(No Model.) 2 Sheets—Sheet 1.

H. W. SPANG.

LIGHTNING CONDUCTOR.

No. 284,082. Patented Aug. 28, 1883.

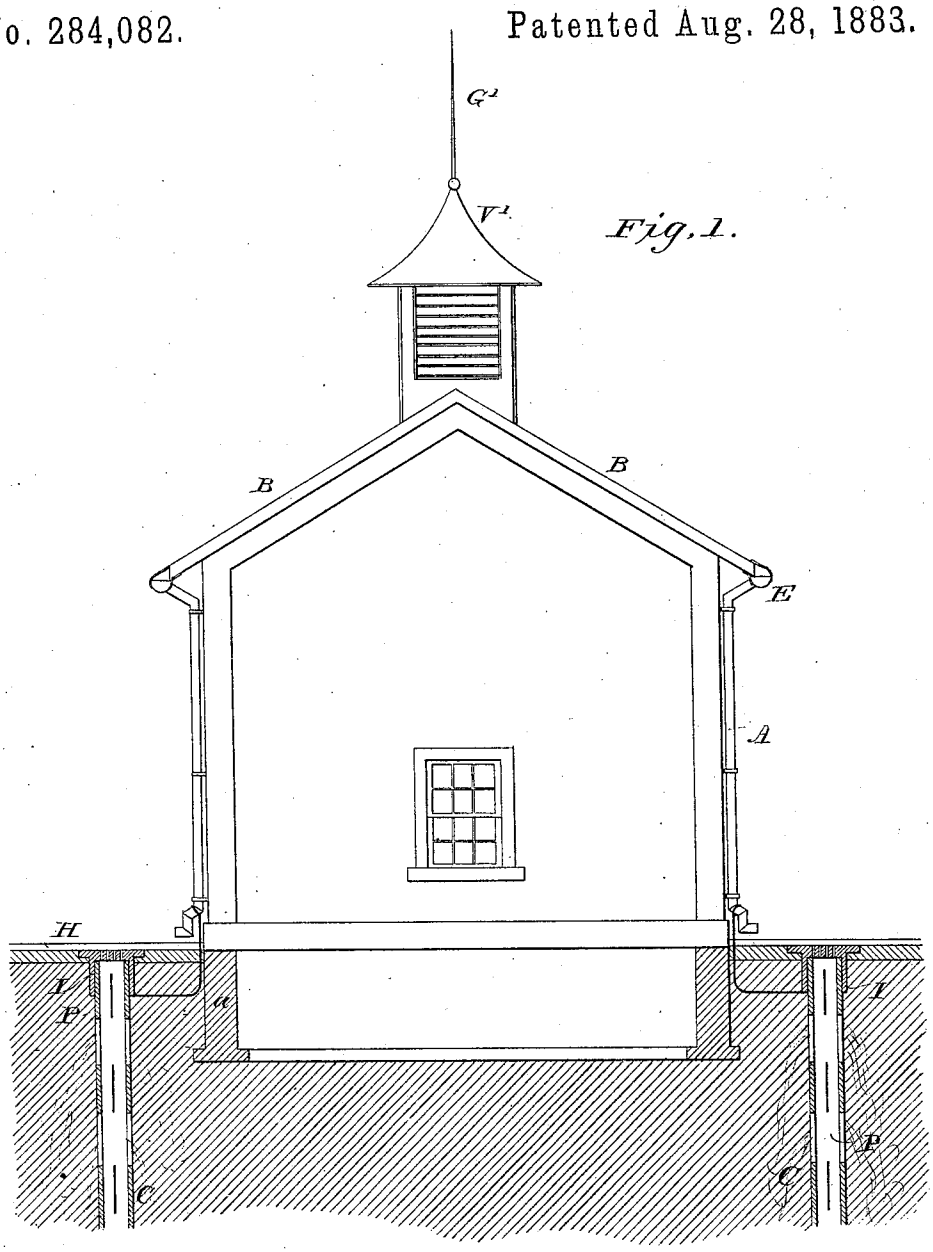


Fig. 1.

Witnesses:

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(No Model.) 2 Sheets—Sheet 2

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Fig. 2.

