T. A. EDISON.

Method of Manufacturing Electric Lamps.

No. 230,255. Patented July 20, 1880.

Fig. 5.

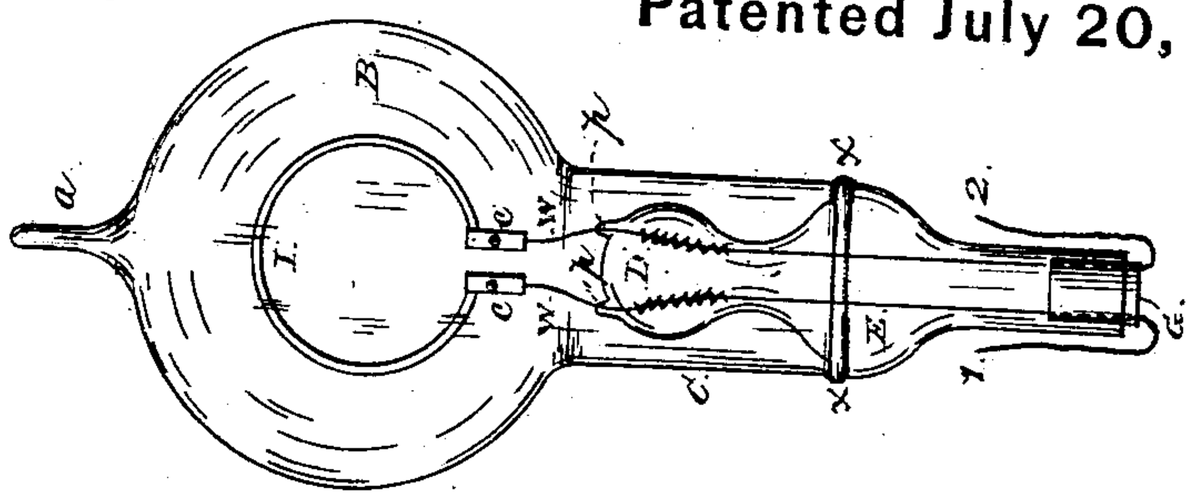


Fig. 4.

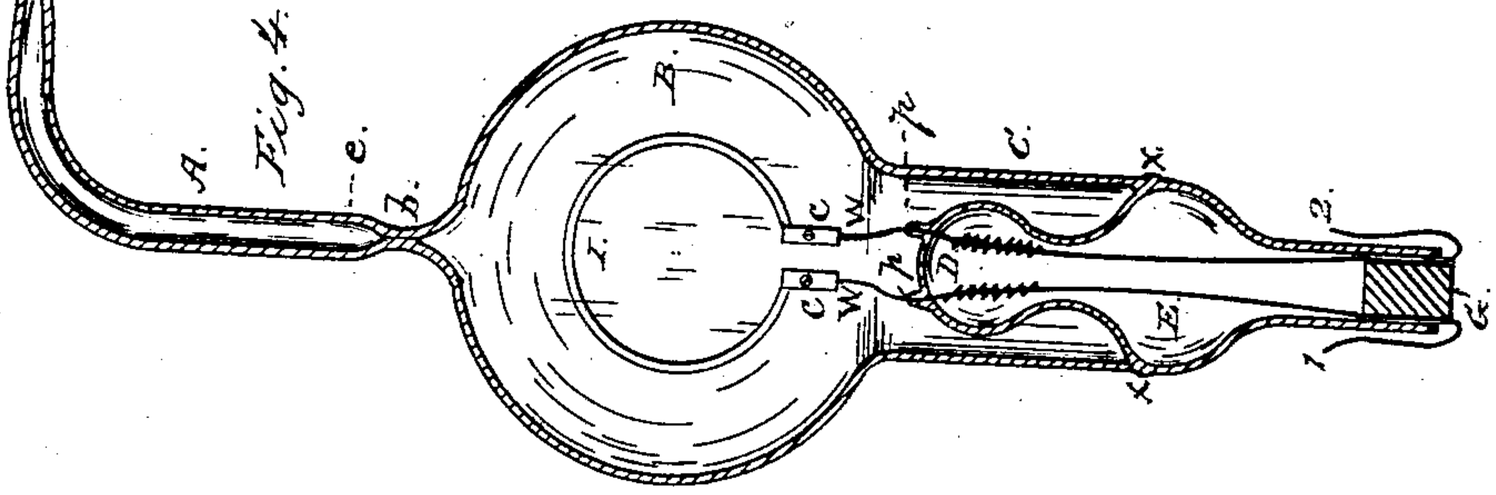


Fig. 3.

