April 4, 1939. A. J. WHITE ET AL 2,153,404

METHOD OF MAKING STEMS FOR SEALED ELECTRICAL DEVICES

Filed April 19, 1934

Fig 1

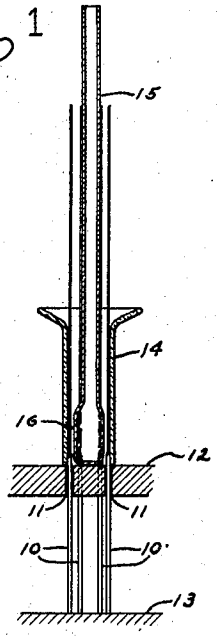

Fig 2

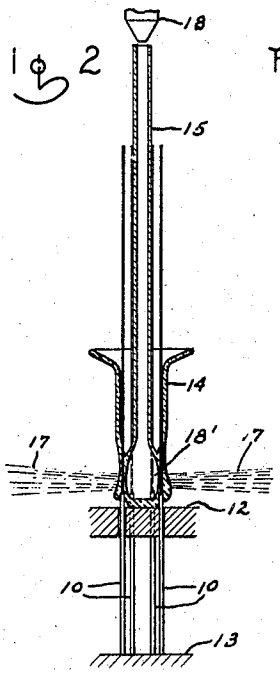

Fig 3

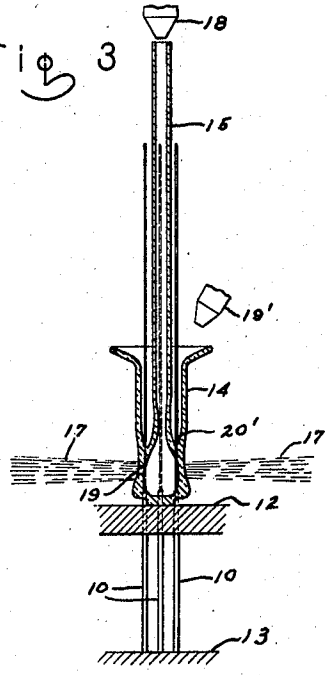

Fig 4

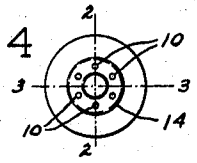

Fig 5

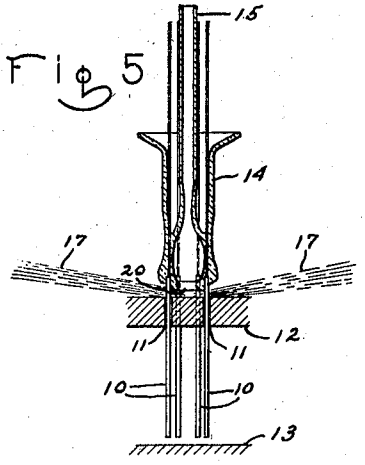

Fig 8

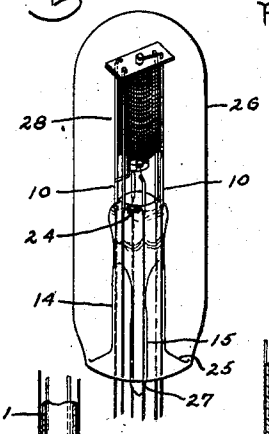

Fig 9

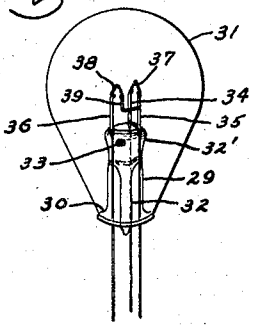

Fig 6

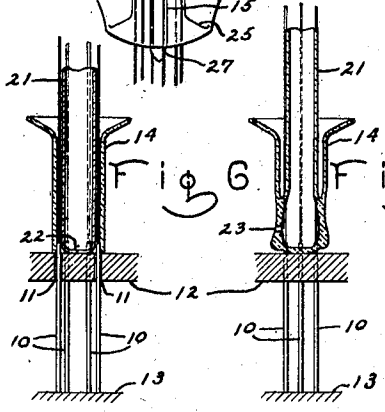

Fig 7

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METHOD OF MAKING STEMS FOR SEALED ELECTRICAL DEVICES

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Application April 19, 1934, Serial No. 721,270

5 Claims. (Cl. 49—78)

Our invention relates to so-called tipless radio tubes, incandescent lamps and similar devices and to methods of manufacturing the same.

