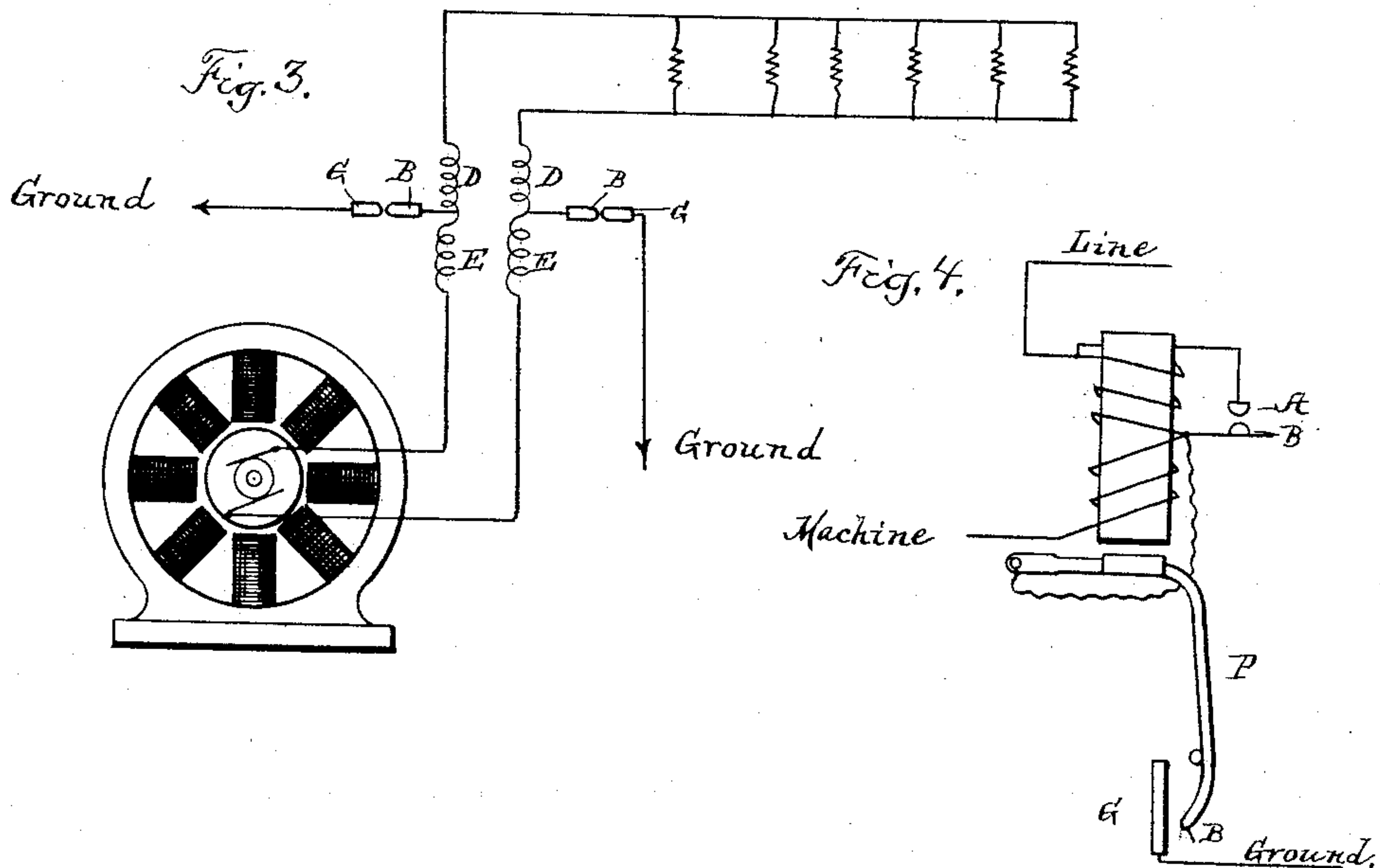
