June 7, 1949. G. S. QUINN ET AL 2,472,778

COIL CLAMPING METHOD AND APPARATUS

Filed May 22, 1948 4 Sheets-Sheet 1

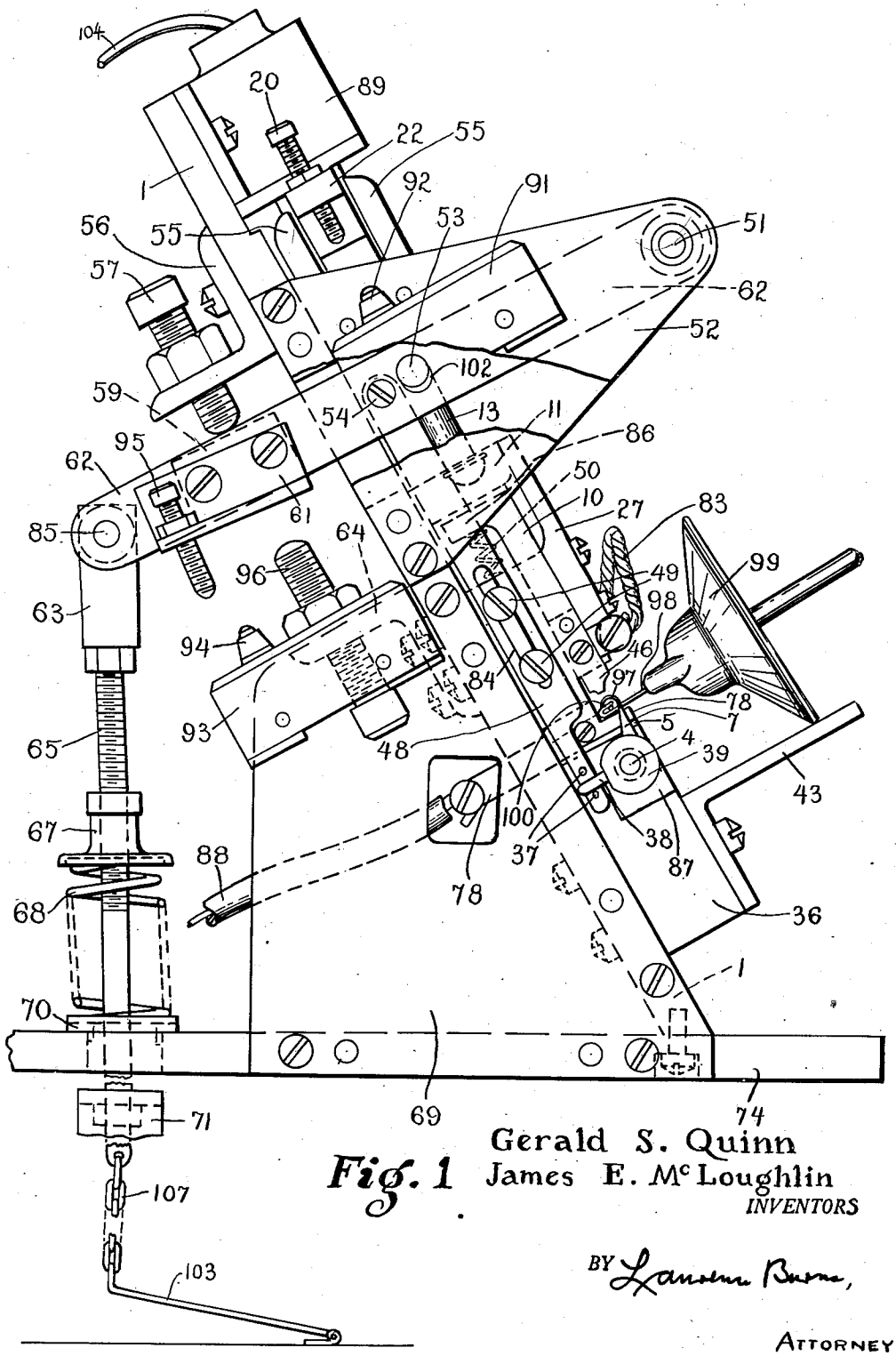


Fig. 1

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COIL CLAMPING METHOD AND APPARATUS