The present practice in making the stems which carry the exhaust tube and the leading-in wires upon which the internal elements of the radio tubes or incandescent lamps are mounted, is to assemble a stem tube, an exhaust tube and the leading-in wires with the inner ends of the stem and exhaust tubes substantially in line. The expression "inner end" is used herein with reference to the stem to indicate that end of the said tube which extends into the bulb 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 said inner ends of the exhaust and stem tubes are fused together and then compressed by clamping the fused glass around the lead wires. This results in a "press" portion consisting of a flat solid mass of glass at the inner end of the stem tube with the leading-in wires extending therethrough and disposed side by side in a line. Air pressure is then applied through the exhaust tube, and additional heat may be supplied to thoroughly fuse the glass around the inner end of the exhaust tube, thus causing the mass of glass to swell and become bulb shaped. As the air pressure is continued, a passage is blown through the glass at an angle to the flat surface of the press portion. The exhaust tube communicates through this passage with the interior of the bulb when the stem is sealed thereto. This process is disclosed in Patent No. 1,423,956, Mitchell and White.

The above described type of stem has the disadvantage that the linearly disposed leading-in wires require a comparatively wide press portion where a considerable number of said wires are used, as in a radio tube. This requires that the flare at the outer end of the stem tube also be comparatively large and therefore necessitates the use of a large bulb. It is desirable in many cases to use a smaller bulb, as in tubes for radio sets for automobiles, where compactness is desired.

According to our invention, the exhaust tube is closed at its inner end and it is preferable to blow a small bulb at this end, although this is not essential. The parts are then assembled with the bulbous end of the exhaust tube substantially in line with the inner end of the stem tube and the leading-in wires disposed in spaced relationship between the said ends of the stem and exhaust tubes. Any number of leading-in wires may be arranged in any desired relationship, for example, in a circle, square, oblong or triangle. The application of a flame results in a fusing together of the inner ends of the stem and exhaust tubes and the introduction of air pressure into the outer end of the exhaust tube prevents the walls of the tubes from collapsing and fusing solidly, thus forming a chamber or bulb portion having the leading-in wires sealed in the walls thereof without the application of external pressure. As the air pressure is continued, a passage or aperture is formed for communication of the exhaust tube with the interior of the bulb when the stem is sealed thereto. The said passage may be formed at the side or at the end of the stem, depending upon which is the hotter, and this of course may be controlled.

Among the advantages of the type of stem comprising our invention are: Greater spacing of leading-in wires for a given diameter of stem tube; the use of a smaller stem tube, which permits the use of a smaller bulb or enclosure; and the arrangement of any number of leads as required. An annular or circular arrangement of leading-in wires is particularly suitable for radio tubes, making possible the use of a large number of wires, suitably spaced apart and providing a compact and rigid supporting structure for the internal elements of the said tubes. The invention is of course also applicable to incandescent lamps, particularly to multiple filament lamps which employ a number of lead wires.

Further features and advantages of our invention will appear from the following detailed description of species thereof and from the drawing.

In the drawing, Fig. 1 is an elevation in section showing the way in which the parts of the stem are preliminarily assembled according to our invention; Fig. 2 is a similar view showing the stem tube and exhaust tube fused together, both views corresponding to a section through 2—2 of Fig. 4; Fig. 3 is an elevation in section of a finished stem having a transverse aperture or passage through which the exhaust tube communicates with the interior of the bulb, the section being taken at 3—3 of Fig. 4; Fig. 4 is a plan view of the stem shown in Figs. 1-3; Fig. 5 is an elevation in section showing a method of making a longitudinal aperture at the end of the stem; Fig. 6 is an elevation in section of the assembly of the parts for a modified method of making the stem and Fig. 7 is a sectional elevation of the finished stem; Fig. 8 is a perspective

view of a radio tube having a stem comprising our invention; and Fig. 9 is a perspective view of an incandescent lamp having a stem comprising our invention.

