Dec. 20, 1960 J. W. TIMMERMAN 2,965,734

CURRENT CONDUCTIVE SPRING BEARING FOR VACUUM SWITCH CONTACTS

Filed Aug. 7, 1958

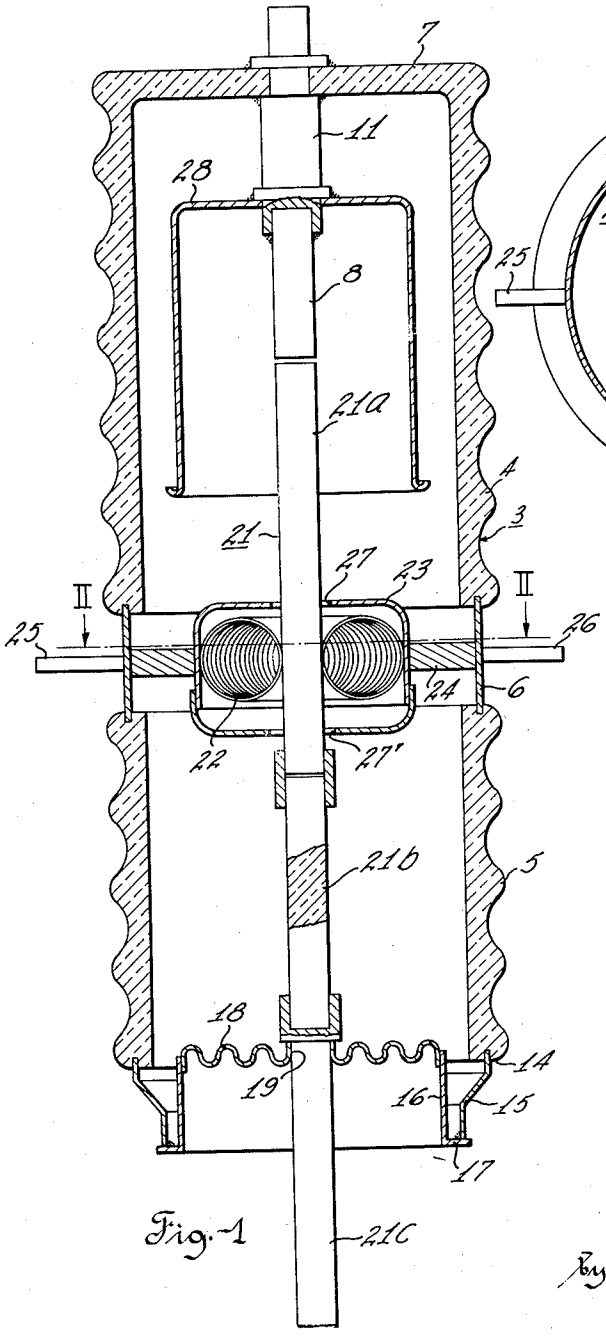

Fig. 1

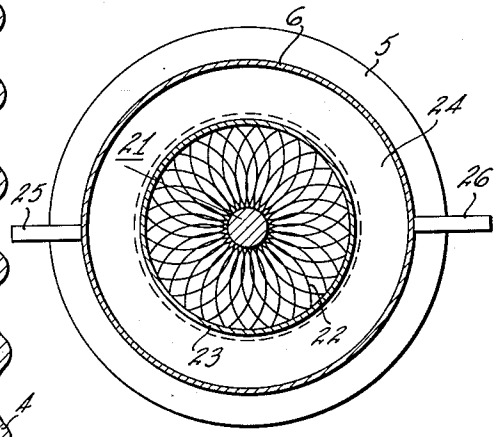

Fig. 2

Inventor
Julius W. Timmerman
By Warren F. B. Leedy
Attorney

United States Patent Office 2,965,734 Patented Dec. 20, 1960

2,965,734

CURRENT CONDUCTIVE SPRING BEARING FOR VACUUM SWITCH CONTACTS

Julius W. Timmerman, North Weymouth, Mass., assignor to Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Filed Aug. 7, 1958, Ser. No. 753,665

5 Claims. (Cl. 200—144)

This invention relates to vacuumized electrical devices and more particularly to a new and improved vacuum switch employing current conductive contact controlling means for restraining axial movement and substantially eliminating lateral movement of a movable contact.

