F. W. ERICKSON & F. W. LORD.

ABNORMAL POTENTIAL DISCHARGING AND ARC DISRUPTING DEVICE.

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932,541. Patented Aug. 31, 1909.

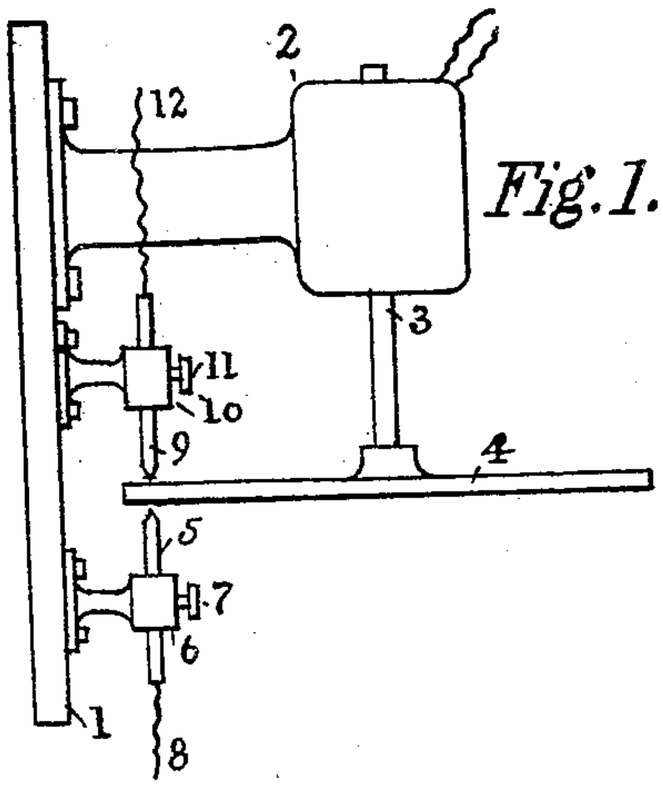

Fig. 1.

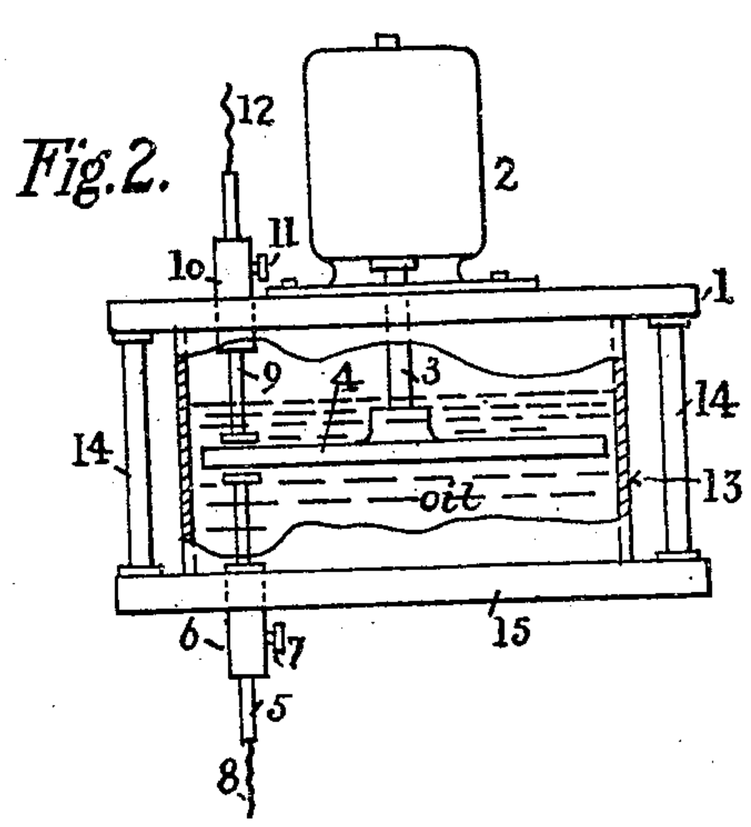

Fig. 2.

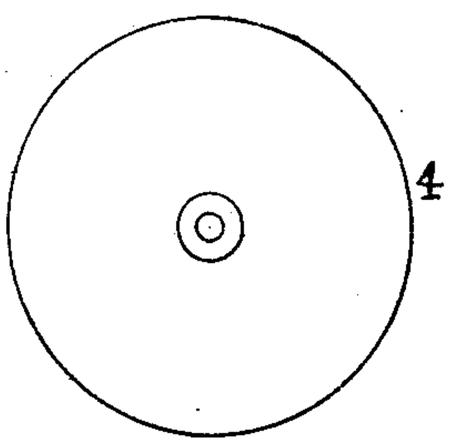

Fig. 3.

