(No Model.) 2 Sheets—Sheet 1.

O. P. LOOMIS.

LIGHTNING ARRESTER.

No. 424,562. Patented Apr. 1, 1890.

Fig. 1.

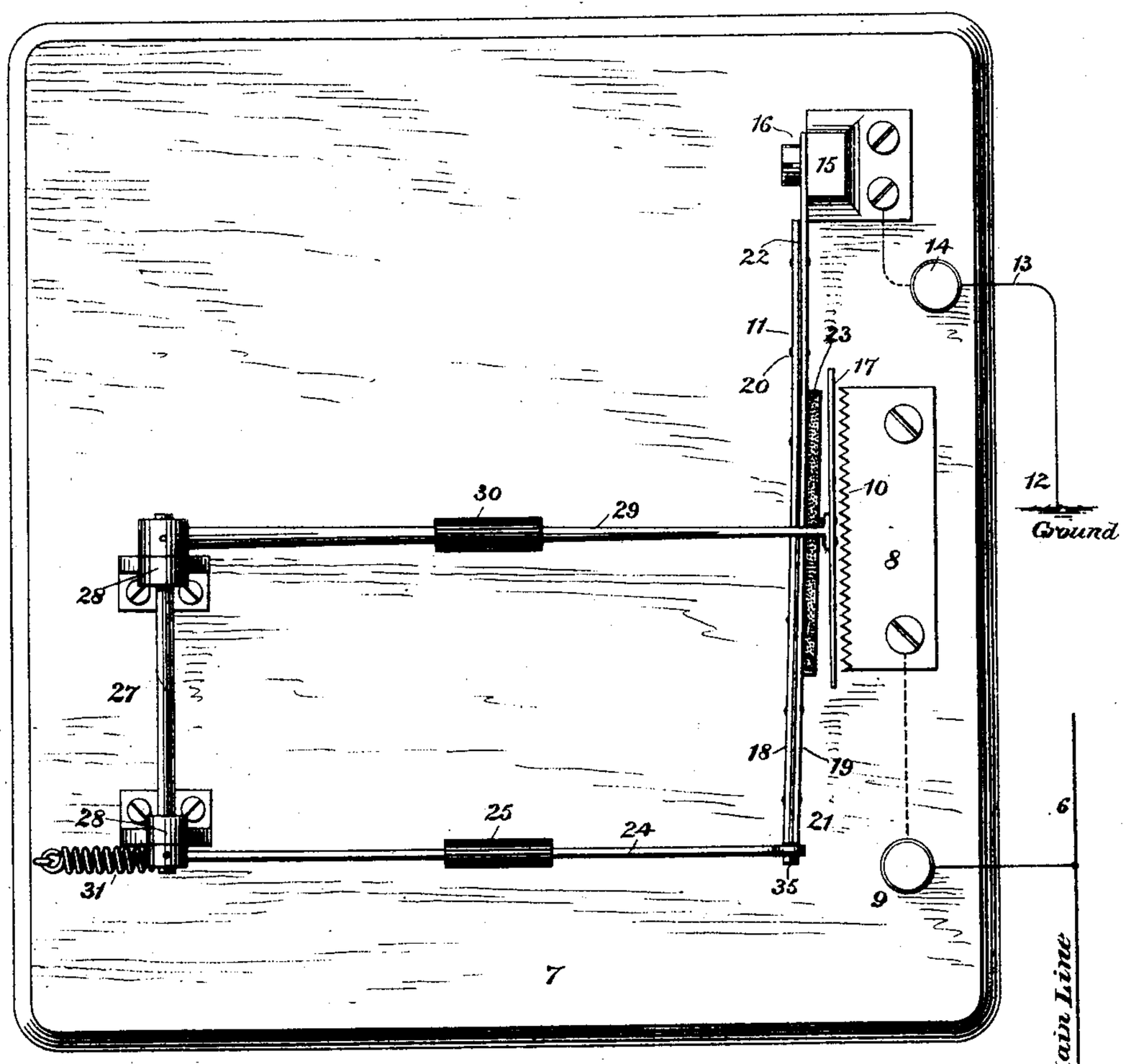
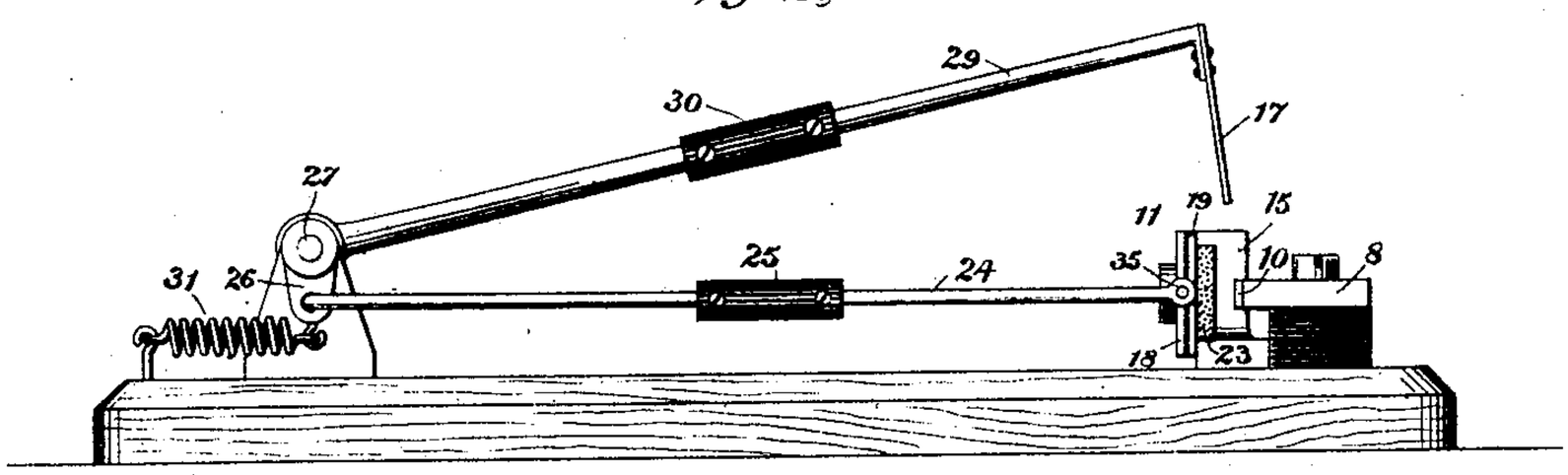


