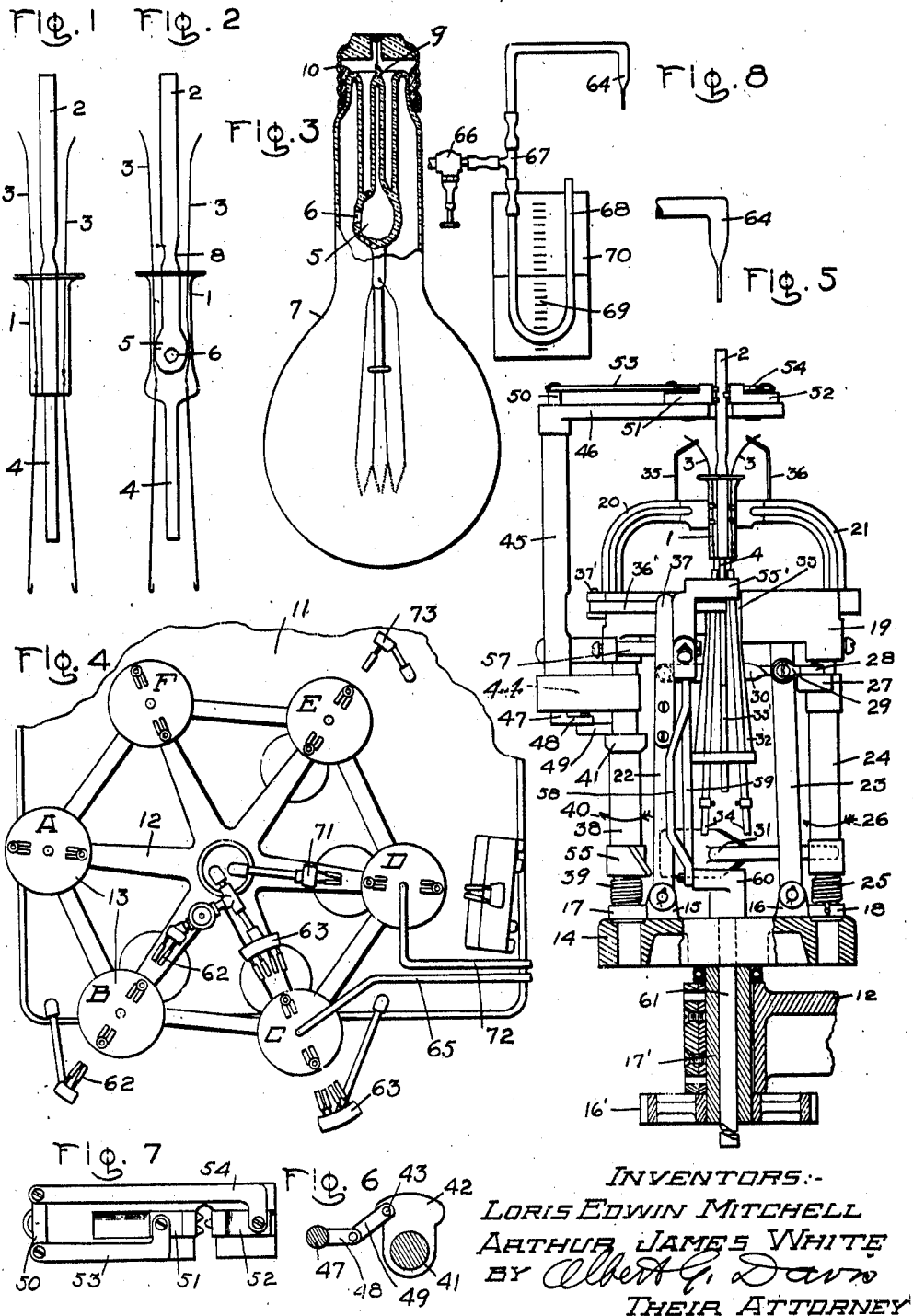


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 TIPLESS INCANDESCENT LAMP AND SIMILAR ARTICLE.
 APPLICATION FILED MAR. 20, 1919.

1,423,956.

Patented July 25, 1922.



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TIPLESS INCANDESCENT LAMP AND SIMILAR ARTICLE.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, LORIS EDWIN MITCHELL and ARTHUR JAMES WHITE, citizens of the United States, residing at Cleveland, county of Cuyahoga, State of Ohio, have invented certain new and useful Improvements in Tipless Incandescent Lamps and Similar Articles, of which the following is a specification.

