L. C. NICHOLSON.

INSULATOR PROTECTING APPARATUS.

APPLICATION FILED SEPT. 10, 1909.

966,583.

Patented Aug. 9, 1910.

Fig:1

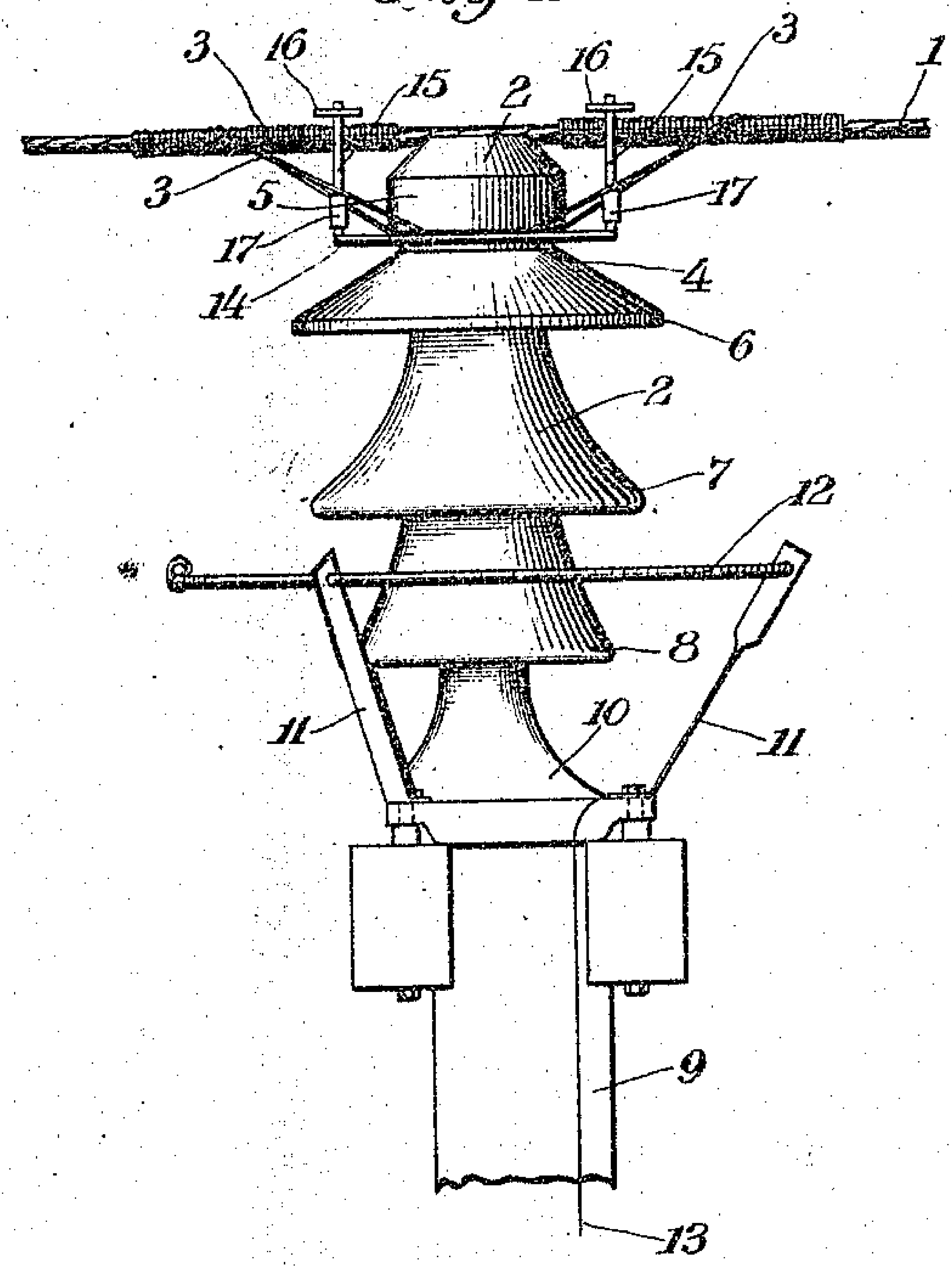


Fig:2

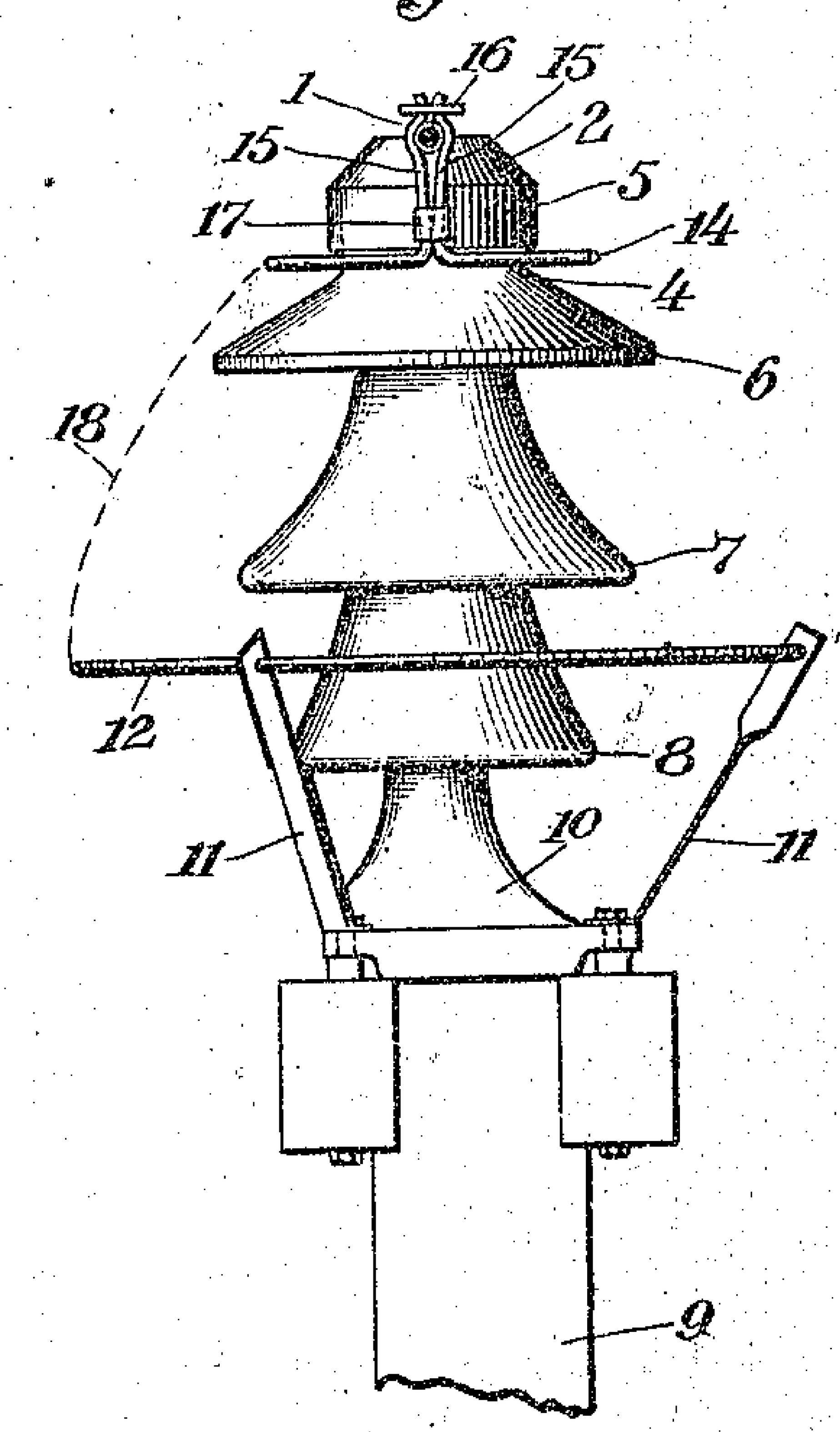
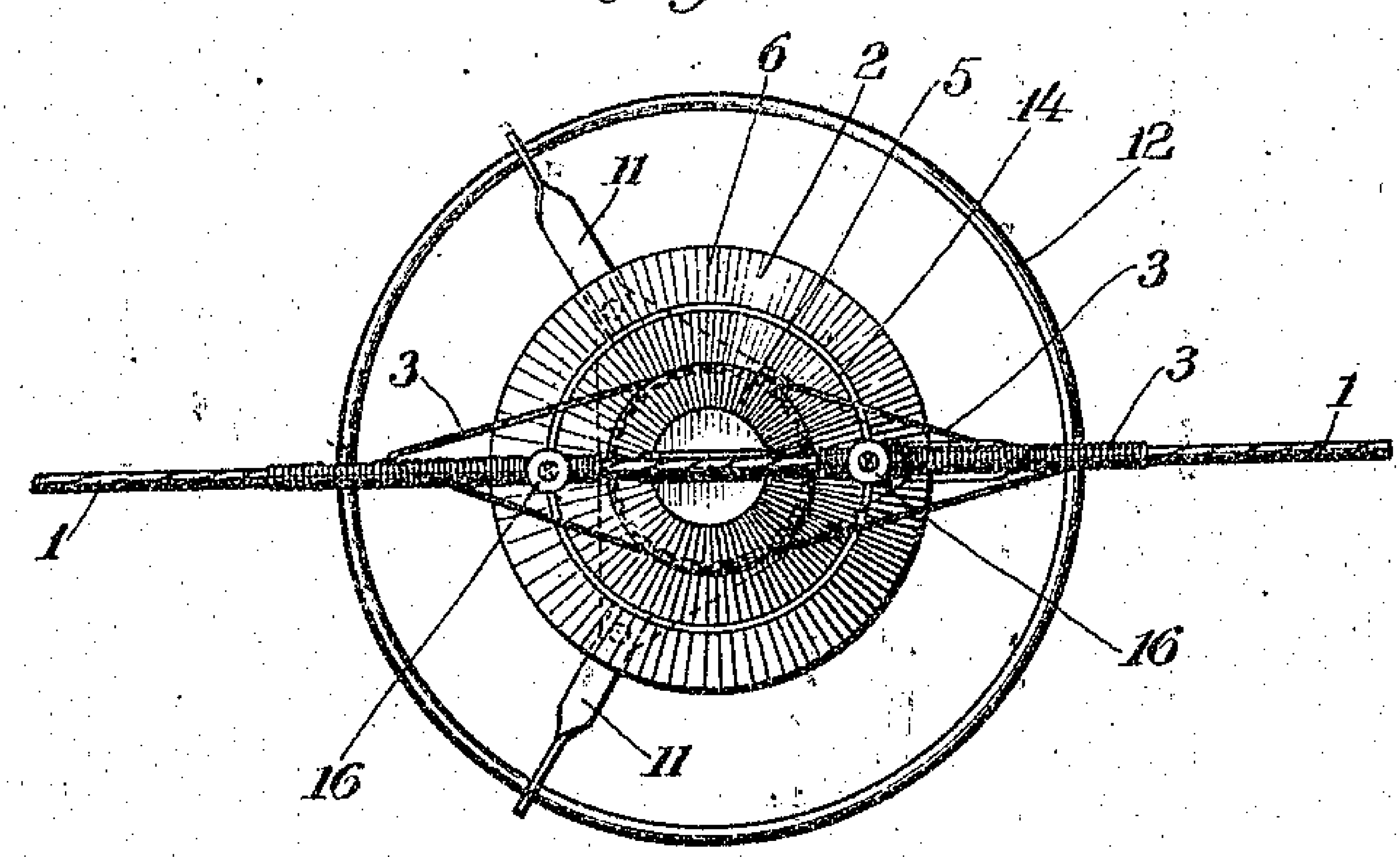


