARY HOUSING CONTACT

This invention relates to an improved electrical switch construction as well as to an electrical control system utilizing such electrical switch construction.

Push button operated electrical switch constructions are well known in the art for various uses such as an interlock switch with a gasoline engine wherein a lead wire is to be connected to a grounded housing of the switch construction when the push button thereof is released. For example, releasing of the push button of the electrical switch construction can short out the ignition of the gasoline engine in emergencies. Another typical application of such a push button switch construction is an automotive application wherein a dome light or warning light is operated when a door is open and thus releases the push button of the electrical switch construction.

Accordingly, it is a feature of this invention to provide an improved electrical switch construction of the above push button type.

In particular, one embodiment of this invention provides an electrical switch construction having a housing means and a movable plunger means carried by the housing means. A compression spring means is carried by the housing means and is engageable with the plunger means. The spring means when in one operative position is in a wedged relation with the housing means to provide an electrical circuit through the spring means to the housing means at the wedging engagement therebetween. The spring means, housing means and plunger means are so constructed and arranged that when the plunger means has been moved to a certain position relative to the housing means, the spring means is moved out of its wedging relation to break the electrical circuit through the electrical switch construction.

Accordingly, it is an object of this invention to provide an improved electrical switch construction having one or more of the novel features set forth above or hereinafter shown or described.

Another object of this invention is to provide an electrical control system utilizing such electrical switch construction.

Other objects, uses and advantages of this invention are apparent from a reading of this description which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIG. 1 is a cross-sectional view of the improved electrical switch construction of this invention and schematically illustrates the electrical control system utilizing such electrical switch construction.

FIG. 2 is a view similar to FIG. 1 and illustrates the push button electrical switch construction moved to another operative position thereof.

FIG. 3 is an exploded perspective view of the various parts of the electrical switch construction of this invention.

While the various features of this invention are hereinafter illustrated and described as being particularly adaptable to provide an electrical switch construction which is adapted to complete an electrical circuit through a grounded housing of the electrical switch construction, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide an electrical switch construction for other uses as desired.

Therefore, this invention is not to be limited to only the embodiment illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIG. 1, the improved electrical switch construction of this invention is generally indicated by the reference numeral **10** and is schematically illustrated as controlling an electrical control circuit that is generally indicated by the reference numeral **11** and comprising an electrical power source **12** having one side **9** grounded by a lead **8** and the other side **13** interconnected by a lead **14** to one side **15** of a control device **16** having the other side **17** thereof interconnected by a lead **18** to one side **19** of the electrical switch construction **10** while the other side **20** of the electrical switch construction **10** is interconnected by a lead **21** to ground.

Thus, it can be seen that when the electrical switch construction **10** completes the electrical circuit between the sides **19** and **20** thereof in a manner hereinafter set forth, an electrical circuit is completed so that the electrical power source **12** can operate the control device **16.** However, when the electrical switch construction **10** is operated to break the electrical circuit between the sides **19** and **20** thereof, the electrical power source **12** can no longer operate the device **16.**

The electrical switch construction **10** of this invention comprises a housing means that is generally indicated by the reference numeral **22** in FIG. **1** and comprises an electrically conductive tubular part **23** having opposed ends **24** and **25** that are respectively interrupted by a stepped passage **26** passing completely through the housing member **23.** The stepped passage **26** forms a first cylindrical portion **27** at the end **24** of the member **23,** an annular shoulder **28,** a reduced cylindrical portion **29,** an annular shoulder **30,** a larger diameter cylindrical portion **31,** a frusto-conical portion **32** having its smaller base **33** interconnected to the cylindrical portion **31** and its larger base **34** interconnected to a larger diameter cylindrical portion **35,** an annular shoulder **36** and a larger diameter cylindrical portion **37** at the end **25** of the housing member **23.**

A second housing part **38** is disposed in the end **25** of the housing part **23** to close the end **25** and is formed of electrically non-conductive material, such as plastic or the like. The housing part **38** includes a first cylindrical portion **39** telescoped within the cylindrical part **35** of the passage **26** of the housing part **23** and has a larger cylindrical part **49** defining a shoulder **41** therewith that is adapted to abut against the shoulder **36** of the housing part **23.** If desired, a sealing gasket **72** can be disposed between the shoulder means **41** and **36** to seal the housing part **38** within the housing part **23** as illustrated with the larger cylindrical part **40** of the housing part **38** being telescoped within the cylindrical part **37** of the passage **26** of the housing part **23.**

After the housing part **38** has been assembled with the housing part **23** as illustrated in FIG. **1,** the end **25** of the housing part **23** can be turned over as illustrated to secure the housing part **38** in place.

