Oct. 13, 1942. J. H. GREEN 2,298,937

METHOD AND MACHINE FOR SECURELY CLAMPING FILAMENTS TO LEADS

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Fig. 1.

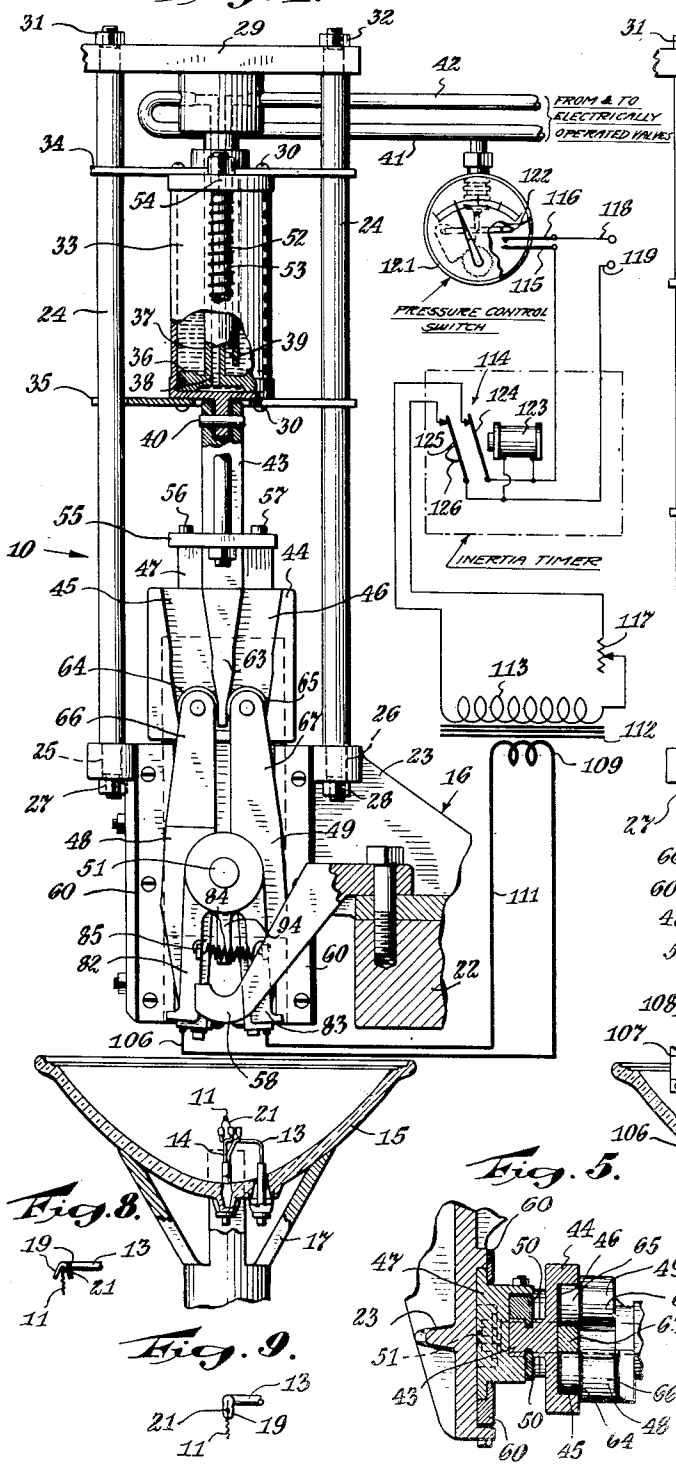


Fig. 2.

