

May 23, 1950

K. M. VAN GESSEL
ELECTRICAL DISCHARGE DEVICE

2,508,979

Filed Jan. 16, 1946

3 Sheets-Sheet 1

Fig. 1.

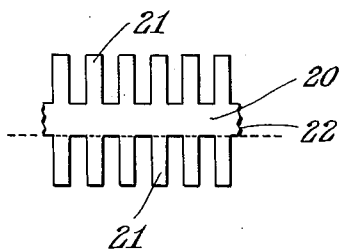


Fig. 2.

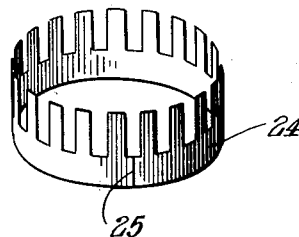


Fig. 3.

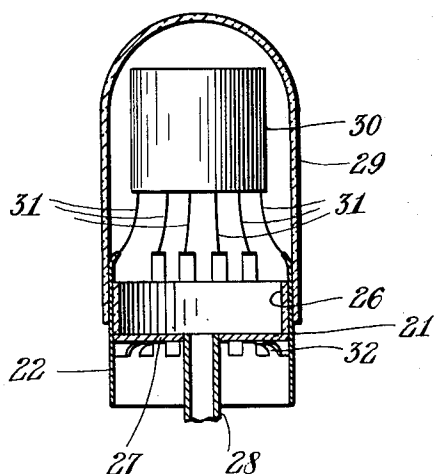


Fig. 4.

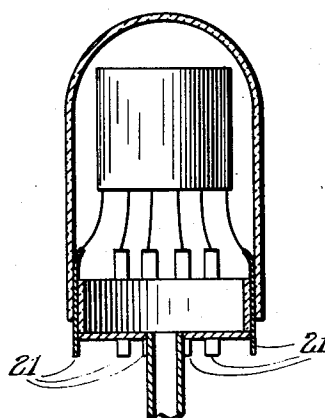


Fig. 5.

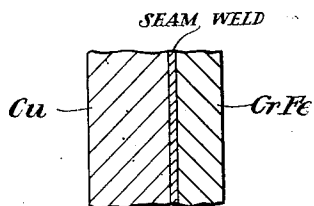
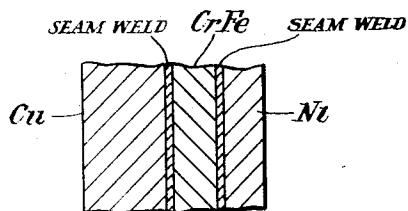


Fig. 6.



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Fig. 7.

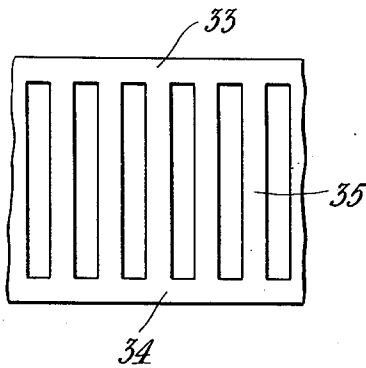


Fig. 8.

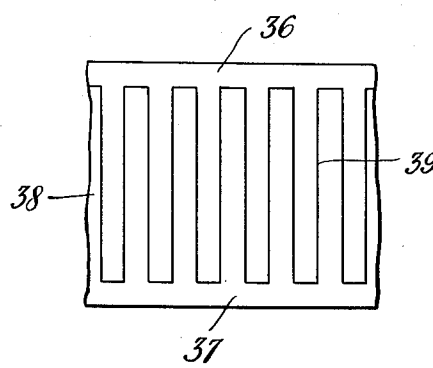


Fig. 9.

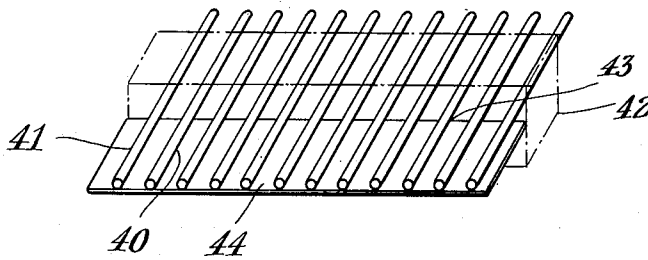


Fig. 10.