Filed May 22, 1948 4 Sheets-Sheet 2

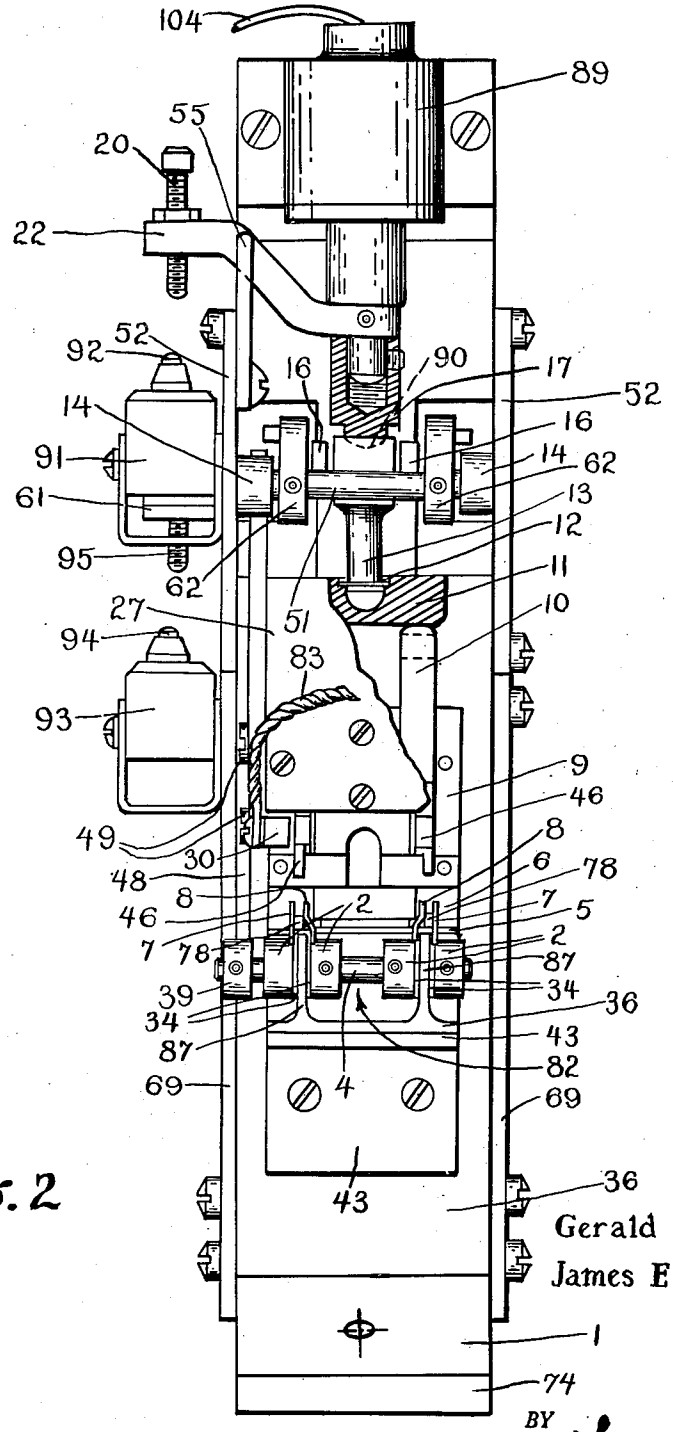


Fig. 2

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COIL CLAMPING METHOD AND APPARATUS

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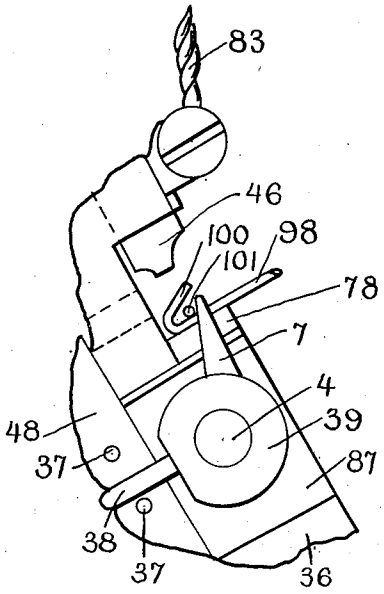


