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VACUUM RELAY

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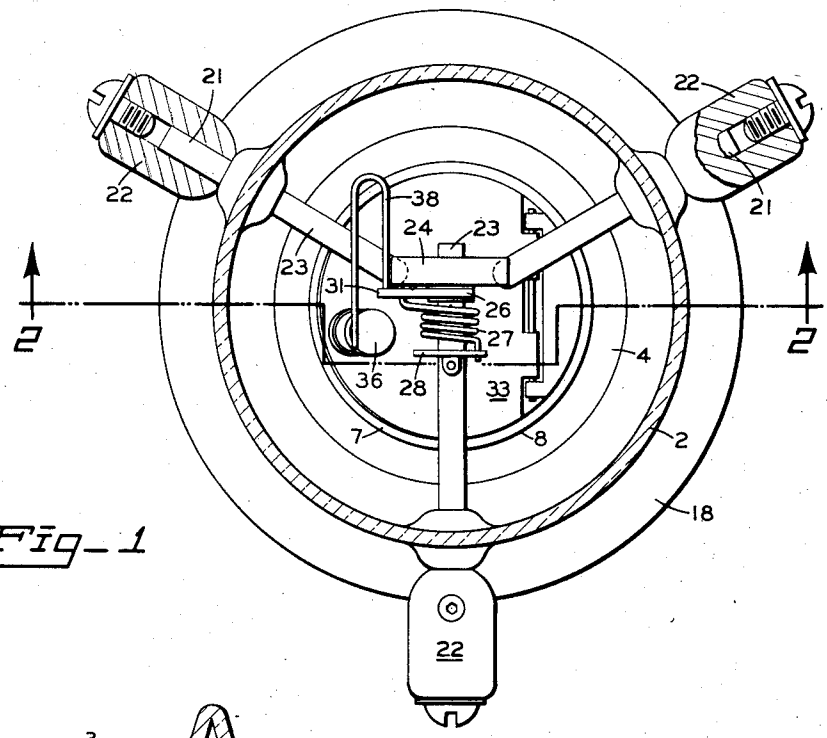


Fig_1

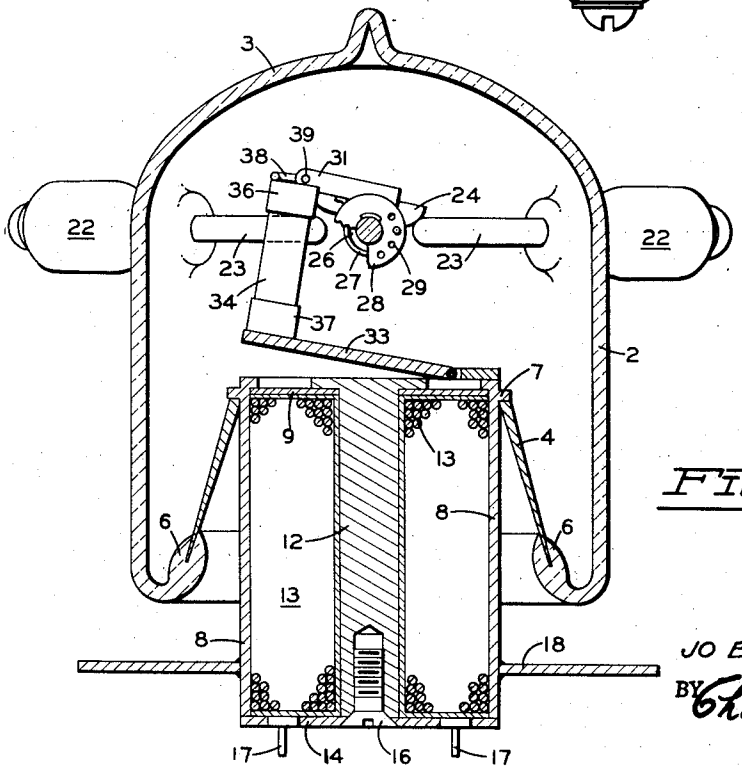


Fig_2

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VACUUM RELAY

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8 Claims. (Cl. 200—87)

My invention relates to vacuum relays or switches, and particularly to vacuum relays suitable for use with high radio frequency voltages and currents.

