(No Model.) 2 Sheets—Sheet 1.

W. WURDACK.

LIGHTNING ARRESTER.

No. 500,454. Patented June 27, 1893.

FIG. 1

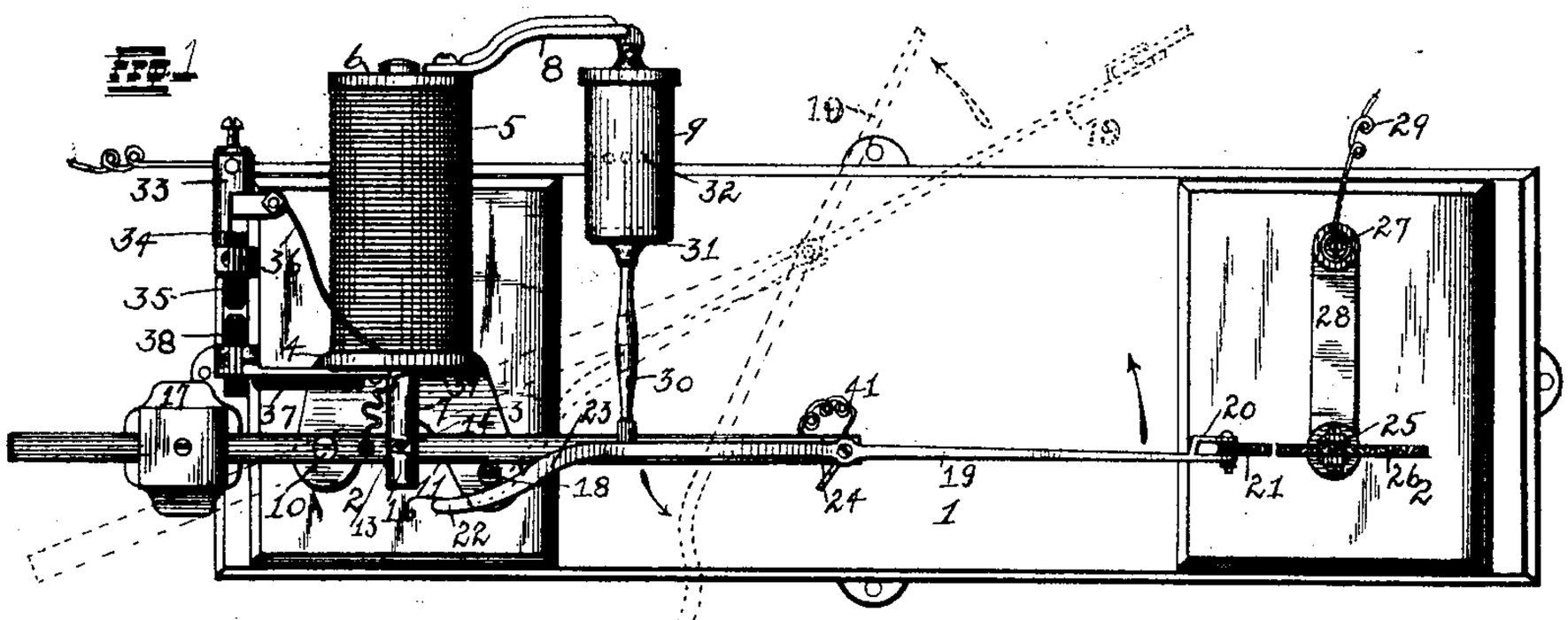


FIG. 2

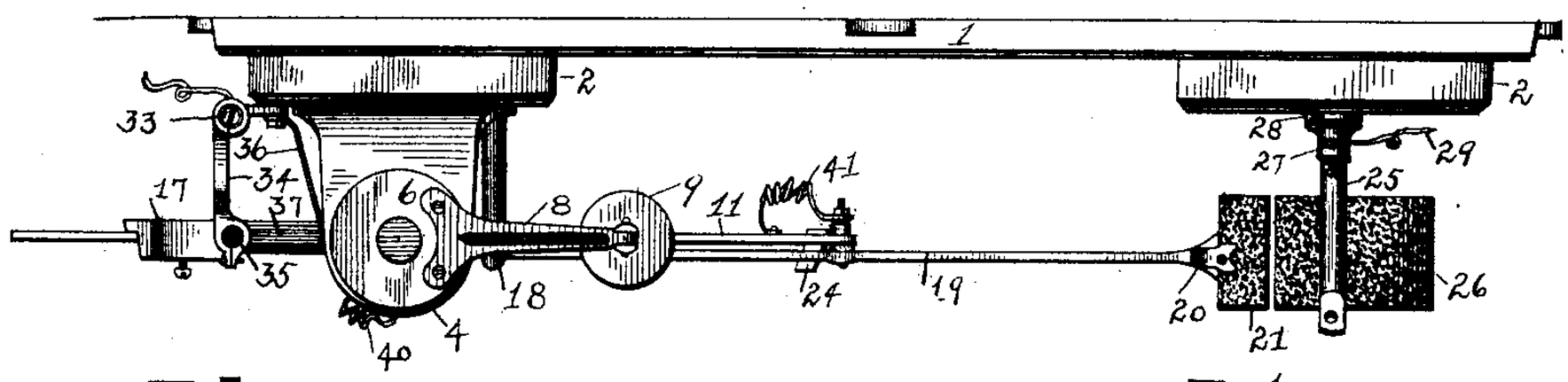


FIG. 3

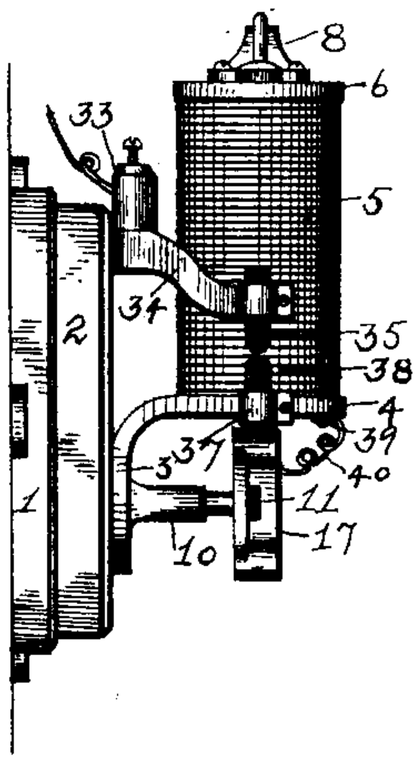


FIG. 5

