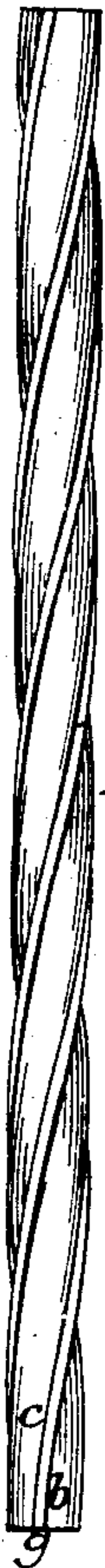


S. D. CUSHMAN.

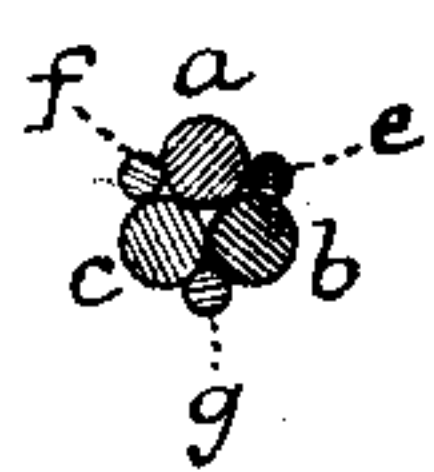
Lightning Rod.

No. 112,426.

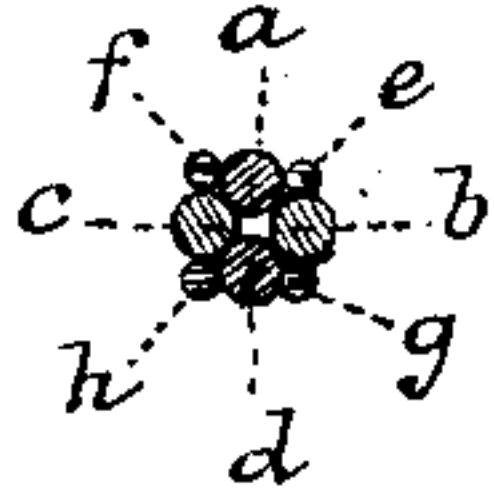
Patented March 7, 1871.



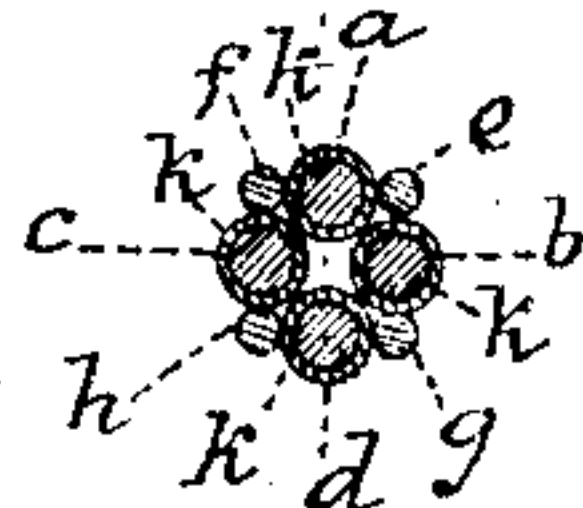
Figs. 1.



Figs. 2.



Figs. 3.



*Sylvanus D. Cushman, Inventor.*  
*by Jobabboth, Attorney.*

# UNITED STATES PATENT OFFICE.

SYLVANUS D. CUSHMAN, OF NEW LISBON, OHIO.

## IMPROVEMENT IN LIGHTNING-RODS.

*Specification forming part of Letters Patent No. 112,426, dated March 7, 1871.*

*To all whom it may concern :*

Be it known that I, SYLVANUS D. CUSHMAN, of New Lisbon, Columbiana county, Ohio, have invented certain new and useful Improvements in Lightning-Rod; and I do hereby declare that the following is a full, clear, and exact description of my invention, reference being had to the accompanying drawing, forming a part of this specification, and to the letters of reference marked thereon, of which drawing—

Figure 1 is an elevation and end view of my improved rod. Fig. 2 is an elevation and end view of a modification of the same. Fig. 3 is an elevation and end view of another modification of the same.