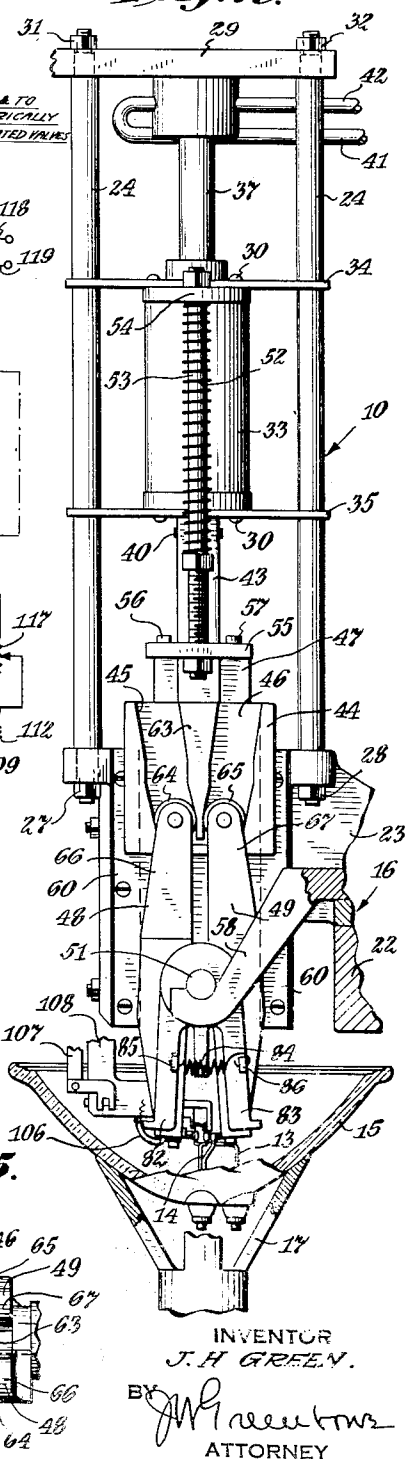


Fig. 8.

Fig. 9.

Fig. 5.

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Fig. 3.

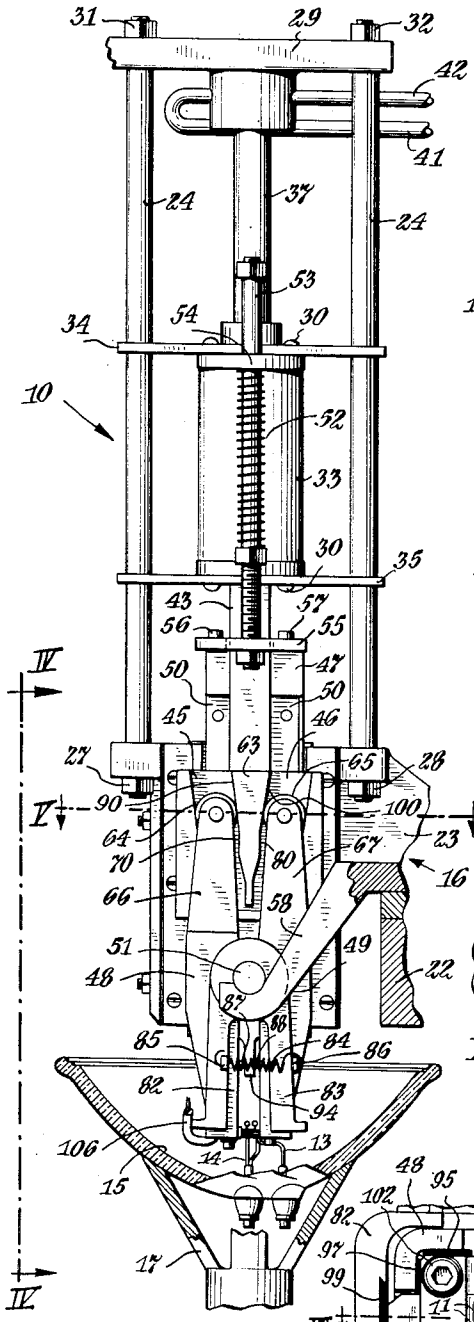


Fig. 7.