One of the objects of the invention is the provision of a vacuum relay in which the actuating coil is detachable and replaceable.

Another object of the invention is the provision of a vacuum relay capable of satisfactory operation under a wide range of vibration and shock conditions, and wide temperature variations.

A further object is the provision of a relay in which contact is made under resilient pressure to insure low contact resistance.

A still further object of the invention is the provision of a vacuum relay which is not dependent on atmospheric pressure and will operate satisfactorily in a rarified atmosphere or immersed in an insulating liquid.

The invention possesses other objects some of which with the foregoing will be brought out in the following description of the invention. I do not limit myself to the showing made by the said description and the drawings, since I may adopt variant forms of the invention within the scope of the appended claims.

Referring to the drawings:

Fig. 1 is a plan view with parts of the device broken away to reveal the underlying structure.

Fig. 2 is a vertical sectional view taken in the plane indicated by line 2—2 of Fig. 1.

Both figures are drawn approximately twice actual size.

Broadly considered, the vacuum relay of my invention comprises a dielectric bulb or shell having an open end closed hermetically by a metallic wall to form a vacuumized envelope. Extending through the wall and hermetically brazed thereto is a magnetizable core. A metallic housing surrounding the core encloses an energizable coil fitting snugly in the annular space between core and housing and mounted on a detachable housing cover plate. Within the envelope, an armature is pivotally mounted adjacent the inner end of the core. The armature is operatively connected to and insulated from a contact movably supported on one of a plurality of spaced contact points and movable to engage and disengage adjacent contact points. Each contact point within the envelope is integrally continuous with a lead terminating outside the envelope.

In more specific terms, the relay of my invention comprises a dielectric shell or bulb 2 symmetrical about a longitudinal axis and hermetically closed by a dielectric wall 3 at one end and by a metallic wall at the other end. The metallic end wall is formed by a hollow conical copper shell 4 having its larger perimeter hermetically sealed to an integral reentrant marginal bead 6 on the open end of the bulb. The conical shell extends inwardly into the bulb and is hermetically brazed at its inner end to the inner end 7 of a hollow cylindrical magnetizable housing 8.

The housing is hermetically closed at its inner end by

a non-magnetizable metallic wall 9 brazed to the housing. Brazed to the wall 9 and extending on both sides thereof is a metallic core 12. The core extends outwardly through the housing and terminates flush with the outer end thereof. An energizable coil 13 fits snugly within the space between housing and core and is mounted on a metallic cover plate 14 which is detachably secured to the outer end of the core by a screw 16. The cover plate thus encloses and demountably supports the spool-wound coil and completes the magnetic circuit at this end between the core and housing. Coil terminals 17 extending through the cover plate serve to connect the coil to a source of power, and a radially extending metallic mounting plate 18 brazed to the outer periphery of the housing provides means by which the relay may be mounted in a panel. The mounting plate 18 is particularly useful where it is desired to enclose the relay within an oil-filled container. Under these conditions the plate may be brazed or silver soldered to the container to render a fluid-tight connection.

Extending radially into the bulb are a plurality of contact rods, each extending hermetically through the bulb wall and rigidly supported thereby. Exteriorly the contact rods constitute terminal leads 21 and are provided with easily attachable and detachable connector means 22 for connecting the relay into a circuit. The contact rods preferably lie in a common plane and are equally spaced about the bulb at 120° intervals. Within the envelope, each contact rod terminates in a contact point 23 radially spaced from the longitudinal axis of the bulb and circumferentially spaced from the next adjacent contact point.

Journaled on one of the contact points within the envelope is a movable contact 24, conveniently a short cylindrical tungsten rod brazed to and carried by a copper block 26. The copper block is journaled on one of the contact points adjacent the end thereof and positions the contact 24 so that it may be tilted to engage one or the other of the two remaining contact points. The contact 24 is biased into engagement with one of the contact points, as shown in Figs. 1 and 2, by a coil spring 27 wound around the supporting contact point. One end of the spring is anchored to washer 28 spot-welded to the contact point and having a plurality of peripheral apertures 29 useful for adjusting the tension of the spring. The other end of the tensioned spring is caught under a lug 31 extending from the journal block 26. The contact is thus normally held resiliently pressed against one of the contact points with a force which is adjustable during assembly to a value desirable for a particular installation.

