Nov. 1, 1927. 1,647,624

J. J. HIGGINS

MACHINE FOR AND METHOD OF MOUNTING FILAMENTS

Filed May 8, 1923 3 Sheets-Sheet 1

FIG. 1.

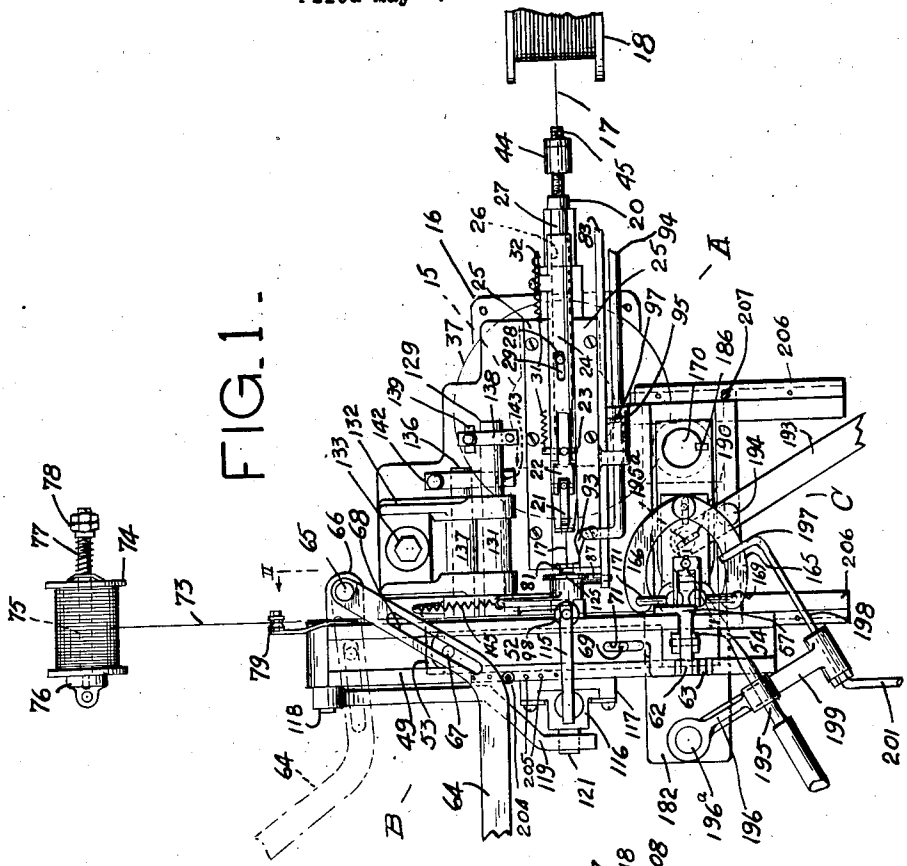


FIG. 3.

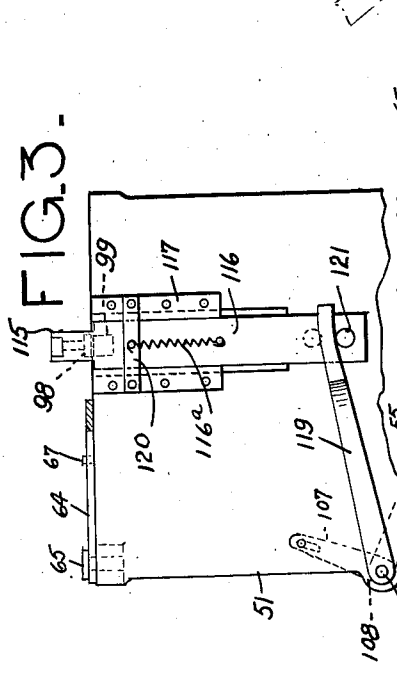
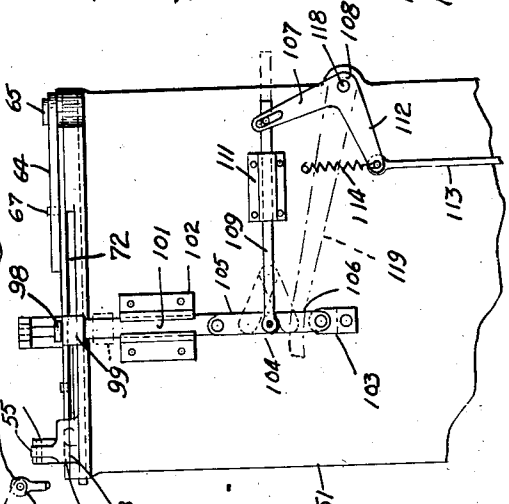


FIG. 2.



INVENTOR
JOHN J. HIGGINS
BY
ATTORNEY

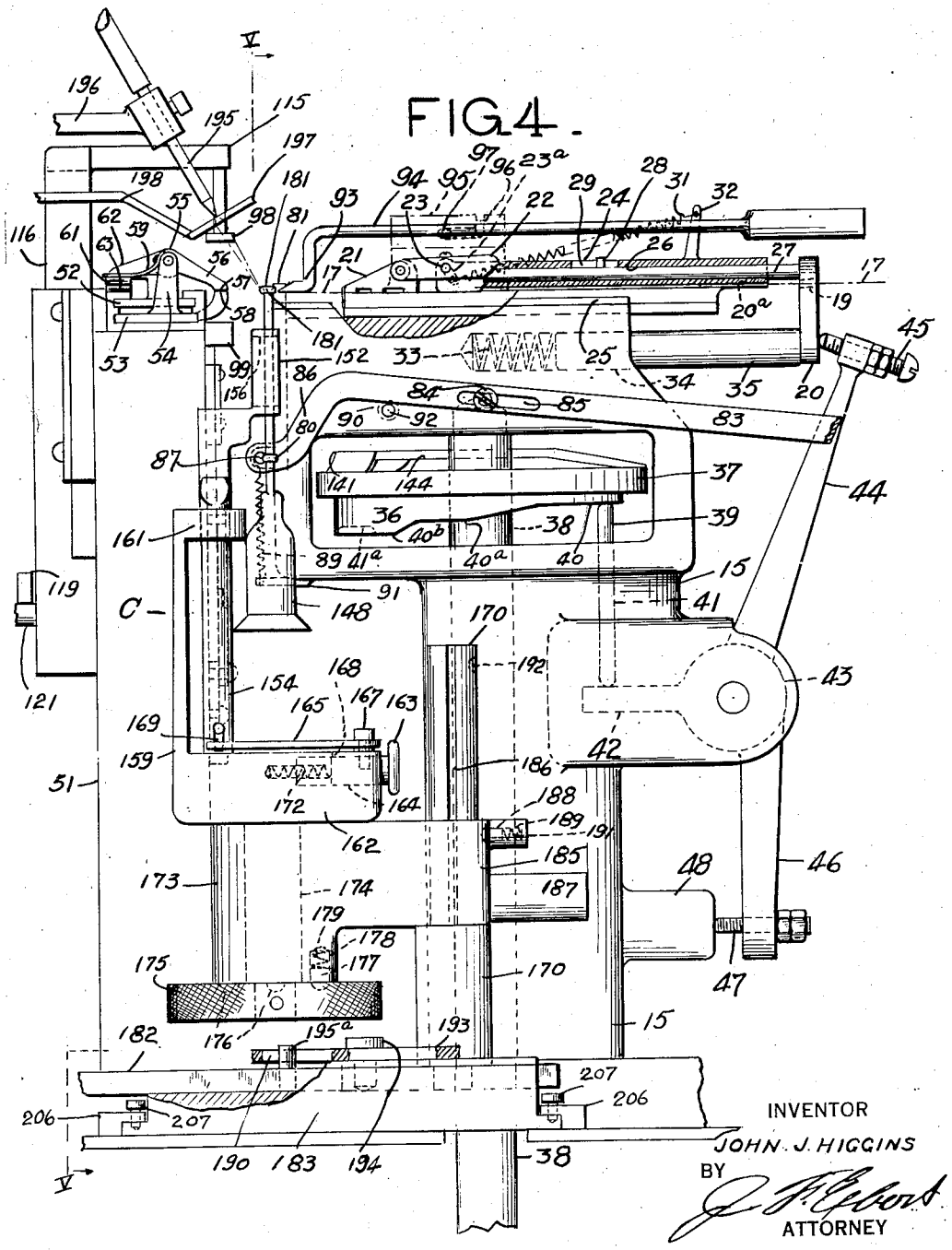
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J. J. HIGGINS

