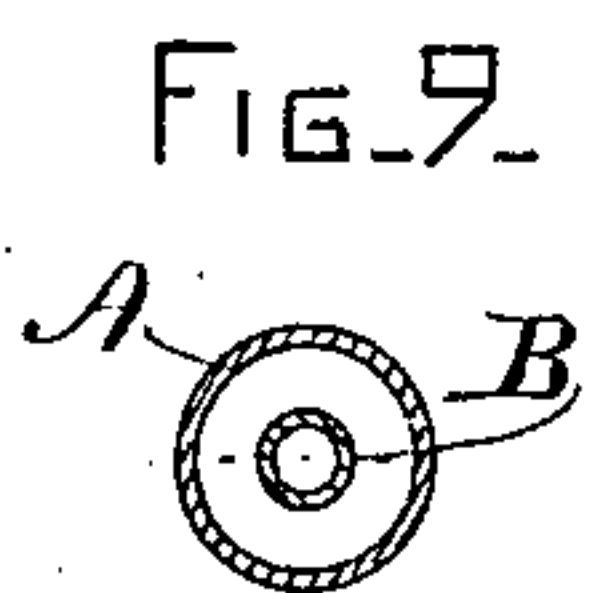
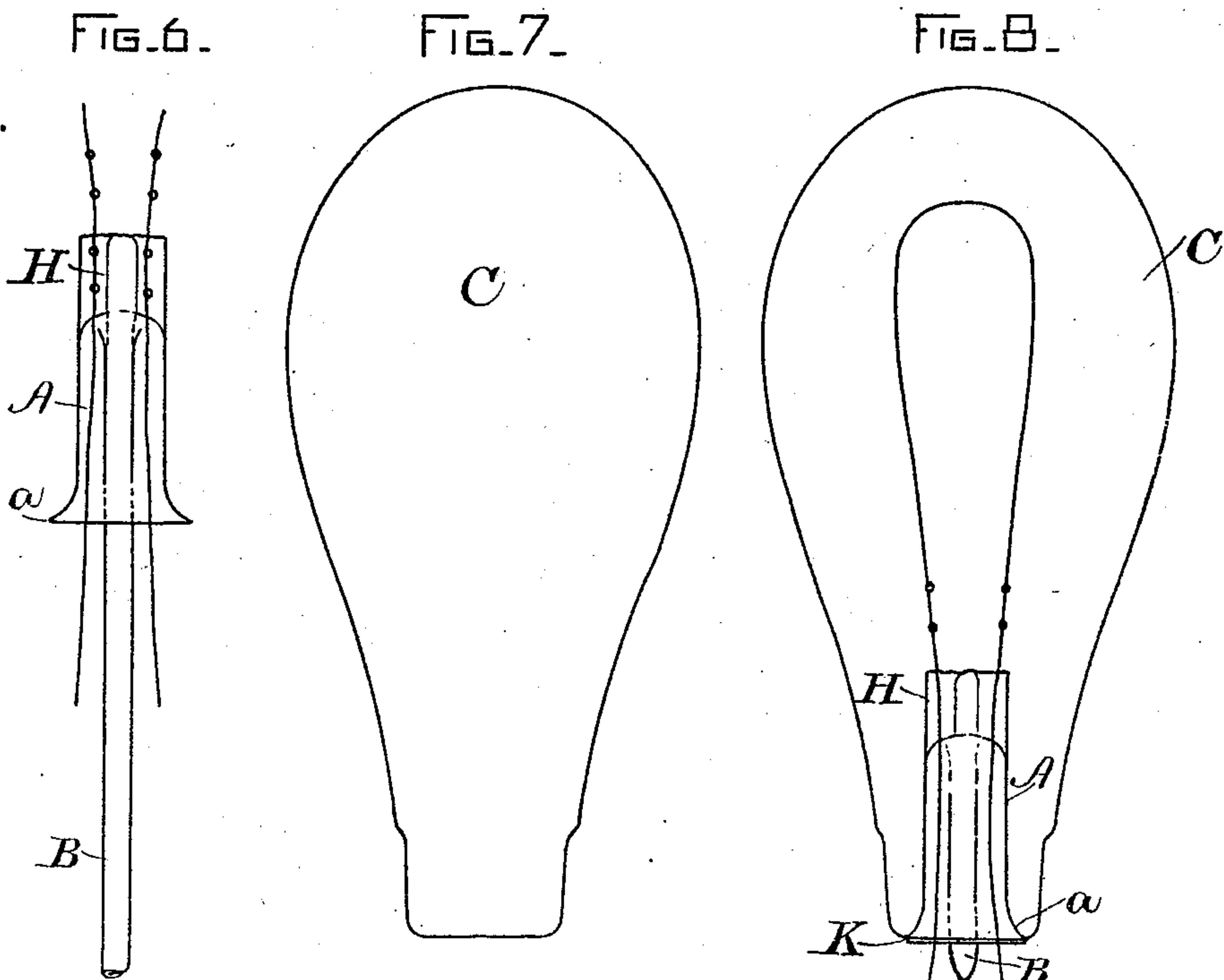