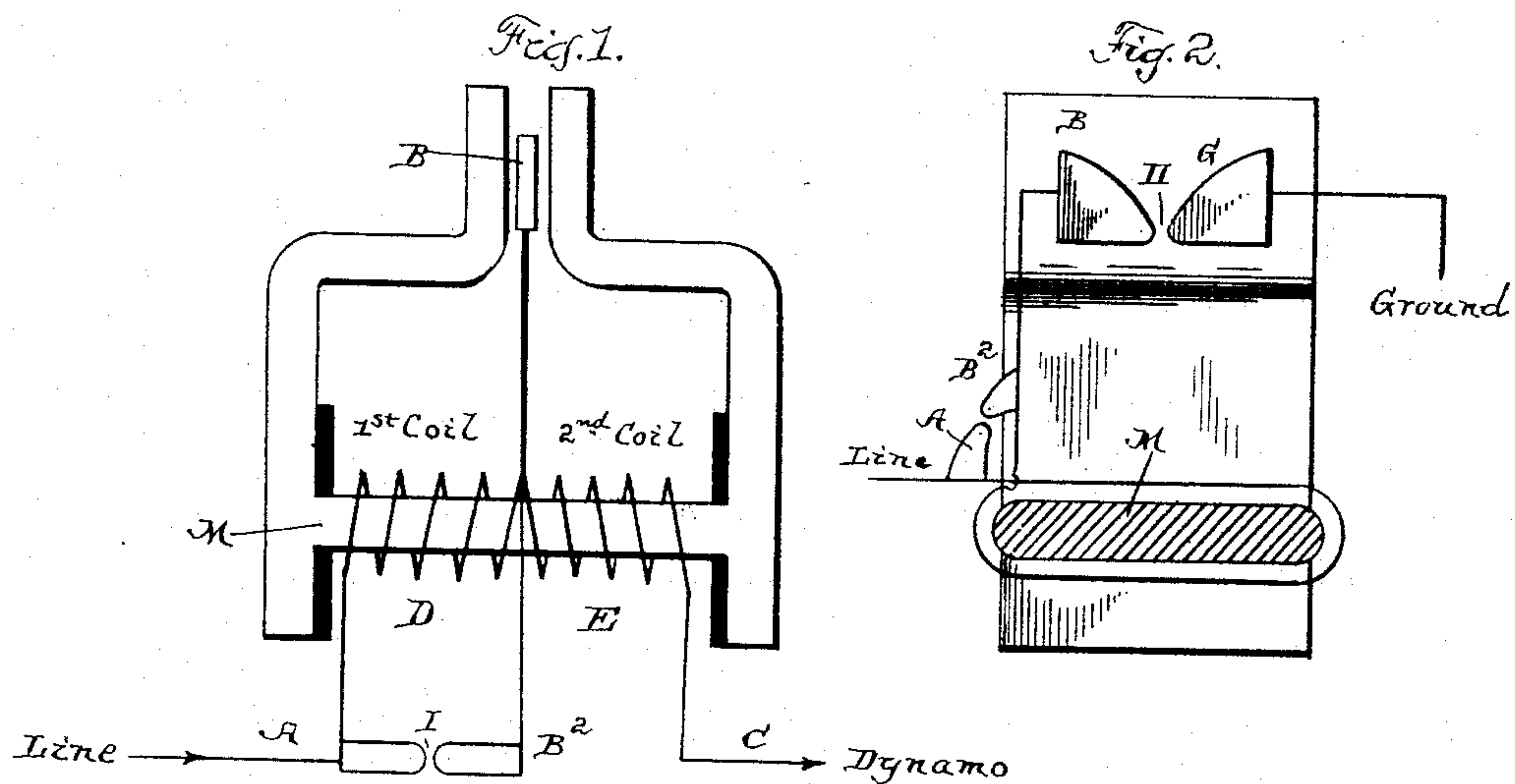