MACHINE FOR AND METHOD OF MOUNTING FILAMENTS

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FIG 4.



INVENTOR
JOHN J. HIGGINS
BY
ATTORNEY

Nov. 1, 1927. 1,647,624

J. J. HIGGINS

MACHINE FOR AND METHOD OF MOUNTING FILAMENTS

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FIG. 11.

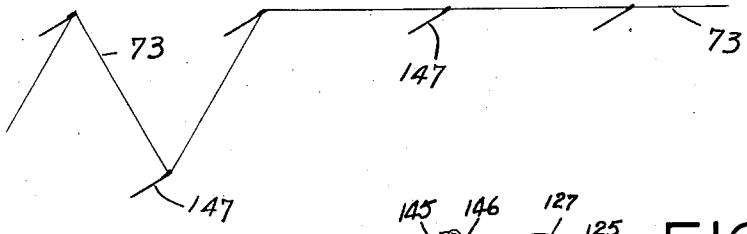


FIG. 6.

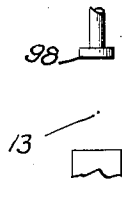


FIG. 7.

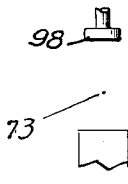


FIG. 8.

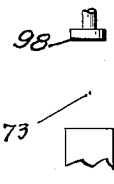


FIG. 9.

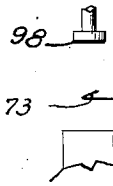


FIG. 10.

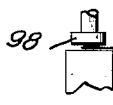


FIG. 5.

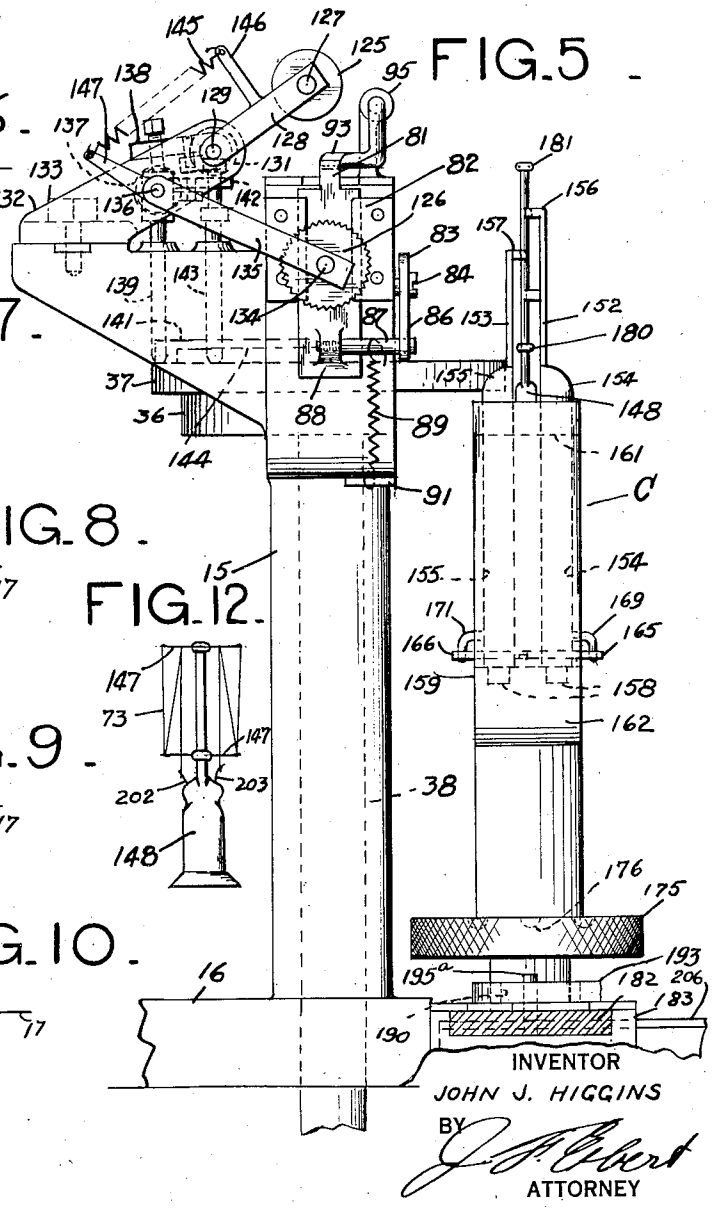


FIG. 12.

INVENTOR
JOHN J. HIGGINS
BY
ATTORNEY

Patented Nov. 1, 1927.

1,647,624

UNITED STATES PATENT OFFICE.

JOHN JOSEPH HIGGINS, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO WESTINGHOUSE LAMP COMPANY, A CORPORATION OF PENNSYLVANIA.

MACHINE FOR AND METHOD OF MOUNTING FILAMENTS.

Application filed May 8, 1923. Serial No. 637,456.

This invention relates to a method and a machine for mounting a filament upon a non-conductive lamp part.

An object of the invention is to provide a machine for securing relatively short lengths of wire to another wire at spaced intervals throughout the length thereof.

Another object of the invention is to provide a machine for clamping a relatively rigid supporting member to a wire, and for securing an end of the supporting member in a non-conductive lamp part.

