Feb. 9, 1943. C. A. HORN 2,310,237

MOLDED STEM

Filed Feb. 24, 1939

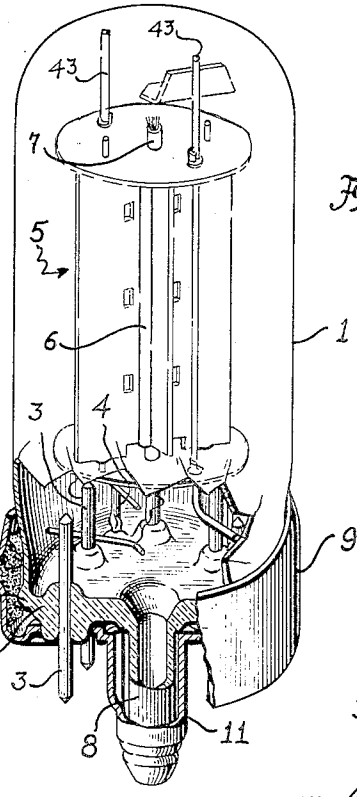


Fig. 1.

Fig. 3.

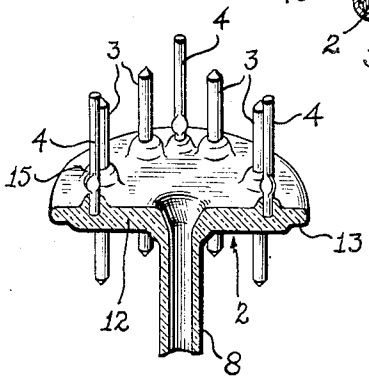


Fig. 4.

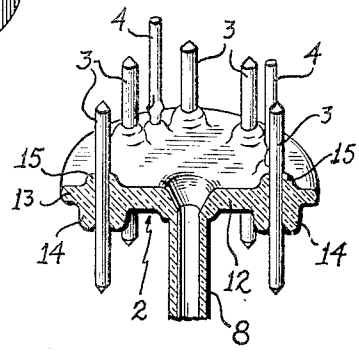
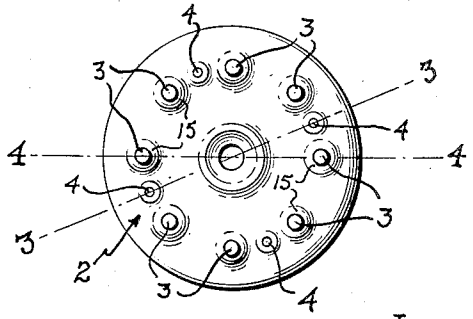


Fig. 2.



INVENTOR
CLARENCE A. HORN
BY Elmer J Gorn
ATTORNEY

Patented Feb. 9, 1943

2,310,237

UNITED STATES PATENT OFFICE

2,310,237

MOLDED STEM

Clarence A. Horn, Newton, Mass., assignor to Raytheon Production Corporation, Newton, Mass., a corporation of Delaware

Application February 24, 1939, Serial No. 258,263

4 Claims. (Cl. 250—27.5)

This invention relates to electrical discharge devices comprising sealed envelopes, such as electron discharge devices and the like, and more particularly to a novel stem for such devices.

Attempts have been made to produce electron discharge tubes with glass envelopes in which the stem serves as the tube base itself, and which carries lead-in conductors which also serve as the external contact pins. Difficulties have been encountered in constructing a stem which readily could be sealed to the envelope.

An object of this invention is to devise a stem of the foregoing type which can be sealed to an envelope in a simple, inexpensive and reliable manner.

Another object is to devise such a stem which is inexpensive to manufacture.

The foregoing and other objects of this invention will be best understood from the following description of an exemplification thereof, reference being had to the accompanying drawing, wherein:

Fig. 1 is a perspective view, partly broken away, of an electron discharge tube incorporating my novel stem;

Fig. 2 is a top view of a stem made in accordance with the present invention;

Fig. 3 is a section taken along line 3—3 of Fig. 2; and

Fig. 4 is a section taken along line 4—4 of Fig. 2.

