W. A. BINION.

LIGHTNING ARRESTER.

APPLICATION FILED FEB. 26, 1909.

947,692. Patented Jan. 25, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

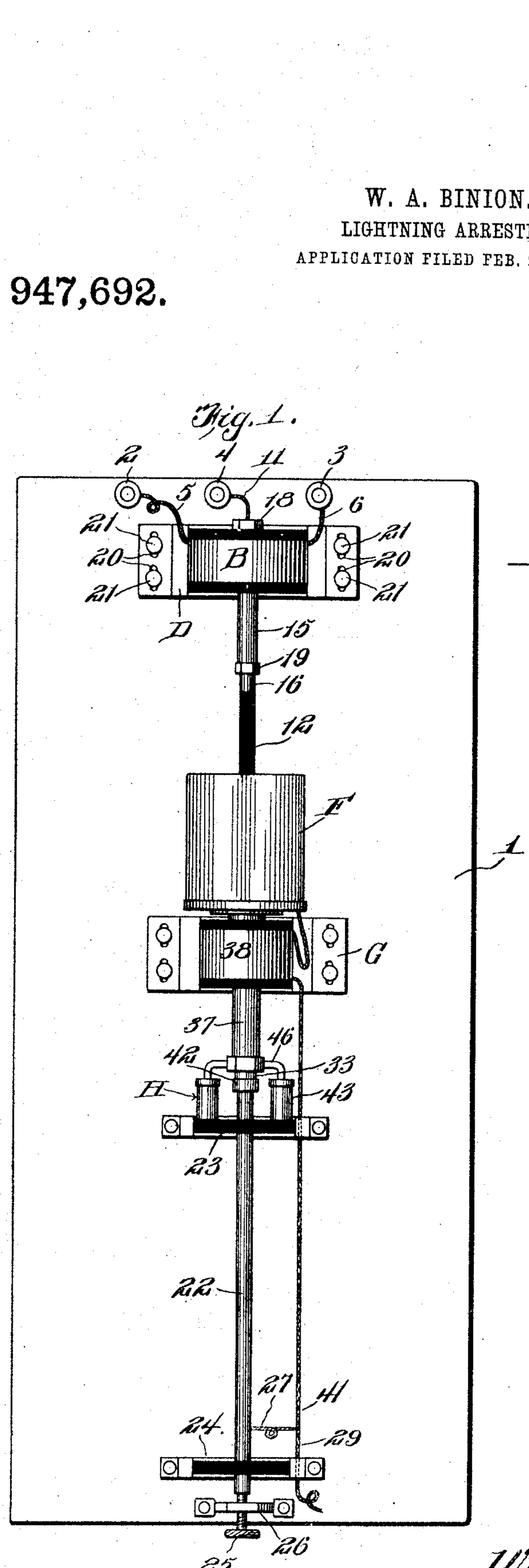
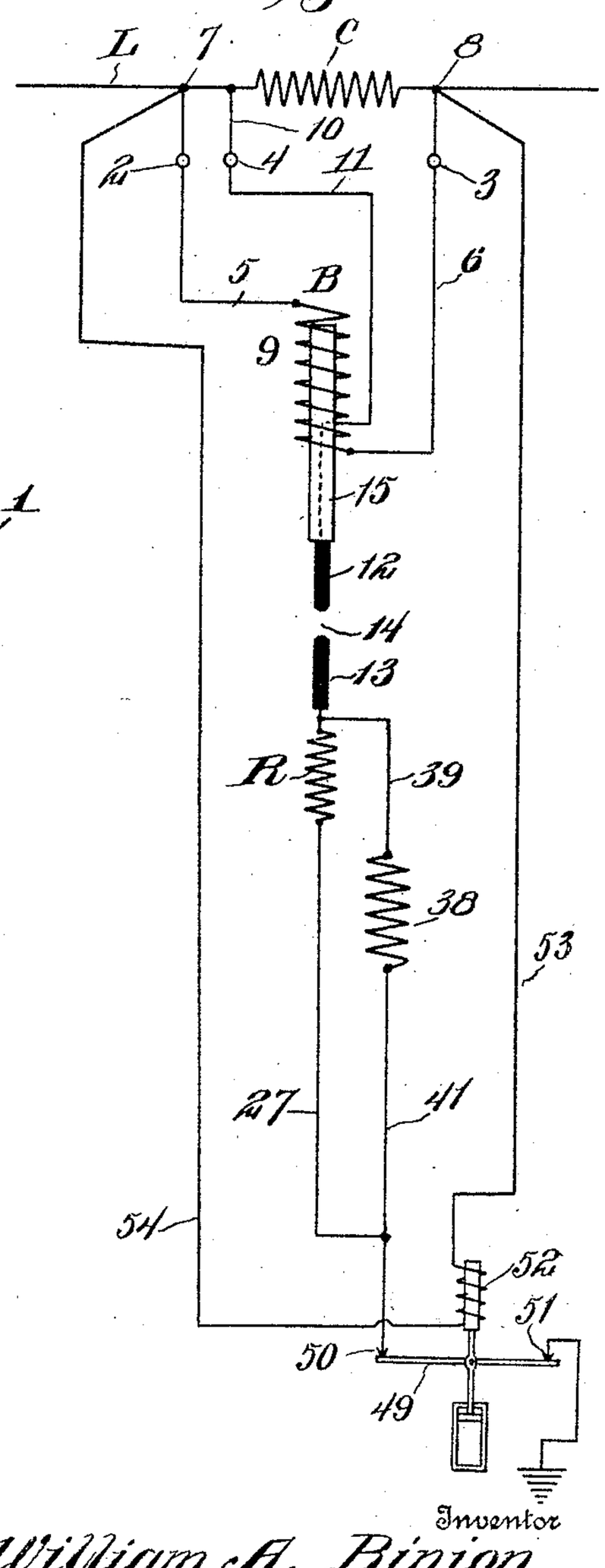