A further object of the invention is to expedite the manufacture of incandescent electric lamps by providing a machine which may be operated to secure supporting members at spaced intervals upon a length of filament and to insert the supporting members alternately in upper and lower buttons of an arbor.

Other objects and advantages will be apparent from the following description.

An incandescent electric lamp, as generally constructed, comprises a mount which may consist of a stem composed of a flare tube, conductive or leading-in wires disposed therein, an arbor, filament supports secured to the arbor and a filament mounted on supports.

During the manufacture of a mount, an arbor is disposed with one of its ends within one end of a flare tube, leading-in wires also being properly positioned therein. Heat is then applied adjacent the end of the flare tube within which the arbor is disposed, until these portions become plastic. Pressure jaws are then actuated to press and unite the flare tube and the arbor, thus forming what is usually termed the press or flare press. The leading-in wires are, at the same time, embedded in the press.

For the manufacture of the type of lamp to which the present invention relates, the arbor of the mount is provided with two buttons, one upon its exposed end and the other adjacent to the press. Support wires are then inserted radially in each of the buttons, the number of support wires inserted being determined by the length of filament required for the type of lamp desired. The support wires are provided with a common form of hook, or what is termed a pig-tailed loop. After the supports have been inserted, it is customary to manually mount a filament over the hooks for the purpose of retaining the filament.

Considerable difficulty has been experienced in providing automatic means for draping or mounting the filament upon the relatively delicate support wires. This operation requires a peculiar movement in order to properly pass the filament into the loop ends of the supports, great accuracy and positiveness of the operation being necessary to avoid pull upon the supports. Although such automatic mounting may be otherwise attained, it is the object of the present invention to provide a machine which may be operated to secure the support wires to a filament and to subsequently mount the filament upon an arbor.

The present invention distinguishes from the ordinary mounting operation, since it provides for the attachment of the support wires to the filament prior to the insertion of the former into the arbor.

By the provision of means for securing the support wires to the filament, it is not only possible to pass the filament to the arbor for the insertion of the support wires into the arbor, but, if desirable, a considerable length of filament may be manufactured having the support members attached in the proper spaced relation. This support wire may be sold and handled as an article of manufacture, since it is possible to card and store the wire for use upon other machines or for insertion by hand.

It has been found that a desirable type of support member is that having a substantially rectangular transverse cross-section, such as found in what is termed a flattened-wire.

A machine embodying the present invention may comprise a suitable supporting structure including what may be termed briefly, as three cooperative actuating machines. Certain elements of these machines are similar to those described in my copending application, Serial No. 600,072, filed November 10, 1922, entitled "A method of and machine for forming and mounting a

filament" (W L 216) and assigned to the Westinghouse Lamp Company.

The three above mentioned mechanisms may be designated as follows: a filament-feeding device, a support-wire-feeding device and a device for supporting and rotating a lamp stem in operative relation to the other devices.

The filament-feeding device may comprise a slide bar having a pair of jaws operable to grip the filament wire and adapted to be moved a predetermined distance, after which, the jaws may release the filament and return to grip it at a new portion for a repetition of the feeding operation. Thus, a continuous actuation of the feeding device results in an intermittent feeding of the filament wire.

The support-wire-feeding mechanism may comprise a gripping member reciprocable in a guide and adapted to grip a support wire and move it in a path substantially transverse to the path of movement of the filament wire.

Associated with the feeding mechanisms above referred to are other devices, as for instance, movable parts which may be actuated to form a hook at the end of a support wire when the same is in a given position. A presser member is also provided to compress the hook portion of the support wire when the hook has been disposed about the filament. In addition, an automatic cutting device is provided to sever the support wire a given distance from the filament, in accordance with the length of the support desired.

After a support wire has been secured to the filament, the sliding member of the filament feeding mechanism operates to carry the support wire in operative relation to the button of an arbor of a stem secured in the stem support above mentioned. Suitable fires may then be directed upon the button to locally heat and soften a portion thereof, after which the stem support is actuated to move the button toward the support wire until the end thereof enters the plastic portion, which subsequently cools and secures the support wire therein.

The stem support may then be raised and rotated a given number of degrees to position the lower button of the stem for the insertion of a support wire. After the stem holder has been adjusted to position the lower button adjacent to the path of movement of the filament wire and in the inserting position, the gripping jaws of the filament-feeding mechanism are actuated to position another support wire in position for insertion, the fires being directed to properly soften the button for such insertion.

It has been found desirable to employ wire substantially oblong in cross-section in preference to a cylindrical wire, although such wire may, if desired, be used. The flattened wire adapts itself more readily to the feeding operation, and has been found more practical for the formation of hooks at the ends thereof.

The invention will be more fully understood by reference to the accompanying drawings in which,

Fig. 1 is a plan view of a machine embodying the invention;

Fig. 2 is a fragmentary view, in elevation, of the machine taken on line II of Fig. 1, looking in the direction of the arrow;

Fig. 3 is a fragmentary view, in elevation, of the left-hand side of the machine as positioned on the drawing;

Fig. 4 is an enlarged view, in elevation, of the inserting side of the machine and showing the stem support;

Fig. 5 is a view, in elevation, of one of the mechanisms of the machine taken substantially on line V—V in Fig. 4;

Figs. 6 to 10 show, diagrammatically, the operation of several elements to form and compress a hook about a filament;

Fig. 6 shows the wire about to be fed for the hook-forming operation;

Fig. 7 shows the wire disposed upon one element of the hook former;

Fig. 8 shows the hook-forming elements when shaping the end of the wire;

Fig. 9 shows the hook moved forward and disposed about a filament;

Fig. 10 shows hook-clamping members compressing the hook to secure it to the filament, also cutting jaws;

Fig. 11 shows an example of a bent filament wire having the support members secured thereto; and,

Fig. 12 shows a mount complete.

An embodiment of the present invention may comprise suitable supporting structure to carry, first: the support-wire-feeding mechanism, second: filament-feeding mechanism, and third: the stem support or holder. These three mechanisms are, in the present machine, so arranged that they form a unitary cooperating structure. Certain movable elements of each of the mechanisms cooperate with certain elements of the other mechanisms to perform functions necessary to mount a filament upon a stem.

Referring to the mechanisms in the order above given, the support-wire-feeding portion "A" of the entire machine may comprise a suitable bearing bracket or casting 15 (see Figs. 1 and 5) having a base 16, by means of which it may be secured to a table or other support.

Flattened relatively heavy wire 17 may be employed for the supports and may be unreeled from a spool 18, the spool being supported at any desirable distance from the machine and in a suitable manner. The wire 17 may then be threaded through an eyelet

19 (see Fig. 4) in a depending arm 20 and may be then led through a groove 20[a] and beneath a jaw 21 pivoted upon a lever member 22, which member is secured to a transverse shaft 23, having its bearing at an end of a reciprocable part 24, the latter being slidable in a guide 25 at the upper end of the bracket 15.

