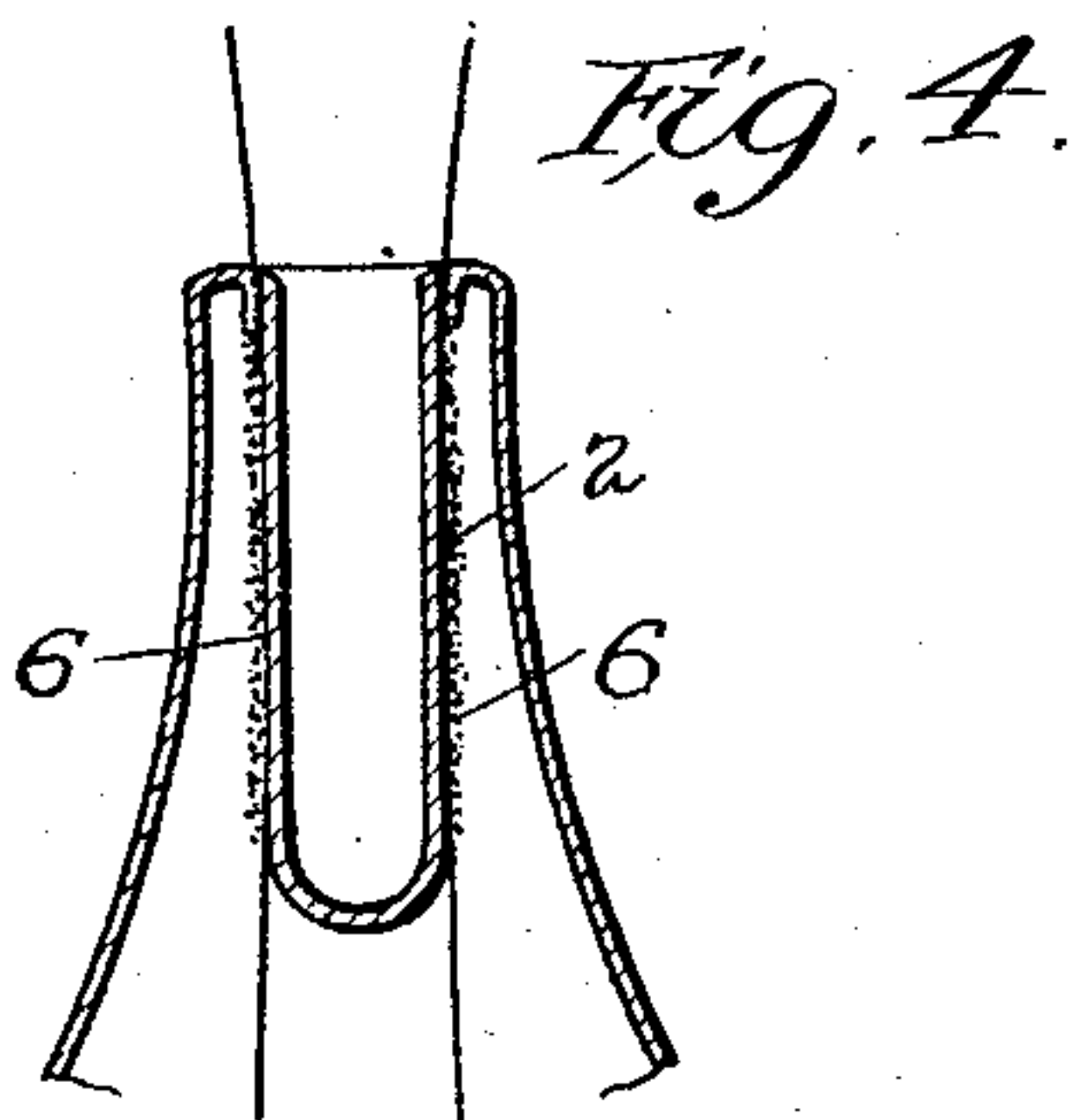
