No. 869,318. PATENTED OCT. 29, 1907.

N. MARSHALL.

APPARATUS FOR CEMENTING THE FILAMENTS OF ELECTRIC LAMPS TO THE STEM WIRES.

APPLICATION FILED FEB. 8, 1906.

5 SHEETS—SHEET 1.

Fig. 1.

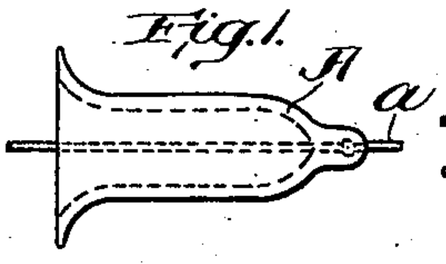


Fig. 2.

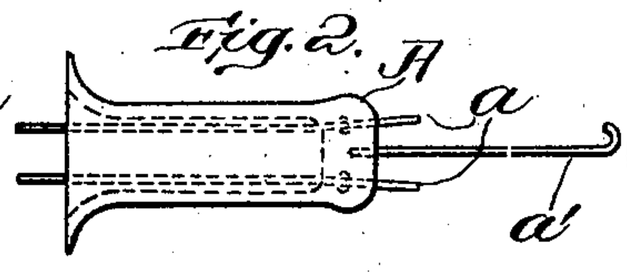


Fig. 3.

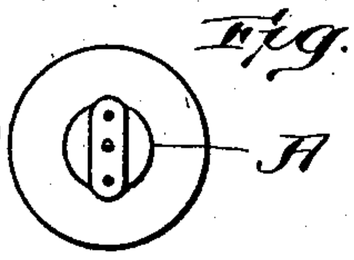


Fig. 4.

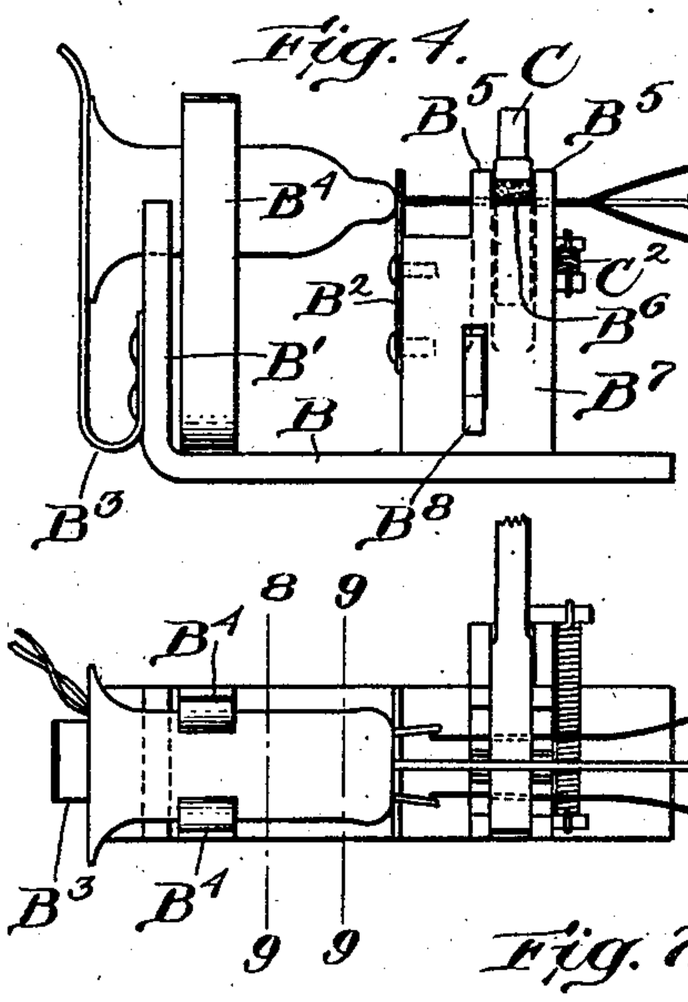


Fig. 5.

