No. 798,336. PATENTED AUG. 29, 1905

E. S. HALSEY.

HIGH POTENTIAL SWITCH.

APPLICATION FILED NOV. 30, 1904.

Fig. 1.

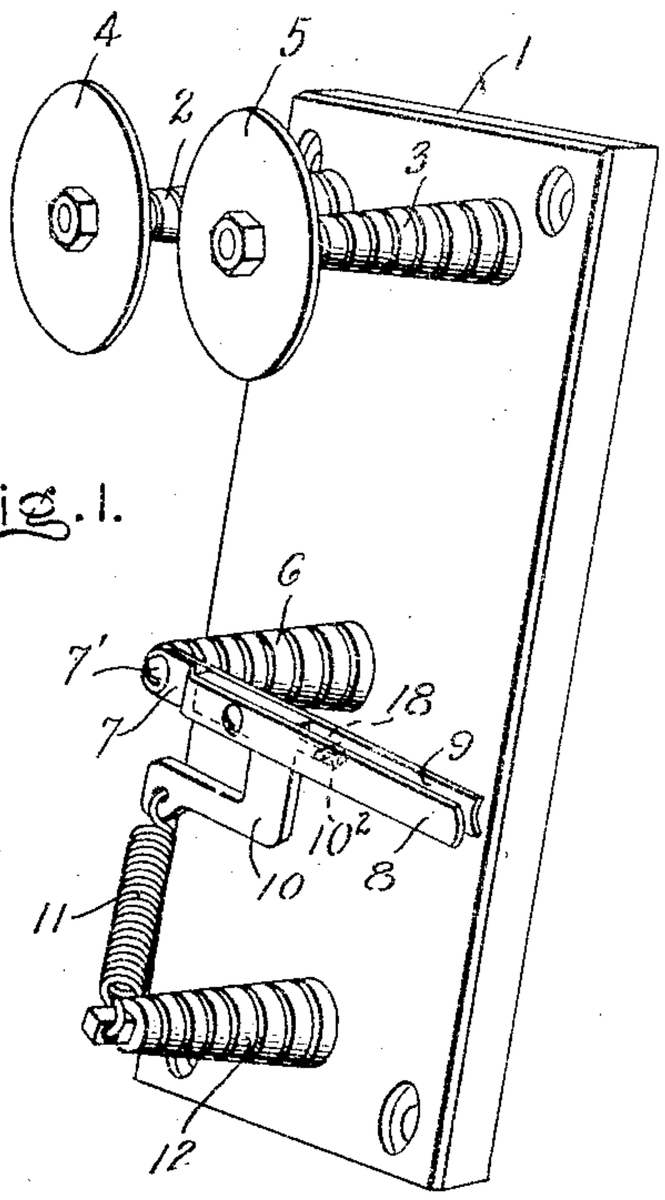


Fig. 3.

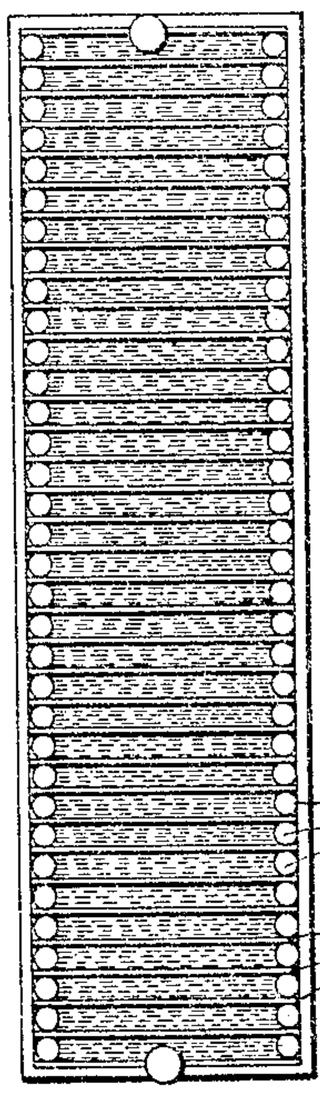
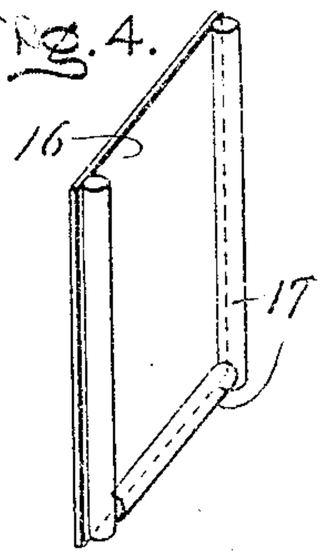


Fig. 2.

