(No Model.)

A. G. WATERHOUSE.

LIGHTNING ARRESTER.

No. 475,645. Patented May 24, 1892.

Fig. 1.

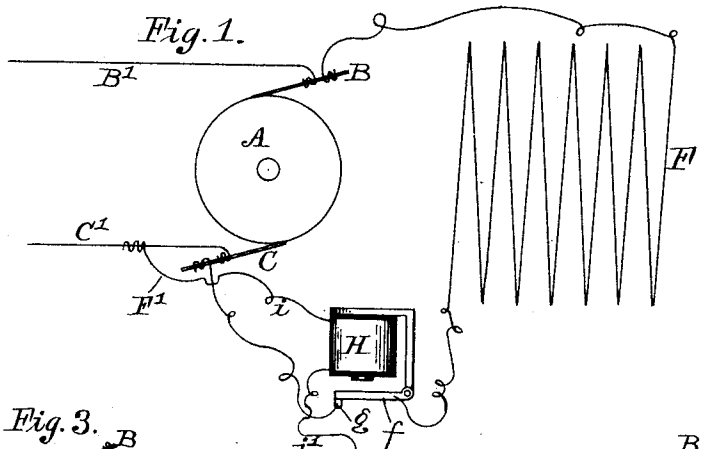


Fig. 3.

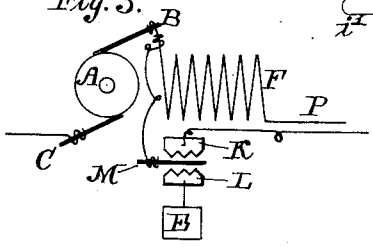


Fig. 2.

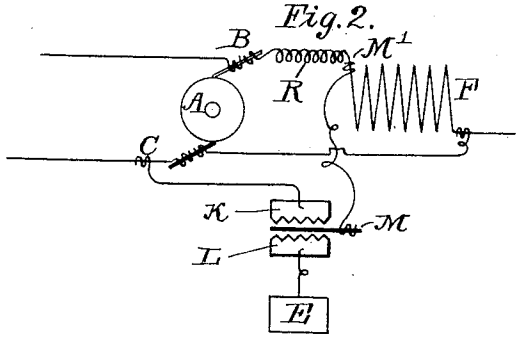


Fig. 4.

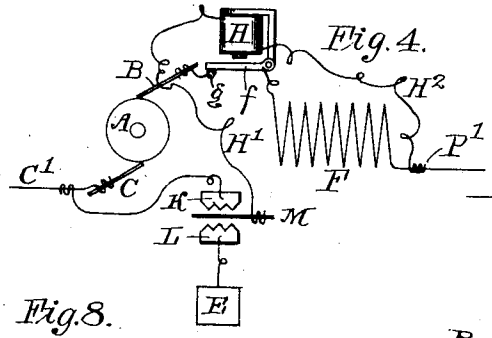


Fig. 5.

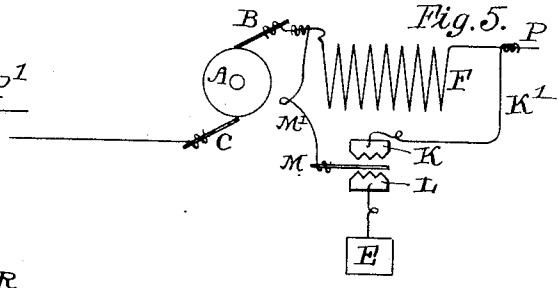


Fig. 8.

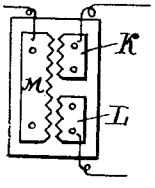


Fig. 7.

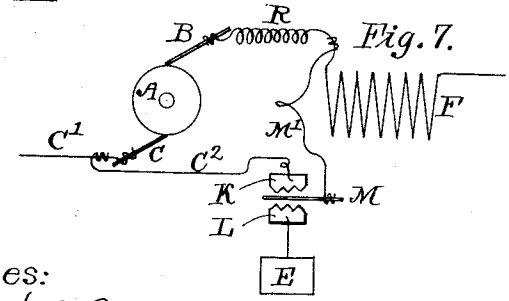
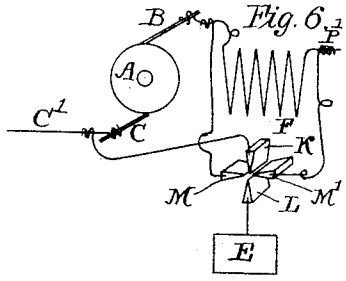


Fig. 6.



Witnesses:
William A. Lorenz.
Arthur F. Lynch

Inventor:
Addison G. Waterhouse

UNITED STATES PATENT OFFICE.

