United States Patent [19]

Green

[11] **3,842,228**

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[54] **CIRCUIT BREAKER ASSEMBLY WITH INTERPOSED WEDGE NON-CONDUCTOR AND COMPLEMENTARY HOUSING ARC-PREVENTION STRUCTURE**

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[73] Assignee: **The United States of America as represented by the Secretary of the Navy,** Washington, D.C.

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[52] **U.S. Cl.**..... **200/151,** 200/61.19, 200/153 M, 335/201

[51] **Int. Cl.**..... **H01h 9/32,** H01h 33/06

[58] **Field of Search**..... 200/61.19, 149 R–149 B, 200/150 R, 151; 317/11; 335/14, 187, 201; 307/136

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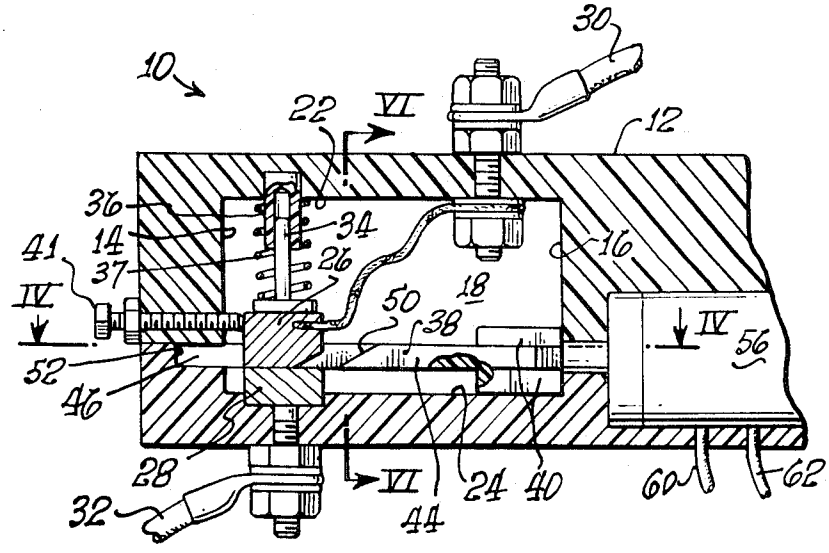
Primary Examiner—James R. Scott

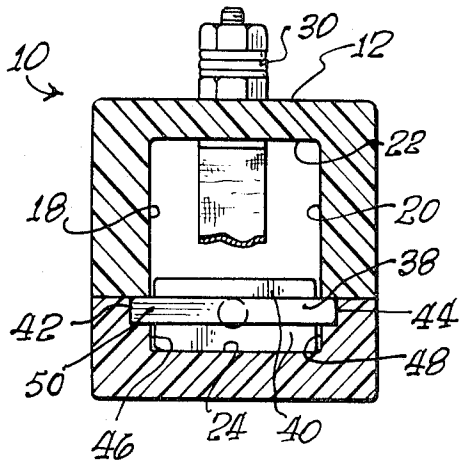
Attorney, Agent, or Firm—Richard S. Sciascia; Ervin F. Johnston

[57] **ABSTRACT**

A compact non-arcing switch which includes a housing which is constructed of dielectric material. A pair of electrical contacts are mounted within the housing for movement between open and closed positions with a means for biasing the contacts to the closed position. An elongated dielectric wedge is slidably mounted within the housing for opening and closing the contacts. The mounting of the wedge within the housing provides electrical closure paths which prevent arcing between the contacts when they are opened.

5 Claims, 7 Drawing Figures





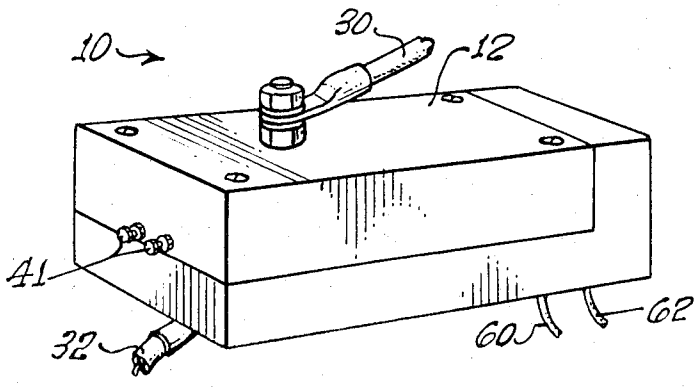


FIG. 1.

