# United States Patent [19]

**Frye**

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[54] **DUAL REVERSING SOLENOID OPERATED SWITCH**


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[73] Assignee: **Norco Sales and Manufacturing Company,** Gardena, Calif.



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[52] **U.S. Cl.** ..... **335/136,** 335/262, 335/266

[51] **Int. Cl.** ..... **H01h 50/58**

[58] **Field of Search** ..... 335/126, 131, 136, 137, 335/184, 266, 256, 267, 251, 262



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[57] **ABSTRACT**

A reversing solenoid operated switch unit has a single central plunger which carries two heavy gage copper contact discs. Facing opposite surfaces of each disc are pair of diametrically spaced heavy duty electrical contact shoulders at locations adapted to be contacted by and interconnected by the adjacent disc as each disc moves axially from one pair of shoulders to the other, thereby to periodically reverse the flow in each of two circuits.


**7 Claims, 5 Drawing Figures**

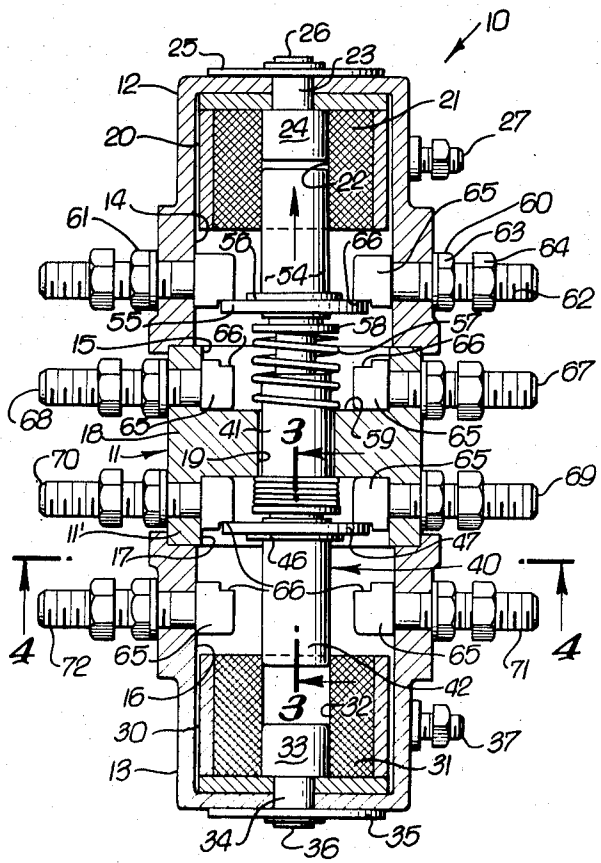


FIG. 1.

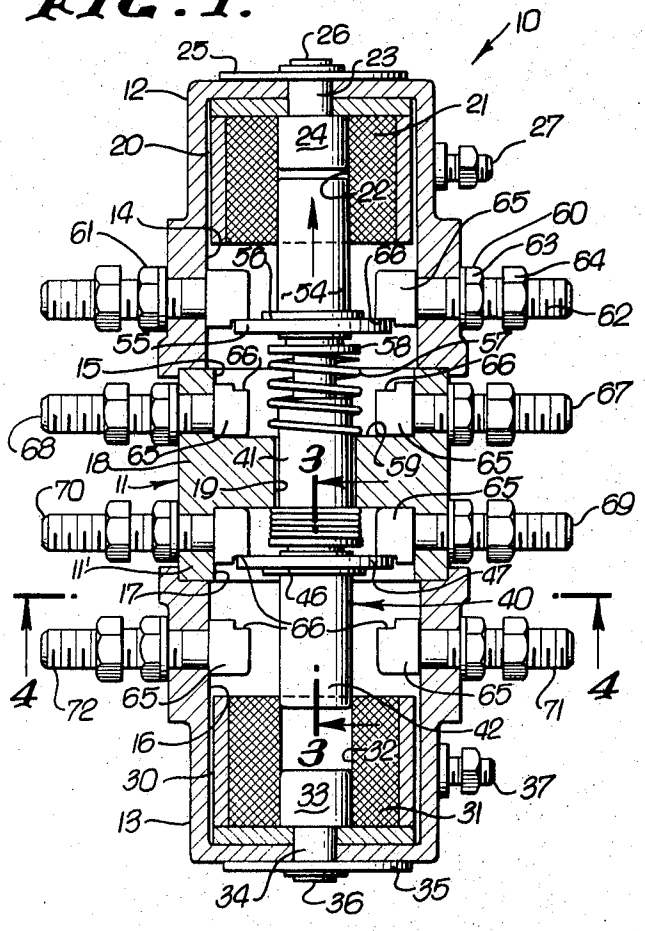



FIG. 2.

