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H. E. ALLEN

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INCANDESCENT ELECTRIC LAMP AND METHOD

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Fig. 1

Fig. 2

Fig. 4

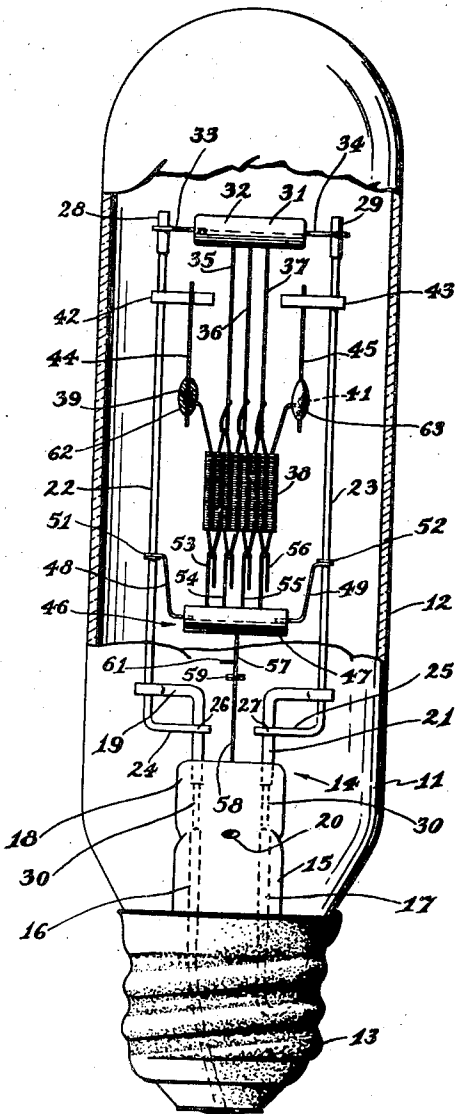
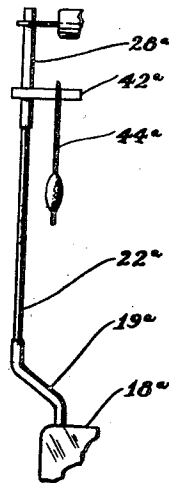
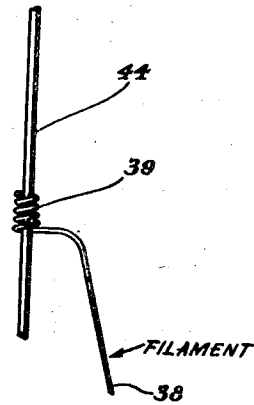
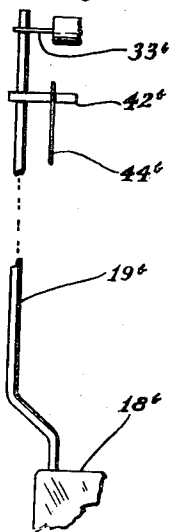
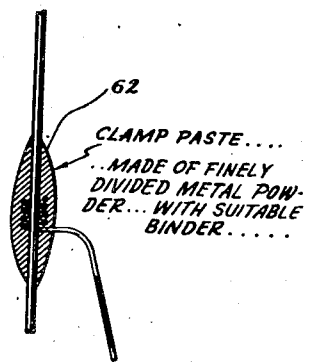


Fig. 5

Fig. 3



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## UNITED STATES PATENT OFFICE

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## INCANDESCENT ELECTRIC LAMP AND METHOD

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15 Claims. (Cl. 176-39)

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This invention relates to incandescent electric lamps and more particularly to such adapted for projection service.

The primary object of my invention, generally considered, is to improve on the construction of such lamps in order to adapt them for assembly by less experienced operators, thereby making it possible to increase production.

Another object of my invention is to reduce the strain or tension on the filament of a lamp of the projection type, thereby avoiding distortion when current is applied.