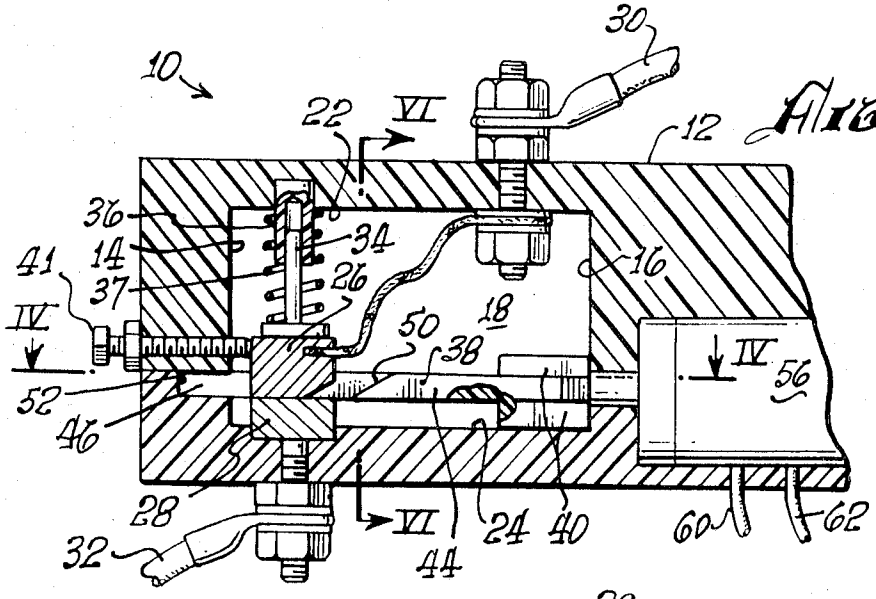


FIG. 2.

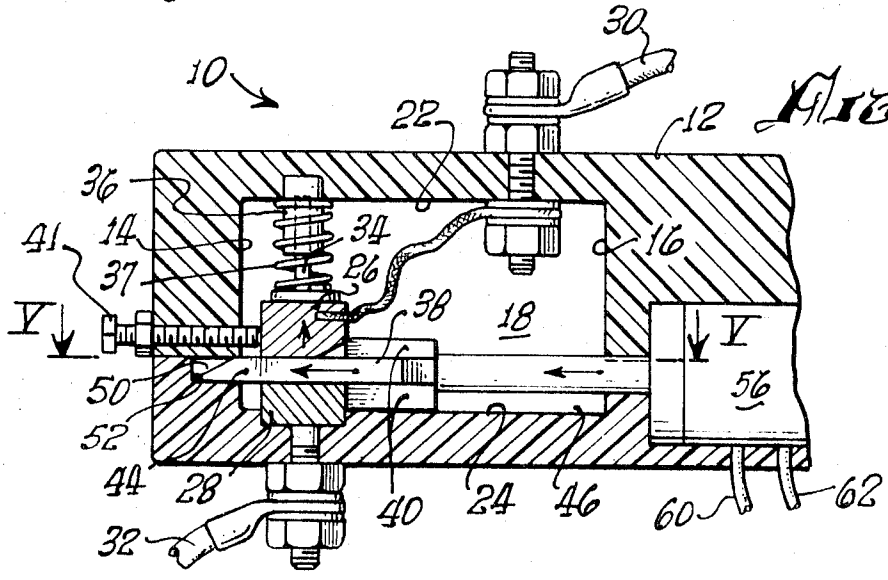


FIG. 3.

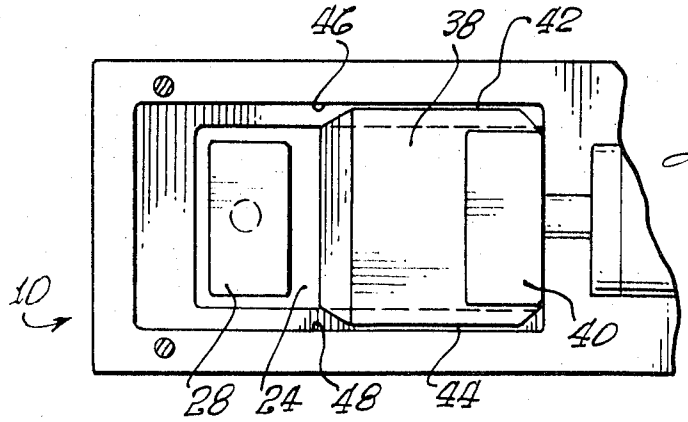


FIG. 4.

