Sept. 30, 1958 A. CAPART 2,854,499

RADIOACTIVE LIGHTNING ARRESTER

Filed Aug. 31, 1953 2 Sheets-Sheet 1

Fig. 1.

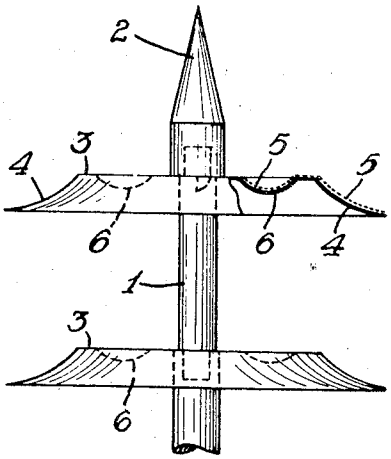

Fig. 3.

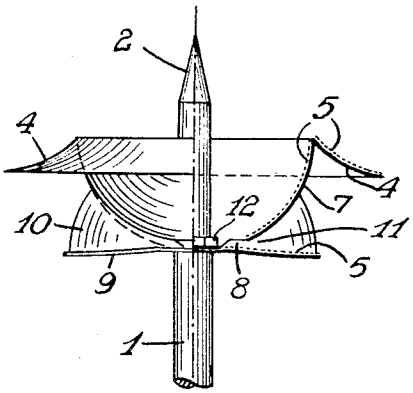

Fig. 2.

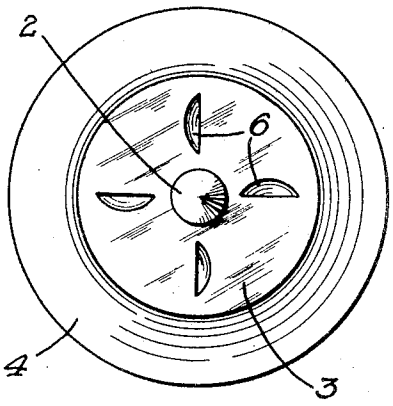

Fig. 4.

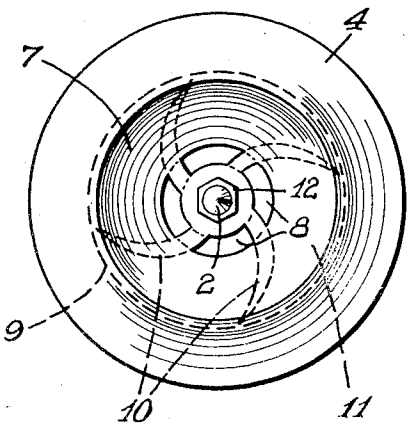

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Fig. 5.

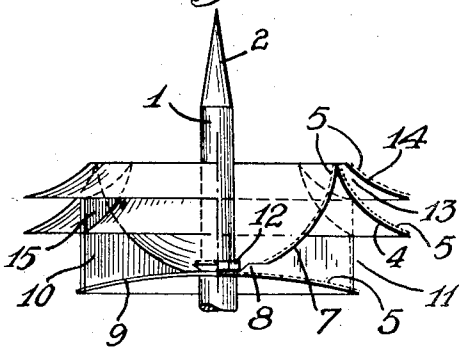


Fig. 7.

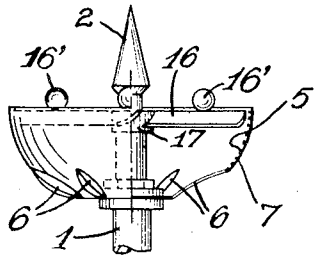


Fig. 6.

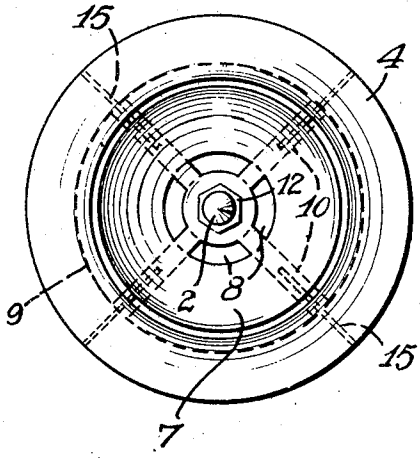


Fig. 8.

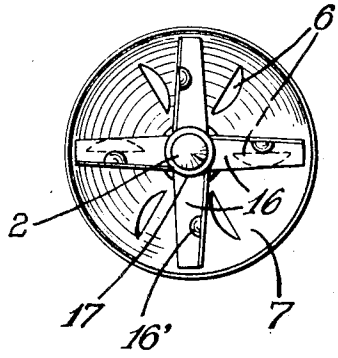


Fig. 9.