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

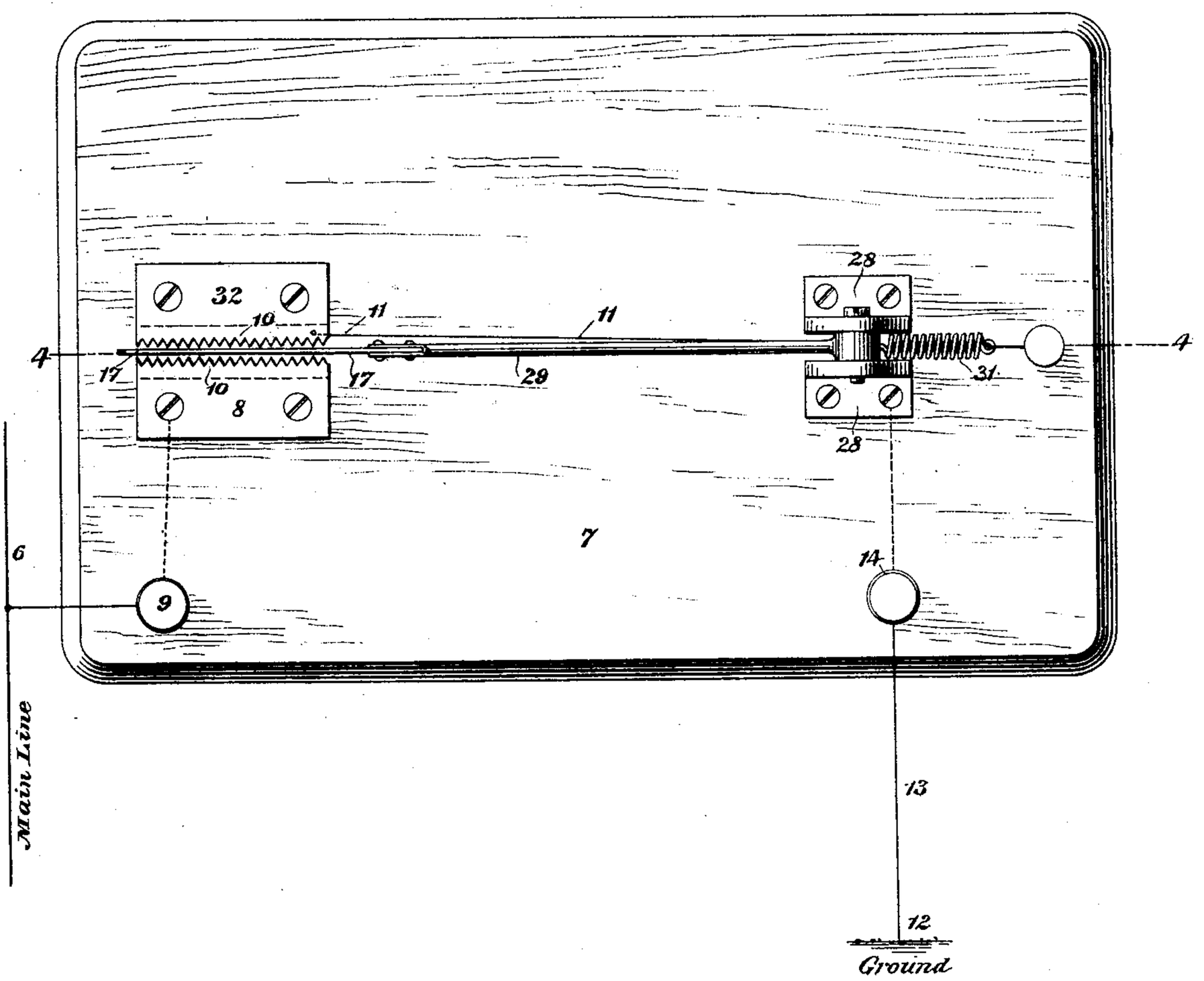
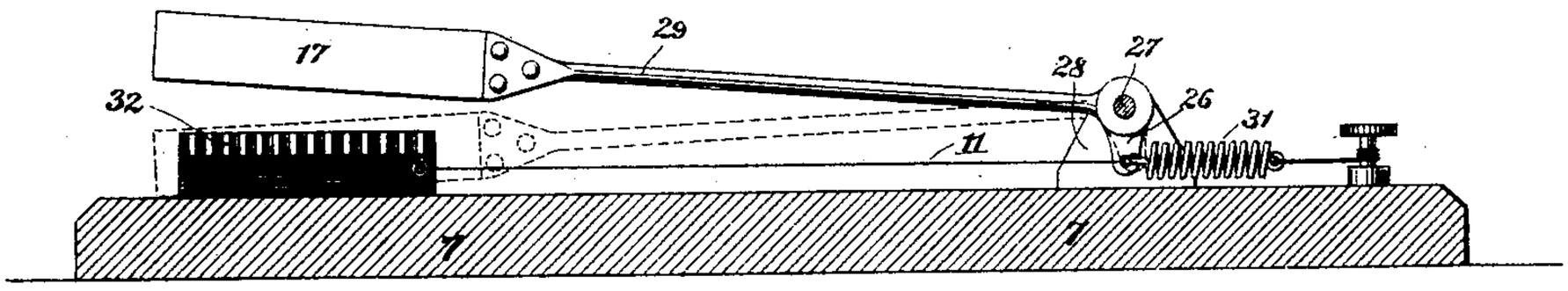


Fig. 4.



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UNITED STATES PATENT OFFICE.

OSBORN P. LOOMIS, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE EUREKA ELECTRIC COMPANY, OF NEW YORK.

LIGHTNING-ARRESTER.

SPECIFICATION forming part of Letters Patent No. 424,562, dated April 1, 1890.

Application filed August 19, 1889. Serial No. 321,201. (No model.)

To all whom it may concern:

Be it known that I, OSBORN P. LOOMIS, a citizen of the United States, residing at Brooklyn, Kings county, and State of New York, have invented certain new and useful Improvements in Lightning-Arresters, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to lightning-arresters that are employed with electric apparatus to prevent the same being injured by lightning discharges or strokes, and which in general comprise an auxiliary circuit leading from the main—for instance, a ground-connection—over which the lightning-discharge may pass, and in which circuit is located a pair of permanently separated discharge points or electrodes, between which an arc is formed by the discharge, which arc is subsequently ruptured in order to prevent the current of the main line flowing to the ground and short-circuiting the apparatus contained therein.

The principal object of my present invention is to effect a timely rupture of the arc established between the discharge plates or electrodes of the arrester upon the passage of a lightning discharge over the apparatus.

A further object of the invention is to render the arc-rupturing means automatic, so that after the same has effected a severance or rupture of a discharge-arc it may restore itself to normal position ready for a repetition of action.

To the above purposes my invention consists in controlling the operation of arc-rupturing means by the agency of a thermo-motive or thermostatic device that is arranged in such manner as to be made operative by the passage of a current over the arrester, and, further, in such a device included in the circuit of the arrester.

