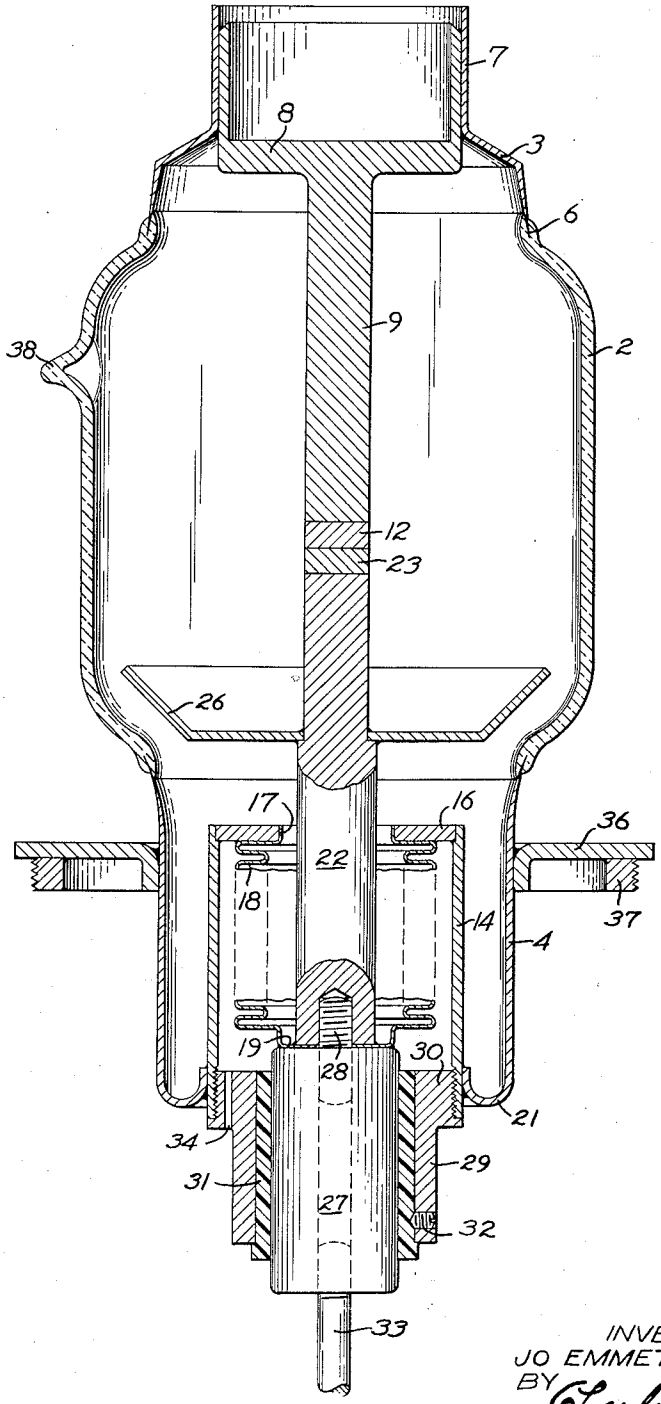
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VACUUM SWITCH

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VACUUM SWITCH

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My invention relates to vacuum switches and particularly to such switches in which a bellows is used to seal hermetically the mobile actuating stem in the wall of the vacuumized envelope.

One of the objects of my invention is to provide a bellows mounting in which the active portion of the bellows is not subjected to the heat of brazing used to unite integrally other portions of the structure, so that the useful life of the bellows is greatly prolonged.

Another object is the provision of a vacuum switch assembly having particular application in the design of high power vacuum switches.

Another object is the provision of a bellows mounting in a vacuumized implement which also provides a protective shield to the bellows.

Still another object of the invention is the provision of a vacuumized implement of the character described in which the actuating stem is insulated from direct contact with its bearing.

Another object of the invention is the provision of a vacuumized implement having its mobile electrode sealed by a flexible bellows so protected from the heat required for its manufacture that its active life is many times increased.

Another object of the invention is the improvement of the bearing structure, so that both elements, fixed and movable may be readily removed for inspection or repair.