Fig. 3

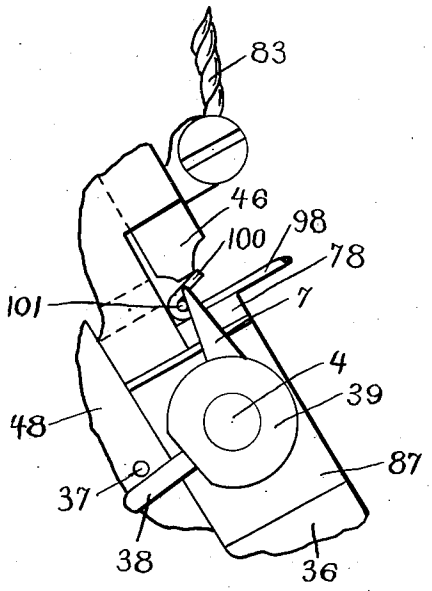


Fig. 4

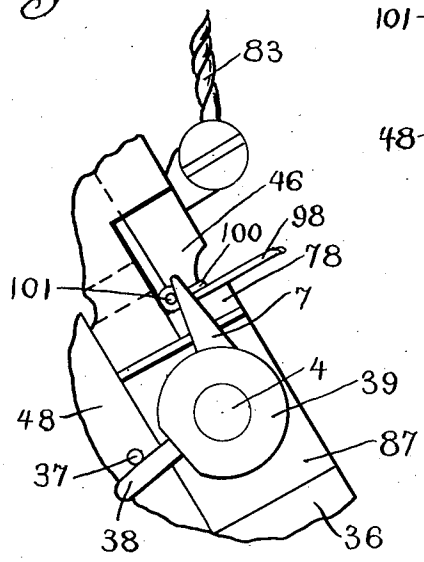


Fig. 5

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COIL CLAMPING METHOD AND APPARATUS

Filed May 22, 1948 4 Sheets-Sheet 4

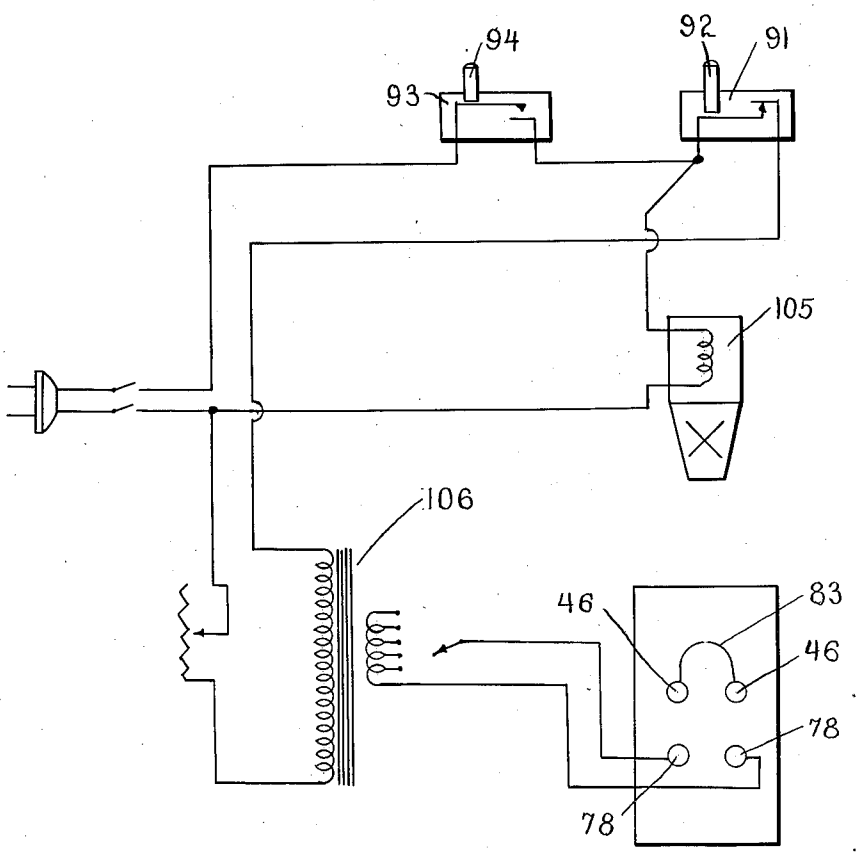


Fig. 6

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Patented June 7, 1949 2,472,778

