

June 21, 1949.

M. L. STONE  
METHOD AND APPARATUS FOR ASSEMBLING  
INCANDESCENT LAMP MOUNTS

2,473,919

Filed Aug. 14, 1947

5 Sheets-Sheet 1

FIG. 1.

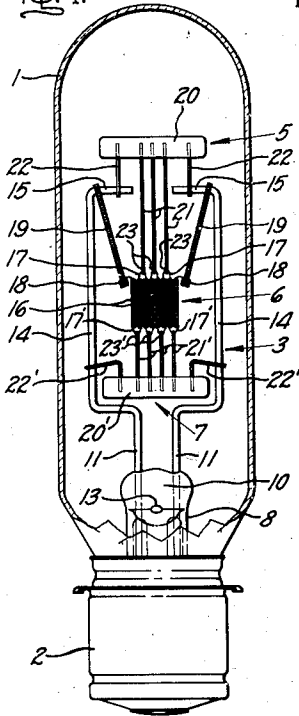


FIG. 2.

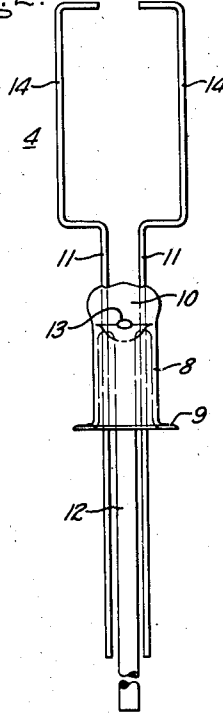


FIG. 3.

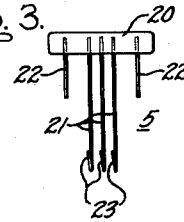


FIG. 4.

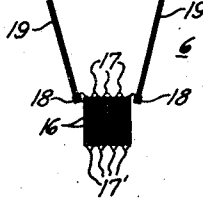


FIG. 5.

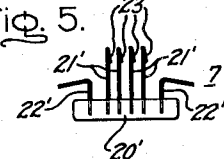


FIG. 6.

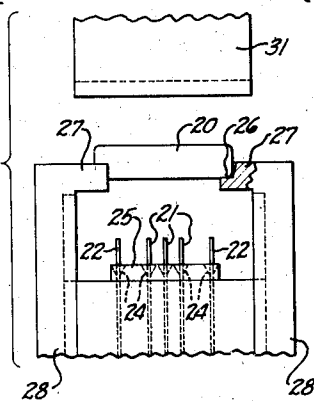


FIG. 7.

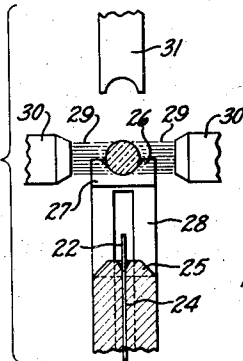
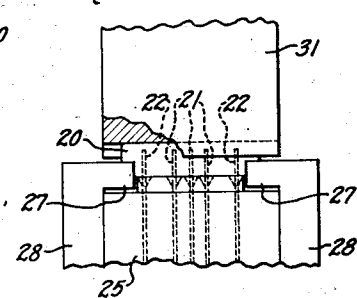


FIG. 8.



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FIG. 9.

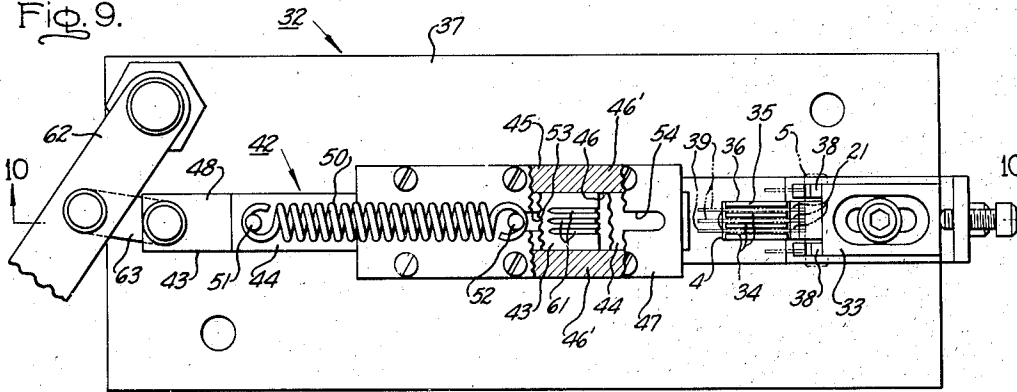


FIG. 10.

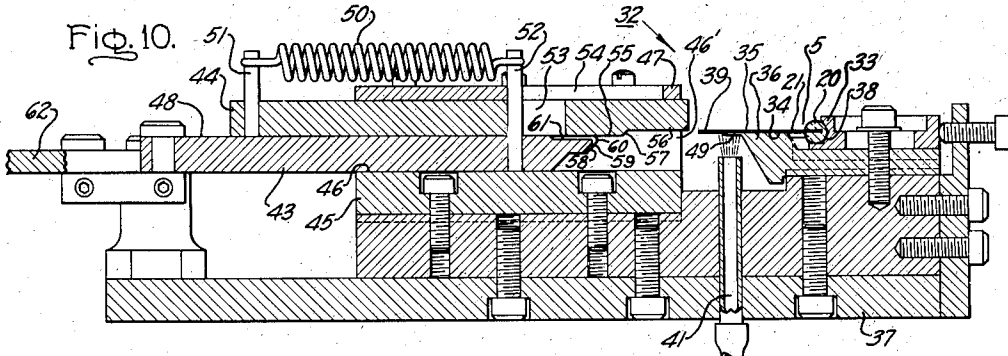


FIG. 11.

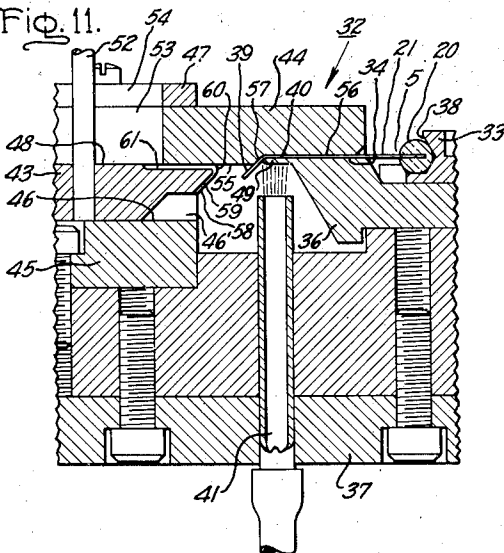
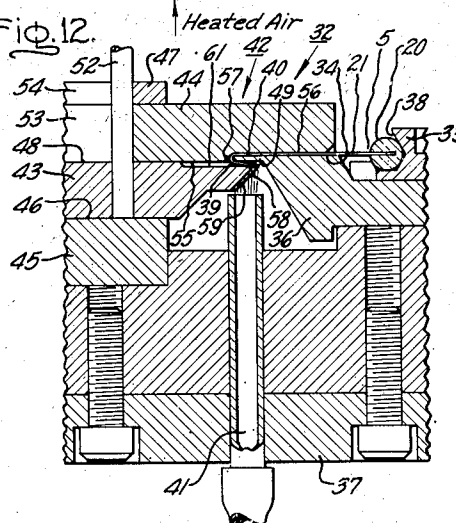


FIG. 12.