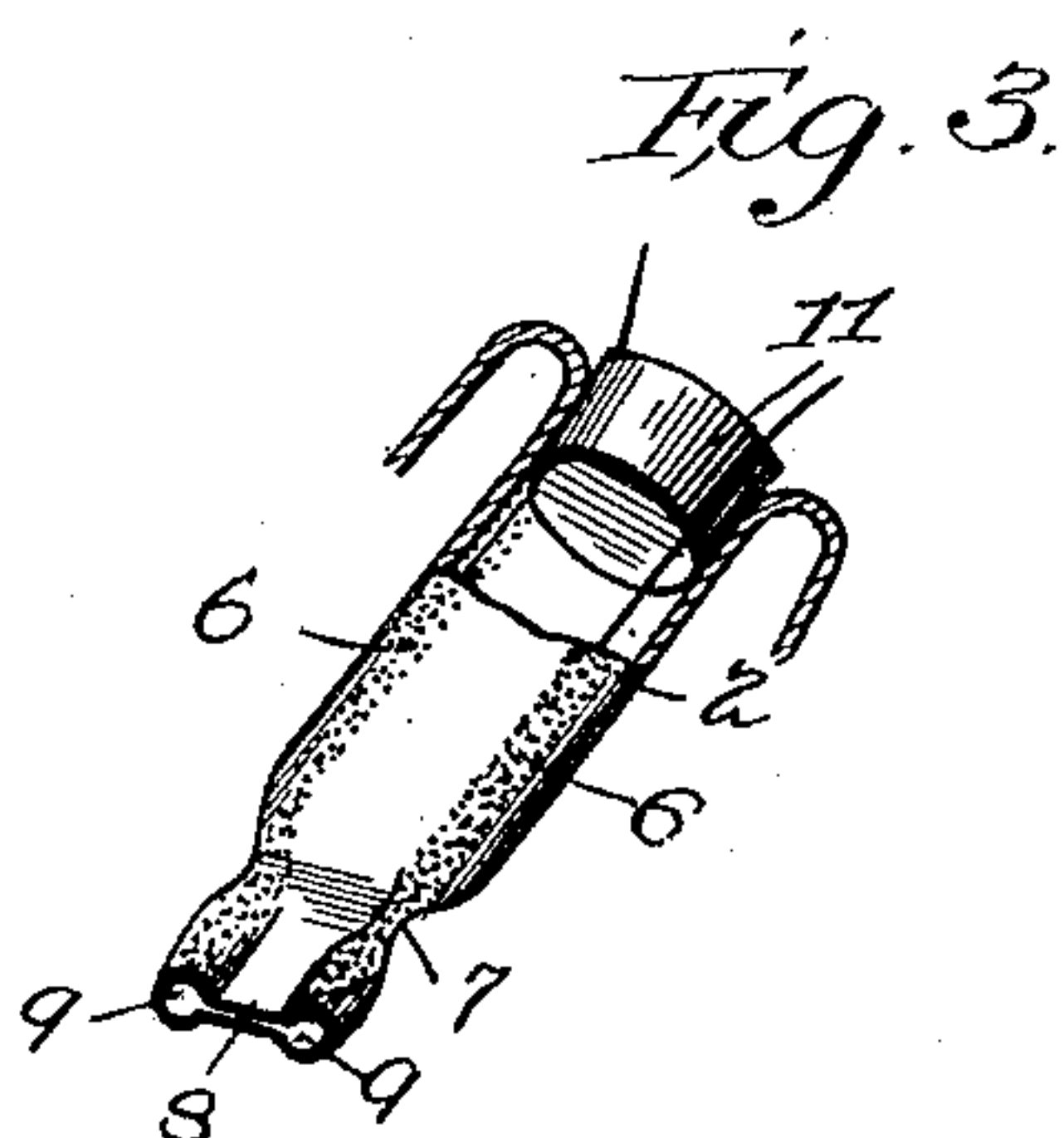
