Jan. 7, 1964 A. GREINER ETAL 3,116,992

METHOD OF MANUFACTURE OF LAMP FILAMENT SUPPORTS

Filed Oct. 2, 1959

Fig. 1.

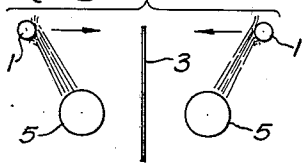


Fig. 2.

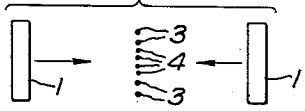


Fig. 3.

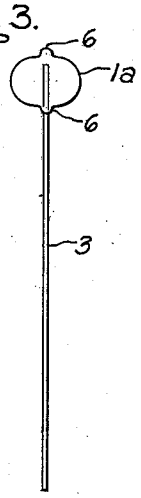


Fig. 4.

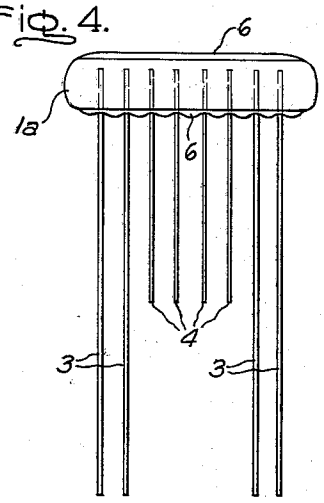


Fig. 5.

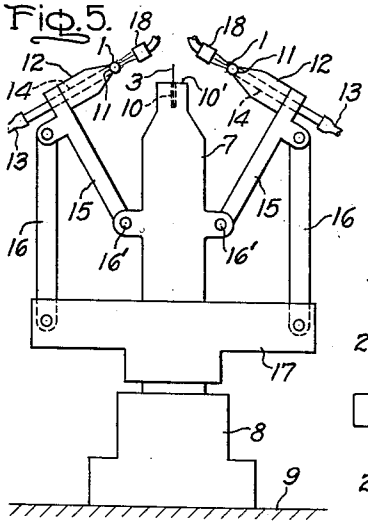


Fig. 6.

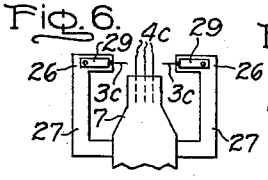


Fig. 8.

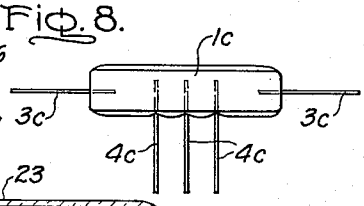


Fig. 7.

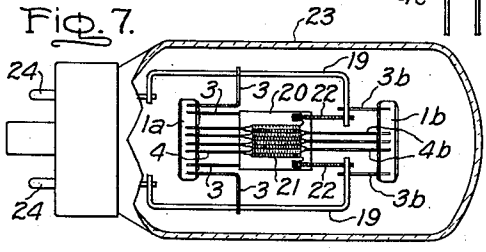


Fig. 9.

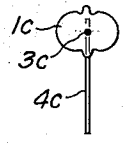


Fig. 10.

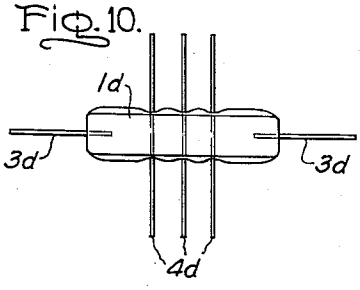


Fig. 11.

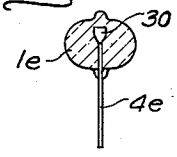


Fig. 12.

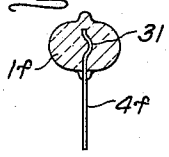
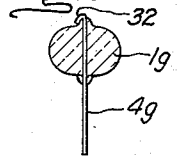


Fig. 13.



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3,116,992

METHOD OF MANUFACTURE OF LAMP FILAMENT SUPPORTS

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5 Claims. (Cl. 65—54)

Our invention relates to improvements in the manufacture of electric lamps or similar devices, and more particularly to a method of manufacturing lamp filament supporting means.