FIG. 4.



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UNITED STATES PATENT OFFICE.

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HIGH-POTENTIAL SWITCH.

No. 798,336. Specification of Letters Patent. Patented Aug. 29, 1905.

Application filed November 30, 1904. Serial No. 234,842.

To all whom it may concern:

Be it known that I, EDWARD S. HALSEY, a citizen of the United States, residing at Palmetto, in the county of Manatee and State of Florida, have invented certain new and useful Improvements in High-Potential Switches, of which the following is a specification.

This invention relates to an improved form of switch mechanism for opening electrical circuits of high potential.

It is well known that it is practically impossible to open high-voltage circuits with ordinary knife-blade switches for the reason that the current will follow the switch-blade when it leaves the clip and will volatilize sufficient copper to maintain an arc of great length. To overcome these difficulties in the handling of high-potential circuits, it is customary to break the circuit under oil or to provide other special means for extinguishing the arc. Such constructions are for the most part complicated and expensive; and it is the object of this invention to provide a simple and inexpensive high-potential switch which may be operated with certainty in the open air.

The invention comprises two contact-disks separated by an air-gap and means for introducing this air-gap in series with the line to be opened and comprising also a condenser or other reactive device to be introduced in series with the air-gap. When this air-gap is introduced into the circuit, the current readily jumps from one contact-disk to the other, forming an arc between the two; but when the reactance is introduced in series with this arc it cuts down the current to such an extent that the arc goes out of its own accord. I have found that an electrolytic condenser is particularly serviceable as a reactance because of its peculiar properties—such, for instance, as its ability to stand an exceedingly high pressure and because of the fact that the capacity of such a condenser is to a certain extent a function of the time during which the condenser is in circuit.

The invention will be better understood by reference to the drawings forming a part of this specification, in which—

Figure 1 is a perspective view of the contact-disks and the movable blade for opening the circuit. Fig. 2 is a diagrammatic representation of the mode of connecting my improved switching device in circuit with a high-potential line. Fig. 3 is a plan view of my improved form of electrolytic condenser, and Fig. 4 is a detail view showing one plate of the condenser and the wooden insulating-strips which serve to separate it from the next plate.

The base-plate 1, which may consist of slate or other good insulating material, has connected thereto the rubber standards 2 and 3, carrying at their extremities the circular contact-disks 4 and 5. These disks consist, preferably, of aluminium and are loosely mounted on the rubber standards, so that they may be turned by hand to present fresh surfaces toward each other if in the course of time the edges become scarred or roughened from the arc. At the top of another standard 6 is mounted a contact-blade 7, comprising two clips 8 and 9, adapted to engage, respectively, with the upper and lower surfaces of the disks 4 and 5. Pivotally connected to the contact-blade 7 is an irregular-shaped lever 10, with which engages a coil-spring 11, connected to the insulating-standard 12. When the switch is in the closed position, as shown in Fig. 2, the line of pull of the coil-spring 11 falls slightly to the left of the pivot 7′, so that there is no tendency for the contact-blade 7 to swing around to the right, and, furthermore, it is prevented from moving to the left, because of the fact that the lower edge of the blade strikes against the inner surface of the lever 10. An electrolytic condenser 15, of the form hereinafter described, is connected between the auxiliary contact-disk 5 and the contact-blade 7. When it is desired to open the switch, the operator pushes against the projection 10′ of the lever 10 with a stick of wood or other insulating material and forces the arm 7 over until the line of pull of the coil-spring 11 falls to the right of the pivot 7′, after which the coil-spring will quickly swing the contact-blade around to the position shown in Fig. 1. When the contact-blade leaves the main contact-disk 4, the current follows across to the auxiliary contact-disk 5, establishing an arc across the air-gap. The contact-blade 7 does not stop on the disk 5, but continues to swing to the right to the position shown in Fig. 1. This movement throws the condenser 15 in series with the arc and the absorbing power of the condenser quickly extinguishes the arc. At the instant the contact-blade 7 leaves disk 5 the condenser 15 is in shunt between these two,