Heretofore vacuum switches employed a plurality of sliding members for controlling the axial and lateral movement of the movable contacts. These sliding members not only are costly to manufacture but make the vacuum switch highly susceptible to shock and vibration.

In accordance with the invention claimed a new and improved electrical device such as an electric switch, a vacuum condenser or an electron discharge device is provided comprising in combination a vacuumized envelope, a member mounted for movement within the envelope, and an electric terminal mounted on the envelope between the ends thereof. A bellows is fixedly attached in vacuum tight engagement along its outer periphery to the envelope and the member is arranged to extend through the aperture in the bellows inside of the envelope. The member is attached in vacuum tight engagement to the bellows along the periphery of the aperture. A current conductive tube is mounted within the envelope and is conductively connected to the terminal. As claimed, a spring is mounted within the tube and around the movable member. The spring aligns the movable member within the envelope, guides by a relatively rolling motion the movable member during actuation thereof and forms a current path from the movable member to the tube.

It is, therefore, one object of this invention to provide a new and improved electrical device.

Another object of this invention is to provide a new and improved vacuum device in which a movable member is restrained in its axial movement and prevented from substantial lateral movement.

A further object of this invention is to provide a new and improved vacuumized electrical device in which a relatively rolling motion type guiding means is arranged within the vacuumized portion of the envelope.

A still further object of this invention is to provide a new and improved nonsliding guiding means comprising a garter type spring which restrains axial movement and substantially prevents lateral movement of a movable member in a vacuumized electrical device.

A still further object of this invention is to provide a new and improved contact guiding means for a vacuum switch which aligns the movable contact within the envelope, guides by a relatively rolling motion the movable contact during actuation thereof and forms a current conductive path from the movable contact to an electric terminal.

Objects and advantages other than those set forth will be apparent from the following description when read in connection with the accompanying drawing, in which:

Fig. 1 is an elevational view partly in axial section of a vacuum switch embodying the invention; and

Fig. 2 is a plan view of the vacuum switch illustrated in Fig. 1 looking in the direction of the arrows along the line II—II.

Referring more particularly to the drawing by characters of reference, Fig. 1 illustrates an electric switch comprising a vacuumized envelope 3 having cylindrical portions 4 and 5 interconnected by a conductive cylindrical portion 6. Portions 4 and 5 may be formed, for example, of any suitable electrical insulating material such as a vitreous or ceramic substance. One end of envelope 3 is provided with an apertured end cap 7 to which is fixedly secured in vacuum tight connection thereto one end of a fixed contact 8. Cap 7 may be a separate structure from portion 4 of envelope 3 or a part of it and further may be reentrant, flat or even protruding, if desired.

Cap 7 supports a contact mounting or bushing 11 to which is secured one end of the fixed contact 8. Contact 8 is arranged to extend along the longitudinal axis of envelope 3 and is substantially rigidly supported so as to restrict longitudinal or lateral movement thereof. Cap 7 may support a venting passage (not shown) through which envelope 3 is evacuated and sealed off in the usual way.

The opposite end of envelope 3 is provided with an annular rim 14 to which is fixedly secured in a vacuum tight connection one end of a ring or flange 15. A retainer or tube 16 is sealed throughout its rim 17 to the other end of flange 15 and in the example shown in Fig. 1 is arranged to extend inwardly of envelope 3. A metallic disklike bellows 18 is fixedly secured in a vacuum tight connection at the outer periphery thereof to the inwardly extending end of tube 16. Bellows 18 is provided with an aperture 19 extending substantially centrally thereof through which a movable contact 21 is arranged to project. Contact 21, as shown, comprises two conductive portions 21*a* and 21*c* interconnected by an insulating portion 21*b*. Contact portion 21*c* of contact 21 is arranged in vacuum tight connection with the walls of aperture 19 in bellows 18 so that contact 21 extends through tube 16 into envelope 3 with contact portion 21*a* being in cooperating relationship with contact 8.