A passage **42** passes through the housing part **38** and defines a first cylindrical part **43,** an annular shoulder **44,** a reduced cylindrical part **45,** an annular shoulder **46** and a large diameter cylindrical part **47.** A metallic

eyelet **48** is disposed in the passage **45** as illustrated so that one flanged end **49** of the eyelet **48** is disposed against the annular shoulder **44** of the housing part **38** while the other flanged end **50** of the eyelet **48** is disposed against the shoulder **46.**

The lead **18** can comprise an electrical cable **51** having the electrical strands or wire **52** thereof passing through the eyelet **48** as illustrated and be soldered or otherwise electrically fastened thereto so that the insulation **53** of the cable **51** will be received within the cylindrical part **43** of the housing part **38** and be sealed therein by a suitable plastic sealing material **74** as illustrated whereby the conductive part **52** of the cable **51** is electrically insulated by the housing part **38** from the conductive and grounded housing part **23.**

A coiled compression spring **54,** formed of metal or other conductive material, is disposed within the housing part **23** and has opposed ends **55** and **56,** the end **55** being fastened to the flanged end **50** of the eyelet **48** so as to be fixed from movement within the housing means **22** while being in electrically conductive relation with the lead **18** as illustrated. If desired, the conductive strands or wire **52** of the cable **51** can also be soldered directly within the end **55** of the spring **54.**

The compression spring **54** is so constructed and arranged that the same has a frusto-conical configuration with the end **56** being the larger base thereof and being of such a size that when the same is received within the cylindrical part **31** of the passage **26** of the housing part **23** as illustrated in FIG. **1,** the first two or three turns of the spring **54** at the end **56** is radilly inwardly compressed by the cylindrical part **31** of the housing **23** so as to be disposed in wedging relation therewith and, thus, in good electrical contact with the housing part **23** at the cylindrical part **31** thereof. However, when the end **56** of the spring **54** is moved from the cylindrical part **31** of the passage part **26** of the housing **23** to within the larger cylindrical part **35** of the passage **26** as illustrated in FIG. **2** in the manner hereinafter described, it can be seen that the wedging relation of the end **56** of the spring **54** with the housing part **23** is terminated so that the end **56** of the spring **54** is no longer in electrical contact with the housing part **22** whereby the circuit between the sides **19** and **20** of the electrical switch construction **11** is broken for a purpose hereinafter set forth.

A push button or plunger means **57** is carried by the housing means **22** and has a cylindrical part **58** passing through the cylindrical part **29** of the passage **26** of the housing part **23** and out through the open end **24** thereof to define an end **59** which can be engaged to push the push button **57** from the position illustrated in FIG. **1** to the position illustrated in FIG. **2** in opposition to force of the spring **54** to open the electrical circuit through the switch construction **10.**

In particular, the push button **57** has a disk-like end part **60** at the right-hand end thereof which is adapted to be received within the cylindrical part **31** of the passage **26** of the housing part **23** and abut against the shoulder **30** as illustrated in FIG. **1** by the force of the compression spring **54** acting against the side **61** of the flange or disk **60** of the push button **57** so as to limit outward movement of the push button **57** relative to the housing means **22.** If desired, a cylindrical part **62** can extend from the flange part **60** of the push button **57** to be received within the end **56** of the spring **54** to provide a guide means therefor as will be apparent hereinafter.

If desired, a suitable O-ring seal **63** can be disposed within the cylindrical part **27** of the passage **26** in the housing part **23** and about the cylindrical part **58** of the push button **57** to seal the passage **26** from the exterior thereof at the shoulder means **28.** A cylindrical bearing means **64** can also be disposed in the end **24** of the housing part **23** to hold the O-ring **63** in place and also to guide axial movement of the push button **57** relative thereto.

The housing part **23** can have an exteriorly threaded portion **65** at the end **24** thereof to permit fastening of the housing means **22** to the desired structure, such as to a door frame or the like so that the closing of the door will cause the door to engage against the end **59** of the push button **57** and push the same to its "in" position illustrated in FIG. **2** when the door is in its closed position. However, the push button **57** is then adapted to move to the "out" position illustrated in FIG. **1** when the door is moved to an open position thereof.

The operation of the electrical switch construction **10** of this invention as utilized in the electrical control system **11** of this invention will now be described.