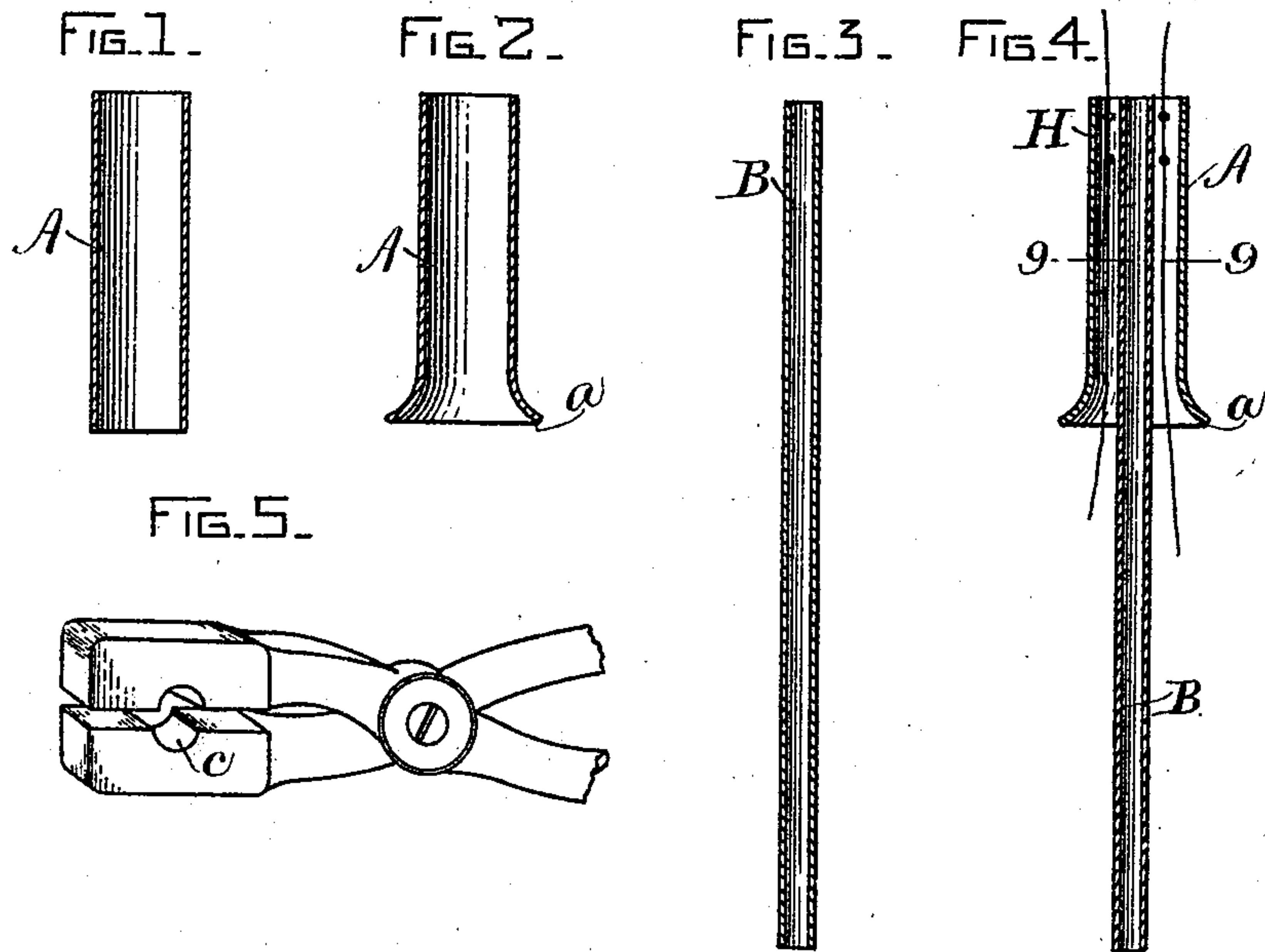