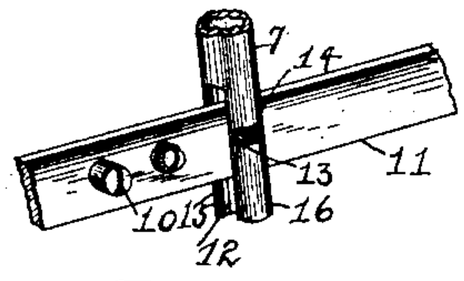


FIG. 4

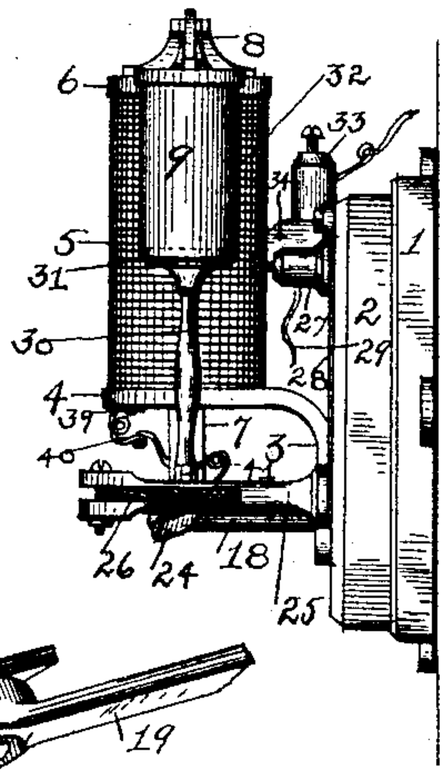
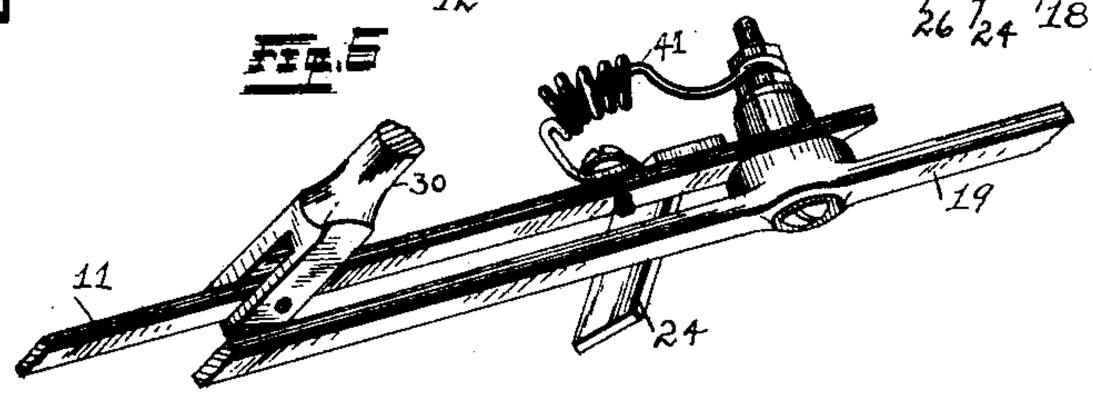


FIG. 6



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(No Model.) 2 Sheets—Sheet 2.

W. WURDACK.

LIGHTNING ARRESTER.

No. 500,454. Patented June 27, 1893.