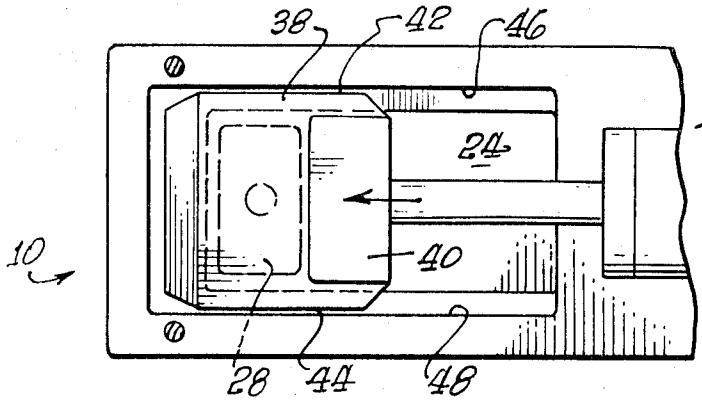


FIG. 5.

FIG. 6.

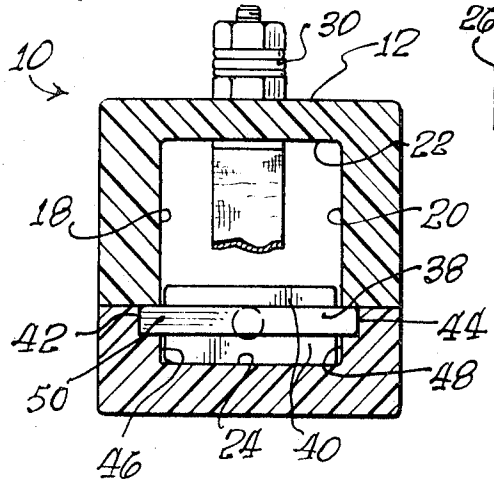
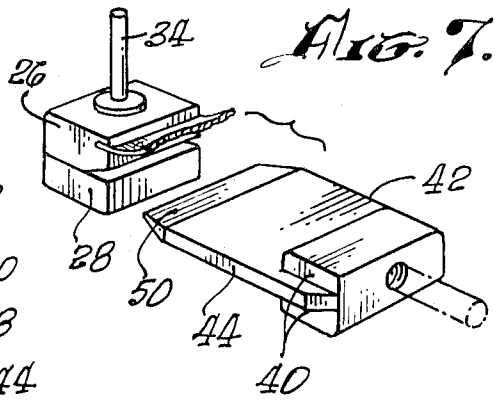


FIG. 7.



CIRCUIT BREAKER ASSEMBLY WITH INTERPOSED WEDGE NON-CONDUCTOR AND COMPLEMENTARY HOUSING ARC-PREVENTION STRUCTURE

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

The present invention relates to a compact switch which will open and close electrical contacts in high amperage and voltage circuits without any arcing between the contacts.

Some of the navy underwater vehicles require the making and breaking of high current and high voltage D.C. circuits. When the contacts of a switch are opened to break circuits in the order of 250 volts and 250 amperes an intense arc occurs which results in burning, pitting or welding the contacts together. Arcing is typically not a problem if the circuit is below 50 volts or 50 amperes. When arcing is a problem, one typical solution is to rapidly separate the contacts by a wide spacing, such as several inches. This results in a large switch, and the action is usually not fast enough to completely eliminate contact damage. Another common technique to eliminate the arcing problem is to use a magnetic arc deflector. In this technique an auxiliary magnetic field is generated in the proximity of the broken contacts so as to deflect the arc through a long path until it breaks. The magnetic arc deflector is quite effective in preventing contact damage, however, it results in a large switch because of the space required for the magnetic field generator and the long paths required for breaking the arc. Accordingly, there has been a strong need, especially for the Navy's underwater submersibles to provide a compact switch which will break high current and high voltage D.C. circuits without any arcing between the contacts.

