Oct. 13, 1936. A. E. LYLE 2,057,305

ELECTRON DISCHARGE APPARATUS

Filed Jan. 30, 1929 2 Sheets-Sheet 1

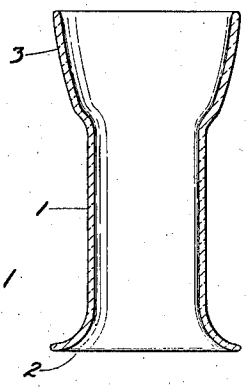


FIG. 1

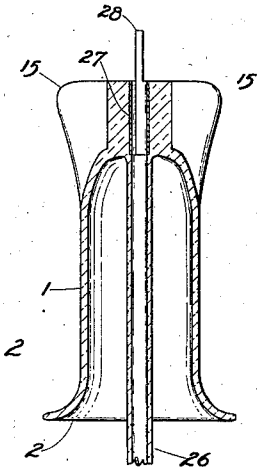


FIG. 2

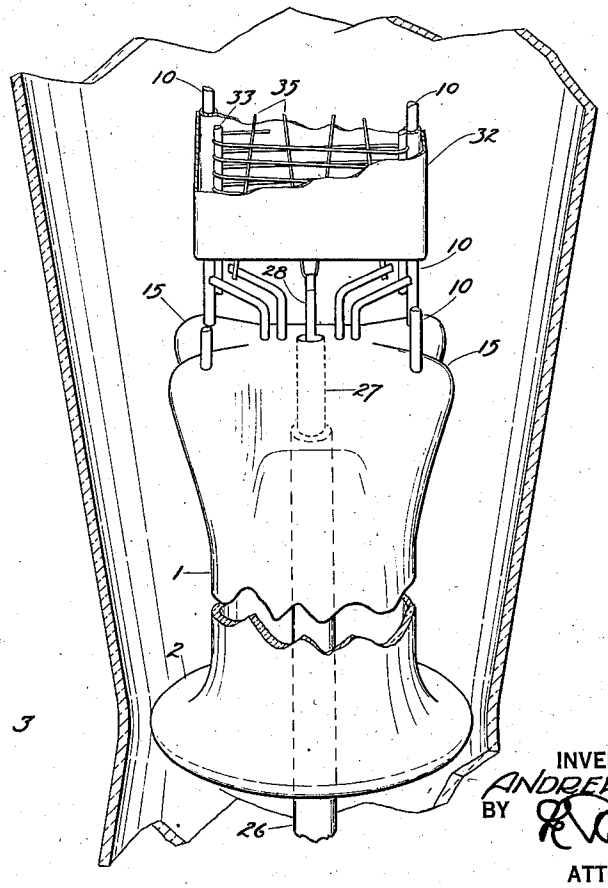


FIG. 3

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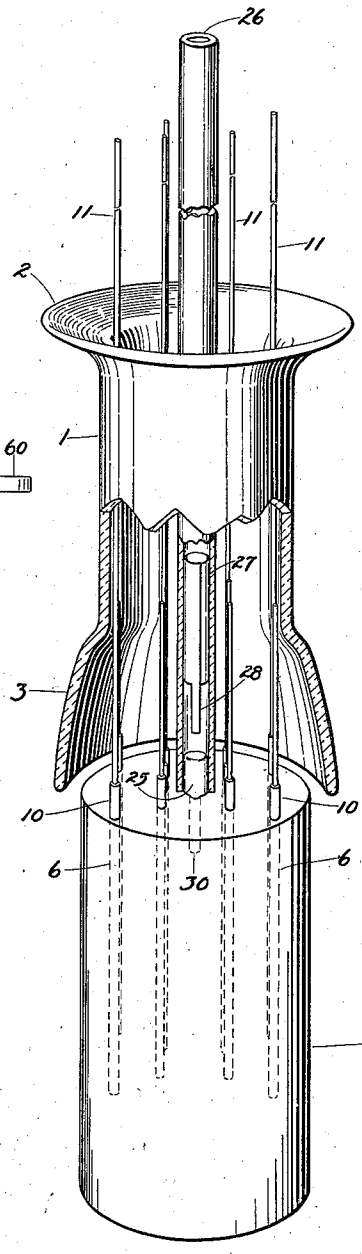


FIG. 4

FIG. 5

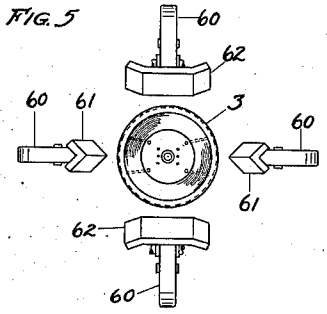
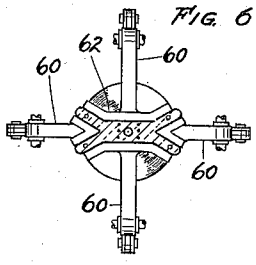


FIG. 6



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ELECTRON DISCHARGE APPARATUS

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Application January 30, 1929, Serial No. 336,244

3 Claims. (Cl. 250—27.5)

This invention relates to electron discharge apparatus and particularly to the construction thereof. The invention is especially applicable to the construction of stems, presses, and supports sealed therein, upon which such apparatus is usually mounted.

