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A. WURTS.

LIGHTNING ARRESTER.

No. 465,958. Patented Dec. 29, 1891.

Fig. 2.

Fig. 1.

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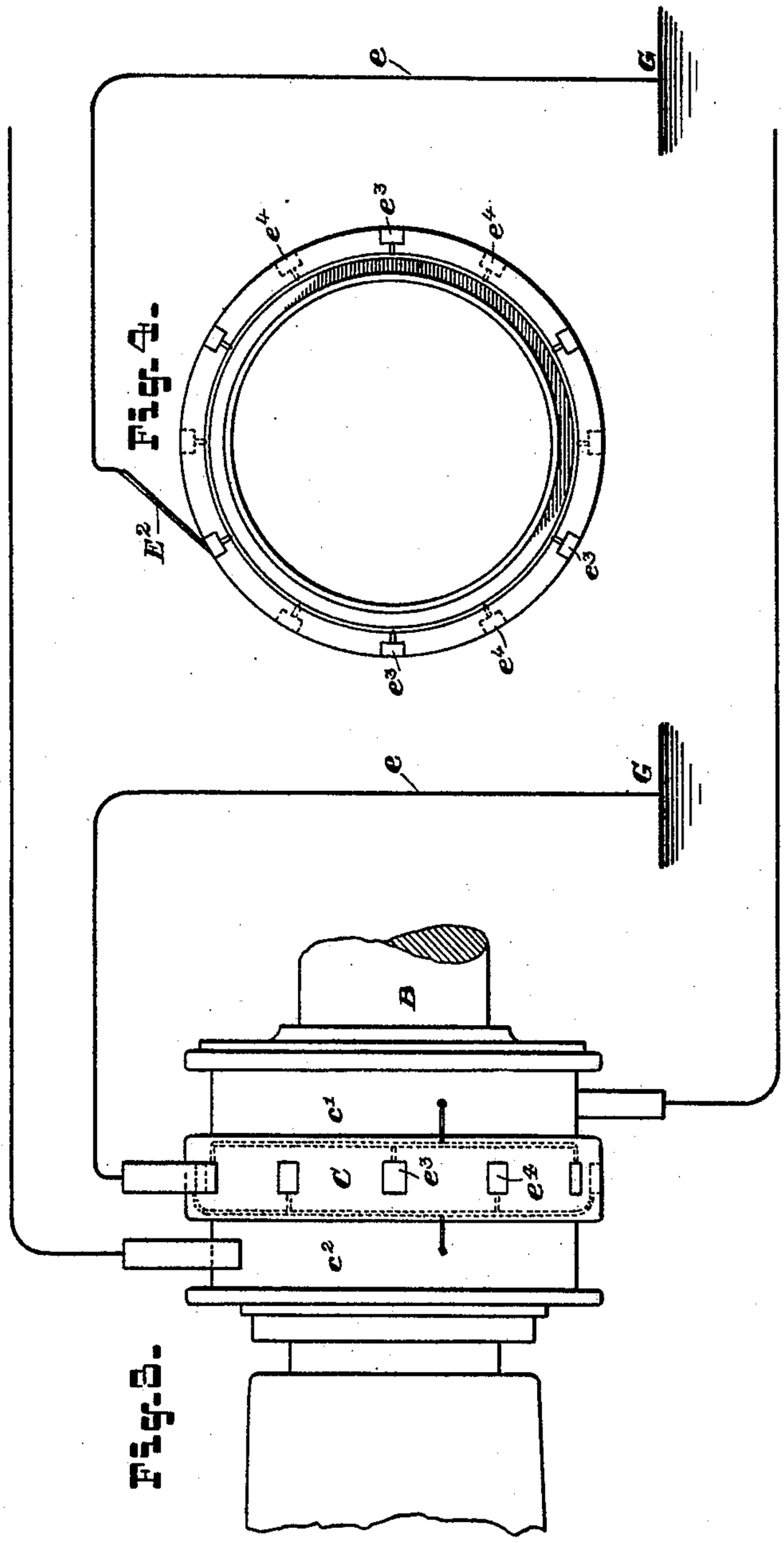

Fig. 4.

Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

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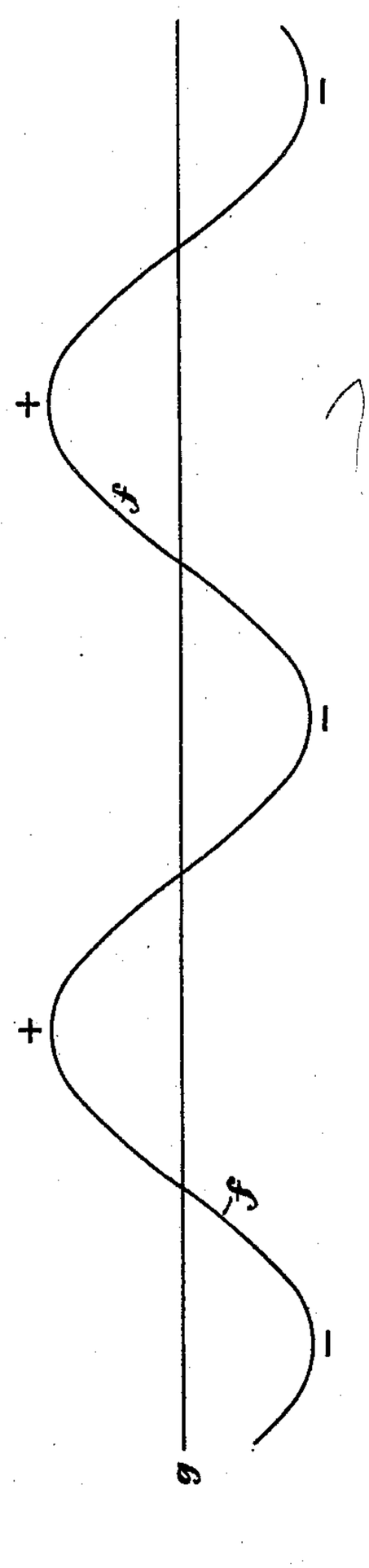

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UNITED STATES PATENT OFFICE.

ALEXANDER WURTS, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, OF SAME PLACE.

LIGHTNING-ARRESTER.

SPECIFICATION forming part of Letters Patent No. 465,958, dated December 29, 1891.

Application filed October 5, 1891. Serial No. 407,737. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER WURTS, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Lightning-Arresters, (Case No. 465,) of which the following is a specification.

The invention relates to an organization of apparatus for relieving electric circuits from excessive static charges which are especially liable to accumulate during the occurrence of thunder-storms, or which may be otherwise received from the atmosphere.

In extended electric circuits the static charge upon the lines frequently becomes so great as to cause a destructive discharge to take place through the insulation of the armature of the generator supplying the circuit or through other apparatus connected therewith, thus effecting considerable injury.

In another application, filed by me on the 6th day of July 1891, Serial No. 398,503, I have described a method of and apparatus for relieving circuits from the accumulation of excessive static charges, and in an application filed by me jointly with Charles F. Scott on the 18th day of July, 1891, Serial No. 399,875, there is described a modified form of apparatus for accomplishing the same result. In the latter application it is proposed to organize a system of discharge-plates which are connected, respectively, with the circuit and with the earth, so as to be brought into proximity at rapidly-recurring intervals and permit frequent discharges of comparatively-low potential to take place between the conductors and the earth, and thus the presence of a dangerously-high static charge is prevented. In that organization it is desirable that the proximity into which the plates are brought should not be such as to allow the generated current to pass across the intervening air-gap, as in that case there might be danger of short-circuiting the machine under certain circumstances. I have found, however, that in the case of an alternating-current generator or a generator of undulatory currents good results are effected by so placing the plates with reference to each other that the discharge from the circuit will take place at the time the electro-motive-force wave is neutral—that is to say, at the time the electro-motive force has fallen to zero, for at that instant there will be little or no tendency for the current delivered by the machine to pass across the intervening air-space, and therefore the plates may be brought into very close proximity or even into actual contact, and static charges of very low electro-motive force may be drawn from the circuit with little or no danger of the generated current following.

The invention will be described more in detail in connection with the accompanying drawings, in which—

Figure 1 is a view of the end of the shaft of an alternating-current electric generator equipped with suitable apparatus for drawing off the static charge, and Fig. 2 is a detail. Figs. 3 and 4 illustrate a modification. Fig. 5 is a diagrammatic representation of an alternating electro-motive force.

