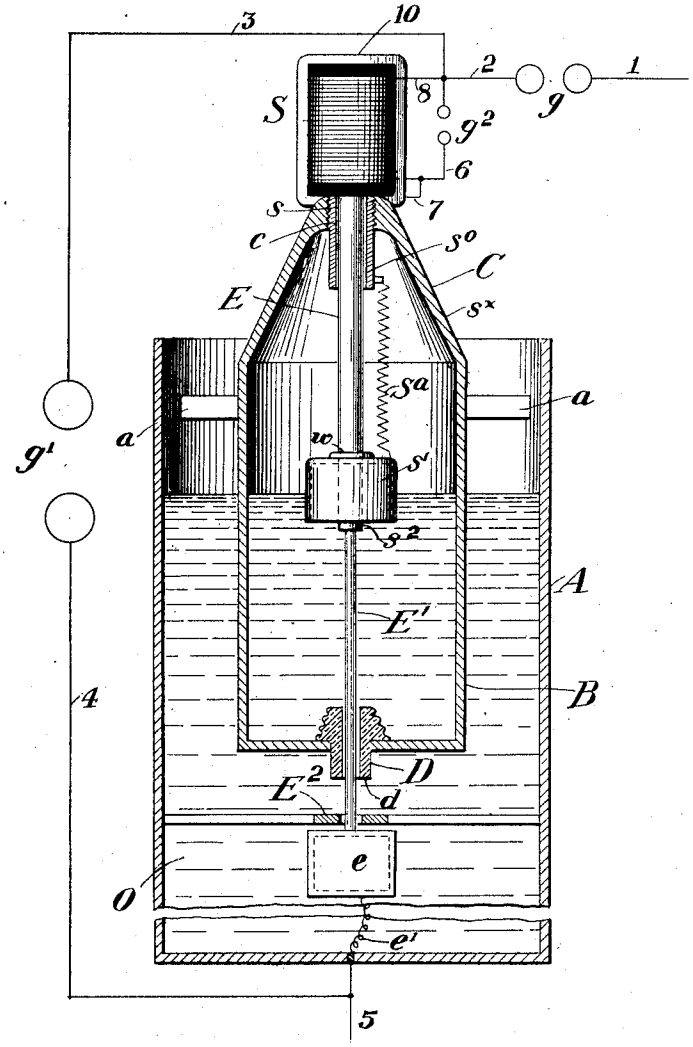
J. D. HILLIARD & C. E. PARSONS.

SWITCHING DEVICE FOR ELECTRICAL CIRCUITS.

APPLICATION FILED SEPT. 3, 1908.

1,009,748. Patented Nov. 28, 1911.



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SWITCHING DEVICE FOR ELECTRICAL CIRCUITS.

1,009,748. Specification of Letters Patent. Patented Nov. 28, 1911.

Original application filed August 22, 1906, Serial No. 331,553. Divided and this application filed September 3, 1908. Serial No. 451,617.

To all whom it may concern:

Be it known that we, JOHN D. HILLIARD and CHARLES E. PARSONS, citizens of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Switching Devices for Electrical Circuits, of which the following is a specification, reference being had therein to the accompanying drawing.

Our invention relates to switching devices for electrical circuits, and especially to oil break switches used in connection therewith.

In our copending application, filed August 22, 1906, Serial No. 331,553, we have described a protective system using balls, cylinders or blunt points instead of goat horn arresters. Since the discarding of the goat horn arrester does away with the means for breaking the arc, we provide means for performing that function separately from the spark gap or gaps comprising an automatic oil switch actuated by a solenoid. The oil switch forms the subject matter of the present application, which is a division of our prior application above named. We may state the features of the oil switch broadly, as follows: An outer containing vessel is partly filled with oil in which is sunk, to a suitable level, an inner vessel in which the switch parts proper are housed. Mounted upon the upper part of this vessel is a solenoid whose stem extends down and constitutes one electrode, being fitted preferably with a float. Supported by another float in the outer vessel and projecting into the inner vessel, is a rod constituting the second electrode, connected to a flexible pigtail, carried through the outer vessel in order to make a suitable outside connection. One spark gap is provided in the line connection, one around the entire vessel, and one around the solenoid for its protection. The discharge from the line passes through the solenoid and through the switch to ground or one of the other lines, breaking the arc. If a second discharge comes, or if the line potential piles up while the switch is open, the main gap around the apparatus which is set for a high break-down point, will take care of the discharge until the switch closes.

Our invention is illustrated in the accompanying drawing wherein the figure is a sectional view of our switch with circuit connections indicated diagrammatically.

Referring to the drawing, 1 indicates the line which is to be protected, or a branch therefrom. This is separated from the wire 2 by an air gap between the terminals g which is set for break-down at any desired point, and constitutes the principal air gap element of the apparatus. From wire 2, separate paths to ground are provided, one through the solenoid S, flexible pigtail, s^a (this being connected to a sliding core E magnetically lifted into the coil of the solenoid S and retracted by gravity), float s', contact s^2, the rod E′, its float e, and the flexible pigtail e', to wire 5; the other through wires 3 and 4 to the wire 5, through spark terminals g', interposed and adjusted with a relatively wide air gap so as to have a high break-down point for this branch. The circuit of the solenoid itself is from wire 2 as follows: 8, S, 7, s^0, s^a, s', s^2, E′, e, to wire 5. The shunt wire 6 with air gap g^2, is connected around the solenoid and is grounded upon the iron yoke 10 around the coil, which is normally in connection with the top s^x of the inner vessel B.