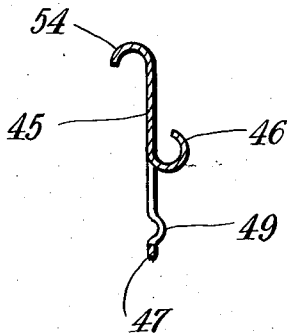
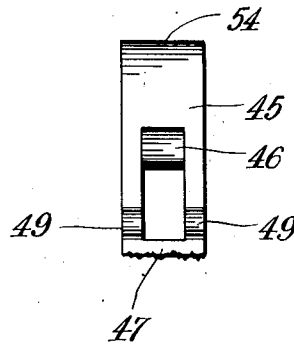


Fig. 11.



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Filed Jan. 16, 1946

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Fig. 12.

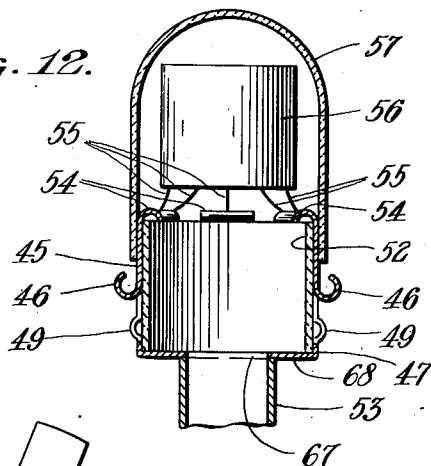


Fig. 13.

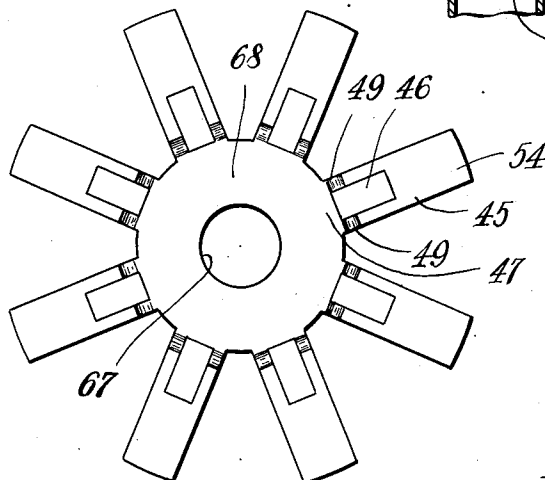


Fig. 14.

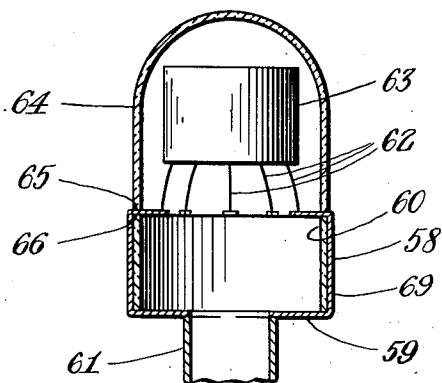
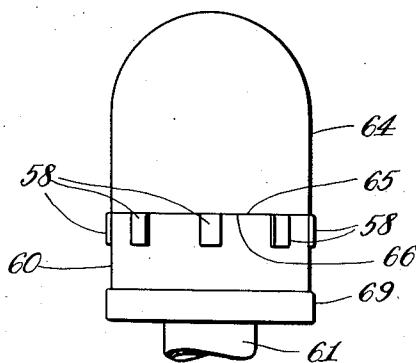


Fig. 15



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UNITED STATES PATENT OFFICE

2,508,979

ELECTRICAL DISCHARGE DEVICE

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Application January 16, 1946, Serial No. 641,601

5 Claims. (Cl. 29—25.13)

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This invention relates in general to electrical apparatus, and more particularly to improved ways and means for electrically insulating metal parts and the like.

The invention is of interest in the manufacture of devices including insulated connecting elements such as the lead-in wires of electric discharge tubes and the like.

It is an object of the present invention to facilitate the manufacture and installation of insulated parts having certain electrical characteristics.

It is another object of the invention to improve the simultaneous bonding of insulating material to a plurality of spaced apart metal elements, and particularly, to provide simplified metal to glass seals.