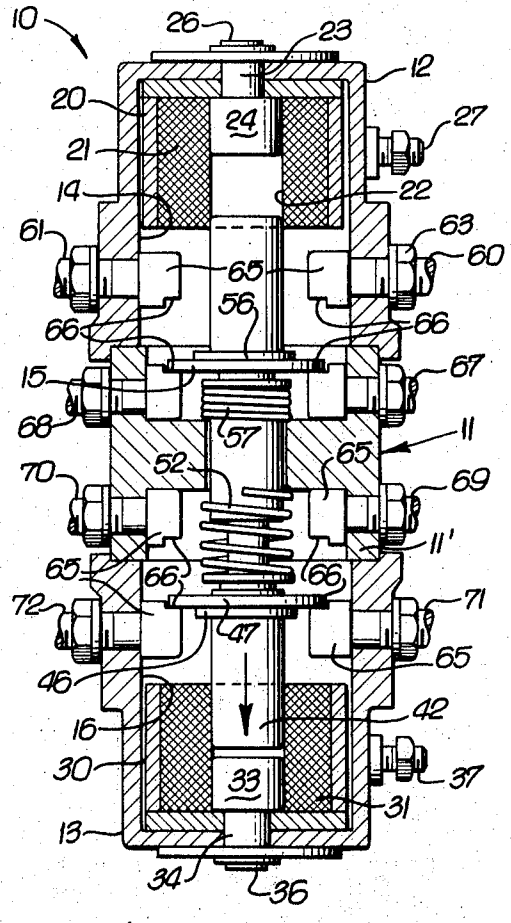



FIG. 3.

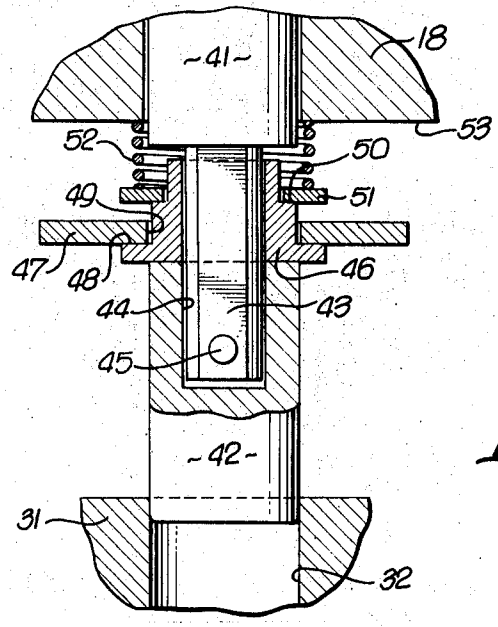



FIG. 4.

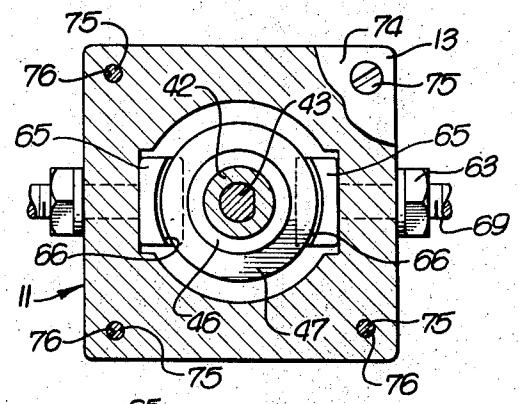
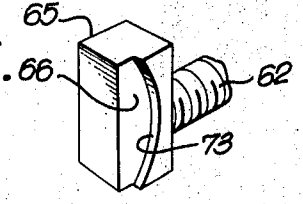



FIG. 5.