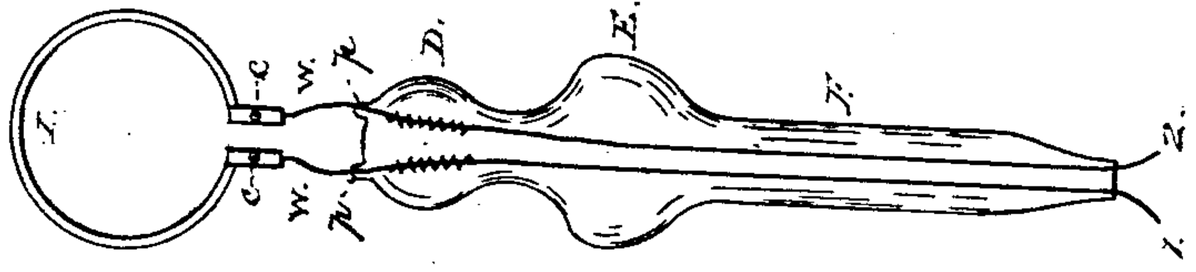


Fig. 2.

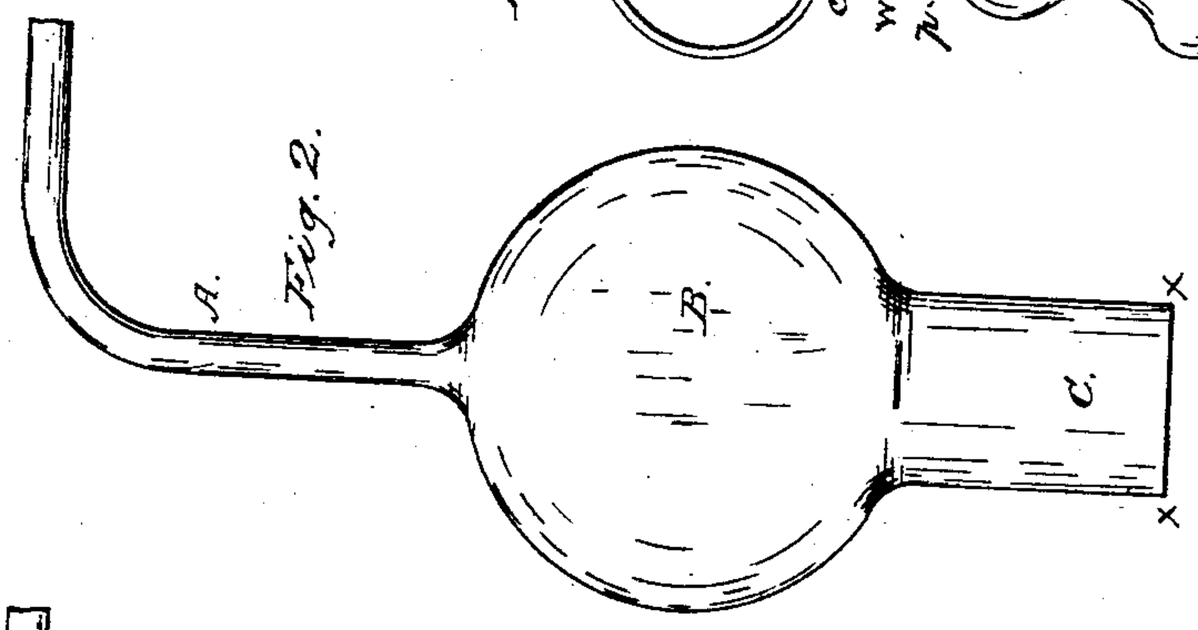
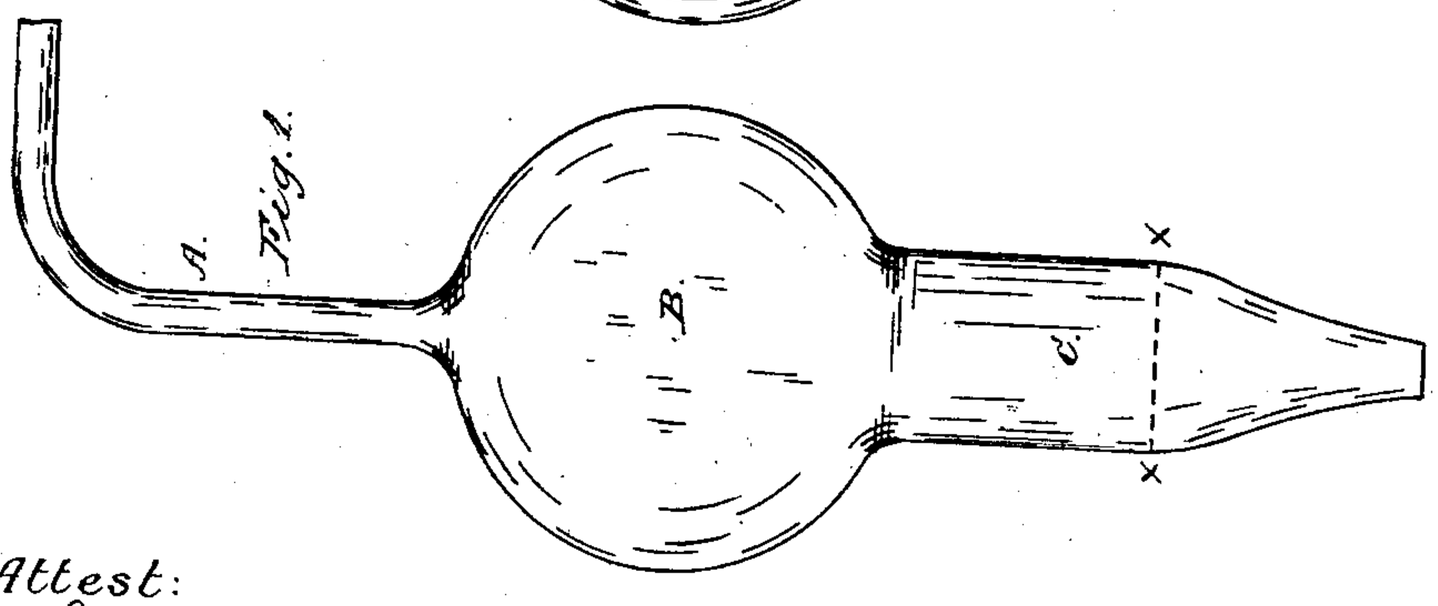