FIG. 7

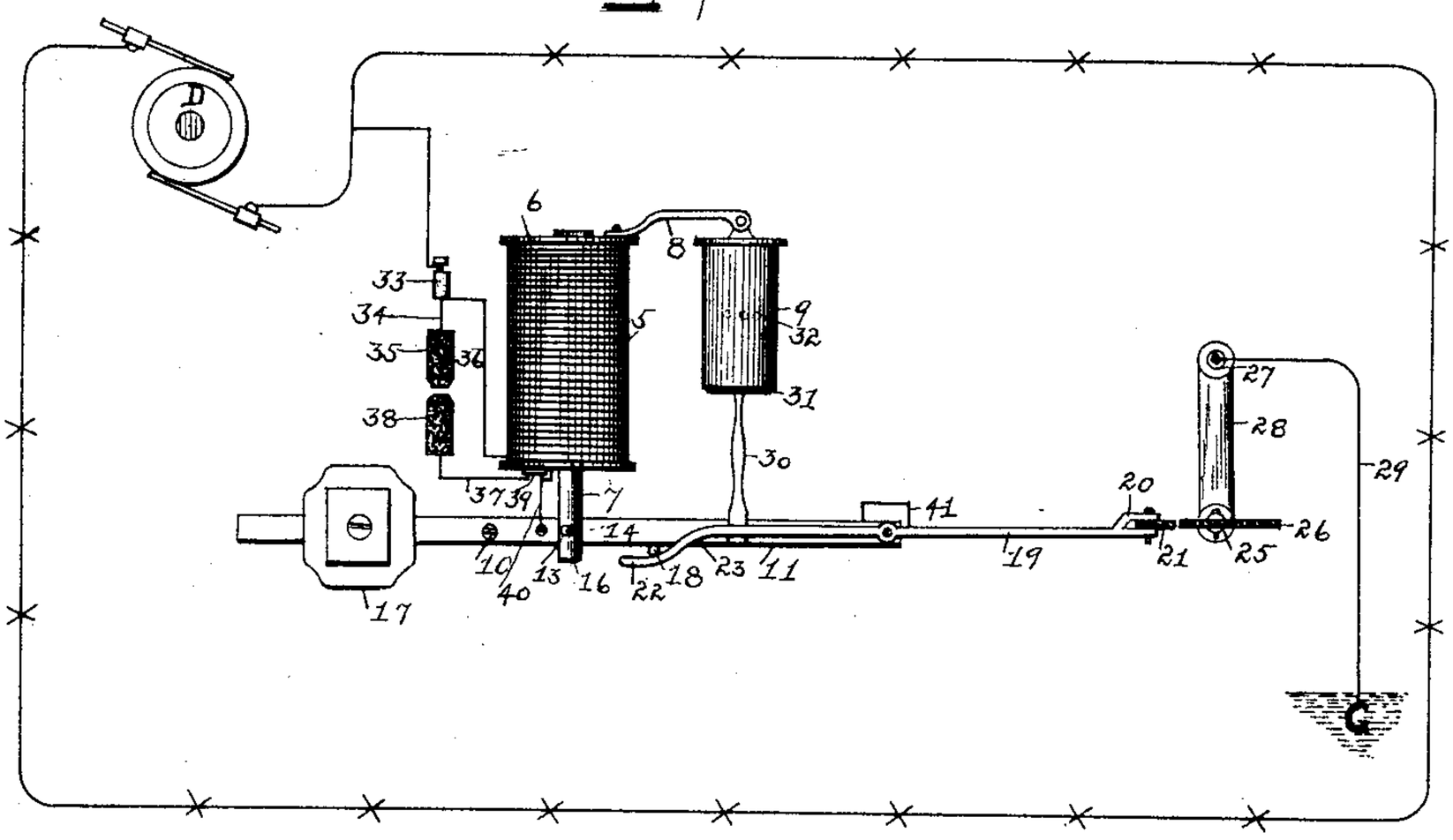
