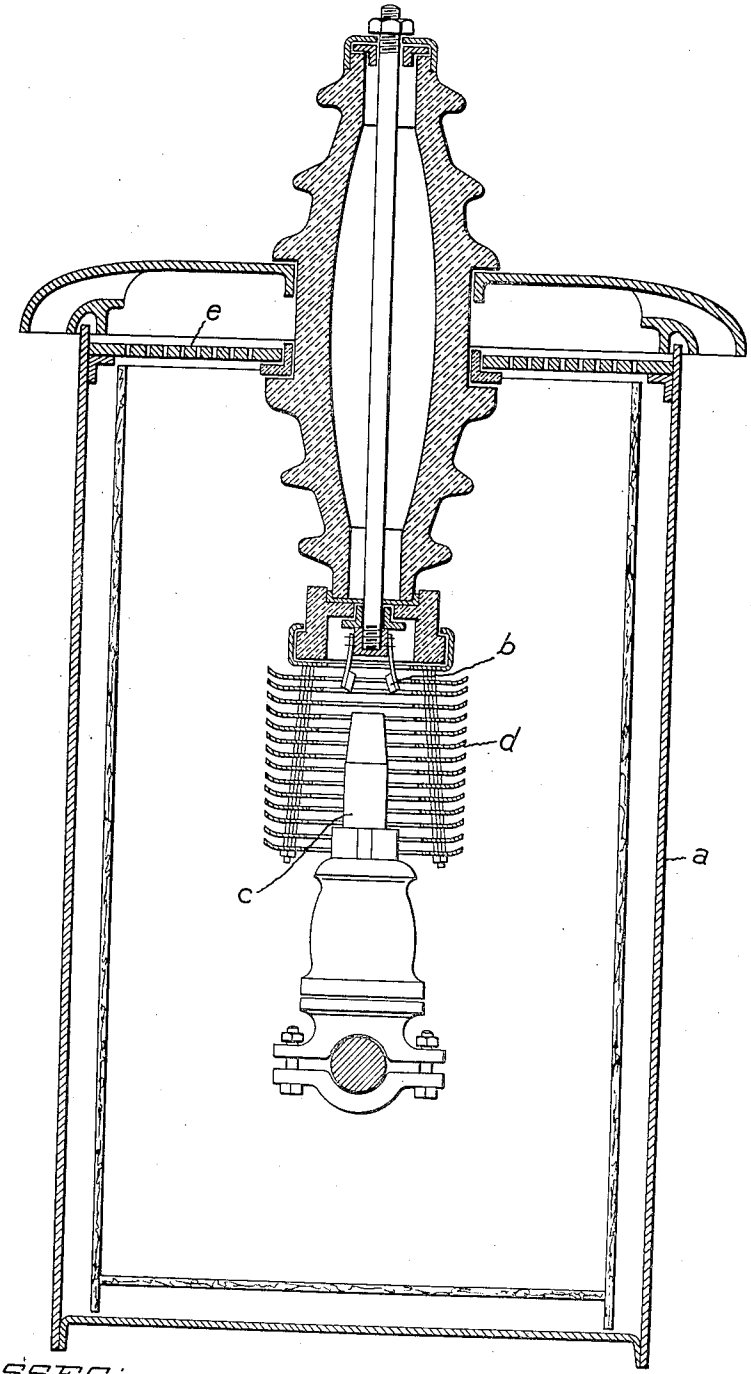
R. TRÖGER.

OIL SWITCH.

APPLICATION FILED OCT. 11, 1912.

1,180,805.

Patented Apr. 25, 1916.



WITNESSES:

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OIL-SWITCH.

1,180,805. Specification of Letters Patent. **Patented Apr. 25, 1916.**

Application filed October 11, 1912. Serial No. 725,172.

To all whom it may concern:

Be it known that I, RICHARD TRÖGER, a subject of the King of Prussia, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Oil-Switches, of which the following is a specification.

My invention relates to electric switches, and particularly to oil switches for controlling circuits carrying large amounts of energy.

Experience has shown that when the contacts of a switch are separated under oil, the arc produced exerts an explosive effect and tends to throw the oil out of the switch, particularly if a large amount of current is flowing in the circuit when the contacts separate. Efforts have been made to prevent these explosions by strengthening the oil tank, or by inclosing the contacts in an insulated casing or chamber strong enough to resist the explosive action of the arc and protect the main body of the oil from the explosive action of the arc. In some types of switches, baffles or perforated plates have been mounted near the fixed contacts to dampen the movement of the oil and keep it as near the contacts as possible. All of these expedients deal only with the explosive action of the arc itself. Experience has shown, however, that the explosive action of the arc is not the only reason for explosions in oil switches, but that explosions occur in cases where the arc is confined in various ways and where there has been no direct discharge between the contacts at the surface of the oil. Such explosions appear to be caused by the formation of bubbles of vapor of very high temperature in the immediate vicinity of the arc. These bubbles of vapor tend to rise through the oil and are still at a very high temperature when they reach the surface of the oil where they ignite explosively as soon as they come in contact with the oxygen of the air. It is also probable that the air at the surface of the oil is impregnated with oil vapor, and forms an explosive mixture which is ignited by the hot vapors from the arc. The various plans proposed for inclosing the arc or limiting its direct action upon the oil have but little effect in preventing explosions due to the hot bubbles of vapor rising into the air space from the oil.

