Oct. 27, 1964 J. S. HAWKINS 3,154,655

THREE-PHASE VACUUM SWITCH

Filed April 18, 1962 2 Sheets-Sheet 1

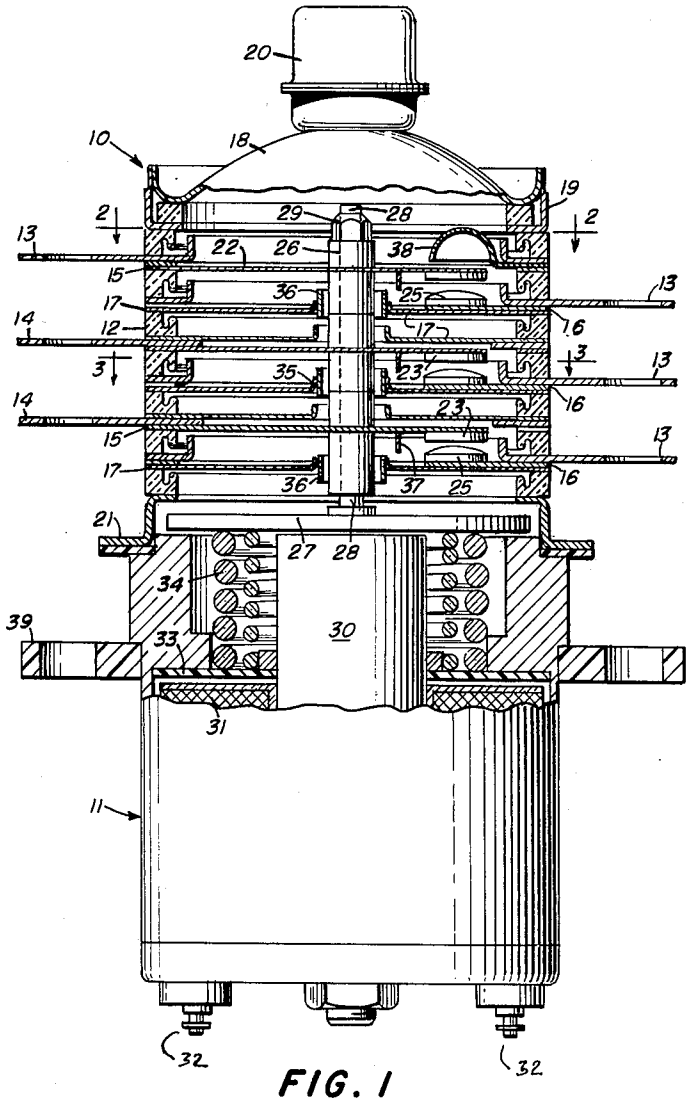


FIG. 1

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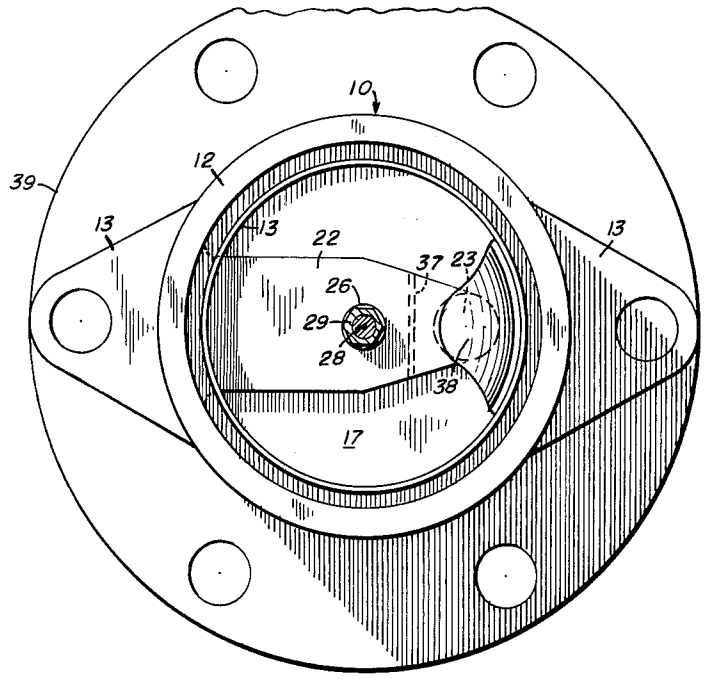