(No Model.)

H. LEMP.  
LIGHTNING ARRESTER.

No. 409,689.

Patented Aug. 27, 1889.



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# UNITED STATES PATENT OFFICE.

HERMANN LEMP, OF LYNN, MASSACHUSETTS.

## LIGHTNING-ARRESTER.

SPECIFICATION forming part of Letters Patent No. 409,689, dated August 27, 1889.

Application filed January 19, 1889. Serial No. 296,932. (No model.)

*To all whom it may concern:*

Be it known that I, HERMANN LEMP, a citizen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Lightning-Arresters, of which the following is a specification.

My invention relates to electro-magnets placed on alternating-current circuits and required to be constantly in circuit and ready to perform their work on the occurrence of certain conditions, but normally, or under the usual conditions, not in operation.

The object of my invention is to avoid the sacrifice of electrical energy which would ordinarily arise from the self-induction or reactive effect of the coils of said electro-magnet constantly in circuit; to which end my invention consists, essentially, in the combination, with said magnet, of a neutralizing, opposing, or differential coil placed in circuit therewith and operating to kill, neutralize, or oppose the effects of said magnet's coils, thereby killing their self-induction. When said magnet is required to act, the opposing coils are shunted or thrown out of action automatically or by any desired mechanism. In the application of my invention herein described the shunting is automatic.

My invention is especially applicable to the arc-rupturing magnets of lightning-arresters or devices which, being placed in a ground connection from a line, are designed to divert from said line lightning-strokes or abnormally high-tension currents, which, if allowed to reach a dynamo or other source of current or other device, might do damage to the same. The arc-rupturing magnet is one which performs any action, magnetic or mechanical, suitable for putting out the arc, should any form on the branch or ground connection. Two of the ways in which the magnet may operate to put out the arc are hereinafter described.

My invention consists, further, in the combination, with an arc-rupturing magnet placed on the main circuit with an alternating-current source, of an opposing coil on the same circuit and a safety branch or ground taken from a point in the line between said coils.

My invention consists, also, in the combi-

nation, with the opposing coil, of a branch of normally high resistance but low self-induction around the same, such resistance being of proper character to be overcome by the lightning-stroke, and in the special combinations and details, to be hereinafter described in connection with the accompanying drawings, and then specified in the claims.

In the accompanying drawings, Figure 1 illustrates diagrammatically the application of my invention to an arc-rupturing magnet of a lightning-arrester. Fig. 2 is a section of the magnet and side view of the arrester-electrodes. Fig. 3 is a diagram illustrating the application of the invention to both poles or mains leading from an alternating-current dynamo which supplies lamps or other devices in multiple. Fig. 4 illustrates the application of the invention to an arc-rupturing magnet which performs its office of putting out the arc in another way.

M indicates the core of an arc-rupturing magnet, and E coils which develop magnetism for rupturing the arc by magnetic effects or other action. The coils E are in a circuit with a dynamo or other source of alternating current, and are disposed upon the core of the magnet in any desired way.

D indicate coils which are wound over, beside, or underneath coils E, and which are wound, connected, applied, or furnished with alternating currents in such manner as to oppose or neutralize the effects of coils E when traversed by the alternations flowing over the line or main circuit. It is preferable and convenient to place the coils D in the main-line circuit with E, such coils between being wound or connected in the opposite direction to E, (and of the same number of turns,) in which case it is obvious that coils E also have the effect of preventing waste of energy from counter electro-motive force—effects which would otherwise arise from the self-induction of coils D. The coils are shown applied side by side for the sake of simplicity in the drawings.

From a point of the circuit between the coils D E the ground connection to the electrodes B G of the lightning-arrester is taken. These electrodes are separated from one another by a narrow space at H, across which a high-tension current may force its way, and



in this instance are placed between the poles of the electro-magnet, as shown.

In order to protect the coils D from injury by a lightning-stroke, I provide a branch 5 around them which shall be of very high resistance to the currents on the line, but of low self-induction, so that a lightning-stroke passing to the arrester from line may pass 10 through or over said line instead of being obliged to pass through coils D, whose self-induction to said stroke might lead to their injury. When the resistance of the branch around D is practically infinite, the coils D and E may be exactly alike in number of 15 turns, as before stated; but if the branch around D be of a character which would allow some of the alternating current to pass around the coils D the latter should be made larger and adjusted with reference to such action.

20 The best way of constructing the branch is to employ two electrodes A B, separated by a small insulating-space I, like the electrodes of a lightning-arrester; but I do not limit myself to this way. The purpose is only to have a 25 high resistance normally, but one of less resistance to the lightning-stroke than the coils D. This is attained in the low self-induction and high resistance at I between the electrodes A B.