The fixed contact 8 and contact portion 21*a* of movable contact 21 may be made of any suitable material such as tungsten or tungsten alloys. As shown in Fig. 1 contact 21 is arranged for axial movement a limited predetermined distance by a contact actuating mechanism (not shown) while being restrained from lateral displacement. To accomplish this contact 21 is supported within envelope 3 by at least one coil spring guiding means such as garter spring 22.

Garter spring 22 is snugly mounted within a tube or canister 23 which is fixedly mounted within envelope 3 between the ends thereof by an annular ring 24 attached to metallic portion 6. A pair of electric terminals 25 and 26 are fixedly attached to portion 6 of envelope 3. As noted from the drawing contact 21 when actuated moves axially through the terminals 25 and 26.

Spring 22 forms a bearing for the straight line guiding movement of contact 21 and also a means to transfer current from the movable contact 21 through ring 24 and portion 6 of envelope 3 to the electrical terminals 25 and 26. The individual coils of the garter spring 22 used for straight line guidance of contact 21 form a very intimate multipoint contact with the movable contact 21 and the canister wall. The canister is part of the flange or ring 24 and forms one part of the current path to terminals 25 and 26. The garter spring, therefore, effectively serves as a shunt connection between the flange and the movable contact and eliminates the prior art braid connections. Further, spring 22 reduces the friction wear of the moving parts of the switch.

As shown in the drawing spring 22 fits snugly into tube

or canister 23. Canister 23 is provided with a pair of apertures 27, 27' through which contact 21 extends. The ends of canister 23 defining the walls of apertures 27, 27' serve as a means for holding spring 22 within the canister during closing and opening operations of the vacuum switch.

In order to control the arcing products emitted upon separation of the engaging surfaces of contacts 8 and 21 a cylindrical cup shaped tube or shield 28 is provided around and spaced from contact 8. Shield 28 is arranged to extend beyond the engaging ends of contacts 8 and 21 so as to surround at least a part of contact 21 when in contact engaging position. Shield 28 may be formed of glass or any suitable metallic or nonmetallic material.

Upon actuation of movable contact 21 in contact engaging or contact disengaging direction bellows 18 deflects allowing restricted axial movement of contact 21. The required range of movement of contact 21 is very small. With only three-sixteenths of an inch separation between engaging surfaces of contacts 8 and 21 a current of several hundred amperes at an A.C. voltage of 15,000 may be safely interrupted and the switch can continuously conduct current up to fifty amperes. Since normal atmospheric pressure tends to expand the bellows into envelope 3, the atmospheric pressure may be utilized to hold the contacts together in normally closed position or to speedily close the gap between them upon release of an externally applied contact separating force.

The drawing clearly indicates that the vacuum switch envelope 3 may be mounted by flange 15 at ground potential whereupon the lower portion 5 of envelope 3 then permanently insulates the terminals 25 and 26 from ground and the upper portion 4 of envelope 3 insulates terminals 25 and 26 from the terminal cap end of the envelope which end is at line potential when cooperating contacts 8 and 21 are in circuit open position.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

Having now particularly described and ascertained the nature of my said invention and the manner in which it is to be performed, I declare that what I claim is:

1. An electric device comprising in combination a vacuumized envelope, a member mounted within and axially movable through one end of said envelope, a first tube mounted on said one end of said envelope in vacuum tight engagement therewith, a disklike apertured bellows fixedly attached in vacuum tight engagement along its outer periphery to the inside surface of said first tube, said movable member extending through the aperture of said bellows inside of said envelope and attached in vacuum tight engagement to said bellows along the periphery of said aperture, a second tube fixedly mounted within said envelope between the ends thereof, an electric terminal mounted outside of said envelope between the ends thereof and in electrical contact with said second tube, said movable member extending through said second tube, and a coil spring mounted within said second tube and around said movable member, said coil spring aligning said movable member within said envelope, guiding by a relatively rolling motion said movable member during actuation thereof and forming an electrical connection between said movable member and said second tube.