Fig. 1.



Attest:

James A. Payne.

John C. Schroeder

Inventor:

H. A. Edison

per Dyer & Wilbur

his Atty's.

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY.

METHOD OF MANUFACTURING ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 230,255, dated July 20, 1880.

Application filed February 5, 1880.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, resident at Menlo Park, State of New Jersey, have made certain new and useful Improvements in Electric Lamps and the Method of Manufacturing them, of which the following is a specification.

My electric lamp consists, essentially, (as shown in prior applications of mine for patents,) of an incandescing conductor of high resistance hermetically sealed in a glass vacuum-chamber.

Great difficulty has always been experienced in so sealing a glass vacuum globe or chamber that complete union of the parts was had and danger of opening or separation avoided, in order that a stable vacuum might be maintained when the parts forming the seals were *in vacuo* when the sealing was done. In fact, the maintenance of a stable vacuum has been pronounced impossible by many scientists.

The object of my invention is to furnish a method of manufacturing electric lamps so that a stable vacuum may be maintained therein.

In carrying out my method of manufacture, a glass bulb, of the size desired for the inclosing-globe of the lamp, is formed with a supporting-neck extending in one direction, of a diameter sufficient to permit the passage of the incandescing conductor through it. Preferably a piece of tubing, of the size of the neck, has the bulb blown in it. Upon a point on the bulb, preferably exactly opposite the center of the neck, is formed a long tube for attachment of the bulb to the air-exhausting apparatus.

Upon the end of a smaller piece of tubing a small bulb is formed, and the body of the tube, a little below the bulb, is enlarged for a small space to about the size of the supporting-neck. This portion forms the arc-supporting part, wires, terminating in clamps for holding the conductor, being passed therethrough and hermetically sealed therein. After the conductor has been secured on the supporting portion it is passed up through the neck of and into the bulb until the farther passage of the supporting portion is stopped by the enlargement thereon taking against the end of the neck of the bulb, when the two are sealed together at that point by fusion.