ADDISON G. WATERHOUSE, OF HARTFORD, CONNECTICUT.

LIGHTNING-ARRESTER.

SPECIFICATION forming part of Letters Patent No. 475,645, dated May 24, 1892.

Application filed December 17, 1891. Serial No. 415,419. (No model.)

To all whom it may concern:

Be it known that I, ADDISON G. WATERHOUSE, a citizen of the United States, residing at the city of Hartford, in the State of Connecticut, have invented new and useful Improvements in Lightning-Arresters for Protecting Dynamo-Electric Machines, of which the following is a specification.

My invention consists of a lightning-arrester having means for conducting abnormal electrical currents to the earth, which may be communicated to the conductors of a dynamo-electric machine by lightning or other source of electrical energy, which I will call "lightning discharges," and a means for temporarily short-circuiting the field-magnets or suspending the current-producing capacity of the dynamo-electrical machine while said discharges are passing to the earth and until after said discharge is broken, which would during its continuance offer a path for the current of the dynamo-electric machine.

Figure 1 shows, diagrammatically, a dynamo-electric machine of the derived-circuit type with a lightning-protector embodying my invention adapted for interrupting the current which passes through the field-magnet coil. Fig. 2 shows a modified form of my invention adapted for short-circuiting the field-magnet coil as applied to a derived-circuit machine. Fig. 3 shows a form adapted to short-circuiting the field-magnet coil of a series-wound type of a machine by having plate K connected at any convenient place on the working circuit away from the dynamo. Fig. 4 shows a form in which the lightning-protector is adapted for interrupting the current in the field-magnet coils of a series-wound machine and at the same time creating a path for the current around said field-magnet. Figs. 5, 6, and 7 are modified forms of my invention. Fig. 8 is a detail.

Fig. 1 shows, diagrammatically, a dynamo-electric machine with appliances embodying my invention, in which A is the armature, having contact-brushes B and C, and main-circuit conductors B′ and C′ leading therefrom and forming the working circuit; also, a derived-circuit field-magnet coil F, extending from brush B to C. There is placed in this circuit a circuit-breaker consisting of the movable armature *f* and stationary contact-point *g*. The armature *f* is electrically connected to the field-circuit F and rests upon *g*, and completes the circuit leading to brush C. Above *f* is placed an electro-magnet H, which is adapted to raise the armature *f* from *g* and break the field-circuit F. Connected to main conductors C′ is a wire leading to and around the magnet H and then to the flashing-plate K. Near K is placed a second plate L, with connection leading to the earth E. When an electric discharge enters on wire C′, it passes around magnet H to plate K, then to L, and the earth E. In doing so it energizes magnet H, and, lifting *f*, breaks the field-circuit, which interrupts the current passing through the field-magnet coil and stops the current-producing energy of the dynamo until the arc formed between plates K and L is broken.

Fig. 2 shows a form in which the energy of the machine is interrupted by short-circuiting the field-magnet coil F. In this case I will suppose the lightning-discharge enters on main line C′. In doing so it passes on the wire leading to the plate K, then arcs across and passes to the plate L and earth E. In forming an arc between K and L the pointer M, owing to its position, is inclosed by the flame of the arc. This would form a circuit around the armature A, starting at point M′, and which includes the arc between plate K and pointer M and also the resistance R, used in series with the field-coils F, which resistance would be sufficient to oppose the building up of too great a current, because at the same time the circuit formed from M′ *via* M and K to brush C, including resistance R, would form a shunt around the field-magnet coil F and divert the current from passing that way until by interrupting the force of the dynamo the arc between K and L, and consequently the arc between K and M, would break.

Fig. 3 shows an application of the same device in the case of a series-wound dynamo where the lightning-discharge passing in on line P would follow the conductor leading to plate K, then arc across to plate L, and pass to the earth E. In doing so it would inclose pointer M in the arc-flame and form a short circuit around the field-magnet coil F *via* line P, plate K, pointer M, and brush

B. This would consequently paralyze the field-coils and stop the current until the arc between plates K and L breaks.

Fig. 4 shows a series-wound dynamo having a circuit-breaker in the line between the armature A and field-magnet coil F. This circuit-breaker is composed of the movable armature *f* and stationary contact-point *g*. When an electrical discharge enters on line C′ and arcs from plate K to L, it forms a circuit to M and on the conductor H′, leading from M to the electro-magnet H, and then on wire H^2 to contact P′. This completely shunts the field-magnet F and at the same time causes the magnet H to raise the armature *f* from contact-point *g*′, thereby interrupting the current passing around the field-magnet coil F.