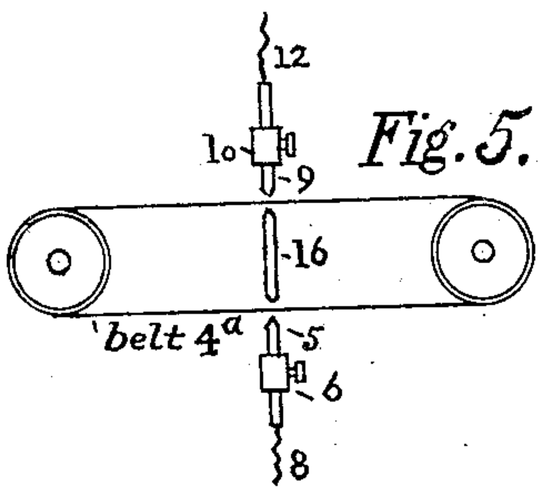

Fig. 5.

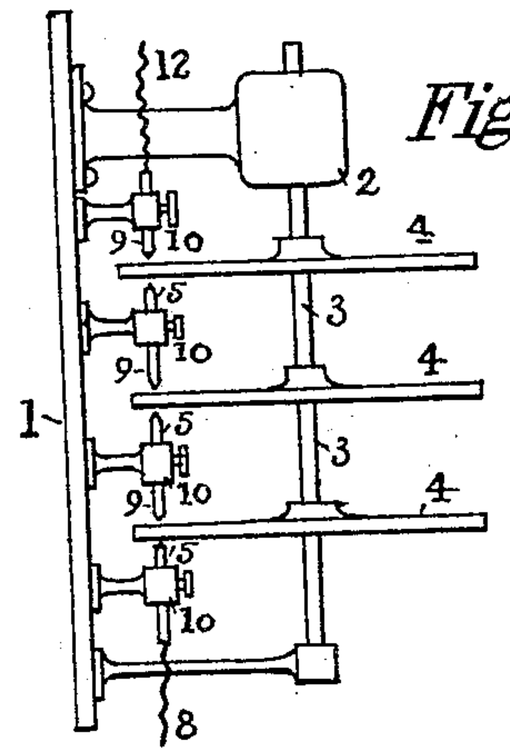

Fig. 4.

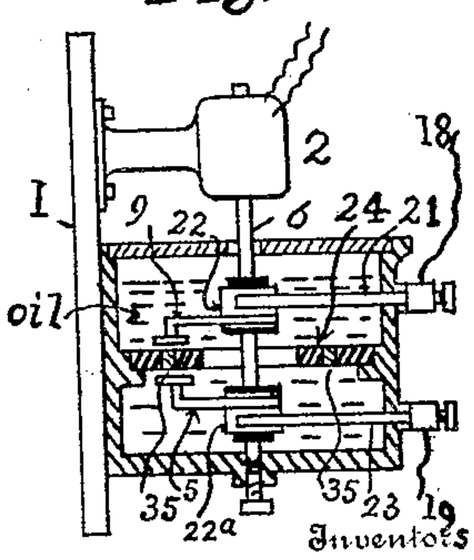

Fig. 6.

Witnesses

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ABNORMAL POTENTIAL-DISCHARGING AND ARC-DISRUPTING DEVICE.

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To all whom it may concern:

Be it known that we, FREDERIC WM. ERICKSON and FREDERIC W. LORD, residing at New York, in the county of New York and State of New York, have invented certain Improvements in Abnormal Potential-Discharging and Arc-Disrupting Devices, of which the following is a specification.

In overhead electric transmission lines trouble is often experienced in central stations and sub-stations by lightning striking the line or striking near the line. This causes a wave of current of very high potential to momentarily flow over the line to the station and do damage to the electric apparatus therein. Similar trouble is caused by so called static charges on the line, as well as by short circuits, sudden changes of load, etc. All damage so caused may be avoided if an easy path to earth or ground is provided before any such abnormal wave of current reaches the station. It has been found that this extraordinary surge of current may be easily carried to earth, by connecting to the overhead line an electrode or terminal, and placing opposite and near thereto, but not touching it, a second terminal or electrode which in turn is grounded or connected to earth. It has been found, however, that this static discharge or abnormal surge of current will cause a spark to jump across these terminals, thereby furnishing a path of relative low resistance to earth, which, as is well known, is due to the volatilized particles of the electrode made by the spark. This low resistance path, once established, will result in the heavy discharge and flow of the normal current over it, as evidenced by the so-called "following arc". This following arc is most difficult to extinguish, and the invention which we are about to describe provides a combination of terminals, one of which is connected to earth and the other connected to the overhead line that is to be protected, and a means to quickly and effectually dissipate and extinguish the following arc which the normal line current tends to sustain.