Fig:3



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UNITED STATES PATENT OFFICE.

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INSULATOR-PROTECTING APPARATUS.

966,583. Specification of Letters Patent. Patented Aug. 9, 1910.

Application filed September 10, 1909. Serial No. 517,159.

To all whom it may concern:

Be it known that I, LLOYD C. NICHOLSON, a citizen of the United States, and a resident of Buffalo, county of Erie, State of New York, have invented certain new and useful Improvements in Insulator-Protecting Apparatus, of which the following is a specification.

My invention relates to improvements in protecting apparatus and is more especially designed to prevent injury to insulators used on high potential lines.

In ordinary high potential electric systems when the voltage on the line conductor rises abnormally due to lightning or other causes a flash-over current is apt to take place over the surface of the insulator to the pin beneath it and thence to the earth. If this discharge current is of sufficient value to overcome the dielectric strength of the medium and break it down an arc will follow, which arc is due to the power current or voltage of the line. That is, the actual discharge due to the high voltage of the lightning is of very short duration but the heavy discharge which follows is due to the flow of the power current which follows the flash-over when the dielectric strength of the air has been broken down. The insulators used in such high potential electric systems are usually of glass or porcelain. Therefore, when such power arcs occur over the skirts of the insulator the heat is apt to injure or wholly destroy it. To prevent such destruction I place an electrode connected with the earth so that when a flash-over and power arc occur thereon the whole arc is diverted away from the insulator to the electrode so that it will not injure the insulator. In such high potential insulators there is also liability of the insulator puncturing directly from the tie-wire to the pin carrying the insulator, or else only one or two of the skirts of the insulator may be punctured, the discharge taking place over the surface of the remaining skirts.

For obviating certain of the above difficulties I have provided an arrangement which is clearly shown and described in my application for United States Letters Patent filed January 25, 1909, Serial No. 473,980.