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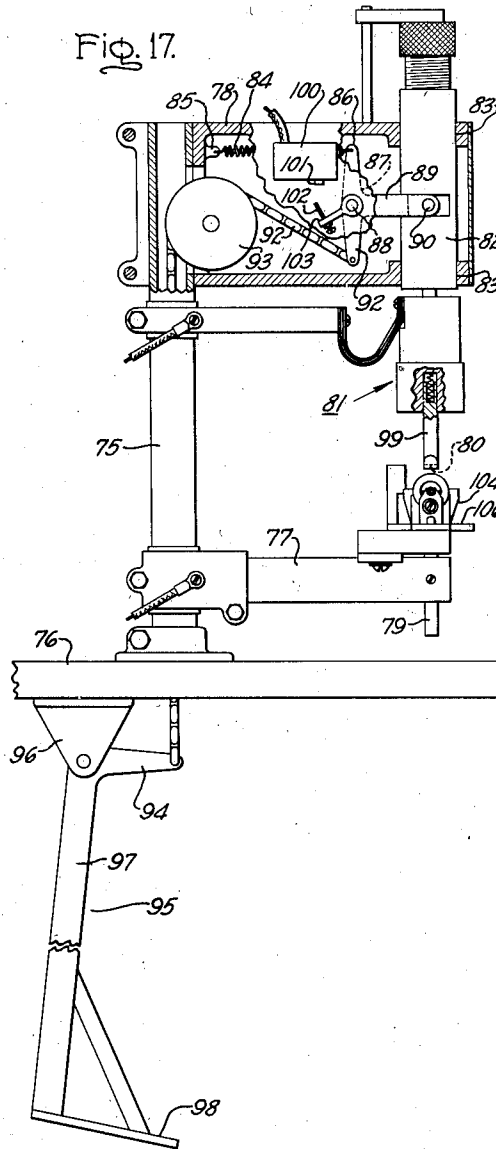
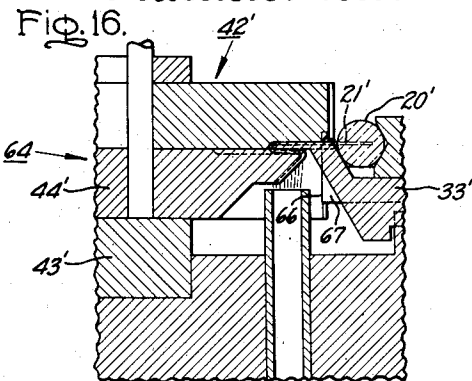
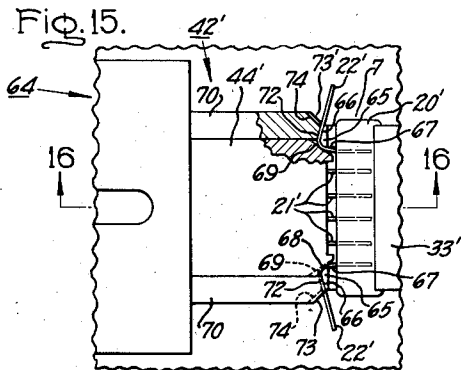
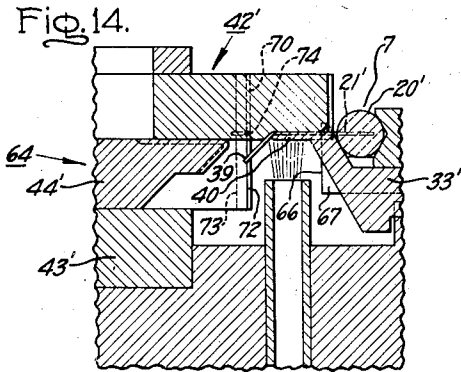
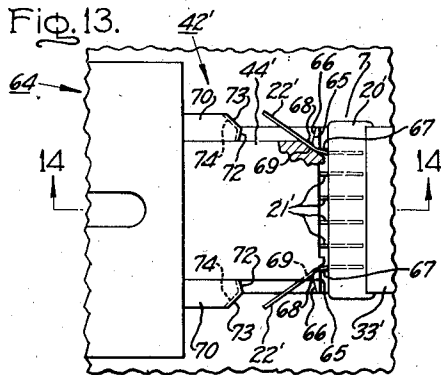
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Fig. 18.

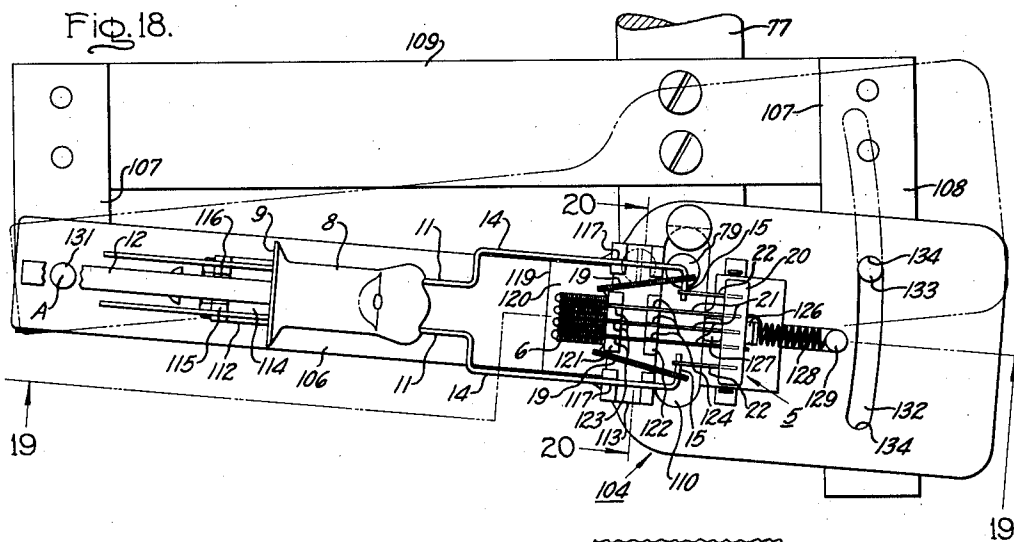


Fig. 19.