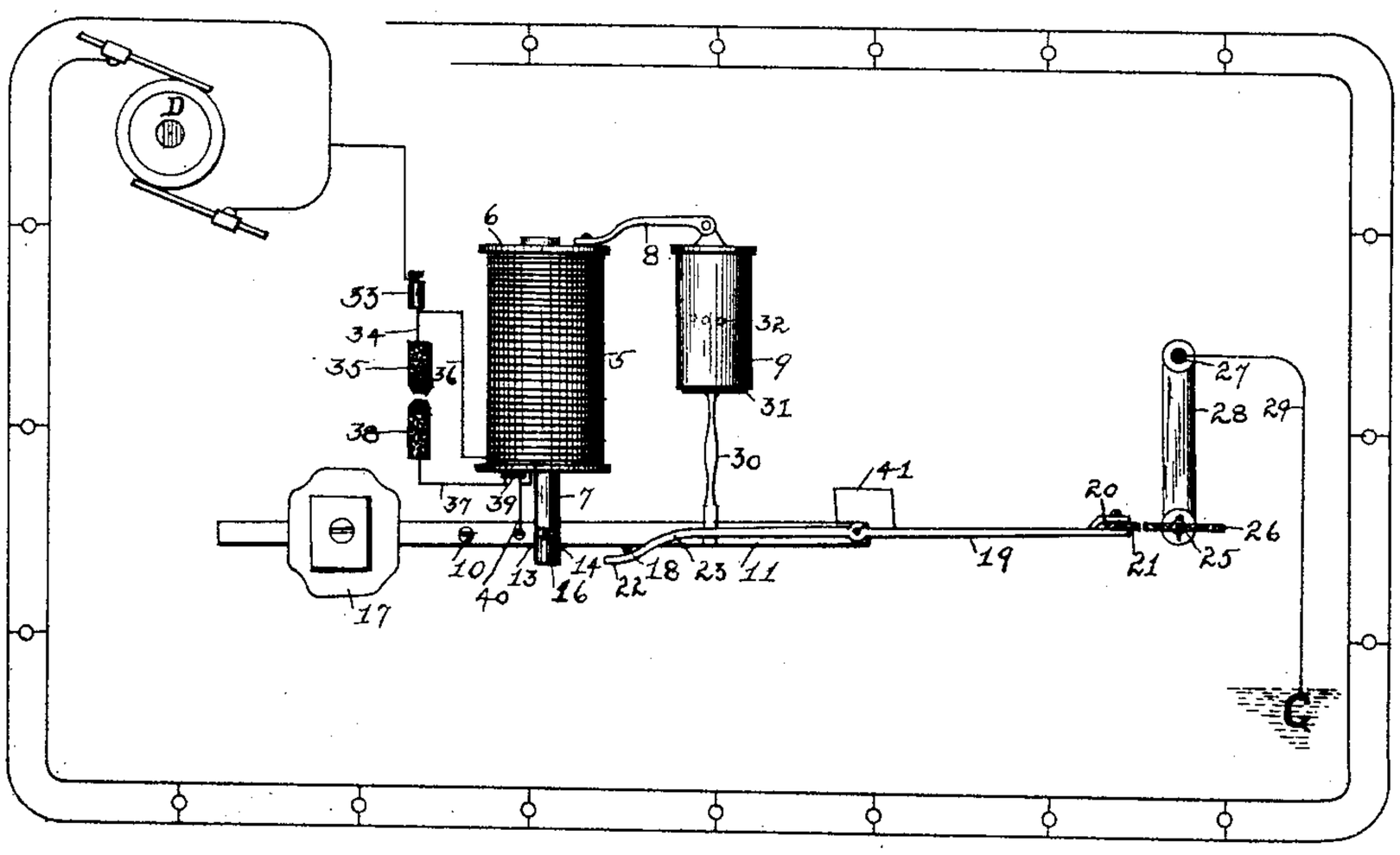


