

(No Model.)

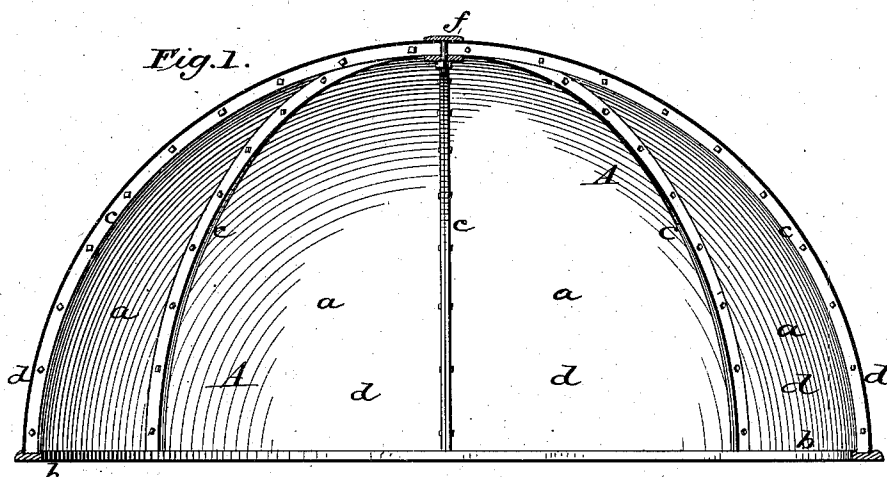
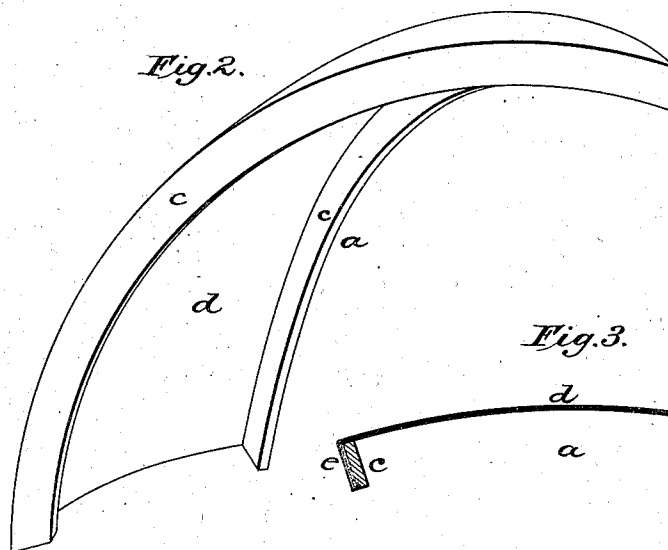
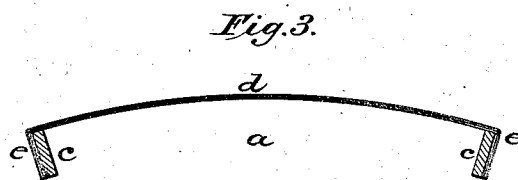
2 Sheets—Sheet 1.

E., C. W., & G. A. WATERS.

Paper Dome.

No. 240,868.

Patented May 3, 1881.