(No Model.)

2 Sheets—Sheet 1.

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INCANDESCENT LAMP AND METHOD OF MANUFACTURING SAME.
No. 516,800. Patented Mar. 20, 1894.



WITNESSES.

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Henry D. Burnett and
Samuel E. Doane by
Bentley and Blodgett
Attys.

(No Model.)

2 Sheets—Sheet 2.

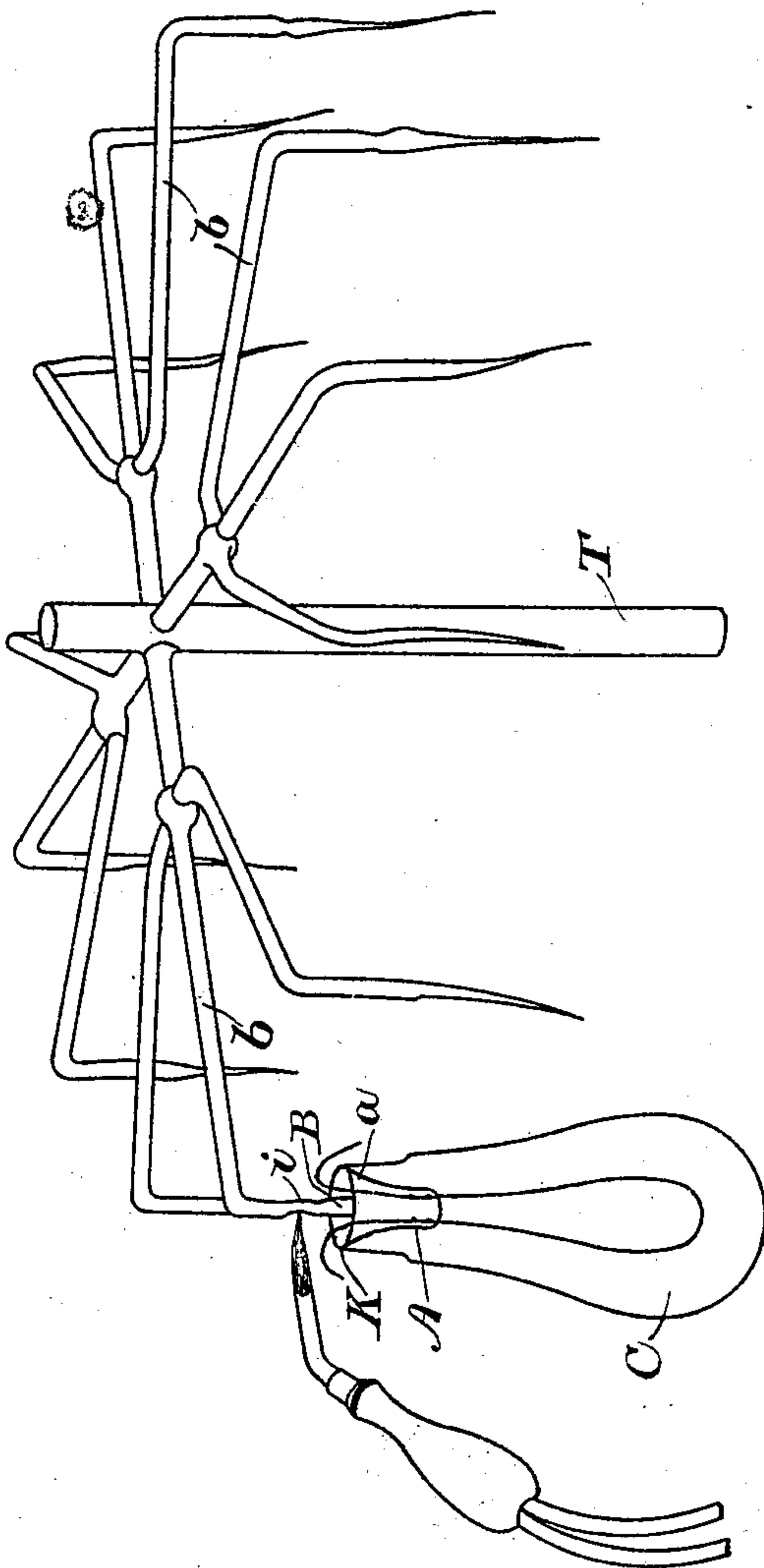
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FIG. 10—