The mechanical structure of the switch is as follows: An outer containing vessel A is provided, preferably of wood or other similar material, with supporting arms or studs a extending radially from its inner wall to support the inner vessel B which is preferably constructed of heavy steel pipe to resist the excessive pressure generated when the switch is opened. This vessel contains the working parts of the switch. These comprise two rods, E and E′, arranged axially in the cylindrical inner vessel and projecting from opposite ends thereof, the upper one, E, forming the core of the solenoid, and therefore made of soft laminated iron. As we have already stated, the vessels are partly filled with oil of a suitable character to smother the arc. Each of the rods E and E′ is provided with a float, which, being submerged or partly submerged in the oil carries the weight of the rod for a purpose which will be apparent from the statement of operation. The upper rod E, as stated, forms the core of the solenoid S which is conveniently supported by the conical head s^x integral with the inner vessel B, its upper

end carrying the spool and supporting the winding of the solenoid, while from its apex depends a tube s^0 to form a stop for the upward movement of the float s' and the contact s^2 carried thereby. The tube s^0 is preferably connected to the inner vessel B by being threaded into the head s^x as shown, and may be extended to constitute the inner tube of the solenoid.

The operation of the switch thus described is as follows: A discharge from line 1, passing the gap g, is conducted partly through the solenoid and partly through the shunt g^2—6, hence through pigtail s^a, rods E and E′, wires e' and 5 to a suitable resistance not shown, and through whatever other devices may be deemed desirable and so to ground. This circuit may of course be varied by putting the solenoid in a separate branch for manual or other control. The solenoid S becoming energized, which may be either by a portion of the actual discharge or by a portion of the line energy which follows it, draws up its core E. This requires the expenditure of a very small amount of energy, because under normal conditions the weight of the rod E is sustained by the buoyancy of the floats, s' and e. As the rod E lifts, the contact s^2 leaves the top of the rod E′ and an arc is established and drawn out therebetween until the leather washer w on top of the float s' strikes against the lower end of the tube s^0 sealing the latter against the escape of the gases. The generation of such gases due to the arc immediately produces a very high pressure upon the surface of the oil, which after having forced out the rod E′ is itself in part forced downward and expelled violently from the inner vessel through the orifice d at the bottom. This smothers the arc, whereupon the line being cleared, the solenoid is deënergized, the core E drops, the rod E′ rises through its guide E^2 to meet it, and normal conditions are reestablished.

The rods may be adjusted with their contacts normally beneath the oil, so as to obtain a great submersion of the rod E for the break. We do not limit ourselves to this, or other details of arrangement, which may be varied without departing from the scope and purview of our invention.

In case a second discharge follows the first, or in case the potential of the line piles up to a dangerous point while the switch is open, which might readily occur, the increased tension will break down the gap g' taking the discharge through the wires 3, 4 and 5. In such case, as soon as the solenoid has dropped its core, and the circuit through the rods of the switch has become reëstablished, the arc at g' will disappear, and the solenoid S will then operate as before to break the connection at s^2 and smother the arc.

Having thus described our invention what we claim and desire to secure by Letters Patent is—

1. A switch for protective systems comprising a closed containing vessel, an insulating fluid therein, and a pair of electrodes normally maintained in contact by buoyancy in said fluid, means responsive to a high potential discharge through the switch, to initially separate the electrodes, and means adapted to guide one of the electrodes into and out of the closed vessel, whereby the arc of the discharge formed upon initial separation of the electrodes will complete their separation by causing fluid under pressure to drive one electrode out of the vessel, to extinguish the arc by attenuation and pressure, and the circuit will be again restored thereafter by the automatic return of said electrode, due to its buoyancy.

2. An automatic switch comprising the following instrumentalities: an outer vessel and an inner vessel one partly filled, the other partly or wholly filled with an insulating liquid, a pair of electrodes in said inner vessel, the lower one normally supported by a float in the liquid and the two normally in contact with each other, a solenoid controlling one electrode, and an insulated opening between the inner and outer vessels through which the lower electrode passes, whereby upon the occurrence of a discharge the solenoid or equivalent magnet will initially separate the electrodes, and the pressure created by the arc upon the liquid in the inner vessel will force said liquid through the aforesaid opening after having driven out the lower electrode and thereby breaking the arc.

3. An oil break switch comprising the following instrumentalities: an outer containing vessel as A, an inner vessel as B carried on insulating supports, a solenoid supported upon said inner vessel and having a movable core projecting through the same into the inner vessel, a float and a contact upon the lower end of the said core, a rod extending through an insulated opening in the bottom of the inner vessel, a float upon said rod in the outer vessel and a connection therefrom to the outer vessel, and a body of oil partly filling both vessels and supporting said floats, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

JOHN D. HILLIARD.
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Witnesses:
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