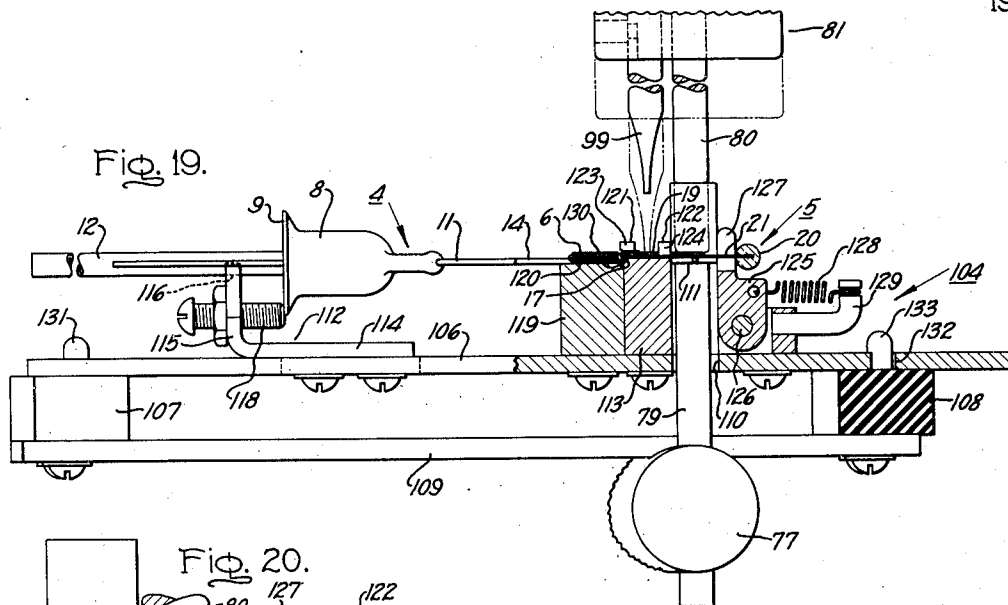
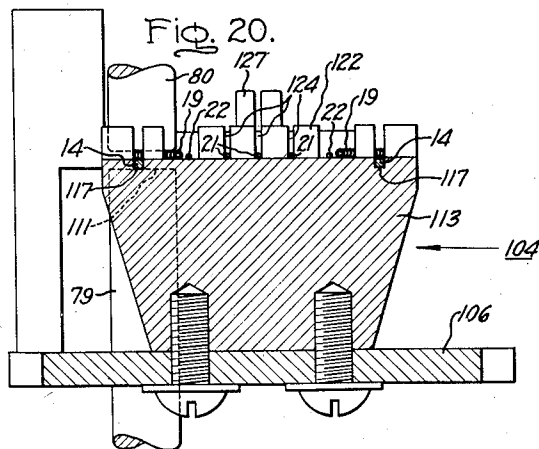


Fig. 20.



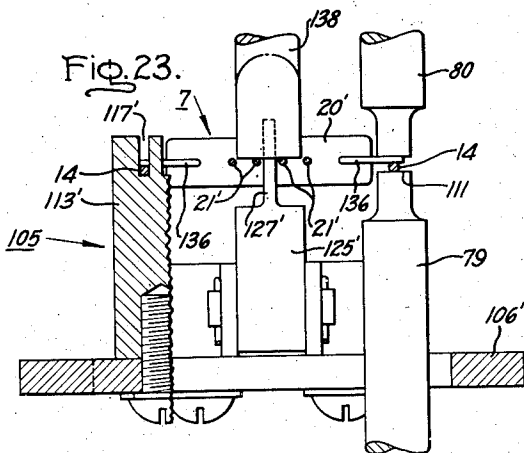
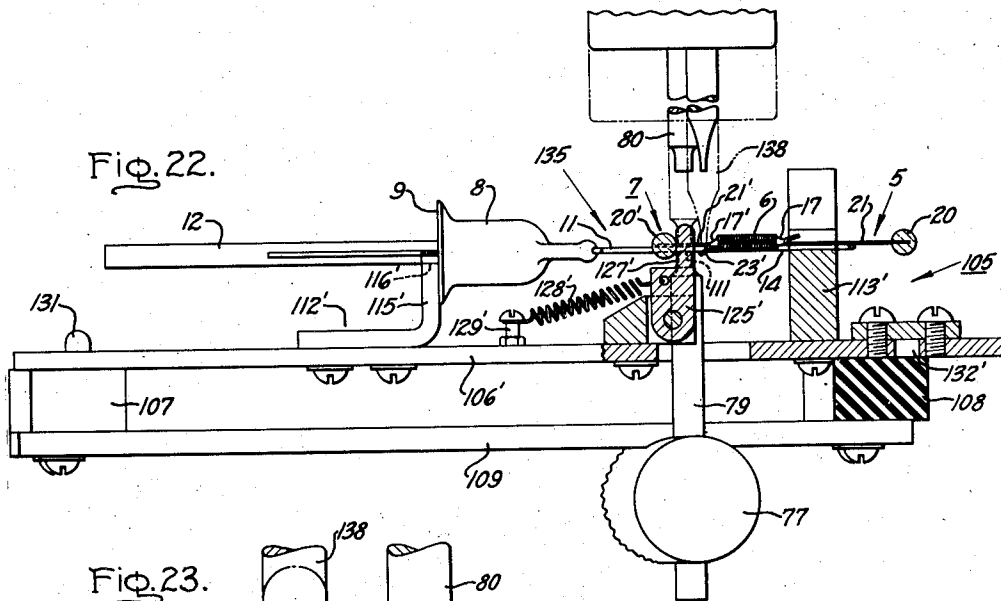
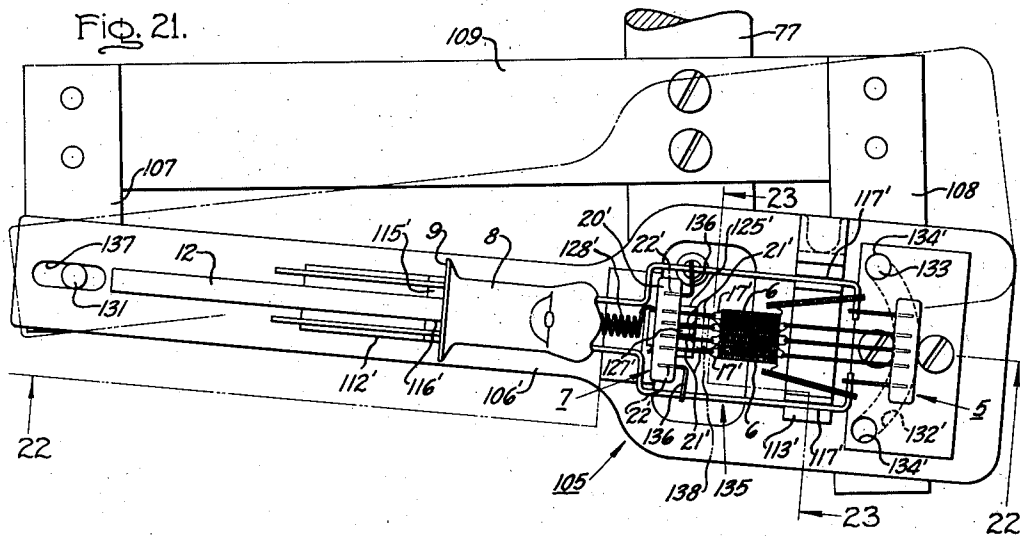
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5 Sheets-Sheet 5



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## UNITED STATES PATENT OFFICE

2,473,919

## METHOD AND APPARATUS FOR ASSEMBLING INCANDESCENT LAMP MOUNTS

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New York

Application August 14, 1947, Serial No. 768,643

10 Claims. (Cl. 219—4)

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My invention relates in general to electric incandescent lamps and similar devices, and more particularly to method and apparatus for the manufacture and assembly of the mount thereof.

In certain types of high wattage incandescent lamps such as are used for projection purposes, for instance, and which employ a planar or segmental type filament comprising a plurality of coiled sections disposed in side-by-side relation, the filament is supported in place on the lead-in conductors of the lamp mount by means of a plurality of anchor wires which are hooked around the bights of the filament and which extend from upper and lower insulating bridge members mounted on the said conductors.