Referring to Fig. 1, the first step in making a stem comprising our invention consists in inserting a plurality of leading-in wires 10 through holes 11 in a block 12, the ends of said leading-in wires being supported on a surface 13. The said leading-in wires are thus supported in a definite spaced relationship. A stem tube 14 is then slipped over the wires from the top until the inner end thereof comes to rest on the block 12. An exhaust tube 15 having a bulb 16 at one end thereof is then inserted, bulb end foremost, at the inside of the annularly disposed leading-in wires until the end of said bulb comes to rest on the block 12. The parts are then disposed as shown in the drawing with portions of the leading-in wires between the inner end of the stem tube and the bulb end of the exhaust tube.

Referring to Fig. 2, the application of a flame or flames 17 results in a fusing together of the end of the stem tube 14 and the bulb 16. As seen in Fig. 2, the wall of the bulbous portion 16 and the wall of the inner end of the stem tube 14 are sealed around their entire peripheries to enclose portions of the leading-in wires 10 therebetween. Air pressure is then introduced into the exhaust tube 15 from a nozzle 18 to prevent the walls of the tubes from collapsing and forming a solid mass of glass, the ends of the stem and exhaust tubes merging instead to form a chamber or bulb-shaped portion 18' having portions of the leading-in wires 10 sealed in the walls thereof. The sealing-in of the leading-in wires is thus accomplished without the usual compressing of the glass therearound. A further application of air pressure results in the formation of a passage or aperture 19 (Fig. 3) for communication of the exhaust tube 15 with the inside of the bulb when the stem is sealed thereto. Air pressure is then introduced between the stem tube 14 and exhaust tube 15 from a nozzle 19' to round out the joint at 20' between said stem and exhaust tubes to prevent cracking. The said aperture 19 may be formed at the side or at the end of the stem depending upon which is the hotter, and this of course may be controlled. For example, when an aperture at the end is desired, it may be accomplished as shown in Fig. 5, by raising the stem so that there is a space between the end thereof and the block 12, and directing the flames 17 into said space. This causes the said end of the stem to be heated intensively so that the application of air pressure into the exhaust tube 15 results in the formation of a passage or aperture 20 at the said end. The formation of a passage at the side, as at 19 in Fig. 3, always occurs between a pair of leading-in wires since the said wires conduct the heat away rapidly, and the seal between the said wires and the glass is therefore not interfered with.

Fig. 4 shows the annular distribution of six leading-in wires 10 as made according to Figs. 1–3. The number and arrangement of lead wires may of course be varied as required. They may be disposed, for example, in a circle, square, oblong or triangle.

Instead of an exhaust tube having a bulb at one end such as that used in Fig. 1, a symmetrical tube 21, as shown in Fig. 6, may be employed, the said tube 21 being closed off at one end 22. The procedure is the same as that described in connection with Figs. 1–3 and results in the stem shown in Fig. 7, the exhaust passage being illustrated at 23.

A radio tube having a stem 14 of the type shown in Figs. 3–4 is illustrated in Fig. 8, the exhaust passage being illustrated at 24. A flare 25 at the outer end of the stem is sealed to the end of the bulb 26 which is evacuated through the exhaust tube 15 which is then sealed-off at 27. The internal elements 28 characteristic of this type of device are mounted on the support and leading-in wires 10, the annular arrangement of the wires as shown making possible a very rigid and compact assembly of the said internal elements. The use of a comparatively small bulb is made possible by the annular disposition of the leading-in and supporting wires instead of a linear disposition in which the leads pass through a flat stem press. In order to get the proper spacing between the leads with the flat stem press used heretofore, the said press had to be made comparatively wide, and since the flare on the stem had to be still larger in order to permit insertion of the mount in the bulb, the said bulb had to be made unnecessarily large.