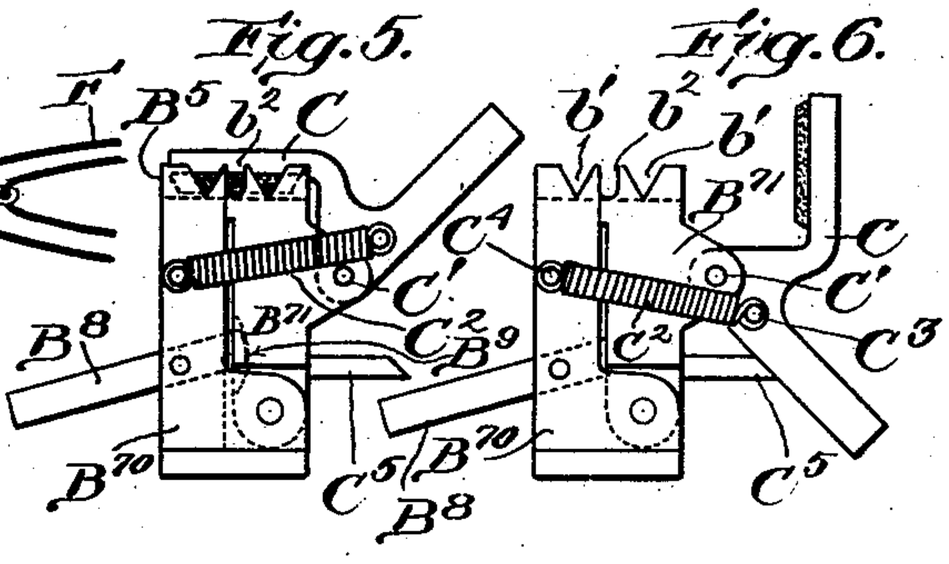


Fig. 6.

Fig. 7.

Fig. 8.

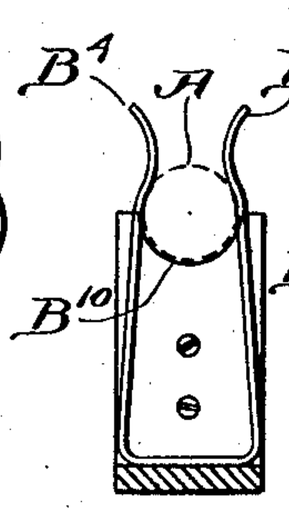


Fig. 9.

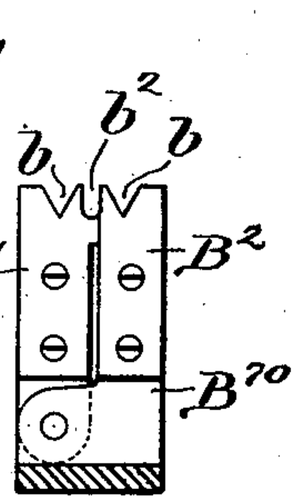


Fig. 10.

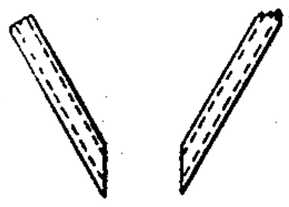


Fig. 11.

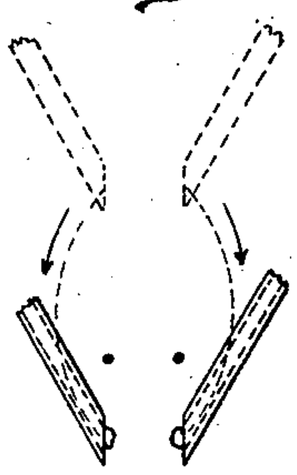
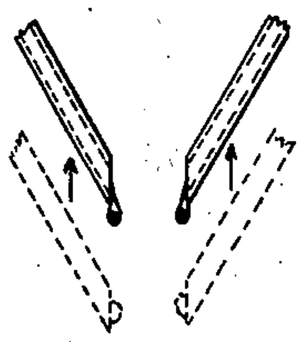


Fig. 12.