It is a further object of the present invention to insure the predetermined spaced relation of a plurality of metal to glass seals.

Another object of the invention is to improve the manufacture of devices incorporating electrically insulated connecting elements, such as the lead-in wires of electric discharge tubes, collectively insulating elements of connecting assemblies and the like, by reducing the time and cost of such manufacture and insuring the predetermined accuracy of the steps involved therein.

A further object of the present invention is to provide electric discharge tubes and other like devices incorporating insulated lead-in connecting elements distinguished by improved electrical characteristics, ease of assembly, ruggedness of construction and capacity.

Still another object of the invention is to provide improved electric discharge tubes facilitating the insulation of the lead-in conductors in a predetermined manner.

Yet another object of the invention is to provide improved lead-in conductors for electric discharge tubes and the like so that the installation of the associated electrode assembly is simplified.

A further object of the invention is to provide lead-in conductors for insulated connecting assemblies initially made, for example, from a continuous piece or strip of metal.

Another object of the invention is to provide lead-in elements constituting portions of connecting assemblies in such a manner that they may be collectively installed in definite predetermined insulating relation in a single assembly operation.

Other objects, and the manner in which the same are brought about will be obvious from the following description:

Electrically insulated parts and devices incor-

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porating electrically insulated conductors such as electric discharge tubes, insulated connecting assemblies and the like heretofore were made by various methods which, in industrial practice, were found to be quite time consuming, complex and costly so that methods of manufacturing such parts and devices more simply, more accurately, more cheaply and more speedily, for a long time have been a desideratum in the electrical arts.

In the manufacture of electric discharge tubes, for example, it is common practice when making the stem or base of the tube to seal metal lead wires in glass tubing or in a glass disk. In most cases it is necessary to cement a cap of metal or some insulating material, such as Bakelite, over the stem to protect the lead-in wires from breaking and to form a firm support for the base pins and other contact or mounting elements.

In addition, the present methods of making the stem and inserting the lead-wires in the mold are slow and laborious operations. Each of the lead-wires required have to be separately positioned before the sealing operation. Furthermore, because of the usual limited space available for the stem and the associated lead-wires, the arrangement becomes crowded and great care has to be taken to insure proper lead-in wire spacing. The insulating space limitation in turn limits the possible safe voltage and frequency impressed on adjacent lead-wires.

The method of passing lead-wires and conductors through insulation filled depressions in metal discs as described in my co-pending U. S. application Ser. No. 586,283, filed April 3, 1945, eliminates this crowding to a considerable extent, but the lead-in wire spacing is nevertheless limited by diameter of the metal socket.

The present invention, in one embodiment, embraces novel method of forming the lead-in conductors from one piece of metal so as to have a common connecting portion and thence shaping the said lead-in conductors symmetrically about a common axis so as to be collectively held in such relation by the said common portion during the sealing operation.

In the drawings accompanying this specification and forming a part thereof, several embodiments of the invention are illustrated diagrammatically by way of example, but I wish it to be understood that I do not desire to be so limited to the exact details of construction, design or methods shown and described as numerous modifications within the scope of the appended claims will occur to a person skilled in the art.

In the drawings:

Fig. 1 shows a plan view of a plurality of lead-in elements formed from a single piece of material so as to have a common connecting portion.

Fig. 2 shows a perspective view of the piece of material of Fig. 1 with the ends of the common portion welded together to form a tube.

Fig. 3 is a view in partial sectional elevation showing the tubular lead-in conductor material of Fig. 2 in position with the insulation material of an electric discharge tube for sealing the lead-wires of Fig. 2.

Fig. 4 shows the means of Fig. 3 with the common lead-in wire connecting portion 22 of Fig. 1 cut-away after the sealing operation.

Fig. 5 shows a cross-section of a bimetal material from which the metallic tube of Fig. 2 can be formed.

Fig. 6 shows a cross-section of a piece of multi-metal material from which the metallic tube of Fig. 2 is formed.

Fig. 7 is a plan view of a modification of the means of Figs. 1 and 2 showing the stamping formation when long lead-wires are required.

Fig. 8 is another modification of the means of Fig. 1 showing a method of forming the stamping so as to utilize all the material.

Fig. 9 is a perspective view of a method of arranging rod-shaped lead-in wires on a common base.