UNITED STATES PATENT OFFICE

2,472,778

COIL CLAMPING METHOD AND APPARATUS

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Application May 22, 1948, Serial No. 28,574

10 Claims. (Cl. 219—3)

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This invention relates to a method of and apparatus for closing a metal clamp around a fragile object, and more particularly to a method of and apparatus for closing simultaneously two preformed relatively stiff, heavy, metal hooks on the ends of the lead wires of an electric lamp mount around a fragile tungsten filament. The method and apparatus of our invention may be readily applied to closing one or more metal hooks simultaneously around any similar fragile body.

An object of our invention is to provide a method of and apparatus for mounting a filamentary coil of tungsten wire on the ends of the lead wires of a fluorescent lamp mount.

Another object is to provide a method of and apparatus for mounting fluorescent lamp filamentary coils which will minimize the fractures in the wire of the coils which sometimes occur due to the severe conditions imposed on the coils during the hook closing operation.

A further object is to provide a method of and apparatus for effecting a positive mounting of the coils.

Further objects, advantages, and features will be apparent from the following specification when read in conjunction with the accompanying drawings in which:

Figure 1 is a side elevational view of the apparatus of our invention.

Figure 2 is a front view of the apparatus of our invention with portions thereof cut away to permit a more complete illustration of the apparatus.

Figures 3, 4, and 5 are enlarged details illustrating the action of the apparatus on the work.

Figure 6 is a wiring diagram of the electrical circuit employed with the apparatus.

As may be seen in Figures 1 and 2, the apparatus of our invention is mounted on a back plate 1 which is supported by and between gusset plates 69 which are mounted on a base plate 74. A block 36 and a punch guide 9 are mounted on the back plate 1 and are separated from each other by an electrode holder 6 and a pad 5, both of insulating material. The block 36 serves as a support for a finger assembly 82. A work table 43 is also mounted on the block 36. The punch guide 9 is provided with a pair of channels therein in which punches 10 are slidably mounted. The punch guide 9 is provided with a cover plate 27.

Punch electrodes 46 are mounted on the lower end of the punches 10 and are connected to each other by a jumper 83. A pair of punch springs 50 are seated in recesses in the top of the punch guide 9, the upper ends thereof engaging the base 86 of

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the inverted L-shaped punches 10. A finger actuator 48 is supported from a lever 62 by means of an actuator screw 54. The finger actuator 48, which extends along a side of the punch guide 9, is provided with an elongated slot 84 therein, through which guide screws 49 extend to guide the finger actuator 48 and define its path of travel along the side of the punch guide 9 when it is actuated by the lever 62 from which it is supported.

A pair of levers 62 are pivotally mounted at one end on lever shaft 51 and at the other end on clevis shaft 85. Shaft 51 is supported by and extends between trunnion plates 52 which are mounted on back plate 1. The clevis shaft 85 is mounted in and extends through a clevis 63, into the base of which a draw rod 65 is threaded. A rocker shaft 53 is supported by and extends between the two levers 62 intermediate their ends. A rocker arm 13 is mounted on shaft 53 and its spherical free end is seated in spherical recess in the top of a rocker 11 which, in turn, is seated on top of the base 86 of the inverted L-shaped punches 10.

The draw rod 65, extending downwardly from the clevis 63, to which levers 62 are pivotally connected, serves as the means through which the levers may be actuated. It extends through the base plate 74 and is connected through a chain 107, and a clevis 71 to an actuating means such as a foot treadle 103, for example. A return spring 68 is disposed about the draw rod 65, the upper end of the spring engaging a retainer 67 mounted on the rod 65 and the lower end engaging a retainer 70 mounted on the base plate 74.