The invention further consists in a lightning-arrester having an arc-rupturing shield made of insulating material, appropriately arranged to be moved in between the discharge points or electrodes and to be withdrawn therefrom by means of a thermo-motive or thermostatic device located in the discharge-circuit and actuated by the heat produced by the passage of the discharge-current over the arrester.

The invention further consists in the novel and peculiar constructions and arrangements of the various parts of the apparatus, all as hereinafter fully described, and particularly pointed out in the claims.

I have illustrated my invention in the accompanying drawings, and in the description will refer to the same by means of numbers of reference marked thereon, like numbers designating like and corresponding parts throughout.

In the said drawings, Figure 1 is a top plan view of my improved lightning-arrester, shown closed, or in the position in which the thermo-motive device has caused the discharge-arc to be ruptured. Fig. 2 shows a side view of the apparatus in open position, or in condition to receive or divert from the main line a lightning-discharge. Fig. 3 is a top plan view of another form of the apparatus, and Fig. 4 is a sectional view of the same taken on a plane indicated by line 4 4 in Fig. 3.

Referring to the drawings, and having special reference to Figs. 1 and 2 thereof, 6 designates a main line that is fed by any suitable source of electricity, and in which may be located any of the ordinary consumptive devices—such, for instance, as electric lights.

Upon a suitable platform 7 is mounted, in insulated condition, a discharge plate or electrode 8, that is connected, by way of binding-post 9, to the main line 6. The active or discharge part or end of the electrode 8 is formed with suitable discharge projections 10, opposite to which and suitably spaced therefrom is arranged a fellow discharge plate or electrode 11, which in the present construction is a thermo-motive device, through whose agency the rupturing of the discharge-arc is effected. This combined electrode or thermo-motive device 11 is connected to ground 12 by way of the wire 13, binding-post 14, and a suitable stand 15, to which the end 16 of the bar 11 is attached in any proper manner to sustain it in operative position.

The parts 8 and 11 constitute the discharge

surfaces or electrodes, between which an arc is formed whenever a lightning-discharge is thrown on the apparatus. In order to rupture this discharge-arc formed between the permanently-separated electrodes, I provide a thermo-motive or thermostatic device 11, which is made part of the discharge-circuit, so that the heat from the current passing thereover may cause such member to so act that it may break or rupture the discharge-arc. In the present construction this device 11 is arranged so as to control the movements of an insulating arc-rupturing shield or body 17, that is movable in and out between the electrodes 8 and 11. When the shield 17 is entered in the arcing-space between the electrodes, it will rupture any arc existing therebetween and prevent the formation of one so long as it remains between the electrodes, and upon its removal from the arcing interval the electrodes stand so related that an arc may be again formed between them when a discharge occurs.

In the construction shown in Figs. 1 and 2 the arc-rupturing shield 17 is controlled in its movements indirectly by the thermo-motive device 11 in the following manner: The device 11 consists in a bar attached fixedly by its end 16 and projecting free, and it is composed of two strips 18 and 19, placed with their flat sides together and fastened to each other by means of suitable fasteners or rivets 20, which may be constructed in such way as to prevent the conduction of current or heat. The materials of these strips 18 and 19, preferably metal, have different coefficients of expansion, and this difference, of course, is made as great as is practically convenient. The strip 19 has greater expansibility under the influence of heat than has the strip 18, so that when an arc is formed between the electrode 8 and 11 the heat of the arc, as well as the heat produced by the passage of the current over the part 11, will expand the strip 19 to a greater degree than its companion 18, thereby producing in a well-known manner a lateral flexure of the free end 21 of the bar 11, the direction of the flexure being, of course, in a direction away from the electrode 8.

To gain a quick and extended movement of the thermal bar 11, I extend the inner end of the strip 18 of the bar to a point considerably short of the adjacent end of the strip 19, so as to permit of a more ready lateral movement of the bar. I further take the precautionary measure, for the same purpose, of protecting the strip 18 from the heat of the strip 19. I do this by interposing between the strips a sheet of material 22—that is, a non-conductor of heat—for instance, asbestus. As usual in thermostatic bars, the metals composing the bar are to be as near extremes in their sensitiveness to heat as is practical. A good action may be obtained by making the strip 19 of brass, German silver, or aluminium, and the strip 18 of iron. In order to prevent the rapid oxidation of the bar 11 by action of the discharge-arc, I arm the same with a carbon plate 23 at a point where the arc is formed.