Referring to the figures, A represents a bearing-pillar of the machine, and B the armature-shaft. A discharge-plate E is suitably supported from the machine and is connected with the earth by conductor *e*. The collector is constructed with two contact-rings c' c^2, constituting the respective terminals of the armature-circuit. These rings are suitably insulated from each other, and between them there is placed a ring C of insulating material, which carries discharge-plates e' e^2. The plates e' are connected with the ring c' and the plates e^2 with the ring c^2. These plates are shown as alternating in position around the ring, and by the revolution of the shaft they are brought alternately in front of the discharge-plate E. It is well known that an alternating-current electric generator develops an electro-motive force which rises to its maximum, then falls to zero, reverses and attains a maximum value of the opposite potential, then again falls to zero and reverses, and so on, repeating the operation. Such an electro-motive force is diagrammatically represented in Fig. 5 by the curved sinusoidal line *f*, the neutral line being represented by

the line *g*, which is crossed and recrossed by the sinusoidal line. The point of crossing represents the neutral point in the electro-motive force. Now it is evident that if the discharge-plates e' and e^2 are brought into proximity with the stationary plate E, which is connected with the earth at or about the instant the electro-motive force has fallen to its zero value, then there will be little or no tendency for the dynamo-current to follow across the intervening air-space; but whatever static charge there may be upon the line will preserve its tendency to escape to the earth across the air-space, thus clearing the line. For this reason the plates may be adjusted to come into very close proximity, or, as shown in Figs. 3 and 4, into actual contact without increasing the danger of short-circuiting the generator provided the moment of proximity coincides with the moment of little or no electro-motive force on the part of the dynamo. I therefore so locate the plates E, e', and e^2 with reference to each other and to the poles of the machine that the passage of the plates will occur at or about the time of the neutral points of the electro-motive-force waves, which usually coincide or approximate the times of the pole-passages. They may, however, pass immediately before the neutral point of the wave is reached—that is to say, before the reversal, for then the tendency of the dynamo-current to follow will be in a measure neutralized by the reversal.

It will be evident that a sufficient number of plates may be provided for causing a discharge of the line at every alternation of the electro-motive force or at intervals separated by several alternations, as may be found desirable in different instances. It is evident, furthermore, that both sides of the line may be discharged at the same time, and therefore a second discharge-plate E′, which is also electrically connected with the earth, may be so placed with reference to the plate E that one of the plates e' will pass its face at the same moment that a plate e^2 passes the plate E′, and vice versa.

For convenience of adjusting the plates E and E′ with reference to the plates e' and e^2, they may be carried upon an arm K, which is supported from an arc *k*, secured to the pillar A, or to some other suitable portion of the machine. It is evident that the plates may be carried upon an independent shaft instead of the armature-shaft and driven in any suitable manner, provided the passages of the plates are caused to take place at the required moments.

In Figs. 3 and 4 a modification is illustrated in which, instead of causing the discharge to take place through an air-gap, an actual electrical contact is made. In this instance insulated contacts e^3 e^4, respectively connected with the rings c' c^2, are caused to touch a stationary plate E^2 at instants of electro-motive-force reversals or at the neutral points in the wave. In this instance, as in that already described, both sides of the circuit may be discharged at the same time, if desired, or only one side at a time, and the frequency of the discharges may be made such as desired.

I claim as my invention—

1. The combination, with an alternating-current electric generator, of two discharge-plates, one constantly moving with reference to the other, said plates being so located with reference to each other that they will pass at the moment of a neutral point in the wave phase of the electro-motive force, substantially as described.

2. The combination, with one or more plates carried by the armature-shaft of an electric generator, of one or more stationary plates in proximity to the path of the first-named plate or plates, said plates being so located with reference to each other that the movable plate or plates will pass one or more stationary plates at or near the moment of the neutral point in the wave phase of the electro-motive force.

3. The combination, with a source of alternating electric currents, of a discharge-plate connected with one terminal of the source, and a second discharge-plate connected with the earth, the two being movable with reference to each other, and means for causing the two plates to pass each other at or near the moment of no potential upon the machine, substantially as described.

4. The combination, with the two sides of an alternating-current electric circuit, of discharge-plates respectively connected with the same and one or more corresponding discharge-plates connected with the earth, and apparatus for bringing the earth plate or plates into proximity to the circuit-plates alternately and at or near the moment of electro-motive-force reversal, substantially as described.

5. The combination, with the two collecting-rings of an alternating-current generator, of a ring of insulating material, discharge-points carried thereby electrically connected with the respective collecting-rings, and a stationary discharge-point confronted by the first-named discharge-points at the moments of electro-motive-force reversals.

6. The combination, with an alternating-current electric generator, of two discharge-plates, said plates being so arranged with reference to each other that they will be thrown into action at the moment of a neutral point in the wave phase of the electro-motive force, substantially as described.

In testimony whereof I have hereunto subscribed my name this 28th day of September, A. D. 1891.

ALEXANDER WURTS.

Witnesses:
J. W. SMITH,
CHARLES A. TERRY.