R. B. FORBES.

Lightning Rod.

No. 11,217. Patented July 4, 1854.

Fig. 1.

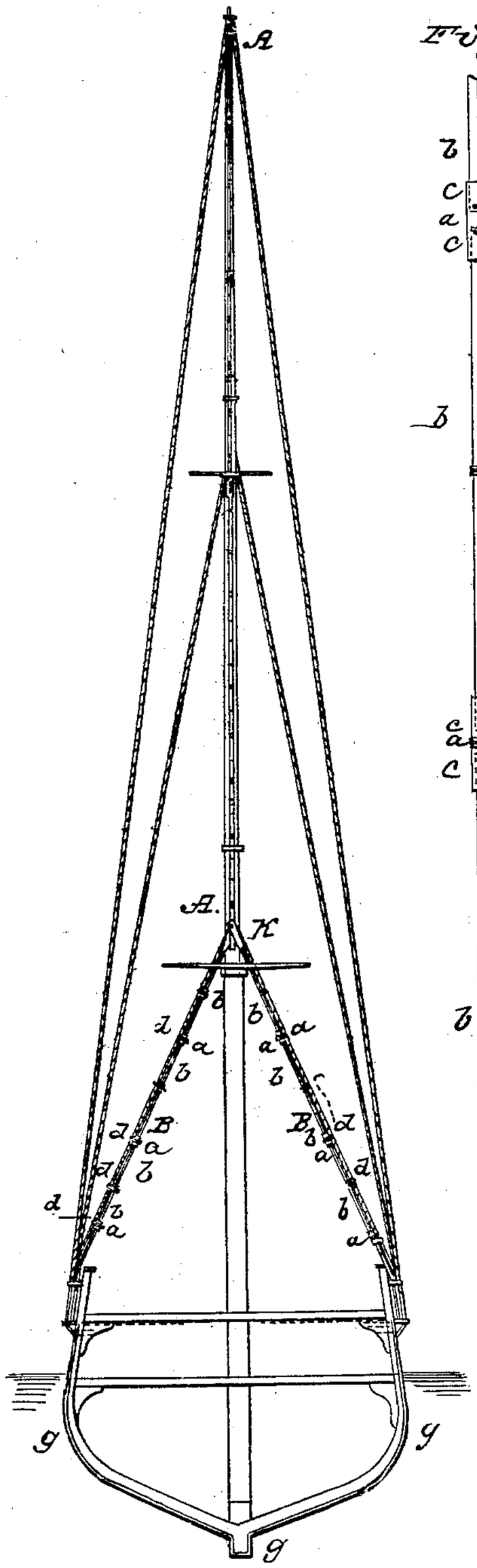

Fig. 4

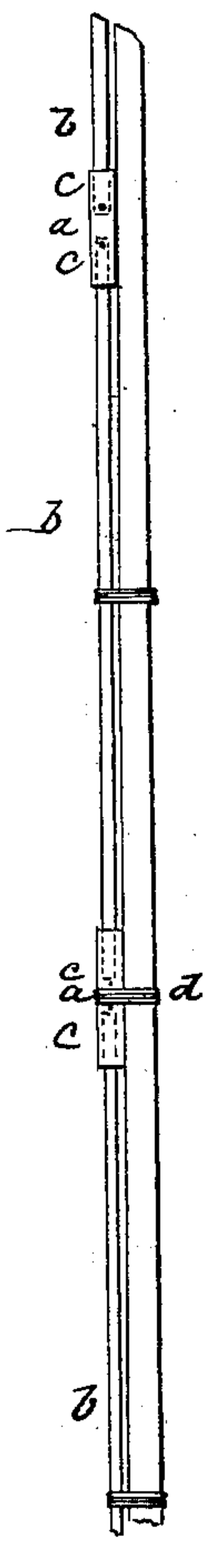

Fig. 3

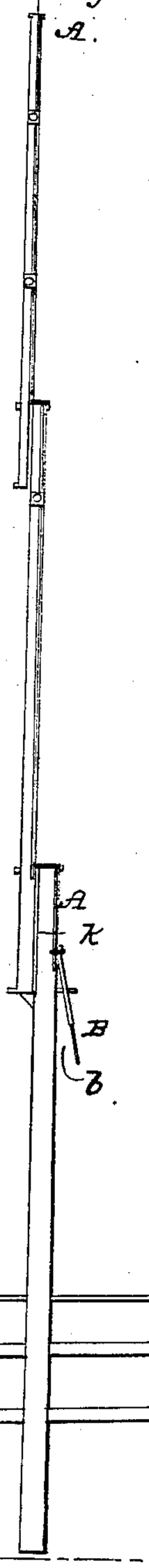

Fig. 2

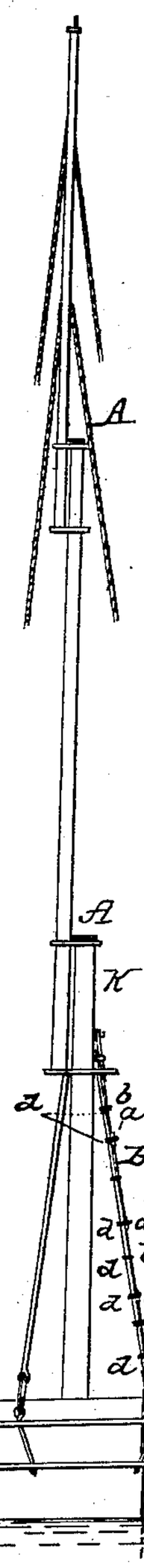

Fig. 5

UNITED STATES PATENT OFFICE.