A further object of my invention is to make permanent electrical filament connections, as between the terminals of a sectional coiled filament in a projection lamp, after adjustment with respect to the lead-in conductors, by means of a refractory conductive paste, thereby facilitating the manufacture as well as improving appearance and quality of the lamp.

A still further object of my invention is to improve the connection of the terminals of a sectional coiled filament to the supports of the mount by providing additional or supplementary supports connected to and disposed inwardly of the supporting leads, and upon which terminal coils of the filament are adjustably slidable, and finally permanently electrically connecting said terminal coils thereto by refractory conductive paste applied thereover.

An additional object of my invention is to provide an improved method of connecting filament terminals to current supplying leads.

Other objects and advantages of the invention, relating to the particular arrangement and construction of the various parts, will become apparent as the description proceeds.

Referring to the scale drawing illustrating my invention:

Fig. 1 is a side elevational view, slightly larger in the original drawing than I would propose making a 750 watt projection lamp embodying my invention, with portions of the envelope broken away to more clearly show the interior construction.

Fig. 2 is a fragmentary detailed view of one terminal of the filament positioned on a supplemental or additional support prior to application of clamp paste thereto.

Fig. 3 is a view corresponding to Fig. 2 but showing the parts after the clamp paste has been applied.

Figs. 4 and 5 are fragmentary views corresponding to Fig. 1, but showing modifications.

Referring to the drawings in detail, like parts

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being designated by like reference characters, and first considering the embodiment of my invention illustrated in Figs. 1, 2 and 3, there is shown a lamp 11 designed for basedown operation and comprising an envelope or bulb 12 with a base 13 and enclosing a mount 14.

The mount of the present embodiment comprises a flare tube 15 sealed to the bulb and provided with an exhaust tube opening therethrough, as indicated at 20, leading-in conductors 16 and 17, desirably formed of stranded nickel-plated iron wire provided with press-lead portions 30 of tungsten extending through the flare press 18 from the base 13, and connecting with relatively rigid inner supporting leads 19 and 21, which may be formed of nickel, nickel-plated iron or other suitable material, with their normally lower ends embedded in the press 18.

In the present embodiment the supporting leads 19 and 21 have their normally upper or free ends bent at right angles, as illustrated, and bent around and crimped over the mount support leads or wires 22 and 23, desirably formed of molybdenum because the lamp is intended for operation at high temperatures. The normally lower ends of the support wires 22 and 23 which form, in effect, inner supporting leads or extensions thereof for the mount 14, are bent at right angles as indicated at 24 and 25 and have their inner ends welded or otherwise suitably secured to intermediate portions of the supporting leads 19 and 21, as indicated at 26 and 27, thereby providing a rigid connection between the parts 22 and 23 and their press-embedded supports 19 and 21.

The normally upper or free ends of the molybdenum supporting leads 22 and 23 are desirably tipped with short sections of material such as nickel or nickel-plated iron wire 28 and 29 as by means of welding, in order to facilitate the connection of the top bridge 31 thereto. This bridge desirably comprises an intermediate insulating section 32, which may be a piece of glass cane, and molybdenum wires 33 and 34 embedded in the ends thereof and the remote ends of which are desirably spot welded to the sections 28 and 29, respectively.

Supporting members 35, 36 and 37, desirably formed of molybdenum wire and with their upper ends embedded in the insulator 32, have their lower ends hooked, as illustrated, to provide top supports for the coiled filament 38. Of course the number of supports depends on how many coiled sections form the filament 38. In the present em-

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bodiment, this filament comprises eight coiled sections which are connected by inter-section loops and staggered so that four are disposed in one normally vertical plane parallel to that of the support leads 22 and 23, and four in a normally vertical plane parallel thereto and so spaced that in plan they lie at the vertices of isosceles triangles. The upper uncoiled portions of the connected sections of the filament 38 are draped over the hooked or doubled over lower ends of members 35, 36 and 37, as illustrated, and the extreme short coiled terminal portions 39 and 41 are electrically connected to the support leads 22 and 23 in a manner which will now be explained.