10 Our invention relates to so-called tipless incandescent lamps and to methods of manufacturing the same. In the manufacture of ordinary incandescent lamps, the bulb is perforated at the larger end and a tube is sealed over the perforation so as to allow subsequent exhaust of the air from the bulb. The step of attaching this tube is called "tubulating". The tip is a pointed projection which remains after the aforesaid tube has been fused off to close the opening in the bulb after the exhausting operation is completed. Beyond functioning as a closure, the tip is not useful but, on the other hand, is objectionable not only because it is unsightly, but also because it obstructs the transmission of light from the lamp. In some types of lamps, such as those made from opal or colored glass, tubulating and sealing off injure the color around the tip.

20 Many attempts have been made to eliminate the tip but none of them has resulted in an effective commercial method of its accomplishment. In some cases it has been attempted to attach the exhaust tube to the bulb neck. One of the objections to this method is that it produces a lamp which is difficult to handle and causes a high percentage of breakage. Difficulty is also experienced in attaching the base to such a lamp. According to our invention the exhaust tube is attached to the stem tube which serves to carry the filament mounting and the leading-in wires. While attempts have been made to do this heretofore, none of them has met with a high degree of commercial success for the reason that the aperture through which the exhaust tube has been connected with the interior of the bulb has not been properly disposed nor have the methods of its formation been efficient in preventing strain in the glass and in avoiding injury to the mounting for the leading-in wires and other parts of

the lamp. Moreover, certain of these prior methods have been incapable of application to the metal filament lamp which comprises a filament supporting rod fused to the top of the stem tube. It is also the fact that prior methods for producing tipless lamps have been essentially hand methods and have not lent themselves to the use of labor-saving machinery.

According to our invention, the exhaust tube is joined to the stem tube at the inner end thereof. In this specification, the expression "inner end" is used with reference to the stem to indicate that end of the said tube to which the filament support is attached and in which the leading-in wires are sealed, while the expression "outer end" indicates the end which is united to the bulb. The corresponding ends of the exhaust tube are similarly designated. The aperture or passage through which the exhaust tube communicates with the interior of the bulb is preferably lateral or transverse with reference to the stem tube and thus allows the mounting of a filament supporting rod at the top of the stem. Such passage is preferably formed by applying air pressure to the mass of fused glass which is formed around the inner end of the exhaust tube during the operation of sealing-in the leading-in wires and immediately thereafter. The customary method of sealing in these leading-in wires is to extend them through the stem tube, to fuse the inner end of the stem tube, and to compress by clamping the fused glass around the said wires. This results in a flat, solid mass of glass at the inner end of the stem tube. When this method is applied in connection with our invention, the inner end of the exhaust tube is fused at the same time as the inner end of the stem tube and is clamped with the latter. Sufficient air pressure is applied through the exhaust tube and, preferably, additional heat is supplied to thoroughly fuse the glass around the inner end of the exhaust tube, and this causes the mass of glass to swell and become bulb-shaped. As the air pressure is continued, a passage is blown through the glass at the point of least resistance, which passage is at an angle to the flat surface of the clamp portion and usually substantially normal there-

to. Inasmuch as the plane of the leading-in wires is in the direction of the flat surface, the passage is formed between them and does not interfere with their seal.

5 A notable result of our method is the elimination of strains in the glass adjacent to the exhaust tube union. This is due to the distribution of the glass by the blowing operation and also the completeness of the union
10 between the exhaust tube and the stem tube.

Our method results in a very low percentage of cracked seals and is commercially reliable.

In certain cases, it may be desirable to
15 supply air pressure through the exhaust tube during the fusing and clamping operation so as to prevent, to a certain extent, the collapse of the walls of the exhaust tube. This will cause the passage to be later blown
20 at a point closer than otherwise to the inner end of the seal. In most cases however, this supplemental blowing operation is unnecessary.

The pressure of the air supplied through
25 the exhaust tube should be sufficiently low to prevent too quick a blow out and to allow a gradual spreading of the glass to form a bulb-shaped thin-walled rather than a narrow thick-walled orifice or passage. The
30 low pressure accomplishes this by keeping the exhaust tube against the stem tube thus securing a thorough fusion of the glass which is then blown thin until it blows out at some point to form an aperture. The amount of
35 pressure is a matter which can be determined by trial. It has been found in certain cases that when too great a pressure was applied, a narrow passage and small aperture resulted probably due to imperfect fusion of the glass.
40 We have hereinafter set forth specifically a pressure which we have found suitable for stems to be used in 75 watt lamps and also a convenient means for gauging this pressure.

