

D. M. GREENE.

Thermometer.

No. 76,625.

Patented April 14, 1868.

Fig. 1

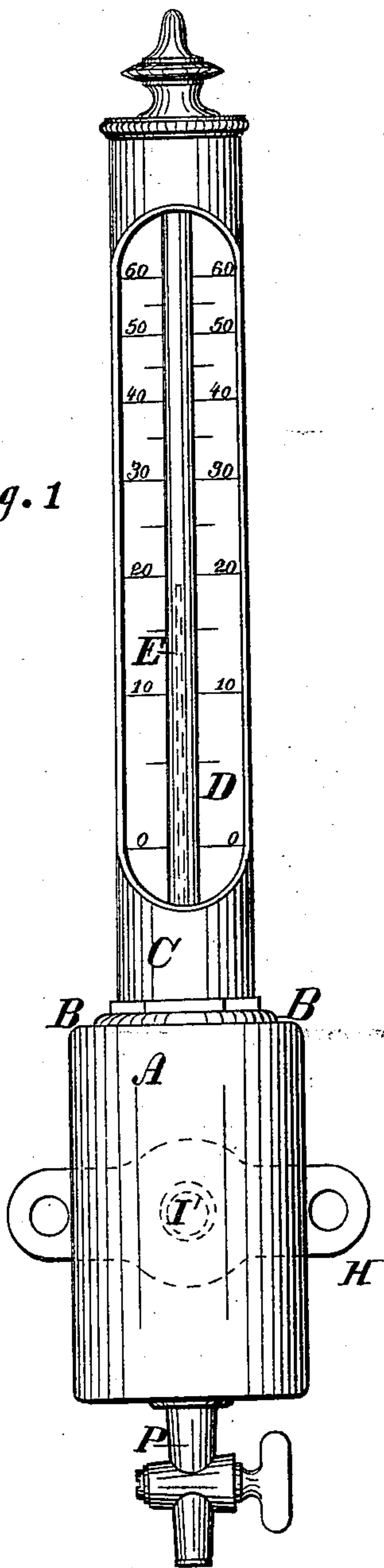
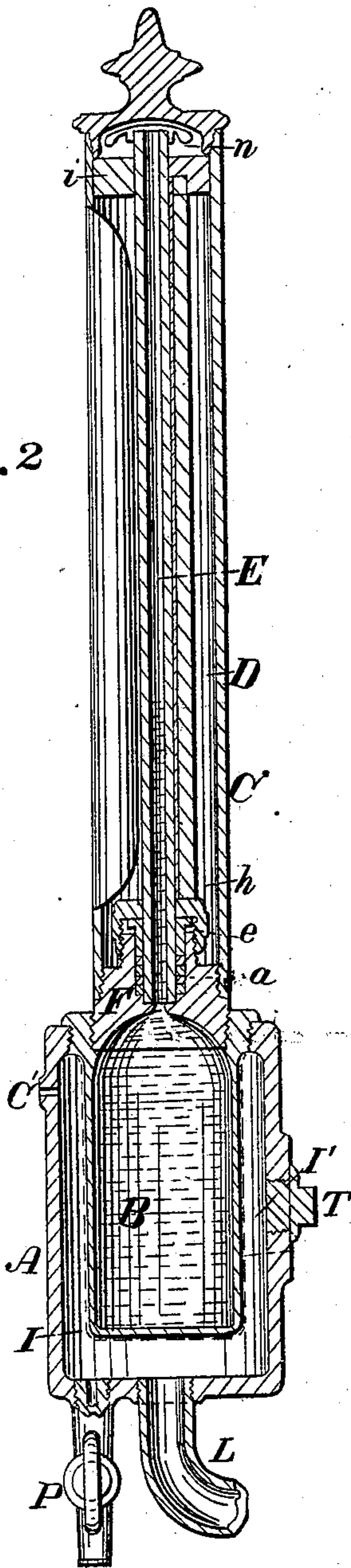


Fig. 2



Witnesses:

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D. M. Greene  
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# United States Patent Office.

D. M. GREENE, OF TROY, NEW YORK.

*Letters Patent No. 76,625, dated April 14, 1868.*

## IMPROVEMENT IN THERMOMETRIC STEAM-GAUGES.

*The Schedule referred to in these Letters Patent and making part of the same.*

### TO ALL WHOM IT MAY CONCERN:

Be it known that I, D. M. GREENE, of Troy, in the county of Rensselaer, and State of New York, have invented certain new and useful Improvements in Steam-Gauges; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the annexed drawing, making a part of this specification, in which—

Figure 1 is a front elevation, and

Figure 2 is a vertical section through the centre.

My improvement relates to a novel construction of steam-gauge for indicating the pressure of steam, by means of the temperature or degree of heat of the steam, as hereinafter more fully explained.

The application of the expansion of mercury by the heat of the steam within a boiler, as a means of indicating the pressure of the boiler, has been heretofore suggested, but it has not been heretofore carried into practice as a steam-gauge, for want of a practical, substantial, and certain mode of applying it, and for want of a proper mode of graduating pressure-gauges acting upon such principle.

My invention consists in forming a pressure-gauge by combining, with a suitable metallic reservoir or fountain of mercury, an exterior steam-chamber surrounding it, said steam-chamber having a tubular connection with the steam-space of the boiler, and said fountain of mercury being attached to the lower extremity of a glass tube, having a pressure-scale attached thereto.

My invention, secondly, consists in forming or graduating the scale of said pressure-gauge, by exposing the reservoir of mercury to the action of steam at a series of temperatures due to pressures determined by a standard pressure-gauge. The pressures are to be marked directly on the scale. This means of graduating the scale of pressures direct, without making use of thermometric degrees reduced to pressures by the table, as heretofore suggested, obviates liability to error, and renders the pressure-gauge so obtained entirely reliable.

