May 24, 1960 L. B. STEWARD 2,938,092

MULTIPLE CONTACT DOUBLE THROW VACUUM SWITCH

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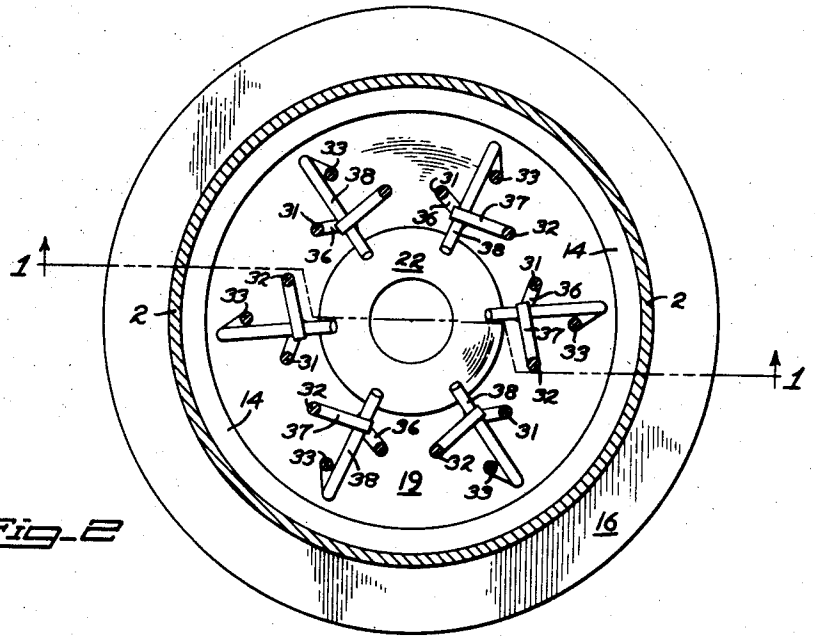


Fig-2

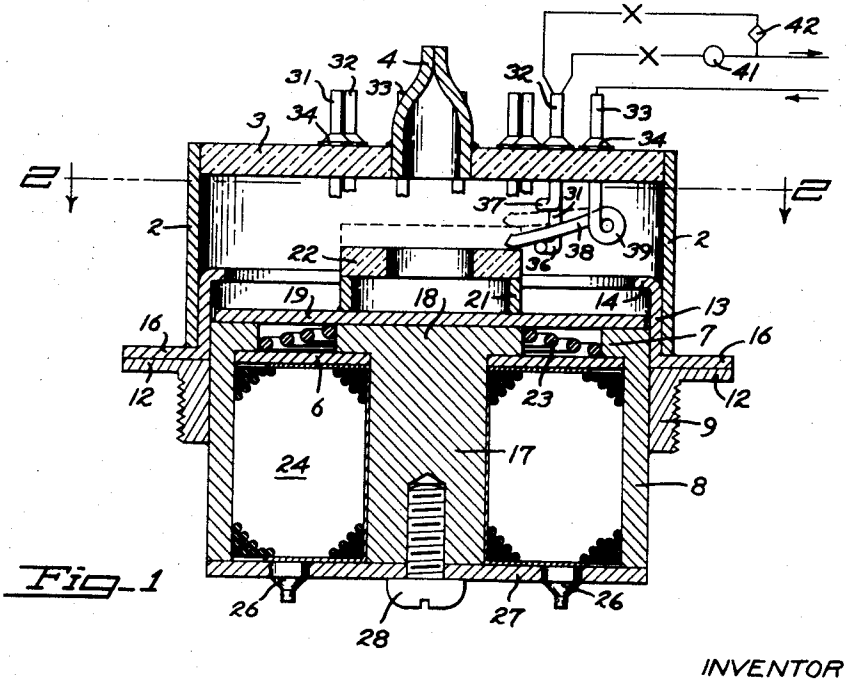


Fig-1

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MULTIPLE CONTACT DOUBLE THROW VACUUM SWITCH

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9 Claims. (Cl. 200—104)

My invention relates to a multiple contact double throw vacuum switch; and one of the objects of my invention is the provision of such a switch with a minimum of moving parts and with no journaled or pivot pin bearings whatsoever.

Another object is the provision of a multiple contact double throw vacuum switch which is readily assembled from relatively few simple parts, and is therefore of low manufacturing cost.

Another object of my invention is the provision of improved means for hermetically closing the ends of a vacuumized switch envelope with plates on both sides of which main components are first readily assembled.

Another object of my invention is the provision of a small, light weight, multiple switch of rugged construction to withstand shock and vibration, and reliably operative over a wide range of temperatures.

Still another object of the invention is the provision of a switch of the type described having extremely low contact resistance, which remains substantially unchanged during hot or cold break operations.