The incandescent lamp illustrated in Fig. 9 comprises a stem 29 having a flare 30 at its outer end which is sealed to the neck of a bulb 31. The said bulb is evacuated through an exhaust tube 32 which communicates through a chamber 32' and an exhaust passage 33 with the interior of the bulb. The particular lamp illustrated employs three leading-in wires 34, 35, 36, which are triangularly disposed and portions of which are sealed in the walls of the correspondingly substantially triangular shaped chamber 32' at the inner end of the stem 29. A filament 37 is mounted on the leading-in wires 34, 35, and a second filament 38 is mounted on the leading-in wire 36 and on a branch lead 39 which is mounted on the common lead 35.

What we claim as new and desire to secure by Letters Patent of the United States, is:

1. The method of making stems for sealed electrical devices which consists in assembling a stem tube, an exhaust tube inside of said stem tube and closed at one end and leading-in wires extending longitudinally between said tubes, fusing together portions of the walls of said stem tube and exhaust tube around their entire peripheries to enclose portions of said leading-in wires therein, the entire fused portions of said stem and exhaust tubes forming the side walls of a chamber and the closed end of the exhaust tube forming the end wall of said chamber, and delivering air pressure into said exhaust tube to prevent the said walls of the chamber from collapsing and to blow an aperture through a portion of said chamber.

2. The method of making stems for sealed electrical devices which consists in assembling a stem tube, an exhaust tube inside of said stem tube and having a bulb portion at one end and leading-in wires extending longitudinally between said stem tube and the bulb portion of said exhaust tube, fusing together portions of the walls of said stem tube and bulb portion of said exhaust tube around their entire peripheries to enclose portions of said leading-in wires therein, the entire fused portions of said stem and exhaust tubes forming the side walls of a chamber and the closed end of the exhaust tube forming the end wall of said chamber, and delivering air pressure into said exhaust tube to prevent the said walls of the chamber from collapsing and to

blow an aperture through the wall of said chamber.

3. The method of making stems for sealed electrical devices which consists in assembling a stem tube, an exhaust tube inside of said stem tube and closed at one end and leading-in wires extending longitudinally between said tubes, applying heat to portions of the walls of said tubes to fuse together said portions of the walls of said stem tube and exhaust tube around their entire peripheries to enclose portions of said leading-in wires therein, the entire fused portions of said stem and exhaust tubes forming the side walls of a chamber and the closed end of the exhaust tube forming the end wall of said chamber, and delivering air pressure into said exhaust tube to prevent the said walls of the chamber from collapsing and to blow a transverse aperture through the wall of said chamber.

4. The method of making stems for sealed electrical devices which consists in assembling a stem tube, an exhaust tube inside of said stem tube and closed at its inner end and a plurality of leading-in wires extending longitudinally between said tubes, said leading-in wires being supported in spaced relationship in openings in a block and said stem and exhaust tubes being disposed with their inner ends on said block, fusing together portions of the walls of said stem tube and said exhaust tube around their entire peripheries to enclose portions of said leading-in wires therein, the entire fused portions of said stem and exhaust tubes forming the side walls of a chamber and the closed end of the exhaust tube forming the end wall of said chamber, and delivering air pressure into said exhaust tube to prevent the said walls of the chamber from collapsing and to blow an aperture through the wall of said chamber.

5. The method of making stems for sealed electrical devices which consists in assembling a stem tube, an exhaust tube inside of said stem tube and closed at one end, the closed end of said exhaust tube being located adjacent to one end of said stem tube, and leading-in wires extending longitudinally between said tubes and held rigidly in spaced relationship, fusing together the walls of the said adjacent end portions of said stem tube and exhaust tube around their entire peripheries to enclose portions of said leading-in wires therebetween, the entire fused portions of said stem and exhaust tubes forming the side walls of a chamber and the closed end of the exhaust tube forming the end wall of said chamber, and delivering air pressure into said exhaust tube to prevent the said walls of the chamber from collapsing and to blow an aperture through a portion of said chamber.

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