The mechanical construction of the lamp being now complete, it is attached, by the neck before mentioned, to the air-exhausting pump. When a proper vacuum has been attained the end of the tube is softened and sealed, after which the lamp is removed from the pump. The tube is then softened and sealed near its point of juncture with the globe, as the neck was before sealed at the tip. There is the same degree of vacuum upon both sides of this last seal—*i. e.*, within the globe and in the tube between it and the tip. The vacuum in the neck is then destroyed by fracture of the neck, and the neck is again softened and sealed immediately above the seal which was formed at the juncture of the tube and globe, and the surplus portion of the tube removed.

For a more particular description reference is to be had to the drawings accompanying and forming part of this specification, in which—

Figure 1 is a view of the globe, the neck, and tube as first formed. Fig. 2 is a view of the same ready to receive the incandescent conductor and its support. Fig. 3 is a view of the incandescent conductor and its support ready for union with the globe. Fig. 4 is a sectional view of the parts of the lamp joined together and sealed; and Fig. 5 is a view of the completed lamp.

A piece of tubing, the size of C, is taken, on which is blown or otherwise formed the bulb B, whose upper portion is drawn out into the tube A, curved so that several bulbs may be attached to one air-exhausting pump.

The part C is left unchanged in order to form a supporting-neck for the lamp. In forming this tubing, however, the lower end is often drawn out, as shown in Fig. 1. This small end is removed on the line *x x*, leaving the globe, neck, and tube as shown in Fig. 2.

F is a piece of glass tubing, of a size somewhat less than C. Upon its upper end is formed the bulb D, on whose top are drawn out the two wire seals *p p*. Below D the enlargement E is formed in the tube F, its exterior diameter being the same as that of C. Platinum wires *w w*, joined to conductors 1 2, are passed through openings in the projections *p p*, which are then fused by heat around the

wires *w w*, so as to seal the wires hermetically in the glass by seals extending around the wire above the general surface of the bulb D, as clearly shown in the drawings. Clamps *c c* are then attached to the wires, and the incandescing conductor fastened in the clamps.

It is to be here remarked that the clamps or wires within the globe must be of some material not so affected by any influences existing within the globe, where the proper vacuum has been attained, as to interfere with the light or its proper dissemination. If iron be used, it is so acted on that it is gradually destroyed, with an ensuing deposit on the glass, obscuring the transparency of the globe, and also acting on the carbon, uniting with it, and finally destroying it. In order to prevent this and to guard against any injurious influences whatever, the clamps *c c* and wires within the globe should be of platinum or some metal or metals of the platinum group, treated by the process described by me in an application for a patent now pending.

The arc I and bulb D are inserted in the neck C until the end *x x* of the neck C rests upon the enlargement E, when the two are securely and hermetically there joined by fusion of the glass at that point. The lamp is then attached, by the tube A, to an exhaust-pump. When the proper degree of exhaustion has been reached the tube A is sealed by fusion of glass at *d* and removed from the pump, whereupon a seal, *b*, is made in the tube A, immediately above the globe B. This last sealing is made entirely *in vacuo*, and the degree of vacuum in B and in A, between *b* and *d*, is the same. I have found, however, that a perfect seal cannot be made when all the portions of the glass which unite to form the seal were in a vacuum when the seal was made. Hence the seal *d* of the tube A is now broken off, admitting air in A above *b*. A is now sealed by fusion at *e*, or A may be broken off at *e*, and a drop of molten glass placed thereon to form the seal. The seal *a*, Fig. 5, is now the resultant of two sealings—one at *b in vacuo* and one at *e* in air.

I have found that such a seal is lasting under all conditions, and that by the method here indicated a globe is so constructed and sealed that a vacuum perfectly stable is maintained therein.

The wires 1 2, for attachment to devices for completing the circuit, pass out of the end of the tube F, in order to prevent their accidental crossing or displacement. A plug, G, of cork, plaster-of-paris, or other insulating material, is put in the end of F, securing the wires therein.

What I claim is—

1. The method of forming electric lamps, substantially as set forth, consisting in separately forming the inclosing-globe and the supporting-bulb for the incandescent conductor, attaching the wires and incandescent conductor thereto, and then hermetically uniting the parts prior to the formation of the vacuum, substantially as herein described.

2. The method of hermetically sealing a vacuum-chamber, substantially as described, which consists in first sealing *in vacuo* and then sealing in air, substantially as described.

In testimony whereof I have hereunto affixed my signature this 28th day of January, A. D. 1880.

THOS. A. EDISON.

Witnesses:
C. P. MOTT,
S. D. MOTT.