Fig. 10 is a side sectional view of a lead-wire conductor formed with a resilient spring-clip portion.

Fig. 11 is a front elevation view of the stamping from which the resilient conductors of Fig. 10 is formed.

Fig. 12 is a side elevation view partly in section showing the lead-wires of Figs. 11 and 12 in position for sealing with the glass insulating portions of a discharge tube assembly or the like.

Fig. 13 is a plan view of the stamping with which the lead-in conductors of Figs. 10 and 11 are formed.

Fig. 14 is a side view partly in sectional elevation illustrating still another modification of my invention showing a method of sealing in the lead-in wires of an electric discharge tube enclosure.

Fig. 15 illustrates the finished discharge tube of Fig. 14 with the common connecting portion removed.

Referring now to the drawings, there is shown by Fig. 1 a stamping 20 formed from a continuous strip of lead-in wire material. This stamping 20 is preferably formed into a cylinder 24 when the ends of the common portion 22 are welded together at the junction 25 of Fig. 2. Any number of lead-in wires 21 having a common connection such as the portion 22 may be formed. The portion 22 may be relatively moved up or down in Fig. 1 so that the resulting upper and lower lead-in conductor portions 21 are of unequal length. In some modifications the punching 20 of Fig. 1 is cut along the dotted line of Fig. 1 so that only the upper lead-in portions remain.

In Fig. 3 there is shown an exhaust tube assembly including the tubular metal piece 24 of Fig. 2 cut along the said dotted line of Fig. 1.

In assembling the elements of Fig. 3 a metal disc 27 of slightly smaller diameter than the tubular metal member 24 is first welded to a metal exhaust tube 28 and thence to three or four of the lead-in conductors 21 bent in at points 32 so that the stamping will be securely attached

to the disc 27 in approximately the position shown by Fig. 3.

The glass ring 26 is now placed inside of the portions 21 and pushed down to seat on the metal disc 27 after which the lead-in conductors 21 are connected to the electrodes 31 of the tube assembly 30.

A glass bulb 29 is now pushed down over the outside of the unwelded connector portions 21 so that the upper end of the said portions 21 will be held between the glass ring 26 and the lower portion of the bulb 29 approximately in the relation as shown by Fig. 3.

When the glass bulb 29, metal tubular portion 24, glassing ring 26 and the metal disc 27 are all in position they are sealed together by the proper application of heat. After the sealing operation, the common portion 22 may be cut or ground away as shown by Fig. 4 and the outside portions of the lead-in conductor portions moved into a desired position so as to be connected to an external circuit.

Any number of lead-in portions 21 may be sealed in between the bulb 29 and the ring 26 at the same time and in definite spaced relation as determined by the initial punching 20 of Fig. 1. Instead of a metal disc 27 and a metal exhaust tube 28, a glass disc and tube may be used without departing from the spirit of the invention.

The metal strips from which the metal punchings as shown by Figs. 1 and 2 may be made from CrFe, an alloy of iron, nickel and cobalt which has the same temperature coefficient of expansion as that of glass, Cu or any other metal that can be sealed to glass. In some cases, especially where the lead-in conductors are relatively long, the resistance of the conductors will be formed of certain material high enough to be objectionable. In this event, the strip material may be made up of two or three thinner strips of different metals such as CrFe, an alloy of iron, nickel and cobalt which has the same temperature coefficient of expansion as that of glass, Cu by seam welding as shown by Figs. 5 and 6.

Any combination of metals is possible as long as the seal is made between glass or like material and a suitable metal with the proper coefficient of expansion.

Where long leads are required, it might become necessary to employ two common connecting strips or busses as 33 and 34 of Fig. 7. The lead-in strip or conductors 35 would thus be firmly held in place or in spaced relation during installation.

After the sealing operation both of the common connector portions 33 and 34 are cut away from the said conductors.

By means of Fig. 8 there is shown a method of producing the punchings as shown by Fig. 1 without any loss of metal. By cutting the strip 38 as along the slot 39 into the portions indicated as 36 and 37, two punchings of lead-in conductors are made in one operation and without any loss of material.