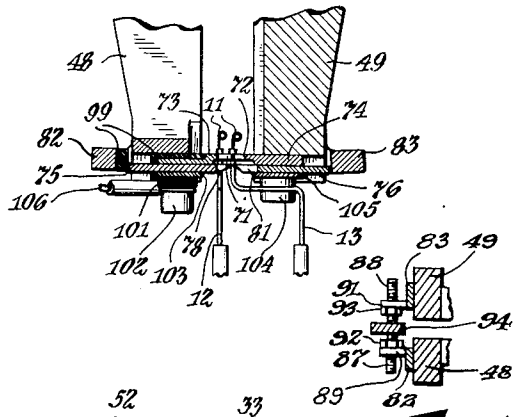


Fig. 10.

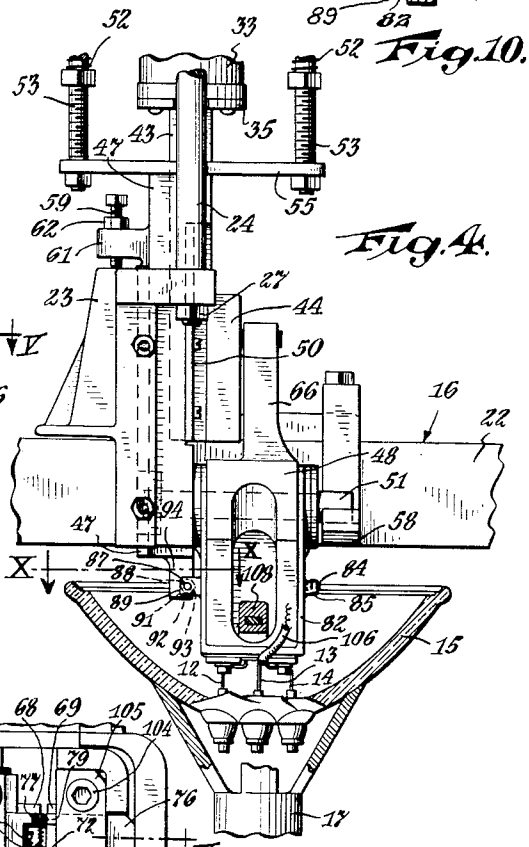
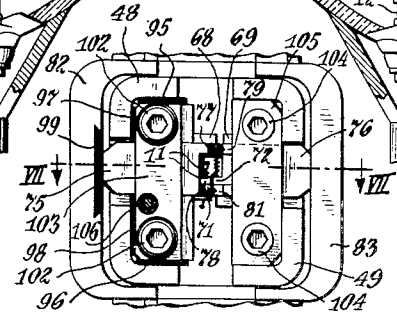


Fig. 4.

Fig. 6.



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METHOD AND MACHINE FOR SECURELY CLAMPING FILAMENTS TO LEADS

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Application April 30, 1941, Serial No. 391,152

16 Claims. (Cl. 219—3)

This invention relates to methods and machines for connecting filaments to leads in incandescent electric lamps, and more particularly to such for the "sealed beam" automotive type of lamps.

The principal object of my invention, generally considered, is to clamp filaments securely to their leads, by using heat to anneal the metal of the leads, so that poor contact therebetween is avoided.

Another object of my invention is the connection of filaments to associated leads in an incandescent electric lamp by slitting or notching the ends of the leads, positioning the filament with its end portions disposed in the lead notches so formed, closing said notches to clamp the end portions of the filament in place, and heating the split portions of said leads, simultaneously with the application of more closing pressure, to a temperature sufficient to anneal or eliminate some of the resiliency of the metal and permanently set, without welding or melting, said split portions in position about the filament ends and avoid any possibility of loose connections.

A further object of my invention is the provision of apparatus for use in practicing the above-described method.

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 drawings illustrating my invention:

Fig. 1 is a fragmentary elevational view of apparatus for practicing my invention, showing the clamping device in uppermost normally open position.

Fig. 2 is a view corresponding generally to Fig. 1, but showing the clamping device in lowered open position.

Fig. 3 is a view corresponding generally to Fig. 2, but showing the subsequent position of the device in which the clamping jaws have been closed or moved together to compress the split leads about the filament to be connected thereto.