It has previously been the practice to connect these terminal portions 39 and 41 of the filament in the manner such as disclosed in my prior Patent No. 2,140,977, dated December 20, 1938, that is, such sections 39 and 41 have previously been forced over connecting members designated 38 and 39 in said patent, the outer ends of which were spot welded to the supporting leads, there designated 20, as there indicated at 40 and 41. Outer coils, there designated 42' and 43', were then screwed over the coiled end sections, there designated 42 and 43, for short-circuiting the turns thereof to improve the uniformity of rating. Such an operation was difficult to perform, required skilled operators, and was apt to leave the filament in a strained condition.

In accordance with my invention I have improved on this prior construction by providing supplemental or additional supports comprising pieces of preferably nickel ribbon 42 and 43, in the embodiment illustrated desirably .02" x .05" in section and about 8 mm. long, the remote end portions of which are desirably spot welded to the supporting leads 22 and 23, and the adjacent portions of which carry filament leg inserts or supplemental molybdenum wire supports 44 and 45, the normally upper end portions of which are desirably spot welded to the nickel ribbons 42 and 43, after assembly with the filament 38.

In making the assembly using my construction, after the filament has been supported by the wires 35, 36 and 37, the coiled terminal portions 39 and 41, preferably short, that is not longer than 3 mm., have the wires 44 and 45 slipped thereinto, as illustrated in detail in Fig. 2. The diameter of the wires 44 and 45 is less than that of the mandrel about which the coils 39 and 41 have been formed, so that said coils adjustably slide thereon without binding.

In order to hold the filament 38 in position between the leads 22 and 23, and at the same time eliminate strains due to expansion and contraction of the metal parts of the lamp, I provide a light bridge device 46 which may correspond generally with the bridge assembly 44 of my prior patent referred to, and comprise an insulating portion 47 formed of a piece of glass cane and having wires 48 and 49, the inner ends of which are embedded in the ends of the insulator 47, and the outer ends of which normally extend diagonally or longitudinally outward and upward and are formed with eyes or loops 51 and 52 to receive the supporting leads 22 and 23 respectively. These eyes or loops are adjusted so as to slide freely on the leads without binding, even when the bridge device is slightly tilted.

This bridge device 46 is normally suspended from the filament 38 by having desirably molybdenum wire members 53, 54, 55 and 56, the lower ends of which are embedded in the insulator 47 and the upper ends of which are bent to hook

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over the loops formed between the lower portions of the coiled sections of said filament.

In order to prevent undesired tilting of the bridge device 46 when the lamp is inclined from its normally vertical base-down position, the insulator 47 is desirably provided with a bottom guide 57 of molybdenum wire, the upper end of which is embedded therein, cooperating with a wire 58 desirably formed of tungsten and extending upwardly from the press 18 in which its lower end is embedded. The member 57 may be provided with a loop or eye 59 in which the wire 58 slides for guiding the bridge member during the thermal expansion and contraction of the parts, or the construction may be reversed, as illustrated in Fig. 5 of my prior patent referred to. In both instances, however, the wire 58 is, after assembly, bent over as indicated at 61, in order to prevent disengagement, leaving, however, ample clearance for the desired amount of contraction and expansion.

The hook portions of the members 53 to 56, inclusive, are desirably so long that even when the lamp is positioned base up they will not become disengaged, even upon movement of the loop or eyelet 59 into engagement with the bend or portion 61 of the guiding wire 58. The member 57 is desirably curved to clear the guiding wire 58, except where its eyelet 59 slides therearound, as illustrated in Figs. 2, 3 and 4 of my prior patent referred to.

After complete assembly and adjustment of the filament with respect to its supports, previously described, the terminal coils 39 and 41 will take a free adjusted position on their supporting wires 44 and 45. The final permanent connection with said wires is then made by applying clamping paste thereover, as illustrated at 62 and 63 in Fig. 1 and at 62 in Fig. 3. A preferred embodiment of this paste is molybdenum powder mixed with a suitable preferably silicate binder, such as sodium silicate solution, to the consistency of heavy cream. It may be applied by means of a small brush.