FIG. 2

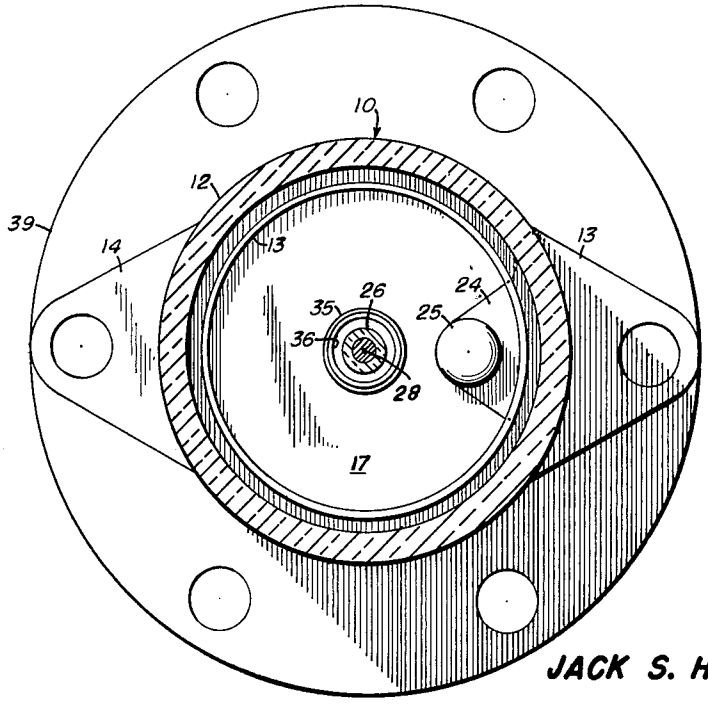


FIG. 3

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THREE-PHASE VACUUM SWITCH

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8 Claims. (Cl. 200—144)

This invention relates to vacuum switches having a plurality of contacts enclosed within a vacuumized envelope and adapted for simultaneous operation.

A principal object of this invention is the provision of a small three-phase switch in which three pairs of contact points can be effectively operated within a single vacuumized envelope.

Another object of this invention is the provision of a three-phase vacuum switch having novel baffles disposed between the pairs of contacts.

Another object is the provision of a three-phase vacuum switch having baffle plates disposed between the pairs of contacts for forming a plurality of chambers in communication with each other at only a small annular opening.

Another object of the invention is the provision of a three-phase vacuum switch having baffle bars on movable contact fingers.

Other objects of the invention are the provision of a three-phase vacuum switch of easy and inexpensive manufacture, small compact size, rugged construction, and adaptability for volume construction at low cost. These and other objects of the invention will be readily apparent from the following specification wherein like numerals refer to similar parts throughout.

In the drawings:

FIGURE 1 is a partial elevation and a partial section of a three-phase switch embodying the invention;

FIGURE 2 is a section taken along the line 2—2 of FIGURE 1; and

FIGURE 3 is a section taken along the line 3—3 of FIGURE 1.

In its broadest aspects the vacuum switch comprises a cylindrical housing or envelope which is constructed from a plurality of ceramic rings and alternating metal rings. Selected metal rings have inwardly extending contact fingers and adjacent metal rings have stationary contacts for forming a plurality of pairs of contacts. The movable contact fingers are secured to a central stem, and means is provided to move this stem axially for making and breaking contact between the movable contact fingers and respective stationary contacts. End plates are provided at the terminal ceramic rings, and the envelope is evacuated to create the vacuumized chamber.

In the operation of this switch, the heat of the arc will cause small amounts of metal to vaporize at the contacts. This metalized vapor provides an electrical path between the pairs of contacts if some means to prevent the vapor flow is not provided. If this vapor is allowed to form such an electrical path, the current will flow between phases allowing high currents to destroy the switch and possibly related equipment. In this invention novel baffle means have been provided to substantially eliminate any contact vapor from any of the individual pairs of contacts from reaching the housing or vapor from an adjacent pair of contacts. In this way a number of pairs of contacts may be effectively operated within a single, small vacuumized envelope.