2. An electric switch comprising in combination a vacuumized envelope, a pair of relatively movable cooperating contacts mounted within said envelope, one of said contacts being axially movable through one end of said envelope, a first tube mounted on said one end of said envelope in vacuum tight engagement therewith, a disklike bellows fixedly attached in vacuum tight engagement along its outer periphery to the inside surface of said tube, said movable contact extending through an aperture in said bellows inside of said envelope and attached in vacuum tight engagement to said bellows along the periphery of said aperture, a second tube fixedly mounted within said envelope between the ends thereof, an electric terminal mounted outside of said envelope between the ends thereof and in electrical current conductive contact with said second tube, said movable contact extending through said second tube, and a coil spring mounted within said second tube and around said movable contact, said coil spring aligning said movable contact within said envelope, guiding by a relatively rolling motion said movable contact during actuation thereof and forming an electrical current conductive connection between said movable contact and said second tube.

3. An electric switch comprising in combination a vacuumized envelope, a pair of relatively movable cooperating contacts mounted within said envelope, one of said contacts being axially movable through one end of said envelope and comprising an insulating portion and a conductive portion, a first tube mounted to extend within said one end of said envelope in vacuum tight engagement therewith, a disklike bellows fixedly attached in vacuum tight engagement along it souter periphery to the inside surface of said first tube, said movable contact extending through an aperture in said bellows inside of said envelope and attached in vacuum tight engagement to said bellows along the periphery of said aperture, said insulating portion of said movable contact insulating said conductive portion of said movable contact from said one end of said envelope, a second current conductive tube fixedly mounted within said envelope between the ends thereof, said movable contact extending through said second tube, terminal means mounted on said envelope between the ends thereof and conductively connected to said second tube, and a coil spring snugly mounted within said second tube and around said conductive portion of said movable contact, said coil spring aligning said movable contact within said envelope, guiding by a relatively rolling motion said movable contact during actuation thereof and forming a current path from said conductive portion of said movable contact to said second tube.

4. An electric switch comprising in combination a vacuumized envelope, said envelope comprising a pair of insulating portions interconnected by a conductive portion forming a terminal connection, a pair of relatively movable cooperating contacts mounted within said envelope, one of said contacts being axially movable through one end of said envelope and comprising an insulating portion and a conductive portion, a first tube mounted to extend within said one of said envelope in vacuum tight engagement therewith, a disk-like bellows fixedly attached in vacuum tight engagement along its outer periphery to the inside surface of said tube, said movable contact extending through an aperture in said bellows inside of said envelope and attached in vacuum tight engagement to said bellows along the periphery of said aperture, said insulating portion of said movable contact insulating said conductive portion of said movable contact from said one end of said envelope, a second tube fixedly mounted within said envelope between the ends thereof and conductively connected to said conductive portion of said envelope, said movable contact extending through said second tube, and a coil spring mounted with said second tube and around said movable contact, said coil spring aligning said movable contact within said envelope, guiding by a relatively rolling motion said movable contact during actuation thereof and forming a current conductive path from said movable contact to said second tube.

5. An electric switch comprising in combination a vacuumized envelope, a pair of relatively movable cooperating contacts mounted within said envelope, one of said contacts being axially movable through an electric

terminal mounted on and extending through said envelope between the ends thereof, bellows fixedly attached in vacuum tight engagement along its outer periphery to said envelope, said movable contact extending through an aperture in said bellows inside of said envelope and attached in vacuum tight engagement to said bellows along the periphery of said aperture, a current conductive tube mounted within said envelope between the ends thereof, said tube being conductively connected to said terminal, said movable contact extending through said tube, and a spring mounted within said tube and around said movable contact, said spring aligning said movable contact within said envelope, guiding by a relatively rolling motion said movable contact during actuation thereof and forming a current path from said movable contact to said tube.

References Cited in the file of this patent

UNITED STATES PATENTS

1,814,851	Prince	July 14, 1931
1,935,228	Kopeliowitsch	Nov. 14, 1933
2,101,346	Robertson	Dec. 7, 1937
2,449,479	Hopper et al.	Sept. 14, 1948
2,773,154	Williams	Dec. 4, 1956
2,863,026	Jennings	Dec. 2, 1958

FOREIGN PATENTS

407,725	Germany	Jan. 2, 1925
686,525	France	Apr. 14, 1930
594,282	Germany	Mar. 14, 1934
524,494	Belgium	Dec. 15, 1953
1,007,576	Germany	May 2, 1957