When the push button **57** of the electrical switch construction **10** is in the "out" position illustrated in FIG. **1,** it can be seen that the end **56** of the frusto-conical shaped compression spring **54** is forced into the small diameter cylindrical part **31** of the passage **26** of the housing part **23** by the force of the compression spring **54** so that the first few turns of the spring **54** at the end **56** thereof is disposed in wedging relation with the cylindrical part **31** of the housing part to provide good electrical contact therebetween. Thus, the lead **18** of the electrical control system **11,** by being electrically interconnected to the end **55** of the spring **54** at the side **19** of the switch construction **10,** is effectively interconnected to ground through the spring **54** and housing part **23** to the grounded lead **21** so that the electrical power source **12** can now operate the control device **16.**

For example, the control device **16** can comprise a dome light of an automobile and the electrical power source **12** can comprise the storage battery thereof with the electrical construction **10** being a door-operated switch of the automobile. Thus, when the car door that operates the particular switch **10** is in the open position to cause the plunger **57** be in the "out" condition illustrated in FIG. **1,** the dome light **16** is now operated by the electrical power source **12** as the electrical circuit is completed through the switch construction **10.**

However, when the door is closed to engage against the end **59** of the plunger **57** and move the same inwardly from the position illustrated in FIG. **1** to the position illustrated in FIG. **2,** the plunger means **57** has moved the end **56** of the spring **54** completely out of the chamber **31** of the housing part **23** and into the larger diameter chamber **35** whereby the end **56** of the spring **54** is now held out of electrical contact with the housing part **23** so that the electrical circuit between the sides **19** and **20** of the switch construction **10** is broken and, thus, the control device **16** is no longer operated by the power source **12.** Thus, in the case of an automobile door switch, the dome light **16** will be in its "off" condition if the door for the particular switch construction **10** is in its closed position as illustrated in

FIG. 2 and will be in its "on" condition when the door is open.

It can be seen that the cylindrical part **62** of the plunger means **57** guides the movement of the end **56** of the compression spring **54** into the larger diameter cylindrical part **35** of the housing means **23** so as to hold the same in a centered position therein so as to be completely out of electrical contact with the housing part **23** whereby the lead **18** cannot be grounded through the switch construction **10** under this "in" condition of the spring **54.**

From the above, it can be seen that this invention provides an improved switch construction **10** that can be formed of a relatively few parts and be assembled in a simple and effective manner to provide a switch construction that can operate an electrical control system for opening and closing the circuit means thereof. The sealing means of the switch construction **10** also renders the switch construction **10** of this invention desirable for outdoor applications or anywhere that conductive or corrosive liquids may be splashed on the switch construction **10.**

Thus, this invention not only provides an improved electrical switch construction, but also this invention provides an electrical control system utilzing such switch construction.

While the form of the invention now preferred has been disclosed as required by the patent statutes, other forms may be utilized and all come with the scope of the appended claims.

What is claimed is:

1. An electrical switch construction comprising a housing means having a generally cylindrical internal peripheral surface, a movable plunger means carried by said housing means, and a coiled compression spring means having a longitudinal axis and being carried by said housing means, said spring means being engageable with said plunger means, said spring means when in one operative position being in wedged relation radially outwardly of said axis thereof with said internal peripheral surface of said housing means to provide an electrical circuit through said spring means to said housing means at said wedging engagement therebetween, said spring means and said housing means and said plunger means being so constructed and arranged that when said plunger means is moved to a certain position relative to said housing means said spring means is moved out of its wedging relation to break said electrical circuit by being compressed along its said longitudinal axis.

2. An electrical switch construction as set forth in claim **1** wherein said housing means has a chamber therein, said spring means being disposed in said chamber.

3. An electrical switch construction as set forth in claim **2** wherein said spring means has opposed ends, one of said ends being disposed at one end of said chamber and the other end being movable relative to said housing means by said plunger means.

4. An electrical switch construction comprising a housing means, a movable plunger means carried by said housing means, and a compression spring means carried by said housing means and being engageable with said plunger means, said spring means when in one operative position being in wedged relation with said housing means to provide an electrical circuit through said spring means to said housing means at said wedging engagement therebetween, said spring means and said housing means and said plunger means being so constructed and arranged that when said plunger means is moved to a certain position relative to said housing means and spring means is moved out of its wedging relation to break said electrical circuit, said housing means having a chamber therein, said spring means being disposed in said chamber, said spring means having opposed ends, one of said ends being disposed at one end of said chamber and the other end being movable relative to said housing means by said plunger means, one of said other end of said spring means and said chamber having a substantially frusto-conical portion that provides said wedging relation therebetween when said spring means is in said one operative position thereof.

5. An electrical switch construction as set forth in claim **4** wherein said other end of said spring means has said frusto-conical portion, said chamber having a first cylindrical portion and a second cylindrical portion with a larger diameter than said first portion, said other end of said spring means being in said wedging relation when received in said first cylindrical portion and being out of said wedging relation when moved into said second cylindrical portion by said plunger means.

6. An electrical switch construction as set forth in claim **5** wherein said plunger means has a guide thereon received in said other end of said spring means to guide movement of said other end of said spring means between said cylindrical portions of said chamber.

7. An electrical switch construction as set forth in claim **1** wherein said spring means has opposed ends, one of said ends being fixed from movement relative to said housing means and the other end being movable relative to said housing means by said plunger means and providing said wedged and unwedged relation therewith.

8. An electrical switch construction as set forth in claim **7** wherein said housing means has an electrical insulative part carrying said one end of said spring means to electrically isolate said one end of said spring means from the remainder of said housing means.