In certain types of electric lamps, particularly incandescent projection lamps, portions of the filament are supported by a so-called "bridge structure" comprising a glass rod or cane and a plurality of support wires having their ends embedded in the glass rod and extending away therefrom. Generally, such bridges are made by inserting or thrusting the heated ends of the wires end-foremost into the glass rod which has been heated to a softened or plastic condition so that the ends of the wires are embedded in the rod. In a common form of bridge, for example, the wires are arranged in side-by-side relation in a single plane and extend at right angles to the axis of the glass rod, the outermost wires being secured to the lead-in or current supply conductors of the lamp, and the intermediate wires having their free ends bent to form hooks for supporting the filament.

While such bridges have been used successfully in many applications, nevertheless there has been a need for bridges which are more resistant to the effects of high temperatures. In certain types of projection lamps the intense heat generated by the filament causes the glass rod to soften and deform with the result that the filament sags and twists out of shape so that the closely spaced coils of the filament touch each other to cause arcing and short-circuiting with resultant early burn-out of the filament. In some cases where the wires have not been inserted sufficiently deeply into the glass rod, one or more of them may be pulled out of the rod when it is heated during operation of the lamp. These difficulties are encountered even when the bridge is made of so-called "hard glasses" having a relatively high softening point of approximately 900° C.

Accordingly, it would be desirable to employ fused silica or quartz cane or rod as a bridge material since its softening point is in the neighborhood of 1650° C. However, it is not feasible to manufacture bridges of quartz in the conventional manner employed in making glass bridges, namely, by simply inserting the wires end-foremost into the heated quartz rod. The wires, usually of molybdenum or tungsten, do not adhere tightly to the quartz. Because quartz does not flow as does glass, the wires merely form an indentation in the body of the quartz rod and are easily removed.

It is therefore the principal object of our invention to provide a bridge construction and method of manufacture thereof whereby the bridges may be made of quartz in a simple and practicable manner. As will appear hereinafter, our novel method of manufacture also possesses certain advantages when employed in the manufacture of glass bridges.

Generally speaking, in accordance with one aspect of our invention, the bridge is formed from two separate pieces of quartz or glass rod. With the support wires arranged in a desired array, the vitreous rods are heated to a softened or plastic condition along one side of the length thereof and are then pressed together along the softened sides thereof with portions of the wires

therebetween to join together the said rods with the said portions of the wires firmly embedded in the joint. In this way it is possible to embed the wires to any desired depth in the body of the vitreous rod, even so that they extend completely through the rod. This method also makes it possible, when desired, to even more securely anchor the wires into the rod by laterally deforming the ends of the wires, for example by kinking, flattening, notching or bending over those ends, so as to provide a firm mechanical anchoring of the wires in the interior of the rod.

Further features and advantages of our invention will appear from the following detailed description and from the drawing wherein:

FIGS. 1 and 2 are diagrammatic showings, in elevation and plan respectively, of an arrangement of elements employed in practicing the process comprising our invention;

FIGS. 3 and 4 are end and side elevation views, respectively, of a completed bridge;

FIG. 5 is a front elevation of a form of apparatus with which the process may be practiced;

FIG. 6 is a fragmentary side elevation of a modified form of the apparatus;

FIG. 7 is an elevation of an incandescent lamp employing bridge structures comprising our invention;

FIGS. 8 and 9 are side and end elevation views of a modified form of bridge which may be made in the apparatus illustrated in FIG. 6;

FIG. 10 shows a further modification of the bridge structure; and

FIGS. 11 to 13 show sections through bridges wherein the support wires are deformed to provide additional anchorage in the vitreous rod member.