Fig. 5.



Witnesses

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2 SHEETS—SHEET 2.

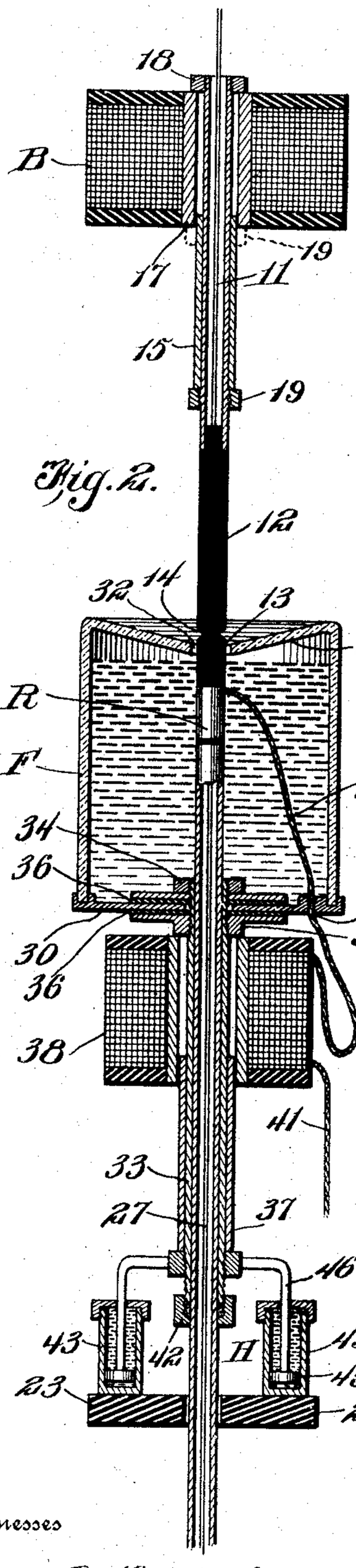

Fig. 2.

