F. S. CHAPMAN.

LIGHTNING ARRESTER.

APPLICATION FILED NOV. 16, 1906.

1,034,584. Patented Aug. 6, 1912.

Fig. 1.

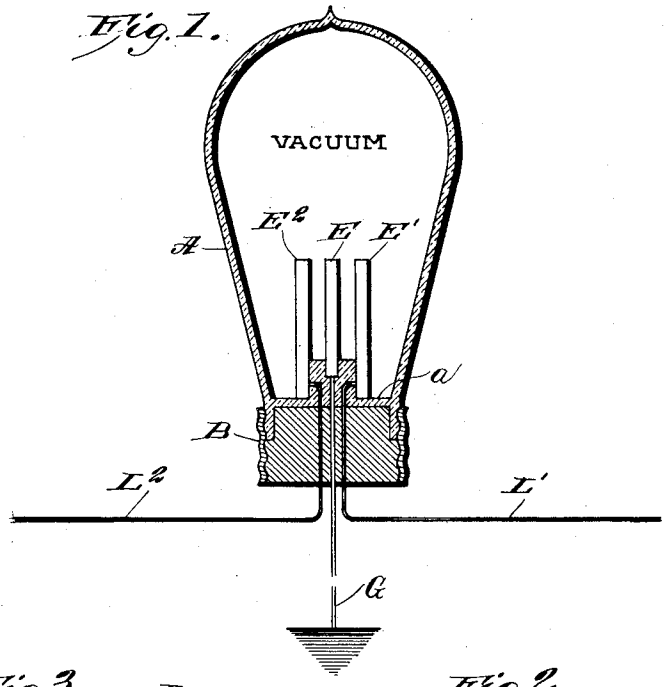


Fig. 3.

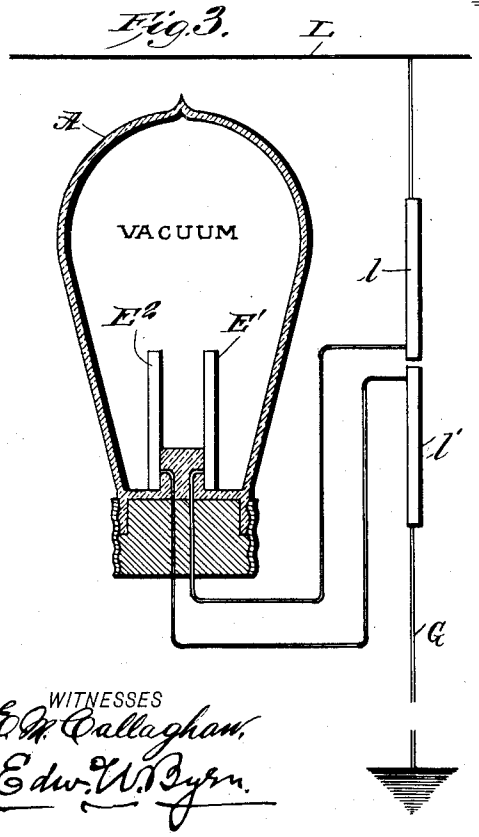
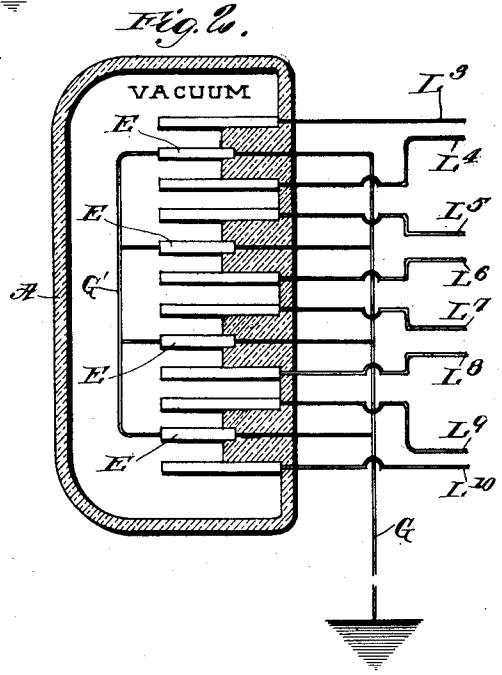


Fig. 2.



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LIGHTNING-ARRESTER.

1,034,584. Specification of Letters Patent. Patented Aug. 6, 1912.

Application filed November 16, 1906. Serial No. 343,700.

To all whom it may concern:

Be it known that I, FRANK S. CHAPMAN, a citizen of the United States, residing at Kenton, in the county of Hardin and State of Ohio, have invented a new and useful Improvement in Lightning-Arresters, of which the following is a specification.

My invention relates to lightning arresters of that form in which a silent discharge takes place in a vacuum.

Lightning arresters have been heretofore made on this principle after the manner of a Geissler tube, in which a tube with a partial vacuum, or rarefied gas, was provided with two electrodes, one arranged in each end.

My invention provides for the arrangement of both electrodes in the same end of the vacuum chamber and also, when this is desirable, for a multiplicity of electrodes; these novel constructions and arrangements resulting in certain advantages in manufacture and operation as will be hereinafter fully described.

Figure 1 is a sectional view of my lightning arrester with three electrodes. Fig. 2 is a sectional view of a modified form of the device where there are a number of electrodes in the same vacuum space attached to different circuits. Fig. 3 is a further modification showing an adaptation to lighting or power circuits.