Fig. 4 is a fragmentary elevational view, of the apparatus as it appears in Fig. 3, in the direction of the arrows IV—IV in said figure.

Fig. 5 is a transverse sectional view on the line V—V of Fig. 3, in the direction of the arrows.

Fig. 6 is an enlarged bottom plan view of the lead gripping jaws shown in the preceding figures.

Fig. 7 is a fragmentary vertical sectional view on the line VII—VII in Fig. 6 in the direction of the arrows.

Fig. 8 is a fragmentary plan of one of the leads after splitting an end portion, a filament being shown in position prior to being gripped by said lead.

Fig. 9 is a view corresponding to Fig. 8, but showing the next position where the end portion of the filament has actually been clamped between the slit portions of said lead.

Fig. 10 is a detailed horizontal sectional view on the line X—X of Fig. 4, in the direction of the arrows.

The machine which is at present used for mounting filaments on the leads of lamps of the well-known "sealed beam" type, used mainly for automobile headlights, includes positions where the ends of the leads, to which the filaments are to be connected, are slit, and it first clamps the "major" filament and then the "minor" filament, in the previously slit portions of said leads. In some instances, due to the resiliency of the metal such as copper which forms the leads, the clamping is not always as tight as might be desired, whereby a poor contact may occur between the filament end and the connected lead.

To improve this clamping operation and avoid the possibility of any looseness between a lead and a filament I have modified one of the jaws of the clamping device by insulating end portions thereof from the cooperating jaw to provide for the application of heating current through the split portion of the lead during the clamping operation. As the jaws close by hydraulic action to clamp the filament under a desired predetermined pressure, a sufficient amount of current is passed through the compressed portion of the lead which grips the filament end portion to anneal and give a permanent set to the metal, whereby a tight and perfect electrical connection is produced without actually effecting a weld therebetween.

Referring to the drawings in detail, like parts being designated by like reference characters, there is shown in Fig. 1 a fragmentary view of one of the heads **10** on a rotary machine which clamps the filaments **11** to the leads **12** and **13** and the duplex or third lead **14** extending from the corresponding seals in the reflector portion **15** of a "sealed beam" automotive type lamp.

The machine, generally designated by the reference character **16**, is provided with a number of lamp-holding devices or pockets **17**, arranged (on a rotary conveyor) in a circle about the periphery thereof, and adapted to respectively in-

dex with the heads 10, which perform the successive operations thereon. After a number of preliminary operations have been performed, the reflector portion 15 of a lamp carrying the single leads 12, 13 and double lead 14 bifurcated or split, as indicated at 19 in Fig. 8, for the reception of an end portion 21 of an associated filament 11, is placed in registry with or "indexed" under the head, as shown in Fig. 1.

The head 10 is one of a series arranged in a circle about the machine and supported from a central frame 22 by means of a bracket 23. From the bracket 23 extends a pair of guide standards 24, secured to said bracket as by having their lower ends reduced in section, passed through apertures 25 and 26, and held in place as by means of nuts 27 and 28. The upper ends of the standards are secured together by means of a plate 29, likewise held by nuts 31 and 32 applied to reduced end portions of the standards 24 which pass through said plate.

Disposed between the standards 24 is a cylinder 33, carrying end plates 34 and 35, secured thereto, as by means of screws 30, which are notched to receive and slide on the standards 24. Operating in the cylinder 33 is a piston 36, the rod 37 of which is provided with ports 38 and 39 to respectively allow for the admission of fluid under pressure to one side or the other of the piston, for effecting lowering thereof from the position shown in Fig. 1 to that shown in Figs. 2, 3 and 4, or raising thereof from said lowered position. The fluid is applied to the port, 38 or 39, as the case may be, from supply pipe 41 or 42, controlled by valves operated automatically by electricity at the proper time, in accordance with the manufacturing sequence.

The cylinder 33 is secured to a central connecting member 43, as by means of pin 40, which member carries a block 44, slotted or grooved, as indicated at 45 and 46, and reciprocates in guides 50 carried by a cross head 47. The cross head 47 also carries the clamping jaws 48 and 49 pivoted thereto as indicated at 51, and reciprocates in guides 60 on the bracket 23.