FIG. 8



Witnesses
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Inventor
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By his Attorneys: Higdon & Higdon & Longan

UNITED STATES PATENT OFFICE.

WILLIAM WURDACK, OF ST. LOUIS, MISSOURI, ASSIGNOR TO THE INTER STATE COMPLETE ELECTRIC CONSTRUCTION COMPANY, OF SAME PLACE.

LIGHTNING-ARRESTER.

SPECIFICATION forming part of Letters Patent No. 500,454, dated June 27, 1893.

Application filed September 12, 1892. Serial No. 445,681. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM WURDACK, of the city of St. Louis and State of Missouri, have invented certain new and useful Improvements in Lightning-Arresters, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to improvements in "lightning arresters," and consists in the novel arrangement and combination of parts as will be more fully hereinafter described and designated in the claims.

It relates particularly to that class of arresters in which arcs are used for the conducting of an over-charge to the ground.

It is a well-known fact that in electric installations, a provision for the care of lightning and other high potential charges must be made, and in the contruction of my improved arrester I have embodied features which are simple and certain in operation. In the use of this class of lightning arresters, especially in arc circuits, it is necessary to provide a means for causing the arc break in the arrester, to be a long and quick one, as the arc once formed by the overcharge will continue as long as the static discharge exists, unless some means is provided for breaking the same. In providing this arc breaker it is expedient and necessary to construct the same for automatic operation, in order that the arrester will always be in readiness for a repetition of the overcharge, which might follow in a few seconds. In covering deficiencies in former lightning arresters I have applied a construction which in operation insures a long and quick break in the arc and a sure instantaneous return of the arc breaker in order that the device may be in constant readiness for the next overcharge.

An important feature of my improved lightning arrester lies in its applicability to connection in circuits of any voltage. It may be connected in a circuit at any point by branch wires running to each arrester if more than one are made use of instead of the old method of connecting them in a circuit direct. They are also adapted to be placed in any part of the circuit to protect both lamps and generators and need not be necessarily located in the power-house.

Another strong feature in the construction is the long stroke of the arc breaking arm, attained by a comparatively short stroke of the armature, the increased movement of same being caused by the momentum of the arm gained by the quick upward movement of the armature and its lever to which the above stated arm is pivoted.