The tube as illustrated in Fig. 1 consists of a glass envelope 1 having a bottom wall consisting of a stem or base 2. A plurality of lead-in rods 3 are sealed through said stem 2. These lead-in rods are made of some metal which readily seals to the glass of said stem, and may conveniently be made of chrome iron. The lead-in rods 3 are disposed in a circle concentric with the center of the stem 2. These lead-in rods are also rigid so that in the completed form of the tube they serve as the external contact pins adapted to be inserted into a cooperating tube socket. If desired a number of dummy support wires 4 may likewise be sealed into the upper surface of the stem 2. These dummy support wires do not extend through the stem, and therefore need not form an air-tight seal therewith. For this purpose these dummy support wires may be made of a metal which does not make a perfect seal with the glass. They may conveniently be formed of nickel. The usual type of mount 5 is supported by the lead-in rods 3 and the dummy support wires 4. The mount 5 may consist of a plurality of electrodes, for example, an anode 6 surrounding a cathode 7. In order to enable the tube to be exhausted, the stem 2 is provided at its central portion with an exhaust opening communicating with an exhaust tube 8. The bottom of the tube is surrounded by a guard shell 9 held in place on the tube by means of a ring of cement 10. The guard shell 9 is provided with a central tubular member 11 which surrounds and protects the portion of the exhaust tube remaining on the completed tube. The guard shell 9 is provided with sufficiently large openings around each of the lead-in rods 3 so that electrical contact between the shell 9 and the rods 3 is effectively prevented.

The tube, as illustrated in Fig. 1, is adapted to be inserted in a suitable tube socket, the tubular member 11 cooperating with some suitable locking arrangement, and the pins 3 cooperating with suitable contact members in said socket, whereby the proper electrical connections may be made to the electrode elements within the envelope 1.

A tube of the foregoing type presents certain difficulties and requirements if such an arrangement is to be commercially successful. Since the lead-in rods 3 serve as the external contact members for the tube, they must be kept parallel and maintained accurately in their predetermined circular relationship in order that such tubes may fit interchangeably in standard sockets provided therefor. The glass of the stem must not extend too far up or down along the lead-in rods 3. Glass extending down along the lead-in rod 3 might well interfere with the proper insertion of the tube into its socket. Glass extending along said rod 3 in either direction to an excessive degree produces a tendency for cracks to occur at the lead-in rods. Another requirement is that the stem 2 may be easily sealed to the envelope 1 by the usual type of sealing-in machine. A further requirement is that during this sealing-in process, the main body of the stem 2 carrying the lead-in rods 3 shall not be subjected to any distortion which might tend to upset the requisite positional accuracy of said lead-in rods. Stems made in accordance with my present invention satisfy each of these requirements, and produce a tube which satisfies all of the objects of my invention as stated above.

My novel stem consists of a substantially flat disk of glass having a central thickened portion 12 into which the lead-in rods 3 and the dummy support wires 4 are sealed. This thickened portion must be sufficiently strong to withstand atmospheric pressure exerted on its lower flat surface upon completion of the tube. It must also

be thick enough to firmly and definitely support the lead-in rods 3 and the dummy wires 4 without cracking. It also must be sufficiently massive so that during the sealing of the stem to the envelope 1, it is not heated sufficiently to soften to any appreciable extent. I have found that the thickness of this central portion in a particular instance conveniently may be between .080 and .095 of an inch. However, thicknesses as low as .060 might be feasible in some instances. Surrounding the thickened portion 12 is a thinned edge 13. The top of this edge 13 is preferably disposed in the same plane as the top of 12, for reasons which will be explained below. This thinned edge 13 must have a thickness sufficiently less than that of the central portion 12, so that during the sealing-in process it can soften sufficiently to seal readily to the glass envelope 1 without producing any appreciable softening of the central portion 12. I have found that the thickness of the edge 13 conveniently may be made about half of the thickness of the central portion 12. In a particular instance I have used .045 to .055 as a thickness of said edge. In the particular examples which I have cited, the thickness of the wall of the glass envelope 1 was between .030 and .050 of an inch. The stem 2 is preferably formed with a lower boss 14 around each lead-in rod 3, and a smaller upper boss 15 around each of said lead-in rods. The bosses 14 project through the openings in the guard shell 9, and thus maintain said guard shell in its proper position as well as insure against electrical contact between said guard shell and the lead-in rods. The bosses 14 are slightly recessed around the rods 3, as shown most clearly in Fig. 4.