# DUAL REVERSING SOLENOID OPERATED SWITCH

In operating equipment at low voltage, 12 volts for example, it is often necessary to make use of a relatively heavy current. This means that connections and contacts should be generous, as for example contacts on a 12 volt storage battery used for automotive equipment. A common article of equipment driven from a 12 volt automotive storage battery consists of outriggers for a conventional camper. Such devices are legs or stilts which are extended by application of power through either a hydraulic or an electric actuator which elevates the camper to a position where the vehicle which carries it, usually a pickup truck, can be disengaged, after which the camper, again by use of power, can be lowered to a position adjacent the ground. Obviously when such a device is to be again mounted on the pickup truck, the outriggers must be manipulated in a reverse or elevating direction to a position where the pickup truck can again be moved into a position wherein the camper can be lowered upon it for transportation.

Equipment of the type mentioned by way of example, needs a reversing type switch to first elevate a heavy load and then to lower it, after which it must be again elevated and subsequently lowered by a reversal of operation. Driven from a conventional **12** volt battery, reversing contacts must be such as to be capable of handling the type of current available.

Since equipment of the kind suggested frequently is moved into areas where servicing is difficult and where demands are rugged, the mechanical equipment must be durable and dependable. Burned out motors and wiring far from a service center can generate an inordinate amount of inconvenience.

Although reference has been made expressly to outriggers for a camper, by way of example, there are other types of equipment powered by a comparable electrical source of power which in the normal course of operation need to be reversed periodically and which also may readily need more than one set of electrical contacts.

Moreover, since when such equipment is to be carried by vehicle, space is often at a premium as well as load and for that reason, conventional equipment capable of performing the necessary operation may be objectionable as being too complex or just taking up too much room.

It is therefore among the objects of the invention to provide a new and improved dual reversing solenoid operated switch which is very compact in its physical dimensions but, at the same time, adequately rugged so as to be capable of operating continuously for long periods of time without the need for servicing.

Another object of the invention is to provide a new and improved dual reversing solenoid operated switch of a compact, dependable, rugged character which is sufficiently versatile to be capable of adaptation to a great variety of uses.

Another object of the invention is to provide a new and improved dual reversing solenoid operated switch possessed of multiple leads for operation in both directions but which, at the same time, is incorporated in a single compact unit and housed within a unitary housing.



Still another object of the invention is to provide a new and improved dual reversing solenoid operated switch the sundry operating parts of which are compactly housed within a single unitary housing capable of being located in a position convenient with respect to the apparatus and thereby adapted to the elimination of excess wiring.

Still another object of the invention is to provide a new and improved dual reversing solenoid operated switch having contact areas broad and rugged in character and multiple in number thereby to ease the strain which otherwise would be placed upon coil windings and wiring to the end that burned out equipment is substantially minimized.

Still another object of the invention is to provide a new and improved dual reversing solenoid operated switch constructed in a somewhat modular fashion so that the mutually movable contact members can be moved into position and made functional as a result of a relatively simple operation and which, at the same time, can be just as readily dismantled should there come a time when replacement of worn parts might become necessary or on which other servicing operations might be needed.

Also included among the objects of the invention is to provide a new and improved rugged inexpensive dual reversing solenoid operated switch device wherein contact paths are made sufficiently large to substantially avoid conditions such as burned out coils and wiring.

With these and other objects in view, the invention consists in the construction, arrangement, and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

FIG. **1** is a longitudinal sectional view of the device showing the contact areas in one position of adjustment.

FIG. **2** is a longitudinal sectional view similar to FIG. **1** but showing other contact areas in engagement.

FIG. **3** is a fragmentary longitudinal sectional view on the line **3—3** of FIG. **1.**

FIG. **4** is a cross-sectional view on the line **4—4** of FIG. **1.**

FIG. **5** is a side perspective view of one of the contact shoulder members.

In an embodiment of the invention chosen for the purpose of illustration, there is shown a dual reversing solenoid operated switch unit indicated generally by the reference character **10** consisting of a three-part housing wherein there is a relative solid central section **11** on opposite sides of which are caps **12** and **13.** The cap **12** provides a chamber **14** which is in communication with a recess **15** in the central section **11.** Similarly, the cap **13** provides a chamber **16** which is in communication with a recess **17** in the central section **11.** The central section provides a partition **18** through which extends a bore **19.**

In the chamber **14** is a solenoid **20** of substantially conventional construction, with a coil **21** surrounding a bore **22** which is in axial alignment with the bore **19.** A fastening stud **23** has an enlarged shank **24** located in the outer end of the bore **22,** the outer end of the stud overlying a washer **25** over which it is anchored,

whereby to provide a ground connection **26** for the coil.

