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VACUUM RELAY

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Fig. 1

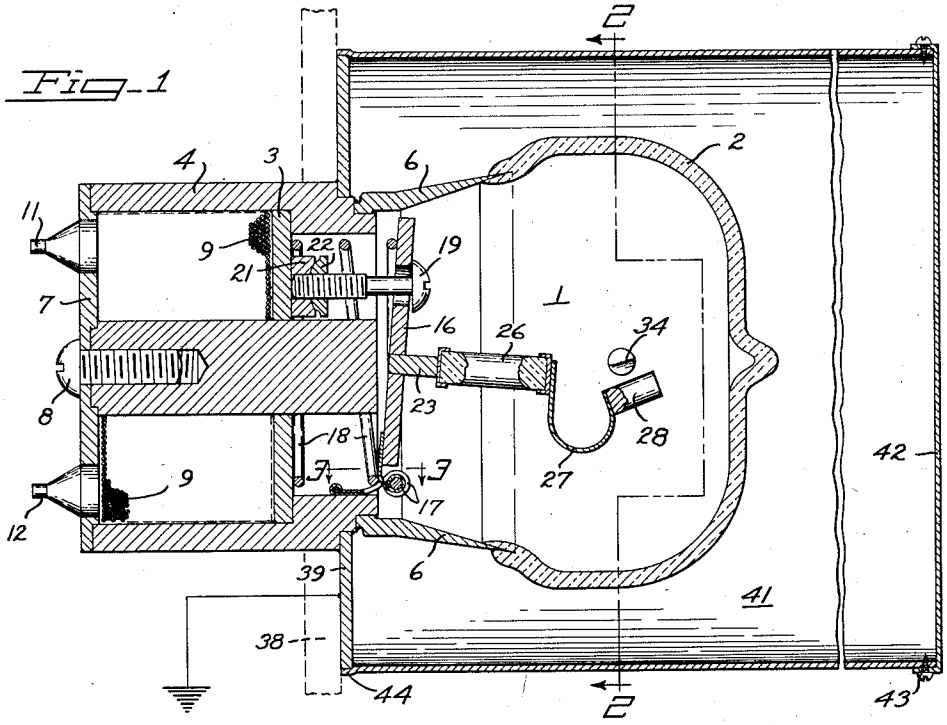
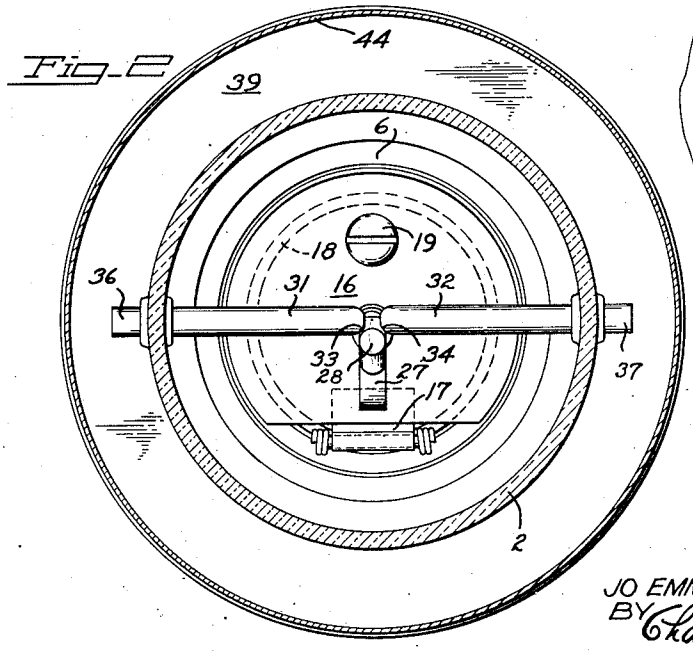


Fig. 2



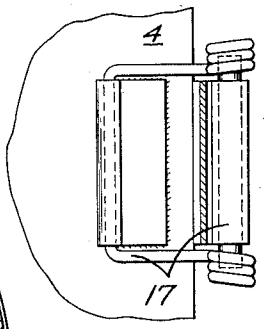


Fig. 3

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VACUUM RELAY

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7 Claims. (Cl. 200—87)

My invention relates to a vacuum relay or switch of special usefulness as a transmit-receive switch in the communication field.

One of the objects of my invention is the provision of a switch of the type described of low contact resistance, and free of tendency to arc over.

Another object of my invention is the provision of a switch of the type described which is shielded against radiation from the outside in, or from the inside out.

Another object is the provision of such a switch having an adequate ground connection so as to prevent any feedback of energy into the receiver while the transmitter is in operation.

Still another object is the provision of a switch having its contacts arranged in a vacuumized chamber to be operated by electro-magnetic means outside the chamber, and in which the coil is readily replaceable with one of like or different characteristics.

