

Smith et al.

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[54] **BRIDGING PUSH-BUTTON SWITCH WITH PLASTIC MATING HOUSING PORTIONS**

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200/159 R, 160, 166 BF, 166 CT

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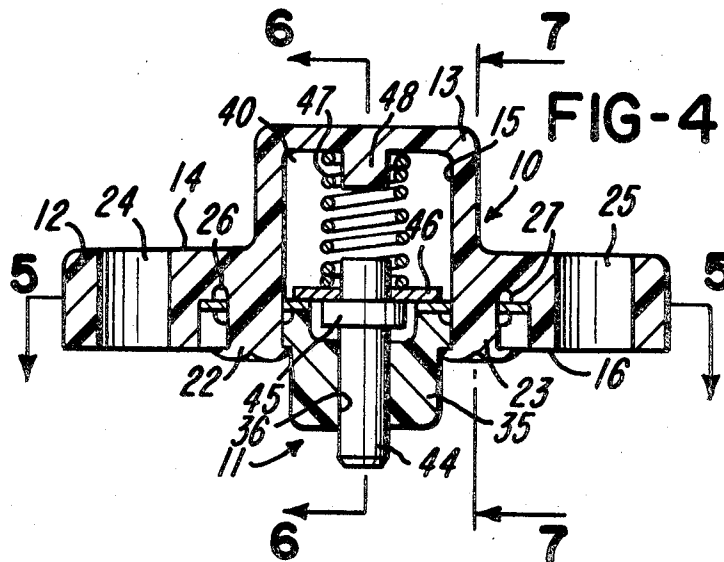
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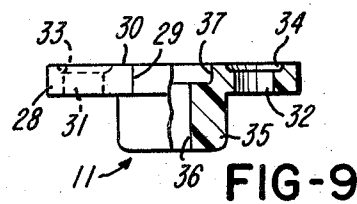
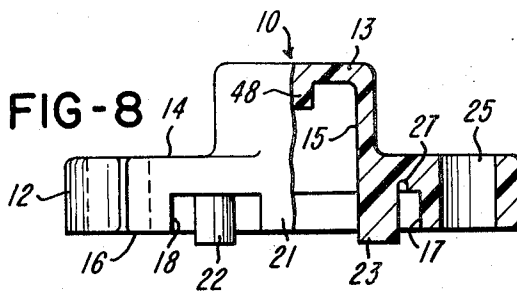
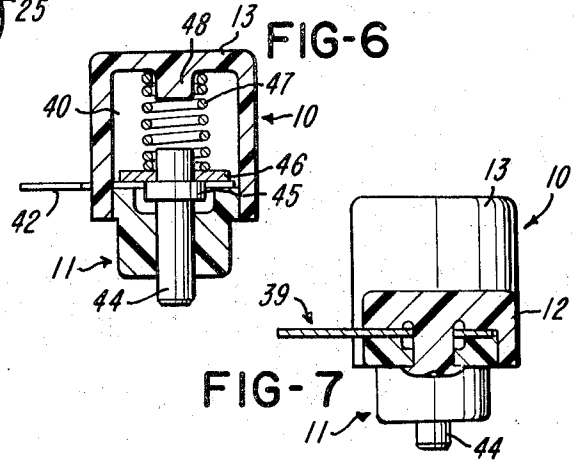
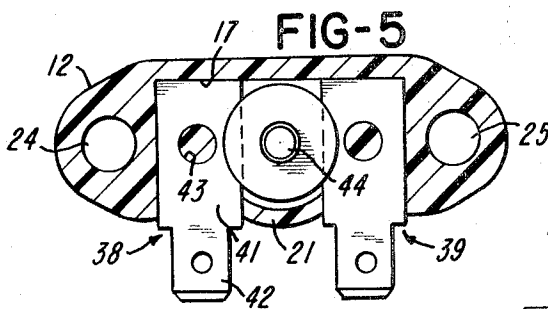
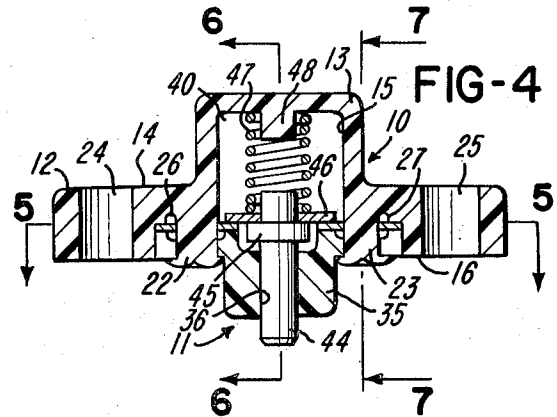
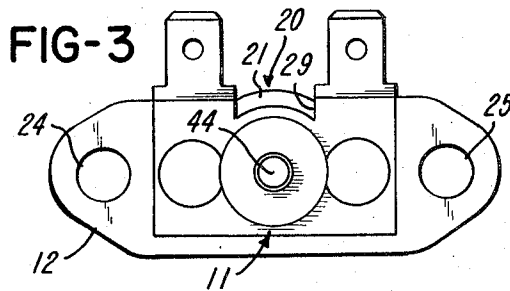
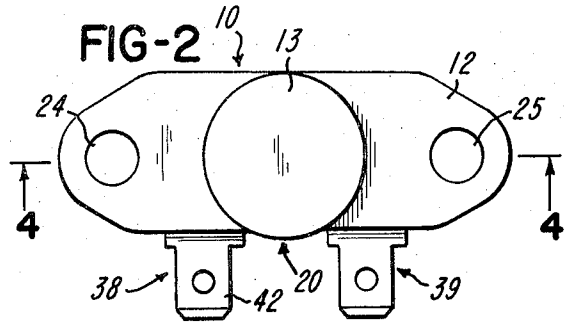
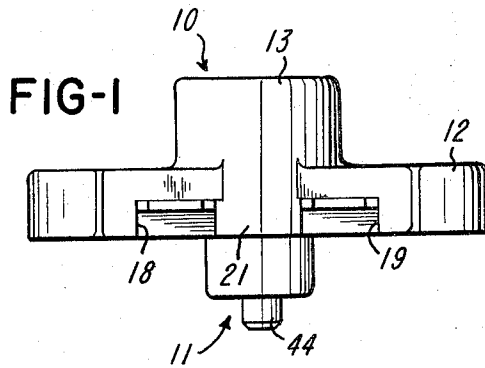
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ABSTRACT