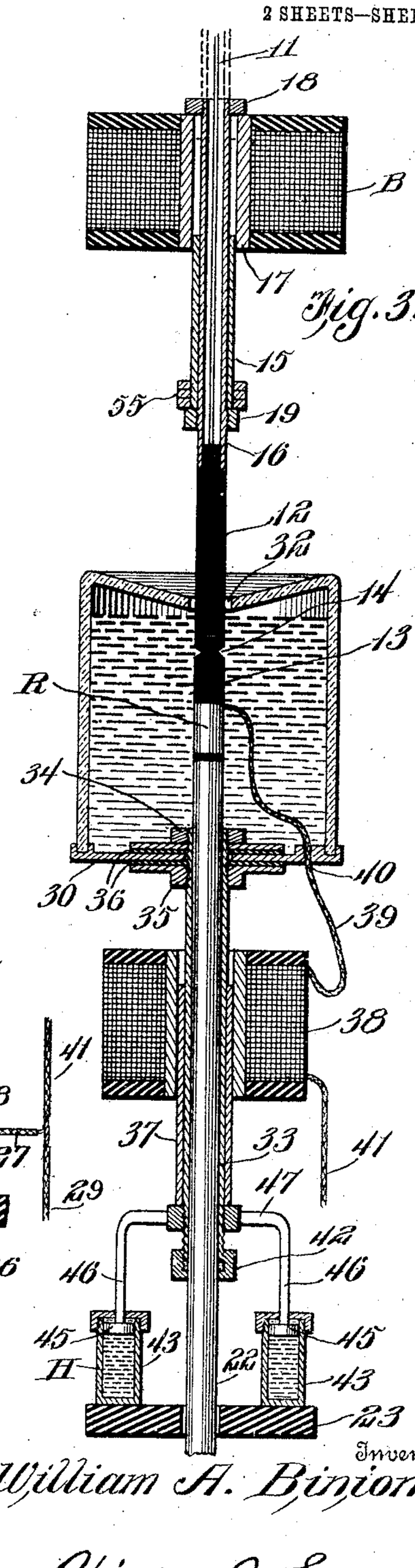

Fig. 3.

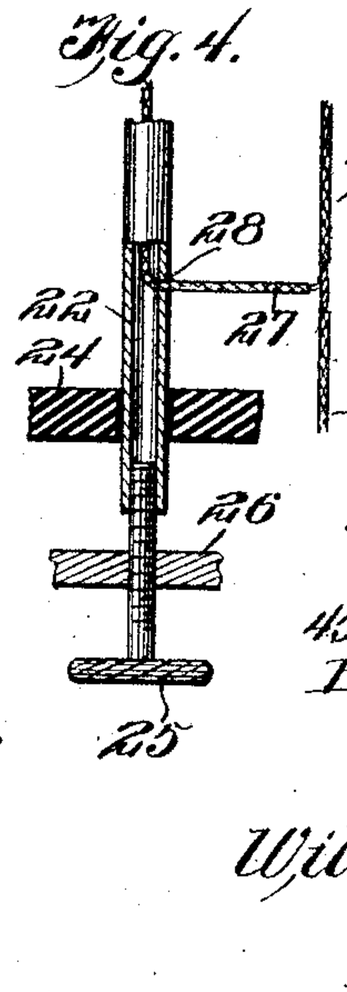

Fig. 4.

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LIGHTNING-ARRESTER.

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Application filed February 26, 1909. Serial No. 480,101.

To all whom it may concern:

Be it known that I, WILLIAM A. BINION, a citizen of the United States, residing at Lisbon, in the county of St. Lawrence and State of New York, have invented new and useful Improvements in Lightning-Arresters, of which the following is a specification.

This invention relates to lightning arresters designed for use in connection with electrical transmission systems of the high tension type, whereby the apparatus at the power station and translating devices connected with the system are effectively protected against high potential charges such as result from lightning.

The invention has for one of its objects to improve and simplify the construction and operation of apparatus of this character so as to be comparatively simple and inexpensive to manufacture, reliable and efficient in use, and adapted for use in transmission systems of various voltage.

Another object of the invention is the provision of a lightning arrester including a path for the charge to pass off to ground, there being an air gap in such path and combined therewith is an oil-containing casing which is moved into operative relation with the gap as to effectively extinguish the arc.

A further object is the employment of a dampening or retarding device for preventing the oil-containing case restoring to normal position with a destructive shock.

An additional object is the employment of separate electro-magnets operating, respectively, to separate the electrodes or carbons of the air gap, and to move the oil-containing case into operative relation with the air gap incident to the passage of a charge through the arrester, the first electro-magnet being connected with the transmission line and the other being included in the path through which the charge passes to ground.