In order to produce a lightning-rod perfectly adapted to the public requirement, several electrical and mechanical features are to be combined, which may be thus stated:

(a.) The rod should be electrically continuous from the point on the roof to the end in the ground, in order that it may have but two poles, one at each end of the rod, so that no retardation takes place in the passage of the electric fluid from the point to the earth.

(b.) It should be made of such metal and in such a manner as to give it a conducting power superior to that of any object on which it is placed, else the electric fluid might leave the rod and follow the superior conductor.

(c.) It should have a maximum amount of surface with a minimum weight, as the amount of surface determines its conducting power.

(d.) It should be of such construction as to avoid subjecting the metal of which it is constructed to any torsional or compressive strain during its construction and erection, as these strains diminish the conducting power of the metals.

(e.) It should be made of such metals and in such a manner as that its surface shall be as free as possible from the effects of oxidation, as its conducting power depends on the bright and clean condition of its surface.

(f.) If economy in construction require that a part only of the rod be made of the best conducting metal, it should be so constructed as to obtain the full conducting power of the superior metal, so that the maximum effect of the rod, as a continual discharger of atmospheric electricity, should be obtained, and at

the same time the superior and baser metals should be so combined as to obtain the full electrical capacity of the rod in conducting a current of unusual magnitude.

In addition to these electrical features of the rod, its mechanical construction should be such as that—

(g.) It should have a maximum amount of stiffness with a minimum amount of metal, in order to have the rod stand erect without bending above the object to be protected.

(h.) It should be of a form which would allow of its economical transportation and easy application to the object to be protected.

(i.) It should be of easy and simple construction, so that it may be produced at a moderate cost.

To construct a lightning-rod combining these features is the object of my invention, which consists, first, in the construction of a lightning-rod composed of three or more iron wires and three or more copper wires, which are laid together in a rope form, the iron wires being laid together at the center to form the body or core of the rod, and the copper wires being arranged between the iron wires at the outside of the rod in such a manner as to bring an iron wire between any two adjacent copper wires, as is hereinafter more fully shown.

My invention also consists in the construction of a lightning-rod composed of three or more iron wires covered with a coating of zinc or tin, and three or more copper wires, which are laid together in a rope form, the iron wires being laid together to form the body or core of the rod, and the copper wires being arranged between the iron wires at the outside of the rod in such a manner as to bring an iron wire between any two adjacent copper wires, as is hereinafter more fully shown.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and application.

In the annexed drawing, A, in Fig. 1, represents the simplest form of my improved rod, which consists of three iron wires, *a*, *b*, and *c*, and three copper wires, *g*, *e*, and *f*, the copper wires being made somewhat smaller than the iron wires, both for the sake of economy and to secure a rod of a round and symmetrical appearance.



The iron wires *a*, *b*, and *c* are arranged in contact with each other, as shown in end view, and are "laid" together in a spiral form, like the strands of a rope, each wire being bent, as it were, around a cylinder of a diameter equal to that of a circle drawn in the center of the triangle formed by the three wires, and tangent to the inner side of each wire, so that, if the surface of the rod were developed by unrolling it on a plane surface, each wire would be represented by a straight line similar to the developed thread of a screw, from which it is evident that these iron wires are laid in a solid cluster, in contradistinction to being twisted into the form shown, so that no torsional force is applied in their construction.

The copper wires *e*, *f*, and *g* are laid in between the iron wires *a*, *b*, and *c*, as shown, care being taken that they be brought into this position by simply bending them in the manner described in laying the iron wires, so that no torsional force be applied to them.

The iron wires *a b c* may be first laid together, and the copper wires *e, f, and g* be afterward laid in between them; or both the iron and copper wires can be laid together at one operation, the latter plan being the most economical.

Various machines can be devised to lay these wires together in the manner described; but it is not necessary to describe them here, as the machinery for producing this rod forms no part of this application. Examples of this class of machinery will be found in the English patent of Heiman, No. 8,876, sealed March 8, 1841; also in the American patent of J. Cushman, No. 16,790, dated March 10, 1857.