One object of the present invention is to provide improvements in the arrangements shown and described in said prior application and especially to provide means for thoroughly protecting the top and neck of the insulator from such power discharges.

Further objects, features and advantages will more clearly appear from the detailed description given below taken in connection with the accompanying drawing which forms a part of this specification.

In the drawing Figure 1 is a side view of a conductor and insulator provided with one form of my improvement. Fig. 2 is another view of the same. Fig. 3 is a plan view of the same.

Referring to the various figures, 1 represents the main line high potential conductor secured to the insulator 2 by means of a tie wire 3 passing around the neck 4 at the head 5 of the insulator. The insulator 2 in the present instance is made up of three skirts 6, 7 and 8, and is secured to a pole or other base 9 by means of an iron pin 10. Bolted to the base of the iron pin 10 are metallic members 11 projecting upwardly and outwardly and carrying at their outer ends the guard ring 12. Guard ring 12 is below or on the same side of the horizontal plane of the conductor 1 as the insulator 2 and curves or extends in the form of a circle about the insulator 2 at a height between the skirts 7 and 8 and is somewhat larger in diameter than any of the skirts so that it is spaced therefrom and from the insulator 2. The conducting member or pin 10 is electrically connected with the guard ring 12 by means of metallic members 11 and the whole is connected with the ground or earth by means of a conductor 13.

Spaced about the neck of the insulator I provide an electrode 14 in the form of a ring. The ring 14 is composed of two semi-circular pieces having their ends bent upwardly as at 15. The corresponding ends of these semi-circular pieces are secured together above the conductor 1 by means of ring members 16. The corresponding ends 15 of the semi-circular members are also secured together below the conductor 1 by means of suitable clamps 17. It will thus be seen that the members composing the ring 14 form an electrode curving about the neck of the insulator near the top thereof which are clamped to the conductor so that they are spaced from the insulator at all points but are electrically connected with the conductor 1.

When an abnormal voltage exists upon the main line conductor 1 the same voltage

exists upon the tie wire 3 and the electrode 14. This tends to increase the leakage current over the surface of the insulator and if the voltage becomes large enough the dielectric strength of the intervening medium will be broken down and a heavy discharge will take place over the surface of he insulator to the conductor 13 and to earth. This heavy discharge which follows is however due to the power current which flows from the conductor to the ground over the path which has been broken down because of the initial high voltage to which it has been subjected. The power discharge, however, immediately forms into a flaring arc which will now take the more favorable path through the surrounding air from electrode 14 to the guard ring 12, in which position it is far enough removed from the insulator parts so that they will not be injured by heat. If the electrode 14 were not present, the upper terminal of the arc would remain at some point on tie-wire 3 and would cause intense heat to exist at that point, so much so that the head piece 5 of the insulator would be broken, and the tie-wire itself severely burned.

By placing the ring electrode 14 as described, a means is provided for taking the upper terminal of the arc off of the tie-wire away from the neck and providing an electrode which is at every point separated sufficiently from the neck of the insulator to prevent damage thereto. Thus, immediately after the power arc forms between tie-wire 3 and the pin 10, its upper end flares and attaches to electrode 14, while its lower end transfers to the guard ring 12, assuming the position shown by dotted line 18 in Fig. 2, the current supplying this arc passing through the members 15 in its passage from the conductor 1 to the electrode 14.

In order that the presence of the guard rings 12 and 14 may not cut down the resistance offered by the insulator or increase the flashover liability, they are so arranged that the initial resistance through the surrounding medium between these electrodes is greater than the initial resistance over the surface of the insulator. This is accomplished by proper proportioning and placing rings 12 and 14 with reference to the size and height of the insulator. By the term "initial resistance" I intend to comprehend the tendency of the air gaps to resist the discharge of current and not break down as well as the tendency of the conductors to resist the passage of current. The guard ring or electrode 12 is thus so situated that the initial resistance through the air between it and the electrode 14 or the tiewire 3 is so great that the initial discharge will not pass directly through the air, but will take place over the surface of the insulator to the pin 10 and thence to earth. However, immediately the arc has been formed its flaring in various directions causes it to shift to the neck ring 14 and the guard ring 12 so that the arc is not only drawn away from the skirts of the insulator but is also drawn away from the neck of the insulator so that no part of the insulator will become unduly heated and damaged.