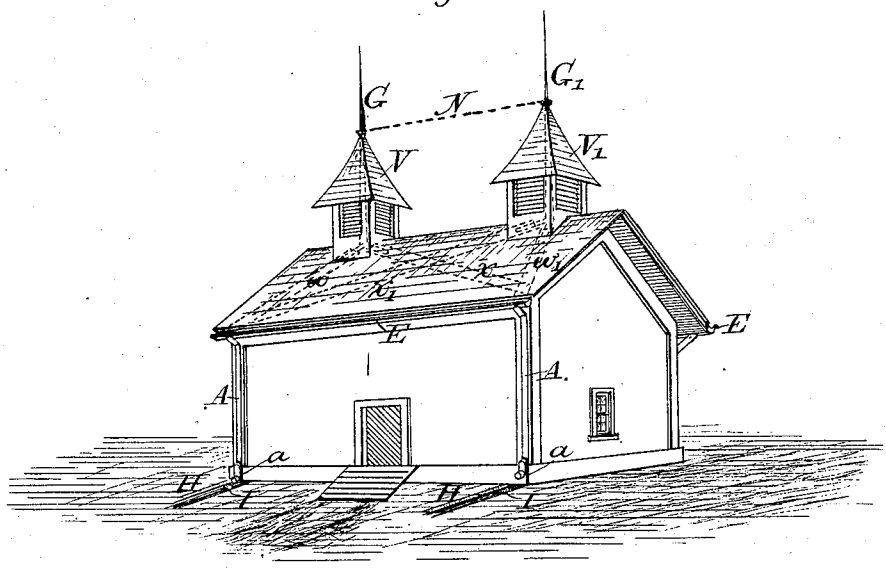


Fig. 3.

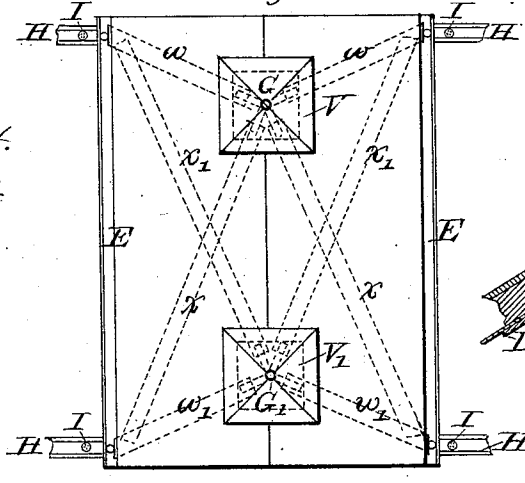


Fig. 4.

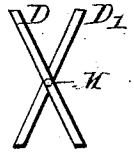
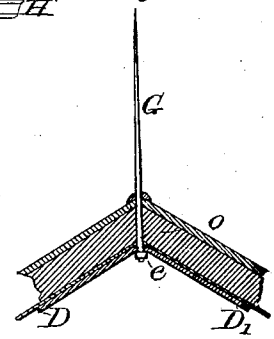


Fig. 5.



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UNITED STATES PATENT OFFICE.

HENRY W. SPANG, OF READING, PENNSYLVANIA.

LIGHTNING-CONDUCTOR.

SPECIFICATION forming part of Letters Patent No. 284,082, dated August 28, 1883.

Application filed February 14, 1882. (No model.)

To all whom it may concern:

Be it known that I, HENRY W. SPANG, a citizen of the United States, residing at Reading, in the county of Berks and State of Pennsylvania, have invented certain new and useful Improvements in Lightning-Conductors, of which the following is a specification.

The object of my invention is to provide an efficient means of protection against the destructive effects of atmospheric electricity or lightning, and one which is especially applicable to large structures — such as barns, churches, manufactories, &c.—which cannot be effectually preserved from injury or destruction by the appliances hitherto employed for that purpose.

My invention consists, generally, in the combination, with the edifice or structure to be protected, of two or more lightning-conductors terminating in the air above the highest portion thereof, and four or more earth-terminals situated at the respective opposite sides, or opposite corners, or both, of said structure, each of said earth-terminals being electrically connected to a continuous vertical conductor extending upward to the edge of the roof, each and every air-terminal being electrically united with each and every vertical conductor extending to the earth by a suitable number of metallic conductors extending upon, along, or within the roof in a direct or nearly direct line, so as to practically and permanently short-circuit all of the earth and air terminals.