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5 SHEETS—SHEET 2.

Fig. 13.

Fig. 15.

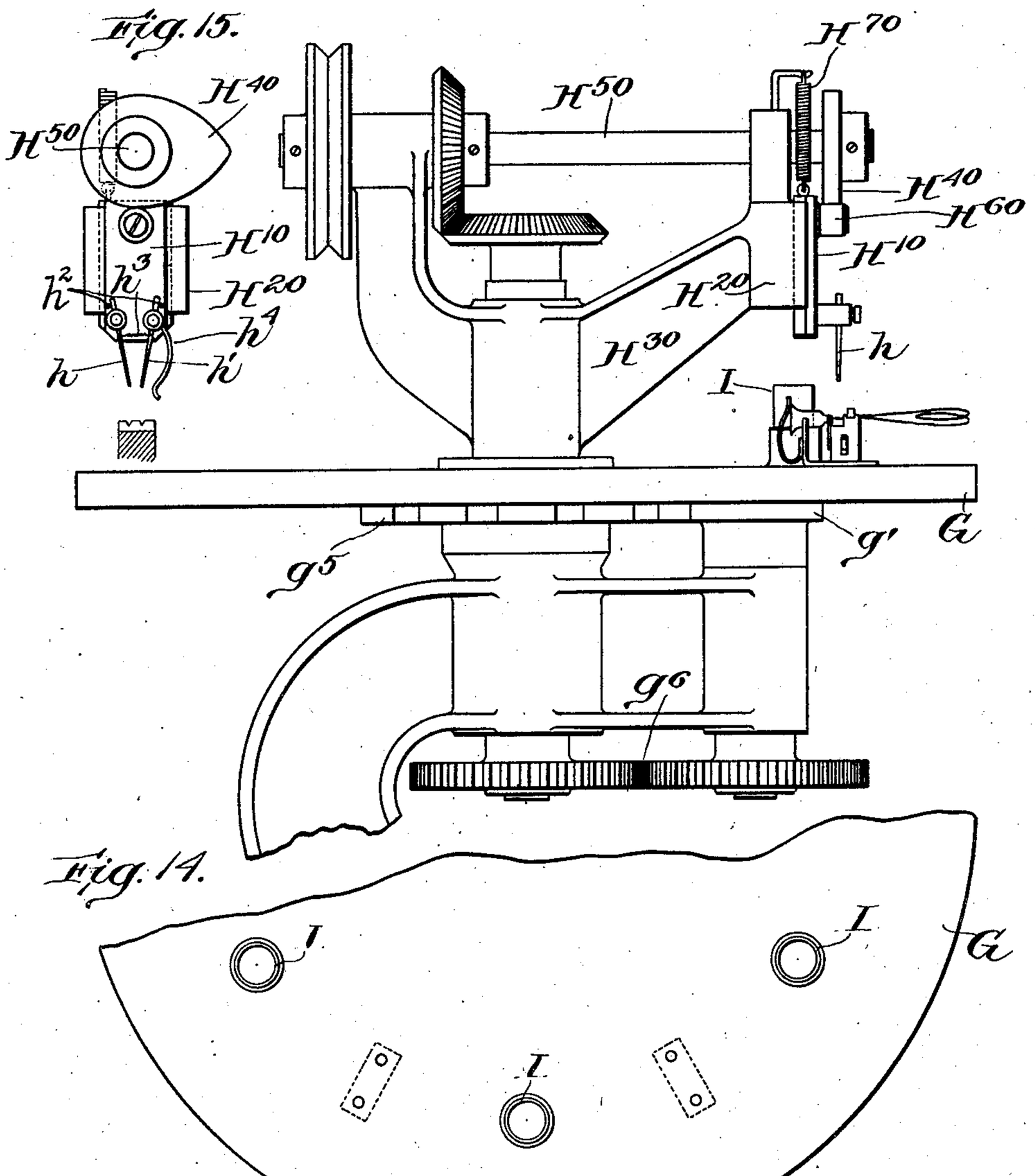

Fig. 14.