As was mentioned above, the block 36, which is mounted on the back plate 1, serves as a support for the finger assembly 82. The upper portion of the block 36 is cut away in part to define a pair of brackets 87. A finger shaft 4 is mounted in and extends through the brackets 87. Four finger collars 2 are mounted on the finger shaft 4, one on the inside and one on the outside of each of the two brackets 87, and insulated therefrom by fibre washers 34. A finger 7 extends upwardly from and is preferably formed integral with each of the two collars 2 which are mounted on the finger shaft 4 outside the brackets 87. An offset finger 8 extends upwardly from and is preferably formed integral with each of the two collars 2 which are mounted on the finger shaft 4 inside the brackets 87. An actuator collar 33 is mounted on an end of the finger shaft 4. This collar is provided with an actuator lever 30 which is engaged by actuator pins 37 on the actuating lever 48. Thus, movement of the actuating lever

48 effects rotation of the finger shaft 4 through pins 37, lever 38 and collar 39.

A pair of lower electrodes 78 are mounted in electrode holder 6 of insulating material which is disposed between the pad 5 and the punch guide 9 on the back plate 1. These electrodes extend through the holders 6 and the back plate 1 and are connected to a source of electrical energy by means of cables 88.

An air cylinder 89 is mounted at the top of the back plate 1 and is provided with an extension 17 extending downwardly therefrom. Air cylinder extension 17 is provided with a spherical head 90 which is seated in a recess in the top of the rocker arm 13. An air supply line 104 connects the air cylinder 89 to a source of air through a solenoid valve 105 (Figure 6).

A snap switch 91 is mounted on the outside face of one of the trunnion plates 52. A switch button 92 extends out of the top of the switch 91 in position to be engaged by a switch-actuating screw 20 mounted in a bracket 22 which is attached to the air cylinder 89. A guide 55 for bracket 22 is mounted on a trunnion plate 52.

A snap switch 93 is mounted on the outside face of one of the gusset plates 69. A switch button 94 extends out of the top of the switch 93 in position to be engaged by a switch-actuating screw 95 mounted in a bracket 61 which is attached to a lever 62.

As was mentioned above, actuation of levers 62 is effected by means of the foot treadle 103 through draw rod 65 which is connected at one end to the actuating means and, at its other end, through the clevis 63, to lever 62. Stops are provided to positively define the upper and lower limits of travel of the levers 62. A stop block 59 is mounted between the levers 62 and intermediate their ends. A screw 57 is threaded in an upper stop bracket 56, and a screw 96 is threaded in a lower stop bracket 64. Both of these brackets are mounted on the back face of the back plate 1.

The steps in the cycle of operation which effects closing of the hooks on the ends of the mount lead-wire to the filamentary coil are illustrated in Figures 3, 4, and 5 when read in conjunction with Figures 1 and 2. An operator positions filamentary coil 97 in the open hooks on the ends of lead wires 98 which are sealed in a glass flare 99. The operator then positions this assembly in the apparatus of our invention, with the hooks 100 seated on the electrodes 78 (Figure 3) and the periphery of the flare 99 resting on the work table 43.

The operator then depresses the foot treadle 103. Depression of the foot treadle draws the rod 65 downwardly. As the rod 65 moves downwardly it draws with it the levers 62. The finger actuator 48, which is supported from one of the levers 62, moves downwardly and the actuator pin 37 thereon depresses the actuator lever 38, thereby effecting rotation of the finger shaft 4. Rotation of the shaft 4 causes the finger collars 2 to rotate counter-clockwise and the fingers 7 and 8 thereon push the legs 101 of the coil into the base of the hooks 100 (Figure 4). The rocker arm 13, mounted on the rocker shaft 53, which is supported by and extends between the two levers 62, moves downwardly with the levers 62 and depresses the rocker 11. The rocker 11, in turn, pushes the punches 10 downwardly and causes the upper electrodes, which are attached to the ends of the punches 10, to establish a positive contact with, and slightly deform the hooks 100 (Figure 4). The stroke of the levers 62 is completed when the stop block 59, which is disposed therebetween, engages the end of the screw 96 which is threaded in the lower stop bracket 64.