To the free end of the thermo-motive bar 11 is attached a connecting-rod 24 by means of a pin 35, projecting from the bar into a suitable perforation therein, and upon the end of this pin is a nut. The connecting-rod 24 is provided with a suitable insulating section 25, and is hinged by its other end to a projection or lug 26, that is suitably made fast to a rock-shaft 27, mounted horizontally in bearings 28.

Upon the rock-shaft is mounted a plunger-arm 29, provided with a suitable insulating-section 30, and making an angle with the projection or arm 26, the two rocking in fixed relation.

Upon the end of the plunger-arm 29 is removably secured a shield or body 17, made of suitable insulating material, and which, as before referred to, is designed to be thrust in between the discharge-electrodes 8 and 11 and to be withdrawn therefrom. This shield may be made of any material that is suitable to withstand the heat of the arc, as well as to insulate the current—for instance, mica may be used. Besides the positive motion imparted to the plunger-arm indirectly through means of the movement of the bar 11, this arm also normally tends to gravitate and move the shield 17 in between the electrodes.

To further facilitate the moving of the shield into the arcing-space to rupture the arc, I provide a spring 31, that is connected between a fixed point and the movable arm or lug 26, so that it normally tends to turn the rock-shaft 27 in such manner as to lower the plunger-arm.

Upon the formation of an arc between the electrodes 8 and 11 the heat therefrom, as well as the heat due to the passage of the current over the strip 19, will cause the bar 11 to be flexed laterally at its outer end 21 in a direction away from the electrode 8, and this movement will force the connecting-rod 24 outwardly, so as to rock the shaft 27, thereby lowering the arm 29 and moving the arc-rupturing shield 17 in between the electrodes, as shown in Fig. 1. This will at once destroy the arc and interrupt the flow of current to the ground. The shield 17 will remain interposed between the electrodes until the thermo-motive bar 11 has become sufficiently cooled to straighten itself out into normal position, whereby the connecting-rod 24 will be drawn inwardly—that is, from left to right—and the shield 17 be raised from between the electrodes, thus restoring the various parts of the apparatus to normal positions, ready for a repetition of the above-described operation, as shown in Fig. 2.

In the construction shown in Figs. 3 and 4 the thermo-motive device 11 consists merely in a fine wire, made so to increase the resistance of the current, so as to become quickly

heated and respond promply in its action. In this form the thermo-motive member 11 is constructed so that upon being heated by the passage of a current over it it will elongate, and thereby cause the arc-rupturing shield 17 to be moved in between the discharge-electrodes to rupture the arc. This wire 11 is secured by one end to a fixed point on the discharge plate or electrode 32, which is similar to and arranged opposite the electrode 8, with a suitable space between their opposing faces. This electrode 32 is properly insulated, and is likewise formed with discharge-teeth 10. The other end of the thermostatic wire 11 is attached to a lug or arm 26, secured to the shaft 27, mounted in suitable bearings 28. The plunger-arm 29, mounted on shaft 27, carries at its ends the arc-rupturing shield 17, and is movable in a vertical plane over a range of movement, (shown in Fig. 4 by the full and dotted line positions,) the shield 17 traveling in and out between the electrodes. The spring 31, previously described, tends to normally throw the shield 17 in between the electrodes. In its principal features the action of this form of the apparatus is like that above described. A lightning-discharge passing over the apparatus will form an arc between the electrodes 8 and 32, and as the current passes to ground by way of the thermo-motive wire 11, parts 26 27 28, and binding-post 14 the heat generated in this wire 11 by the passage of the current thereover will act to lengthen the same, thereby dropping the arc-rupturing shield 17 in between the electrodes and rupturing the arc, as shown in Fig. 4 in dotted lines. This breaking of the arc interrupts the flow of current over the wire 11, which gradually cools and contracts on its length, so as to draw upon the arm 26 in opposition to the spring 31, and gradually raise the plunger-arm, and thus move the shield out from between the electrodes, leaving the apparatus in normal position, as shown in Figs. 3 and 4.

From the foregoing it will be seen that my invention is not limited to the specific apparatus shown and described, but that it is of such scope as to contemplate many changes in the construction, which may be variously modified, in order to embody the principle of rupturing the arc formed between the discharge-electrodes of a lightning-arrester through the action of a thermo-motive device made active by the heat due to the passage of a current over the arrester.