45 Various other advantages and features of our invention will appear from the detailed description which follows and from a reference to the accompanying drawing.

Fig. 1 is an elevation showing the way in
50 which the parts of the stem are preliminarily assembled according to our invention; Fig. 2 is a front elevation of the finished stem made according to our invention; Fig. 3 is an elevation partially in section of a
55 lamp made according to our invention, the section being in a plane normal to that of Fig. 2; Fig. 4 is a fragmentary top plan view of a machine by means of which our invention may be practiced; Fig. 5 is a
60 front elevation of the holder for the rotating head which serves to hold the stem parts; Fig. 6 and Fig. 7 are sectional views of details thereof; and Fig. 8 is a diagram showing means for gauging pressure.

65 Referring now to the Figs. 1, 2 and 3 in

the drawing, the stem tube 1, exhaust tube 2, the leading-in wires 3 and the filament support rod 4 are assembled as shown in Fig. 1 with the exhaust tube between the leading-in wires and the inner end thereof substantially in line with the inner end of the stem tube. In types of lamps requiring a filament support rod the latter is included as shown, with its end substantially abutting against the end of the exhaust tube so as to allow
70 all these parts to be fused together. The application of a flame results in the formation of a mass of fused glass and this glass is compressed in a direction substantially normal to that of the plane of the leading-in
80 wires. During this fusing and clamping operation, it may be desirable to introduce air pressure through the exhaust tube 2 to overcome, to a certain extent, the tendency of the walls to collapse. In any event, air
85 pressure is introduced after the clamping operation and it is preferable to preliminarily and simultaneously apply heat adjacent to the clamped portion. This results in a formation of the stem such as shown in
90 Figs. 2 and 3 in which the end of the exhaust tube 2 merges into that of the stem tube 1 and in which a substantially bulb-shaped portion 5 is formed communicating by a passage or aperture 6 with the interior
95 of the lamp bulb. After the formation of the stem, as shown in Fig. 2, it may be introduced in the usual manner into a lamp bulb 7 and the bulb exhausted according to the usual practice, being sealed off after the
100 exhaust at the contraction 8. The exhaust may be accomplished in any of the ordinary machines which are used in lamp factories for this purpose. Afterwards, the lamp may be based and otherwise handled in the usual
105 manner. As shown in Fig. 3, the bulb 7 is tipless, the seal 9 in the exhaust tube 2 being covered up by the base 10.

In Figs. 4, 5 and 6, is illustrated an apparatus by means of which our invention
110 may be practiced although it is obvious it may also be practiced by hand. So-called stem making machines have been in use for a long time in lamp factories and our invention does not contemplate any change in
115 these machines beyond the addition of such attachments as may be necessary to incorporate the exhaust tube and to perform the other steps of the method comprised by our invention.

The machine illustrated is of the general type disclosed in Patents 843,750—Feb. 12, 1907—Howell and Burrows and 860,977—
120 July 23, 1907—Howell and Burrows. On the bed 11 is mounted a rotatable frame 12
125 which carries several rotatable heads. In the form shown there are six heads and the position of each represents a separate step in the stem-making operation.

As shown in detail in Fig. 5, each rotatable
130

head 13 consists of a base 14 with the pivot projections 15 and 16. The head is rotated by power applied to gear 16' fastened through the tubular shaft 17' to the base 14. The shaft 17' is held in the rotatable table 12. Upon the base 14 are mounted the supporting rods 17 and 18 which carry on their top guide bed 19 in which are slidably held the clamping jaws 20 and 21 which are connected by links 22 and 23 respectively to the pivot projections 15 and 16 respectively. A sleeve 24 mounted on the supporting rod 18 has a spring 25, between its lower end and the base 14, which acts to turn the sleeve in the direction indicated by the arrow 26. At the upper end of the sleeve 24 is a T-shaped collar 27 having a pin on each wing. As shown in the drawing, the pin 28 on the front wing of the collar is connected to the link 23 by a short link 29. The pin on the back wing of the collar is connected to the link 22 by the long link 30. A handle 31 attached to the lower end of the sleeve 24 permits a turning movement to be applied to the sleeve, in the direction opposite to that of the arrow 26 which acts through the collar 27 to actuate links 29 and 23 on the one hand and 30 and 22 on the other to cause clamping jaws 21 and 20, respectively, to be separated to permit the insertion of the stem tube.