After the mount is completed as described and after the paste becomes dry, current is applied to the filament in an atmosphere of hydrogen and the several sections are adjusted, if necessary, while the filament is hot. It is sealed in the envelope 11, the latter exhausted, and the lamp finished in accordance with standard practice.

Referring now to the embodiment of my invention illustrated in Fig. 4, there is shown a fragmentary portion of a construction which is similar to that of Fig. 1 except that the inner supporting leads, (only one of which is illustrated and designated 19\*) consist of nickel-surfaced material, such as nickel or nickel-plated iron, and extend from the press 18\* in a manner such as illustrated in Fig. 1 of my prior Patent No. 2,140,977, previously referred to, except that no arbor is used.

Said inner lead, however, as in Fig. 1, desirably consists of an intermediate section 22\* formed of molybdenum and terminates in a tip portion 28\* of nickel-surfaced material, such as nickel or nickel-plated iron. In the present embodiment, however, the length of the portion 28\* is greater than shown in Fig. 1 so that the nickel ribbon 42\* carrying the depending molybdenum wire 44\* is welded thereto rather than to the molybdenum wire, thereby tending to make a more durable connection with respect thereto.

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Referring now to the embodiment of my invention illustrated in Fig. 5, this shows a construction similar to that of Fig. 1 except that the inner supporting leads (only one of which is illustrated and designated 19<sup>b</sup>), each is a continuous piece of nickel or similar material extending from the press 18<sup>b</sup> to the extreme or upper end thereof. This simplifies the manufacture of such leads and makes it possible to connect the molybdenum spud 33<sup>b</sup> directly thereto as well as the nickel ribbon 42<sup>b</sup> which supports the molybdenum wire 44<sup>b</sup>, as in the first embodiment.

Except as specifically described in Figs. 4 and 5, the lamp may otherwise agree with that illustrated in Figs. 1, 2 and 3.

From the foregoing it will be seen that I have developed an incandescent electric lamp, particularly adapted for projection purposes, in which the normally upper portions of the coiled filament are supported in a relatively rigid manner, while the normally lower portions carry a light bridge device having side loops which slide freely on the inner supporting leads and has a lower slidable connection with the press of the flare, which prevents tilting of the bridge member and coiled filament. The terminal coils of the filament are connected in an easy manner by freely slipping the supporting wires thereto, welding said supporting wires in place and, after all other filament adjustments have been made, cementing them in adjusted position by means of a small amount of conductive paste applied thereover, which paste hardens and makes a permanent connection during the subsequent manufacturing operations.

Although a preferred embodiment of my invention has been disclosed, it will be understood that modifications may be made within the spirit and scope of the appended claims.

I claim:

1. An incandescent electric lamp comprising supporting wires, insulator means connecting portions of said wires, supports depending from said insulator means, a filament comprising a plurality of sections united by loop portions connected to said supports, additional supports connected to and disposed inwardly of said supporting wires, the terminals of said filament comprising coiled sections slidable on said additional supports, and means making permanent electrical contact between said coiled sections and additional supports comprising a conductive paste applied to said coiled sections and the engaged portions of said supports.

2. An incandescent electric lamp comprising an enclosing envelope, a press, interior supporting wires extending therefrom, insulator means connecting the free end portions of said wires, supports depending from said insulator means, a filament comprising a plurality of sections united by loop portions connected to said supports, additional supports connected to and disposed inwardly of said supporting wires, wire means depending from said additional supports, the terminals of said filament comprising coiled sections receiving said depending wire means, and means making permanent electrical contact between said coiled sections and wire means comprising a conductive paste applied to said coiled sections and the engaged portions of said wire means.