*Attest.*

*Sidney P. Hollingsworth.*  
*Walter S. Dodge.*

*Inventors.*

*Elisha. Waters,*  
*W. Waters,*  
*Geo. A. Waters,*  
*By Dodge & Co., attys*

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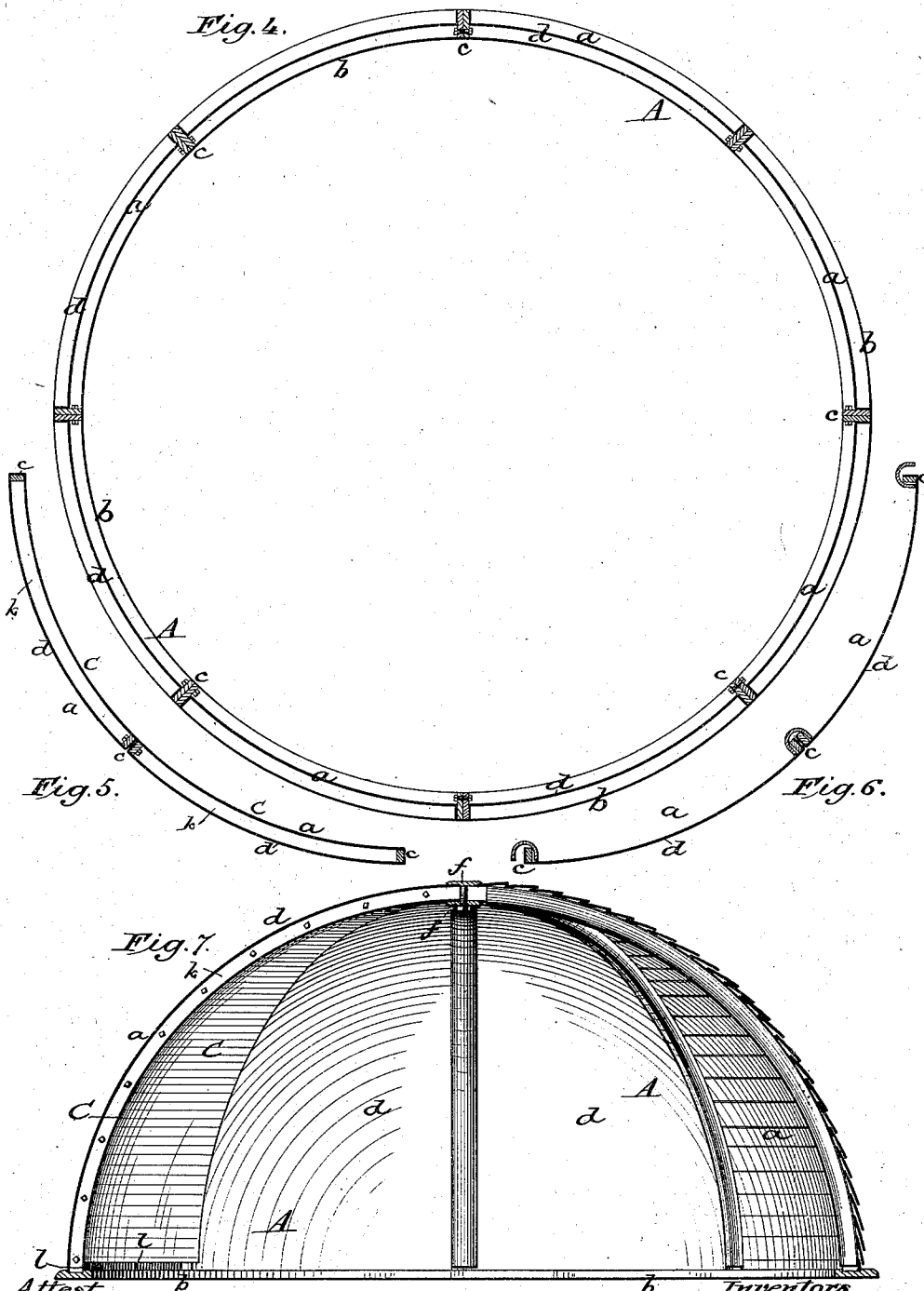
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# UNITED STATES PATENT OFFICE.

ELISHA WATERS, CLARENCE W. WATERS, AND GEORGE A. WATERS, OF TROY,  
NEW YORK.

## PAPER DOME.

SPECIFICATION forming part of Letters Patent No. 240,868, dated May 3, 1881.

Application filed March 2, 1881. (No model.)

*To all whom it may concern:*

Be it known that we, ELISHA WATERS, CLARENCE W. WATERS, and GEORGE A. WATERS, of Troy, in the State of New York, have invented certain Improvements in Methods of Constructing Domes of Paper, of which the following is a specification.

The object of this invention is to produce a paper dome for use in connection with astronomical instruments which shall be free from the many objections attending the domes as ordinarily constructed wholly or largely of metal.

As is well known, domes for astronomical purposes require to be mounted in such manner that they may be readily revolved horizontally. It is also well known that in order to secure the best results in the use of the instruments employed it is necessary that the dome shall be, as far as possible, a non-conductor of heat and of electricity, in order to maintain a uniform temperature within the building, and to prevent an electrical disturbance of the instruments employed.