The methods heretofore employed in the manufacture of that type lamp mounts have generally involved the application of various hand operations, such as the shaping of the segmental filament, its attachment to the lead-in conductors, and the bending of the filament anchor wires around the filament bights, which entailed a considerable amount of time, expense and inconvenience. In addition, such hand operations precluded the manufacture of a uniform finished product since the individual filament segments of each mount were not positioned in the same exact relation to one another and to the lead-in conductors and stem flare of the mount. However, the principal service (projection purposes) for which such type lamps are intended makes it highly desirable to have the filament and its individual sections positioned as accurately and uniformly as possible within the lamp in order to obtain the most efficient utilization of the light therefrom by the optical system of the apparatus with which the lamp is used.

It is one object of my invention therefore to provide an improved method of forming the mount structure of an electric incandescent lamp of the character described.

Another object of my invention is to provide apparatus for the manufacture of incandescent lamp mounts of the character described in accordance with the method comprising my invention.

Further objects and advantages of my invention will appear from the following detailed description of a species thereof and from the accompanying drawings in which:

Fig. 1 is an elevation, partly in section, of an electric incandescent lamp provided with a mount structure formed by the method and apparatus comprising my invention; Figs. 2-5 inclusive are

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detail views showing in elevation the stem, upper bridge, filament and lower bridge, respectively, of the lamp mount prior to their assembly in accordance with the invention; Figs. 6-8 inclusive are views illustrating the various steps in the manufacture of the bridge members shown in Figs. 3 and 5 prior to the formation of the hooks on the filament anchor wires thereof; Fig. 9 is a plan view of apparatus for forming the hooks on the filament anchor wires of the upper bridge; Fig. 10 is a section on the line 10-10 of Fig. 9; Figs. 11 and 12 are fragmentary sectional views of the apparatus of Figs. 9 and 10 showing the successive steps in the formation of the hooks on the filament anchor wires of the upper bridge; Fig. 13 is a fragmentary plan view of apparatus for forming the hooks and bending the fastening wires of the lower bridge, the view showing the first step in the hook forming and wire bending operation; Fig. 14 is a section on the line 14-14 of Fig. 13; Figs. 15 and 16 are fragmentary views, similar to Figs. 13 and 14 respectively, showing the second step in the formation of the hooks on the anchor wires of the lower bridge and the bending of the end fastening wires thereof; Fig. 17 is an elevation, partly in section, of apparatus according to the invention for assembling electric incandescent lamp mounts of the character described; Fig. 18 is a plan view of the mount assembly jig and associated support means of the apparatus shown in Fig. 17 for assembling the filament and upper bridge of the mount with the stem thereof; Fig. 19 is a front elevation, partly in section on the line 19-19 of Fig. 18, of the assembly jig illustrated in Fig. 18; Fig. 20 is a transverse section on the line 20-20 of Fig. 18, with the movable upper welding electrode shown in its lowered welding position; Fig. 21 is a plan view, similar to Fig. 18, of an assembly jig and associated support means according to the invention for assembling the lower bridge with the intermediate assembly of the stem, upper bridge and filament formed by the apparatus of Figs. 17-20; Fig. 22 is an elevation, partly in section on the line 22-22 of Fig. 21, of the assembly jig illustrated in Fig. 21; and Fig. 23 is a transverse section on the line 23-23 of Fig. 21.

Referring to Fig. 1 of the drawings, the electric incandescent lamp there illustrated comprises a tubular glass bulb or envelope 1 having a base 2 secured to its neck end. Extending into the bulb longitudinally thereof from its neck end and sealed thereinto is a mount 3 according to the invention comprising a stem 4, upper bridge 5, filament 6, and lower bridge 7, shown in detail

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in Figs. 2-5, respectively. The stem 4 comprises a glass stem tube portion 8 having an outturned flange or flare 9 at one end and a press portion 10 at its other end through which are sealed a pair of rigid lead-in conductors or wires 11-11. The stem 4 is also provided with a glass exhaust tube 12 extending through the stem tube 8 and fused at one end into the press portion 10 of the stem tube. The exhaust tube 12 communicates with the interior space of the bulb 1 through an opening 13 in the press portion 10 of the stem tube. After the mount 3 is sealed into the bulb by fusion of the stem tube flange 9 to the bulb neck, the bulb is exhausted and gas filled through the exhaust tube 12 and the latter then tipped or sealed off in the usual manner.

The lead-in conductors 11-11, which are connected at their outer ends to the terminals of the base 2, extend into the bulb longitudinally thereof from the stem press 10 in parallel relation to each other. Inwardly of the bulb the said conductors 11-11, in the particular form of lamp shown, are laterally bent outwardly away from each other to form parallel extending off-set or side portions 14-14 between which the filament 6 is mounted. At their innermost ends, the lead-in conductors 11-11 are bent inwardly towards one another to form inturned portions 15-15 to which the filament 6 is connected.

The filament 6 is of the high-wattage planar type comprising a plurality of parallel coiled segments 16 of tungsten wire disposed in side-by-side relation and joined by upper and lower uncoiled or bight portions 17, 17', respectively. For the purposes of the invention, the filament 6 should be accurately formed to shape so as to locate the upper bights 17 as well as the lower bights 17' and the individual coil segments 16 of each filament in substantially the same exact relation to each other. For such reason, I have found it especially desirable to employ mechanically formed filaments 6 as made by the apparatus disclosed and claimed in copending U. S. application Serial No. 686,656, Isaac et al., filed July 27, 1946, and assigned to the assignee of the present invention, now Patent No. 2,449,653, dated September 21, 1948. The particular filament 6 illustrated is of the biplane type having alternate segments 16 staggered so as to lie alternately in two parallel planes. However, the invention is applicable as well to the mounting of other types of filaments, such as monoplane type filaments which have their individual coiled segments lying in a single plane only. The opposite ends of the filament 6 are provided with coiled end portions or segments 18-18 which are electrically connected to the inturned end portions 15-15 of the conductors 11-11 by screw-threaded spuds or insert plugs 19-19 which are screwed at one end into the filament end coils 18-18 and have tight frictional engagement therewith. The other ends of the spuds 19-19 are welded to the inturned inner end portions 15-15 of the lead-in conductors. In the particular form of filament illustrated, the spuds 19-19 extend more or less upwardly away from the filament and diverge at a slight angle. For the purposes of the appended claims, the spuds 19-19 together with the filament end coils 18-18 into which they are screwed may be considered as constituting the end connection portions of the filament itself.

The planar filament 6 is disposed in the plane, more or less, of the side portions 14 of the lead-in conductors, and it is supported in place by means of the upper and lower bridges, 5 and 7, respec-

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tively. The said bridges 5 and 7 are each comprised of short insulator members 20 or 20' of suitable insulating material, such as a short length of glass rod for instance, having a plurality of filament anchor wires 21 or 21' and end support or fastening wires 22 or 22' extending in parallel relation therefrom and suitably secured thereto, as by embedding therein. The anchor wires 21 and 21' of the bridges 5 and 7 are formed at their ends with hooks 23 and 23', respectively, which are hooked around the bights 17, 17' of the filament 6 to thereby support the same in place. The upper bridge 5 is mounted on the lead-in conductors 11 in a transversely extending position overlying the inturned conductor ends 15 with the anchor wires 21 extending down between and in the plane of the said conductors, and it is fastened in place by welding its end support wires 22 to the said inturned ends 15 of the lead-in conductors. The lower bridge 7 is mounted on the lead-in conductors 11 in a transversely extending position beneath the filament 6 and between the offset side portions 14 of the said conductors with the anchor wires 21' extending upwardly in the plane of the lead-in conductors, and it is fastened in place by welding its end support wires 22' to the said side portions 14 of the lead-in conductors.