The cross head 47 is normally held in downward position, as compared with the block 44, by coil compression springs 52 mounted on carrying rods 53, extending between outstanding ears 54 on the upper portion of the cylinder 33 and a plate 55 secured to the cross head 47, as by means of screws 56 and 57.

The central frame 22 carries a stop member 58 which is engaged by the pivot pin 51, when the cross head 47 is moved downward by the cylinder 33, stopping further movement thereof and allowing follow-up movement of the block 44 against the pressure of the springs 52. A stop-screw 59 is threadably mounted in a lug 61 projecting from the rear of the cross-head 47, so that it is adjustable to engage the bracket 23 at the same time the pin 51 engages the stop member 58, and avoid eccentricity in the stopping force. A nut 62 serves to lock the screw in adjusted position.

This follow-up movement of the block 44 forces the wedge-shaped projection 63, which serves to define the adjacent boundaries of the slots 45 and 46, between the rollers 64 and 65 carried by the upward extensions 66 and 67 of the clamping members 48 and 49, thereby causing said members to swing about the pivot 51 to grip the slit portions of the leads and clamp the filament ends in place with respect thereto.

In order to effect a guiding action on the leads, as well as a gripping action on the split portions thereof, for clamping the filaments in place, the clamping jaws 48 and 49 not only have clamping projections extending toward one another, but are provided with relatively movable, resiliently actuated, lead guides arranged in a manner which will now be described.

The lower portion of the jaw 48 carries a plate 73 with a projection 68 which cooperates with a corresponding projection 69 on a plate 74 carried by the jaw 49 for closing the slit or grooved portion 19 of a lead, such as 12 or 13, and clamping the end portion 21 of a filament 11 therein. Likewise the plate 73 has a projection 71 adapted to engage the corresponding projection 72 on the plate 74 for closing the slit portion of another lead for said filament, such as one of the branches of the double lead 14, and clamping the corresponding filament end in tight relation with respect thereto. The plate 73 from which the projections 68 and 71 extend is fixed, with regard to the arm 48, but not integral therewith, and the plate 74 from which the projections 69 and 72 extend is fixed to the arm 49, but not necessarily integral therewith.

The jaw 48 also carries a plate 75 slidable beneath the plate 73 and the jaw 49 carries a plate 76, likewise slidable beneath the plate 74.

The plates 75 and 76 are provided with opposed and notched lead-gripping extensions 77 and 78 on the one, and 79 and 81 on the other, as shown most clearly in Figs. 6 and 7, which serve to resiliently grip the leads below the slit portions thereof, under the action of the yokes 82 and 83, pivoted about the same axis as the jaws 48 and 49, and urged together by a coil spring 84, the ends of which are connected to outstanding lugs 85 and 86, extending from yokes 82 and 83, respectively.

The yokes are limited in their movement toward one another by set screws 87 and 88, respectively threaded to lugs 89 and 91 extending rearwardly from said yokes 82 and 83, respectively. Said screws may be locked in adjusted position, by nuts 92 and 93, with their adjacent ends adapted to engage opposite sides of a lug 94 depending from the lower end of the cross head 47, so that while the notched projections 77 and 78 move close enough to the notched projections 79 and 81 to lightly guide the leads, yet they are not pushed tightly into contact therewith, like the projections 68 and 69, 71 and 72, and, therefore, do not take an undesirable proportion of the heating current.

In order to make it possible to pass current between the projections 68 and 71 on the one side, and 69 and 72 on the other, for mere hot clamping, as distinguished from a welding operation involving melting of metal, the filament ends in the corresponding split portions of the leads, the plates 73 and 75 are insulated from their carrying jaw 48 and the yoke 82 by strips of mica or other suitable insulating material 95, 96, 97, 98 and 99, as well as insulation 101 for the screws 102, which secure a cross plate 103 beneath the sliding plate 75 for holding it assembled. No insulation, of course, need be provided on the jaw 49, yoke 83, or for the holding screws 104 for the cross plate 105, which underlies the slidable plate 76. Heavy insulated lead 106 serves for bringing current to the insulated plates 73 and 75, whereby it is adapted to travel therefrom through the slit portions of the leads mainly between the projections 68 and 71 on the one

hand, and the registering projections 69 and 72 on the other to the grounded jaw 49.