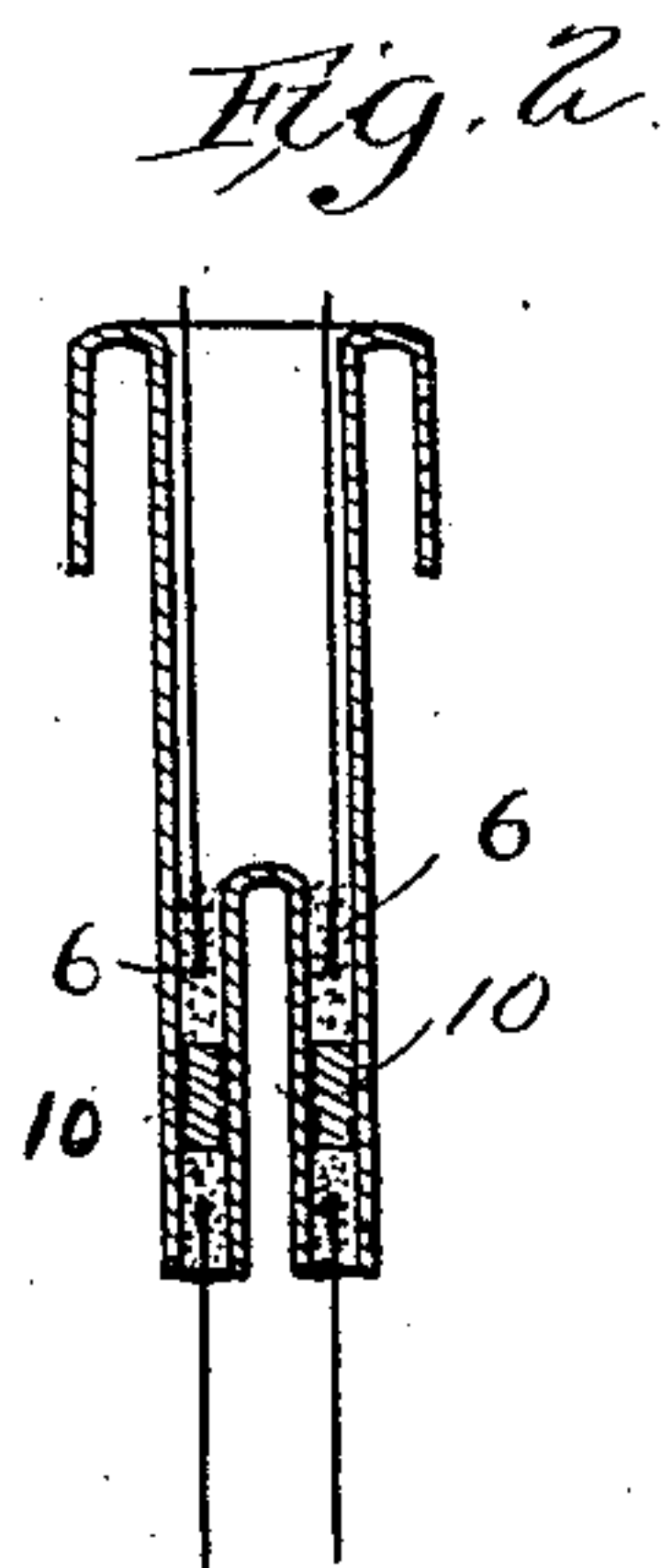
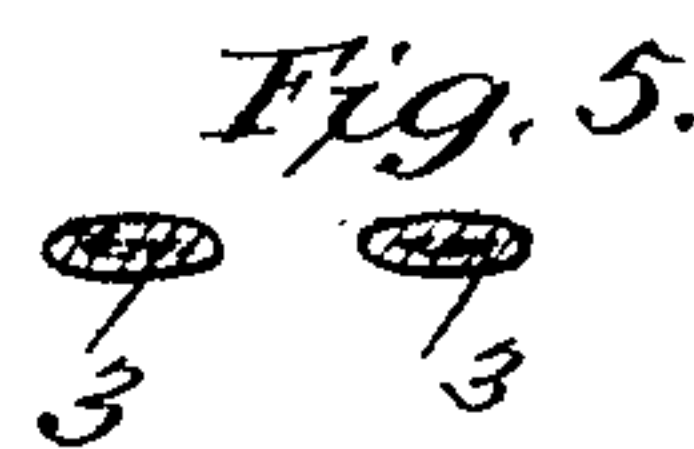