With these objects in view and others, as will appear as the description proceeds, the invention comprises the various novel features of construction and arrangement of parts which will be more fully described hereinafter and set forth with particularity in the claims appended hereto.

In the accompanying drawings, which illustrate one embodiment of the invention, Figure 1 is a front view of the lightning arrester. Figs. 2 and 3 are enlarged vertical sectional views showing the operating parts in extreme positions. Fig. 4 is a detail sectional view for showing the adjusting means for varying the size of the air gap. Fig. 5 is a diagramatic view of the circuit connections.

Similar reference characters are employed to designate corresponding parts throughout the views.

Referring to the drawings, 1 designates a supporting slab of marble, slate, fiber, or other insulating material, on which the various parts of the apparatus are mounted. At the top of the panel 1 are binding posts 2, 3 and 4, for connecting the arrester with the transmission line. The binding posts 2 and 3 are connected by wires 5 and 6 with an electro-magnet B which controls the separation of the air gap electrodes, and, as shown in Fig. 5, the binding posts 2 and 3 are connected with the line L at the points 7 and 8. Between the points 7 and 8 is a choke coil C that is disposed in shunt relation with the winding 9 of the electro-magnet B. The terminal 4 is connected by a wire 10 with the line L between the choke coil C and point 7, and this post is also connected by wire 11 with the charge-conducting path of the arrester.

A pair of carbon or equivalent electrodes 12 and 13 are arranged in superimposed relation so that between their inner extremities an air gap will be provided. The upper carbon is suitably connected with an iron core 15 for the electro-magnet B, so that the electrodes will be separated when current passes through the winding of the electro-magnet. The core of the electro-magnet is so arranged as to drop under the attraction of gravity when the electro-magnet is unenergized. The core 15 is shrunk or otherwise secured to a brass tube 16 extending downwardly through the spool 17 of the electro-magnet, and on the upper end of the tube 16 is a nut 18 which rests on the top of the spool to thereby limit the downward movement of the upper electrode and core. On the lower end of the sleeve 16 is a nut 19 against which the bottom end of the core 15 bears. The upper carbon fits into or is detachably connected in any suitable manner with the tube 16 so that electrodes of different length or sizes can be employed for adapting the apparatus for use in systems of different voltages. The electro-magnet B is mounted upon a bracket D of suitable insulating material, which bracket is secured to the panel 1, there being slots 20 in the

bracket through which fastenings 21 extend for securing the bracket to the panel in a manner to provide vertical adjustment of the bracket. The wire 11 connected with the middle binding post 4 passes downwardly through the tube 16, as shown in Figs. 2 and 3, and is electrically connected with the upper electrode 12.

The lower electrode 13 is connected with ground to conduct off the lightning charge. This lower electrode is supported on the upper end of the vertical brass tube 22 which is supported in upright position by passing through brackets 23 and 24 of insulating material and secured to the panel 1. The lower end of the tube 22 is supported on an adjusting screw 25 threaded in a bracket 26 arranged on the panel 1 below the bracket 24. By adjusting this screw, the rod 22 that supports the lower electrode is raised or lowered so as to vary the air gap between the electrodes. Attached to the upper end of the tube and insulated therefrom is a suitable resistance R that is electrically connected with the lower electrode 13, and interposed between the bottom of the latter and the top end of the tube or hollow rod 22. Connected with the lower end of the resistance R is a wire 27 which passes downwardly through the brass rod 22 and out through an opening 28 therein, Fig. 4, to connect with a grounded wire 29. A path is thus provided for the discharge to ground through the electrode and air gap.