Referring to the drawings: Figure 1 is a front elevation of my complete invention. Fig. 2 is a top plan view of the same. Fig. 3 is an elevation of one end of my device. Fig. 4 is an elevation of the opposite end of the complete invention. Fig. 5 is a perspective view showing the connection between the armature and lever, with parts of both broken away. Fig. 6 is a perspective view of the pivotal connection between a lever and arc rupturing arm, with parts of both broken away. Fig. 7 is a diagrammatic view, in which the current is traced through the arrester connected to an arc circuit. Fig. 8 is a view similar to Fig. 7 except that the arrester is connected in an incandescent circuit.

Referring to the drawings: 1 indicates an oblong shaped frame preferably constructed of metal, and upon which the parts of my complete invention are secured.

2 indicates two square blocks of insulating material which are secured to the frame base 1 upon its outer flat surface near both ends and which are properly insulated from said frame 1.

3 indicates a casting which is secured to one of the blocks 2 and which has a projecting portion 4 at right angles with the plane of said block 2 and is adapted to support a magnet coil 5. The magnet 5 is wound upon an ordinary spool 6 and has a center-bore in which an armature 7 is operated.

Before proceeding further, I will state that the end of the construction at which the magnet is located may properly be termed the receiving end, while the opposite end is the discharge end, and this discrimination may aid in the clear understanding of my description.

Secured to the top of the spool 6 and ex-

tending at right angles therefrom toward the discharge end is a bracket 8 from the end of which depends a dash-pot 9, which is pivoted near the end of said brace 8 and which has an oscillating motion in a vertical plane with the balance of the construction.

The casting 3 has a standard 10 which extends at right angles from the insulation block 2 and which is of such a height that a lever 11 removably pivoted to its upper end, oscillates in a plane with the center of the spool 6 and at a short distance below the same for purposes hereinafter set forth.

The lower end of the armature 7 is provided with a transverse vertical slot 12 and with a circular opening 13 extending through the armature above its lower end and at right angles with the slot 12. The lever 11 fits into the slot 12 and a pin 14 in said lever 11 passes through the perforations 13 in each of the ears 15 and 16 formed by the slot 12. An adjustable weight block 17 is adapted to fit over the free end of the lever 11 which extends outwardly at the receiving end and is adjustable upon said lever 11 in order to act as a balance to facilitate the successful operation of the lever and parts connected therewith. The casting 3 is also provided with a pin 18 extending at right angles from the block 2 and which serves as a stop-pin or limit for the downward movement of the lever 11. The lever 11 extends toward the discharge end to a point about midway between the two ends of the arrester, and has pivoted near its end the center of an arm 19 one end of which, the same being the one adjacent the discharge end is provided with a suitable holder 20 in which a discharge plate 21 is removably secured, the opposite end of said arm 19 being provided with an off-set portion 22 forming a shoulder 23, said off-set 22 being adapted to engage the pin 18 to limit the upward movement of said arm 19. A gage 24 to limit the downward movement of said arm 19 is provided adjacent the pivotal connection between said arm 19 and the lever 11 and between said connection and the receiving end of the construction. It consists of a small arm projecting at right angles from the side of the lever and under the same.

Upon the insulation block 2 secured at the discharge end of the arrester and in alignment with the normal plane of the arm 19 is an upright post 25 provided with a longitudinal slot for the reception and securance of a discharge plate 26 which is in alignment with the discharge plate 21 held by the end of the arm 19 and which is held a certain distance from said plate 21 in order to form an electrical arc, under certain conditions hereinafter named. Said plate 26 is adjustably secured in said post 25 in order that it may be fed toward the brush 21 when a portion of its face has been burned off by an electrical discharge. A binding-post 27 is also secured upon said insulation block 2 and has a proper electrical connector 28 preferably consisting of a strip of copper, connecting it with the post 25. From said binding-post 27 an electrical conductor 29 is secured and passes to a suitable ground connection for purposes well-known.