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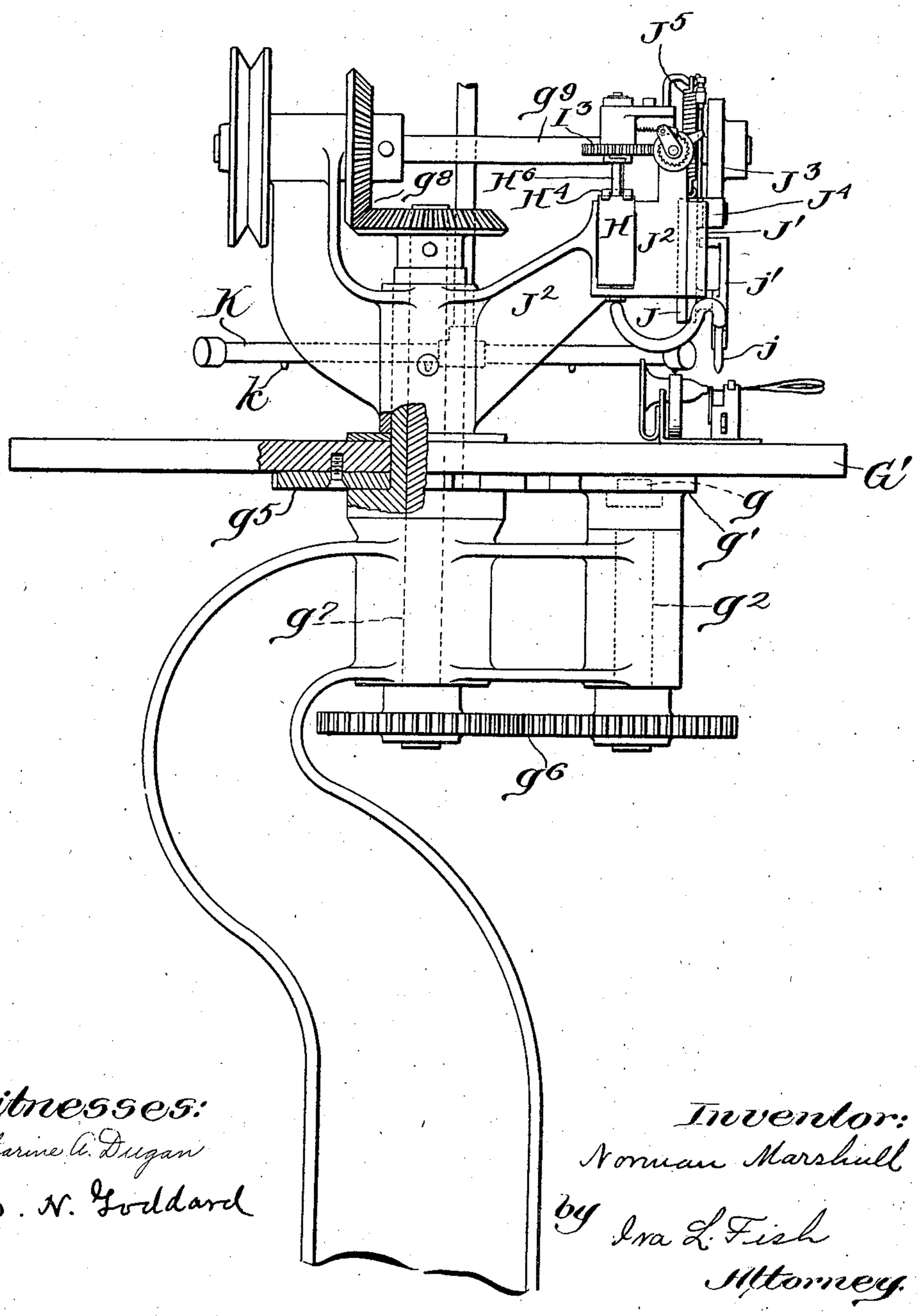
5 SHEETS—SHEET 3.