Referring to FIGS. 1 and 2 of the drawing, the process may be practiced by supporting in parallel relationship two separate pieces of quartz or glass cane or rod 1 of proper diameter and length, with a plurality of wires supported in the space between the rods 1. In the illustrated arrangement, the wires are disposed in vertical side-by-side relation in a single plane with their upper ends at a common elevation, there being two heavier wires 3 at each end of the row and four finer and shorter intermediate wires 4. The rods 1 are heated to a plastic condition along the length of their opposing sides by suitable burners 5 and are then pressed together at their heated sides with the upper ends of the wires 3, 4 therebetween to form a complete bridge with the wires firmly embedded in the rod 1*a* (FIGS. 3 and 4) which is formed by the consolidation of the rods 1. It will be noted that the consolidated bridge rod 1*a* is characterized by longitudinal ridges 6 when the original rods 1 are joined together, the lower ridge 6 having a scalloped appearance.

The apparatus shown in FIG. 5 comprises an upright support standard 7 which is mounted on a base or pedestal 8 supported on a table 9. The molybdenum or tungsten wires 3, 4 are supported in a row of vertical passages 10 in the upper face 10' of the support 7, the passages being of proper diameter and depth to support the respective wires 3 and 4 with their upper ends at a common level. The pieces of quartz rod 1 are held in the concave and horizontally elongated faces 11 of respective vacuum jaws 12 where they are firmly held by suction applied through a conduit 13 and a passage 14 in the jaws 12 which is in communication with small apertures or slits in the face 11. The jaws 12 are supported on respective arms 15 which are pivoted on pins 16' in the standard 7 and are actuated through links 16 pivotally connected to a collar 17 which is slidable along the standard 7. The quartz rods 1 are heated by respec-

tive horizontally elongated oxyhydrogen burners **18** which are supported on an arm (not shown) mounted on the collar **17**.

In the operation of the apparatus, when the quartz rods **1** have been heated along the length of their exposed sides by the burners **18**, they are pressed together, with the ends of the wires **3**, **4** therebetween, by raising the collar **17** to cause the jaws **12** to close, the burners **18** being raised out of the path of the jaws by virtue of their attachment to collar **17**.

In FIG. 7 there is shown a projection lamp employing bridge structures made in accordance with the invention. As illustrated therein, the bridge structure **1***a*, **3**, **4** at the left is like that shown in FIGS. 3 and 4, the outermost heavier wires **3** being bent and welded to respective lead-in conductors **19** to support the bridge in place. The adjacent heavier wires **3** support a flat sheet metal reflector **20** which is located behind the filament **21**. The filament is composed of a plurality of coiled segments arranged in parallel relation and serially connected at one end by bight portions which are supported by hooks formed in the ends of the finer support wires **4** of the bridge. The other ends of the filament segment are similarly supported by a second bridge comprising the rod **1***b* of vitreous insulating material, bridge support wire **3***b* secured to the bent ends of the lead **19**, and filament support wires **4***b* having hooked ends engaging the bight portions at that end of the filament segments. The filament **21** is connected at its ends to the leads **19** through spuds **22**, the said leads **19** being connected to terminal pins **24** extending through the end of the enclosing glass bulb **23**.

In FIGS. 8 and 9 there is shown another form of bridge wherein the filament support wires **4***c* extend laterally from the vitreous rod portion **1***c* as before, but the bridge supporting wires **3***c* extend axially from the ends of the said rod portion **1***c*. As seen in FIG. 9, the transverse or cross sectional shape of the rod **1***c* differs slightly from that in FIG. 3 because, in forming the consolidated rod **1***c*, the original separate rod members **1** (FIGS. 1 and 2) were not pressed or squeezed together to the same extent as in the case of the FIG. 3 bridge, the original rods thereby retaining their original cylindrical cross section to a greater degree.

For assembling the bridge shown in FIGS. 8 and 9, the apparatus shown in FIG. 5 may be modified as shown in FIG. 6 to provide support means for the axially extending wires **3***c*. To that end, there is provided a pair of holder members **26** which are supported on arms **27** from the support standard **7**. The wires **3***c* are supported in horizontal slots or grooves in the faces of the respective holders **26** and are retained therein by leaf springs **29** attached to the faces of the holders. The wires **4***c* are supported in passages in the upper end of the support standard **7** with their upper ends at a common level adjacent to the common line or axis containing the wires **4***c*, so that when the two pieces of heated rod **1** are pressed together along the said line or axis the ends of the wires **3***c* and **4***c* will be embedded in the fused joint therebetween.