The movable part 24 may be provided with a cylindrical bore 26 in which a plunger 27 is reciprocable; the plunger having the depending arm 20 secured to the exposed end thereof.

A pin 28, secured to the plunger 27 and positioned in a slot 29 of the part 24, limits the movement of the plunger which has its inner end tapered to engage with a tapered surface at one end of the lever member 22. When the plunger is thrust to make contact with the lever member, the said member is actuated and transmits a force to the jaw 21 causing it to press firmly upon, and secure, the support wire 17. Normally, the jaw 21 is lightly pressed upon the wire by reason of the action of a spring 31 secured to a rigid arm 32 integral with the reciprocable part and to an end of the shaft 23 which is bent to provide a lever arm 23[a]. Thus, the contractive action of the spring 31 tends to rotate the lever member 22 and exert a downward pressure upon the jaw 21. This light tensional force upon the jaw is sufficient for gripping the wire to feed it from the spool when the part 24 is actuated.

It is necessary, however, to provide a more firm grip upon the wire since the wire is inserted into a button by the forward movement of the reciprocable part 24, hence the provision of the plunger 27, which, during the inserting operation forces one end of the lever 22 upwardly to more firmly press the jaw 21 upon the wire.

The above described mechanism for gripping the wire and thrusting it through a given path is known in the art as a ram and will be hereinafter so termed.

The ram may normally be maintained in an outer position, ready to feed wire from the spool, by a helical spring 33 disposed in a recess 34 in the bracket 15. Motion is imparted from the spring to the ram by a rod 35 disposed in the recess and having one end in engagement with the spring 33 and the other end in contact with the arm 20 depending from the plunger 27. Thus, the plunger may be thrust outwardly until the pin 28 reaches an end of the slot 29, whereupon, the spring 33 may continue to act to move the entire ram outwardly to its initial position. The inward movement of the ram is effected through the action of a cam 36 upon the under side of a cam carrier 37.

The cam wheel or carrier 37 is secured to a vertical shaft 38 positioned in a suitable bearing within the bracket 15. The shaft 38 may be rotated by any suitable means, as by suitable connection to an electric motor (not shown). Movement may be translated from the cam 36 to the ram through a vertical rod 39 disposed in a vertical bore 41. The upper end of the rod 39 may be disposed in the path of the cam 36, and the lower end may make contact with an arm 42 of a bell-crank 43, an upper arm 44 of which is provided with a set screw 45 adapted to make contact with the depending arm 20 of the ram.

It will thus be evident that a rotation of the cam wheel 37 will cause a movement of the arm 44 and an inward movement of the ram, the return movement of the ram being effected through the action of the spring 33.

It will be understood that a variety of movements of the ram may be had by the proper formation of the face of the cam 36. For example, when an end of the rod 39 is disposed in contact with the lower surface 40 of the cam, the ram may be in its remote position from the filament wire. However, when the rod end traverses the surface 40 and reaches the portion 40[a], the ram may be in another position and may be finally advanced when the rod makes contact with the surface 40[b] of the cam. As will be hereinafter set forth, it is necessary that, after the complete advance movement of the ram, it may be slightly retreated to provide for a slight return movement.

A depression 41[a] may be provided in the face of the cam 36. This depression may be sufficiently deep to allow for the proper return movement of the ram and may be of sufficient length to maintain the ram in such position until other operations have been performed.

The bell-crank 43 may be provided with a stop arm 46 having a set screw 47 to engage with a stop 48 integral with the bracket 15. By an adjustment of the set screws 45 and 47, a variation in the length of travel of the ram may be had.

Other mechanism, to be described hereinafter, is associated with the ram and carried on the bracket 15.

The filament-feeding mechanism, indicated in Fig. 1 by the reference letter "B", may comprise a guide 49 mounted at the upper end of a support 51. The guide may be disposed substantially at right angles to the path of movement of the support wire 17. Movable in the guide, are upper and lower slide bars 52 and 53, respectively (see Fig. 4), the lower slide bar 53 being provided with an upright bearing 54. A double-arm lever 55 is pivoted at the upper end of the bearing. One arm 56 of the lever 55 projects beyond the guide 52 and toward the support-wire-feeding mechanism and terminates in a jaw 57.

The jaw 57 is positioned to engage a jaw 58 integral with, and projecting from, the lower slide bar 53. The jaws are normally maintained open through the action of a spring 59 secured to the bearing 54 and exerting pressure upon a lug 61 integral with the end of an arm 62 of the lever 55.

The jaws may be closed, in opposition to the spring 59, through the action of a wedge member 63 which is integral with and offset from the end of the slide bar 52. The wedge member 63 is adapted to pass beneath the end of the arm 62 and lift it, thereby effecting an engagement between the faces of the jaws 57 and 58. The jaws are movable with the slide bar 53 when a hand lever 64 is oscillated. The lever is pivoted on a pin 65 secured in a bearing 66 at one end of the guide.

A pin 67, projecting upwardly from the slide bar 52, is disposed in a slot 68 provided in the lever 64. The upper and lower bars 52 and 53, respectively, are associated by a pin 69 which is secured to the lower bar 53 and which extends through a slot 71 in the upper bar 52. When the jaw-operating lever 64 is moved to the position indicated in dotted lines in Fig. 1, the wedge member 63 will be removed from beneath arm 62, and pin 69 in the slide bar 53 will make contact with an end of the slot 71. A continued movement of the lever 64 will carry the slide bars and jaws 52 and 53 to a suitable position for a grip upon a filament wire.

A suitable slot 72 is provided at the side of the guide to allow for the longitudinal movement of the jaws 57 and 58. A filament 73 may be unwound from a spool 74 and, when gripped by the jaws, the lever arm 64 may be moved to advance the jaws away from the spool.

The spool 74 may be rotatable upon a suitable spindle 75 secured in a bracket 76. A tensioning device consisting of a spring 77 disposed between lock nuts 78 and the spool, serves to prevent the filament from unwinding too quickly.

An idler or guide wheel 79 is provided, and the wire may be associated therewith by a bight and threaded through the machine adjacent to the guide 49. The filament may then be gripped by the jaws until other mechanism has operated to secure the wire, at which time the jaws may be operated for a new grip, as will presently be described.

When the filament has been secured by the jaws and stretched taut, the ram which feeds the support wire may be operated to thrust the end of a support wire slightly beyond the end of the guide 25 and directly over a V-shaped female member 81 of a hook-forming device.

The member 81 may be movable in a guide 82 (see Figs. 4 and 5) to and from the path of movement of the support wire. Any suitable mechanism may be provided for operating this female member, and, in the present invention, such movement may be accomplished by a double-arm lever 83 pivoted on a pin 84 disposed in a slot 85 provided in the lever.

