

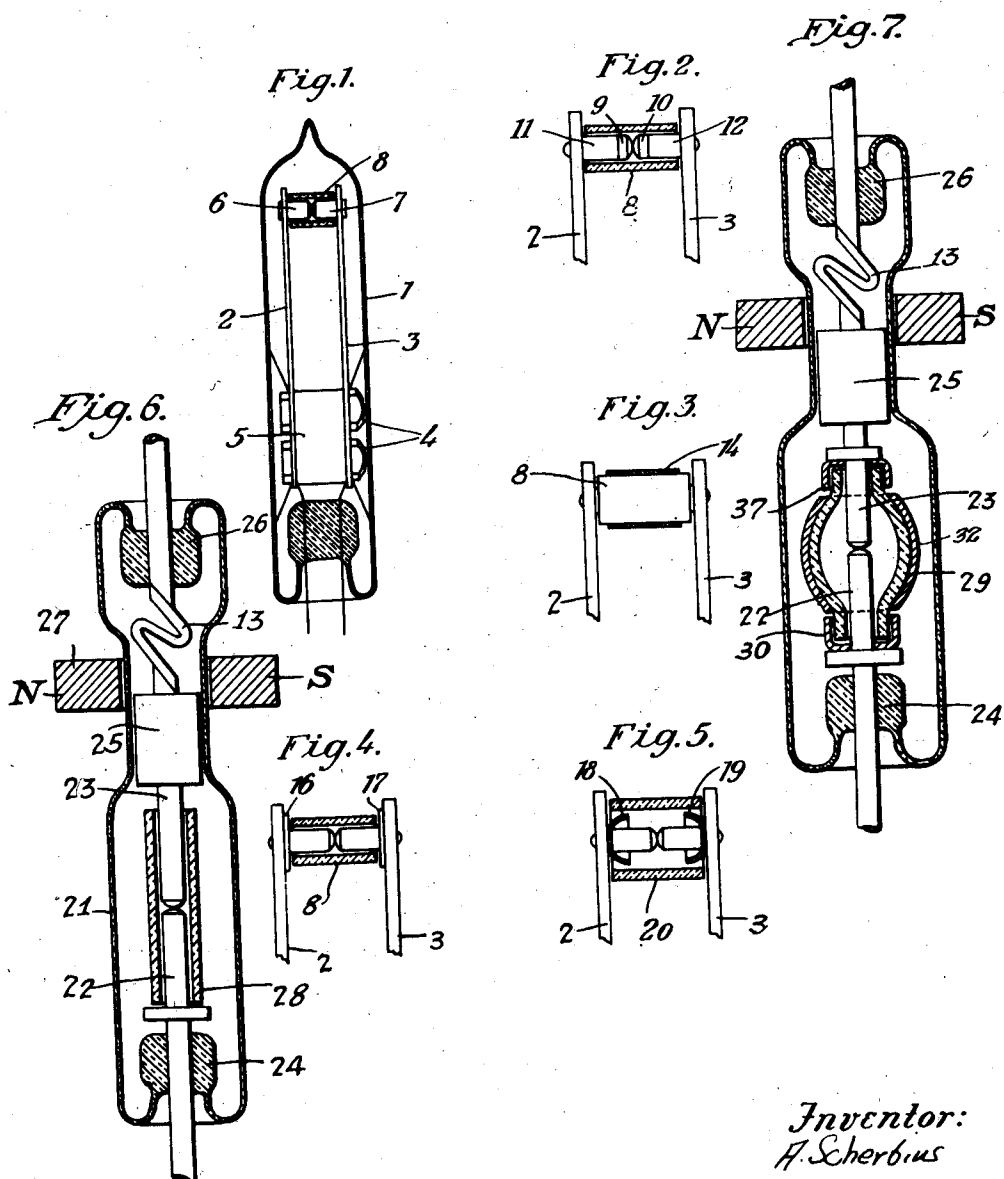
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A. SCHERBIUS

VACUUM SWITCH

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Inventor:
A. Scherbins

By: Marko & Clark
ATTYS.

UNITED STATES PATENT OFFICE

ARTHUR SCHERBIUS, OF BERLIN-WANNSEE, GERMANY

VACUUM SWITCH

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It is known to allow contacts of metals of high melting points to work in vacuum vessels or in vessels filled with neutral gases. It has been found that with such switches there is a tendency at heavy loads for arcs to form in the interior of the vessel, whereby a limit is set to their employment. It is found by experience that the arcing starts for the most part not directly after the high load is put on but very frequently only after the switch has previously worked almost without any sparking. The arc then extends to the constructional material consisting of metals of lower melting point and makes the switch, which has for a long time been working without sparking, useless in a fraction of a second.

The present invention obviates this disadvantage.

The invention is illustrated in the accompanying drawing, which shows in Figs. 1 to 7 inclusive various constructional forms partly elevational and partly sectional.

In Figure 1, 1 denotes a vacuum-tight vessel. The switch consists of two metal strips 2 and 3, which by the aid of screws 4 are secured to an insulating piece 5. The metal strips 2 and 3 each carry a contact pin, 6 and 7 respectively, of material difficult to fuse such as tungsten either alone or welded on pins of another material such as nickel, iron and copper. The invention consists in surrounding these pins by a small tube 8 consisting of insulating material which surrounds at least at their ends the contacts with a small space. This tube may be supported by the contacts themselves and loosely arranged thereon. As an insulating material it is preferable to employ a material that is rather difficult to fuse, magnesia, steatite, porcelain, quartz for example.