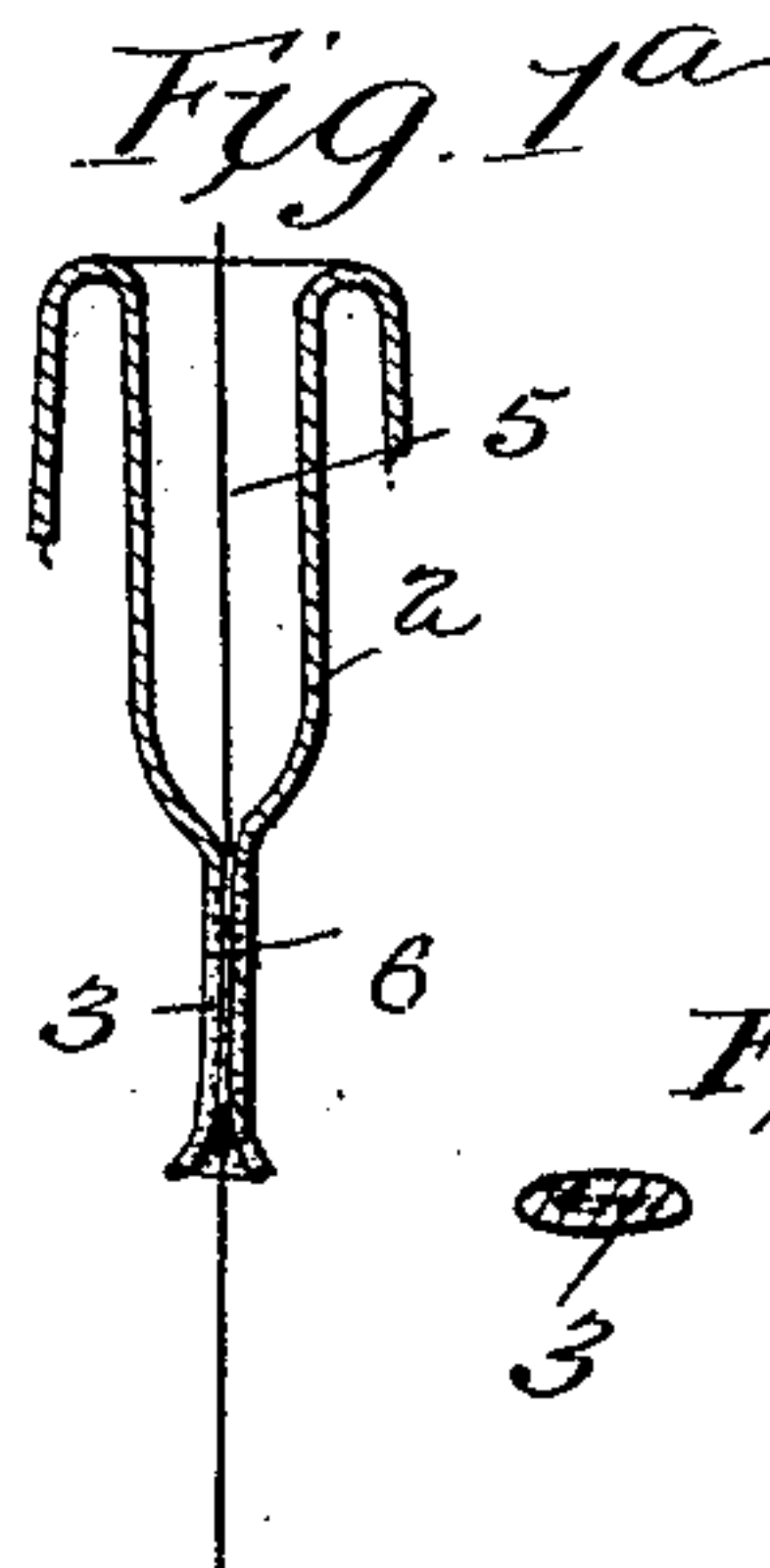