A short arm 86 of the lever may be connected by a stud 87 to the lower end 88 of the member 81. A spring 89, secured to the stud and to a projection 91, normally maintains the female member out of the path of movement of the support wire. When the lever 83 is moved to raise the female member, it may pass over a suitably positioned latch (see Fig. 4) which may comprise the usual helical spring (not shown) disposed in a socket 90 to eject the end of a pin 92. Thus, when the lever arm passes over the latch, the arm will automatically be secured in an upper position against accidental adjustment. Cooperating with the female member 81 of the hook-forming device is a male member 93 in the form of a wedge-shape forming die at the end of a rod 94. The rod may be disposed in a bearing 95 integral with the bracket 15, as indicated in dotted lines in Fig. 4.

The bearing 95 may be provided with an arcuate slot 96 connecting with a longitudinal slot. A pin 97, secured in the rod 94, may be disposed in the slot; thus, a movement of the rod 94 longitudinally of the bearing may be had, as well as a partial rotation.

When the support wire is moved so that it may be disposed upon the female member 81, the forming die 93 of the male part is moved downwardly to bend the wire substantially at right angles to the horizontal, after which, the male member is thrust forward to move a portion of the support wire into the V-shaped slot of the female member, thus forming a hook at the end of the support wire. The use of a flattened wire lends itself readily to the bending of the hook by this device.

When the hook has been formed, the rod 94 may be moved longitudinally of the bearing, and thus from an engagement with the female member 81, after which, it may be rotated to bring the male part 93 out of the path of movement of the support wire. The female member may then be lowered by releasing the lever arm 83, and the formed hook will spring from the V-shaped recess as the female member is lowered.

When a hook has been formed at the end of a support wire, the ram may be operated to move the support wire until the hook has moved beneath and slightly past the filament wire. The two wires are so disposed that the filament wire will be positioned in contact with the support wire. The ram may then be slightly retreated to position the hook about the filament wire. The two wires, when thus engaged, may be disposed

between upper and lower clamping members 98 and 99, respectively. These members are more clearly shown in Figs. 2 and 3.

The lower member 99 is provided with a slide bar 101 movable in a guide 102. Between the lower end of the slide bar 101 and a projection or offset bearing 103, is provided a toggle 104 consisting of links 105 and 106 which are attached to an arm 107 of a bell-crank 108, by a connecting rod 109 movable in a guide 111.

An arm 112 of the bell-crank may be secured to a treadle 113, a portion only of which is shown. A spring 114 may be provided to normally break the toggle and lower clamping member 99, the member being shown in its upper position in Figs. 2 and 3.

The upper clamping member 98 is secured to a projection or offset portion 115 of a slidable part 116, movable in a guide 117. The sliding part, which carries the clamping member 98, is disposed at the side of the supporting structure 51, opposite to that at which the slide bar 101 of the lower clamping member is disposed.

The bell-crank 108 is secured to one end of a shaft 118 which extends through, and projects from, the supporting structure 51 at both sides thereof. This shaft is utilized to operate mechanisms for actuating the upper and lower clamping members. For the purpose of operating the member 98, a finger 119 is secured to the shaft 118 and adapted to make contact with a projection or pin 121 secured to the slidable part 116. The slide 116 is normally urged to lift the clamping member 98 by a spring 116ª secured to the slide and to a cross-piece 120. Thus, when the treadle 113 is actuated to raise the lower clamping member 99 to position, the finger 119 will be actuated simultaneously to lower the upper clamping member 98, thus bringing the two members together to clamp the hook of the support wire about the filament, after which it is necessary to sever the support wire.

After the clamping operation has been performed, the lever arm 64 may be operated to close the jaws 57 and 58 upon the clamped portion of the filament and support wire. The support wire may then be severed and it will be appreciated that, during such operation, the support wire must be properly secured. For the purpose of severing the support wire, a pair of upper and lower cutting discs, 125 and 126, respectively, (see Fig. 5) are provided. The upper disc is mounted on a spindle 127 at the end of an arm 128 which is secured to a shaft 129 movable in a bearing 131. The bearing 131 may be integral with a bracket 132 secured, by means of a tap bolt 133, to the upper end of the bracket 15.

The lower cutting disc 126 is mounted on a spindle 134 at one end of an arm 135, the opposite end of the arm being secured to a shaft 136 movable in a bearing 137 integral with the bracket 132.

The cutters 125 and 126 are moved or oscillated by reason of their association with cam surfaces upon the upper face of the cam carrier 37. The shaft 129 is provided with a lever arm 138 disposed in engagement with the upper end of a vertical push rod 139. The lower end of the push rod is disposed and maintained in contact with the upper face of the cam carrier and in the path of a cam 141.

The shaft 136 is provided with a lever arm 142 disposed in contact with the upper end of a push rod 143, the lower end of the rod being maintained in contact with the upper face of the cam carrier 37 and in the path of a cam 144.

The cutter discs are maintained apart through the action of a spring 145 secured to a projection 146 on the arm 128 and to a lever arm 147 on the arm 135. It will thus be evident, that a rotation of the shaft 38 will cause an actuation of the push rods 139 and 143, with a consequent translation of motion to the cutter discs which may be moved to sever the support wire.

It is obvious that the disposition of the cams 141 and 144 on the cam carrier may be such that the cutting operation may be properly timed. After the severing operation, the jaw-operating lever 64 is moved to secure the severed section 147 of the support wire 17. This severed section may hereinafter be termed a support. The support may then be moved in operative relation to a stem 148 (see Fig. 4) secured in a holder C.

Any suitable type of stem holder may be employed as an element of the present invention. The one hereinafter described provides for the intermittent rotation as well as the vertical reciprocation of a stem.

As illustrated in Figs. 1, 4 and 5, the holder C may comprise oscillatory arms 152 and 153 secured to vertical rotatable rods 154 and 155, the upper or free ends of the arms being equipped with the usual V-shaped jaws 156 and 157.

The rods 154 and 155 may have their lower ends rotatably disposed in bearing apertures 158 provided in a rotatable bracket or carrier 159, the upper end of which is provided with guide bearings 161 in which upper portions of the rods 154 and 155 are disposed.

The bracket 159 is of right-angle construction, and the lower or horizontal leg may be proportioned to provide a base 162 in which part of the mechanism for effecting an oscillation of the rods 154 and 155 may be positioned.

The stem holder, as illustrated, may be manually operated by the application of pressure to a plunger 163, which is recipro-

cable in a suitable cylindrical aperture 164 in the base 162. The plunger 163 may be associated with the rods 154 and 155 by links 165 and 166, respectively, which links are pivoted upon a stud 167 secured to the plunger 163 and movable in a slot 168 at the upper side of the base 162. The links 165 and 166 are, in turn, pivoted to lever arms 169 and 171, respectively, which arms are secured to and project from the rods 154 and 155, respectively.