A special feature of the invention therefore is to provide means which will permit the immediate passage to earth of the static charge coming on the line, and which will obstruct and eliminate the following commercial current flowing in the circuit, and the means which we have devised consists in the use of a highly insulating, non-inflammable porous material such as asbestos in the form of a disk to be rapidly rotated between the line electrode and the ground electrode; we may use a disk of harder insulation such as porcelain.

The invention therefore consists in the provision of a path from the line to earth for the static charge, and for breaking up this initial path to prevent the regular line current from continuing therethrough to earth. After the static current or charge has passed to earth, the commercial current in the line will endeavor to pass over the path of the volatilized metal particles, but will suppress an initial arc virtually coincident with its formation, as the rotating drop will by the interposition of its relatively cold substance eliminate the arc.

Of the drawings, which form a part of this specification and illustrate the invention, Figure 1 is a side view of the invention operating in air. Fig. 2 is a side view of the invention operating in oil. Fig. 3 is a plan view of the disk or rotor. Fig. 4 is a side view of an amplification of the invention with multiple disks. Fig. 5 is a side view of a modification. Fig. 6 is a sectional view of a modification showing the reversibility of the parts.

In Fig. 1 the electrode 9 is connected by the conductor 12 to the over-head line which is to be protected. This electrode is held by an insulated support 10 mounted on base 1. The electrode 9 is capable of vertical adjustment by means of set screw 11. The lower terminal, or electrode 5, is connected to earth by conductor 8. It is supported by an insulated standard 6 mounted on base 1 and capable of vertical adjustment by means of set screw 7. On base 1 is mounted a driving motor 2, which is preferably an electric motor, but it may be any suitable source of power. This motor 2 furnishes continuous rotation to shaft 3, which in turn causes the disk 4 to revolve. The construction and motion of this disk forms the essential part of the apparatus. The disk may be constructed of a highly insulating, porous material such as asbestos, or of non-porous material as porcelain. If the disk be of a porous, highly insulating material such as asbestos, the size of the electrodes is not material, provided they are of at least the carrying capacity of the conductors 12 and 8. With this construction the path from the overhead line to earth is

through the conductor 12, through the electrode 9, through the porous disk from electrode 9 to electrode 5, through electrode 5, through conductor 8 to earth.

It will be seen from the above description that with either form of disk, there is an easy path from the overhead line to earth, intercepted only by the disk, which offers no greater static discharge barrier than if there were no disk of any form between the electrodes 9 and 5. This we have found by extensive experiment to be true, because the spark caused by the abnormal surge of current will jump from electrode 9 to 5 equally readily with no disk between the electrodes or with either form of disk revolving at a high rate of speed between the electrodes. With the porous material, such as asbestos, the spark will jump through the porous material as it will not act as a static discharge barrier, there being a sufficient air space around the fibers of the material through which the spark will pass. Where the disk is of non-porous material, the current-path extends over the edge of the disk, the latter being so located with respect to the electrodes as to place the electrodes in close proximity to the perimeter of the disk, as indicated in the drawings.

We have found that the so-called "following arc" of the normal working current will not, as we explained above, follow this low resistance path made by the spark, on account of the fact that the disk revolving at a high rate of speed will instantly carry away and dissipate the volatilized portions of the electrodes made by the spark as it passes. If the disk were at rest this low resistance volatilized conducting path would remain undisturbed and the following normal current would very shortly melt the electrodes and cause damage by a virtual short circuit of the overhead system to ground. With the disk in motion, however, this following arc is attenuated and extinguished at its very inception, on account of the immediate displacement of this low resistance volatilized conducting path by the relatively cold porous or non-porous substance of the disk as the case may be.

The above description illustrates the principle of our device in a simple form. There might be many modifications of the above idea, such as having the revolving disk rotate in a bath of insulating oil, as illustrated in Fig. 2, in which the motor 2 is mounted on the base 1, the motor driving shaft 3, which is connected to disk 4, revolving between electrodes 5 and 9, all substantially as described in Fig. 1.