3. An incandescent electric lamp comprising an enclosing envelope, a press, interior supporting molybdenum wires extending therefrom, the

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free ends of said wires having nickel surfaced tips, insulator means comprising a piece of glass cane with molybdenum spuds extending from the ends thereof and spot welded to said tips, molybdenum supporting wires the normally upper ends of which are embedded in said cane and which depend therefrom, the lower ends of said wires being formed into hooks, a filament comprising a plurality of coil sections united by loop portions draped over said hooks, additional supports comprising wires depending from nickel ribbons, the outer ends of which ribbons are spot welded to said first-mentioned supporting molybdenum wires, and from inner end portions of which molybdenum wires depend, the terminals of said filament comprising coiled sections encircling said depending wires, and means comprising a paste making permanent electrical contact between said coiled sections and said depending wires for final adjustment of the filament with respect thereto.

4. An incandescent electric lamp comprising an enclosing envelope, a press, interior supporting molybdenum wires extending therefrom, the free ends of said wires having nickel surfaced tips, insulator means comprising a piece of glass cane with molybdenum spuds extending from the ends thereof and spot welded to said tips, molybdenum supporting wires the normally upper ends of which are embedded in said cane and which depend therefrom, the lower ends of said wires being formed into hooks, a filament comprising a plurality of coil sections united by loop portions draped over said hooks, additional supports comprising wires depending from nickel ribbons, the outer ends of which ribbons are spot welded to said tips, and from inner end portions of which molybdenum wires depend, the terminals of said filament comprising coiled sections encircling said depending wires, and means comprising a paste making permanent electrical contact between said coiled sections and said depending wires for final adjustment of the filament with respect thereto.

5. An incandescent electric lamp comprising an enclosing envelope, a press, interior supporting nickel wires extending therefrom, insulator means comprising a piece of glass cane with molybdenum spuds extending from the ends thereof and spot welded thereto, molybdenum supporting wires the normally upper ends of which are embedded in said cane and which depend therefrom, the lower ends of said wires being formed into hooks, a filament comprising a plurality of coil sections united by loop portions draped over said hooks, additional supports comprising wires depending from nickel ribbons, the outer ends of which ribbons are spot welded to said nickel wires, and from inner end portions of which molybdenum wires depend, the terminals of said filament comprising coiled sections placed on said depending wires, and means comprising a paste making permanent electrical contact between said coiled sections and said depending wires for final adjustment of the filament with respect thereto.

6. An incandescent electric lamp comprising an enclosing envelope, a press, interior supporting wires extending therefrom, insulator means connecting the free end portions of said wires, supports depending from said insulator means, a filament comprising a plurality of coil sections united by loop portions draped from said supports, additional support wires connected to and

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disposed inwardly of said supporting wires, the terminals of said filament comprising coiled sections positioned on said additional wires, and a paste formed of a silicate solution admixed with molybdenum powder and applied to said coiled sections and the engaged portions of said additional wires.

7. An incandescent electric lamp comprising interior supporting leads, insulator means connecting portions of said leads, supports depending from said insulator means, a filament comprising a plurality of sections united by loop portions connected to said supports, additional supports connected to and disposed inwardly of said supporting leads, the terminals of said filament comprising coiled sections in adjusted position on said additional supports, means supported by and below said filament and with members extending longitudinally outward and upward and slidable on said leads for eliminating filament strains due to expansion and contraction of lamp parts, means extending from an intermediate portion of said slidable means to prevent undesired tilting thereof, and means making permanent electrical contact between said coiled sections and additional supports, comprising a conductive paste applied to said coiled sections and engaged portions of said supports.

8. An incandescent electric lamp having a mount comprising a flare tube, interior supporting leads extending therefrom, insulator means connecting the free end portions of said leads, wires depending from said insulator means, a filament comprising a plurality of coils with their axes generally parallel and disposed between said leads, means securing one set of inter-section loops between said leads, additional supports connected to and disposed inwardly of said supporting leads, wire means depending from said additional supports, the terminals of said filament comprising coiled sections mounted on said wire means, means normally disposed below and attached to the other set of inter-section loops and formed with guides extending outwardly and in a normally upward direction and slidable on said leads for holding said filament in place and eliminating strains therein due to expansion and contraction, means extending in a normally downward direction to form a supplemental guide and prevent undesired tilting of said slidable means, and means making permanent electrical contact between said coiled sections and wire means comprising a conductive paste applied to said coiled sections and the engaged portions of said wire means.