A plate 32 carried by the guide bed 19 in a wide vertical slot 33 in the center of the guide bed, supports the metal tubes 34 which hold the lower ends of the leading-in wires 3 so as to be in proper position for making the seal. The upper ends of the leading-in wires 3 are held in supports 35 and 36 mounted respectively on the clamping jaws 20 and 21. The plate 32 also carries a vertical rod 35' which serves to support the filament support rod 4 which is retained in the space between the tubes 34 by a finger 36' pivoted at 37' in the clamping jaw 20 and held against the filament support rod by a spring clip 37 fastened to the vertical link 22.

The supporting rod 17 carries a sleeve 38 resting on the spring 39 tending to turn the sleeve in the direction indicated by the arrow 40. At the upper end of the sleeve is a collar 41 having an arm 42 (Fig. 6) upon which is mounted the pin 43. Above the collar 41 and fastened to the rod 17 is an arm 44 carrying the vertical supporting tube 45 which carries the horizontal arm 46. Extending through the tube 45 is a rod 47 having an arm 48 at its lower end which is connected to the arm 42 through the link 49. To the upper end of the rod (see Fig. 7) is attached a cross bar 50 which is linked at opposite ends with the slidable clamp jaws 51 and 52 through the links 53 and 54 respectively. A turning movement applied to the handle 55 of the sleeve 38 in the direction opposite to the arrow 40, through the

mechanism just described, causes the jaws 51 and 52 to be separated to permit the insertion of the exhaust tube 2.

The glass seal is accomplished by the two clamps 55' (only one of which is shown) pivoted on the pin 57 attached to guide bed 19 and connected through the links 58 and 59 to the collar 60 on the rod 61 which is given an upward motion at the proper point in the rotation of table 12 sufficient to cause the clamps to close upon the fused glass, as hereinafter described.

The assembly of stem parts takes place at position A shown in Fig. 4, the rotatable head 13 not being driven in this position. To begin with, the filament support rod 4 is placed in position; the stem tube 1 is placed between the clamping jaws 20 and 21 with its lower edge preferably in line with the top of the rod 4; the two leading-in wires 3 are extended through the stem tube and into the tubes 34 and the exhaust tube 2 is inserted into the stem tube with its lower end preferably in line with the rod 4 and held by the clamping jaws 51 and 52. At B, the gas jet 62 gives a preliminary heat to the juxtaposed parts of the stem, while the head 13 is rotated. At C, the gas jets 63 fuse these parts and the fused glass is compressed by the clamps 55' to form a solid flat union while the head 13 is rotated.

While in the position C, we preferably direct air under low pressure from the nozzle 64 attached to the pipe 65 into exhaust tube 2, the nozzle 64 being a short distance above the exhaust tube 2 and centered therewith as shown in Fig. 5. This is for the purpose of lessening the tendency of the walls of the exhaust tube to collapse.

Fig. 8 shows in diagram, the means we use for regulating the pressure of the air leaving the nozzle 64. For a nozzle, we preferably use one having a contraction as shown in Fig. 5 and having the small orifice drilled by a number 54 drill. The valve 66 controls the compressed air supply and is attached through a T-shaped connection 67 to the nozzle 64 and to the U-shaped glass tube 68 which is filled with water. A scale 69 is laid out on a cardboard 70 rigidly attached to the tube 68. When the valve 66 is opened the difference in the height of the water in the two arms of the tube 68 is an indication of the pressure of air leaving the nozzle 64.

The head 13 then passes to the position D where it is rotated while the gas jets 71 extend the zone of fusion upwardly to a slight extent. At the same time, low pressure air from a nozzle on pipe 72, positioned similarly to nozzle 64, enters the tube 2 and produces the bulb portion 5. At this point we preferably use a pressure of air sufficient to cause a difference in height of the water in the arms of the tube 68 equal to approxi-

mately 12 to 16 inches. As the bulb portion enlarges, the wall thereof becomes so thin as to blow out. The aperture 6 thereby produced, may occur on either side of the bulb portion 5 as the latter is shown in Fig. 3 but is prevented from occurring elsewhere by the presence of the leading-in wires 3 which cool and prevent the glass immediately adjacent thereto from being blown thin. As soon as the aperture 6 is formed, the head 13 is brought into position E where the flame from gas jet 73 smoothes the edges of the said aperture and anneals the glass of this portion of the stem. However, the head 13 may remain at position D for annealing. Position F is a cooling position and the stem as shown in Fig. 2 is removed from the head in position A and is replaced by a new assembly of stem parts.