Referring to the drawings and more particularly to FIGURE 1, the three-phase vacuum switch of this invention will be seen to include a hermetically tight assembly or envelope, generally designated 10, and a steel housing, generally designated 11, which includes the actuating elements of the switch. The envelope 10 comprises ceramic

rings 12, which have been metalized on both flat faces, alternated with copper rings 13 or 14, molybdenum contact rings 15 or 16, and nickel iron baffle plates 17 until the complete cylindrical assembly has been formed.

The upper end of the switch is hermetically closed by a domed metal top plates 18 welded to a metal ring 19 which is united to the uppermost ceramic ring 12 as by brazing. A cover 20 is secured to the plate 18; this cover encloses a metal tube which is used to seal off the envelope after the exhausting procedure.

A metal ring 21 is brazed to the lower face of the bottom ceramic ring, and this ring 21 is secured to the housing of the switch actuating mechanism 11.

Thus, a hermetically tight assembly or envelope may be found. For a more extensive discussion as to the manner of uniting all of the rings and evacuating the envelope, reference may be had to the patent to Steward et al., 2,886,668, issuing on May 12, 1959.

As best seen in FIGURE 2, each of the contact rings 15 has an inwardly extending finger 22 provided with a contact 23 on the underside of the end thereof. As seen in FIGURE 3, each of the contact rings 16 has an inwardly extending shelf-portion 24 provided with a second contact 25 on the upper surface thereof. The rings 15 and 16 are alternated between the ceramic rings 12 to form a plurality of pairs of aligned contacts. The contacts 23 are caused to make and break electrical contact with the stationary contacts 25 by a ceramic stem 26 which is secured to each contact finger 22 and to an armature plate 27. The stem 26 may be made from a plurality of hollow, cylindrical ceramic elements secured together and fastened to the armature plate by a bolt 28 and nut 29. The contact fingers have an aperture adapted to receive the bolt 28; they are held in spaced-apart relation along the stem by the cylindrical ceramic elements. Axial movement is imparted to the stem 26 by any suitable means such as an electro-magnetic core 30 and a coil 31 adapted to be energized by leads attached to terminals 32. Between the armature plate 27 and a partition plate 33 are two spiral springs 34 which normally press the armature plate 27 and stem 26 upwardly to open the pairs of contacts. When the coil 31 is energized the armature plate and stem are drawn downwardly making the contacts.

As pointed out above, in the operation of the switch the heat of the arc will cause small amounts of metal to vaporize at the contacts, and since this metalized vapor provides an electrical flow path, it must be prevented from flowing to an adjacent pair of contacts. Such a flow is substantially prevented by the baffle plates 17. These plates separate the envelope into a plurality of shallow chambers in communication with each other only at a small annular opening where the plates are apertured for receiving the stem 26. The flow of metalized vapor is further impeded by the provision of an upturned lip 35 at the periphery of the central aperture in the baffle plate 17. As an even further obstacle to prevent the flow of vapor from one pair of contacts to another, a sleeve 36 concentric with the stem 26 is secured to the lip 35 in selected baffle plate 17. The metalized vapor emanating from the contacts is prevented from flowing directly to the small annular opening surrounding the stem 26 by the provision of baffle bars 37 attached to the underside of the contact fingers 22. The effect of these baffles is the provision of a tortuous flow path between pairs of contacts.

It will be observed that two baffle plates 17 are mounted between the pairs of contacts. This construction has the effect of providing a chamber between chambers containing the contacts for further aiding in electrically separating the pairs of contacts. This construction also precludes any possibility of one of the contact fingers com-

ing into contact with a baffle plate 17 which is adjacent a stationary contact of one of the other pairs of contacts. A solid ceramic disk having only a central aperture for receiving the stem 26 could be provided in lieu of this extra chamber formed by the two baffle plates. It should also be noted in the construction shown that when the contacts are in their de-energized position, the contact finger 22 substantially closes the annular opening between the stem and the baffle plate located just above the contact finger. Thus, the flow of vapor is practically precluded when the contacts are de-energized.

