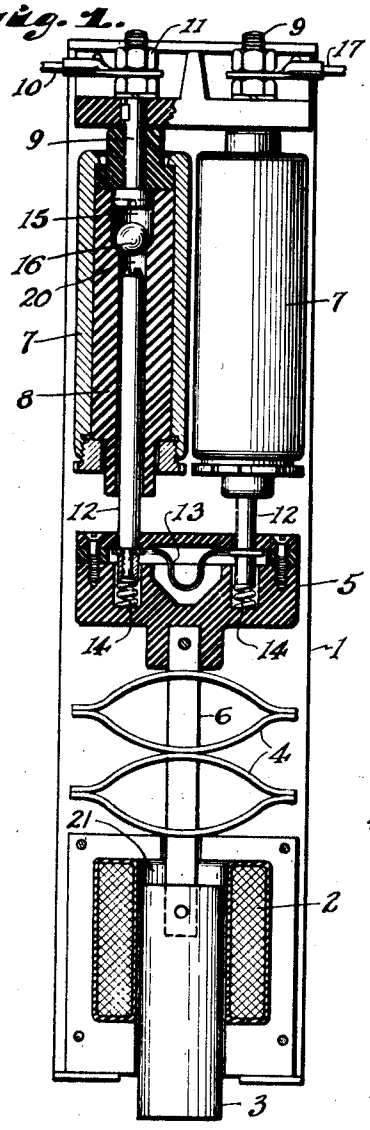
Dec. 13, 1938. A. ARUTUNOFF 2,140,149

SWITCH

Filed April 10, 1936

Fig. 1.



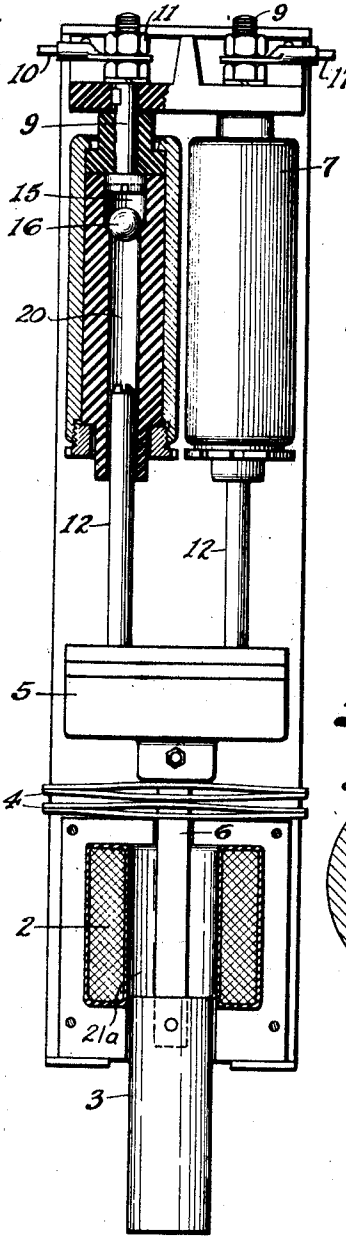


Fig. 2.

Fig. 3.

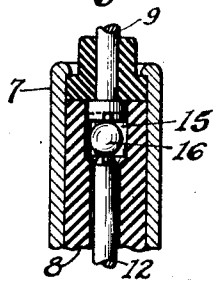


Fig. 5.

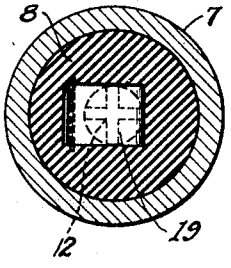
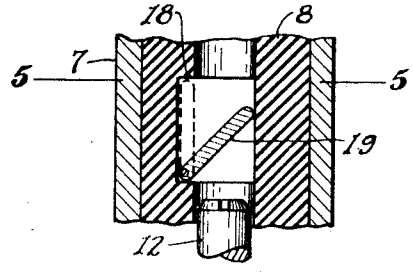


Fig. 4.



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SWITCH

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Application April 10, 1936, Serial No. 73,692

5 Claims. (Cl. 200—111)

My invention relates to switches and more particularly to switches or circuit breakers for electrical currents of high potential.

Heretofore, whenever the potential exceeded 660 volts, the opening and closing of industrial electrical circuits such as is required for frequent starting and stopping of large electrical motors and the like, has been conducted by switches immersed in insulating oil. The oil switches have many disadvantages. They are cumbersome, complicated, difficult and expensive to install or replace.