9. An electrical switch construction comprising a housing means, a movable plunger means carried by said housing means, a compression spring means carried by said housing means and being engageable with said plunger means, said spring means when in one operative position being in wedged relation with said housing means to provide an electrical circuit through said spring means to said housing means at said wedging engagement therebetween, said spring means and said housing means and said plunger means being so constructed and arranged that when said plunger means is moved to a certain position relative to said housing means said spring means is moved out of its wedging relation to break said electrical circuit, said spring means having opposed ends, one of said ends being fixed from movement relative to said housing means and the other end being movable relative to said housing means by said plunger means and providing said wedged and unwedged relation therewith, said housing means having an electrical insulative part carrying said one end of said spring means to electrically isolate said one end of said spring means from the remainder of said housing means, and an electrical lead means being electrically connected to said one end of said spring means.

10. An electrical switch construction as set forth in claim 9 wherein said plunger means is formed of electrically non-conductive material.

11. An electrical control system comprising an electrical power source, an electrical circuit means operatively interconnected to said power source, and an electrical switch construction disposed in said circuit means and having a housing means interconnected to one side of said circuit means and being provided with a generally cylindrical internal peripheral surface, a movable plunger means carried by said housing means, and a coiled compression spring means having a longitudinal axis and being carried by said housing means, said spring means being engageable with said plunger means, said spring means being interconnected to the other side of said circuit means and when in one operative position being in wedged relation radially outwardly of said axis thereof with said internal peripheral surface of said housing means to complete said electrical circuit means through said spring means and said housing means at said wedging engagement therebetween, said spring means and said housing means and said plunger means being so constructed and arranged that when said plunger means is moved to a certain position relative to said housing means said spring means is moved out of its wedging relation to break said electrical circuit means by being compressed along its said longitudinal axis.

12. An electrical control system as set forth in claim 11 wherein said housing means has a chamber therein, said spring means being disposed in said chamber.

13. An electrical control system comprising an electrical power source, an electrical circuit means operatively interconnected to said power source, and an electrical switch construction disposed in said circuit means and having a housing means interconnected to one side of said circuit means, a movable plunger means carried by said housing means, and a compression spring means carried by said housing means and being engageable with said plunger means, said spring means being interconnected to the other side of said circuit means and when in one operative position being in wedged relation with said housing means to complete said electrical circuit means through said spring means and said housing means at said wedging engagement therebetween, said spring means and said housing means and said plunger means being so constructed and arranged that when said plunger means is moved to a certain position relative to said housing means said spring means is moved out of its wedging relation to break said electrical circuit means, said housing means having a chamber therein, said spring means being disposed in said chamber, said spring means having opposed ends, one of said ends being disposed at one end of said chamber and the other end being movable relative to said housing means by said plunger means.

14. An electrical control system as set forth in claim 13 wherein one of said other end of said spring means and said chamber has a substantially frusto-conical portion that provides said wedging relation therebetween when said spring means is in said one operative position thereof.

15. An electrical control system as set forth in claim 14 wherein said other end of said spring means has said frusto-conical portion, said chamber having a first cylindrical portion and a second cylindrical portion with a larger diameter than said first portion, said other end of said spring means being in said wedging relation when received in said first cylindrical portion and being out of said wedging relation when moved into said second cylindrical portion by said plunger means.

16. An electrical control system as set forth in claim 15 wherein said plunger means has a guide thereon received in said other end of said spring means to guide movement of said other end of said spring means between said cylindrical portions of said chamber.

17. An electrical control system comprising an electrical power source, an electrical circuit means operatively interconneced to said power source, and an electrical switch construction disposed in said circuit means and having a housing means interconnected to one side of said circuit means, a movable plunger means carried by said housing means, and a compression spring means carried by said housing means and being engageable with said plunger means, said spring means being interconnected to the other side of said circuit means and when in one operative position being in wedged relation with said housing means to complete said electrical circuit means through said spring means and said housing means at said wedging engagement therebetween, said spring means and said housing means and said plunger means being so constructed and arranged that when said plunger means is moved to a certain position relative to said housing means said spring means is moved out of its wedging relation to break said electrical circuit means, said spring means having opposed ends, one of said ends being fixed from movement relative to said housing means and the other end being movable relative to said housing means by said plunger means and providing said wedged and unwedged relation therewith.

18. An electrical control system as set forth in claim 17 wherein said housing means has an electrical insulative part carrying said one end of said spring means to electrically isolate said one end of said spring means from the remainder of said housing means.

19. An electrical control system as set forth in claim 18 wherein an electrical lead means is electrically connected to said one end of said spring means and comprises said other side of said circuit means.

20. An electrical control system as set forth in claim 19 wherein said plunger means is formed of electrically non-conductive material.

* * * * *