In accordance with the invention, the upper and lower bridges 5 and 7 are accurately preformed to uniform final shape or form (Figs. 3 and 5) ready for assembly with the stem 4 and filament 6. For this purpose, the said bridges 5 and 7 are jig-formed in a manner that assures their uniformity of construction. Figs. 6-8 illustrate the procedure employed for embedding the anchor wires 21 and the end fastening wires 22 in predetermined position within the glass rod 20 of the upper bridge 5, a similar procedure being also followed for the lower bridge 7. As shown in Figs. 6-8, the anchor wires 21 and end fastening wires 22 are first inserted or dropped into retaining apertures 24 in a stationary holder block 25, the said wires being held by the block in predetermined parallel relation with one another with their upper ends projecting upwardly a predetermined distance from the holder block. A glass rod 20 is then supported at its ends in recessed seats 26 provided therefor in the inturned spaced arms 27 of a vertically reciprocal slide or carrier 28, the glass rod 20 being supported on the slide in a horizontal position overlying and in the plane of the said wires 21 and 22. In the particular case illustrated, the slide 28 is slidably mounted on the holder block 25 for vertical movement thereon, and it is spring held in the elevated position shown in Figs. 6 and 7 by suitable spring means (not shown). With the wires 21, 22 and the glass rod 20 thus held in the block 25 and slide 28, the glass rod 20 is heated to a softened condition by gas fires 29 from burners 30 located on opposite sides of the slide, whereupon the glass rod 20 and its supporting slide 28 are pushed or moved downwardly by a depressor member 31 engaging the glass rod, against the resistance of the spring means acting on the slide, to thereby force the softened glass rod down onto the upper ends of the wires 21 and 22 so as to cause the said wires to be embedded to a predetermined depth in the glass rod. Upon cooling and solidification of the glass rod 20, the depressor member 31 is raised and the glass rod with the wires 21, 22 embedded therein is removed from the carrier slide 28.

The free ends of the anchor wires 21, 21' of the respective bridge members 5 and 7 are then

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bent to provide accurately formed hooks 23, 23' thereon. In accordance with the invention the hooks 23, 23' are formed by suitable hook-forming devices, such as shown in Figs. 9-16, which assure the uniformity in the shape and positioning of the hooks. The hook-forming device 32 for the upper bridge 5 is shown in Figs. 9-12 and it comprises a holder 33 on which the bridge 5 is rested in a horizontal position, with its unformed anchor wires 21 extending horizontally and resting in parallel aligning grooves 34 formed in the horizontal upper surface 35 of the anvil portion 36 of the holder. The said holder 33 is mounted on a base member 37, and it is provided with a transversely extending channel-way or positioning recess 38 for receiving the glass rod 20 of the bridge 5 to position the latter in a predetermined position in the holder with the free ends of the anchor wires 21 projecting a predetermined distance, as indicated at 39, beyond a forming lip or finger 40 on the holder anvil position 36, around which lip the said wires 21 are bent to form the hooks 23. Extending upwardly through the base 37 at a point directly beneath the forming lip 40 of the anvil 36 is a tube 41 which is connected at its lower end to a supply of heated air or other gaseous medium under pressure for the purpose of directing a stream of the heated air or gas against the lip 40 and the projecting portions 39 of the bridge anchor wires and thereby prevent their breakage during the bending thereof. The projecting ends 39 of the bridge anchor wires 21 are bent around the forming lip 40 by a slide assembly 42 comprising a lower or main slide 43 and an upper or sub-slide 44, which assembly 42 is slidably mounted in a guide block 45 for horizontal reciprocating movement therein in a direction towards and away from the anvil 36 of the bridge holder 33. The guide block 45 is secured to the base 37 of the forming device, and it is provided with an upwardly facing guide way or channel way 46 within which the slide assembly 42 is guided and retained by a cover or retaining plate 47 fastened to the ways 46'. The upper slide 44 rests on top the flat upper surface 48 of the lower slide 43, which surface 48 is horizontally aligned with the flat under surface or face 49 of the forming lip 40 on the anvil 36 in a manner such as to pass underneath and slide across the said lip underface 49, with a very slight clearance therebetween, when the slide assembly 42 is moved forwardly towards the anvil into its hook forming position. The two slides 43 and 44 are also slidable relative to each other in the direction of the sliding movement of the slide assembly itself, and the upper slide 44 is normally held in an advanced position relative to the lower slide 43, when the slide assembly is in its retracted position as shown in Figs. 9 and 10, by the pull of a tension coil spring 50 fastened at one end to a post 51 upstanding from the upper slide 44 at a point spaced from the rear end of the retaining plate 47. The other end of the spring 50 is fastened to a similar post 52 upstanding from the lower slide 43, and projecting through slots 53 and 54 in the upper slide 44 and retaining plate 47, respectively.

At its forward end, the under surface 55 of the upper slide 44 is under-cut, as shown at 56, for a distance corresponding more or less to the length of the upper anvil surface 35 and to a depth corresponding to the thickness of the forming lip 40 on the anvil, to thereby align the under-cut surface 56 with, and permit it to pass or slide over the said anvil surface 35, with a very slight clearance therebetween, when the slide assembly

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42 is advanced to its hook-forming position. The under-cut portion 56 of the upper slide terminates in a transversely extending shoulder 57 which tapers downwardly and rearwardly at an angle, for instance 45° or thereabouts, to the horizontal. The forward end of the lower slide 43 is also tapered and beveled downwardly and rearwardly, as indicated at 58, at an angle corresponding more or less to the taper of the shoulder 57 on the upper slide, and it is provided with grooves 59 which are longitudinally aligned with the grooves 34 in the anvil 36 and which are adapted to receive the projecting ends 39 of the bridge anchor wires 21 after they have been bent down at an angle by the tapered shoulder 57 on the upper slide. The said grooves 59 are continued around the rounded upper corner 60 of the slide 43 and back over the upper surface 48 thereof, as indicated at 61, to receive and continuously guide the bent or hooked ends of the bridge anchor wires 21 (Fig. 12) as they are being bent to final hook shape by the said slide 43.

In the operation of the hook forming device 32, the bridge 5 with its unformed anchor wires 21 is first positioned in the holder 33 after which the slide assembly 42 is advanced towards the anvil 36 by swinging movement of a hand lever 62 pivotally mounted at one end on the base 37 and connected by a link 63 to the lower slide 43. As the lower slide 43 is moved forwardly by the hand lever 62, the upper slide 44 is carried along therewith by the pull of the coil spring 50. During the advance movement of the slide assembly 42, the forward end of the upper slide 44 first passes over the upper surface 35 of the anvil 36, thus trapping the bridge anchor wires 21 in the grooves 34 in the said anvil surface 35 and so locking the bridge 5 firmly in place on the holder 33. Further forward movement of the slide assembly 42 to its forwardmost position shown in Fig. 11 causes the tapered shoulder 57 on the underside of the upper slide to engage the projecting ends 39 of the anchor wires and bend them down at an angle over the end of the forming lip 40 on the anvil 36. Upon further forward movement of the lower slide 43 relative to the upper slide 44 (the latter being restrained from such further forward movement by the engagement of the shoulder 57 with the anchor wires 21 bent around the lip 40), the down-bent ends of the said wires 21 are engaged by the tapered forward end of the lower slide 43 within the guide grooves 59 therein and are bent around the forming lip 40 into their final hook shape, in the manner shown in Fig. 12.