When rod-shaped or tube-shaped lead-in conductors are required they are first cut into required lengths as indicated by the numeral 41. These lead-in conductors 41 are then assembled in a metal jig or holder 42 provided with spaced apart holes 43 of proper size. When the desired number of lead-in conductors 41 are assembled on the jig they are then welded to a common connector or base 44 at the lower ends 40. If the lead-in conductors 41 are employed in connec-

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tion with exhaust tube construction and the like the holder portion 44 is cut away after the sealing operation as hereinbefore described for the construction in Fig. 3.

Still further the base 44 may be bent so that the rods 41 may be held to radiate out or in from a common center so as to be placed between the bulb 29 and the glassing 26 of Fig. 3 as herein-after described.

Another modification of the invention is illustrated by Figs. 10, 11, 12 and 13. In Figs. 10 and 11 there is shown side and front elevations of a clip-type lead-in conductor 45 formed of a single piece of suitable material such as Cu, Ni, CrFe or any other suitable material of the proper coefficient of expansion for sealing (see Fig. 13). These lead-in elements 45 are punched from flat strips so as to be crinkled at the portions 49 and thence the clip portions 46 are curled up as shown in Fig. 10 so as to leave two projecting crinkled legs. These legs are crinkled or bent at the portions 49 in the direction shown by Figs. 10 and 12. These lead-in elements 45 are then electrically connected at the hooked end 54 to electrodes 55 forming portions of a desired electric discharge tube assembly 56. The lead-in elements 45 are then bent up and hooked over the end portion 52 of a glass tube of the required diameter. This glass tube 52 is seated on the flat base portion 60 of the stamping of Fig. 13. When the clip conductor portions 45 are in the positions shown in Fig. 12 the glass portion 52 and the stamping will be locked together. The metal exhaust tube 53 is welded to the metal portion 68.

When the clip-type lead-in conductor elements 45 are suitably arranged around the top portion 52 in the required number and spaced relation, a glass bulb 57 is pushed down over the lead-in elements 45 so that the hooked ends will be lined up and resting on the top end of the glass portion 52 and the portions 45 will be positioned between the said end portion 52 and the bulb 57 approximately in the relation shown by Fig. 12. After this operation the bulb 57, lead-in elements 45 and the exhaust tube portion 52 may be sealed together by the proper heating operation.

After the sealing operation, the crinkled portion 49 (see Fig. 11) is ground or cut away electrically separating the lead-in conductors 45 and leaving the metal base portion 68 (see Fig. 13) sealed to the glass tube 52.

The resilient clip portions 46 of the said conductors will then be available for resiliently connecting the said electrodes 55 to an external circuit. By means of the larger diameter of the clip portions 46 of lead-in wires or connectors 45 it is possible to increase the number and size of the electrodes 55 and thereby the capacity of the said electric discharge tube or the like.

Still another modification of the invention is illustrated by means of Fig. 14. Lead-in conductors 58 are formed with a common cup shaped connector 59 in somewhat the same manner that the lead-in elements 45 are provided for the assembly shown in Fig. 12.

The stamped cup shaped metal form is welded to a metal exhaust tube 61 and then pushed over a glass tube 60 and the lead-in fingers or conductors 58 bent over the top of the said glass portion 60 thereby to be in symmetrical radial relation about the axis of the glass tube 60 and all approximately in the same plane. The lead-in conductors 58 are then electrically attached to the electrodes 62 of an exhaust tube assembly 63. A glass bulb 64 is placed on the lead-in portions

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58. This bulb 64 is preferably of the same thickness and diameter as the glassing 60 so that the glass end portions 65 and 66 of the glassing 60 and the bulb 64 are in axial alignment.

Fig. 15 illustrates the assembly means of Fig. 14 except that the common connecting portion 60 has been cut or ground away after which the outside ends 58 will be connected to other leads as required.

It is suggested that some downward pressure be applied to the bulb 64 during the sealing period in order to insure a flow of glass around the lead-in portions 58 and to cause the bulb to settle down.

It is obvious from this disclosure that the production of exhaust tube assemblies and the like will be simplified and accelerated by producing the lead-in wires or conductors from a single continuous strip of material so as to have a common connection portion.

In the arrangement according to the present invention both the time and cost of sealing lead-in conductors will be decreased since the need for individual lead-in conductor holding, positioning and alignment is eliminated.

Still further, the spacing of the lead-in portions is increased to increase the allowable impressed voltage and the said portions.