Other objects of the invention together with the foregoing will be set forth in the following description of the preferred embodiment of my invention which is illustrated in the accompanying drawing. It is to be understood that I do not limit myself to the showing made by the said description and drawing, as I may adopt variations of my preferred form within the scope of my invention as set forth in the claims.

Referring to the drawings:

Fig. 1 is a vertical half sectional view of my switch, the plane of section being indicated by the line 1—1 of Fig. 2. The view includes a partial wiring diagram, indicating one way in which the switch may be connected to different instrumentalities which are to be controlled by it.

Fig. 2 is a horizontal sectional view of the switch, the plane of section being indicated by the line 2—2 of Fig. 1.

In broad view my switch comprises a miniaturized structure usable for multiple switching in many fields, including missile control and aircraft. In these uses, a satisfactory switch must be rugged and highly resistant to shock and vibration damage. It must have contact reliability after storage, and over a wide range of temperature in use, for A.C. or D.C. currents for power or instrumentation. It must be small and light in weight. It must have extremely low contact resistance which must not change during operation. These qualifications have ruled out delicate parts with complicated assemblies and have enforced a simplicity of parts and assembly having the twin advantages of economy and reliability.

In greater detail, my switch comprises a cylindrical copper shell 2, closed at one end by a ceramic plate 3 in which is brazed a copper tubulation 4, sealed off in a conventional manner after the switch envelope is vacuumized.

The opposite end of the shell is closed by the inconel base plate 6, brazed into the inturned flange 7 of the soft iron housing 8. A threaded copper ring forming a mounting flange 9 and having the radial flange 12 therearound, is brazed to the outer surface of the housing, and provides a seat for the doubly flanged copper annulus 13, brazed to the free rim of the shell 2, and having a radial flange 14, extending inwardly and a flange 16 extending outwardly in contact and coextensive with the flange 12.

Integrally uniting the rims of the two flanges 12 and 16 as by heliarc, hermetically seals the envelope on one side of the base plate. At the same time, a readily accessible mounting is provided for components fixed on both sides of the plate before assembly.

Prior to assembly, a soft iron core 17 with an enlarged head 18 is brazed to the base plate, the head on the inside and the core extending through it on the outside.

Disposed also on the internal side of the plate between it and the flange 14, is an unattached armature 19, having a ring 21 at its center supporting a light push ring 22 of ceramic or other suitable dielectric material.

In the annular space between the flange 7 and head 18 is a helical compression spring 23, normally pressing the armature and push ring upwardly against the flange 14, which thus serves as a stop to limit their upper positions.

Means are provided for drawing the armature and push ring down to their lowermost position at which time the armature lies flat across the flange 7 and head 18 with the spring compressed within the annular space therebetween.

Surrounding the core 17 is a magnetic coil 24, connected to a suitable energizing current supply by leads through tight nipple seals 26, arranged in the soft iron cover plate 27, secured by a single screw 28, threaded into the end of the core. It is to be noted that the coil is thus readily assembled in its housing and as easily removed for repair or replacement.

Spring-pressed movement of the armature and push ring in one direction, and their electro-magnetically induced movement in the opposite direction are utilized to open and close the multiple circuits controlled by my switch.

Arranged in symmetrical order around the ceramic plate 3 are a plurality of groups, each comprising three conductive resilient wires 31, 32 and 33. Each wire passes through the plate and is hermetically sealed therein by brazing to a small spot gasket 34 of molybdenum manganese, also brazed to the metallized margin of the hole.

On the outside of the plate, the wires constitute leads for connection to the various circuits controlled by the switch. On the inside the lead wires extend as studs. One stud 31 ends in a contact hook 36. Stud 32 ends in a resilient contact finger 37, and the third stud 33 is formed with a resilient contact arm 38 continuous with the stud portion of the wire and preferably connected thereto by a coil 39 of one or several turns to enhance the resilience of its connection.

While the major portion of resilient play may be supplied in the longer contact arm with its coil connection to its supporting stud, a smaller degree of springiness is desirable in both hook and finger. This may be effected by the L-shape shown, or by the inclusion of one or more turns, or by an increase in length of stud or contact part.

The free end of the arm is curved upwardly as in a runner, and lies immediately above the upper surface of the push ring 22 in its lower position as shown in Fig. 1, wherein armature 19 and push ring 22 are drawn down to their lowermost positions. In this position of the parts, the contact arm 38 presses resiliently upon the contact hook 36, so that the circuit through wires

31 and 33 is completed to operate the instrumentality 41.

With release of the armature by the deenergized core, the helical spring 23 raises the armature and push ring to their highest position against the stop flange 14. During this upward movement, the push ring engages the runner end of the contact arm and raises it into firm resilient engagement with the under side of contact finger 37 extending from the wire stud 32. This upward movement of the contact arm 38 interrupts the circuit through leads 31 and 33, and closes the circuit through 32 and 33 to operate the instrumentality 42.