parts, so that there is little tendency for the formation of a spark as the blade leaves the disk. The circular form of the contact-disks 4 and 5 assists materially in the dissipation of the arc, for as the arc is carried upward by the rush of heated air it increases in length and is thus more easily broken when the condenser is thrown in circuit. A projection 10^2 on the lever 10 affords a means for restoring the switch to its normal position, as shown in Fig. 2, and at the same time acts as an automatic stop when the switch is opened by striking against a pin 18, passing through the blades 8 and 9. While I may use a condenser of ordinary form for this purpose, I prefer to use an electrolytic condenser, constructed as shown in Figs. 3 and 4. This condenser consists of a plurality of aluminium plates 16, placed side by side and separated by wooden strips 17, secured to the sides of the aluminium plates near the bottom and edges. These plates are mounted in a rectangular tank of insulating material, and the joints at the edges of the aluminium plates are covered by insulating-varnish to form a plurality of water-tight compartments separated by aluminium plates. These water-tight compartments are filled with a suitable electrolyte—such, for instance, as a solution of citric acid.

The capacity effect produced by aluminium plates immersed in an electrolyte is commonly supposed to result from the production of a thin coating of aluminium oxid on the aluminium plates, and although this oxid is extremely thin it has the power of resisting a comparatively high voltage, particularly when a solution of citric acid is used as the electrolyte. This thin film is, however, more or less unstable, so that when the condenser is first thrown in circuit there is a considerable leakage of current directly through the condenser before the film has been sufficiently "formed" to produce the maximum condenser action. This leakage effect produces a gradual increase in the voltage drop across such a condenser when connected in series with a high-voltage circuit. This property is of importance when such a condenser is used in connection with my improved switch, for the condenser presents a comparatively small resistance to the flow of current at the instant it is thrown into circuit, or, in other words, at the instant the switch-blade 7 leaves the edge of the contact-disk 5, so that there is little tendency for the formation of a spark between the blade and the disk. As soon, however, as the film is completely formed on the plates of the condenser the voltage drop across the condenser and the condenser's absorbing and buffing action are sufficient to quickly extinguish the arc between the contact-disks 4 and 5. After this arc has once been broken there is no tendency to reëstablish it, as the condenser and all parts of the switch mechanism are then permanently disconnected from the contact-disk 4 and the corresponding side of the high-pressure line.

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

1. The combination, with a high-potential line, of means for successively introducing an air-gap and a condenser into said line to interrupt the current therein.

2. A high-potential switch, comprising an air-gap, means for producing an arc across said air-gap, and means for introducing a condenser in series with said arc.

3. A high-potential switch, comprising a main contact-plate, an auxiliary contact-plate, means for forming an arc between said plates, and means connected to said auxiliary contact-plate for decreasing the current carried by said arc.

4. The combination, with a high-potential line, of means for successively introducing a spark-gap and an electrolytic condenser into said line to interrupt the current therein.

5. The combination, with a high-potential line, of a contact-plate, means for drawing an arc to said plate, and an electrolytic condenser connected to said plate to decrease the current carried by said arc.

6. The combination, with a high-potential line, of a main contact-disk, an auxiliary contact-disk spaced therefrom to form an air-gap, a contact-blade movable from said main disk to said auxiliary disk to establish an arc therebetween, and a reactance device connected to said auxiliary disk to decrease the current carried by said arc.

7. The combination, with a high-potential line, of a main contact-disk, an auxiliary contact-disk spaced therefrom to form an air-gap, a contact-blade movable from said main disk to said auxiliary disk to establish an arc between said disks, and means for preventing the formation of an arc between said contact-blade and said auxiliary disk when said blade leaves said auxiliary disk.

8. A high-potential switch, comprising a main contact-disk, an auxiliary contact-disk spaced therefrom to form an air-gap, a contact-blade movable from said main disk to said auxiliary disk to establish an arc between said disks, and an electrolytic condenser connected between said auxiliary disk and said contact-blade to decrease the current carried by said arc.

In witness whereof I have hereunto set my hand this 25th day of November, 1904.

EDWARD S. HALSEY.

Witnesses:
SUSIE HALSEY,
ELIZABETH CURRY.