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UNITED STATES PATENT OFFICE.

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CHUSETTS.

INCANDESCENT LAMP AND METHOD OF MANUFACTURING SAME.

SPECIFICATION forming part of Letters Patent No. 516,800, dated March 20, 1894.

Application filed March 17, 1893. Serial No. 466,506. (No model.)

To all whom it may concern:

Be it known that we, HENRY D. BURNETT, residing at Lynn, in the county of Essex, and SAMUEL E. DOANE, residing at Swampscott, in the county of Essex, State of Massachusetts, citizens of the United States, have invented certain new and useful Improvements in Incandescent Lamps and Methods of Manufacturing the Same, of which the following is a specification.

Our invention relates to incandescent electric lamps and their manufacture, more particularly to the manufacture of the glass part of such lamps, including their exhaustion and the connecting to them of the leading-in wires which convey current to the inclosed filament; and has for its objects to cheapen the labor cost of such lamps and to improve their appearance by giving them a smooth contour, pear-shaped spherical or globular shaped, having no protuberance upon the body of the bulb. To these ends we change the location of the ordinary tubular connection, providing for exhausting the air from the globe. This tubular connection is generally made upon the round surface of the globe opposite the middle or bend of the filament; a small glass tube being usually sealed to this part of the lamp, the operation being known among manufacturers as "tubulating." It is one of the operations requiring skill and experience on the part of a gas blower to prevent the collapse or deformation of the bulb by improper heating or by unskilled manipulation after it has been heated. It also requires dexterity to connect this small exhaust tube so that the protuberance upon the lamp bulb, when the lamp is sealed off, shall be exactly central. These operations requiring delicacy and skill (and being therefore expensive), we avoid by our improved process; moreover, the objectionable protuberance upon the bulb is not found and the lamp has a smooth surface. To attain these ends, we seal off the lamp from its base or neck. We are aware that this has been proposed and to some extent carried into operation; but our invention differs from all former methods of performing this operation, with which we are acquainted as will be more fully explained hereinafter.

In the accompanying drawings hereby referred to and made part of this specification, we illustrate the means employed in carrying our invention into effect, like letters referring to like parts throughout; and wherein—
Figure 1 is a longitudinal section of a piece of tubing employed in our invention. Fig. 2 is a similar section of the same piece of tubing after the second step of our process. Fig. 3 is a similar section of a smaller piece of tubing to be placed inside of the first; Fig. 4, a similar section of the two tubes with the leading-in wires in place; Fig. 5, a view of an instrument used in sealing the leading-in wires into the glass; Fig. 6 an elevation of the parts shown in Fig. 4 after the seal has been made; Fig. 7, a representation of a lamp bulb before the wires have been inserted; Fig. 8, a representation of the lamp completed and sealed off ready for insertion in its socket; Fig. 9, a cross section upon the line 9, 9, of Fig. 4, and Fig. 10 a representation of the exhausting tube or spider showing one of our improved lamps after the exhaustion has been completed, attached thereto and in process of being separated therefrom.

Referring by letter, A is a short piece of tubing of suitable size, constituting the filament support; this piece of tubing being softened by heat, it is spread out at one end into a flared shape, or in other words, a flange marked *a*, Fig. 2, is formed upon it.

B is a smaller piece of tubing through which the lamp is exhausted.

C is the bulb into which the parts shown in Fig. 6 are to be sealed at the point K, as shown in Fig. 8.