Midway between the pivotal connection of the arm 19 to the lever 11 and the connection of the armature 7 to said lever 11 is pivoted the lower end of a valve rod 30 having on its upper end a valve 31 operative in a dash-pot cylinder 9. The dash-pot 9 is provided in its periphery and intermediate of its length with a number of perforations such as 32, for purposes hereinafter set forth.

Secured upon the upper corner of the insulation block 2 at the extreme outer end of same is a binding-post 33 which has a downwardly depending projection 34 forming a holder for a carbon point 35 and which also has a conductor 36 leading direct to the magnet coil.

Extending at right-angles from the armature 7 and secured to the base plate 4 is a bracket arm 37 which has its end constructed to provide a holder for a carbon point 38 which is in vertical alignment with the carbon point 35, and the points of which are in close proximity to each other.

The inside end of the magnet wire is secured to a plate 39 upon the under side of the base casting 4 and a conductor 40 leads therefrom to the lever 11.

A conductor 41 is made use of to connect the lever 11 with the arm 19 in order to guarantee a clean connection for the passage of the current.

The magnet 5 is preferably direct wound and therefore, connected as it is in the circuit causes the arc formed between the carbon points 35 and 38 to act as a shunt and necessitates the arc to form when the overflow of current comes through the wire 42 from the dynamo or line wire. A certain amount of the current necessarily passes into the magnet, but before the entire charge will pass into the same and burn out the coil, a major portion of the current will pass into the carbon point 35 and cause an arc to form between its terminal and the terminal of the carbon point 38. The energizing of the magnet 5 draws up the armature 7 and the lever 11 pivoted thereto, into a position as shown by the dotted lines in Fig. 1, while the arm 19 assumes a plane still more vertical than that which the lever 11 assumes owing to its pivotal connection therewith and the momentum imparted by the quick upward movement of said lever 11. The limit of this movement is regulated by the gage 24 which prevents the arm 19 from tilting forward out of its plane. To prevent the lever 11 from going up too quickly and jarring the parts I have provided the dash-pot 9 with its valve 31 connected by a rod 30 to said lever 11.

The function of the holes 32 is to insure the quick fall of the lever 11 and parts connected therewith (after passing said holes)

when the arc is broken, by allowing the ingress of air into the dash-pot cylinder 9, above the valve and the operation of which is well known.

As before stated, this lightning arrester is applicable to connection in a circuit of any voltage, and either direct or alternating. In use, in an incandescent circuit it would be necessary to connect an arrester to each of the lines while in an arc circuit, only connection with one wire would be necessary. We will now trace the current in its passage to the ground. As is well-known, an overcharge in an electrical current seeks an outlet and connection and this outlet is preferably found in the ground or something directly connected therewith, and this fact forms the primary basis upon which all such constructions are made. The normal current would never cause an arc to form at the carbons 21,—26, but the instant that the overcharge enters the wire, the arc is formed on account of the ground connection of the carbon 26 and to which it seeks an outlet. The current entering at the binding-post 33 passes into the magnet coil 5, and the surplus of the current causes an arc to form at the carbons 35—38 before the same would pass into the magnet 5 and burn out the coil. The electrical connection between the magnet 5 and the lever 11 and the carbon 38 and the lever 11 guarantees the certain passage of the current into the lever 11 and its parts connected therewith and to the arc carbon 21. Simultaneous with the formation of the arc at the carbons 21—26, the energizing of the magnet 5 causes it to develop a well-known attractive power which draws up the armature 7 and the lever 11 pivoted thereto. This action takes place very swiftly and the quick motion of the lever 11 gives to the arm 19 an increased momentum which causes it to rise out of the plane of the lever 11 and assume a position substantially vertical, thus giving a longer sweep to the arc breaking arm 19 for the purpose of breaking the arc formed at 21—26. The advantages of the length of this stroke will readily be seen, as it is a well known fact that an arc once formed between two carbons under the conditions which operate my device, will pull out to a considerable length when one of the poles of the arc is moved. From practical experiments I found that the length of this break varies from ten to fifteen inches, the length of same being fully ten inches if the arm 19 were to remain in a plane similar to that of the lever 11. The instant that the overcharge in the current is discharged into the ground through the arc formed at the carbons 21—26, the other parts are necessarily demagnetized and the arc formed at the carbons 35—38 broken and the coil 5 is inert. When the magnet 5 becomes demagnetized the attraction to the armature 7 is broken and the same drops downwardly in a vertical plane and the parts assume their normal position, the downward movement of the lever 11 and the upward movement of the arm 19 being controlled by their respective contacts with the pin 18.