Another object is the provision of an improved coil assembly for the switch described, whereby operation at maximum magnetic efficiency is assured.

Still another important object of my invention is the provision of a vacuum switch in which the electrical demands in aviation use are fully met, as well as those imposed by mechanical shock and vibration.

Other objects will be brought out in the following description of the invention. I do not limit myself to the showing made by said description and the drawings, since I may use variant forms of the invention within the scope of the appended claims.

Referring to the drawings:

Fig. 1 is a vertical sectional view taken in the long axis of the switch.

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

Fig. 3 is a view of the armature hinge taken in the plane indicated by the line 3—3 of Fig. 1. The scale is twice that of Fig. 1.

In terms of broad inclusion my switch comprises a dielectric bulb closed on one side with a metallic wall to form a vacuumized chamber. The wall is formed in part by a ferreous cylindrical housing concentric with the long axis of the bulb and on which the bulb is secured by a copper seal ring, and in part by a copper transverse wall across the adjacent end of the housing. The copper wall is brazed to the housing and forms the bottom of a coil chamber therein, lying on the side opposite to the vacuum chamber. A ferreous cylindrical core concentric with the housing is integrally united with the copper wall, extending on one side into the vacuumized chamber and on the other side into the coil chamber.

Coil means for energizing the core is disposed in the core chamber of the housing, preferably being mounted on a readily removable cover plate so as to facilitate change.

Within the vacuumized chamber are fixed spaced contact rods, mounted on the bulb; and each is provided with leads external to the chamber. A hinged or pivotally

mounted armature within the vacuumized chamber is responsive to the energized armature and mounts a movable contact point which engages without rubbing both spaced contact rods to close the circuit between them when the core is energized to attract the armature.

The armature mounted contact is carried on the end of a stem which includes both a dielectric section and a resilient section. In some uses of my relay, it is desirable to shield the bulb, and this is effectively accomplished by fixing a lidded housing on the mounting flange, which extends radially from the housing adjacent the bulb.

The energizing means for the core is a coil fabricated on the cover plate for fast assembly within the housing. When the cover plate is fastened in place by a single screw the magnetic path around the core is closed so that magnetic efficiency is assured. Since the movable contact point is insulated from its actuating assembly, the latter and its connected housing is never part of the controlled circuit which includes only the fixed contact rods and the movable contact. In this construction no pigtails are necessary internally, no electrical loops are set up, and clean contacts are assured.

In greater detail my vacuum relay comprises a vacuumized chamber **1**, within a glass or other dielectric bulb **2**, closed at its base end with the copper wall **3**, brazed into the cylindrical ferreous shell **4**. The shell is joined to the glass bulb in hermetically tight unions by the intervening copper seal **6**, brazed on one edge to the shell and on the other united to the bulb edge in a well-known metal-to-glass seal.

A magnetic core of ferreous metal is brazed to the wall **3**, extending on both sides of the wall and concentric with the shell. A closure plate **7**, for the core chamber secured to the core at its outer end by a cap screw **8**, provides a mounting for a magnetic coil **9** for energizing the core. Leads **11** and **12** for connecting the coil into a control circuit are arranged in the cover plate. It will be noted that this arrangement facilitates the replacement of the coil assembly with the same or differing electrical values, without disturbing the relay otherwise.

Adjacent the inner end of the core and within the vacuum chamber is a ferreous armature **16**, pivotally mounted on the shell **4** by a hinge **17**. A spring **18** presses the armature away from the core; and a limit screw **19**, extending through the armature and threaded into a boss **21** on the wall **3**, limits the outward movement of the armature. A lock nut **22**, permanently fixes the adjustment of the limit screw, since this assembly is inaccessible within the vacuumized chamber.

Extending forwardly into the vacuumized chamber and rigidly fixed in the armature is a tungsten stem **23**, on the outer end of which is fixed, as by brazing, a dielectric portion **26**, preferably of ceramic material having metalized ends. The free end of the dielectric portion **26** is connected by a curved spring **27** with a tungsten contact **28**, preferably of cylindrical form as shown; and spaced, when the armature is free, from the fixed contact rods **31** and **32**, so that when the core is energized to pull the armature back against it, the movable cylindrical contact resiliently meets the rounded ends **33** and **34** of the fixed contact rods in line engagement, closing the circuit therebetween with resilient pressure but no grinding together. This results in low contact resistance and long life.

The contact rods **31** and **32** pass through and are sealed in and supported by the wall of the bulb **2** as shown, terminating in controlled circuit leads **36** and **37** respectively on the outside of the bulb.