The arc between the electrodes, due to the passage of a lightning charge, is adapted to be broken in a body of oil. For this purpose, an oil-containing casing F is arranged in such a manner as to be moved into coöperative relation with the air gap when a charge passes through the arrester. The casing is normally disposed below the air gap and the supporting rod 22 for the lower electrode passes upwardly through the center of the bottom 30 of the casing F. The casing is a glass cylindrical structure having a conical reëntrant top 31 that is provided with an opening 32 through which the lower electrode protrudes. Surrounding the rod 22 and disposed below the oil casing F is a short brass tube 33 that has its upper end exteriorly threaded and disposed within the opening in the bottom 30 of the oil casing. Threaded on the rod 33 are internal and external nuts 34 and 35 for clamping the sleeve or tube 33 to the casing F, the said tube being slidably mounted on the rod 22. Packing disks 36 are clamped against the inner and outer surfaces of the bottom 30 by the nuts 34 and 35 so that a fluid-tight joint will be provided at the opening through which the rod 22 extends. Securely fastened to the outer sleeve 33 is a tubular iron core 37 forming part of the electro-magnet or solenoid 38. This electro-magnet is arranged below the casing F and is supported on a bracket G which is adjustably secured to the panel 1 like the upper bracket D. The electro-magnet forms a rest for the oil-containing casing F when the latter is in normal or lowered position and through the hollow of the electro-magnet the tubes 22 and 33 extend. The winding of the electro-magnet 38 is arranged in a shunt path between ground and the lower electrode. This shunt path consists of a wire 39 connected with the upper end of the resistance R which is, at all times, within the casing F, and the wire passes out through an oil-tight opening 40 in the bottom of the casing and is connected with the winding of the electro-magnet 38, the other terminal of the electro-magnet winding being connected by a wire 41 with the grounded wire 29. The resistance of the windings 38 is suitably proportioned with respect to the resistance R so that a current of suitable value, incident to a discharge, will pass through the electro-magnet 38 to raise the core 37 thereof and the oil casing carried thereby. On the lower end of the tube 33 is a packing box 42 which prevents lubricant from creeping down between the tubes 32 and 33 and leaking out.

In order to prevent the oil-containing casing from dropping to normal position with destructive shocks or jars, a dampening or retarding device is employed. This comprises one or more dash pots H of the hydraulic or air type, as desired, and consists of plunger cylinders 43 supported on a bracket 23 and disposed at opposite sides of the hollow rod 22 and in which are arranged plungers 45, the rods 46 of which extend upwardly out of the cylinders and are connected with a yoke piece 47 screwed on the lower end of a brass tube 43 at a point above the packing box 42. By means of these dash pots, the oil-containing receptacle 6 and attached parts gradually settle by gravity to their lowermost position.

In the ground wire 29 is an automatically-actuated switch which consists of a metal or other conducting bar 49 that is adapted to engage contacts 50 and 51 for maintaining the path closed to ground as long as the transmission system is in operation. This ground switch, which may be mounted on the panel on the lightning arrester, is closed by an electro-magnet 52 operating against gravity, the electro-magnet being connected by wires 53 and 54 with the transmission line at opposite terminals of the choke coil C. The closing movement of the switch bar 49 is retarded by a dash pot so that the ground switch will not close until after the top electrode 12 is raised.

In practice, the parts are in the position shown in Figs. 1 and 2, when no current is passing in the transmission line, and as soon

as the transmission line becomes energized, the electro-magnet B raises the upper electrode 12 until the stop or nut 19 strikes the bottom of the electro-magnet spool, as indicated by dotted lines in Fig. 2, thereby creating an air gap of several inches. At the same time the electro-magnet of the ground switch will be energized so as to close the ground wire after the electrodes 12 and 13 have been separated. By the separation of the electrodes, the normal current will be prevented from passing off to ground so that the electro-magnet 38 will be deënergized and the oil receptacle F in lowered position. The air gap between the separated electrodes can be adjusted not only by means of the screw 25, but also by placing washers or rings 55 on the nut 19, as shown in Fig. 3 so as to shorten the upward movement of the upper electrode. As soon as a lightning discharge occurs, the upper electrode 12 will move downwardly toward the relatively-fixed electrode 13 and admit of the lightning passing off to ground through the two paths provided by the resistance R and electro-magnet 38. This may be due to the fact that the abnormal charge passing off through wire 11 deprives wire 5 of current, thus allowing electrode 12 to fall against electrode 13. The electro-magnet is thus energized so as to raise the oil receptacle at a point to cause the tips of the electrodes 12 and 13 to be submerged to thereby cause the oil to extinguish the arc between the electrodes as the upper one is raised by the electro-magnet as soon as the charge passes off. After the discharge has passed to ground, the electro-magnet 38 becomes deënergized and the vessel F gradually settles to normal position.