An interlock type switch in which mating housing portions define a closed interior chamber and clamp projecting terminals. A contact member within the chamber is adapted to bridge the terminals which perform dually as terminals and contacts. An actuator has a sliding mount in one of the housing portions and is externally accessible to raise and lower the contact member. Integrated stud means hold the housing portions in an assembled relation and fix the terminals therein.

7 Claims, 9 Drawing Figures





BRIDGING PUSH-BUTTON SWITCH WITH PLASTIC MATING HOUSING PORTIONS

BACKGROUND OF THE INVENTION

This invention relates to interlock type switches of general utility. It has, however, particular although not limited reference to interlock switches as used in riding mowers and like equipment. Switch devices of that general application are required to be weather protected, resistant to misoperation caused by vibration and unskilled handling, reliable in use and relatively inexpensive of construction. Prior art devices have had limited success in meeting these requirements. Attempts to impart reliability and long life in their performance have been accomplished at a sacrifice of simplicity and low cost. Efforts towards simplified design and reduced construction costs have produced devices of low reliability susceptible to misoperation under the relatively rugged imposed operating conditions.

SUMMARY OF THE INVENTION

The instant invention has in view an interlock or like switch having relatively few, easily assembled parts which yet lends itself to precise, reliable operation over extended periods of time and under severe environmental conditions. In a feature of the device, terminals by which the device is connected in an electrical circuit serve dually as switch contacts. A compact, sealed construction is achieved through use of opposing housing portions which are interconnected by integrated stud means serving also to anchor the terminals in place. The need for separable connectors is obviated. The housing portions define a closed interior chamber containing a bridge member alternately lifted from and returned to a seat on said terminals. An actuator accessible from the exterior of the switch has a sliding mount in one of the housing portions and projects into the closed interior chamber variably to position the bridge member. Movements of the bridge member and actuator are in a straight line, with the device having in effect but one moving part. Making and breaking of the circuit which the switch controls is a quick, positive action occurring in a controlled environment with minimal opportunity for arcing and excessive contact wear.

An object of the invention is to provide an interlock or like switch of general utility and characterized by a simple, compact construction of high reliability.

Another object of the invention is to provide a switch device in which switch housing portions cooperate in confining terminal and switching components and are precisely fit together without need for separable connectors.

A further object of the invention is to provide a switch device in which switch housing portions interfit to provide for straight line motion of a switch actuator and an associated switch contact, said actuator and contact constituting a single moving switch component.

Still another object of the invention is to provide a switch device in which terminals connecting the device in an electrical circuit serve dually as switch contacts.

With the above and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combina-

tions thereof, and the mode of operation as hereinafter described or illustrated in the accompanying drawings, or their equivalents.