In Fig. 2 are shown fragmentary portions of the arms 107 and 108, carrying fingers which grip, transfer, place, and hold the filament in position, while the ends thereof are clamped between the split portions of the leads. These fingers are not illustrated in detail as they are in commercial use for such a purpose.

In order to apply a desired amount of electrical energy to the split portions of the leads at the proper time, the insulated conductor 106 is connected to one side of the low voltage secondary winding 109 of transformer 112, and the jaw 49 is connected to the other side by a conductor 111. The primary winding 113 of transformer 112 is connected through inertia timer 114, pressure controlled contacts 115—116, and rheostat 117 to power lines 118 and 119. The contacts 115 and 116 are automatically closed causing energization of the circuit through lines 106 and 111, when the pressure in the gauge 121 rises to such an extent that the contact strip 116 is pushed into engagement with strip 115 by pressure-actuated arm 122 in said gauge. This action occurs when the desired pressure has been applied to the split leads to hot clamp the associated ends of the filament in place.

The apparatus described may be operated as follows:

The conveyor for the lamp-holding devices 17, moves until the reflector portion 15 of a lamp, after the leads are split or notched as shown in Fig. 8, is indexed under the head 10, as shown in Fig. 1. Fluid under pressure is then admitted automatically, by mechanism (not shown) on the machine, to the pipe 41 causing descent of the cylinder 33 until the cross head 47 moves down to the position shown in Fig. 2 where it is stopped by engagement of the pivot member 51 and set screw 59 with the stop member 58 and bracket 23, respectively Fig. 4 illustrates the engagement between the set screw 59 and bracket 23. The arms 107 and 108 then pick up a filament, in a well-known manner, transport and deliver it to the position, represented in Fig. 8, in which its ends are disposed between the open portions 19 where the leads, 12 and one branch of 14, for example, for said filament are split. While so held, the block 44 moves down, upon further increase in pressure in the cylinder 33, to cause the wedge-shaped portion 63 to move between the rollers 64 and 65, against the pressure of the springs 52, to cause the jaws 48 and 49 to close about the leads to the position represented in Figs. 3, 4, 5, 6 and 7, except that the wedge has only moved to the position where the parallel sides 70 and 80 engage the rollers 64 and 65, respectively. The notched portions 77, 78, 79 and 81, first embrace the leads below the split portions thereof, to insure that they are properly centered, and then further closing movement thereof is stopped by engagement between the set screws 87 and 88 and the lug 94 therebetween.

As the pressure in the cylinder 33 builds up further, the upper diverging sides 90 and 100 of the wedge-shaped portion 63 move down between the rollers 64 and 65, causing the projections 68 and 71 on the one hand, and 69 and 72 on the other, to squeeze the slit portions of the leads about the ends of the filament, until the pressure is such that the contacts 115 and 116 are caused to engage, energizing the primary 113 of transformer 112 and applying a high current at low voltage through the slit portions of said leads to hot clamp them about the end portions of the filament until the current is shut off by the solenoid 123 of the inertia timer, pulling the contacts 124 and 125 to open position against the action of the weight 126.

The length of time electrical energy is applied to the split portions of the leads for hot clamping the same, is controlled by the adjustment of the weight 126, while the strength of the current applied during this time is controlled by adjustment of the rheostat 117, whereby the exact amount of heat desired for the purpose is applied. I have found that approximately four cycles of sixty-cycle current at 150 amperes gives satisfactory results.