The construction and arrangement of lightning-conductors upon large buildings has heretofore, for the most part, been carried out in accordance with the laws governing the distribution of galvanic electricity, and the peculiar properties of atmospheric electricity, especially when moving, as it almost invariably does, in a zigzag or, more properly, spiral path, when a discharge takes place between the clouds and the earth, have not been properly considered. When a zigzag or spiral discharge of lightning occurs between a cloud and the earth, an enormous amount of electrical energy is concentrated, possessing a high degree of self-repellent and expansive force or action, which tends to direct said discharge toward any body or bodies upon the surface of the earth over and throughout which the electricity can readily expand or diffuse itself. During a thunder-storm the earth's surface is highly electrified over an area equivalent to the area of the clouds above, and during a lightning-discharge the electricity of the earth rushes from different portions of the said area toward the electricity descending from the clouds. This is another cause, and no doubt the principal one, for the great expansive action of the electricity of a lightning-discharge. The cylindrical metallic rods, cables, spiral ribbons, and other like forms of lightning-conductors, as hitherto constructed and applied, do not offer sufficient scope for this expansive action of the electricity, and hence in many cases the discharge does not confine itself to the conductors, but leaves them and diffuses itself through the buildings to which they are attached, frequently injuring or destroying them with their contents.

According to my invention, the conductors are so constructed and arranged that they offer less resistance in any direction to the expansive and self-repellent action of the atmospheric electricity in its passage to the earth than that offered by the protected buildings and their contents, inasmuch as its expansive and diffusive action takes place along radial lines of conductors in various directions.

Barns filled with large masses of hay or grain, especially when not thoroughly cured or dried, as well as buildings in which ice or other semi-conducting materials are compactly stored in large quantities, are peculiarly liable to be injured and destroyed by discharges of lightning, even when provided with lightning-conductors constructed and arranged in the ordinary manner.

In order to thoroughly protect a barn, warehouse, or other large building filled with conducting or semi-conducting materials, and having, as is usually the case, a wooden or slate roof, I make use of a system of conductors, in which each air-terminal is provided with conducting connections radiating directly to the several earth-terminals.

In the accompanying drawings, Figure 1 is a sectional elevation, showing the manner in which my system of conductors is connected to the earth-terminal. Fig. 2 is a perspective view, showing the application of the invention

to a building of moderate size; and Fig. 3 is a plan of the building, showing the arrangement of the conductors thereupon. Figs. 4 and 5 illustrate certain details in the construction and arrangement of the conductors.

Similar letters denote like parts.

The radial conductors *w x* and *w' x'* are preferably of sheet metal, and are applied to both sides of the roof, as seen in Fig. 3.

V V' represent wooden ventilators of the usual construction, which should be not less than one foot square and three feet high, having suitable openings upon at least two of the sides, through which the gases generated by the stored products may readily escape. The centers of the two ventilators should be each about ten feet from the adjacent ends of the roof.

G and G' are the air-terminals, which may consist of cylindrical or conical iron rods about half an inch in diameter, extending not less than three feet above the summit of the ventilators. These air-terminal rods extend directly downward through the interior of the ventilators, as shown, and are each inserted into a hole, M, formed at the intersection of two iron bars, D D', (see Fig. 4,) being firmly secured thereto by a nut, *e*. These iron bars, which may be about one and a half inches broad, one-eighth of an inch thick, and of any suitable length, should be bent as indicated in Fig. 5, and placed at a proper angle to each other, according to the size of the building, so that their ends may be readily and conveniently connected with the other conductors of the system, as shown in Fig. 4. The ends of these bars are secured to the inner side of the rafters of a wooden or slate roof by means of nails or otherwise. In case the building is not provided with ventilators, the rods G and G G' may pass through the rafter *o* of the roof at the ridge, as shown in Fig. 5. The sheet-metal bands *w x* and *w' x'*, constituting the radial conductors, are preferably formed of tinned or galvanized iron plates, fourteen inches wide and of a thickness commercially known as "No. 27" wire-gage. These are preferably placed beneath the wooden laths or rafters or slate covering of the roof, and are in contact with the ends of the metallic bars D and D' for about twelve inches, being also carefully soldered thereto. The lower ends of the metallic bands *w w* and *w' w'* are soldered to the metallic troughs or gutters E E at the point of junction therewith of the vertical metallic rain-pipes A A. The lower ends of the bands *x x'* in Fig. 3 are likewise soldered to the bands *w* and *w'* near the eaves of the roof, as shown in the figures. Each rain-pipe constitutes an independent vertical conductor extending from the edge of the roof downward nearly or quite to the ground, and is electrically connected by a suitable metallic conductor, *a*, preferably of flat or round iron, with an iron pipe, C, perforated with openings P P, as shown in Fig. 1. The perforated pipe C is placed in the earth in a vertical position, and should be directly in the gutter or drain H, which carries away the water from the rain-pipe A. A perforated cap, I, is placed upon the pipe C, through which the waste and rain water will enter said pipe, and thence penetrate to the surrounding earth through the openings P P, thus keeping the same in a moist condition. At the commencement of a thunder-storm the water from the four rain-pipes A, flowing along the gutters H, will fill the pipes C, and also overflow in a body over each of the caps I, and establish an electrical conducting connection between the tops of the pipes and the moist surface of the surrounding earth. The radial conductors, uniting the lower extremity of each and every air-terminal with the upper extremity of the four rain-pipes A and the moist earth around and beneath the four pipes C, to which said rain-pipes are connected, as well as the water flowing in different directions away from the building along the gutters H, together with the moist surface of the earth, will offer a great number of different channels for the diffusion of an electrical discharge, in case such a discharge should take place upon or in line with the air-terminals. The radial conductors form direct electrical connection between the air-terminals, whether one or more, and each of the four vertical pipes A at the corners of the building, and hence the discharge is so diffused and dissipated throughout the entire system of conductors that the building itself is effectually protected from injury. In cities and towns the perforated pipes C, upon the front side of the building, may be placed in the street gutters near the curbstone, and may be connected with the rain-pipes by suitable iron pipes or other conductors driven through holes in the curbstone and passing beneath the pavement of the sidewalk.