The modified form of bridge shown in FIG. 10 is like that shown in FIG. 8 except that the filament support wires **4***d* are embedded in the vitreous rod **1***d* at their midpoint so as to extend from both sides of the rod.

While the above described method makes it possible to embed the wires in the vitreous bridge to a sufficient depth to assure a firm connection, yet in some cases, as where the bridge rod is made of glass which might soften in service and permit one or more of the wires to be pulled out of the bridge, provision may be made for still further assuring a firm mechanical anchorage or locking of the wires in the glass rod. Thus, the ends of the wires may be deformed in any suitable manner, as by bending, kinking, notching, flattening, upsetting, etc. In FIG. 11, the end **30** of the wire **4***e* is flattened to anchor it in the vitreous rod **1***e*, and in FIG. 12 the wire **4***f* is kinked or bent at **31** for anchorage in the rod **1***f*. In FIG. 13 the wire **4***g* extends completely through the vitreous rod **1***g* and has its end portion **32** bent back against the surface of the rod **1***g* to anchor it.

A lamp containing a bridge structure described herein is separately claimed in our divisional application Serial No. 276,021, filed April 26, 1963.

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

1. The method of making a bridge structure of the class described which comprises supporting a plurality of wires in an array wherein at least portions of the wires are located substantially in a common plane and closely adjacent a common imaginary line in said plane, supporting a pair of rods of vitreous material in spaced relation from each other and from said wires, heating to a plastic condition the length of only one side of each of said pair of spaced rods, discontinuing the heating, and then bringing the said rods together along the said plastic sides thereof and along the said imaginary line and pressing them together with sufficient force to flatten said plastic sides and to join together said rods with said portions of the wires embedded in the joint therebetween.

2. The method of making a bridge structure of the class described which comprises arranging a plurality of wires in side-by-side relation substantially in a common plane, supporting a pair of cylindrical rods of vitreous material in spaced relation from each other and from said wires, heating to a plastic condition the length of one side of each of said pair of rods, discontinuing the heating and then bringing said rods together along the said plastic sides thereof and with portions of said wires therebetween and pressing the rods together with sufficient force to flatten the said plastic sides to join together said rods with said portions of the wires embedded in the joint therebetween.

3. The method of making a bridge structure of the class described which comprises supporting a plurality of wires in an array wherein at least portions of the wires are located substantially in a common plane and closely adjacent a common imaginary line in said plane, said portions of the wires being deformed laterally, supporting a pair of cylindrical rods of vitreous material in spaced relation from each other and from said wires, heating to a plastic condition the length of one side of each said pair of rods, of discontinuing the heating, and then bringing the said rods together along the said plastic sides thereof and along the said imaginary line and pressing the rods together wth sufficient force to flatten the said plastic sides to join together said rods with said deformed portions of the wires embedded and anchored in the joint therebetween.

4. The method of making a bridge structure of the class described which comprises arranging a plurality of wires in side-by-side relation substantially in a common plane, and with proximate end portions at a common level, supporting a pair of cylindrical rods of vitreous material by engagement of a support member with the length of one side of each rod and with the rods in spaced relation from each other and from said wire, heating to a plastic condition the length of the side of each of said pair of rods opposite that engaged by the support member discontinuing the heating and then bringing said rods together along the said plastic sides thereof and with proximate end portions of said wires therebetween and pressing the rods together with sufficient force to flatten the said plastic sides to join together said rods with said portions of the wires embedded in the joint therebetween.

5. The method of making a bridge structure of the class described which comprises supporting a plurality of wires substantially in a single plane and with a portion of each wire closely adjacent an imaginary common straight line in said plane, supporting a pair of cylindrical quartz rods in spaced relationship at opposite sides

of said plane and parallel to each other and to said common imaginary line, heating the lengths of the opposed sides of said rods to a plastic condition, discontinuing the heating, and bringing said rods together along their plastic opposed sides and along said common imaginary line and pressing the rods together with sufficient force to flatten the said plastic sides to join them together and to embed the said portion of each wire in the joint therebetween.

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