For the same reasons the applied frequency is increased. Still further, more electrode contacts will be possible, and because of the thin lead-in elements possible according to this invention dangerous sealing stresses in the glass portions are avoided.

While I have shown and described and have pointed out in the annexed claims certain new and novel features of the invention, it will be understood that certain well-known equivalents of the elements illustrated may be used, and that various other substitutes, omissions and changes in the form and details of the devices illustrated and in their operation may be made by those skilled in the art without departing from the spirit of the invention.

I claim:

1. In a method of assembling an electric discharge tube containing a bulb, an exhaust tube, and a plurality of electrodes, the steps which comprise stamping a metallic strip to form a plurality of spaced conductor elements connected to a common portion of the strip member, forming the stamping into a cylinder by welding together the ends of said common connecting portion, electrically connecting the electrodes to the free ends of said spaced conductor elements, placing the cylinder to dispose an intermediate portion of each conductor element between portions of said bulb and said exhaust tube, heat sealing the tube, bulb and intermediate conductor portions, and removing the said common connecting portion from said conductors so that the spaced elements may serve as separate lead-in members.

2. In a method of assembling an electric discharge tube containing a glass bulb, a metal exhaust tube, a glass ring, and a plurality of electrodes, the steps comprising stamping a metallic strip to form a plurality of spaced conductor elements connected to a common portion of the strip member, forming the stamping into a cylinder by welding together the ends of said common connecting portion, mounting said glass ring on the metal tube, placing the cylinder to dispose an intermediate portion of each spaced element outside of and in contact with said glass ring, electrically connecting the electrodes to the free ends

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of said spaced elements, slipping the open end of said glass bulb over the spaced elements to bring them between the glass ring and the inside bottom portion of the bulb, heat sealing the bulb, conductor elements, glass ring and tube, and cutting off the said common connecting portion from said conductor elements so that the spaced elements may serve as separate lead-in members.

3. In a method of assembling an electron discharge tube containing a glass bulb, a glass exhaust tube, and a plurality of electrodes, the steps which comprise stamping a metallic strip to form a plurality of spaced conductor elements connected to a common portion of the strip member, forming the stamping into a cylinder by connecting the ends of the common portion, electrically connecting the electrodes to the free ends of said spaced conductor elements, placing the cylinder to dispose an intermediate portion of each conductor element between portions of said bulb and said exhaust tube, heat sealing the tube, bulb, and intermediate conductor portions, and removing the said common connecting portion from said conductors so that the spaced elements may serve as separate lead-in members.

4. In the manufacture of an electron discharge tube containing a bulb, an exhaust tube, and a plurality of electrodes the method of providing unitary supporting and lead-in conductors for said electrodes, which comprises the steps of stamping a metallic strip to form a plurality of spaced conductor elements connected to a common portion of the strip member, forming the stamping into a cylinder by connecting the ends of the common portion, placing the cylinder to dispose an intermediate portion of each spaced conductor element around the upper portion of said exhaust tube, with the free ends of said elements extending beyond the exhaust tube toward the electrodes to be free for connection therewith, connecting the electrodes to said ends, slipping the open end of said bulb over the spaced elements to place them between said exhaust tube and the inside bottom portion of said bulb, heat sealing the tube, bulb and intermediate conductor

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portions, and removing the common connecting portion from said conductors so that the spaced elements may serve as separate lead-in members to the electrodes.

5. In the manufacture of a glass electric discharge tube produced by sealing a glass bulb portion and a glass exhaust tube portion, the method of making a plurality of lead-in wire seals to permit said lead-in wires to be connected to an electrode assembly within the glass bulb and to act as supporting members for said electrode elements, comprising the steps of forming a plurality of lead-in wires connected by a common support, bending the said support and welding the ends together to form a metal cylinder, pushing said cylinder over the said glass tube so that a portion of each of said wires projects above and beyond the upper edge of the glass tube, connecting the electrodes of the tube assembly to the projecting portions of the lead-in wires, slipping the open end of the bulb portion over and outside of the portions of the lead-in wires that rest against the side of the glass tube, heat sealing the said glass tube portion and the said glass bulb portion to the wires and to each other, and cutting away the common support from the wires so that they will become electrically separated at the bottom and will be available to serve as lead-in wires.

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