When the downward stroke of the levers 62 is about completed, the switch actuating screw 95, which is mounted in the bracket 61 attached to one of the levers 62, engages and depresses the switch button 94 on the snap switch 93 This action closes the circuit through this switch and energizes the heating circuit through the snap switch 91 which is normally closed (Figure 6). The heating circuit consists of the circuit through one of the lower electrodes 78, one of the hooks 100, the adjacent upper electrode 46, the jumper 83, the other upper electrode 46, the other hook 100, and the other lower electrode 78. Heating of the hooks 100 conditions them for the hook closing operation which consists of a squeezing of the hooks between the upper electrodes 46 and the lower electrodes 78.

Actuation of the upper electrodes 46 to effect the hook closing operation is accomplished as follows. Closing of the snap switch 93 which energized the heating circuit also energizes the solenoid coil of the air cylinder operating valve 105 thereby supplying air to the operating cylinder to effect a downward stroke thereof. The downstroke depresses the rocker arm 13 which is trunnioned in an elongated slot 102 to permit the downward movement effected by the air cylinder. The downward movement of the rocker arm 13 is transmitted through the rocker 11 to the punches 10, on the ends of which the upper electrodes 46 are mounted. The downward movement of the electrodes 46 deforms the heated hooks 100 and closes them (Figure 5). The punches 10, on which the electrodes 46 are mounted, are independently mounted so that there is an equalizing action between them through the pivotally mounted rocker 11 to insure equal clamping pressure on each hook.

As the air cylinder stroke approaches completion the switch-actuating screw 20, which is mounted in the bracket 22 which is attached to the air cylinder, engages and depresses the switch button 92 on the snap switch 91. This opens the circuit through this switch. Opening of the circuit through this switch deenergizes the heating circuit described above.

The operator now releases the pressure which was applied to the foot treadle, thus permitting the levers 62 to move upwardly and cause the switch-actuating screw 95 to break contact with the button 94 on the snap switch 93, thus opening the circuit through this switch and denergizing the solenoid coil of the air cylinder operating valve 105. De-energization of this circuit effects the return stroke of the air cylinder and permits the several parts of the apparatus, which were actuated by the stroke of the levers, to return to their normal positions as shown in Figures 1 and 2, with the stop block 59 striking the end of the screw 57 in the upper stop bracket 56.

A suitable voltage transformer 106 is interposed in the heating circuit between the upper switch 91 and the lower electrodes 78 to provide for reducing and controlling the voltage in the heating circuit. The timing of the heating circuit is controlled by a suitable throttling means disposed between the air cylinder 89 and its operating valve 105.

This method of clamping provides a controllable amount of equalized hook closing pressure,

and eases the crushing effect on the coil, used as a fulcrum, since the metal being bent over it is red hot. It is possible under certain conditions for the turns of the tungsten wire to be imbedded on the heated hook. This provides a mechanical lock for the coil in the hook. In the case of a tungsten wire coil, since tungsten is known to be more ductile when warm than cold, the heating of the clamp area of the coil through contact with the hot section of the hook makes the wire in the coil less liable to be fractured by the clamping operation. The entire coil area can be flooded with an inert gas by means of tubes (not shown) during the heating cycle to prevent objectionable oxidation.

What we claim is:

1. The method of closing a metal hook about a wire member which comprises: sequentially positioning the wire member in the hook, bringing a heating means into engagement with the hook, heating the hook, and deforming the heated hook.

2. The method of closing a metal hook about a wire member which comprises: sequentially positioning the hook between a pair of electrodes, positioning the wire member in the hook, bringing the electrodes into positive engagement with the hook, heating the hook, and deforming the heated hook.

3. Apparatus for mounting a lamp filament on the hooked ends of lamp lead wires, said apparatus comprising: a pair of fixed electrodes on which the shank portions of the hooks are seated, a pair of movable electrodes mounted above and in register with the free ends of said hooks, means for positioning the lamp filament in the hooks, means for moving the movable electrodes into positive engagement with the free ends of the hooks, means for heating said hooks through said electrodes, and means for deforming the heated hooks.