The hook forming device 64 (Figs. 13-16) for the lower bridge 7 is similar to that employed for the upper bridge 5 except that the bridge holder 33' and the lower and upper slides 43' and 44' are provided with additional cooperating means for engaging and bending the end fastening wires 22' of the bridge laterally outward. For this purpose, the holder 33' is provided with side anvil portions 65 disposed outwardly of and extending upwardly alongside and above each of the bridge fastening wires 22' when the bridge 7 is positioned in place in the holder. The said side anvil portions 65 are formed with front anvil surfaces 66 facing the slide assembly 42' and extending laterally at an angle corresponding substantially to the angle at which the fastening wires 22' are to be ultimately bent. In the particular case illustrated, the anvil surfaces 66 taper outwardly and back at a slight angle. The upper slide 44' is made of a width slightly greater than

the space between the inside or facing sides 67 of the side anvil positions 65 so as to engage the bridge fastening wires 22' upon forward movement of the slide. At its forward end, the upper slide 44' is formed with vertically extending beveled forming surfaces 68 at each side thereof which taper back at an angle of about 45° or so and are provided with grooves 69 horizontally aligned with and adapted to receive and guide the end fastening wires 22' of the bridge 7 on the holder 33'. The lower slide 43' is provided with upstanding side extensions 70 which extend upwardly on each side of the upper slide 44' and slide along the side faces 71 thereof. The forward ends of these side extensions 70 are formed with inner and outer forming surfaces 72 and 73 respectively, for engaging and bending the bridge fastening wires 22' to final shape. The inner forming surfaces 72 oppose the tapered anvil surfaces 66 on the side anvil portions 65, and they extend approximately parallel to the said surface 66. The outer forming surfaces 73 taper outwardly and back at an angle of about 45° or so. The forming surfaces 72 and 73 are also provided with grooves 74 which are horizontally aligned with and are adapted to receive and guide the bridge fastening wires 22' during the bending thereof to final shape.

Upon advance movement of the upper slide 44' to its forwardmost position as shown in Figs. 13 and 14, the projecting ends 39' of the bridge anchor wires 21' are bent down over the anvil lip 40 as before while the end fastening wires 22' are engaged by the beveled forming surfaces 68 and are bent laterally out at an angle corresponding to the bottom of the grooves 69 within which the said wires 22' are received and guided. Continued advance movement of the lower slide 43' to its forwardmost position shown in Figs. 15 and 16 then bends the down-turned ends of the bridge anchor wires 21' to final hook shape as before, while the side forming surfaces 72 and 73 engage the out-turned ends of the fastening wires 22' and bend them backwardly against the tapering anvil surfaces 66, the wires 22' being continuously received and guided; during the bending thereof, in the guide grooves 74 and being finally clamped between the said anvil surfaces 66 and the innermost forming surfaces 72 of the lower slide, as shown in Fig. 15.

The bridges 5 and 7, as pre-formed in the manner described above, are then assembled together with the filament 6 and stem 4 to form the finished lamp mount 3. In accordance with the invention, the assembly of each of the bridges with the filament and stem is performed in a manner which assures the accurate and uniform mounting of each filament 6 on the stem in definite predetermined relation to the lead-in conductors 11 and to the flange 9 on the stem tube 8. For this purpose, assembly jigs are employed for holding the various parts in properly assembled and positioned relation to each other while they are welded together on an electric resistance welder (Fig. 17) of conventional type comprising a hollow support column 75 upstanding from a table or bench 76 and provided with a lower bracket 77 and a hollow upper bracket 78 which carry vertically extending opposed welding electrodes 79 and 80 relatively movable in a vertical direction towards and away from each other. The lower electrode 79 is held stationary on the lower bracket 77 while the upper electrode 80 is vertically reciprocal on the upper bracket 78, it being carried by a head 81 comprising a ver-

tically extending slide rod 82 which is slidably mounted in bearings 83 on the upper bracket 78 for vertical reciprocating movement therein. The slide rod 82 with its associated electrode 80 is normally held in a raised or elevated position, as shown in Fig. 17, by the pull of a tension coil spring 84 located within the hollow interior of the upper bracket 78 and connected at one end to a spring post 85 on the bracket and at its other end to one arm 86 of a three-armed lever 87 mounted at its hub on a horizontal shaft 88 which is rotatably supported within the bracket 73. A second arm 89 of the lever 87 is pivotally connected to the slide rod 82 by a pin 90, while the third arm 92 of the lever is connected to a chain 92 which passes over and around a guide pulley or sheave 93 mounted within the bracket 78 and extends down through the hollow column 75 and through an opening (not shown) in the table 76 where it is connected to one arm 94 of a foot lever or treadle 95 pivotally mounted beneath the table on a bracket 96 fastened thereto. The other arm 97 of the treadle 95 is provided with a foot pedal 98 which, when depressed or moved backwardly, pulls down on the chain 92 which, acting through the three armed lever 87, then moves the slide rod 82 and its electrode 80 downwardly into welding position. The head 81 also carries a spring pressed hold-down pin 99 which is adapted to engage and hold, during the welding operation, the parts of the mount to be welded together.

Mounted on the upper bracket 78 is a switch 100 for connecting the electrodes 79, 80 to a suitable source of power supply. The said switch 100 is provided with an operating push-pin or plunger 101 which is engaged by an adjustable screw 102 carried by an arm 103 mounted on the shaft 88. When the upper electrode 80 is lowered to its welding position, the arm 103 is swung upwardly by the rotation of shaft 88, causing the screw 102 to engage and depress the switch plunger 101 and thus close the switch.

Mounted on the lower bracket 77 of the welding apparatus directly beneath the upper electrode 80 thereof is an assembly jig 104 for holding the stem 4, filament 6, and upper bridge 5 in predetermined assembled relation with each other and in proper welding position between the spaced electrodes 79 and 80. A different jig 105 (Figs. 21-23), mounted in a similar position on a similar welding apparatus such as shown in Fig. 17, is employed to hold the lower bridge 7 in assembled welding relation with the welded assembly of the stem 4, filament 6 and upper bridge 5 as formed in the jig 104.

The assembly jig 104, shown in detail in Figs. 18-20, comprises an elongated base plate 106 mounted in a horizontal position on arms 107, 108, of suitable plastic or other insulating material, which extend from a holder cross bar 109 secured to the lower bracket 77 of the welding apparatus. The base plate 106 is provided with a transverse slot 110 through which the stationary electrode 79 projects upwardly. On its upper side, the base plate 106 is provided with support means on which the stem 4, filament 6 and upper bridge 5 are rested and held in predetermined relation to each other, as shown. The stem 4 is supported in a horizontal position extending longitudinally of the base plate 106, with its side conductor portions 14 disposed in a horizontal plane immediately above the plane of the upper end 111 of the stationary electrode 79, by means of spaced supports 112 and 113 spaced apart longitudinally

of the base plate. Support 112 comprises an L-shaped bar, one leg 114 of which is secured to the base plate 106 and the other leg 115 of which extends upwardly therefrom and is provided with a notch or recess 116 in its upper end within which the exhaust tube 12 of the stem is received and supported. The other stem support 113 comprises a block-shaped member upstanding from the base plate 106 and provided with upwardly opening guide slots 117 in its upper surface within which the side portions 14 of the stem lead-in conductors are received and supported. The stem 4 is located in a definite position longitudinally of the base plate 106, with its in-turned conductor ends 15 overlying the cross slot 110 in the base plate, by means of an adjustable stop screw 118 on the support 112 against the end of which the rim of the stem tube flange 9 is held by the operator during the welding operation, as shown in Fig. 19.