The object of my invention is to prevent explosions of every kind in oil switches, even when the switches open circuits carrying very large amounts of energy. I accomplish the desired result by not only dampening and diminishing the direct explosive action of the arc, but also by preventing the access of hot vapor or particles to the air space above the surface of the oil. To this end, I provide means for so reducing the temperature of the vapor and particles from the arc, that by the time they reach the surface of the oil they are at such a low temperature that they will not cause explosions.

My invention will best be understood by reference to the accompanying drawing, in which I have shown merely for purposes of illustration, one of the many forms in which the invention may be embodied, and in which the figure is a longitudinal section of one form of oil switch showing one embodiment of my invention.

In the particular form of switch shown in the drawing, an oil tank *a* contains oil or other suitable insulating fluid. This tank is provided with a suitable cover, in which there is mounted an insulator for carrying a stationary contact *b* submerged in the oil in the tank. A coöperating movable contact *c* is mounted to move vertically into and out of engagement with the stationary contact and to move toward the bottom of the tank as the circuit is opened.

The arc formed upon the separation of the contacts *b* and *c* tends to expand and throw the oil away from the contacts, and this action of the arc may be sufficient to throw the oil out of the tank. To prevent this direct explosive action of the arc, and also to prevent access of the hot arc vapors and particles to the air space above the oil, I surround the contacts with some good heat conducting shell, which is preferably metallic and has many perforations, so that the hot gases of the expanding arc must pass through this perforated metal shell. Owing to the small perforations, and the inertia and viscosity of the oil in them, the arc encounters a great deal of resistance as it attempts to expand through the metal shell. In this way the direct explosive effect of the arc is weakened. The arc gases are furthermore sub-divided into many small jets and are very much cooled by passing through the metal shell. As

these small jets enter the body of oil in the tank they are further cooled until any arc gases or vapor bubbles which reach the surface of the oil are at such a low temperature that no ignition or explosion can occur.

One particular form of heat conducting shell which I may use, is indicated in the drawing, which shows the contacts surrounded by a protecting shell or barrier *d* consisting of a series of parallel flat rings made of some suitable metal, such as copper. These copper rings are bent up slightly at their outer edge, and are spaced away from each other to a slight extent to leave between them, comparatively small passages through which the arc gases may pass out into the body of oil in the tank. The copper rings are insulated from one another in any suitable way, as by insulating spacers, and are firmly held in proper relation to the contacts and to each other by bolts which extend through the plates. By insulating the individual parts or rings of the perforated protecting body *d*, the arc formed when the circuit is opened cannot use the protecting body *d* as a metallic bridge between the two contacts, but instead the protecting body breaks the arc up into a number of small arcs in series, which are more easily extinguished by the oil than one continuous arc of equal length.

As the contacts separate, the arc formed between them tends to expand and the hot arc gases are driven out through the passages between the metal rings. As these passages are narrow and are sealed up with oil, the protecting body *d* acts to some extent like an inclosing chamber for the arc and very materially decreases the direct explosive action of the arc. The metal rings abstract a great deal of heat from the arc gases flowing between them, and also compel the arc gases to emerge from the protecting shell in the form of thin sheets instead of in a compact body. The oil in the tank exerts a much more marked cooling and extinguishing action upon the gases in the form of thin sheets than it would upon an equal amount of gas in a compact mass or bubble.

In the particular switch shown in the drawing, the protecting shell *d* extends downwardly nearly to a point that corresponds to the lowest position of the movable contact *c*. In case there is any danger that the arc gases may be driven out of the lower end of the protecting shell *d* and then rise to the surface of the oil without sufficient cooling, the protecting shell may be made longer. In order to guard still further against the access of hot gases and heated particles to the air space above the oil, protecting bodies of good heat conducting material and provided with many perforations may be placed above the contacts or directly at the surface of the oil. For example, a perforated protecting body *e* may be placed above the protecting body *d* in any suitable position, which may be on the surface of the oil, or directly under or over it. The protecting body *e* may be made in any suitable manner, preferably of a thick perforated metal plate.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. An electric switch comprising an oil vessel, relatively movable coöperating contacts mounted to separate beneath the oil in said vessel, means for moving one of said contacts vertically away from the other to open the circuit, and a protecting bell shaped shell with a closed top and open at the bottom and mounted beneath the oil in said vessel with the open end down and with the upper one of said contacts always within said bell and near the upper closed end thereof, said protecting shell having in its walls restricted vents to permit only slow escape of arc gases and to cool said escaping gases.

2. An electric switch comprising an oil vessel, a fixed contact mounted in said vessel beneath the oil, a coöperating movable contact mounted to move downwardly from said fixed contact to open the circuit, and a protecting bell shaped shell closed at the top and open at the bottom and secured to said contact with the open end downward and said contact near the closed top of said shell having narrow slits in the wall thereof to permit slow escape of arc gases and to cool the escaping gases.

3. An electric switch comprising an oil vessel, a fixed contact mounted within said vessel beneath the surface of the oil, a metallic bell with an imperforate top mounted on said contact to depend therefrom and completely inclose said contact, said bell comprising a plurality of metallic perforated plates spaced apart to form narrow passages to cool the escaping arc gases, and a vertically movable coöperating contact separable from said fixed contact within said bell to draw an arc within said bell and beneath the imperforate top of said bell and thus compel the arc gases formed within said bell to pass through said narrow passages.

In witness whereof, I have hereunto set my hand this eighteenth day of September, 1912.

RICHARD TRÖGER.

Witnesses:
JULIUS RUMLANDS,
ALFRED WOLF.