Having thus described my improvements in lightning-arresters, what I claim as my invention, and desire to secure by Letters Patent, is—

1. A lightning-arrester having arc-rupturing means entering between the discharge-electrodes for breaking the arc formed therebetween, and a thermo-motive device controlling the arc-rupturing means and made operative by the heat produced by the passage of a current over the arrester, and a spring normally tending to move the thermo-motive device and acting to assist the movement of the same, for the purpose set forth.

2. A lightning-arrester having discharge-electrodes across which an arc may form, an arc-rupturing shield movable into and out of the arcing-space between the said electrodes, and an actuating device connected with the arc-rupturing shield and controlling its movements, said actuating device being operated by the passage of a lightning-discharge over the arrester, for the purpose set forth.

3. A lightning-arrester having separated discharge electrodes or plates across which the arc may form, an arc-rupturing shield movable into and out of the arcing-space between the electrodes, a thermo-motive device heated and made operative by the passage of a lightning-discharge over the arrester, and connections intermediate such device and said arc-rupturing shield, whereby the movements of the latter may be controlled by the thermo-motive device to break the arc between the electrodes upon the passage of a lightning-discharge, for the purpose set forth.

4. A lightning-arrester having permanently-separated discharge electrodes or plates across which the arc may form, an arc-rupturing shield movable into and out of the arcing-space between the electrodes and suitably mounted, a spring tending normally to thrust the arc-rupturing shield in between the electrodes, a thermo-motive device moved by the influence of the heat generated by the passage of the current over the arrester, and connections intermediate such device and said arc-rupturing shield, which is held against the action of the spring by said thermo-motive device, whereby upon the passage of a current over the arrester and the formation of an arc between its electrodes the thermo-motive device, together with the spring, may move the arc-rupturing shield between the electrodes and break the arc, for the purpose set forth.

5. A lightning-arrester having permanently-separated discharge electrodes or plates, a swinging arm provided with an arc-rupturing shield of insulating material, which is adapted to be moved into and out of the arcing-space between the electrodes, and a thermo-motive device operated by the heat produced by the passage of a current over the arrester, and normally holding the swinging arm in the position in which the arc-rupturing shield is away from the electrodes, substantially as and for the purpose set forth.

6. A lightning-arrester having a thermo-motive bar for effecting the breaking of the arc, such bar composed of strips secured together and having different coefficients of expansion, and a sheet of material that is a non-conductor of heat interposed between the said strips composing the bar, for the purpose set forth.

7. A lightning-arrester having a discharge electrode or plate connected to the main line and a thermostatic bar connected to ground,

said bar arranged opposite said discharge-electrode and a suitable distance therefrom and constituting a discharge-electrode, an arc-rupturing shield movable in between the said discharge-electrodes and out therefrom, and connections between the free and movable end of the said bar and the said shield, whereby upon the movement of the thermostatic bar under the influence of the heat generated therein by the passage of a current over it the said shield may be moved in between the discharge-electrodes and break the arc, and whereby upon the reactive or return movement of the bar the said shield may be withdrawn from between the discharge-electrodes, for the purpose set forth.

8. A lightning-arrester having in its circuit a thermostatic bar, a swinging arm suitably mounted and carrying an insulating-shield movable in and out between the discharge-electrodes of the arrester for breaking the arc formed therebetween, and a connection between the free end of the thermostatic bar and the said swinging arm, whereby the movements of the bar may be communicated to the shield, so as to control the same, substantially as and for the purpose set forth.

9. A lightning-arrester having suitably-spaced discharge electrodes or points and an arc-rupturing shield, such as 17, movable in and out between the electrodes for breaking the arc formed therebetween, a thermo-motive device, such as 11, included in the circuit of the arrester and made operative by the heat generated by the passage of a current thereover, and connections intermediate the device 11 and the shield 17, whereby the movements of the former may control the operations of the shield, substantially as and for the purpose set forth.

10. A lightning-arrester having a discharge electrode or plate 8, connected to the main line, and a thermostatic bar 11, connected to ground and disposed opposite the plate 8, at a suitable distance therefrom, and adapted to be bent outwardly under the influence of the heat produced therein upon the passage of a current, a plunger-arm, such as 29, provided with an arc-rupturing shield, such as 17, of insulating material, which is adapted to be moved into and out of the space between the plate 8 and the bar 11, a shaft 27, upon which the arm 29 is mounted, and a connecting-rod 24, intermediate the shaft 27 and the free end of the bar 11, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand and seal, this 12th day of August, 1889, in the presence of the two subscribing witnesses.

OSBORN P. LOOMIS. [L. S.]

Witnesses:

ANDREW J. PROVOST,

WILLIS FOWLER.