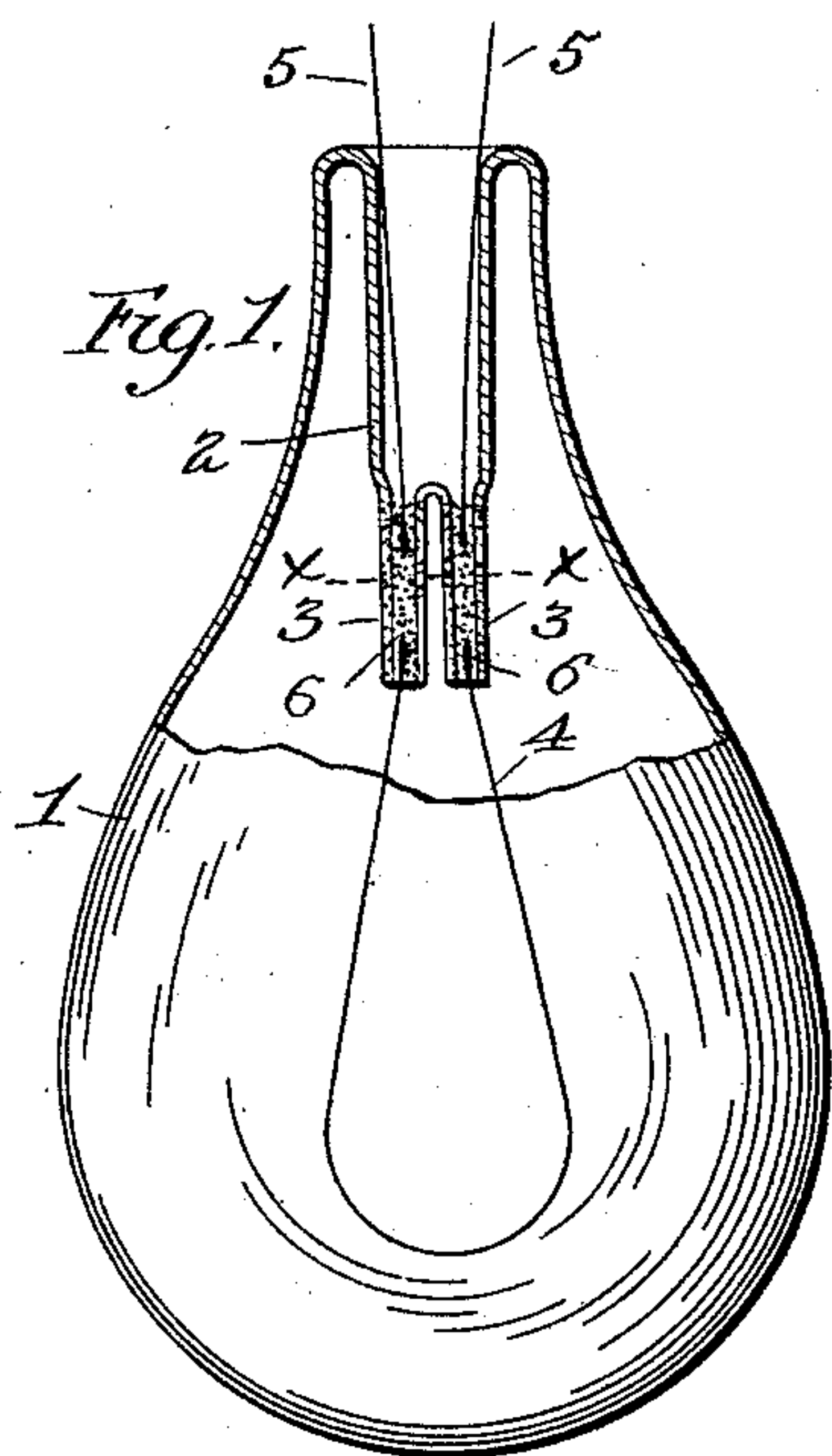