In insulators constructed as shown in the figures it is a necessary condition that the electrostatic capacity of a shell or part be less than that of the shell or part into which it fits. This is true because the active dielectric area of the inner shell is smaller than the active area of the outer shell into which it engages. This condition causes more voltage to act upon the inner shell per unit thickness than upon the outer shell or shells when two or more shells are assembled as shown. For this reason when an abnormally high potential exists on an insulator the inner part will have to resist more voltage per unit thickness than any of the other parts. Thus, when a high voltage acts the inner part is more liable to puncture than the others. Also, if the inner part punctures the other parts may puncture also because of the ineffectiveness of the inner part when punctured. If the dielectric strength of the skirt 6 is great enough and its electrostatic capacity is large enough the discharge will take place over its surface, but may puncture the skirts 7 and 8 on account of the lower electrostatic capacity of these parts. In a like manner if the skirts 6 and 7 have sufficient dielectric strength and sufficient electrostatic capacity the discharge will take place over the surface of the skirts 6 and 7 and will puncture skirt 8 on account of its relatively low electrostatic capacity. Since the electrostatic capacity of the inner skirt 8 is necessarily less on account of the size of its top than that of 7 and the capacity of skirt 7 is for the same reason less than that of the skirt 6, it is evident that the skirt 8 is more liable to puncture than the skirt 7 and that the skirt 7 is more liable to puncture than the skirt 6. Hence it is apparent that if the skirt 8 can be preverted from puncture, the puncture of the ther skirts is likewise prevented. The puncture of skirt 8 is prevented by means of the electrode or guard ring 12 being placed at a position such that the dielectric strength of the surrounding medium will be broken down between the lower edge of the skirt 7 and the guard ring 12 before the surrounding medium will be broken down between these points when the path is over the surface of skirts 7 and 8. This result is accomplished, therefore, by causing the ring 12 to slightly lower the flashover value of the insulator below the skirt 7, but without lowering the flashover value of the insulator above that point.

From the above it will appear that by providing the electrode 14 spaced about the neck of the insulator 2 I have provided a means which prevents any injury being done to the top part or neck of the insulator when a power arc occurs thereover. It will also be apparent that the neck ring arrangement is simple and economical in construction and easy to put in place since the clamps 17 are readily bent over the ends 15 by a suitable tool to securely hold the members of the ring 14 together and at the same time clamp the electrode in place upon the conductor 1.

Although I have described my improvements in great detail I do not desire to be limited to the exact details shown and described except as hereinafter claimed, but

Having fully and clearly explained my invention, what I claim as new and desire to secure by Letters Patent of the United States is:—

1. In an arrangement of the class described, an electric conductor, an insulator therefor, a tie wire for securing the conductor to the insulator, an electrode opposite said tie wire, spaced from the insulator and electrically connected with the conductor to protect the tie wire and neck of the insulator, and a second electrode arranged to divert the power arc away from the insulator when a flashover occurs over the surface of the insulator.

2. In an arrangement of the class described, an electric conductor, an insulator of the pin type therefor, a tie wire for securing the conductor to the insulator, an electrode opposite said tie wire, spaced from the insulator and electrically connected with the conductor, said electrode being formed in the shape of a ring spaced around the neck of the insulator and a second electrode arranged to divert the power arc away from the insulator when a flashover occurs over the surface of the insulator, said second electrode being electrically connected with earth.

3. In an arrangement of the class described, an electric conductor, an insulator therefor, an electrode spaced from the insulator and electrically connected with the conductor, said electrode being formed of two semi-circular members placed around the insulator and spaced therefrom, each member having its ends bent to embrace the conductor, means for securing the corresponding ends of the members together on one side of the conductor, clamps for securing them together on the other side of the conductor and means arranged to divert the power arc away from the insulator when a flashover occurs over the surface of the insulator.

4. In an arrangement of the class described, an electric conductor, an insulator therefor, an electrode spaced from the insulator and electrically connected with the conductor, said electrode being formed of two members placed around the insulator and spaced therefrom, each member having its ends bent to embrace the conductor, means for securing the corresponding ends of the members together on one side of the conductor, clamps for securing them together on the other side of the conductor and means arranged to divert the power arc away from the insulator when a flashover occurs over the surface of the insulator.

5. In an arrangement of the class described, an electric conductor, an insulator therefor, an electrode spaced from the insulator and electrically connected with the conductor, said electrode being formed of two members placed around the insulator and spaced therefrom each member having its ends bent to embrace the conductor and means arranged to divert the power arc away from the insulator when a flashover occurs over the surface of the insulator.

6. In an arrangement of the class described an electric conductor, an insulator therefor and an electrode opposite the insulator and electrically connected with the conductor, said electrode being formed of two members clamped to the conductor on each side of the insulator.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

LLOYD C. NICHOLSON.

Witnesses:
H. E. Nichols,
A. G. Bierma.