After the "major" filament, has been clamped in position between slit portions of a lead 12 and one branch of the lead 14, pressure in the pipe 41 is released and applied in the pipe 42 to cause the jaws to open. The arms 107 and 108 then move away, the cross-head 47 rises, and the conveyor moves the reflector 15 to the next position, where another filament, the "minor" or "passing beam" filament, is clamped between the two remaining leads thereof, that is, 13 and 14.

From the foregoing it will be seen that I have devised a method and machine for overcoming loose clamping, that sometimes occurred using a filament-mounting machine without provision for heating the unions between the leads and filaments, to thereby overcome the normal resiliency of the metal and effect a permanent set of the copper or other lead metal, with consequent perfect electrical contacts without melting or welding between it and the tungsten filament.

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. The method of uniting the end portions of a filament to leads of a lamp, comprising positioning said filament with said end portions longitudinally disposed in side notches in said leads, closing said notches and clamping the material defining them about the received end portions of said filament, and heating said closed notched portions, during the application of pressure, to a temperature merely sufficient to anneal and set the lead metal about the filament end portions.

2. The method of uniting a filament to leads of a lamp stem, comprising positioning said filament with its end portions longitudinally disposed in side notches in said leads, closing said notches about the received ends portions of said filament to squeeze the notch-defining material thereabout and clamp them in place, and heating the notched portions simultaneously with the application of more closing pressure, to a temperature merely sufficient to anneal and permanently set them in position about said filament end portions and avoid loose connections.

3. The method of uniting a filament to leads of a lamp stem, comprising longitudinally slitting the sides of said leads adjacent the ends, positioning said filament with its end portions alined with said leads and disposed in the lead notches formed by such slitting, closing said notches to clamp the end portions of said filament in place, and heating the slit portions simultaneously with the application of more closing pressure, to a temperature merely sufficient to permanently set them in position about said filament end portions and avoid loose connections.

4. The method of uniting the end portions of

a filament to leads of a lamp, comprising positioning said filament with said end portions longitudinally disposed in side notches in said leads, closing said notches about the received end portions of said filament to squeeze the notch-defining material thereabout and clamp them in place, and passing an amount of electrical energy through said closed notched portions, during the application of pressure, predetermined so that it heats said portions to a temperature merely sufficient to permanently set the lead metal about the filament end portions and thereby avoid loose connections.

5. The method of uniting a filament to leads of a lamp stem, comprising longitudinally slitting the sides of said leads adjacent the ends, positioning the end portions of said filament alined with said leads in the notches so formed in said end portions, closing said notches to clamp the adjacent end portions of said filament in place, and simultaneously passing electric current through said notched portions to heat them to a temperature merely sufficient to permanently set the unions and avoid loose connections.

6. The method of uniting a filament to leads of a lamp stem, comprising longitudinally slitting the sides of said leads adjacent the ends, positioning clamping jaws over said end portions, transporting a filament and holding it in position between said jaws, with its end alined with said leads and portions disposed in the lead notches formed by said slitting, moving said jaws together to clamp the end portions of said filament in place, and simultaneously passing electric current from one of said clamping jaws to the other through the clamped portions of said leads and the united filament therebetween, to heat said portions to a temperature merely sufficient to permanently set them in place about the filament end portions and avoid loose connections.

7. Apparatus for clamping filaments in place with respect to leads of incandescent electric lamps comprising means for holding such filaments with their end portions alined with said leads and lying in side notches adjacent the end portions of the latter, means for causing jaws to squeeze the notched portions of said leads about the filament end portions received therein, and means for heating said notched end portions during said clamping operation to a temperature merely sufficient to set the metal thereabout and avoid loose connections.

8. Apparatus for clamping filaments in place with respect to leads of an incandescent electric lamp, comprising means for holding said filaments with their end portions in longitudinal notches in said leads, a head carrying jaws, means for causing said jaws to descend and come together to squeeze the notched portions of said leads about said filament end portions, and means for applying merely enough heat to said notched portions while squeezed, to overcome the natural resiliency of the metal and permanently set said leads about the associated filament ends.