Referring to the accompanying drawings wherein is shown one but not necessarily the only form of embodiment of the invention;

FIG. 1 is a view in side elevation of an interlock switch in accordance with the illustrated embodiment of the invention;

FIG. 2 is a top plan view of the switch of FIG. 1;

FIG. 3 is a bottom plan view of the switch of FIG. 1;

FIG. 4 is a view in longitudinal section, taken substantially along the line 4—4 of FIG. 2;

FIG. 5 is a view in horizontal section taken substantially along the line 5—5 of FIG. 4;

FIG. 6 is a view in cross section taken substantially along the line 6—6 of FIG. 4;

FIG. 7 is a view in cross section taken substantially along the line 7—7 of FIG. 4;

FIG. 8 is a detail view, partly in section, of one of the switch housing portions; and

FIG. 9 is a view like FIG. 8, showing another switch housing portion.

Referring to the drawings, an interlock switch in accordance with the illustrated embodiment of the invention includes mating housing portions 10 and 11 which, for convenience, will be identified, as illustrated, respectively as upper and lower housing portions. It will be understood that the switch is in use oriented in any desired attitude, including the reverse of that here illustrated.

Upper housing portion 10 is made of a non-conductive plastic or like material and is molded or otherwise formed as a single element. It includes a generally rectangular plate portion 12, having tapered rounded ends, from the mid portion of which rises an inverted cup-like portion 13. The diameter of the cup portion 13 is slightly greater in dimension than the width of the plate portion 12. It will be seen that the cup portion is so arranged to have its outer wall surface coincident at one point with one edge of the plate portion, providing thereby that the cup wall includes an arcuate segment 20 producing a projection at the opposite edge of the plate portion 12.

The cup 13 projects above what may be considered an outer or upper face 14 of the plate portion 12, in the orientation shown, to define a cavity 15 opening at the mouth thereof through what may be considered an inner or lower face 16 of the plate portion. The plate portion 12 is provided with a recess 17 centered in the face 16, which recess has back and side walls which are rectangularly arranged and a front wall including lateral openings at its dependent edge defined by spaced apart notches 18 and 19. The latter are separated by an arcuate web portion 21 of the projection 20 of the wall of the cup 13, being defined thereby at the lip of the cup. Positioned at diametrically opposed locations referenced to the mouth of the cavity 15 and projected outwardly from and perpendicular to the base of the recess 16 are integrally formed stud-like portions 22 and 23. The projected extremities of the studs 22 and 23 terminate outwardly of the plane of the plate surface 16.

It is noted that the stud-like projections 22 and 23 are located in the major axis of the housing portion 10. In the same axis and positioned outwardly of the stud 22

and 23, in the tapered end portions of the plate portion 12, are respective openings 24 and 25. The material in the base of the recess 17 is undercut around each of the stud means 22 and 23 to form annular grooves respectively identified by the numerals 26 and 27.

The upper housing portion 10, by reason of its configuration, is accordingly comprised of an inverted cup-like member having laterally out-thrust wing sections by means of which the switch housing may be mounted in use. The inverted cup member forms a cavity which opens to a recess which circumscribes the mouth thereof, from the base of which recess project a pair of diametrically spaced stud means 22 and 23.

The lower housing portion 11 includes a rectangular plate portion 28 generally corresponding in configuration to that of the recess 17 in the housing portion 10. An arcuate cut-out 29 along one marginal edge of the plate portion 28 is shaped to accommodate the web segment 21 forming part of the wall of the cup 13 of the upper housing element. Near opposite ends of the plate portion 28, in its major axis, are through openings 31 and 32. On what may be considered an upper or inner face 30 of plate portion 28, the openings 31 and 32 are respectively surrounded in each case by an annular groove, the grooves being respectively identified by the numerals 33 and 34. Positioning intermediately of the openings 31 and 32, and projecting outwardly or downwardly of the plate portion 28, is a cylindrical body portion 35. The latter is provided centrally thereof with a bore 36 terminating at what may be considered its upper or inner end in a counterbore 37. Lower housing portion 11 is made of a non-conductive material like that of which the upper housing 10 is made.

Terminals of the switch disclosed are represented by metal plate-like members 38 and 39. The members 38 and 39 are identical, each having a blade-like body portion 41 incorporating a co-planar attachment portion 42 which projects from one edge thereof. In the blade-like body portion 41, toward what may be considered an inner end thereof, is an aperture 43 having a diameter corresponding approximately to the outside diameter of the stud means 22 and 23. As will be noted, the body 41 is generally rectangular, with straight parallel sides. The width of body 41 corresponds approximately to the width of one of the notches 18 or 19 and is such that with a terminal member inserted through such notch a side edge of the member overlaps a peripheral portion of the mouth of the housing cavity 15. The terminal members 38 and 39 are made of a rigid material having good electrical conductivity.