Domes for astronomical purposes have been constructed in a great variety of ways and of various materials and combinations of materials; but so far as we are aware they have each and all been open to serious objections, such as the changing of form under the influence of heat, cold, and moisture, excessive weight, which rendered the operation of turning them laborious and difficult, the rapid condensation of moisture on their inner surfaces, rendering the room damp and the atmosphere injurious to the instruments employed, a rapid transmission of heat and cold, causing sudden and troublesome changes in the temperature, and a susceptibility to the influence of atmospheric electricity, which under certain conditions interfered materially with the accuracy of the instruments employed.

In order to overcome these difficulties and produce a dome which is at once cheaper, lighter, and more durable than those hitherto employed, and which shall be a non-conductor of heat and electricity, we construct a dome composed mainly of paper applied, substantially as hereinafter described, to a supporting-frame and rendered water-proof.

The details of construction may be modified

in many respects without departing from the limits of our invention.

We prefer to construct the dome, as herein-after described, of six, eight, twelve, or more duplicate sections bolted or secured together at their edges, each section composed of a hard paper sheet or body molded to the required curvature and secured at the edges to sustaining-ribs.

We prefer to construct the sections by providing a solid mold or form having a curvature corresponding with that of the required dome-sections, and to apply the paper thereto in sheet form in one or more layers, shrinking the paper thereon and rubbing it down with hot irons, blocks, or other instruments until it conforms to the surface of the mold and is set permanently in shape. If the paper skin is to be formed of a number of layers, after the application and formation of one sheet upon the mold, a second sheet is applied over the first and glued or cemented thereto, being molded and pressed thereon until the two are firmly united, after which a third is formed in the same manner, and so any desired number of sheets being thus laid upon one another and united to form a solid inseparable body, the whole is then placed in a drying-room and the skin thoroughly dried and hardened.

Before or during the application of the sheet or sheets to the mold, ribs to sustain the edges of the sheet are placed upon or in the mold and the sheet or sheets secured firmly thereto during the process of building up the section. These ribs may be placed either inside or outside of the paper and the paper secured thereto by turning or flanging its edges around or against the ribs and cementing them thereto, or in any other suitable manner. It is preferred to have the ribs located on the inside of the sections and to have the flanges of the paper turned inward over the outer faces of the ribs, so that when the sections are placed together the edges of the paper surfaces will be brought directly against each other.

In practice it is found that at certain times moisture condenses upon the inside of the ribs, and that it is liable to drip therefrom, to prevent which we provide the inner edges of the ribs with conductors, of paper or like material,

to receive the water and carry the same downward and outward to the base of the dome.

As an additional means of maintaining an equable temperature within the dome, we provide the same with a paper sheathing or lining, placed preferably against the inner face of the ribs in such manner as to leave an air-space between said sheathing and the outer shell or body of the dome.

Referring to the accompanying drawings, Figure 1 represents a vertical central cross-section of a dome constructed on our plan. Fig. 2 represents a perspective view of one of the dome-sections; Fig. 3, a cross-section of the same, showing clearly the manner in which the paper is applied to the sustaining-ribs. Fig. 4 is a cross-section of the dome-sections without outside ribs, showing the manner in which they are joined. Fig. 5 is a similar view of two sections having inside ribs. Fig. 6 is a cross-section, showing the manner in which the internal conductor is applied to the ribs. Fig. 7 is a vertical section, illustrating the manner in which the internal sheathing or lining is applied.

A represents the dome as a whole, composed essentially of a number of sections, *a*, joined at their edges to each other, and united and supported at the base by a horizontal sill or plate, *b*, to which the lower ends of the sections are attached. Each section, as ordinarily constructed, consists, as shown in Figs. 2 and 3, of two ribs, *c*, curved lengthwise to conform to the curvature of the required dome and joined at their upper ends, and of a paper covering or sheathing, *d*, sustained by and secured at its edges to the ribs *c*, as shown, the paper being molded rigidly to the proper curvature to form a section of the outer surface of the dome.