From the foregoing description, taken in connection with the accompanying drawings, the advantages of the construction and of the method of operation will be readily apparent to those skilled in the art to which the invention appertains, and while I have described the principle of operation of the invention, together with the apparatus which I now consider to be the best embodiment thereof, I desire to have it understood that the apparatus shown is merely illustrative, and that such changes may be made when desired as are within the scope of the claims appended hereto.

Having thus described the invention, what I claim is:—

1. A lightning arrester comprising relatively-movable electrodes, an electro-magnet normally connected with the main of the transmission system for holding the electrodes separated, and means for automatically submerging the electrodes in a body of insulating liquid upon a lightning discharge through the arrester.

2. A lightning arrester comprising relatively-movable electrodes providing an air gap, and electro-magnetically actuated means responsive to an electric discharge through the arrester for submerging the electrodes in a body of insulating liquid to break the arc between the electrodes.

3. A lightning arrester comprising relatively-movable electrodes forming an air gap, an electro-magnet for holding the electrodes separated, a vessel containing oil for submerging the electrodes at the air gap to break the arc incident to a discharge through the arrester, and an electro-magnet responsive to the discharge current for moving said vessel into operative position.

4. A lightning arrester comprising spaced electrodes forming a path for a lightning discharge, a vessel containing oil, an electro-magnet responsive to a discharge current for raising the vessel against the action of gravity to submerge the electrodes at their spaced ends, and means for retarding the return movement of the vessel as the latter drops by gravity.

5. A lightning arrester comprising electrodes constituting an air gap, means for connecting one of the electrodes to a transmission line, means for grounding the other electrode including a shunt, an electro-magnet in the shunt, a receptacle containing oil and movable by the electro-magnet to a position for extinguishing the arc when a discharge occurs through the arrester, and a dash pot connected with the vessel for retarding the return movement thereof.

6. A lightning arrester comprising an electro-magnet, means for connecting the same in series with a transmission line, a choke coil arranged in shunt relation to the electro-magnet, electrodes providing an air gap and adapted to be separated by the electro-magnet, means for connecting one of the electrodes with the transmission line, means for grounding the second electrode and including a resistance, a shunt bridging the resistance, an electro-magnet included in the shunt, and an oil-containing vessel moved by the shunt to a position for breaking the arc between the electrodes.

7. A lightning arrester comprising an electro-magnet, means for connecting the same in series with a transmission line, a choke coil arranged in shunt relation to the electro-magnet, electrodes providing an air gap and adapted to be separated by the electro-magnet, means for connecting one of the electrodes with the transmission line, means for grounding the second electrode and including a resistance, a shunt bridging the resistance, an electro-magnet included in the shunt, an oil-containing vessel moved by the shunt to a position for breaking the arc between the electrodes, and a retarding device connected with the said receptacle whereby the latter returns gradually to normal position.

8. The combination of a lightning arrester comprising a support, electro-magnets mounted thereon in spaced relation, electrodes disposed between the electro-magnets, means connecting one of the electrodes with the core of the upper electro-magnet, means for connecting the upper electrode and the upper electro-magnet with a transmission line, a member connected with the core of the lower electro-magnet, a vessel supported on the said member and containing oil in which the electrodes are submerged when the vessel is raised by the lower electro-magnet, means on the support for adjusting the member to vary the air gap between the electrodes, a retarding device connected with the member and mounted on the panel to cause the vessel to return to normal position gradually, and a grounded path connected with the lower electrode and in which the winding of the lower electrode is connected.

9. The combination of a lightning arrester including relatively-movable electrodes, electrical means for holding the electrodes normally separated, a transmission line connected with the said means, a ground wire connected with one of the electrodes, a switch for closing the ground wire, electrical means connected with the transmission line and arranged to close the ground switch after the separation of the electrodes by the first-mentioned electrical means.

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

WILLIAM A. BINION.

Witnesses:

HARVEY LOCKERBY,

ROY C. BINION.