After the stem has been completed, the mount 5 is assembled on the lead-in rods 3 and dummy support wires 4. The envelope 1 is then sealed to the stem around the mount.

I have found that tubes made in accordance with my invention produce satisfactory seals which have very little tendency to crack at the sealing-in point 46. This is due partly to various aspects of the invention pointed out above involving the thickened central portion 12 and thinned edge 13 of the stem 2. I have found that if the internal surface of the envelope adjacent the sealing-in point 46 (see Fig. 1) is kept free of all sharp bends and a smooth and rounded contour preserved, substantially all tendency to crack at this point will be eliminated. By forming the stem 2 with the thinned edge 13 in the same plane as the upper surface of said stem, this elimination of sharp bends and the preservation of a smooth contour are readily obtained, since due to the particular construction which I have described, when the edge 13 is made plastic during the sealing-in process, the wall of the envelope will fuse to this thinned edge 13 and form a continuation thereof. During the pull-down operation, the thinned edge 13 will have some slight tendency to be bent upwardly, thus producing a smooth transition curve from the thinned edge 13 to the interior walls of the envelope. Since the edge 13 is originally formed as a continuation of the upper surface of the stem 2, this smooth transition will be carried down without break or interruption onto the upper surface of said stem 2, as indicated most clearly in Fig. 1. Even if said edge 13 were not formed in this way, the requisite sealing might still be accomplished with proper precautions. Thus considerable advantage is still obtained from the thinned edge 13 irrespective of its relationship with respect to either surface of the stem 2.

The method of making the stem described herein is claimed in my co-pending application, Serial No. 269,871, filed April 25, 1939, which is a division of the present case, Serial No. 258,263.

Of course it is to be understood that this invention is not limited to the particular details as described above as many equivalents will suggest themselves to those skilled in the art. For example, in some instances it may be desired to utilize this invention in tubes having the conventional base with additional contacting prongs. Various other changes will suggest themselves to those skilled in the art. It is accordingly desired that the appended claims be given a broad interpretation commensurate with the scope of the invention within the art.

What is claimed is:

1. In combination, a stem assembly for electric tubes comprising a relatively thick glass wall member having substantially flat parallel upper and lower surfaces and a relatively thin glass sealing edge projecting from said wall member, and a plurality of lead-in conductors sealed into said wall member, and a glass envelope sealed only to the outer edge of said sealing edge.

2. In combination, a stem assembly for electric tubes comprising a relatively thick glass wall member having substantially flat parallel upper and lower surfaces and a relatively thin glass sealing edge projecting from said wall member, and a plurality of lead-in conductors sealed into said wall member, said conductors being parallel to each other and having their lower ends disposed in a plane, and a glass envelope sealed only to the outer edge of said sealing edge.

3. In combination, a stem assembly for electric tubes comprising a relatively-thick, substantially-flat glass wall member, a relatively thin glass sealing edge projecting from said wall member, the thickness of said sealing edge at the point where it joins said wall member being substantially less than the thickness of said wall member, the top surface of said sealing edge lying in substantially the same plane as the top surface of said wall member, and a plurality of lead-in conductors sealed into said wall member, and a glass envelope sealed only to the outer edge of said sealing edge.

4. In combination, a stem assembly for electric tubes comprising a relatively thick glass wall member having substantially flat parallel upper and lower surfaces, and a glass sealing edge having a thickness at the point where it joins said wall member substantially less than the thickness of said wall member and projecting from said wall member a substantial distance with substantially uniform thickness, a plurality of lead-in conductors sealed through said wall member, and a glass envelope sealed only to the outer edge of said sealing edge.

CLARENCE A. HORN.