One object of my invention is to provide an air breaker for use for potentials in which oil breakers have been heretofore employed.

Another object of my invention is to provide an air breaker of large capacity.

Another object of my invention is to provide means which utilizes forces created by the arc to extinguish the arc.

Another object of my invention is to provide a contact means in which the contacting surfaces are automatically changed.

Still another object of my invention is to increase the working range of the movable contacts of the switch beyond the working range of the actuating means of the switch.

Another object of my invention is to provide a circuit breaker in which the circuit cannot be made immediately after it is broken to preclude rapid switching on and off.

Other and further objects of my invention will appear from the following description.

In the accompanying drawing which forms part of the instant specification and is to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views;

Figure 1 is a diagrammatic view of a switch containing one embodiment of my invention with parts in section in the normal open position ready to be closed.

Figure 2 is a view of the switch of Figure 1 just after the circuit has been broken.

Figure 3 is a fragmentary detail view showing the switch in closed position.

Figure 4 is a fragmentary view on an enlarged scale showing a modification of the embodiment shown in Figure 1.

Figure 5 is a sectional view taken on a line 5—5 of Figure 4.

In general, my invention contemplates the use of a plunger making contact through a ball in an enclosed chamber. The ball acts as a valve within the chamber besides presenting a fresh contact surface during successive operations of the switch. The pressure built up upon the breaking of the circuit tends to extinguish the arc. Pressure created below the ball valve forces the plunger away from the other contact surface. Pressure of the arc may also be effectually used without employment of a ball or valve.

More particularly referring now to the drawing, mounted upon a suitable base 1 is a solenoid 2, which is adapted to be energized from a push button station. An armature 3 is normally held in the position shown in Figure 1 by any suitable springs 4. A block of insulating material 5 is connected to the armature 3 by a link 6. Supported upon the base 1 are a plurality of shells 7 in which is housed a bushing 8 made of high temperature insulating composition such as asbestos, fibre, ceramic material, soapstone, glass, or the like. A stationary conducting post 9 is secured in the upper portion of the bushing and any suitable means such as nut 11 provided for making connection with an electrical conductor 10. Each of the shells 7 houses similar constructions, it being understood that any number of points may be provided for making and breaking the circuit, to be used in parallel in one branch of the circuit or in groups across two parts of the circuit. In the drawing a single phase or single line switch having two shells 7 is shown. For a three phase or three line switch, six shells or housings 7 are mounted on block 5. In the form shown in Figure 1, the circuit is broken in four places. The insulating block 5 carries a pair of conducting plungers 12, which are connected by a jump conductor 13. Suitable cushioning compensating means such as springs 14 are provided beneath each of the plungers 12. Within each of the bushings 8 is formed an enlarged or high pressure chamber 15 in which is housed a circuit making ball 16. On the opposite side of the contact making ball valve 16 is the low pressure chamber 20 in which is positioned the plunger 12.

To the other stationary conducting post 9 is secured another conductor 17 so that, when the solenoid 2 is energized, the armature 3 will be raised, moving insulating block 5 and plungers 12 upwardly. The ends of the plungers move balls 16 against stationary conducting posts 9 completing a circuit from conductor 10 through one conducting post 9, through one ball 16, through one plunger 12, through the other ball 16, through the other contact post 9, to the other conductor 17.

In the modification shown in Figure 4, the in-

sulating bushing 8 is recessed at 18 and houses a pivoted gate 19, positioned so that the gate tends to move to the full line position of Figure 4 of its own weight. As the plunger 12 is raised, the gate 19 is engaged thereby and moved to the dotted line position shown in Figure 4.

Normally, the plunger 12 fits fairly close in the bushing 8.

In operation, the switch is actuated to closed position by energizing solenoid 2, thus raising the armature 3 and moving the parts to the position shown in Figure 3, completing the circuit as heretofore described. This distance traveled by the plunger 12 in closing the circuit is the working range of the solenoid and is shown in Figure 1 as the space above the top of the armature 3, designated by numeral 21. The energizing current of solenoid 2 may be broken manually or automatically by an overloading or undervoltage device of the prior art when it is desired to use the switch as a circuit breaker. On deenergizing of solenoid 2, the weight of the plungers 12 and the insulating block 5, as well as the weight of the armature, allows the switch to open as shown in Figure 1. An arcing which takes place upon the moving of plungers 12 downwardly will produce pressure which acts in two ways. In chamber 15 the higher pressure is created which is effective in quenching the arc, while in chamber 20, the pressure will not substantially exceed that required for compressing the springs 4, the arc quenching being accomplished by virtue of the distance of movement of the plunger and space separating the contact surfaces.