To move the contact in a direction against the tension of the spring 27, an armature 33 is provided within the envelope pivotally mounted on the housing adjacent the inner end of the core. A ceramic post 34, having top and bottom metallic end caps 36 and 37 brazed thereon, is fixed on the armature, as by brazing, and extends upwardly into the bulb to about the plane of the contact points. A U-shaped resilient metallic lever 38 has one arm brazed to the top cap 36 on the post, and its other end is engaged in an aperture 39 in the lug 31.

Tension in the coil spring 27 thus biases the block and contact so that the lug 31 is elevated. This elevation is reflected by movement of the U-shaped resilient lever 38 upwardly, which in turn pivots the armature and resiliently holds it away from the inner end of the core. This is the normal position of the parts.

When the coil 13 is energized, the armature is pulled down against the inner ends of housing and core to complete the magnetic circuit around this end of the housing. Post 34, being fixed adjacent the edge of the armature opposite the hinge, moves downwardly with the armature and tensions lever 38, which also moves downwardly,

pivoting the block 26 against the tension of coil spring 27, to break the normally closed circuit and make the normally open one. The relay contact is thus resiliently pressed alternately in both directions to insure positive engagement and freedom from arcing due to vibration and shock.

It should be noted that the armature is electrically insulated from the contact points by the ceramic post 34, making it possible to operate the relay with a grounded base and mounting structure. Also significant is the 120° spacing of the terminal leads and the reentrant configuration of the metallic end wall. This increases the insulating capabilities of the bulb, permitting 20 to 25 kv. operation, and also reduces the over-all height of the relay, thus effecting a saving in space.

I claim:

1. A vacuum relay comprising a dielectric bulb closed on one side with a metallic wall and therewith enclosing a vacuumized chamber, a magnetic core integral with the metallic wall and extending on both sides thereof, core energizing means adjacent the external end of the core, an armature pivotally mounted within the chamber adjacent the inner end of the core, means pressing the armature away from the core, spaced contact points within the chamber fixedly mounted on the bulb and each integrally continuous with a lead external to the bulb, a contact mounted within the vacuumized chamber and movable to connect two adjacent contact points to close a circuit therebetween, and means mounted on the armature and operatively connected to the movable contact to effect movement thereof.

2. The combination according to claim 1, in which a metallic housing open at its outer end extends from the wall on the side opposite the bulb, a cover plate closes the open outer end of the housing and is detachably fixed to the core, and said core energizing means comprises a coil mounted on the cover plate and enclosed within the housing.

3. The combination according to claim 1, in which the dielectric bulb is symmetrical about a longitudinal axis and said contact points are radially and circumferentially equally spaced about the longitudinal axis.

4. The combination according to claim 1, in which the contact is mounted on one of the contact points and is movable to engage an adjacent contact point.

5. A vacuum relay comprising a dielectric bulb closed on one side with a metallic wall and therewith enclosing a vacuumized chamber, a magnetic core integral with the metallic wall and extending on both sides thereof, core energizing means adjacent the external end of the core, an armature pivotally mounted for movement within the chamber adjacent the inner end of the core, spaced contact points within the chamber fixedly mounted on the bulb and each integrally continuous with a lead external to the bulb, a stem fixed on the armature for movement therewith and having a dielectric portion and a resilient transverse metallic portion, and a contact mounted on one of the contact points and movable by the stem to engage another adjacent contact point to close a circuit therebetween.

6. The combination according to claim 5, in which said contact is spring-pressed to normally resiliently engage a first adjacent contact point and movable by the stem to resiliently engage another adjacent contact point and disengage said first contact point.

7. The combination according to claim 5, in which resilient means interposed between the armature and one of the contact points normally pivots the armature away from the inner end of the core and energizing the core pivots the armature toward the inner end of the core.

8. The combination according to claim 7, in which pivotal movement of the armature away from the inner end of the core is accompanied by resilient engagement of an adjacent contact point by said contact and movement of the armature toward the inner end of the core is accompanied by disengagement of said contact from the contact point.

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