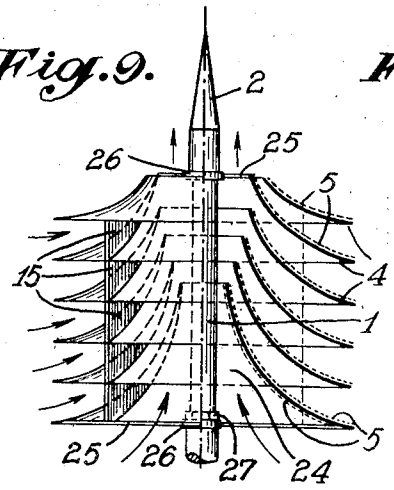
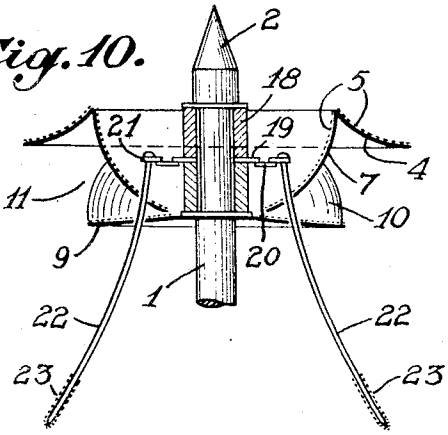


Fig. 10.



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RADIOACTIVE LIGHTNING ARRESTER

Alphonse Capart, Brussels, Belgium

Application August 31, 1953, Serial No. 377,633

Claims priority, application Belgium September 1, 1952

7 Claims. (Cl. 174—4)

The present invention relates to radioactive lightning arresters, that is to say, to lightning arresters designed to produce an increase in the conductivity of the air by ionisation. It is known to provide the rods of lightning arresters with discs (or with a cap) lined with radioactive salts generally fixed by embedding them in a ceramic material or in a covering enamel to produce ionisation of the air around the point of the lightning arrester.

The object of this ionisation is to produce a preventive action consisting in an increase in the exchange of electricity between the storm cloud and the earth and, in the case of a disruptive discharge, an attractive action in the direction of the lightning arrester, consisting in an increase in the deformation of the equipotential surfaces of the electric field around the point and the creation of a path of lowest resistance for the lightning.

The ions formed by the effect of the radiation on the molecules of ambient air, as well as the "emanation" of the salts, however, are subject to the influence of wind, which tends to carry them away from the lightning arrester. It has been proposed to utilise exciters adapted to create an electrostatic field or a magnetic field, one of the effects of which would be to combat this action by directing the ions. However, it has been found that the effect of such devices is uncertain and that, particularly in the absence of an intense electric field, the strata of conductive air are carried away to some distance from the device by the action of the wind, whereby the concentration of a highly ionised zone around the point is prevented and a path of lower resistance for the lightning may be created at other points.

According to the invention, the ionising surfaces are so fashioned as to have a considerable surface of radiation and to direct upwardly the masses of air blown by the wind in order that they may surround the point of the lightning arrester. Under these conditions, the wind is utilised to create an upward movement of the masses of ionised air in the neighborhood of the point and there will always be around the point a zone of highly ionised air capable of supplying the desired preventive effect even in a violent wind. The attractive effect on the lightning will also be increased by reason of the increased conductivity of the air above the device and also by reason of the fact that, since the ionised air is forced upwards a conductive column is created which extends to a distance above the device.

In addition, the intensity of the ionisation is increased by spreading out the currents of air passing through the device in contact with the ionising surfaces in thin layers, for example between convergent surfaces which continuously subject them to the alpha rays, the ionising effect of which is very intense but is only propagated in the air to 3.33 cm. from the emissive surface at atmospheric pressure.

By reason of the closeness of the equipotential surfaces of the electric field of the atmosphere above the point, the ions forced above the latter will be subjected

to the accelerating effect of the high-potential space charges existing at this point, with the production of ionisation by shock. The effect of the latter is very intense by reason of the fact that the rising column of air has a high ion concentration owing to the arrangement of the elements.

The devices according to the invention are therefore essentially characterised by curved ionising surfaces intended to direct the external air towards the point of the lightning arrester or in a direction parallel thereto. These surfaces are preferably disposed close to walls serving as guides for maintaining the air in contact with the said surfaces, which walls may have the form of fixed or movable blades or louvres or any other appropriate form.