An actuator pin 44 also forms part of the disclosed switch. This has a diameter to give it a sliding mount within the bore 36 and includes a flange 45 on what may be considered the inner end thereof. The flange 45 has a greater diameter than the body of the pin 44 but its diameter is somewhat less than that of the counterbore 37. In length, the pin 44 exceeds the length of the bore 36 and counterbore 37 so that in an installed position in the body portion 35 connected integral with the plate portion 28 the pin will project beyond such body portion to either end thereof. Pin 44 is made of a non-conductive material which is or may be the same material of which the housing portions 10 and 11 are fabricated.

Further comprised in the switch is a washer-like member 46. This member is made of a material which is rigid and durable and which will serve as a good elec-

trical conductor. It will be seen that the outside diameter of the washer-like member exceeds the diameter of the counterbore 37 while its inside diameter is such as to relatively loosely pass therethrough a projecting end of pin 44. A compression spring 47 is included to seat within and to react upon the upper or base end of the cup 13, which base end incorporates a stud-like protuberance 48 projected internally of the spring to center the same and function as a spring guide. As applied, the spring 47 functions, as will be seen, to have its base end seat upon and bias the washer 46 towards a seat on the flange 45 of pin 44. In this manner there is produced a yielding force resistant to an axial thrust of the pin 44 in a direction interiorly of the cavity 15.

In assembling the components of the switches described, terminal members 38 and 39 are placed against the upper or inner face of housing portion 11 in a lateral spaced apart side-by-side relation, with apertures 43 thereof aligning with housing portion apertures 31 and 32. Actuator pin 44 is mounted in bore 36, so oriented that its flange 45 is received in the counterbore 37. Washer-like member 46 is then slipped over the short upper end of pin 44 above its flange 45 to seat to the flange. At this point an end of spring 47 is applied thereto. It will be seen from the drawings that in its application to pin 44 the washer-like member 46 achieves an overlapping relation to both adjacent side edges of the terminals 38 and 39, the body portions 41 of which are solidly supported throughout their width by the underlying face of housing portion 11 to which they are seated.

The sub-assembly comprising the housing portion 11, actuator 44, washer 46 and spring 47 as described, is now applied to the upper housing portion 12, to the side thereof including the face 16. In the course of such movement, the free or projected end of the spring 47 is caused to seat to the base of the inverted cup portion 13, around the protuberance 48. With continued approaching motion of the housing portions, the spring 47 is compressed, as a result of which the washer-like member 46 will seat firmly to the opposite side edges of the terminal 38 and 39 which are in turn supported by the underlying portions of housing portion 11. Further in the relative approaching motion of the parts, plate portion 28 of housing portion 11 enters the recess 17 of the housing portion 10 with which it has a substantially complementary relation, from the standpoint of configuration. In the process, stud means 22 and 23 will pass through aligning terminal apertures 43 and the aligning lower housing apertures 31 and 32. The relative approaching motion of the parts is continued until the flat plate-like body portions 41 of the terminal members seat to the base surface of recess 17 at which time the plate-like portion 28 is substantially fully nested within the recess 17 with stud means 22 and 23 projecting through and beyond the plate portion 28. With the parts held in this position, the projected extremities of stud means 22 and 23 are peened over upon the undersurface of the plate portion 28. Heating to facilitate this procedure may be employed or one might use a process of ultrasonic staking or the like. As a result, the housing portions 10 and 11 are brought to a precise assembled relation with little or no permitted lost motion therebetween. The assembly of parts and the simplicity of their connection is believed obvious. The terminals 38 and 39 are accordingly tightly gripped or clamped between the housing portions to preclude

relative bodily lifting or lowering motions with respect thereto and withdrawal of the terminals is prevented by their engagement on the studs 22 and 23. Relative angular turning motion of the terminals is prevented by the interaction thereof with the sidewalls of the recess 17 and with the web segment 21. Thus the terminals are positioned in a co-planar spaced apart parallel relation. The terminals 38 and 39 have a length to project through and beyond the notches 18 and 19 to either side of the web segment 21. In seating within recess 17, lower housing portion 11 closes the cavity 15 in the upper housing portion 10 and defines therewith an interior chamber 40. In function the washer-like member 46 will reciprocate with the pin 44 in such chamber. As previously mentioned, marginal side portions of the terminals 38 and 39 project over the mouth of the cavity 15 and into the chamber and position as limiting devices in the path of the washer-like member 46.