The stem thus produced is then subjected to the usual lamp making operations including the insertion of the filament support hooks, the draping of the filament and the final insertion of the mount in the bulb, the neck of the bulb being fused to the flange on the stem. The exhaust of the bulb or the filling thereof with gas may then be accomplished in the usual manner. Upon the completion of this operation, the exhaust tube is fused at the contraction 8 forming the closure 9 which effectually seals the bulb. The attachment of the base 10 and the connection thereto of the leading-in wires is accomplished according to well-established practice.

What we claim is:—

1. The method of glass working which comprises inserting a glass tube into another hollow glass body, applying heat to cause the formation of a solid glass mass closing off the tube and glass body and then forming a passage extending entirely through said mass and communicating with the passage in said tube.

2. The method of glass working which comprises inserting a glass tube into another hollow glass body, applying heat to cause the formation of a solid glass mass closing off the tube and glass body and then introducing gas pressure through said tube to form a passage extending entirely through said mass and communicating with the passage in said tube.

3. The method of glass working which comprises inserting a glass tube into another hollow glass body, applying heat to cause the formation of a solid glass mass closing off the tube and glass body, compressing said mass, and then forming by means of gas pressure a passage extending entirely through said mass and communicating with the passage in said tube.

4. The method of glass working which comprises assembling two tubular glass bodies, one within the other, and at least one

metal wire extending longitudinally of said tubular bodies and therebetween, applying heat to cause the formation of a solid glass mass closing off the tubular bodies and inclosing said wire and then applying gas pressure through the inner tubular body to expand said mass and form a passage extending entirely therethrough and communicating with the passage in said inner tubular body.

5. The method of making incandescent lamps and other sealed devices which comprises the formation of a mass of fused glass at the juxtaposed ends of an exhaust tube and stem tube and then applying gas pressure to form a passage through said mass.

6. A stem comprising a stem tube having an exhaust tube therein, said tubes being fused together at their ends to form a union having therein an apertured bulb portion communicating with said exhaust tube.

7. In an incandescent lamp or other sealed electrical device, a stem tube, leading-in wires extending through said stem tube, an exhaust tube contained within said stem tube and an element uniting the ends of said tubes having sealed therein said leading-in wires and having therein a bulb portion containing an aperture disposed between said leading-in wires.

8. The method of making stems for incandescent lamps and other sealed devices which consists in fusing together a portion of a stem tube and a portion of an exhaust tube to produce a solid mass of glass closing off the said tubes and then forming a passage through said mass communicating with said exhaust tube.

9. The method of making stems for incandescent lamps and other sealed devices which consists in assembling a stem tube and an exhaust tube with the latter inside of the former, fusing together portions of said tubes to produce a solid mass of glass closing off the said tubes and then forming a passage through said mass communicating with said exhaust tube.

10. The method of making stems for incandescent lamps and other sealed devices which consists in assembling a stem tube, an exhaust tube inside of said stem tube and leading-in wires extending longitudinally of said tubes, fusing together a portion of said stem tube and of said exhaust tube to produce a solid mass of glass inclosing portions of said leading-in wires and closing off said tubes and then forming a passage through said mass communicating with said exhaust tube.

11. The method of making stems for incandescent lamps and other sealed devices which consists in assembling a stem tube, an exhaust tube inside of said stem tube, and leading-in wires extending between the said tubes, fusing a portion of said tubes

to produce a solid mass of glass inclosing portions of said leading-in wires and closing off the said tubes and then forming a passage through said mass between said leading-in wires communicating with the said exhaust tube.

12. The method of making stems for incandescent lamps and other sealed devices which consists in assembling a stem tube and an exhaust tube with the latter inside of the former, fusing portions of said tubes together to form a solid mass of glass and then delivering gas pressure through said exhaust tube to expand the mass of fused glass to form a chamber communicating with said tube and to blow an aperture through the wall of said chamber.