A threaded binding post **27** serves as the second connection for the winding of the coil **21.**

At the opposite end of the unit is a similar solenoid **30** and a coil **31** surrounding a bore **32** and in which is a shank **33** of a fastening stud **34.** The stud **34** extends through the wall of the cap **13** and overlies a washer **35** which is riveted in place, the stud providing a ground connection **36** for the solenoid. A binding post **37** on the side wall of the cap **13** provides the other connection for the coil **31.**

A composite plunger assembly is indicated generally by the reference character **40.** The plunger assembly consists of a midsection **41** which is slidably mounted in the bore **19.**

A lower end section **42** is adapted to be slidably received in the bore **32** of the coil **31.** Interconnecting the end section **42** with the mid-section **41** is a projection **43** of reduced diameter which has a telescoping fit within a pocket **44** of the end section **42,** there being provided a rivet **45** to hold them in assembled condition.

A collar **46** serves as a positioner and mounting means for a relatively heavy gage contact disc **47,** the collar **46** surrounding the projection **43** as shown in FIG. **3,** a stepped recess **48** being provided for that purpose, there being an aperture **49** through he contact disc **47.** A second stepped recess **50** accommodates a washer **51** serving as a spring keeper for a spring **52** which acts between the washer **51** and an adjacent face **53** of the partition **18.**

At the opposite end of the plunger assembly **40** is a similar end section **54** which mounts a contact disc **55** with the aid of a collar **56.** A spring **57** acts between a washer **58** serving as a spring keeper and a face **59** of the partition **18.**

Mounted in the wall of the cap **12** is a pair of diametrically located contact shoulder members **60** and **61.** Each shoulder member consists of a threaded exterior end **62** carrying a lock nut **63** and fastening nut **64.** The other shoulder member **61** is similarly equipped. A lug **65** at the inside end of the shoulder member provides a contact surface **66** against which one side of the contact disc **55** engages as shown in FIG. **1.** The opposite contact shoulder **61** is provided with a similar lug **65** equipped in the same fashion.

In a wall **11'** of the central section **11** is another pair of diametrically spaced shoulder members **67** and **68,** lugs **65** of which lie within the recess **15** and are provided with contact surfaces **66** for the opposite face of the contact disc **55.**

On the opposite side of the central section **11** is a similar pair of diametrically spaced shoulder members **69** nd **70,** these being mounted in a wall **11'** of the central section **11** so that their lugs **65** present contact surfaces **66** for engagement with the contact disc **47.** Again, a pair of diametrically spaced shoulder members **71** and **72** are mounted in the wall of the cap **13** whereby to provide comparable lug **65,** each of which presents a contact surface **66** for engagement with the contact disc **47** on its opposite face.

A perspective view of a typical contact shoulder member is shown in **65** possessed as suggested of a threaded extension **62** and lug **65.** The contact surface **66** is relatively long and wide and is defined on its outer side by an arcuate wall **73** which has a radius of curvature slightly larger than the radius of the corresponding disc **47.**

The caps **12** and **13** may be secured to the central section **11** by any one of a number of acceptable and conventional means, by way of example, and when the central section **11** is square in geometrical form as suggested in FIG. **4,** a flange **74** consisting of a corner of the cap **13** overlies the square corner of the central section and is secured thereto by means of a screw **75** engaging a threaded hole **76** in the central section.

In operation, the plunger assembly is assembled in place on the central section **11,** confining the springs as indicated, and checked to be certain that there is a freely reciprocatable motion of the plunger assembly with respect to the bore **19.** This assumes that the solenoids **20** and **30** previously have been anchored in position in the respective caps **12** and **13.** With shoulder members already anchored in position, the caps **12** and **13** are applied to respective ends of the central section **18** and there secured by means of the screws **75** to the central section.

By this simple assembly operation, the device is made ready for mounting and connection into the circuit. This is accomplished by grounding the ground connections **26** and **36** to the machine on which the unit is mounted and connecting binding posts **27** and **37** to respective electrical terminals.

Power circuits are then connected to the sundry shoulder members **60, 61, 67, 68, 69, 70** and **71, 72.** In the embodiment shown the shoulder members **60** and **62** have attached to them power leads which are in parallel with respect to the shoulder members **69** and **70.** Similarly, shoulder members **67** and **68** are connected to power leads in parallel with shoulder members **71** and **72.**

By applying energy to the solenoid **20** by means of a current directed to the binding post **27,** the solenoid **20** is energized which moves the plunger assembly **40** in an upward direction as viewed in FIG. **1.** This has the effect of bringing the contact disc **55** into engagement with the contact surfaces **66** of the contact shoulder members **60** and **61** closing that circuit and, at the same time, bringing the contact disc **47** into engagement with the contact services **66** of the respective contact shoulder member **69** and **70.** Broad areas of contact are experienced. At the same time, the spring **52** is compressed and the spring **57** permitted to expand.