The aforesaid arrangements may also be combined with the known means for creating an electrostatic field or a magnetic field around the point of the lightning arrester, the useful effect of these fields being increased by reason of the fact that the number of ions subjected to the effects of the field per unit time and for a given quantity of salts is greater, this being due more particularly to the carrying along of almost all the ions formed by the alpha radiation, which passes through the exciters from the bottom upwards due to the rising movement of the air.

Various forms of these devices are illustrated by way of example in the accompanying drawings, in which:

Figures 1, 3, 5, 7, 9 and 10 are elevational views, partly in section, and Figures 2, 4, 6 and 8 are plan views corresponding to Figures 1, 3, 5 and 7 respectively.

Figures 1 and 2 show a simple form of device comprising on the rod 1 of electrolytic copper connected to earth and provided with a catching point 2, a circular plate 3, the edge of which forms an inwardly curved flange 4 coated with radioactive material 5. The said plate is preferably formed with apertures in the form of louvres, the curved walls 6 of which are also lined with radioactive material. The wind arriving horizontally spreads the air over the edge 4, on which it is ionised under the influence of the radioactive rays before being driven towards the point of the lightning arrester. The air trapped by the louvres is also ionised under the influence of the walls 6 and guided upwards.

A number of plates 3 may be disposed one above the other. Figure 1 shows an additional plate so disposed that some of the air ionised by the lower plate passes through the louvres in the upper plate.

In the constructional form shown in Figures 3 and 4, the member mounted on the rod 1 is a cup 7 of sheet steel having in its base a number of apertures 8 serving to admit the air into the cup and for the drainage of rain water. Situated below the cup 7 is a slightly conical steel plate 9 which, like the cup 7, is lined with radioactive material. The plate 9 is connected to the outer face of the cup by helical blades 10 forming with the said face and with the plate 9 convergent ducts 11, each of which leads into the cup 7 through one of the orifices 8. Formed around the upper edge of the cup is a flange 4 coated with radioactive material 5. A nut 12 secures the assembly on the rod 1.

The air forced by the wind penetrates on the one hand into the ducts 11 and on the other hand is deflected upwardly by the flange 4. The air entering the ducts 11 is compressed between the convergent walls and is subjected to an intense alpha radiation, whereafter it is tangentially driven into the cup 7, in which it spreads out, is again subjected to the radiation of the radioactive coating on the inner face of the cup, and continues its upward movement. The air upwardly deflected by the

flange 4 is ionised in contact with the latter and, due to its rising movement, exerts a suction on the interior of the cup, thus creating a continuous movement of the ionised air around the point and in a direction parallel thereto, similar to the action of a chimney.

In the modification illustrated in Figures 5 and 6, the cup 7 is similar to that hereinbefore described, but is provided with a double flange 4, 14 which forms above the ducts 11 a second series of convergent ducts 13 separated by partitions 15. In Figures 5 and 6, the partitions 10 and 15 are straight, but they can naturally be inclined to impart to the air a tangential movement. The surfaces swept by the air are, as before, lined with radioactive enamel or other radioactive coating.

The presence of two series of convergent ducts is favourable to the ionising capacity of the device and the number of similar ducts may naturally be further increased if sufficient space is available.

In this order of ideas, the modification shown in Figure 9 comprises a number of inwardly curved flanges 4 forming around the rod 1 superposed concentric ducts, of which the convergent walls lined with a radioactive coating 5 lead into a central space 24. It will be seen that the wind trapped by the said ducts will create in this space a rising current of ionised air comparable to the draught of a chimney, which will extend around and well above the point 2.

The flanges 4 connected by radial partitions 15, which may be either straight or curved, form a rigid assembly with cross-supporting members 25 provided with washers 26 encircling the rod 1. The lower washer 26 is secured to the said rod by a nut 27.

The constructional form illustrated in Figures 7 and 8 comprises a central rotative member formed of blades 16 mounted on a bearing 17 supported by the rod 1. The said blades are lined with radioactive material and provided with buckets 16' providing points of engagement for the wind to set the said blades in rotation. In this example, the said blades are mounted in a cup 7, in the base of which louvres 6 are formed. The wind will produce a rising movement of the air guided by the walls of the louvres, which is drawn in by the rotative blades 16 and ionised by its contact with the walls of the louvres in the cup and the surface of the blades.

It is obviously possible to combine the arrangements hereinbefore described with electrostatic exciters and/or magnetic exciters which will have an increased effect by reason of the fact that the fields which they create will extend through a space through which almost all the ionised air passes.