Mounted on the upper side of the base plate 106 alongside the block 113 is a filament support block 119 provided with a flat upper surface 120 on which the filament 6 is adapted to be rested flat, to position it in the horizontal plane, more or less, of the stem conductor portions 14 with the diverging end connection or spud portions 19 of the filament extending towards and across the in-turned ends 15 of the stem lead-in conductors. The support block 119 is provided with lugs 121 and 122 upstanding from the upper surface 120 thereof and having a series of aligned slots 123 and 124 therein which correspond in number and spacing to the anchor wires 21 of the bridge 5 and extend longitudinally of the base plane 106, within which slots the said anchor wires are received and supported to thereby horizontally position the bridge 5 in place relative to the stem conductor portions 14.

Pivotaly mounted on the base plate 106, on that side of the cross slot 110 opposite to the bridge support block 113, is a lever 125 pivoted on a pin 126 and provided with an upstanding slotted finger 127 adapted to project up between the anchor wires 21 of the bridge 5 and engage the side of the glass insulator rod 20 thereof facing the filament. A tension coil spring 128, connected between the lever 125 and a spring post 129 fastened to the base plate 106, exerts a constant pulling force on the lever tending to pivot it in a direction away from the bridge support block 113. When the upper bridge 5 and filament 6 are rested in place in assembled position on the support blocks 113 and 119, with the anchor wires 21 of the bridge hooked to the upper bights 17 of the filament and the finger 127 of the lever 125 engaging behind the glass insulating rod 20 of the bridge, as shown in Figs. 18 and 19, the spring pivoted lever 125 then exerts a force on the bridge 5 acting to continuously pull it in a direction longitudinally of the base plate 106 and away from the block 113, thereby drawing the upper bights 17 of the filament tight against the vertical face 130 of the lug 121 on the support block 113 which thus serves to accurately locate the filament in predetermined longitudinal relation to the stem 4. In such position, the end connection portions 19 of the filament and the end fastening wires 22 of the upper bridge extend across and rest on the in-turned conductor end portions 15 of the pre-positioned stem 4.

To enable the selective positioning of the crossed portions of the filament, lead-in conductors and bridge fastening wires in proper welding position between and in vertical alignment with

the electrodes 79 and 80, the jig 104 is movably mounted on its support bracket 77 for movement laterally of the vertical path of travel of the upper electrode. For this purpose, the base plate 106 of the jig is pivoted adjacent one end, on a pivot pin 131 upstanding from the support arm 107, so as to swing in a horizontal plane. Adjacent its other end, the base plate 106 is provided with an arcuate slot 132 having its center of curvature coincident with the axis A of pivotal movement of the base plate on the pin 131, through which slot extends a stop pin 133 upstanding from the support arm 108. The ends 134 of the slot 132 serve as stops against which the pin 133 strikes to limit the swinging movement of the base plate 106 in each direction and thus automatically position the jig in its limiting welding positions, i. e., the positions for effecting the outermost of the two welded connections which are to be made to each in-turned conductor end 15.

After the positioning of the stem 4, filament 6 and upper bridge 5 in place on the jig 104, the latter is then swung to its various welding positions wherein the crossed portions of the filament end connections 19, bridge wires 22 and conductor ends 15 are successively located between and in vertical alignment with the electrodes 79 and 80, with the in-turned conductor ends 15 resting on the upper end 111 of the stationary electrode 79. In each of the said welding positions of the jig 104 the upper electrode 80 is moved downwardly, by movement of the foot pedal 83, to successively clamp the crossed portions of the filament end portions 19, bridge wires 22 and conductor ends 15 between the two electrodes and simultaneously weld them together.

The intermediate welded assembly 135 of the stem 4, filament 6 and upper bridge 5 thus formed on the first jig 104 is then assembled together with the lower bridge 7 in the second jig 105 (Figs. 21-23), and the said lower bridge 7 welded to the side conductor portions 14 of the stem to complete the mount structure 3. The jig 105 is similar to the previous jig 104 and comprises an elongated base plate 106' horizontally positioned on the insulating arms 107, 108 of the lower support bracket 77 of a welding apparatus similar to that shown in Fig. 17. The intermediate welded mount assembly 135 is held by supports 112' and 113' in a horizontal position on the base plate, with the undersides of the side conductor portions 14 horizontally aligned with the upper end 111 of the stationary lower electrode 79. Support 112 is provided with a notch 116' within which the exhaust tube 12 of the mount assembly 135 is received and supported, and the other support 113' is provided with upwardly opening grooves 117' within which the side conductor portions 14 of the stem are received and supported.

The intermediate welded assembly 135, with the anchor wires 21' of the lower bridge 7 hooked to the lower bights 17' of the filament 6 and the laterally bent portions 136 of the bridge fastening wires 22' resting across the side conductor portions 14, is then mounted in place on the supports 112', 113' with the slotted finger 127' of the spring pivoted lever 125' extending up between the two innermost bridge anchor wires 21' and engaging that side of the glass rod 20' of the lower bridge which faces the filament. A tension coil spring 128', connected between the lever 125' and a spring post 129', exerts a constant pulling force on the lever tending to pivot it in a direction away from the filament, thus drawing the

bridge anchor wire hooks 23' tight into the lower bights 17' of the filament and in turn pulling the filament taut between the two support bridges 5 and 7. The spring 128' employed is of relatively soft acting character so as not to cause undue stretching or elongation of the filament segments 16. Engagement of the rim of the stem tube flange 9 with the upturned leg 115' of the support 112' restrains movement of the mount assembly 135 longitudinally of the jig 105 under the influence of the pulling force exerted thereon by the spring actuated lever 125'.

As in the case of the jig 104, the base plate 106' of jig 105 is movably mounted on its support arms 107, 108 for movement laterally of the path of travel of the upper electrode 80 to enable the positioning of the jig in each of its two welding positions wherein the crossed portions of the side conductor portions 14 and the bridge fastening wires 22' are located between and in vertical alignment with the electrodes. As before, the base plate 106' is pivoted at one end of the pivot pin 131 while its other end is formed with an arcuate guide slot 132' into which the pin 133 extends. The slot 132', however, is made of much shorter radius than that of the slot 132 in jig 104 while the pivot pin 131 rides in a longitudinally extending slot 137 in the base plate 106' so as to impart to the jig a combination swinging and linear movement such as will prevent the lower electrode 79 from striking against the glass rod 20' of the lower bridge 7 when the jig is shifted from one of its welding positions to the other thereof.

With the intermediate welded mount assembly 135 and the lower bridge 7 positioned and held in assembled relation as described on the jig 105, the latter is then successively shifted into each of its welding positions (as determined by the engagement of the stop pin 133 with the ends 134' of the arcuate slot 132') and the upper electrode 80 moved down, in each of the said welding positions, to cause it to engage and weld the bridge fastening wires 22' to the side conductor portions 14 of the stem, thus completing the assembly of the mount 3 according to the invention, ready for sealing into the envelope of the lamp. The back weld (i. e., the one indicated in Fig. 21), is preferably made first so that the hold-down pin 138 will engage the anchor wires 21' of the lower bridge 7, as shown in dash-dot lines, to thereby position and hold them in a horizontally extending position during the welding operation.