In the drawing, A represents a glass bulb made like that of an incandescent electric lamp, in which there are located, three carbon electrodes E E′ E^2 set a little distance away from each other in substantially parallel position. These electrodes are connected to supporting wires sealed in or otherwise secured to the inwardly projecting part of the glass neck *a* of the globe and this neck is seated within a metal socket B through which, in a suitable sealing matrix of non-conducting material, the line wires L′ L^2 are brought, the wire L′ leading to the electrode E′ and the wire L^2 to the electrode E^2. The intermediate electrode E is connected to a third wire G which leads to ground. The three conducting wires lead into the same end of the vacuum chamber and are insulated from each other. Now in the event that a lightning charge strikes the line wires, L′ or L^2, the vacuum in the globe allows the charge to silently pass from the electrode E′ or E^2 to the electrode E and thence through the wire G to the ground. In distinguishing my invention from that form in which the electrodes are in the opposite ends of a tube, I would state that when a static discharge takes place through a vacuum, the heavier portion of the discharge takes place on the inner surface of the vacuum chamber and therefore the nearer together the electrodes are to each other at the points where they touch or enter this inner surface, the lower the voltage required to start the discharge. Once started, however, the entire vacuum space becomes ionized and this starts the discharge over the electrodes generally and hence with the arrangement shown in my invention, with electrodes all at one end of the vacuum chamber, a discharge occurs much more sensitively than would be the case if the electrodes were at the opposite ends of the tube as heretofore. The location of the electrodes at one side or end of the glass vessel constituting the vacuum chamber often simplifies the manufacture of the device as the sealing in of the leading-in wires is always a matter of considerable difficulty. It will be observed that the neck *a* of the bulb or vessel is formed with an inwardly extending projection and that the electrodes are mounted on or secured to this projection. This arrangement permits an accurate spacing of the electrodes apart, the projection forming, as it were, a bond of non-conducting material between the electrodes.

In Fig. 2 I show in a single case a plurality of ground electrodes E and a number of circuits L^3 L^4, L^5 L^6, L^7 L^8 and L^9 L^{10}, the two electrodes of each of which circuits are upon opposite sides of the ground electrodes which are connected by wire G′ and all of the wires of the ground electrodes emerge from the same side of the vacuum chamber with the line wires and are connected to a common ground wire G. The placing of a multiplicity of electrodes, connecting with a plurality of circuits, in the same vacuum space secures the result that a discharge between any two of the electrodes in the same vacuum space ionizes the entire vacuum space and such ionization increases the tendency of a discharge between other electrodes and circuits in the same vacuum

space, thus attaining the desirable object of discharging other electrodes which might have an undesirable charge in them of a lower voltage and incapable of discharging unaided. A device of this type shown in Fig. 2 is intended to be used in connection with a plurality of circuits which are more or less close together. It is well known that the effects of lightning discharges often, in fact usually, extend over a considerable area so that although one line may be charged to a particularly high degree all of the circuits in the immediate neighborhood are likely to be effected to a greater or less extent. It is desirable in such case, for example, where there are a number of lines running to the same switch board or other terminus, to clear all of such circuits of the abnormally high potentials resulting from the discharge even when the potentials on some of the lines are not sufficiently high to cause them to discharge independently. It will be understood that in using the term "ionization" I use it in a purely descriptive way referring to the current explanation of the electric phenomena concerned, and that my invention is not dependent upon the correctness of this theory. So, also, with the arrangement as shown in Fig. 1 there may be an objectionably high potential, for example, on wire L′, but not sufficient to discharge to the ground through the arrester. If, now, a sufficiently high potential comes on the wire L^2 of the same line to discharge to the ground through the arrester, the vacuum space will become ionized, breaking down the resistance between electrode E and E′ and thereby clearing the wire L′ of its objectionably high potential and thus clearing both sides of the same line.

In Fig. 3 I have shown an adaptation to light and power circuits, in which between the line L and ground G are interposed two carbons l l', or other material of high resistance, set about 1/32 of an inch apart and connected in series with the two electrodes E′ E^2 in the vacuum chamber. This serves to check the flow of the light or power current which might be started as an arc between the vacuum electrodes by the lightning discharge.

A distinction to be noted between the form having two electrodes and those having three or more is, that while the surface discharge, referred to, starts the discharge at other points than at the surface in the form having but two electrodes, in the forms having three or more electrodes, the discharge between any two electrodes whether at the surface or elsewhere will tend to start a discharge between other electrodes in the same vacuum space regardless of whether they are at the same or opposite ends of the chamber.

I claim—

1. In a lightning arrester, the combination with a vacuum chamber, the walls of which are formed of non-conducting material, of a plurality of electrodes projecting into said chamber from one wall thereof, said electrodes being separated where they project from the inner surface of the wall of the container by a relatively short path measured over the intervening surface and presenting to each other a relatively large extent of exposed surfaces, one of said electrodes being connected to ground and at least one other of said electrodes being connected to a line.

2. In a lightning arrester, the combination with a vacuum chamber, the walls of which are formed of non-conducting material, of at least three electrodes projecting into said chamber from one wall thereof, said electrodes being separated where they project from the inner surface of the wall of the container by relatively short paths measured over the intervening surface and presenting to each other a relatively large extent of exposed surfaces, one of said electrodes being connected to ground and at least two other of said electrodes being connected to lines.

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