SUMMARY OF THE INVENTION

The present invention provides an extremely compact switch which will break a high current and high voltage circuit without any problem of arcing between electrical contacts. This has been accomplished by providing a dielectric housing which has a pair of electrical contacts which are mounted in the housing for movement between open and closed positions. An elongated dielectric wedge is slidably mounted within the walls of the housing so that the paths of slidable engagement make an electrical closure to arcing between the contacts. The forward end of the wedge may be received by a forward wall of the housing so as to make a third electrical closure path which joins the other paths to further isolate the contacts from electrical arcing. The closure may be made complete by a slidable arrangement of the wedge with a rear portion of the housing.

OBJECTS OF THE INVENTION

An object of the present invention is to overcome the aforementioned problems associated with prior art high current and high voltage switches.

Another object is to provide an extremely compact switch which will break a high current and high voltage circuit without any problem of arcing between electrical contacts.

Another object is to provide a extremely compact, but yet efficient and simply constructed switch which will break high current and high voltage D.C. circuits without any problem of arcing between electrical contacts.

Other objects, advantages, and novel features of the invention will become apparent from the following detailed description of the invention, when considered in conjunction with the accompanying drawngs.

DESCRIPTION OF THE DRAWING

FIG. **1** is an isometric view of the exterior of the non-arcing switch.

FIG. **2** is a partial longitudinal cross sectional view of the non-arcing switch with the contacts closed.

FIG. **3** is a partial longitudinal cross sectional view of the nonarcing switch with the contacts open.

FIG. **4** is a view taken along plane IV—IV of FIG. **2.**

FIG. **5** is a view taken along plane V—V of FIG. **3.**

FIG. **6** is a view taken along plane VI—VI of FIG. **2.**

FIG. **7** is an isometric view of the contacts and wedge removed from the housing.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference numerals designate like or similar parts throughout the several views there is illustrated in FIG. **1** an exemplary compact non-arcing switch **10** which includes a housing **12** which is constructed of a dielectric material, such as bakelite. The housing may be essentially a box which includes fore and aft walls **14** and **16,** sidewalls **18** and **20** (see FIG. **6**), and top and bottom walls **22** and **24.** A pair of electrical contacts **26** and **28** are mounted within the box **12** for movement between open and closed positions as illustrated in FIG. **3** and FIG. **2** respectively. A pair of leads **30** and **32** are connected to the contacts **26** and **28** respectively and extend through the top and bottom walls **22** and **24** respectively of the box **12.** The contact **28** may be fixed within a recess within the bottom of the box **12,** and the contact **26** may be mounted in the box for up and down movement by a shaft **34** which is reciprocable within a small hollow cylinder **36.** The bottom end of the shaft is fixed to the top of the contact **26,** and the top of the hollow cylinder **36** is fixedly mounted within the top of the box. Means are provided for biasing the contacts **26** and **28** to the closed position as illustrated in FIGS. **2** and **3.** The biasing means may include a compression spring **37** which may be disposed about the shaft **34** and cylinder **36** so as to bear against the top of the contact **26** and the top wall **22** of the box.

An elongated wedge **38,** which is constructed of dielectric material such as phenolic resin, is provided for opening the contacts **26** and **28.** The wedge **38** may be rectangular in cross section, as seen in FIG. **6,** and may be provided with an abutment **40** which serves as a stop means against the contacts **26** and **28.**

Forward movement of the contact **26** may be prevented by a pair of small non-conducting bolts **41**

which are threaded through the forward end of the box **12.** Means are provided for slidably mounting the longitudinal edges **42** and **44** of the wedge **38** to the side walls **18** and **20** respectively of the box **12** for moving the wedge **38** forward between the contacts **26** and **28** to open the contacts, as illustrated in FIG. **3,** and retracting the wedge rearwardly to allow the contacts to close as illustrated in FIG. **2.** The slidable mounting means also makes electrical closure along the paths of slidable engagement with the edges **42** and **44** of the wedge so that arcing between the contacts **26** and **28** is cut off along the sides of the box when the wedge opens the contacts. The slidable mounting means may include the side walls **18** and **20** of the box having fore and aft extending grooves **46** and **48** which snugly receive the longitudinal edges **42** and **44** of the wedge **38.**