My relay may be mounted in a panel **38** by means of a mounting flange **39**, brazed to the shell **4**, and grounded as shown. This flange also serves when desired to mount the relay in a shield can, either alone or with other instruments. In the drawing, I have shown a cylindrical

shield can **41**, in which only my relay is disposed. The shield is closed by a lid **42**, held with screws **43**. The shield is conveniently formed with an offset rim **44**, into which the edge of the mounting flange is soldered.

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 stem fixed on the armature and having a dielectric portion substantially axially aligned with said core and having a resilient transverse metallic portion and a movable contact to engage the contact points for closing the circuit therebetween mounted on the resilient metallic portion of the stem.

2. A vacuum relay comprising a dielectric bulb closed on one side with a metallic wall and therewith enclosing a vacuumized chamber, a metallic housing open at its outer end and extending from the wall on the side opposite the bulb, a magnetic core extending therethrough to provide a free end projecting on both sides of the wall and fixed therein with an hermetically tight joint, a cover plate closing the open outer end of the housing and detachably fixed to the outer free end of the core, a coil for energizing the core mounted on the cover plate and lying within the housing, spaced contact points within the chamber fixedly mounted on the bulb and each integrally continuous with a lead external to the bulb, an armature pivotally mounted within the chamber adjacent the inner end of the core, a movable contact to engage the contact points for closing the circuit therebetween, and means mounting the movable contact on the armature.

3. A vacuum relay comprising a dielectric bulb closed on one side with a metallic wall and therewith enclosing a vacuumized chamber, a metallic housing open at its outer end and extending from the wall on the side opposite the bulb, a mounting flange for the relay extending from the housing and integrally united therewith, a magnetic core extending on both sides of the wall and fixed therein with an hermetically tight joint, a cover plate closing the open outer end of the housing and detachably fixed to the outer end of the core, a coil for energizing the core mounted on the cover plate and lying within the housing, spaced contact points within the chamber fixedly mounted on the bulb, and each integrally continuous with a lead external to the bulb, an armature pivotally mounted within the chamber adjacent the inner end of the core, a movable contact to engage the contact points for closing the circuit therebetween, and means resiliently mounting the movable contact on the armature.

4. A vacuum relay comprising a dielectric bulb closed on one side with a metallic wall and therewith enclosing a vacuumized chamber, a metallic housing open at its outer end and extending from the wall on the side opposite the bulb, an annular mounting flange for the relay extending radially from the housing and integrally united therewith, a cylindrical metal shield fixed on the outer peripheral edge of the mounting flange and therewith enclosing the bulb, a magnetic core extending on both sides of the wall and fixed therein with an hermetically tight joint, a cover plate closing the housing and detachably fixed to the core, a coil for energizing the core mounted on the cover plate and detachable therewith and lying within the housing when the cover is in place, spaced contact points within the chamber fixedly mounted on the bulb and each integrally continuous with a lead external to the bulb, an armature pivotally mounted within the chamber adjacent the inner end of the core, a movable contact to engage the contact points for closing the circuit therebetween, and means mounting the movable contact on the armature.

5. A vacuum relay comprising a cylindrical metallic housing having an hermetically tight transverse wall extending thereacross intermediate its ends, a bulb hermetically sealed to the housing on one side of the wall and enclosing with the housing and wall a vacuumized chamber, a magnetic core within the housing and extending on both sides of the wall to provide inner and outer portions integrally united therewith, a magnetic coil surrounding the outer portion of the core, an armature pivotally mounted on the housing within the chamber and adjacent the inner end of the core, spring means interposed between the wall and armature and pressing the armature away from the core, spaced contact points fixedly mounted on the bulb within the chamber and each integrally continuous with a lead external to the bulb, a movable contact for engaging the contact points to close the circuit therebetween, and means for mounting the movable contact on the armature and insulating it therefrom.

6. The combination according to claim 5 wherein adjustable means are interposed between the armature and the wall to adjustably limit movement of the movable contact relative to the fixed contacts.

7. A vacuum relay comprising a hollow cylindrical housing having an integral annular flange extending thereabout intermediate its ends and together cooperating to provide a mounting structure, a dielectric bulb hermetically sealed to one end of the cylindrical housing on one side of said flange, a metallic wall within the cylindrical housing extending transversely thereacross intermediate its ends and with said bulb and a portion of said housing defining a hermetically sealed vacuum chamber, a magnetic core within the housing projecting through said wall on both sides thereof to provide inner and outer end portions integrally united therewith, a metallic cover plate closing the end of the housing opposite the bulb and detachably fixed to the outer end of the core, a coil for energizing the core mounted on the cover plate and removable therewith when the cover plate is detached, spaced contact points within the vacuum chamber fixedly mounted in the bulb and each integrally continuous with a lead external to the bulb, an armature pivotally mounted within the housing intermediate the ends thereof and adjacent the inner end of the core, a movable contact for engaging the contact points to close the circuit therebetween, and means for mounting the movable contact on the armature and insulating it therefrom.

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