4. The method of closing a metal hook about a wire member which comprises sequently positioning the wire member in the hook, partially closing the hook about the wire member, heating the hook, and completing the closing of the hook about the wire member.

5. The method of closing a metal hook about a wire member which comprises sequentially positioning the wire member in the hook, partially closing the hook about the wire member, bringing a heating means into engagement with the hook, heating the hook, and completing the closing of the hook about the wire member.

6. Apparatus for mounting a lamp filament on the hooked ends of lamp lead wires, said apparatus comprising: a pair of fixed electrodes on which the shank portions of the hooks are seated; a pair of movable electrodes mounted above and in register with the free ends of said hooks; means for positioning the lamp filament in said hooks; means for moving the movable electrodes into positive engagement with the free ends of the hooks; means for heating said hooks through said electrodes, said means being actuated by the movement of the means for moving the movable electrodes into positive engagement with the free ends of the hooks; and means for deforming the heated hooks.

7. Apparatus for mounting a lamp filament on the hooked ends of lamp lead wires, said apparatus comprising: a pair of fixed electrodes on which the shank portions of the hooks are seated; a pair of movable electrodes mounted above and in register with the free ends of said hooks; means for positioning the lamp filaments in said hooks; means for moving the movable electrodes into positive engagement with the free ends of the hooks; means for heating said hooks through said electrodes; and means for deforming the heated hooks, this means and the means for heating the hooks being actuated by the movement of the means for moving the movable electrodes into positive engagement with the free ends of the hooks.

8. Apparatus for mounting a lamp filament on hooked ends of lamp lead wires, said apparatus comprising: a back plate; a punch guide having a pair of channels therein mounted on said back plate; a pair of punches slidably disposed in said channels; a punch electrode mounted on one end of each of said punches; a block mounted on said back plate beneath said punch guide; an electrode holder of insulating material disposed between said punch guide and said block; a pair of fixed electrodes, on which the lead wire hooks are positioned, seated in said electrode holder and disposed beneath and in register with said punch electrodes; means for positioning the lamp filament in the hooks; means for moving the punch electrodes into positive engagement with the free ends of the hooks; means for heating said hooks through the punch electrodes and the fixed electrodes; and means for deforming the heated hooks.

9. Apparatus for mounting a lamp filament on the hooked ends of lamp lead wires, said apparatus comprising: a back plate; a punch guide having a pair of channels therein mounted on said back plate; a pair of punches slidably disposed in said channels; a punch electrode mounted on one end of each of said punches; a block mounted on said back plate beneath said punch guide; an electrode holder of insulating material disposed between said punch guide and said block; a pair of fixed electrodes, on which the lead wire hooks are positioned, seated in said electrode holder and disposed beneath and in register with said punch electrodes; means for positioning the lamp filament in the hooks; means for moving the punch electrodes into positive engagement with the free ends of the hooks; means for heating said hooks through the punch electrodes and the fixed electrodes, said means being actuated by the movement of the means for moving the punch electrodes into positive engagement with the free ends of the hooks; and means for deforming the heated hooks.

10. Apparatus for mounting a lamp filament on the hooked ends of lamp lead wires, said apparatus comprising: a back plate; a punch guide having a pair of channels therein mounted on said back plate; a pair of punches slidably disposed in said channels; a punch electrode mounted on one end of each of said punches; a block mounted on said back plate beneath said punch guide; an electrode holder of insulating material disposed between said punch guide and said block; a pair of fixed electrodes, on which the lead wire hooks are positioned, seated in said electrode holder and disposed beneath and in register with said punch electrodes; means for positioning the lamp filament in the hooks; means for moving the punch electrode into positive engagement with the free ends of the hooks; means for heating said hooks through the punch electrodes and the fixed electrodes; and means for deforming the heated hooks, this means and the means for heating the hooks being actuated by the movement of the means for moving the

punch electrodes into positive engagement with the free ends of the hooks.

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