Fig. 5 shows a form in which an electrical discharge entering on wire P goes to the earth E *via* line K′ and by plates K and L to E. The arc formed between K and L surrounds pointer M and forms a circuit *via* line K′, plate K to M, and on line M′ to brush B. This completely short-circuits the field-magnet coil F and stops the current until the arc between plates K and L is broken.

Fig. 6 shows a double set of flashing-plates K, L, M, and M′. Plate K is connected to line C′, plate M to brush B, and plate M′ to P′, which would form a circuit which would exclude the field-magnet F if plates M and M′ were connected. It is plain if an electrical discharge entered either from line C′ or from point P′ in passing to plate L it would cause a flash which would short-circuit plates M and M′ and by paralyzing the field-coil F stop the current until the arc between any two of the plates was broken.

Fig. 7 shows a series machine arranged so that if a discharge enters from wire C′ to plate K and arcs to plate L in going to E it forms a circuit around the armature *via* brush C, wire C^2, plate K, pointer M, wire M′, and resistance R to brush B. This circuit excludes the field-magnet coil F and stops the current until the arc between the plates K and L and pointer M is broken.

Fig. 8 shows any form of construction in which the pointer M is made in the form of a plate so adjusted that a discharge from K would jump to plate M and then over to plate L in order to reach from plate K to L.

I have shown that the circuit formed by the pointer M can be used for destroying the field magnetism of a dynamo; but it is also plain that the new circuit formed from pointer M can be used to do other kinds of work, such as working an electro-magnet, which will break the working circuit of the machine.

What I claim as my invention is—

1. A lightning-arrester composed of three flash-plates, one of which is electrically connected to the earth and the other two connected to an electrical conductor at two places, which would include work on said conductor between said two places of connection, said three flash-plates being adjusted in relation to each other so as to cause a flame produced by an electrical flash in crossing between two plates to include or envelop the third, substantially as and for the purposes set forth.

2. A lightning-arrester composed of three stationary flash-plates, two of which are connected to the main circuit of a dynamo-electric machine at different points on the line and the third being electrically connected to the earth, substantially as described, and for the purposes set forth.

3. A lightning-arrester composed of three flash-plates, one of which is electrically connected to the earth and the other two connected to an electrical conductor at two places, which would include work on said conductor between said two places of connection, said three flash-plates being adjusted in relation to each other so as to cause a flame produced by an electrical flash in crossing between two plates to include or envelop the third, said third plate being connected to said electrical conductor by means of a conductor, automatic switch, or circuit-breaking devices in said conductor, adapted for interrupting or diverting the current in the main conductor, substantially as and for the purposes set forth.

4. A lightning-arrester composed of three flash-plates adjusted in relation to each other, substantially as described, one of said plates being electrically connected to the earth, a second being directly connected to an electrical conductor, and the third being electrically connected to the same conductor at a different point on its circuit, with switches or circuit-breaking devices in the conductor leading from the third plate, being adapted for interrupting or diverting the main-circuit current upon the passage of a current leading from said third plate, substantially as and for the purposes set forth.

5. A lightning-arrester composed of three flash-plates adjusted in relation to each other, as described, one of which is connected to the earth, the second to a main-circuit conductor, and the third to the same main conductor at a different point by means of a conductor which would form a separate circuit or shunt around the parts of said main conductor between the points at which the second and third plate is connected, said third plate and its conductor being located so as to be brought in circuit by the flame caused by a current passing from the second to the first plate, substantially as and for the purposes set forth.

6. A lightning-arrester composed of two main flash-plates and one or more intermediate flash-plates, one of said main flash-plates being electrically connected to the earth, the other main flash-plate and the intermediate flash plate or plates each being electrically connected to an electric conductor at different points on said conductor, which would include work, distance, or resistances between said points of connection, said main

and intermediate flash-plates being so adjusted in relation to each other as to cause a flame produced by an electrical flash in crossing between two of said plates to include or envelop one or all of the rest, substantially as and for the purposes set forth.

7. A lightning-arrester composed of two main flash-plates and an intermediate flash-plate, one of said main flash-plates being connected to the earth, the other main flash-plate and the intermediate flash-plate each being connected to an electrical conductor forming the field-magnet coil or coils of a dynamo-electric machine at two points, which would include all or part of said field-magnet coil or coils between them, said main and intermediate flash-plates being permanently adjusted in relation to each other, so as to cause a flame produced by an electrical flash in crossing between two plates to include or envelop the third in a way adapted for establishing a path between the said two flash-plates, which would form a short circuit around the said field-magnet coil or coils included between said two points of contact, substantially as and for the purposes set forth.

ADDISON G. WATERHOUSE.

Witnesses:

FRANK G. WATERHOUSE,

ARTHUR H. LYNCH.