Another object of the invention is the provision of a bearing structure in which the journal may be insulated from the bearing so as to eliminate sparking between them which sometimes occurs with fault currents of high potential.

Another object is the provision of a bellows mounting in which both ends of the bellows are fixedly supported, so that in operation of my device the bellows is evenly stressed throughout its length.

Another object is the provision of a switch structure and contact mountings adapted for speedy conduction and radiation of heat generated during operation.

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.

The figure of the drawing is a half sectional view of a vacuum switch embodying my invention. The scale is about full size for a switch intended for heavy current and high power use.

In terms of broad inclusion, by invention is embodied in a vacuumized envelope, mainly of dielectric material such as glass, but hermetically closed at one end by a fixed contact mounting, providing stable support for the contact, fast assembly and improved thermal conductivity and transference; and at the opposite or mobile end of the envelope, by an end cap structure which includes a flexible wall such as a bellows by which an instrumentality wholly within the envelcpe may be more effectively mounted, and better controlled by a mobile operator wholly outside the envelope. My new mobile end cap structure also provides in itself near perfect protection to the bellows from injury by particles emanating from switch electrodes within the envelope.

While the drawing discloses my invention as embodied in a switch, it is obvious that instead of tungsten electrodes interleaving fixed and mobile condenser plates may be mounted on the stems. Whether capacitor or switch, the size is widely variable. My design is particularly adaptable for inclusion in miniature implements. In the followng description however, I shall describe my invention as embodied in a switch adapted for use in circuits of heavy current and high power.

The vucuumized envelope of my electrical implement comprises a dielectric shell **2** conveniently of generally cylindrical conformation and closed at opposite ends by conductive end cap structures **3** and **4**. End cap **3** at the fixed end of the implement forms a hermetic union at **6** with the dielectric shell; and in the large cylindrical flange **7**, forming an outside electrode, the heavy outwardly opening cup **8** having the fixed copper contact stem **9** is brazed. The inner end of the stem **9** is capped by a tungsten contact point or electrode **12**. So constructed and proportioned, the fixed end provides a rigid mounting for the electrode and superior thermal conductivity and radiation of heat generated during operation.

On the opposite or mobile end of the envelope the shell **2** is closed by the end cap **4**, which is formed with an internal return bend or wall **14**, preferably of two integrally united parts as shown. At its inner end the internal wall is provided with an inwardly extending annular flange **16**, to which the inner open end **17** of the large diameter bellows **18** is brazed. The sizes and arrangement of parts is such that the closed end **19** of the bellows is inside the plane of the end bend **21** of the end cap structure.

Brazed and integrally united to the inside surface of the bellows end **19**, and extending out of the bellows past the flange **16** and well into the envelope is the mobile copper stem **22**, on the free end of which is fixed the contact or electrode **23**, axially aligned with and in operative spacing with the fixed stem **9** and contact **12**.

The spacing between the annular bellows flange **16** and the mobile stem **22** is close, but wide enough to permit relative movement without touching or inducing flash-over with high current. To prevent highly heated tungsten particles thrown off from the contact points from passing through this annular space or protective chamber, a dish-like copper shield **26** is fixed on the mobile stem between the contact point **23** and the bellows. Thus it is seen that the bellows is protected from bombardment by tungsten particles, on the outside by the thick wall **14** of the return bend and its internal flange **16**, and on the inside by the shield **26**.

While the particles travel at high velocity and carom around the interior surfaces of the envelope, relatively few find their way through the narrow annular space between the shield and the shell. By this construction and mounting of the bellows I am able to braze the parts together without overheating the active folds of the bellows, so that its active life is many times increased over that possible when subjected to the usual furnace brazing temperature.

Means outside the envelope are provided for moving the stem **22** to separate the contact points to interrupt the circuit controlled by the switch. Rigidly fixed to the out-

side face of the bellows end is a hollow actuating shaft **27**. This may be accomplished by brazing so that shaft, bellows end, and stem **22** are integrally united; or the actuating shaft may be provided with a heavy stud **28**, threaded into the end of the shaft **27** and also through the bellows end and into the stem. Since the stem and bellows end are integrally united by brazing across the entire face of the stem, the penetration of the threaded stud does not affect the hermetic security of the envelope. The advantage of the threaded stud connection is of course the ready disassembly of the actuating shaft in case of need, as well as its simple assembly procedure during manufacture.