In Figure 2 is illustrated another constructional example, in which the contacts 9 and 10 consist of tungsten cups, which are welded on to pins 11 and 12.

In Figure 3 the little tube 8 consisting of insulating material is enclosed by a conducting metal sleeve 14, for the purpose of so guiding the electric fields that the maximum field strength occurs in the solid insulating

material. The sleeve is formed from copper, iron, or aluminum.

In Figure 4, besides the little tube 8 consisting of insulating material, there are also applied at the feet of the contact pins protecting plates 16 and 17, which consist of metal of high melting point, for instance tungsten, molybdenum or tantalum.

In Figure 5 also such protecting plates 18 and 19 are provided, which in this example are bent up in a cup-shaped manner and are surrounded by the little tube 20.

In Figures 6 and 7, again, constructional examples are illustrated for larger switches, actuated by magnetic force.

In figure 6, 21 denotes the vacuum-tight vessel. 22 and 23 are contact pins. The contact 22 passes to the exterior through a fusing piece 24. The contact 23, on the contrary, is secured in an iron cylinder 25, and the current is supplied to this contact through a fusing piece 26. A spring 13 is inserted between the leading-in wire and the iron cylinder 25. If a magnet 27 is excited the iron cylinder 25 is attracted and the contacts 22 and 23 are separated from one another. 28 is a protective tube according to the invention.

The switch shown in Figure 7 is constructed similarly to that of Figure 6, with the difference that the protective tube 29 in this switch has an expansion in the middle, and moreover protective plates 30 and 31 are also provided at the clamping points of the contacts, and partly embrace the protective vessel 29. The switches according to Figures 6 and 7 are intended for particularly large power outputs. It is immaterial for the invention whether the switch is actuated by heat, as for example by the bending of double metal strips, or by magnetic forces as in Figures 6 and 7, or even by electrical forces, as for example by means of two condenser plates facing one another in a vacuum, or by resilient displacement at any part of the wall of the vessel with vacuum-tight closure.

The protective vessel 29 is provided with a sleeve or layer 32, of the same material as the sleeve 14 shown in Fig. 3. It is obvious

that when the contacts 22 and 23 (Fig. 7) are closed, i. e. in metallic contact with each other, there are no electro-static lines of force at the contact point. However, when the contacts are moved a small distance apart for opening the contact connection, the current passes over through the medium surrounding the contacts, i. e. the electric current passes out of a conductor of slight resistance over into a medium of comparatively great resistance. A difference in voltage or pressure thereby arises between the contacts, and this voltage or pressure difference produces electro-static lines of force.

15 The invention consists quite generally in surrounding the contact points of switches which work in vessels with vacuum-tight closure with a protecting tube or protecting vessel with as effective a closure as possible, in order to obviate the passage of electrical discharges or arcs to the carriers and parts other than the contact point. It is not necessary that the protective tube or protective vessel should be closed in an absolutely fluid-tight manner at its end, but it is desirable to make the free space between the contact pin or contact carrier and the protective tube or protecting vessel as small as possible.

What I claim is:

30 1. Electric switch comprising in combination, a vacuum-tight vessel, separable contacts therein movable away from each other during the switching, carriers for the contacts, an enveloping body of insulating material difficult to fuse and substantially spaced in its middle portion from the contacts and surrounding both contacts, said enveloping body closely surrounding the contacts at its outer ends, thereby protecting the carriers of the contacts against an arc which is formed on the contacts and tends to travel to the carriers.

45 2. Electric switch comprising in combination a vacuum-tight vessel, separable contacts therein movable away from each other during the switching operation, carriers for the contacts, an enveloping body of insulating material difficult to fuse and substantially spaced in its middle portion from the contacts, said enveloping body closely surrounding the contacts at its outer ends, cup-shaped protecting plates of material difficult to fuse provided at the bases of the contacts and together with the enveloping body thereby protecting the carriers of the contacts against an arc which is formed on the contacts and tends to travel to the carriers.

60 3. Electric switch comprising in combination a vacuum-tight vessel, separable contacts therein movable away from each other during the switching operation, carriers for the contact, an enveloping body of insulating material difficult to fuse and substantially spaced in its middle portion from the contacts, said enveloping body closely surround-

ing the contacts at its outer ends, a conducting metal layer closely surrounding the enveloping body and together with the latter protecting the carriers of the contacts against an arc which is formed on the contacts and tends to travel to the carriers.

75 4. Electric switch comprising in combination a vacuum-tight vessel, separable contacts therein movable away from each other during the switching operation, carriers for the contacts, an enveloping body of insulating material difficult to fuse and substantially spaced in its middle portion from the contacts, said enveloping body closely surrounding the contacts at its outer ends, a conducting metal layer closely surrounding the enveloping body, cup-shaped protecting plates of refractory material provided at the bases of the contacts and together with the enveloping body protecting the carriers of the contacts against an arc which is formed on the contacts and tends to travel to the carriers.

In testimony whereof I have signed my name to this specification.

ARTHUR SCHERBIUS. 90

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