9. An incandescent electric lamp comprising interior supporting leads, insulator means comprising a piece of glass cane with spuds extending from the ends thereof and spot welded to said leads, supporting wires the normally upper ends of which are embedded in said cane and which depend therefrom, the lower ends of said wires being formed into hooks, a filament comprising a plurality of coil sections united by loop portions draped over said hooks, additional supports comprising depending wires ends of which are secured to said first-mentioned supporting leads, the terminals of said filament comprising coiled sections adjusted in position on said depending wires, a guiding member comprising an insulator portion, hook portions extending from said insulator portion and connected to the normally lower filament loops, wires extending from the ends of said insulator and with their free end portions slidable on said supporting leads, said in-

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ulator having a depending guide member slidably associated with a wire upstanding from said press, and means comprising a paste making permanent electrical contact between said coiled sections and said depending wires for final attachment of the filament with respect thereto.

10. An incandescent electric lamp comprising an enclosing envelope, a press, interior supporting wires extending therefrom, insulator means connecting the free end portions of said wires, supports depending from said insulator means, a filament comprising a plurality of coil sections united by loop portions draped from said supports, additional support wires connected to and disposed inwardly of said supporting wires, the terminals of said filament comprising coiled sections adjustably positioned on said additional wires, a guiding bridge member comprising an insulator portion, hook portions extending from said insulator portion and engaging the normally lower filament loops, wires extending from the ends of said insulator and formed with eyes at their free ends slidable on said supporting wires, said insulator having a depending guide member slidably associated with a wire upstanding from said press, and a paste formed of a sodium silicate solution admixed with molybdenum powder applied to said coiled terminal sections and the engaged portions of said additional wires.

11. The method of uniting a coiled filament terminal to a supporting portion of a mount comprising inserting in said coiled terminal the free end portion of a mount wire therein, adjusting said wire with respect to said terminal, and applying a conductive paste over said terminal and the received portion of said wire.

12. The method of uniting a coiled filament terminal to a supporting portion of a mount comprising inserting in said coiled terminal the free end portion of a mount wire, adjusting said wire with respect to said terminal, and applying a conductive paste consisting of sodium silicate solution admixed with molybdenum powder over said terminal and the encircled portion of said wire.

13. The method of supporting a filament consisting of a plurality of coil sections with their axes disposed generally parallel and connected by upper and lower loop portions, comprising hooking the upper end portions on depending support wires, hooking upstanding wires from a guiding bridge member over the lower connecting loop portions, passing the free end portions of supporting wires, which are generally parallel to said coil section axes, through terminal coiled portions of said filament, and connecting said coiled portions in adjusted position thereon by means of a conductive refractory paste.

14. The method of supporting a filament consisting of a plurality of coiled sections with their axes disposed generally parallel and connected by upper and lower loop portions, comprising hooking the upper loop portions over support wires depending from an insulator mounted between generally parallel support leads, hooking upstanding wires from a guiding bridge member over the lower connecting loop portions, passing the free end portions of supporting wires, which are mounted so as to lie between and be disposed generally parallel to, and respectively connected to one of, said support leads through normally upper terminal coiled portions of said filament, and connecting said coiled portions in adjusted position thereon by means of a paste consisting

of sodium silicate solution admixed with molybdenum powder.

15. In an electrical device, an incandescible filament, and means for supporting said filament comprising coiled terminals and supporting wires depending in said device, free ends of said wires being adjustably positioned in said coiled terminals and secured in place by a conductive paste applied to said terminals and the engaging portions of said supporting wires.

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