Figure 10 shows an arrangement comprising combined electrostatic and magnetic exciters. The rod 1 of the lightning arrester is disposed, as before, in the cup 7 and is surrounded by a permanent magnet 18 formed of two sections separated by a soft steel ring 19. Secured to the said ring is an annulus 20 of insulating material, which in turn supports an annulus 21 of electrolytic copper which is connected to catcher aerials 22, the ends of which are covered with radioactive material 23.

For using the magnetic exciter, the catching point 2 will consist of soft steel and will form the first pole piece, the second being formed by the sheet-steel cup 7.

It is obvious that a magnetic exciter alone or an electrostatic exciter alone may be employed in combination with the devices for imparting a spreading movement and a rising movement to the air and that the form and arrangement of these devices may be modified without departing from the scope of the invention.

I claim:

1. A radioactive lightning conductor comprising a substantially vertical conductor rod, a substantially circular dished plate surrounding said rod and spaced downwardly from the top thereof, said plate having an outer rim with a concave upper surface sloping inwardly and upwardly from the outer circumference thereof a radioactive coating on said plate and means on said plate to catch air currents travelling in a path substantially perpendicular to said rod and deflect said air currents upwardly along said rod in a path substantially parallel to said rod toward the zone of maximum intensity of the electrical field of the atmosphere.

2. A radioactive lightning conductor comprising a substantially vertical conductor rod, a substantially circular cupped plate concave on its upper surface surrounding said rod and spaced downwardly from the top thereof, a coating of radioactive material on the curved top surfaces of said plate, and means to catch air currents moving perpendicular to said rod and direct said currents into said cup through perforations in the under side of said cup whereby said currents are deflected upwardly over said radioactive material and in a path substantially parallel to said rod toward the zone of maximum intensity of the electrical field of the atmosphere.

3. A radioactive lightning conductor comprising a substantially vertical conductor rod, a substantially circular cupped plate surrounding said rod and spaced downwardly from the top thereof, a double upwardly curved rim around said cupped plate, a coating of radioactive material on the curved top surfaces of said plate and said rims, perforations in said plate and between said rims, and means to catch air currents moving substantially perpendicular to said rod and deflect a portion of said air currents through said perforations and upwardly substantially parallel to said rod toward the zone of maximum intensity of the electrical field of the atmosphere.

4. A radioactive lightning conductor comprising a substantially vertical conductor rod, a substantially circular cupped plate surrounding said rod and spaced downwardly from the top thereof, a rim on said cupped plate sloping upwardly and inwardly from the outer circumference thereof, a coating of radioactive material on the cupped surface and rim of said plate, perforations in said plate and means to catch air currents moving substantially perpendicular to said rod and deflect said air currents upwardly over said radioactive material and in a path substantially parallel to said rod toward the zone of maximum intensity of the electrical field of the atmosphere.

5. A radioactive lightning conductor comprising a substantially vertical conductor rod, a plurality of substantially circular dished plates surrounding said rod and spaced downwardly from the top thereof, a radioactive coating on the top side of said plates, perforations in said plates, and means on the under side of said plates to catch air currents travelling in a path substantially perpendicular to said rod and deflect said air currents through said perforations and over said radioactive coating on the top side of said plates and upwardly past the top of said rod in a path substantially parallel to said rod toward the zone of maximum intensity of the electrical field of the atmosphere.

6. A radioactive lightning conductor comprising a substantially vertical conductor rod, a plurality of substantially circular cupped plates surrounding said rod and spaced downwardly from the top thereof, an outer rim on each of said cup-shaped plates sloping inwardly and upwardly from the outer circumference thereof, a coacting of radioactive material on the curved top cupped surfaces of said plates and on the upwardly sloping top surfaces of said rims, perforations in said plates and means to catch air currents moving substantially perpendicular to said rod and deflect a portion of said air currents upwardly over said radioactive material and substantially parallel to said rod toward the zone of maximum intensity of the electrical field of the atmosphere.

7. A radioactive lightning conductor comprising a substantially vertical conductor rod, a substantially circular member surrounding said rod and spaced downwardly from the top thereof, said member having a concave

upper surface sloping upwardly towards the top of the rod, a radioactive coating on said circular member and means to catch air currents traveling in a path substantially perpendicular to said rod and deflect said air currents upwardly along said rod in a path substantially parallel to said rod toward the zone of maximum intensity of the electrical field of the atmosphere.

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