The actuating shaft is journaled in a bearing bracket **29** firmly seated at its inner end **30** in the outer end of the end cap structure close to the bend **21**. Conveniently this is done by threading the bearing into the return bend or wall **14** as shown, but of course it could be brazed in place. In tests with fault currents of high voltage and thousands of amperes, a potential drop can occur between bearing and shaft sufficient to cause spot welding between them, with resultant immobility. To prevent this, a dielectric sleeve **31** of Teflon or other suitable material may be interposed between the two, and held in place by a set screw **32** as shown. Whether or not used as an insulator, the Teflon sleeve together with the detachable shaft and bearing insures a ready replacement and correction of wear or other fault in the bearing. During heating of the implement at bake-out or otherwise, the Teflon sleeve is replaced temporarily by a metal sleeve of the same size.

In the small or miniature sizes of my implement, an insulating sleeve or any sleeve at all may be omitted. It will also be apparent that the actuating shaft **27**, may be made of Teflon or other suitable dielectric material, and thus constitute an insulator coupling between mobile stem **22** and operator link **33**.

Threading the outer end of the hollow shaft **27** provides means for the connection of an operator link **33**. A passage **34** into the chamber surrounding the bellows supplements natural leakage past the bearing surfaces so that the chamber pressure remains at all times the same as the surrounding atmosphere.

Means for mounting my implement in a panel are provided. Surrounding the end cap **4** preferably as near as possible to the center of gravity of the entire structure is a heavy gauge brass annulus or flange **36**, brazed to the end cap. A threaded mounting ring **37** is brazed to the flange and may be turned into a threaded aperture in a panel to mount the implement. This mounting is preferred to the conventional bolts, especially for the smaller sizes of my implement.

It is to be noted that each end cap structure is assembled separately and then sealed into the adjacent rim of the shell. A conventional tubulation **38** permits the usual connection for vacuumization of the envelope.

I claim:

1. In a vacuumized electric switch, the subcombination of a dielectric shell closed at one end by a tubular conductive end cap having an integral internal return bend

portion and a concentrically disposed inner wall portion having an inwardly extending annular flange wholly within the end cap and concentric therewith, a generally cylindrical bellows lying wholly within the end cap and having a closed outer end and having an open inner end integrally united with the annular flange, a conductive stem within the bellows integrally united with the closed outer end and extending out of the open end into the shell, an operating shaft fixed to the outer end of the bellows on the outer face thereof, and a slide dielectric bearing for the shaft mounted on the end cap.

2. An electric switch comprising a vacuumized envelope having conductive end caps hermetically connected by an intervening dielectric shell, one of the end caps having a reverse and inwardly disposed bend portion at its outer end extending as a concentrically spaced inner wall within said end cap and said inner wall having a transversely and inwardly extending flange at its inner end, a generally cylindrical bellows concentrically spaced within said inner wall portion of said cap and having an outer closed end and an inner open end, the latter of which being integrally united with said annular flange portion, a bearing bracket concentrically disposed at one end within and attached to an outer end portion of said inner wall and in spaced relation outward from the closed outer end of said bellows, said bearing bracket having a dielectric bearing bushing therein, an operating shaft journaled in the dielectric bushing of the bearing bracket in axial alignment with the bellows and fixed to the closed end thereof, a stem integrally united with the closed end of the bellows and extending axially out of the bellows open end into the envelope, a first contact on the free end of the stem, and a second contact in operative alignment with the first contact and mounted within the envelope on the other end cap.

3. An electric implement of the character described in claim 2 wherein said bearing bracket is detachably attached to said outer portion of said inner wall.

4. An electric implement of the character described in claim 2 wherein an annular plate constituting a shield is mounted within the envelope to extend transversely to said stem between the bellows and the contact on said stem.

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