The function of the press in electron discharge devices is two-fold. First there is the mechanical function of supporting the electrodes. Secondly, there is the electrical function of insulating the various electrode leads and supports from each other. With low powered tubes, the parts of the apparatus are relatively small and light and hence the mechanical support thereof presents no great problem. Such devices invariably are operated at low voltages and low current intensities, and thus the electrical insulation of the leads is exceedingly simple.

As a rule, such devices have a press made from a glass tube. This glass tube is flared at one end and at this flared end, is joined to the envelope. The other end is invariably pressed down to a flat pinch. In this pinch are sealed the various supporting wires and leads. Of necessity these are in one plane at their point of sealing. In order to meet various portions of electrodes, it is necessary to bend the supporting wires to predetermined shapes. In many tubes numerous welds are also necessary as well as a glass bead from which radiate several supporting wires.

The insulation between the supporting wires sealed in the pinch is sufficient for the purpose to which such low powered tubes are put. The pinch itself is rarely more than one-half inch across the top. Within this distance at the top of the press all the wires are sealed. It is obvious that between adjacent wires there is a comparatively short path.

The great advances in radio receiving systems and equipment has resulted in a demand for tubes, rectifiers, as well as three-element tubes, of great power. Thus, compare the difference between a now obsolete tube, which had a filament input of .250 amperes at 1.1 volts, a maximum permissible plate voltage of about 90 with a plate current of about 2 milliamperes. In contrast to this, consider a modern type tube which has a filament input of 1.25 amperes at 7.5 volts, a maximum permissible plate voltage of 450 with a plate current of around 50 milliamperes and a grid bias of 80 volts.

Such new tubes are considerably larger in physical as well as electrical dimensions than the old tubes in every way but the base.

The physical construction of the old tubes was therefore impractical for such powerful tubes if the base is to remain the same. In order to obtain adequate mechanical support for the elements of such a large tube, the art has turned to the use of metal clamps fastened around the stem. In order to obtain more effective electrical insulation, a somewhat wider pinch has been used. The high potential wires have generally been sealed through the stem away from the pinch proper in order to obtain sufficient surface clearance for the voltage desired.

In all such tubes, however, such a construction is undesirable for various reasons. The first reason is that metal clamps around the press can not be heated sufficiently to drive off all occluded gases. The result of this is that as such a tube grows old, gases are introduced and destroy the vacuum.

A second disadvantage is the fact that the construction involving one or more wires sealed in the tubular part of the stem is inherently expensive and mechanically faulty. Thus in such a construction it is customary to make a hole in the glass of the stem through which the wire is threaded. This wire carries a glass bead. The bead is thereupon melted to the stem at the hole, thus sealing the wire in place. In actual manufacture, it is found that many defective tubes result from this particular step.

It must be borne in mind that the changes in the construction of a tube are limited by the existence of highly developed and expensive machinery for the automatic manufacture thereof. Furthermore, all style tubes, as a rule, have standard bases with which tubes are adapted to be plugged in and out of standard sockets. Hence, it is obvious that whatever the size and power of the tube, the base end is the same for all. While it would be simple enough to use larger tubing from which to make stems, it is necessary that the bottom of the stem have at least ⅛ of an inch flare to which the bulb may be melted. Since this end must fit into a standard base, the use of larger tubing in high powered tubes for stems becomes practically impossible.

I have devised a structure which is satisfactory from a commerical point of view, in that it may be cheaply and quickly manufactured, allows of the adequate mechanical support of high powered tubes, and allows of adequate clearance between various supports along the surface of the glass press while at the same time fitting into standard bases.

Referring to the drawings, Figure 1 is a sec-

tional view of my stem during a preliminary stage in manufacture.

Figure 2 is a section of a completed stem.

Figure 3 is a modification of the stem of Figure 2 shown with the electrodes and supports of a tube mounted thereon and bulb being fitted in place.

Figure 4 is a view showing the stem and all parts sealed therein in position to make the press.

Figures 5 and 6 are diagrammatic views of the stem positioned in a machine with the jaws in open and closed positions respectively.

Referring to the drawings, a stem is made from a tube 1 of glass and of suitable length. The bottom is flared outwardly at 2 at which place it is welded to the bulb to form a unitary structure. It is necessary that the flare at this part be at least ⅛ of an inch in order to effectively weld the glass thereon. Since this portion is disposed within a standard base, it is evident that the size of the base determines the maximum diameter of the glass tube used. In accordance with my invention, the top portion is flared outwardly at 3 in order to provide a press having a greater extent than would ordinarily be the case.