In Fig. 2 the base 1 is supported on a sub-base 15 by means of standards 14, 14. The tank 13, 13 being set on sub-base 15. This tank may be of any insulating material such as glass, this we have found serving as a practical means of containing the oil, at the same time allowing the attendant to watch the operation of the device through the sides of the tank. Another form of device which would furnish a continuous motion of the porous material, such as asbestos, passing between the electrodes 6 and 9, is shown in Fig. 5, in which 4^a is a belt. In this case it might be advisable to have an intermediate conducting electrode 16 in order to be able to easily regulate the total sparking distance between electrode 6 and electrode 9. It is apparent that the same results would be obtained by having the intervening porous material, such as asbestos, or non-porous material, such as porcelain, remain stationary, furnishing a continuous movement of the electrodes as shown by Fig. 7. In this instance the underlying principle would be in no manner affected as there would be provided a rapid relative motion of the electrodes and the intervening material. This construction would be more complicated than such a device as indicated in Fig. 1, but we mention it to bring out the fact that it is immaterial whether the electrodes move or whether the intervening substance moves; in each instance the path of the arc would be continuously interrupted by unheated insulating non-inflammable material.

In Fig. 4 we show a plurality of disks upon a shaft 3, connected to a motor, and a series of electrodes between the disks in order to more quickly, if necessary, eliminate the arc following a static charge. Its operation will be seen without specific description.

In each of the forms shown, it will be seen that the insulating material extends between and has its motion in a direction at substantial right angles to the plane of the axis of the electrodes.

While we have shown several different ways in which the invention may be applied, in each form shown there is comprised two elements located intermediate the point of connection of the wires leading respectively to the line to be protected and the ground, these elements being the electrodes and the arc-dissipating device. One of the elements is movable relatively to the other, but while so movable the elements retain their positions permanently relatively to each other. And owing to the relative positions of these elements both may be said to be located within the current path leading from the wire to be protected to the ground.

As shown in the drawings, the planes of the faces of the opposing elements (the terminals and the dissipating device) are in parallelism, and, with the exception of the construction shown in Fig. 5, retain such parallelism during the movement of the dissipating device. This fact, and the fact that the axis of the motor is located out of alinement with the terminals, permits of the use

of a dissipating device of any desired diameter, or in the form shown in Fig. 5, permits the driving pulleys for the belt to be spaced any preferred distance apart, without requiring the use of widely spaced terminals. In view of the fact that the successful operation of this character of devices depends greatly upon the presentation of a relatively cold surface between the terminals, it will be understood that the particular structures shown herein permit of the obtaining of this result by reason of the ability to retain the portion of the dissipating device which has just passed between the terminals, out of the current path for a maximum period, controlled by the diameter of the disk or the space between the pulleys shown in Fig. 5, without affecting the speed at which the dissipating device is required to move in order to efficiently dissipate the arc, the sizes of the disk and the distance between the pulleys shown in Fig. 5 being determined by the conditions of use.

We claim as our invention—

1. An abnormal-potential discharging and arc-disrupting device comprising two elements mounted in a current path extending from the portion of the circuit to be protected to the ground, one of said elements comprising an arc-dissipating device of larger area than a cross sectional area of the current path to provide an extended dissipating path, portions of which are successively positionable within the current path, and one of said elements being constantly movable, the planes of the faces of said elements being parallel with each other and remaining substantially unchanged relative to each other, the successive positioning of any given point of the dissipating device within the current path being at spaced time intervals of sufficient length to permit the remaining dissipating portions to be positioned within the current path.

2. An abnormal-potential discharging and arc-dissipating device comprising two elements mounted in a current path extending from the portion of the circuit to be protected to the ground, one of said elements consisting of a disk of insulating material extending within the current path, said disk being of larger area than a cross sectional area of the current path to provide an extended dissipating path, portions of which are successively positionable within the current path, and means for imparting a rotative movement to said disk, the successive positioning of any given point of the disk within the current path being at spaced intervals of sufficient length to permit the remaining arc-dissipating portion of the disk to be positioned within the current path.

3. An abnormal-potential discharging and arc-dissipating device comprising two elements mounted in a current path extending from the portion of the circuit to be protected to the ground, one of said elements consisting of a disk of insulating porous material extending within the current path said disk being of larger area than a cross sectional area of the current path to provide an extended dissipating path, portions of which are successively positionable within the current path, and means for imparting a rotative movement to said disk, the successive positioning of any given point of the disk within the current path being at spaced intervals of sufficient length to permit the remaining arc-dissipating portion of the disk to be positioned within the current path.

4. In an abnormal-potential discharging current path having spaced terminals therein, and also having intervening current-conducting means intermediate the terminals and spaced therefrom, an arc-dissipating device having a plurality of disks extending within the current path intermediate the terminals and the intervening current-conducting means, and a motor for imparting simultaneous movement to each of said disks.

In testimony whereof, we have signed our names to this specification in the presence of two subscribing witnesses, this 22d day of April 1907.

FREDERIC WM. ERICKSON.
FREDERIC W. LORD.

Witnesses:
HARRY A. CURTIS,
FRANK W. GARRISON.