The washer-like member 46 is an electrical contact element which when commonly seated on opposing side edges of the terminals 38 and 39 acts as an electrical link or bridge between the terminals. The latter similarly are electrical contacts, serving in this connection a dual function both as terminals and as contacts. Lifting of the contact member 46 from a seat on terminals 38 and 39 disables it as a bridging member and breaks the electrical connection between the terminals.

In the operation of the switch, the parts tend normally to assume the position shown in FIG. 4, wherein spring 47 urges contact member 46 to a position seated upon terminals 38 and 39. The terminals are accordingly at this time electrically connected and tend to close any electrical circuit in which attachment portions 42 may be connected. The pin 44 is externally accessible and when thrust inward or upward as viewed in FIG. 4 acts through its flange 45 to lift contact member 46 from terminals 38 and 39. The terminals are as a consequence electronically disconnected and the circuit of which they are a part is opened. The parts will remain so positioned as long as the inwardly thrusting pressure applied to pin 44 continues to be applied. When such pressure is released, control of the actuator returns to spring 47 which moves the assembly comprising the actuator pin and contact member 46 outward until the latter again seats on the terminals 38 and 39. The making and breaking of the electrical circuit is a quick, positive action and the contact member 46 has relatively broad engagement with the terminals 38 and 39 for an easy transmission of electrical power. Spring 47 applies a substantial pressure to the contact member for a firm seating on the contact terminals. The housing unit comprised of housing portions 10 and 11 is insulated from the flowing electrical current and protects contact members from the weather and from physical damage. The structure is simple to fabricate and to assemble and includes essentially but a single moving part as represented by the actuator pin 44. Contact member 46 may, in this regard, be assembled to move unitarily with the actuator pin, as by being suitably bonded thereto. The switch because of its relatively few parts and simple construction may be considered an expendable article of manufacture which in the event of damage can be replaced as a unit.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is

susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise but one of several modes of putting the invention into effect and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. A switch, including opposing molded plastic housing portions defining therebetween a closed interior chamber, a pair of terminals confined between said housing portions in a spaced apart relation and having portions projecting into said chamber, an actuator slidable in one of said housing portions, and means reciprocable in said chamber responsive to movements of said actuator to occupy positions in bridging and non-bridging relation to said terminal portions, said terminals and said last named means constituting switch contacts, the other one of said housing portions having an inner face, a portion of said inner face being recessed, said other housing portion having a cavity opening into said recessed portion of said inner face, said one housing portion being applied in said recess in a closing relation to said cavity and defining therewith said interior chamber, said terminals having ends received in said recess on respectively opposite sides of said cavity and confined in said recess by said one housing portion, said recess being open along at least portions of the side edge of said other housing to have other ends of said terminals project therefrom.

2. A switch according to claim 1, wherein said one housing portion has a bearing portion aligned with said cavity, said actuator having a sliding mount in said bearing portion with opposite ends projecting respectively into said cavity and outside the switch housing as defined by said housing portions.

3. A switch according to claim 2, wherein said terminals are blade-like elements adjacent edges of which project laterally to overlap peripheral portions of said cavity, said bearing portion of said one housing portion being presented in supporting relation to said adjacent edges and an inner end of said actuator passing therebetween.

4. A switch according to claim 3, characterized in that said reciprocable means is a washer-like element mounted to said inner end of said actuator and adapted to seat on said adjacent edges of said terminal, an inward thrusting motion of said actuator unseating said washer-like element.

5. A switch, including opposing molded plastic housing portions defining therebetween a closed interior chamber, a pair of terminals confined between said housing portions in a spaced apart relation and having portions projecting into said chamber, an actuator slidable in one of said housing portions, and means reciprocable in said chamber responsive to movements of said actuator to occupy positions in bridging and non-bridging relation to said terminal portions, said terminals and said last named means constituting switch contacts, the other one of said housing portions being formed as an inverted cup with laterally extending wing

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portions in rimming relation to said cup, said wing portions providing a recessed seat for said one housing portion, said one housing portion forming with said cup said interior chamber, and stud means formed integrally with said other housing portion and projecting through apertures in said one housing portion to establish and maintain an assembled relation of said housing portions and said terminals.

6. A switch according to claim 5, wherein said terminals are blade-like elements inner ends of which are received between said housing portions, said inner ends of said terminals being fixed by passage of said stud

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means therethrough.

7. A switch according to claim 6, wherein the said wing portions on the other one of said housing portions form a plate portion, said inverted cup having an outer wall surface substantially coincident at one point with one edge of said plate portion and including an arcuate segment producing a projection at the opposite edge of said plate, said arcuate segment being formed with notches accommodating projection therethrough of said terminals.

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