9. Apparatus for clamping filaments in place with respect to leads of an incandescent electric lamp, comprising a conveyor for moving the lead portions of said lamps in a circular path, means for transporting filaments one by one to and holding them with their end portions in notches in said leads when indexed at a certain place along said path, a head carrying jaws, means for causing said jaws to descend and come together to squeeze the notched portions of said leads about said filament end portions while so held, and means for applying merely enough heat to said notched portions while squeezed, to overcome the natural resiliency of the metal and permanently set said leads about the associated filament ends, to thereby avoid loose connections.

10. Apparatus for clamping filaments in place with respect to leads of incandescent electric lamps, comprising means for transporting filaments one by one to and holding them with their end portions in notches in said leads, jaws for clamping said filaments in place in said lead notches, means for causing said jaws to descend and come together to squeeze the notched portions of said leads about said filament end portions, and means for applying merely enough heat to said notched portions while being squeezed to permanently set the notched portions of said leads about the filament end portions without welding them thereto.

11. Apparatus for clamping filaments in place with respect to leads of an incandescent electric lamp, comprising means for holding a filament with its ends portions in notches in said leads, a head carrying jaws, hydraulicly operated piston-cylinder means for causing them to reciprocate vertically, stop means for arresting downward movement of said jaws, whereby said hydraulicly operated means then causes said jaws to close about and squeeze the notched portions of said leads to clamp the filament end portions in place therein, means insulating one of the clamping portions of said jaws, electrical connections to said insulated portion and other jaw, and means controlled by the hydraulic pressure supplied to said cylinder to cause electrical current to pass between said jaws through the clamped portions of said leads, when the pressure therebetween reaches a predetermined amount, to heat the squeezed metal, overcome the natural resiliency thereof, and permanently set said leads about the associated filament end portions.

12. The method of clamping filaments in place with respect to leads of an incandescent electric lamp, comprising holding said filaments with their end portions lying in longitudinal notches in the sides of said leads, causing jaws to squeeze the notched portions of said leads about said filament end portions, and applying merely sufficient heat to said notched portions while squeezed to overcome the natural resiliency of the metal and permanently set said leads about the associated filament ends.

13. The method of clamping filaments in place with respect to leads of incandescent electric lamps, comprising transporting filaments, one by one, to and holding them with their end portions lying in longitudinal notches in said leads, causing jaws for clamping such filaments in place in said lead notches to squeeze the notched portions of said leads about said filament end portions, and applying merely sufficient heat to said notched portions while being squeezed to anneal and set the lead metal about the associated filament end portions.

14. Apparatus for uniting the end portions of a filament to leads of a lamp, comprising means for positioning said filament with its end portions alined with, and disposed in longitudinal notches in said leads, means for closing said notches about the adjacent end portions of said filament, and means for heating said closed notched portions during the application of pres-

sure, merely enough to anneal and set the lead metal about the filament end portions.

15. Apparatus for clamping filaments in place with respect to leads of an incandescent electric lamp, comprising means for holding a filament with its end portions in notches in said leads, a head carrying jaws, means for causing said jaws to close about and squeeze said notched portions of said leads to clamp said filament end portions in place therein, means insulating one of the clamping portions of said jaws, electrical connections to said insulated portion and other jaw, and means to cause electrical current to pass between said jaws through the clamped portions of said leads, when the pressure therebetween reaches a predetermined amount, to heat the squeezed metal and permanently set said notched portions about the associated filament end portions.

16. Apparatus for clamping filaments in place with respect to leads of an incandescent electric lamp, comprising means for holding a filament with its end portions in longitudinal notches in end portions of said leads, clamping jaws, means for causing said jaws to close about and squeeze the notched portions of said leads to clamp said filament end portions in place therein, means insulating the clamping portion of one of said jaws, electrical connections to said insulated portion and other jaw, and means acting in synchronism with the application of pressure by said jaws, to cause electrical current to pass between the latter through the clamped portions of the leads, when the pressure therebetween reaches a predetermined amount, to heat the squeezed metal merely enough to permanently set it about the associated filament end portions.

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