(No Model.)

E. POLLARD.  
INCANDESCENT ELECTRIC LAMP.

No. 485,478.

Patented Nov. 1, 1892.



Attest  
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Inventor  
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by Ellis Spear

Att'y.



# UNITED STATES PATENT OFFICE

EDWARD POLLARD, OF CAMBRIDGE, MASSACHUSETTS; MARTHA W. POLLARD ADMINISTRATRIX OF SAID EDWARD POLLARD, DECEASED.

## INCANDESCENT ELECTRIC LAMP.

SPECIFICATION forming part of Letters Patent No. 485,478, dated November 1, 1892.

Application filed March 2, 1892. Serial No. 423,509. (No model.)

*To all whom it may concern:*

5     Bet it known that I, EDWARD POLLARD, a citizen of the United States of America, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Electric Conductors and Method of Making the Same, of which the following is a specification.

10    The object of my invention is to provide a simple and improved means for conducting electricity for electric lighting and other purposes.

15    The invention is particularly adapted for use in connection with incandescent electric lamps, and I have described it in connection with such a lamp and illustrated it in the accompanying drawings, in which—

20    Figure 1 is a central vertical section of a lamp embodying my invention. Fig. 1<sup>a</sup> is a detail of the same. Figs. 2, 3, and 4 are modifications. Fig. 5 is a section on line *xx* of Fig. 1.

25    In the drawings, 1 represents the globe of an incandescent electric lamp of the ordinary or any desired construction, and 2 a short section of tube formed within or united to the neck of the globe and hermetically sealed in the ordinary manner.

30    3 3 represent the glass tubes which support the carbon filament 4 and through which electrical connection is made with the conducting-wires 5 5, as hereinafter described.

35    Heretofore, so far as I am aware, the only practical manner of connecting the filament with the conducting-wires has been by means of short sections of platinum wire passing through the tubes, which are compressed around the wires while the glass is hot to form a seal to prevent the admission of air to the bulb or globe. This method is not satisfactory however, as it is difficult to maintain a perfect seal for any considerable length of time between the wires and glass. I have  
45    found that by depositing upon glass a line of silver, gold, platinum, or other metal in powdered form and then heating the glass sufficiently to cause the metal to adhere to it the line of minute particles thus united with or  
50    embedded in the surface of the glass will form

a conductor for the electric current. In embodying this principle in a lamp, as shown in Fig. 1, I find it desirable to coat the interior surface of the tubes 3 3 with size suitably adapted for the purpose, and upon this size 55 sprinkle or deposit fine silver powder, after which the tubes are heated sufficiently to cause the particles of silver to adhere firmly to the glass, the size serving to hold the powder in position upon the glass until the glass 60 is raised to the temperature necessary to cause the powder to adhere thereto or become embedded therein. While the glass is hot I pinch or compress each tube until its opposite walls come in contact and become welded together, 65 Fig. 1<sup>a</sup>, thus forming a seal, which will maintain a vacuum in the globe when the air therein has been exhausted. The ends of the carbon filament can be attached within the ends of the glass tubes by any of the carbon pastes well 70 known to those skilled in the art or may be held by any of the plating processes so well known. The conducting-wires 5 5 may be connected by cold-pinching them within the tubes 3 3, having the wire in contact with the silver, as 75 shown in Fig. 1. In a lamp thus formed the minute particles of silver or other metal unite with or become embedded firmly in the glass, and the seal formed by pinching the tube and forcing its opposite faces together while the 80 glass is hot is perfect and all liability of the entrance of air is removed. At the same time the silver particles thus united with the glass form a conducting connection between the conducting-wires and the carbon filament. 85 Instead of sealing the tubes 3 by pinching, as shown in Fig. 1, a pin 10, of solid glass, called "cane," may be inserted into each tube, as shown in Fig. 2, after the silver has been fused in place, and the inner walls of the tube 90 welded by heat upon the cane.