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

1. In the manufacture of a mount for an electric incandescent lamp of the type having a segmental filament supported by a bridge member fastened to the lead-in conductors of the lamp, the step of welding the filament and the support bridge to the lead-in conductors while jig-held in predetermined assembled relation with each other.

2. The method of mounting an incandescent lamp filament in place on the lead-in conductors and support bridges of the lamp mount which method comprises, successively jig-positioning the filament and lead-in conductors together in predetermined assembled relation with each of the support bridges, and welding the filament and the support bridges to the said lead-in conductors while thus jig-held in predetermined interrelation.

3. The method of mounting an incandescent lamp filament in place on the lead-in conductors

and upper and lower support bridges of the lamp mount which method comprises, jig-positioning the filament and lead-in conductors together in predetermined assembled relation with one of said support bridges, welding the filament and the said one support bridge to the lead-in conductors while thus jig-held together to thereby form an intermediate welded assembly, and then jig-positioning the other of said support bridges together with the said welded assembly in predetermined assembled interrelation and welding the said other support bridge to said lead-in conductors.

4. The method of forming a lamp mount of the type having a segmental filament supported by a support bridge fastened to the lead-in conductors of the mount stem which method comprises, performing the support bridge and forming hooks on the filament anchor wires thereof, jig-positioning the filament, stem and support bridge together in predetermined assembled interrelation with the filament anchor wires of the bridge hooked around the bights of the filament, and then welding the filament and support bridge to the lead-in conductors of the stem while thus jig-held in predetermined relation thereto.

5. The method of forming a lamp mount of the type having a segmental filament supported by upper and lower support bridges fastened to the lead-in conductors of the mount stem which method comprises, performing the said support bridges and forming hooks on the filament anchor wires thereof, jig-positioning the filament, stem and upper bridge together in predetermined assembled interrelation with the filament anchor wires of the upper bridge hooked around the upper bights of the filament and with the end connection portions of the filament and the fastening wires of the upper bridge extending across the lead-in conductors of the stem, welding the said filament end connection portions and the bridge fastening wires to the lead-in conductors while the filament, stem and upper bridge are thus jig-held together in predetermined relation to thereby form an intermediate welded assembly, and then jig-positioning the lower support bridge together with the said welded assembly in predetermined assembled interrelation with the filament anchor wires of the lower bridge hooked around the lower bights of the filament and with the fastening wires of the lower bridge extending across the lead-in conductors of the stem, and welding the lower bridge fastening wires to the lead-in conductors while the lower bridge and the said welded assembly are thus jig-held together in predetermined interrelation.

6. Apparatus for welding a support bridge to the lead-in conductors of the stem of an electric incandescent lamp mount having a segmental filament comprising individual coiled sections joined together by bights, the support bridge having anchor wires provided with filament support hooks, said apparatus comprising in combination with a pair of opposed welding electrodes relatively movable toward and away from each other, a jig arranged to hold the said stem and filament and the said bridge in predetermined assembled interrelation with weldable portions of the bridge lying across the lead-in conductors, said jig having a spring-actuated member yieldably engageable with the bridge to draw the hooks on the bridge anchor wires tightly into the bights of the filament, and a support for holding said jig between the said electrodes, said jig being movable on said support laterally of the path of

movement of said electrodes and into fixed positions on said support wherein the crossed portions of the bridge and lead-in conductors are selectively located in welding position between the electrodes.

7. Apparatus for welding a support bridge to the lead-in conductors of the stem of an electric incandescent lamp mount comprising a segmental filament having individual coiled sections joined together by bights, the support bridge having anchor wires provided with filament support hooks, said apparatus comprising in combination with a pair of opposed welding electrodes relatively movable toward and away from each other, a jig arranged to hold the said stem and filament and the said bridge in predetermined assembled inter-relation with weldable portions of the bridge lying across the lead-in conductors, said jig having separate guide slots for respectively receiving the anchor wires of the bridge and portions of the stem to thereby position the bridge and the stem in predetermined lateral inter-relation, said jig further having stop means engageable with the stem to position it in a predetermined longitudinal position on the jig, a spring-actuated member on said jig yieldably engageable with the bridge to draw the hooks on the bridge anchor wires tightly into the bights of the filament, and a support for holding said jig between the said electrodes, said jig being movable on said support laterally of the path of movement of said electrodes and into fixed positions on said support wherein the crossed portions of the bridge and lead-in conductors are selectively located in welding position between the electrodes.

8. Apparatus for welding a filament and a support bridge of an incandescent lamp mount to the lead-in conductors of the stem thereof comprising, in combination with a pair of opposed welding electrodes relatively movable towards and away from each other, a jig arranged to hold the said stem, filament and bridge in predetermined assembled interrelation with weldable portions of the filament and the bridge lying across the lead-in conductors, and a support for holding said jig between the said electrodes, said jig being pivoted on said support to swing in a plane transverse to the path of travel of said electrodes for positioning the jig in selective welding positions wherein the crossed portions of the filament, bridge and lead-in conductors are located between and aligned with the electrodes.

9. Apparatus for welding to the lead-in conductors of an electric incandescent lamp stem a segmental filament having individual coiled sections joined together by bights and a support bridge having anchor wires provided with filament support hooks, said apparatus comprising in combination with a pair of opposed welding electrodes relatively movable towards and away from each other, a jig arranged to hold the said stem, filament and bridge in predetermined assembled interrelation with weldable portions of the filament and the bridge lying across the lead-in conductors and with the hooks on the filament anchor wires of the bridge hooked around the bights at one end of the filament body, said jig having separate guide slots for respectively receiving the anchor wires of the bridge and portions of the stem to thereby position the stem

and the bridge in predetermined lateral inter-relation, said jig further having separate stop means respectively engageable with the filament and with the flare on the stem to thereby position the stem and the filament in predetermined longitudinal interrelation, a spring actuated finger yieldably engageable with the bridge to draw the hooks on the bridge anchor wires tightly into the said bights of the filament and hold the filament against its respective stop means, and a support for holding said jig between the said electrodes, said jig being movable on said support laterally of the path of travel of said electrodes for positioning the jig in selective welding positions wherein the crossed portions of the filament, bridge and lead-in conductors are located between and aligned with the electrodes.

10. Apparatus for welding to the lead-in conductors of an electric incandescent lamp stem a segmental filament having individual coiled sections joined together by bights and a support bridge having anchor wires provided with filament support hooks, said apparatus comprising in combination with a pair of opposed welding electrodes relatively movable towards and away from each other, a jig arranged to hold the said stem, filament and bridge in predetermined assembled interrelation with weldable portions of the filament and the bridge lying across the lead-in conductors and with the hooks on the filament anchor wires of the bridge hooked around the bights at one end of the filament body, said jig having separate guide slots for respectively receiving the anchor wires of the bridge and the lead-in conductors and exhaust tube of the stem to thereby position the stem and the bridge in predetermined lateral interrelation, said jig further having separate stop means respectively engageable with the said end of the filament body and with the end of the flare on the stem to thereby position the stem and the filament in predetermined longitudinal interrelation, a spring actuated finger yieldably engageable with the bridge to draw the hooks on the bridge anchor wires tightly into the said bights of the filament and hold the filament against its respective stop means, and a support for holding said jig between the said electrodes, said jig being movable on said support laterally of the path of travel of said electrodes for positioning the jig in selective welding positions wherein the crossed portions of the filament, bridge and lead-in conductors are located between and aligned with the electrodes.

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