T is the tube leading to the air pumps and shows the point at which the tube is sealed off by the gas flame as shown in Fig. 10.

The operation is conducted as follows: After the flange *a* is formed upon the tube A the small tube B is placed inside it, as shown best in Fig. 4, and the leading-in wires for carrying the filament are passed between the two tubes; the tubes are then softened by heat at the part marked H, and compressed or welded together by the pliers shown in Fig. 5, thus sealing in the leading-in wires effectively, the pliers being provided

with a cut-away portion, *c*, in their jaws to prevent the collapse of the interior tube B; at this stage of the operation the parts appear as in Figs. 6 and 7. The tube A being then
 5 inserted into the lamp bulb the flange *a* and the neck of the bulb are softened in the gas flame in the usual manner and fused together at the point K making a tight joint, but still leaving the tube B open to the interior of
 10 the lamp. This tube is then sealed to one of the tubes *b, b*, as shown in Fig. 10, and after the bulb has been exhausted it is sealed by the gas flame at point *i*.

As a further precaution against the col-
 15 lapsing of the tube B, we may insert in it a rod of carbon or iron or any other suitable substance which would not be affected by the amount of heat necessary to fuse the glass, and which we designate as refractory
 20 material, as compared with glass. In lieu of the solid substance thus described, we may plug the tube full of any comparatively infusible or refractory material which may suffice to hold it open. For this purpose we may
 25 use asbestos thread or asbestos pastes, or graphite held together by any cement which will disintegrate under heat allowing the graphite to be shaken out; or various combinations of calcareous paste, such as plaster
 30 of paris or chalk which under the influence of the heat will soften so they may be shaken or washed out.

In the commercial practice of our invention we have found it advisable to have a clutch
 35 for holding centrally a glass tube and an interior glass tube, together with the leading-in wires, two or more as may be desired; the clutch of course being mounted so that it may be revolved at pleasure. We also provide
 40 means for inserting the rod of carbon or metal as before referred to, in some cases keeping the rod stationary, while the glass revolves, or in others revolving the rod and keeping the glass stationary; we may also advance or
 45 retreat the rod as may be found desirable.

We do not herein illustrate or claim the arrangement of machine adapted to do this work; but we reserve the right by any future application to claim such novelty as may be
 50 found in the construction referred to.

We are aware that lamps may be exhausted through the base in many ways; we therefore do not claim such a method broadly, but

What we claim, and wish to protect by Letters Patent of the United States, is—

1. The method of making incandescent lamps herein set out, which consists in placing the leading-in wires between an inner and outer tube, softening and compressing the ends of said tubes so as to seal in the wires, then
 60 sealing the outer tube to the neck of the lamp, exhausting the lamp by means of the inner tube, and finally sealing off the inner tube.

2. The method of making incandescent lamps herein set out, which consists in placing the leading-in wires between inner and outer concentric tubes, welding together the upper ends of the tubes so as to seal in the wires, sealing the outer tube to the neck of the lamp, exhausting the lamp through the inner
 70 tube and finally sealing off such inner tube.

3. The method of making incandescent lamps herein set out, which consists in forming a flange upon a piece of tubing, placing inside of such tubing a smaller tube, inserting leading-in wires between the tubes, sealing the tubes together around the wires while maintaining the inner tube open, sealing the flange upon the outer tube to the base of the bulb, exhausting the lamp through and seal-
 80 ing off the smaller tube.

4. The method of making incandescent lamps herein set out, which consists in filling a tube with refractory material, placing outside thereof a second tube, placing leading-
 85 in wires between the tubes and sealing them together, removing the refractory material, sealing the outer tube to the neck of the lamp, exhausting the lamp through and then sealing off the inner tube.

5. The method of making an incandescent lamp herein set out, which consists in forming a flange upon a piece of tubing, placing in such tubing another tube containing refractory material, placing leading-in wires be-
 95 tween the tubes and sealing them together, removing the refractory material, sealing the flange to the base of the bulb, exhausting the lamp through and sealing off the inner tube.

In witness whereof we have hereunto set
 100 our hands this 14th day of March, 1893.

HENRY D. BURNETT.
 SAMUEL E. DOANE.

Witnesses:

JOHN W. GIBBONEY,
 BENJAMIN B. HULL.