The person in charge of the plant can readily see if any portion of the carbon 26 has been burned off by the formation of the arc and if this is the case he can readily feed the carbon 26 toward the carbon 21 by adjusting the carbon-holder in the post 25.

In the drawings I have shown diagrammatic views which set forth the connections of my improved lightning arrester both in an incandescent and an arc circuit and by referring to these a clear understanding may be arrived at, as regards the passage of the current through the various parts.

I do not wish to confine myself to the construction and design of the base frame herein shown and described, as in the manufacture of the article it may be found desirable to construct it of a different design and material.

The use of the dash-pot and its connection with the lever 11 is well known as its function is to prevent the jarring of parts and is also adapted to facilitate the operation of the device when a discharge takes place.

Having fully described my invention, what I claim is—

1. An improved lightning arrester having a lever carrying an arc-rupturing arm pivoted thereon, said lever being adapted to be elevated to swing said arm out of its normal position; substantially as set forth.

2. As an improvement in lightning arresters, the combination, with a solenoid, and a shunt therefor, of a lever pivotally connected with the core of the solenoid, an adjustable weight carried upon one end of the lever, and an arc rupturing arm pivoted on the opposite end of the latter; substantially as set forth.

3. An improved lightning arrester having a solenoid, a core operative therein, a lever pivoted to the lower end of said core, an arc rupturing arm pivoted to said lever and said arc rupturing arm adapted to assume a plane higher than that of the lever, by momentum imparted by said lever, substantially as set forth.

4. An improved lightning-arrester constructed with a frame-base 1, insulation blocks 2 secured thereon, a casting 3 secured to one of said insulation blocks 2, said casting 3 having a projection 4 at right angles with same, a solenoid mounted upon said casting 4, a core 7 vertically operative in said solenoid 5, a horizontally projecting casting 8, secured to the top 6 of said solenoid 5, a dash-pot 9 dependingly pivoted to the end of said arm 8, a valve 31 a valve rod depending therefrom, said valve rod 30 pivoted at its lower end to a lever 11, and an arc rupturing arm 19 pivoted to said lever 11, substantially as set forth.

5. An improved lightning-arrester having a casting 33 mounted upon an insulating block 2, a solenoid 5, a conductor 36 leading from

said binding-post casting 33 to said solenoid 5, a carbon holder 34, a projecting arm 37 secured to a casting 4, its outer end forming a carbon holder, carbon points 35 and 38 secured in said carbon holders 34 and 37, a lever 11 pivotally mounted upon a post 10 and pivotally connected with the core of said solenoid, and a sliding adjustable weight block 17 upon the outer end of said lever 11, substantially as set forth.

6. An improved lightning-arrester constructed with a lever 11, an arc rupturing arm 19 pivoted at its center to the outer end of said lever 11, a lug 24 upon the under side of said lever 11, to limit the downward movement of said arm 19, the inner end of said arm 19 having a set-off portion 22 adapted to engage the under side of a post 18, to limit the upward movement of said arm, the outer end of said arm 19 provided with a discharge plate holder 20, a discharge plate 21 secured in said plate holder 20, an upright post 25 mounted upon an insulation block 2, its upper end providing a plate holder for a discharge plate 26, and a copper plate 28 connected with a binding post 27 for ground connection, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM WURDACK.

Witnesses:
HERBERT S. ROBINSON,
ALFRED A. EICKS.