A spring 172, disposed between the inner end of the aperture 164 and the inner end of the plunger 163, normally operates to maintain the plunger in its outer position, thus causing an opposite oscillation of the rods 154 and 155 and a movement of the jaws 156 and 157 toward each other. It will, therefore, be obvious that the jaws may be opened by a slight inward movement of the plunger 163 and that a release of the plunger will cause the jaws to grip and secure a stem when properly positioned therebetween.

The present form of stem holder is adapted to be moved to and from the jaws which secure a support wire and may be intermittently rotated a given number of degrees so that a stem may be rotated about its axis for the insertion of the radially positioned supports, as illustrated in Fig. 12.

The stem holder C may be provided with an offset bearing 173 slidably mounted on a post 170 secured to a slide plate, to be later described.

The base 162 may be provided with a shaft 174 journaled in the said bearing. The shaft 174 may project from the lower end of the bearing 173 and be provided with a hand wheel 175 pinned thereto. A rotation of the hand wheel will, therefore, result in a rotation of the stem, the vertical axis of the shaft 174 being coincident with the vertical axis of the stem.

The upper surface of the hand wheel or disc 175 may be disposed contiguous to the lower surface of the bearing 173. The stem may be intermittently rotated a given number of degrees, and means for temporarily maintaining the stem in a given position may be had by providing the upper surface of the disc 175 with a plurality of depressions 176.

The lower end of the bearing 173 may be provided with a latch consisting of a pin 177 disposed in an aperture 178 and normally urged toward the disc by a spring 179; thus, the holder C may be temporarily maintained in a plurality of positions throughout its rotary movement. If, for instance, a stem is to be made with five upper support wires and four bottom wires, the disc may obviously be provided with nine depressions. If, for example, a lower support wire is, as shown, inserted between two support wires of the upper button, it will be evident that, with each insertion, the holder will be moved one-half the distance of the space between the support wires.

In the drawing, a top button 181 of the stem 148 is illustrated in several of the figures, as being in operative relation to the inserting mechanism. The inserting operation may be performed by changing the relative position of the jaws, which secure the support wire, and the button.

In the present embodiment of the invention, however, the stem holder C is so constructed that it may be moved to and from the jaws 57 and 58 which secure the support wire 147. To effect this operation, the stem may be mounted on a slide plate 182, movable in a guide 183. The plate 182 carries the vertical post 170, upon which is slidably disposed the offset bearing 173 in which the stem holder C is rotatably mounted.

The post 170 is provided with a key-way 186, and extension 185 of the bearing 173, slidable on the post 170, is keyed from rotary movement. It will thus be evident, that, when it is desirable to insert support wires in a lower button 180 in the stem 148, the entire stem holder may be moved upwardly, either by means of a treadle or by a hand piece 187.

A latch may be provided comprising a pin 188 disposed in an aperture 189 and actuated by a spring 191 to move toward the post 170, and a notch 192 may be properly positioned in the post so that when the stem holder has positioned the lower button for the insertion of a support, the holder will be temporarily maintained in such position.

For the purpose of moving the stem holder toward a support wire secured by the jaws 57 and 58, means are provided for moving the slidable plate 182. Such means may comprise a lever arm 193 fulcrumed upon a pin 194, secured at one side of the guide 183. One end of the lever 193 may be provided with a slot 190, in which is disposed a pin or stud 195[a] secured in the slidable plate 182. An oscillation of the lever 193 will, therefore, effect a reciprocation of the plate 182, and a support wire 147 may thus be thrust into a button. Prior to the insertion operation, it is, of course, necessary to locally heat and render plastic a portion of the button. Any suitable means may be provided for this heating operation.

The present construction shows a burner 195 carried on an arm 196 of an upright 196[a], secured to the movable plate 182, thus, the fire may be moved with the button, and the flame applied to the button prior to the inserting operation.

A baffle plate 197 is provided for normal disposition between the flame and the button, to prevent the heating operation when not required. The baffle plate may be carried on

a spindle 198, movable in a bearing 199 secured to the upright 196[a]. The spindle 198 may be provided with a lever arm 201, a movement of which will effect a corresponding movement of the baffle plate to position it in or out of the path of the flame.

The movement of the stem holder toward or away from the jaws 57 and 58 may be accomplished in any suitable manner as by the manual operable means illustrated.

For the purpose of describing the operation of the present machine, let it be assumed that the jaws 57 and 58 are in their initial positions, that is, at the side of the machine adjacent to the spool 74. They will obviously be opened since the action of the lever 64 will have moved the plate 52 to bring the wedge member 63 from beneath the arm 62 of the lever 55. The filament may then be led over the guide 79, and the lever 64 may then be moved until the slide 52 has carried the jaws to a point where they are about to close. The filament 73 may then be inserted between the jaws 57 and 58 that are closed by a slight movement of the lever 64 which may be moved to bring the filament across the machine.

After this operation, a filament will have been stretched taut and substantially at right angles to the path of travel of the support wire. It will be assumed that the other operating parts of the machine, such, for instance, as the clamping members and the hook-forming members will be in their removed or initial positions. The support wire may then be threaded through the eyelet 19 and under the slidable part 24 which is provided with a suitable longitudinal groove 20[a] for the passage of the wire, the end of which may be inserted beneath, and caused to slightly project from, the jaw 21. Rotative movement of the shaft 38 may then be caused to produce an actuation of the cam carrier 37, thus causing the cam 36 to actuate the rod 39, transmitting motion to the bell-crank 43, with the result that the ram is moved forward to carry the projecting end of the wire to a position over the female member 81 of the hook forming mechanism.

When the ram is positioned to bring the support wire over the female member 81 of the hook forming mechanism, the rod 39 will traverse the face 40 of the cam 36 until it has reached the surface 40[a], at which time the rotation of the shaft 38 may be temporarily stopped, or the surface 40[a] may be of sufficient length to maintain the ram in position during the wire bending operation.

The lever 83 of the hook-forming device may then be actuated to raise the female-hook-forming member 81 to position, as indicated in Fig. 7, causing the support wire to rest thereon. The male member 93 of the hook-forming mechanism may then be moved downwardly to bend the wire and form a hook or loop, as shown in Figs. 8 and 9. The male member may then be removed, and the female member lowered leaving the support wire with a hook formed at the end thereof.

A continuous movement of the shaft 38 will then bring the rod 39 in engagement with the surface 40[b] of the cam 36. The support wire will then have been moved forward until the hook at the end thereof passes beneath the filament. The position of the support wire and filament may be such that the hook of the support wire will move beneath the filament and position itself with the hook end at a slightly higher elevation than the filament.

The slight reverse movement of the ram may be caused by a continuous rotation of the shaft 38 to bring the end of the rod 39 into the depression 41[a], thus causing a slight return movement of the ram to bring the hook of the support wire about the filament wire (see Fig. 9). When in this position, the machine may be again temporarily stopped or, as hereinbefore described, the length of the depression may be sufficient to allow for the operations of clamping and cutting prior to the return of the ram to its initial position.