The baffle plates, whose primary purpose is the prevention of the flow of metalized vapor from one pair of contacts to an adjacent pair of contacts, also serve to dampen resonances of the contact fingers when they are in a de-energized position. The additional baffle plate mounted between ceramic rings just above the contact finger of the middle and lower pairs of contacts serves this function. The contacts are shown in their half energized position in FIGURE 1. Resonances of the contact finger of the uppermost pair of contacts are dampened by an arcuate snubber 38 which is preferably integral with a metal ring mounted between selected ceramic rings. In the energized position of the contacts, contact finger resonances are dampened by overtravel of the contact finger itself. In other words, the stem 26 moves the fingers downwardly for a distance slightly greater than the distance between the contacts in their de-energized position.

It can be seen that by this invention a three-phase vacuum switch has been provided which permits the effective operation of a plurality of pairs of contacts in a single, small vacuumized envelope. The arrangement of baffles substantially prevents the flow of metalized vapor from one pair of contacts to an adjacent pair of contacts. The three-phase switch is easy to construct, and it may be conveniently mounted in place by a mounting flange 39 integral with the steel housing 11.

It is to be understood that the embodiment shown is for the purpose of example only, in that other modifications thereof will fall within the scope of the appended claims.

I claim:

1. A vacuum switch comprising a plurality of ceramic rings, metal rings interposed between said ceramic rings, stationary contacts on selected metal rings and movable contact fingers on adjacent metal rings forming a plurality of pairs of contacts, a stem axially disposed within said rings and secured to each of said movable contact fingers, said stem adapted to be axially moved to make and break electrical contact between the movable contact fingers and respective stationary contacts, at least one baffle plate horizontally disposed between said pairs of contacts and sandwiched between selected ceramic rings, said baffle plate having a central aperture proportioned to receive said stem and permit its axial movement therethrough while restricting the passage of vaporized contact metal from one side of the plate to the other, all of said rings and said plate being secured together to form a hermetically tight assembly with end plates at opposite ends of said assembly.

2. A vacuum switch according to claim 1 wherein said baffle plate includes an upturned lip at the periphery of said central aperture.

3. A vacuum switch according to claim 2 wherein said baffle plate includes an axially disposed sleeve secured to said upturned lip, said sleeve adapted to receive and cooperate with said stem to restrict passage of vaporized contact metal from one side of the baffle plate to the other.

4. A vacuum switch according to claim 1 wherein each of said movable contact fingers has a transversely extending baffle bar secured thereto between the free end thereof and the point of affixation of said stem with said contact finger to shield said aperture in the baffle plate from vaporized contact metal.

5. A vacuum switch comprising a plurality of ceramic rings, metal rings interposed between said ceramic rings, stationary contacts on selected metal rings and movable contact fingers on adjacent metal rings forming a plurality of aligned pairs of contacts, a stem axially disposed within said rings and secured to each of said movable contact fingers, means for moving said stem axially to make and break electrical contact between the movable contact fingers and respective stationary contacts, at least one baffle plate horizontally disposed between said pairs of aligned contacts and sandwiched between selected ceramic rings, said baffle plate having a central aperture adapted to receive said stem and permit its axial movement therethrough, all of said rings and said plate being secured together to form a hermetically tight assembly with end plates at opposite ends of said assembly.

6. A vacuum switch according to claim 5 wherein a second baffle plate is disposed between said pairs of aligned contacts and interposed between selected ceramic rings.

7. A vacuum switch comprising a plurality of ceramic rings, metal rings interposed between said ceramic rings, selected metal rings having integral fixed contacts extending inwardly therefrom and adjacent metal rings having integral movable contact fingers extending inwardly therefrom to a free-end portion forming with said integral fixed contacts a plurality of aligned pairs of contacts, a stem axially disposed within said rings and secured to each of said movable contact fingers intermediate its end, means for moving said stem axially to make and break electrical contact between the movable contact fingers and respective stationary contacts, at least one baffle plate horizontally disposed between said pairs of aligned contacts and sandwiched between selected ceramic rings, said baffle plate having a central aperture adapted to receive said stem and permit its axial movement therethrough, all of said rings and said plate being secured together to form a hermetically tight assembly with end plates at opposite ends of said assembly.

8. A vacuum switch according to claim 7 wherein each of said contact fingers has a transversely extending baffle bar depending therefrom between the free end thereof and the point of affixation of said stem with said contact finger.

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