This flare with both ends flared is thereupon placed in a machine in position with all the wires and parts which are to be sealed in the press. This is diagrammatically shown in Figures 4—6 inclusive. A jig 5 comprising a solid block of metal has a plurality of holes 6 drilled down into it in predetermined positions. Into these holes are positioned wires or arbors 10 which are later to support the tube electrodes. These arbors, as a rule, are of stiff nickel and are welded to copper leads 11. The flare is held in position over the jig or weld pocket 5 by suitable lamp making mechanism well known in the art and therefore not necessary to illustrate in detail. The flare is suitably heated and softened to melt the glass at the portion 3. With the flare softened, four jaws 60 cooperate to shape the press. These jaws have shoes 61 and 62 of suitable conformation in order to produce a press having the desired shape. If desired, small lengths of glass tubing may be disposed around each of the arbors, especially the corners where they are sealed into the press. Such glass tubes tend to make up for any deficiency in the amount of glass at the press portion of the stem.

In Figure 2, one form of the press is shown and this comprises rectangularly disposed wings 15.

In Figure 3, I have shown a press substantially similar to that shown in Figure 2 with the exception that the wings 15′ are not disposed at right angles as is the case in Figure 2. It is evident that the angle between the wings may be varied in order to suit particular purposes. Thus in certain tubes, it is desirable to have the corners of each pair of wings separated by considerable distance while the distance between the pairs of corners need not be so great. In other words, instead of the corners of the wings forming a square, it may be found desirable to form a rectangle. The factors which might make this desirable are the size of electrodes and the distance between the logical places of support and high potential leads. It is desirable that the arbors sealed in the wings be left straight since this allows the use of harder and heavier spring wire.

It is of course evident that the top flare 3 of the stem is not necessary if a press of small size is desired. Thus for smaller tubes where it is desirable to secure good electrical as well as mechanical characteristics, a satisfactory press of this character may be made without flaring the tube.

In the manufacture of a press having wings disposed in several planes, it has been found that the glass in the center of the press during the formation thereof, tends to settle and form a cavity. I have, therefore, taken advantage of this tendency and formed a channel through the center of the press and connecting the exhaust tube thereto.

In order to do this, jig 5 is provided with an upstanding cylindrical pin 25. Exhaust tube 26 of glass is positioned over portion 25 of the jig. If the glass is melted and the press formed in this manner, it will be found that there is a tendency for the glass of the exhaust tube to stick to the surface of pin 25. When the stem assembly is taken off the jig, this tendency to stick results in breakage or unevenness at the joint. In order to avoid any trouble on this score, I slide a hollow cylindrical metal sleeve 27 down inside of exhaust tube 26 between the exhaust tube and pin 25. This sleeve is provided with an elongated tongue 28 whose purpose will later be described. A slot 30 is suitably formed in jig 5 so that tongue 28 may fit therein and allow sleeve 27 to fit snugly around pin 25. After the glass has been melted and the press formed, the stem assembly may be removed from the jig without any trouble. Sleeve 27 will be firmly sealed into exhaust tube 26 and will easily slide away from pin 25. Wires 10 will come out of the jig thus leaving the stem free.

Figure 3 diagrammatically shows a complete stem assembly with electrodes mounted thereon. The straight wires or arbors 10 carry a plate 32 of any suitable type. Within the space is disposed a grid 33 in accordance with customary practice. An M-shaped filament 35 is suitably disposed within the grid and as shown has its ends welded to supporting wires sealed in the press. In order to support the bottom loop of the filament, tongue 28 of sleeve 27 is looped around or suitably welded thereto. In this way, the necessity for sealing a separate support wire is avoided.

It is evident that with this construction, it is possible to choose such an angle between wings and make the wings of such an extent that straight arbors may be obtained for any type of electrode and in addition, to obtain substantial clearance between any two wires along the surface of the press. In this way, the entire structure is made rigid and from an electrical as well as a mechanical point of view, results in a tube having desirable characteristics.

Thus it will be seen that I have disclosed a press which is simple, easily and cheaply manufactured, and yet which by simple variations may be made to support the electrodes of various kinds and types of tubes in a suitable manner, while at the same time providing suitable insulation. A further feature is the fact that by suitably locating the angle and extent of the wings of the press, straight arbors may be used in supporting electrodes. Such a combination is desirable for mechanical and electrical reasons.

I claim:

1. In an electron discharge apparatus, a stem, said stem having an axial channel through the press portion, a metal sleeve in said channel, an exhaust tube connected to said press and communicating with said channel, said metal sleeve

having a tongue adapted to function as an anchor for an electrode.

2. In an electron discharge device, the combination of a stem having an open channel through the press portion, an exhaust tube communicating with said channel, a metal sleeve in said channel, said metal sleeve having a tongue, electrodes supported on said press, and means for supporting at least one of the electrodes by said metal tongue.

3. In an electron discharge device, the combination of a press having wings in more than one plane, said press having a centrally disposed axial channel therethrough, an exhaust tube in communication with said channel, a metal sleeve sealed in said channel, said metal sleeve having a tongue adapted to function as an anchor and a plurality of standards sealed in said wings for supporting electrodes.

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