The pressure of the gases generated by the arcing acts upon the plungers 12 to move them downwardly beyond their normal position shown in Figure 1, compressing springs 4 to a position shown in Figure 2. In this position, it will be noted that the armature 3 has been moved beyond the working range of the solenoid 2 as indicated by the number 21 which extended range is shown in Figure 2 at 21*a*. There is no danger of the switch closing under the action of the compressed spring 4 as the gases leak slowly and the pressure diminishes gradually in the chambers 15 and 20. In fact, even if the solenoid were energized, the closing of the switch will be retarded by the gas pressures exerted on the plungers 12.

In order to avoid making the fit between plungers 12 and bushing 8 too close, the required voltage may also be obtained by the construction shown in Figure 4. As the switch moves downwardly, the valve 19 acts as a partition to break the arc and to hold the pressure in the chamber 15, thus aiding in the extinguishment of the arc. In this form of construction, if it is attempted to re-establish the circuit immediately, the pressure of gases behind valve 19 will arrest the throw of armature 13 to prevent the making of the circuit. After the gases have leaked from behind valve 19, the upward force of the armature is sufficient to move the valve to the dotted line position shown in Figure 4.

It will be observed that I have accomplished the objects of my invention. I have provided means for lengthening the distance for arcing far beyond the working range of a solenoid and for extinguishing the arc by the pressure of the gases generated thereby and have employed this gas pressure to prevent the immediate re-establishment of the circuit after it has been broken. I have provided a switch in which there are at least four points of contact from which arcing may take place, thus distributing the damaging effect of arcing onto several members. My switch is easily portable and is of high capacity without the necessity of using oil as a quenching medium. Hanging of the switch is prevented due to the fact that in the pressure chamber heat created by overloading is sufficient to build pressure which will separate the contacts and cause arcing in absence of solenoid action.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is:

1. In a switch, a stationary conducting contact post, an insulating member formed with an elongated chamber open at one end, said stationary contact post extending into said insulating member and exposing a conducting surface to said chamber, a plunger positioned with one end thereof extending into said chamber, a conducting ball disposed between said contact post and said plunger, a spring normally holding said plunger out of contact with said conducting ball and means for moving said plunger against the action of said spring into said chamber to clamp said ball between said contacting post and said plunger to complete a circuit therethrough, the construction being such that the pressure of gases formed by arcing incidental to the breaking of the circuit will be partially maintained within said chamber by said plunger whereby said pressure will tend to extinguish the arcing and move said plunger away from contact making position against the action of said spring.

2. In a magnetically operated switch, stationary and movable contacts, actuating means including a solenoid of predetermined magnetic operating range, means operable upon the breaking of the circuit for moving the actuating means beyond the magnetic range of the solenoid, and means to return the actuating means to a position within the range of the solenoid.

3. In a magnetically operated switch having stationary and movable contacts positioned in a pressure chamber, actuating mechanism for the movable contact including a solenoid of predetermined magnetic range, the contacts being adapted to separate to such a degree that the actuating means is moved beyond the operating range of the solenoid, and means to return the actuating means to a position within the range of the solenoid.

4. In a magnetically operated switch having stationary and movable contacts positioned in a pressure chamber, a conducting ball within the pressure chamber disposed between said stationary and movable contacts, actuating mechanism for the movable contact including a solenoid of predetermined pressure range, the contacts being adapted to separate to such a degree that the actuating means is moved beyond the operating range of the solenoid, said pressure chamber being provided with a seat, said ball being adapted to lodge upon said seat for retaining gases formed by arcing incidental to the breaking of the circuit whereby to extinguish

the arc, and means to return the actuating means to a position within the range of the solenoid.

5. In a magnetically operated switch having stationary and movable contacts positioned in a pressure chamber, a conducting ball within the pressure chamber disposed between said stationary and movable contacts, actuating mechanism for the movable contact including a solenoid of predetermined pressure range, the contacts being adapted to separate to such a degree that the actuating means is moved beyond the operating range of the solenoid, said pressure chamber being provided with a seat, said ball being adapted to lodge upon said seat for retaining gases formed by arcing incidental to the breaking of the circuit whereby to extinguish the arc, means to return the actuating means to a position within the range of the solenoid, and means responsive to the pressure of gases formed by arcing for retarding the return of the actuating means to circuit making position.

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