As shown in Fig. 3, the paper body *b* is composed of a number of sheets placed one upon another and glued or cemented firmly together, their edges being turned or flanged downward over the outer surfaces of the ribs, as shown at *e*, and secured firmly thereto. The paper is treated with shellac, varnish, or any other suitable water-proof material, to prevent it from being affected in any manner by moisture.

The dome may be composed of any suitable number of sections, as convenience may dictate or the size of the structure require. The sections, being constructed as shown in Figs. 2 and 3, are placed together edge to edge, as shown in Figs. 1 and 5, and drawn firmly together by means of bolts passed through the ribs, as shown in the last-named figure, or in any other suitable manner, the joint between them being calked, filled with cement or with elastic packing, or otherwise prepared to render them absolutely water-tight. The sections placed together as stated, they are secured at the base to the plate or sill *b*, and also united at the top by plates *f*, to give the structure additional strength and stiffness. The construction of the base-sill *b* and of the connecting

devices at the top of the dome may be modified as desired, provided only that they hold the sections firmly together.

The conductor or trough by which the moisture from the ribs is carried off is clearly represented in Fig. 6. It consists, as shown, simply of a U-shaped trough, made preferably of paper and applied over and around the inner edges of the adjacent ribs, as represented.

The manner in which the internal sheathing is applied is clearly represented in Figs. 5 and 7, in which *C* represents the sheathing, composed of one, two, or more sheets, molded or sprung into form in the same manner as the outside sheets, rendered water-proof, and secured to the inner edges of the ribs in such manner as to leave an air-space, *k*, between it and the outside of the dome. A small opening, *l*, may be left at the lower edge of the sheathing, and, if desired, openings may be made therein at other points to permit the circulation of air through the space *k*. It is preferred, however, in ordinary cases, to have the space *k* closed at the top, in order that a body of dead air may be retained therein.

The dome will be provided, like other structures of its kind, with an opening in one side and a swinging or sliding shutter to close the same. This shutter will be constructed of suitable form, in the same or substantially the same manner as the dome-sections, and will be sustained and operated in any ordinary or suitable manner.

As the manner of mounting and operating the shutter constitutes no part of the present invention and is well known to those skilled in the art, it is not described herein.

Fig. 7 illustrates at its right-hand side a modified manner of constructing the sections of the dome, consisting in laying sheets or strips of paper upon the ribs with their edges overlapping one another. While a skillful manipulation of the paper and a careful jointing and cementing of the edges of the strips will admit of a dome being thus constructed, the plan previously described is preferred.

Instead of constructing the dome-sections of sheets of paper, they may be made by laying and pressing the paper-pulp into form upon a suitable perforated or solid mold and pressing and manipulating it into form thereon. In all cases, however, whatever the form of structure adopted, the paper is to be molded and set rigidly in shape, rendered absolutely water-proof, and made of such thickness and stiffness as to retain under all circumstances its proper form.

Having thus described the invention, what is claimed is—

1. An improved dome for astronomical purposes, constructed of paper, substantially in the manner and for the purpose herein described.
2. As a new article of manufacture, a dome composed, essentially, of a series of water-proof rigid paper sections, each molded and set permanently in form, substantially as described.
3. As a new article of manufacture, a paper

dome-section consisting of supporting-ribs and a paper body or surface molded and set rigidly in form and secured at its edges firmly to the ribs.

5 4. In a dome, the combination of the sustaining-ribs *c* and the rigid water-proof paper sheets *a*, flanged inward, and having their flanges secured together between the ribs, as described and shown.

10 5. As a new article of manufacture, a non-conducting dome for astronomical purposes, the same composed of water-proof paper, substantially as described and shown.

15 6. In an astronomical dome, the combination of the outside paper surface, *d*, and the

inside paper sheathing, *C*, arranged to leave an air-space between the two.

7. In combination with the series of water-proof paper sections *a* and sustaining-ribs *c*, the supporting-base *b* and a top connection 20 between the ribs, substantially as described.

8. In combination with the dome having the internal ribs, the conductor or trough, applied substantially as shown.

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CLARENCE W. WATERS.

GEO. A. WATERS.

Witnesses:

CHAS. V. WATERS,

W. R. BENEDICT.