I construct my gauge as follows: I first provide a steam-case, A, and insert within it a mercury-cup, B, the latter being suspended within the former, by being screwed into it at the top, as shown in fig. 2, or in any other suitable manner, so as to leave a space surrounding the cup B within the case. Within the upper end of the cup B, I screw a plug, F, having its lower side or end made concave, as shown in fig. 2, and having a hole extending vertically through it, this hole being enlarged or recessed, as shown, in its upper part. Into this hole I insert a glass tube, E, and pack it tight by leather or other suitable material, as indicated by *a*, fig. 2, and secure the packing in place around the tube E, by means of a follower, *e*, and an annular cap, *h*, as represented in fig. 2, or by any other suitable means, the object being to so connect the tube E to the cup B, as to render their union tight, and at the same time not break the glass tube. Behind the tube E, I place a plate, D, of any suitable material, on which graduations and figures can be made with ease and distinctness, and which extends to the top of the tube, or nearly so, and which I secure firmly in place, in such a manner as to hold the top of the tube E in position, and prevent it from being broken. Over the tube and plate, I place a metallic case, *c*, which may be screwed upon the projecting portion of plug F, and thus be held rigidly in place, and forming a case for the protection of the glass tube, and the indicator-plate. This case *c* is cut away in front, as shown in fig. 1, so as to permit the marks and figures on the plate to be readily seen. Over the open upper end of the tube E, a small rubber bag may be tied, as represented by *n* in fig. 2, to prevent the mercury from being spilled, and also prevent particles of dirt or dust from getting into the tube.

I have ascertained by experiment that when the cup B is made of cast iron or similar metal, the thinness that is desirable to render it very sensitive to the action of the heat, the steam admitted to the chamber surrounding it, will, after a time, penetrate it more or less, and, becoming condensed within the cup B, will form globules of water therein. To prevent this, I cover the exterior surface of the cup B with a thin coating or sheet of copper, as indicated by the red line in fig. 2. This copper coating may be deposited on the surface of the iron by any of the usual processes, but I prefer coating it with a thin sheet of compactly-rolled copper secured by solder. The object may also be attained by coating the surface with molten tin or other suitable



metal. The object of making the under surface of the plug F concave, as represented, is that the mercury within the cup, when expanded by heat, so as to rise therein, always assumes a round or spherical form on its surface, the centre being more elevated than at the sides or around the edges, and therefore if the top of the cup, or bottom of the plug F, were made with a plane or straight face, it would follow, that when the mercury rose in the cup, it being highest at the centre, would enter and close the lower end of the tube E, while air would remain confined in the interior angle or corner of the cup, but by making the top of the cup of the spherical form on its interior, as represented in fig. 2, I entirely obviate this difficulty.

In making every gauge, I attach it to a boiler alongside of a standard mercurial gauge, and, commencing with the steam at the lowest point, raise it to the highest pressure desired, marking the graduations with care on the plate D, at the proper points to represent the different degrees of pressure, as the same are indicated by the standard mercurial gauge during the operation. Each gauge is graduated in this way, by direct-pressure test instead of by thermometric marks converted by a table. The gauge is to be connected to the boiler by means of a flange, H, as represented in fig. 1, or by a tube, and steam admitted to the steam-chamber I, surrounding the mercury-reservoir B through the opening I', if attached to the side of the boiler, or through the tube L, if set above the boiler or engine, the proper quantity of mercury, of course, having been first placed within the cup B. As the pressure increases, the heat expanding the mercury in the cup B, will cause it to ascend the tube E, where the graduations and numbers will at once indicate the pressure of the steam. A small orifice, c, is made in the case A, to permit the escape of cold air, as steam is let into it, after having become cool by non-use, and also to permit the constant escape of steam in small quantities, to counteract any condensation that might occur, and which would thus tend to reduce the temperature of the steam in the chamber I below that in the boiler. If desired, this orifice may be provided with a cock, by which it can be closed or opened at pleasure. A drip-pipe, P, with a cock is attached at the bottom of the case, to permit the escape of any water that may be formed by condensation therein. If desired, there may be a pipe connected with the drip-pipe, to convey the water back into the water-space of the boiler. To prevent loss of heat by radiation, the case A, with the steam-pipe leading to it, if one be used, should be packed with any suitable non-conducting material.

I have described the use of mercury in my gauge only, but it is apparent that any other fluid subject to expansion by heat might be used in my apparatus, as above described, although mercury possesses, in my judgment, great advantages over any other fluid.

Having thus described my invention, what I claim, is—

1. The combination of the reservoir B and the exterior steam-chamber I, the glass tube E, and a pressure-gauge scale attached thereto, determined by the expansion of the mercury or other fluid, by the heat of the steam conducted from the boiler to the steam-chamber I.
2. The combination of the reservoir B, the exterior steam-chamber I, the graduated glass tube E, placed outside of a boiler having a steam connection therewith by a tube or flange.
3. The drip-tube, attached to the steam-chamber I.
4. I claim a coating of copper, or other suitable material, when applied to the surface of the mercury-cup, substantially as and for the purpose set forth.
5. The flexible bag n, secured to the end of the tube E, substantially as and for the purpose set forth.
6. The process of graduating the gauge, by applying steam to the steam-chamber at a series of pressures, determined by a standard gauge, and marking the position of the mercury or other fluid corresponding thereto.

D. M. GREENE.

Witnesses:

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H. A. CHADWICK.