13. The method of making stems for incandescent lamps and other sealed devices which consists in assembling a stem tube and an exhaust tube with the latter inside the former, fusing a portion of said stem tube around said exhaust tube, compressing the fused mass and then delivering gas pressure through said exhaust tube to expand the fused mass and to blow an aperture therethrough.

14. The method of making stems for incandescent lamps and other sealed devices which consists in assembling a stem tube and an exhaust tube with the latter inside the former, fusing a portion of said stem tube to form a solid mass of glass closing off said stem tube and said exhaust tube and then delivering gas pressure through said exhaust tube to expand the fused mass and to blow an aperture therethrough.

15. The method of making stems for incandescent lamps and other sealed devices which consists in assembling a stem tube and an exhaust tube with the latter inside the former, fusing a portion of said stem tube to form a solid mass of glass closing off said stem tube and exhaust tube, compressing said mass of glass and then delivering gas pressure through said exhaust tube to expand said fused mass and blow an aperture therethrough.

16. The method of making stems for incandescent lamps and other sealed devices which consists in assembling a stem tube, leading-in wires, and an exhaust tube with the exhaust tube inside of the stem tube and the leading-in wires extending longitudinally of said tubes, fusing a portion of said stem tube to form a solid mass of glass inclosing a portion of said leading-in wires and closing off said exhaust tube and delivering gas pressure through said exhaust tube to expand said mass of glass and blow an aperture therethrough.

17. The method of making stems for incandescent lamps and other sealed devices which consists in assembling a stem tube, leading-in wires, and an exhaust tube

with the exhaust tube inside of the stem tube and the leading-in wires extending longitudinally of said tubes, fusing a portion of said stem tube to form a solid mass of glass inclosing a portion of said leading-in wires and closing off said exhaust tube, compressing said mass of glass and then delivering gas pressure through said exhaust tube to expand said mass of glass and blow an aperture therethrough.

18. The method of making stems for incandescent lamps and other sealed devices which consists in assembling a stem tube, leading-in wires, and an exhaust tube with the exhaust tube inside of the stem tube and the leading-in wires extending between said tubes, fusing a portion of said stem tube to form a solid mass of glass inclosing a portion of said leading-in wires and closing off said exhaust tube and then delivering gas pressure through said exhaust tube to expand said mass of glass and blow an aperture therethrough between said leading-in wires.

19. In an electric incandescent lamp or other sealed device, the combination of an outer and an inner tubular glass element and a hollow glass union comprising a chamber of materially greater diameter than that of the passage in said inner tubular element and having its walls integrally connected with those of the said tubular elements, said chamber walls having an aperture therethrough communicating with the interior of said lamp or other device.

20. In an electric incandescent lamp or other sealed device, the combination of an outer and an inner tubular element and a bulb-shaped union of a materially larger diameter than that of the passage in said inner tubular element and having its walls integral with those of said tubular elements, said union having an aperture communicating with the interior of said lamp or other device.

21. In an electric incandescent lamp or other sealed device, a stem comprising a stem tube and an exhaust tube therein, the walls of said tubes being integrally connected by a union having a chamber blown therein communicating with said exhaust tube and having another aperture in the walls thereof.

22. The combination with the bulb of an incandescent lamp or other sealed device of a stem tube sealed to said bulb at the outer end of said stem tube, an exhaust tube disposed within said stem tube, and a union integrally connecting the walls of said stem tube and said exhaust tube at the inner end of the former, said union having blown therein a chamber communicating with said exhaust tube and also with the interior of said bulb.

23. The combination with a bulb of an

electric incandescent lamp or other sealed device, of a stem tube sealed to said bulb at the outer end of said stem tube, an exhaust tube disposed within said stem tube, and a union integrally connecting the walls of said tubes at the inner end of said stem tube, said union having a chamber therein communicating with said exhaust tube and also with the interior of said bulb and having comparatively thin walls.

24. The combination with a bulb of an electric incandescent lamp or other sealed device, of a stem tube sealed to said bulb at

the outer end of said stem tube, an exhaust tube disposed within said stem tube, and a union integrally connecting the walls of said tubes at the inner end of said stem tube, said union having a chamber therein communicating with said exhaust tube and also with the interior of said bulb and having a materially larger diameter than that of the passage in said exhaust tube.

In witness whereof, we have hereunto set our hands this 14th day of March, 1919.

LORIS EDWIN MITCHELL.
ARTHUR JAMES WHITE.