ROBERT B. FORBES, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN LIGHTNING-RODS FOR VESSELS.

Specification forming part of Letters Patent No. **11,217**, dated July 4, 1854.

To all whom it may concern:

Be it known that I, ROBERT BENNETT FORBES, of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in the Application of Lightning-Conductors to Ships or other Navigable Vessels; and I do hereby declare that the same is fully described and represented in the following specification and the accompanying drawings, letters, figures, and references thereof.

The great success of Sir William Snow Harris's method of constructing lightning-conductors and applying them to navigable vessels, particularly those of the British navy, has rendered it a matter of great importance to devise some means by which conductors involving similar principles of action can be easily applied at any time to ships, and particularly those of the merchant service. The application of the Harris conductors to vessels must generally take place when the vessel is on the stocks or being constructed or is in dock or out of water. There is so much difficulty in making the application when the vessel is in the water or is loaded with cargo as to prevent most ship owners or masters from availing themselves of the benefits of the invention.

Sir William Snow Harris, in the "Edinburg New Philosphical Journal" remarks that "the conductor hitherto employed at sea consists of long flexible chains or links of metal," and that, "partly from inattention and partly from prejudice, they frequently remain in the ship's hold during long and hazardous voyages quite unemployed."

"The necessity of providing the best possible security against the effects of lightning on shipboard has been long admitted; but continuous and fixed metallic rods have been deemed inapplicable to ships, in consequence of their masts, the only parts to which they can be attached, being exposed to chances of injury, to motion in a variety of ways, to frequent elongation and contraction, and to the necessity which frequently arises for removing the higher masts altogether and placing them on deck. It was probably from these causes that the small flexible chains or links above mentioned were employed. Such conductors, owing to their great want of continuity as well as their want of mass and surface, are very unfavorable to the transmission of severe explosions, the electric matter becoming sensible at the points of junction, as is evident by the sparks upon them at the time of the discharge, so that in some instances they have become actually disunited. They are likewise objectionable as being liable to every species of injury incident to a ship's rigging, and much difficulty is experienced in keeping them in their position and unbroken, more especially during gales of wind and at night, and when it is, perhaps, required (as has already been observed) to remove some portions of the higher masts. It has therefore been long considered desirable to apply, if possible, a permanent conductor, which should always be in its place and ready for action.

"To protect a ship effectually from damage from lightning it is essential that a conductor be as continuous and direct as possible from the highest point to the sea, that it be permanently fixed on the masts throughout their whole extent, so as to admit of the motion of one portion of the mast upon another, and in case of removal of any part of the mast together with the conductor attached to it, either from accident or design, the remaining portion should still be perfect and equivalent to transmit an electrical discharge into the sea. To fulfill these conditions pieces of sheet-copper from one-eighth to one-sixteenth of an inch thick and about two feet long, and varying from six inches to one inch and a half in breadth, may be inserted into the masts in two laminæ, one over the other, the butts or joints of the one being covered by the central portions of the other. The laminæ should be riveted together at the butts, so as to form a long elastic continuous line. The whole conductor is inserted under the edges of a neat groove plowed longitudinally in the aft side of the different masts and secured in its position by wrought-copper nails, so as to present a fair surface. The metallic line thus constructed will then pass downward from the copper spindle at the mast-head along the aft side of the royal-mast and the top-gallant mast, being connected in its course with the copper about the sheave-holes. A copper lining the aft side of the cap through, which the top-mast slides, now

takes up the connection and continues it over the cap to the aft side of the top-mast, and so on as before to the step of the mast. Here it meets a thick, wide copper lining twined around the step under the heel of the mast, and resting on a similar layer of copper fixed to the keelson. This last is connected with some of the keelson-bolts and with three perpendicular bolts of copper of two inches in diameter, which are driven into the main keel upon three transverse or horizontal bolts brought into immediate contact with the copper expanded over the bottom. The laminæ of copper are turned over the respective mast-heads and secured about an inch or more down on the opposite side. The cap which corresponds is prepared in a similar way, the copper being continued from the lining on the aft part of the round hole over the cap into the fore part of the square one, where it is turned down and secured as before, so that when the cap is in place the contact is complete. In this way we have a continuous metallic line from the highest points to the sea, which will transmit the electric matter directly through the keel, being the line of least resistance."

I have been thus particular to state the principle of Harris's invention, and in his own words, in order that my invention may be more readily comprehended. It will therefore be seen that, as a general thing, it would be very difficult, if not absolutely impossible, to apply Harris's conductor entire to a merchant vessel when afloat or loaded with cargo. Besides this, it is a very expensive conductor. While my invention secures the principal advantages of that of Harris's, as described, it is particularly applicable to a vessel either laden, unladen, or afloat, as well as when in port or at sea, and has all the advantages of permanency that can be desired. It will answer for vessels of war as well as those of the merchant service.