It will be observed, by reference to Figs. 2 and 3, that the essential features of my improved system of conductors consists in placing the vertical earth-terminals at the several corners of the building, or at other convenient points around the outside thereof, and of establishing a direct connection between each air-terminal and all the independent earth-terminals, so that in case a discharge falls upon any one of the air-terminals or anywhere upon the building it is enabled to diffuse itself readily in every direction without encountering any material resistance, each earth-terminal receiving a portion of the discharge. The electrical accumulations being thus divided, diffused, and weakened by the radial network of conductors which incloses the building, the latter and its contents will in all cases escape uninjured.

The same system may be extended to buildings of any size, it being only essential that air-terminals should be placed along the ridge or highest portion of the building at intervals of, say, twenty feet, and rain-pipes or other earth-terminals along both sides of the building at intervals of about thirty feet, the direct conduct-

g connected radially from the air-ter- to a sufficiently-large number of earth- inals. The air-terminals themselves may with advantage united directly with each ther by a suitable conductor, as indicated by he dotted lines at N in Fig. 2. This may be laced within or beneath the roof, if preferred, thus offering additional facilities for the diffusion and distribution of the electric discharge throughout the protective system. The radial conductors may be placed upon the exterior of the roof, if desired, instead of being within or beneath it. The conductors A A may also be placed within the building, if preferred. A lofty steeple or spire upon a church or other like building must have the metallic ornament or rod at its top connected with the radial roof-conductors at or near the base of the steeple, which may be effected by means of two or more sheet-metal bands extended along the inside of the steeple. The band should be extended beneath the roof in a direct line to the different rain-pipes or earth-terminals on each side of the building, and should also be soldered to the metallic trough or gutters at the eaves of the roof.

I do not confine myself to the particular construction of the vertical rain-pipe, earth-terminal, and connecting-conductor, as herein shown and described, although I consider that such construction is preferable to any other known to me.

I am aware that it is not broadly new to attach a number of conductors to one building and to connect all of said conductors in series, so as to form practically but one path to the ground from any of the air-terminals, the resistance of all parts of the system remaining about equal, and I do not claim a multiplicity of conductors merely, my invention consisting in so arranging and connecting them all that each air terminal being connected directly with all of the earth-terminals by conductors of large capacity, a number of short circuits of great conductivity are at all times ready to carry to ground, and so diffuse any discharge of atmospheric electricity that could pass over either or all of the air-terminals combined.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, with a house, barn, or other like structure, of two or more lightning-conductors supported upon the roof thereof and terminating in the air above the top of said structure and electrically connected therewith, four or more earth-terminals placed at or near the respective opposite sides or corners, or both, of the said structure and each provided with a continuous vertical conductor extending to the edge of the roof, and a conductor or conductors extending upon, along, or within the roof in a direct line, so as to unite the lower extremity of each and every air-terminal directly with the upper extremity of each and every vertical conductor extending to the earth.

2. The combination, substantially as hereinbefore set forth, with a house, barn, or other structure, of two or more air-terminals, G G′, and the bars D D′, adapted to support said terminals, the horizontal rain-troughs E, and vertical pipes A, provided with ground-connections at *a*, a series of conductors, *w w′*, permanently connecting the metallic bars D D′ with the troughs E, and a second series of conductors, *x x′*, permanently connecting the conductors *w w′* and air-terminals with the bars D D′ and troughs E, as set forth.

In testimony whereof I have hereunto subscribed my name this 28th day of January, A. D. 1882.

HENRY W. SPANG.

Witnesses:
C. HOLTON,
ISAAC Y. SPANG.