In Fig. 3 I have shown a modification in which the smaller tubes 3 3 are dispensed with. The tube 2 has formed within it upon sides opposite to each other two strips or de- 95 posits of silver 6 6, extending the entire length of the tube. The tube is pinched together near its lower end, as at 7, to form the seal, and the portions of the end of the tube between the strips of silver are also compressed, 100



as at 8, thus leaving two recesses or indentations 9 9, into which the ends of the filament may be secured in contact with the silver, as above described. The conducting-wires are placed within the upper end of the tube, as shown, and are held in contact with the silver on each side by a non-conducting plug 11. Instead of placing the deposits upon the inside of the tube 2, I may, if desired, form the tube 2 closed at one end and apply the silver or other metal upon the outside, as shown in Fig. 4, the conductor in this case passing through the joint between the tube and the neck of the bulb or globe which forms the seal. When this form is used, the wires and filaments are attached to the strips 6 upon the outer side of the tube by any suitable means, the walls of the tube intervening between the ends of the wire to serve as a non-conductor.

It will be understood that though I have described silver as the conductor used almost any metal may be used. I prefer silver, as it is easily reduced to a fine powder. I find the best method of doing this to be to dissolve the silver in nitric acid and then suspend pieces of copper in the solution to cast down the silver in a very fine powder. Upon removing the silver from the bottom of the solution it should be washed thoroughly and passed through a very fine sieve. If desired, the metal may be applied in the form of a very thin leaf instead of powder. The size used to attach the dust or powder to the glass may be made by mixing together copaiba balsam (two parts) and fir balsam, (one part,) or any of the othersizes may be used, as desired.

I claim as my invention—

1. The herein-described method of forming a conducting-seal for incandescent lamps, consisting in depositing powdered silver or other metal upon the filament-supporting tube or tubes, heating the glass to cause the metal to become fused upon or embedded in the glass, and then bringing the adjacent edges of the glass together while hot to form the seal, substantially as described.

2. The described method of forming a conducting-seal for incandescent lamps, consist-

ing in depositing metallic powder or leaf upon the interior of the filament-supporting tube or tubes, heating the glass to fuse the powder or leaf thereon, and finally pinching the walls of the tube together while hot to form the seal, substantially as described.

3. The described method of forming a sealed conductor for incandescent lamps, consisting in depositing two lines of metallic powder or leaf upon the interior of the filament-supporting tube or tubes, heating the glass to cause the powder to adhere thereto, pinching the lower portion of the tube while hot to form the seal, and compressing the portion of the tube between the strips of powder to form seats or recesses for the ends of the filament, substantially as described.

4. The described method of forming a sealed conductor for incandescent lamps, consisting in painting a line of size upon the tube or tubes, depositing thereon powdered silver, heating the glass to cause the powder to adhere thereto, and uniting the opposite faces of the glass while hot to form a seal, substantially as described.

5. In combination with the filament-supporting tube closed to form a seal, two bands or deposits of silver or other metal upon said tube, extending through the seal and forming an electrical connection between the filament and conducting-wires, substantially as described.

6. In combination with the sealed supporting-tubes 3 3 of an incandescent lamp, a filament supported in the lower ends thereof, conducting-wires leading to the upper portions of said tubes, and a conducting medium for conveying the current from the conducting-wires to the filament, consisting of powdered silver or other metal within the tubes and extending through the seal, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD POLLARD.

Witnesses:

C. H. WELCH,  
WM. E. JEWELL.