When the switching action is to be reversed, the solenoid **20** is deenergized and the solenoid **30** energized. This has the effect of pulling the plunger assembly **40** in a downward direction to the position shown in FIG. **2.** When this occurs, the contact disc **55** moves to a position engaging the contact surface **66** of the contact shoulder members **67** and **68.** At the same time, the contact disc **47** moves into engagement with the contact surface **66** of the respective contact shoulder members **71** and **72,** thereby to cause current to flow in the respective two circuits. Meanwhile the spring **57** is compressed while the spring **52** expands.

By constructing the contact shoulder members in the manner described providing, as described, a lug **65** at the interior end of each, the lug can be made just as ample as need be in order to provide an abundant area for the contact surface **66.** This area can be made just as large as needed inasmuch as irrespective of what size is selected, within reason, it will all provide engagement

with a corresponding portion of the respective contact disc **47** or **55** as the case may be.

Should there be any need for inspection of the contact areas, or servicing or replacement, as occasion might require, the caps can be readily disengaged from the central section **11** whereupon all lugs are exposed and can be readily removed by disengagment of the lock nuts from the threaded exterior ends, subject to replacement in a comparable fashion, after which the caps can be reassembled with the central section.

While the invention has herein been shown and described in what is conceived to be a practical and effective embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

Having described the invention, what is claimed as new in support of Letters Patent is:

**1.** A reversing switch unit comprising a housing having chambers at opposite ends, a partition between the chambers and a bore through the partition interconnecting the chamber, a solenoid in each chamber having a central axial bore and a single plunger assembly extending between the solenoids and through said bore, said plunger assembly comprising a guide portion intermediate the ends having a slidable engagement with said bore and end portions having slidable engagements with the bores of the respective soldenoids, a contact disc in each chamber and mounted on that portion of the plunger assembly which is located in the respective chamber, a pair of diametrically spaced contact shoulder members mounted in each chamber on the side of the respective contact disc adjacent the solenoid and a second pair of diametrically spaced contact shoulder members mounted in each chamber on the side of the respective contact disc remote from the solenoid, the pairs of contact shoulder members in each chamber being spaced axially from each other so that movement of the respective contact disc in an axial direction alternately interconnects the contact shoulder members of each pair of said shoulder member.

**2.** A reversing switch unit as in claim **1** wherein the housing comprises a central section including said partition and having axially opposite facing recesses in communication with respective chambers, one pair of said contact shoulder members being mounted in each recess, said housing comprising cap sections each including a portion of the respective chamber therein and another pair of said contact shoulder members mounted in each cap section, said cap sections being releasably attached to the respective side of said central section.

**3.** A reversing switch unit as in claim **2** wherein there is a compression spring located between each contact disc and the partition.

**4.** A reversing switch unit as in claim **1** wherein each contact shoulder member comprises a stud threaded on the exterior end extending through the wall of the housing and a lug at the interior end projecting into the recess and having a portion of each lug facing the disc depressed and comprising a contact surface throughout its length and width in position adapted for contact by said contact disc.

**5.** A reversing switch unit as in claim **1** wherein the plunger assembly comprises a mid-section slidably mounted in said bore and opposite end sections, each end section being in slidable engagement with the respective solenoid, the end sections having each a releasable telescopic engagement with and attached to the mid-section.

**6.** A reversing switch unit as in claim **1** wherein the central bore of each solenoid is adapted to receive a respective end of said plunger assembly and a fastening stud having a shank in the bore of the outwardly located end of each solenoid and extending through the housing in axial alignment with said plunger and the solenoids whereby to fasten the solenoids in the housing in axial alignment and provide a ground connection for the respective solenoid.

**7.** A reversing switch unit as in claim **1** wherein said contact shoulder members are each provided with a lug at the inner end and said chambers each comprise cylindrical side walls, said walls having radially outwardly extending pockets for said lugs, said contact shoulder members being releasably secured to the housing with the lugs in the respective pockets.

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