Further, means are provided for receiving a forward end **50** of the wedge so as to make an electrical closure path which joins the paths of slidable engagement between the longitudinal edges **42** and **44** of the wedge within the wall grooves **46** and **48.** The means receiving the forward end of the wedge may include the forward wall **14** of the box having a lateral groove **52** (see FIG. **2**) which snugly receives the forward portion **50** of the wedge. The fore and aft extending grooves **46** and **48** in the box are continuous with the lateral groove **52** so that the contacts **26** and **28** are insulated from electrical arcing along three closure paths when the contacts are opened (see FIG. **3**).

A fourth electrical closure path is provided for by the bottom of the stop abutment **40.** As illustrated in FIGS. **2, 3,** and **6** the bottom of the abutment **40** makes snug engagement with the side walls **46** and **48,** and with the bottom wall **24** of the box **12.** This fourth closure path joins the three other closure paths to completely close off the contacts **26** and **28** from any possible arcing when the contacts are opened, as illustrated in FIG. **3.**

If desired, means may be mounted in a rear portion of the box **12** for actuating the wedge in forward and rearward directions. The actuating means may be a longitudinal solenoid **56** which has a pair of coils (not shown) which in turn have their independent pairs of leads **60** and **62** which extend from the box **12** for energization purposes. A plunger (not shown) is mounted to an aft end of wedge **38** so that when one of the coils is energized the wedge is thrusted between the contacts **26** and **28** and when the other coil is energized the wedge **38** is withdrawn therefrom. In order to enable a smooth opening of the contacts **26** and **28** the forward end **50** of the wedge is blade shaped and the receiving edge of the contact **26** is chamfered.

By utilization of the aforementioned teachings of the present invention switches utilized for high voltage and high current circuits may be significantly reduced in size. Switches constructed according to the aforementioned prior art teachings have resulted in a size of about **1** cubic foot for a circuit of 250 volts and 250 amperes. By ultilization of the teachings of the present invention the size of the switch can be produced to a size of approximately a package of cigarettes. This then enables very compact and reliable switches to be made and utilized within small ocean going vehicles which require the compactness for handling high voltage and high amperage circuits.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. A compact non-arcing switch comprising:

a housing which is constructed of dielectric material;

a pair of electrical contacts mounted within the housing wherein at least one of the contacts is mounted for movement between open and closed positions with respect to the other contact;

means for biasing at least one of the contacts to the closed position;

an elongated wedge which is constructed of dielectric material;

means slidably mounting the longitudinal edges of the wedge to the side walls of the housing for moving the wedge forward between the contacts to open the contacts and retracing the wedge rearwardly to allow the contacts to close;

the slidable mounting means also making electrical closure along the paths of slidable engagement with the edges of the wedge so that arcing between the contacts is cut off when the wedge opens the contacts;

means for receiving the forward end of the wedge and making an electrical closure path which joins said paths of slidable engagement of the slidable mounting means with the sides of the wedge so that forward movement of the wedge will open the contacts and insulate the contacts from electrical arcing along three closure paths therebetween; and

said wedge having an abutment which makes slidable continuous engagement with the side and bottom walls of the housing so as to provide a fourth electrical closure path which joins the other three closure paths to completely isolate the contacts from one another when they are opened.

2. A compact non-arcing switch as claimed in claim **1** wherein:

said housing is a rectangular box with fore and aft, side, and top and bottom walls; and

the slidable mounting means includes:

the side walls of the box having fore and aft grooves which snugly receive the edges of the wedge;

the forward wall of the box having a lateral groove which snugly receives the forward edge of the wedge; and

all of said grooves being continuous.

3. A compact non-arcing switch as claimed in claim **2** including:

the bottom contact being fixed within the bottom of the box;

the top contact having a shaft which slides within the hollow cylinder; and

a helical compression spring disposed about the shaft and the hollow cylinder and bearing against the top of the top contact and the top wall.

4. A compact non-arcing switch as claimed in claim **3** including:

a longitudinal solenoid mounted in a rear portion of the box for moving the wedge forward and rearward.

5. A compact non-arcing switch as claimed in claim **4** including:

the rear portion of the top contact being chamfered; and the fore portion of the wedge being a blade.

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