When the hook portion of the support wire is properly disposed about the filament, the treadle 113 may be depressed, and the upper and lower clamping members will be simultaneously operated to compress the hook about the filament. The treadle may then be released and the clamping members separated, the support wire having been clamped about, and secured to, the filament.

After the clamping operation has been accomplished, the lever 64 may be moved to bring the jaws 57 and 58 in position to grip the filament and support wire substantially at their point of union. When the wires are secured, the cutting discs may be actuated and a length of the support wire severed from the roll, this length of support being of the proper length for the insertion into a button and is indicated in the drawing by the numeral 147. The lever 64 may then be again moved to bring the support wire into position for the inserting operation.

Assuming this operation is to be made in the top button, the baffle plate 197 is removed to permit the burner to heat a portion of the button, after which the lever 193 is actuated to move the button toward the support wire until an end thereof has been inserted into the button. The baffle may then be moved to cut off the fire.

All the operations for securing a support to the filament may then be repeated, and, as the jaws 57 and 58 are moved to bring another support wire in operative relation to the stem, the stem may be moved upwardly

and rotated a given number of degrees, thus bringing the lower button in position for the insertion of a support wire.

After the next wire has been secured to the filament, a reverse movement of the holder may be performed to bring the upper button again in position with the positioned support wire. It will thus be evident that by alternately moving the stem holder up or down and rotating it a given number of degrees, the zigzag type of filament may be readily supported by the buttons. When the proper number of supports have been inserted in a stem, a sufficient length of filament is left at each end for attachment to the leading-in wire or conductors 202 and 203, which operation may be performed in any suitable manner.

Although the present embodiment of the invention has been described as operable to mount a filament wire upon a stem having an arbor with the buttons in a given spaced relation, the machine may be adjusted to mount a filament upon a stem having a different spacing between the buttons.

To accomplish the above, the lever 64 which actuates the clamping jaws 57 and 58, may be limited in its movement by engagement with a peg or pin 204 disposed in one of a plurality of holes 205 positioned along the side of the guide 49. The holes may be spaced in any suitable relation, and the peg 204 may be disposed in one of a variety of positions along the guide 49. It will, therefore, be evident that the jaws 57 and 58 may be moved to a variety of positions along the guide for the insertion of a support wire.

The stem holder C may also be made adjustable and supported in the guides or ways 206, and may be moved longitudinally of the guide 49. Thus, a stem positioned in the holder C may be adjusted, in operative relation to the jaws 57 and 58, when moved to a position limited by the stop pin or peg 204.

It will be understood that the distance between the inserting position of the jaws 57 and 58 and the position at which the clamping operation is performed must correspond to the diagonal between an upper and lower button of a mount.

Assuming that the machine has been operating to mount a filament upon a certain type of stem, it may be desirable to operate the machine for mounting a filament upon a stem having greater space between the buttons.

The peg 204 may then be shifted to a hole which will permit a greater movement of the slide plates 52 and 53, to increase the distance between the inserting position of the support and point at which a support wire is clamped to the filament.

The adjustment of the peg 204 may be such that the distance above mentioned will be equal to the required length of a filament when positioned between the buttons.

The stem holder C may then be moved along the ways 206 until it is so positioned that a stem secured in the holder will be in operative relation to the jaws for the inserting operation. The stem holder may be secured in place by set screws 207.

By the above adjustable arrangement of the parts, it will be appreciated by a simple rearrangement of the coordinating elements of the machine, stems of various types may be mounted with a filament.

Considerable advantage is derived from the present invention, since it enables a continuous operation to be performed for the mounting of a filament upon a stem.

The handling of a filament has always been a tedious and delicate operation. Furthermore, the mounting of a filament by disposing the filament in loops or hooks at the end of support wires, required considerable skill and the necessary dexterity was only attained by an operator after considerable practice.

The present invention eliminates this undesirable feature in the manufacture of lamps, since it not only handles the filament during the entire operation, but also inserts the support wires into the button, which has heretofore been an entirely separate operation.

Although a preferred embodiment of the invention has been shown, it is to be understood that changes and modifications may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A lamp-making machine comprising means for feeding a filament, means for feeding a support wire to position an end thereof adjacent to said filament, means for securing said support wire to the filament, a lamp stem holder and means for inserting the opposite end of said support-wire into a stem supported in said holder.

2. A lamp-making machine comprising means for feeding a filament, means for feeding a support wire to position an end thereof adjacent to said filament, means for clamping an end of said support wire upon said filament, a lamp stem holder and means for inserting the opposite end of said support wire into a stem positioned in said holder.

3. A lamp-making machine comprising means for moving a filament in a given path, means for moving a support wire in a direction substantially transverse to said path. means for securing one end of said support to said filament, a stem holder and means

for inserting the opposite end of said support wire into a stem positioned in said holder.

4. A lamp-making machine comprising means for moving a filament in a given path, means for moving a support wire in a direction substantially transverse to said path to position an end of said support wire adjacent to said filament, means for forming a hook at the said end of the support wire, means for positioning said hook about said filament, means for clamping said hook upon the filament, a stem holder and means for inserting the opposite end of said support wire in a stem positioned in said holder.

5. A lamp-making machine comprising means for moving a filament intermittently through a given path, means for feeding a support wire from a spool in a direction transverse to said path after each movement of said filament to position an end of said support wire adjacent to said filament, means for forming a hook at the exposed end of said support wire, means for clamping said hook about said filament, means for severing said support wire, a lamp stem holder and means for inserting the free end of said support wire into a button of a stem positioned in said holder.

6. A lamp-making machine comprising means for intermittently feeding a filament, means for moving the end of a support wire adjacent to said filament with each intermittent movement thereof, means for securing one end of said support wire to said filament, a lamp stem holder and means for inserting the other end of said support wire into a stem positioned in said holder.

7. A lamp-making machine comprising mechanism for feeding a filament intermittently, mechanism for feeding a support wire transversely to the path of movement of said filament after each intermittent movement thereof, means for forming a hook at one end of said support wire, said support wire feeding-mechanism operating to position said hook about said filament, means for closing the hook about the filament, a stem holder and means for inserting the other end of said support wire into a button of a stem positioned in said holder.

8. A lamp-making machine comprising a stem holder, means for feeding a filament, means for feeding a support wire, means for securing one end of said support wire to said filament, means for inserting the other end of said support wire into a button of a stem positioned in said holder, means for moving said holder to a position for the insertion of another support wire into another button of said stem and means for inserting into said last mentioned button one end of another support having its opposite end secured to said filament by the above mentioned means.

9. A lamp-making machine comprising a stem holder, means for feeding a filament, means for feeding a support wire to position one end thereof adjacent to said filament, means for clamping said end of said support wire upon said filament, means for inserting the other end of said support wire into a button of a stem positioned in said holder and means for adjusting said holder to position another button of the stem for the insertion of another support wire.