It will of course be understood that in each group of wires, six as herein described, a contact arm 38 is arranged with its free end immediately above the push ring; and with each upward movement of the push ring, the six arms break six circuits and establish six other circuits. With each downward movement, the last circuits are broken and the first circuits reestablished.

While in the present application, six groups of three contacts each, and controlling twelve circuits and twelve instrumentalities are illustrated and explained, it is obvious that my invention may be applied to any number of groups, limited only by the required lateral spacing as seen in Fig. 2.

I claim:

1. A vacuumized switch comprising a vacuumized envelope, an armature within the envelope, spring means within the envelope for moving the armature in one direction, electromagnetic means outside the envelope for moving the armature in the opposite direction, means outside the envelope for energizing the electromagnetic means, first and second insulated contacts within the envelope, a third insulated contact within the envelope and including a resilient arm arranged to engage the first contact upon movement in one direction and to disengage the first contact and engage the second contact upon movement in the other direction, dielectric means interposed between the resilient arm and the armature to relate the movement of the armature in time and extent to movement of the arm, and an insulated lead outside the envelope continuous through the wall of the envelope with each contact.

2. A vacuumized switch in accordance with claim 1 in which stop means is fixed within the envelope to limit the spring actuated movement of the armature.

3. A vacuum switch in accordance with claim 1 in which the envelope includes a cylindrical shell closed by end walls, an annulus brazed to one end of the shell to provide stop means inside the envelope to limit movement of the armature and a laterally extending mounting flange outside the envelope.

4. A vacuumized switch comprising a vacuumized envelope, an armature within the envelope, a dielectric plate on the armature, spring means within the envelope for raising the armature, electromagnetic means outside the envelope for lowering the armature, means for energizing the electromagnetic means, first and second contacts within the envelope, a third contact within the envelope and including a resilient arm engaged by the dielectric plate to engage the first contact upon downward movement of the plate by said electromagnetic means and to disengage the first contact and engage the second contact upon upward movement of the plate by said spring, and a lead outside the envelope continuous through the wall of the envelope with each contact.

5. A vacuumized switch in accordance with claim 4, in which stop means is fixed within the envelope to limit the rise of the armature.

6. A vacuumized switch comprising a vacuumized envelope including a cylindrical shell, an annulus integrally united to one end of the shell and extending into the shell to provide a stop and away from the shell to provide a mounting flange, a base plate hermetically closing the end of the shell and integrally united to the mounting flange, electromagnetic means arranged on the base plate, an armature responsive to the electromagnetic means and within the envelope between the base plate and the stop, a compression spring within the envelope between the base plate and the armature, means hermetically closing the other end of the shell, a plurality of contacts within the envelope, a lead outside the envelope continuous through the wall of the envelope with each contact, and means actuated by the armature for the selective closing of circuits through the contacts.

7. A vacuumized switch comprising a vacuumized envelope including a cylindrical shell, an annulus integrally united to one end of the shell and extending into the shell to provide a stop and away from the shell to provide a mounting flange, a base plate hermetically closing the end of the shell and integrally united to the mounting flange, a cylindrical casing integrally united to the base plate on the side opposite the shell, a core in the casing and integrally united to the base plate, a coil in the casing and surrounding the core for energizing the core, an armature within the envelope responsive to the core and between the base plate and the stop, a spring within the envelope and compressed between the base plate and the armature, means hermetically closing the other end of the shell, a plurality of contacts within the envelope, a lead outside the envelope continuous through the wall of the envelope with each contact, and means actuated by the armature for the selective closing of circuits through the contacts.

8. In an electric switch, the subcombination of a conductive shell, a ceramic closure plate hermetically closing an end of the shell and having a plurality of apertures therethrough, a metal lead extending through each aperture and constituting a stud on the inside face of the plate, a metal gasket integrally united to each lead and to its immediately adjacent portion of the ceramic plate, a resilient metal contact arm continuous with one of the studs, a contact hook on a second stud in which the arm resiliently seats, and a contact finger continuous with a third stud and extending across the path of movement of the contact arm when lifted from the contact hook.

9. A vacuumized switch comprising a vacuumized envelope, an armature within the envelope, a dielectric plate on the armature, spring means within the envelope for raising the armature, electromagnetic means outside the envelope energizable to lower the armature against the opposition of the spring, first and second contacts within the envelope, a third contact within the envelope and including an arm resiliently impinging on the dielectric plate in opposition to the spring and movable to resiliently engage the first contact upon downward movement of the armature and plate and to disengage the first contact and engage the second contact upon upward movement of the plate, and a lead outside the envelope continuous through the wall of the envelope with each contact.

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