30 The operation is as follows: Under ordinary conditions the resistance of coils D E is that only of an equivalent length of wire without any self-induction whatever, the reaction or kick of E being neutralized by the effects of 35 D, and vice versa. Any lightning-stroke passing over the line toward the dynamo or other source connected to coils E will, if sufficiently severe, pass from A to B and thence to ground across the electrodes B G, in the usual man- 40 ner. Its tendency to pass or be directed to ground, instead of going through coils E to the point to be protected, is in this instance assisted by the reaction of the coils E, which in this case act unopposed, because the path 45 of the exciting-current does not include coils D. At the same time the ground-connection is without self-induction, the coils of the arc-rupturing magnet being in the line. The placing of the coils of the arc-rupturing mag- 50 net in the line instead of in the ground I do not, however, herein claim. Should the current of the dynamo or other source attempt to follow up the high-tension current across electrodes B G and maintain an arc thereat, 55 it will evidently flow then through coil E and will energize the magnet, since the coil D is not on the circuit so formed for the alternating currents. The magnetism so developed will put out the arc in the well-known man- 60 ner. In Fig. 4 the magnetism so developed is shown applied to operating a lever which carries one of the electrodes B G. The arc is put out by the separation of the electrodes to a distance such that the arc cannot be 65 maintained. This operation amounts simply to rupturing the circuit to ground, the interruption taking place at the electrodes of the

lightning-arrester, which are used for this purpose for the sake of simplicity.

As already stated, I do not limit myself to 70 the particular means for rupturing the arc formed between the two electrodes in the ground connection, the invention consisting rather in the use of the opposing coil on the alternating-current circuit with the main coils 75 E and in taking off the ground from a point between the coils.

By my invention it is possible to use a very powerful magnet without sacrificing energy. I moreover attain the very useful results of 80 practically no self-induction in the ground-circuit and a good deal in the main circuit between the line and point to be protected for the lightning or dangerous current, and practically no resistance for the alternating 85 currents of the dynamo or other source under the ordinary conditions of use.

What I claim as my invention is—

1. The combination, with an arc-rupturing magnet on an alternating-current circuit, of 90 an opposing or neutralizing coil in the normal circuit therewith, as and for the purpose described.

2. The combination, with a lightning-arrester, of an arc-rupturing-magnet coil, an 95 opposing or neutralizing coil in the normal circuit therewith, and a ground connection from a point between the two coils.

3. In a lightning-arrester, the combination of an electro-magnet having differential coils, 100 arrester-points in the field of said magnet, and a connection to the arrester taken from a point between the coils.

4. The combination, with an alternating-current circuit, of an arc-rupturing-magnet 105 coil, an opposing or neutralizing coil in the circuit therewith, and a connection to the point at which the arc is to be ruptured taken from a point between the coils.

5. The combination, with separated elec- 110 trodes connected to an alternating-current circuit, of an arc-rupturing magnet having a coil in said circuit, and an opposing coil, said coils having an intermediate connection to said electrodes. 115

6. The combination, with the electrodes of a lightning-arrester connected to an alternating-current circuit, of an arc-rupturing magnet having coils between said arrester and 120 the point to be protected, and an opposing coil at the opposite side of the point of connection of the arrester.

7. The combination, with the electrodes of a lightning-arrester connected to an alternating-current circuit, of an electro-magnet 125 whose poles are arranged in proximity to said electrodes and having its coils in circuit between the arrester and dynamo, and an opposing coil between the arrester and the line, as and for the purpose described. 130

8. The combination, with the arc-rupturing magnet, of an opposing coil in the normal circuit therewith, and a branch of normally high resistance and comparatively low self-



induction around the latter, as and for the purpose described.

9. The combination of the arc-rupturing-magnet coil in the line, the opposing line-coil, and the safety ground connection between said coils.

10. The combination, with an arc-rupturing magnet on an alternating-current circuit, of an opposing or neutralizing coil in the normal circuit therewith, and a branch connec-

tion to a point of the circuit between the neutralizing-coil and the coil of the arc-rupturing magnet.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 17th day of January, A. D. 1889.

HERMANN LEMP.

Witnesses:

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