10. A lamp-making machine comprising a stem holder, means for feeding a filament in a rectilinear path, means for moving a support wire in a direction substantially transverse to said path to position an end thereof adjacent to said filament, means for forming a hook at said end of said support wire, means for clamping said hook upon said filament, means for inserting the free end of said support wire in a button of a stem positioned in said holder, means for adjusting said holder to position another button of said stem for the insertion of another support wire secured to a filament by the aforementioned means.

11. A lamp-making machine comprising means for securing ends of support wires to a filament at intervals throughout the length thereof and means for progressively inserting the free ends of the support wires into a nonconductive lamp part.

12. A lamp-making machine comprising means for supporting a filament wire, means for securing support wires at intervals along the filament wire, means for supporting a lamp stem having upper and lower buttons and means for alternately inserting the support wires in said upper and lower buttons.

13. A lamp-making machine comprising means for supporting a filament wire, means for clamping ends of support wires at intervals along the length of said filament and means for progressively inserting the free ends of said support wires into a non-conductive lamp part.

14. A lamp-making machine comprising a stem holder, means for feeding a filament, means for clamping ends of support wires to said filament at intervals, means for progressively inserting the free ends of said support wires into a button of a stem secured in said holder and means for effecting a partial rotation of said stem about its vertical axis after each inserting operation.

15. A lamp-making machine comprising means for feeding a filament, means for securing ends of support wires to said filament to dispose the supports in spaced relation along the filament, means for progressively positioning said support wires in operative relation to said stem holder, means for locally heating a stem positioned in said holder, means for moving the holder to em-

bed a free end of a positioned support wire into a button of said stem, means for effecting a partial rotation of said stem and means for adjusting the stem holder to position another button for the insertion of a support wire.

16. A lamp-making machine comprising means for feeding a filament, means for securing ends of support wires to said filament in spaced relation along the length of a filament, means for progressively inserting the free ends of the supports into a non-conductive lamp part.

17. A lamp-making machine comprising means for supporting a filament, means for securing ends of support-wires to said filament in spaced relation along the length of said filament, means for varying the spaced relation of said supports, means for holding a lamp stem having upper and lower buttons, and means for alternately inserting the free ends of the supports in said upper and lower buttons.

18. A lamp-making machine comprising means for supporting a filament, means for clamping ends of support-wires in spaced relation along the length of said filament, means for varying the spaced relation of said supports and means for progressively inserting the free ends of said supports into a non-conductive lamp part.

19. A lamp-making machine comprising a stem holder, means for feeding a filament, means for forming hooks at ends of support-wires, means for closing said hooks about said filament to dispose support-wires in spaced relation along a length of said filament, means for varying the spaced relation of said supports, means for changing the relative position of said stem holder in accordance with the spaced relation of said supports and means for progressively inserting the free ends of said supports into a button of a stem secured in said holder.

20. A lamp-making machine comprising a stem holder, means for feeding a filament, means for clamping ends of support wires to said filament to dispose the support-wires in spaced relation along said filament, means for varying the spaced relation of said supports, means for varying the position of said stem holder, means for progressively inserting the free ends of said supports radially into a button of a stem secured in said holder and means for effecting a partial rotation of said stem about its vertical axis after each inserting operation.

21. A lamp-making machine comprising a stem holder, means for feeding a filament, means for clamping ends of support-wires to said filament to dispose the support-wires in spaced relation along said filament, means for varying the spaced relation of said supports, means for changing the relative position of said holder, means for progressively positioning said supports in operative relation to said holder, means for locally heating a stem positioned in said holder, means for moving the holder to embed a free end of a positioned support into a button of said stem, means for effecting a partial rotation of said stem and means for adjusting the stem holder for positioning the stem for the insertion of supports into another button thereof.

22. The method of mounting a filament which comprises the following steps, first, feeding a filament, second, securing sections of a relatively heavy wire to the filament in spaced relation along the length of the filament and subsequently inserting an end of each of said sections into a non-conductive body.

23. The method of mounting a filament which comprises the following steps in the order given, first, feeding a filament, second, clamping the ends of sections of relatively heavy wire to said filament at intervals along the length thereof, third, heating a body to render plastic a portion thereof, and finally inserting an end of each of said relatively heavy sections into said plastic portion.

24. The method of mounting a filament which comprises the following steps in the order given, first, feeding a filament, second, securing sections of relatively heavy wire to the filament at intervals along the length thereof, third, alternately heating to render plastic a portion of an upper and lower button of a lamp stem and finally inserting the free ends of said sections into the heated portions of said stem.

25. The method of mounting a filament having supports secured thereto which comprises the following steps in the order given, first, feeding a filament intermittently, second, feeding a support wire intermittently, third, looping the end of the support wire after each intermittent movement, fourth, positioning the loop about the filament, fifth, closing the loop to secure the support wire to the filament, sixth, severing the support wire, seventh, moving the same with the filament, eighth, inserting the free end of the support wire into a button of a lamp stem and finally changing the relative positions of the stem and support to position another button for the insertion of another support.

26. The method of mounting a filament which comprises the following steps in the order given, first, feeding a filament, second, moving the end of a support wire to position the support substantially at right angles to the path of movement of said filament, third, forming a hook at the end of the support, fourth, passing the hook beneath the filament and across the path of movement thereof, fifth, reversing the direction of movement of the support to position the filament within the hook, sixth, closing the hook upon the

filament and finally inserting the free end of said support into a lamp stem.

27. The method of mounting a filament which comprises the following steps in the order given, first, feeding a filament, second, forming a hook at the end of a support wire, third, moving the support wire in a direction substantially transverse to the path of movement of the filament until the hook has crossed the path of movement of the filament, fourth, moving the support in a reverse direction until the hook thereof is disposed about the filament, fifth, closing the hook and finally inserting the free end of said support into a lamp stem.

28. The method of mounting a filament which comprises the following steps in the order given, first, alternately effecting an intermittent movement of a filament and a support wire in directions transverse to each other, second, forming a hook at an end of a support wire after an intermittent movement thereof, third, positioning the hook about the filament, fourth, closing the hook to secure the support to the filament, fifth, moving the filament and support wire adjacent to a lamp stem, sixth, locally heating the stem and finally changing the relative positions of the support wire and stem to embed the free end of the support wire in said heated portion.

29. As an article of manufacture, a filament having support wires clamped thereto at spaced intervals along its length.

30. An article of manufacture comprising a filament having relatively short sections of a comparatively heavy wire secured thereto at intervals along its length.

31. An article of manufacture comprising a filament having a plurality of flattened relatively heavy sections of wire clamped to the filament at spaced intervals along its length.

In testimony whereof, I have hereunto subscribed my name this 7th day of May 1923.

JOHN JOSEPH HIGGINS.