I make use of the Harris plan of conductor from the top of the mast down to, or nearly to, the eyes of the lower rigging, terminating the same at some convenient point on the head of the lower mast. From thence I branch off to the two after-shrouds, or to any other shrouds, by means of a system of socket-tubes and tubes or rods, or their equivalents, extended down the shrouds and over and against the outside of the hull to the copper sheathing, or down to such a depth on the hull that the lower end of the conductor shall always remain immersed in the water under the ordinary rolling or pitching of the vessel when at sea.

I would remark that the principle of extending a conductor down the shrouds is not new with me, as this also was suggested by Sir William Snow Harris several years ago. My invention has relation more particularly to an improved mode of constructing or applying such a conductor.

Of the drawings above mentioned, Figure 1 denotes a sectional view of a vessel's hull, and shows a mast thereof, together with my invention as applied thereto. Fig. 2 is a side view of the same. Fig. 3 is a longitudinal section of the mast. Fig. 4 is a side view, and Fig. 5 is a section on an enlarged scale, of the mode of making that part of the conductor which is applied to the shrouds. They also exhibit the mode of connecting it with the shrouds.

A, Figs. 1 and 3, represents the course of the conductor from the top of the mast down to where it branches off from the lower mast-head, *k*, such conductor being constructed of plates or thin bars of metal whose ends are lapped over one another and secured together and to the mast by copper nails. This construction of such part of the conductor and its application to the mast does not differ materially from that of Harris's, hereinbefore mentioned. Each movable portion of the mast is to have a separate portion of the conductor affixed to it, as in the plan of Harris, so that it may be moved as circumstances may require and not destroy the electric connection.

The branches down one or both the shrouds on opposite sides of the mast are to be constructed as follows, they being shown at B B: Each consists of a series of metallic socket-tubes, *a a a*, &c., made to receive other tubes, *b b b*, &c., of greater length. Generally speaking, each socket-tube should be made of an internal diameter sufficiently large to receive the two ends of two of the tubes *b b b*, and the socket-tube should be lashed at its middle to the shroud, and to have pins *c c* or projections or suitable contrivances extending from it just above and below the lashing *d*, in order to hold it in place. It should be long enough to allow of the shrinkage and expansion or usual taking up or letting out of the shroud. For this purpose it may be about fifteen inches in length. The slide-tubes *b b* may be much longer, and each may be seized or lashed to the shroud at such number of points between the socket-tubes in which it is inserted as circumstances may require. This system of connected tubes may be extended over the side of the vessel and through the channels, and thence to, and be attached to, the copper sheathing *g*, or to a metallic bar or plate extended down so far toward the keel as to have its lower end always immersed in water under any rolling or pitching motion of the vessel while at sea.

Thus a complete system of tubing, flexible in its nature, presenting a great amount of electric surface both internally and externally, and at the same time sufficiently permanent to be independent of any daily care of the crew, will be secured at a reasonable expense. One great feature of this system is that any ship built and loaded, with lower masts in, can be fitted with the conductors as well as if originally designed to have them.

The plates on the masts should be placed in grooves sufficiently deep to admit the sections so that they will not in any way interrupt the easy passage of the parrals. Said plates may be secured or fixed either by nails or screws,

and they ought to be of a size and surface sufficient to properly convey off any discharge of electricity or stroke of lightning. They may be made of any suitable conducting metal or material or composition of metals or materials.

I disclaim any idea of attempting to improve on the Harris conductor as fitted to pass through the hold of a vessel, but affirm that my plan of constructing a conductor applied to the mast and shroud and led over the side of the vessel (instead of down through the hold) and attached to the copper or extended down toward the keel, as stated, has advantages which are not possessed by said Harris's plan, which cannot be attached to the shrouds, my plan being particularly applicable in the merchant service, where I believe it will be the means of saving many lives and much property.

I do not claim the system of permanent conductors as applied to the mast of a vessel in the manner well known as that of Sir William Snow Harris, wherein the conductor is carried down the mast and through the hold and keel of the vessel; nor do I claim either the common chain or rod conductor, nor the mode or modes of applying the same; nor do I claim to make the conductor of fixed lines of metal and to extend down the mast to near the lower mast-head, and from thence down the after-swifters to the ship's side; nor do I claim to make that part of the conductor extending down on the after-swifter or shroud as one long tube or metal; but

What I do claim is—

Composing it of a system of socket-tubes and slide-tubes, and confining the same to one of the shrouds or the rigging and over and against the outside of the hull, and either to the copper sheathing thereon or down to such a depth on the hull that the lower end of the conductor shall always remain immersed in the water under the ordinary rolling or pitching of the vessel while at sea, all substantially as specified.

In testimony whereof I have hereto set my signature this 23d day of July, A. D. 1853.

R. B. FORBES.

Witnesses:
R. H. EDDY,
T. P. HALE, Jr.