Where a rod of larger size and more stiffness is required, I lay together four iron wires, *a, b, c, and d*, to form the body or core of the rod, as shown in Fig. 2, and lay in the four copper wires *e, f, g, and h* between the iron wires, as shown, the manner of laying the wires by bending or wrapping, in contradistinction to twisting, being the same as that described in first example.

In order to preserve a clean, bright surface, free from rust, on the iron wires *a b c d*, I coat them with zinc or tin before laying them into the rod, either by the galvanic process or in any other suitable manner. I then lay them together, as shown in Fig. 3, in which *a, b, c, and d* represent the iron wires covered with the coating *k* of zinc or tin, and *e f g h*, the copper wires, the arrangement of the parts and the plan of construction being the same as that described in the second example.

It is evident that five or six, or even more, iron wires, and five or six or more copper wires, might be formed into a rod on substantially the plan just described, one of the iron wires being used as a core for the other iron wires to be wrapped around, if found desirable; but I prefer to use not less than three, nor more than four, iron wires, with a corresponding number of copper wires, for less than three wires does not make the rod sufficiently

stiff, unless large wire is used, as the stiffness varies directly as the combined areas of the cross-sections of the wires multiplied by the capacity per square inch against transverse strain, and the use of large wires gives too small an amount of surface for the weight of metal; while if more than four wires be used it is difficult to lay them together in such a manner as to secure their united action against bending, so that the rod would lack the proper stiffness.

From the foregoing description of the construction of my rod, it is evident that iron wires form the body or core of the rod, and serve as a means of supporting the copper wires, which would not have sufficient stiffness in themselves to stand erect.

It is also seen that by separating the copper wires from each other by the iron wires, three or four independent conductors (depending on the size of the rods) of a superior conducting metal are formed from one end of the rod to the other, for the copper being the superior conducting metal, and of the same length as the iron, the electric current will follow it in preference to the iron; hence there is obtained by this construction three or four conductors of superior metal, which are continually acting as dischargers of atmospheric electricity, thus greatly diminishing the liability of an accumulation of the electric fluid and the consequent violent stroke.

It is also evident to any mechanic that rods can be made upon this plan of almost any length, so as to be perfectly continuous in every part, from one end to the other, thus insuring the perfect continuity of the lightning-rod; and that such rods can be easily transported by being coiled up like rope, and that they can be easily applied to any object, such as churches, factories, dwellings, tall chimneys, &c., which it is desired to protect.

Having thus fully described my invention, I do not claim as new the construction of a wire rope; nor the construction of a wire rope with laid strands, in contradistinction to twisted strands; nor the use of a wire rope as an electrical conductor; nor the construction of a wire rope or rod of one or two iron wires and one or two copper wires; nor the construction of a wire rope or rod of three or more iron wires and one or more copper wires, when said copper wire is arranged as a core in the iron wires, or when said iron and copper wires are combined in other and different arrangements from that herein described; nor do I make any broad claim to the use of a wire rope as a lightning-rod; nor to the construction of lightning-rods of dissimilar metals; nor to the coating of the iron in lightning-rods with zinc or tin; but, confining myself to the particular combination and arrangement herein described—

What I claim herein as new, and of my invention, and what I desire to secure by Letters Patent, is—

1. A lightning-rod composed of three or



more iron wires and three or more copper wires, said iron wires being laid together to form the body or core of the rod, and said copper wires being arranged between the iron wires on the outside of the rod in such a manner as that an iron wire is interposed between any two adjacent copper wires, as is hereinbefore specified.

2. A lightning-rod, composed of three or more iron wires and three or more copper wires, said iron wires being coated with zinc or tin, and being laid together to form the

body or core of the rod, and said copper wires being arranged between the iron wires on the outside of the rod in such a manner as that an iron wire is interposed between any two adjacent copper wires, as is hereinbefore specified.

As evidence of the foregoing witness my hand this 10th day of March, A. D. 1870.

SYLVANUS D. CUSHMAN.

Witnesses:

IRA A. CHASE,  
C. K. SHEARS.