Fig. 16.



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5 SHEETS—SHEET 4.

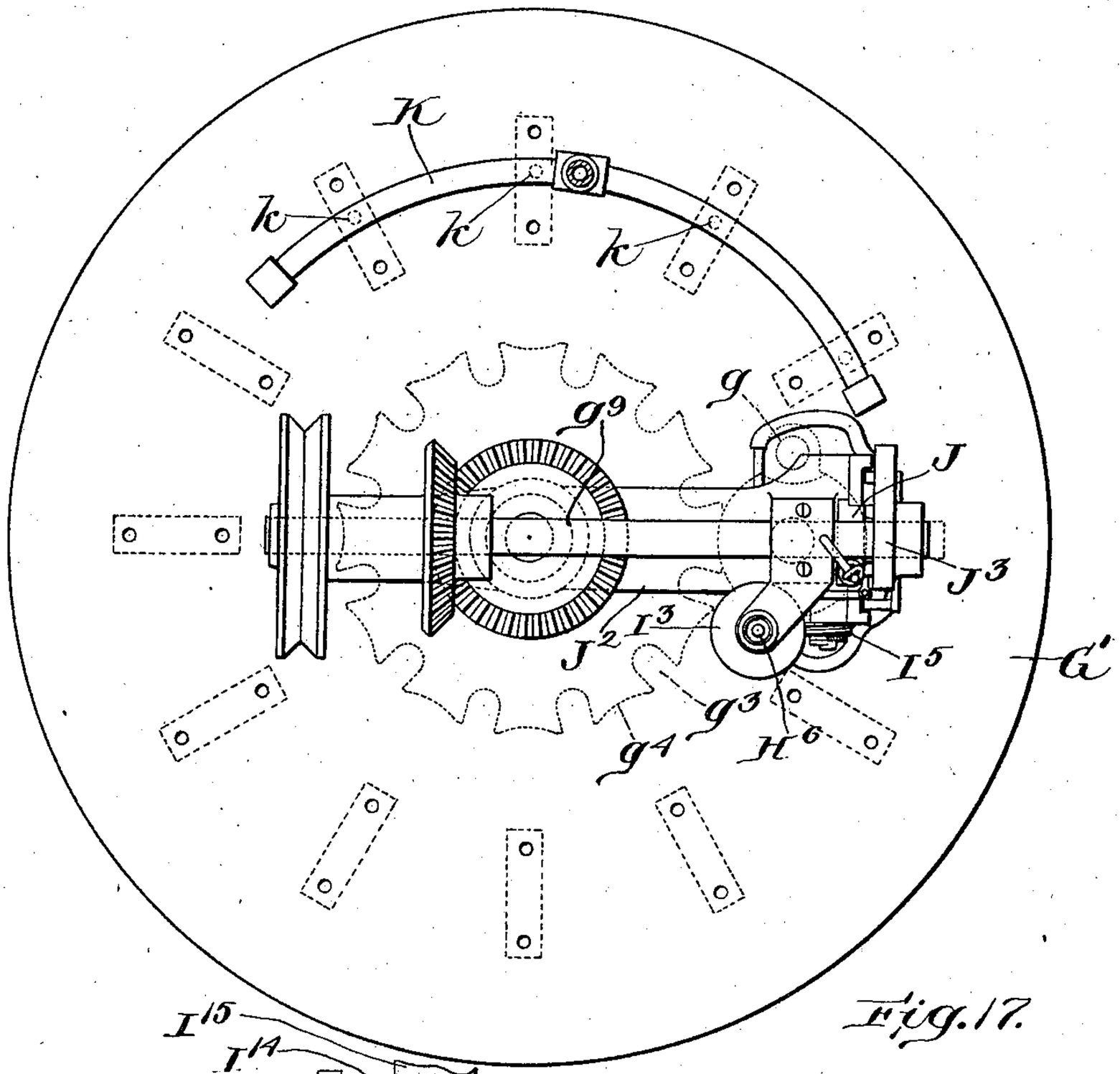

Fig. 17.

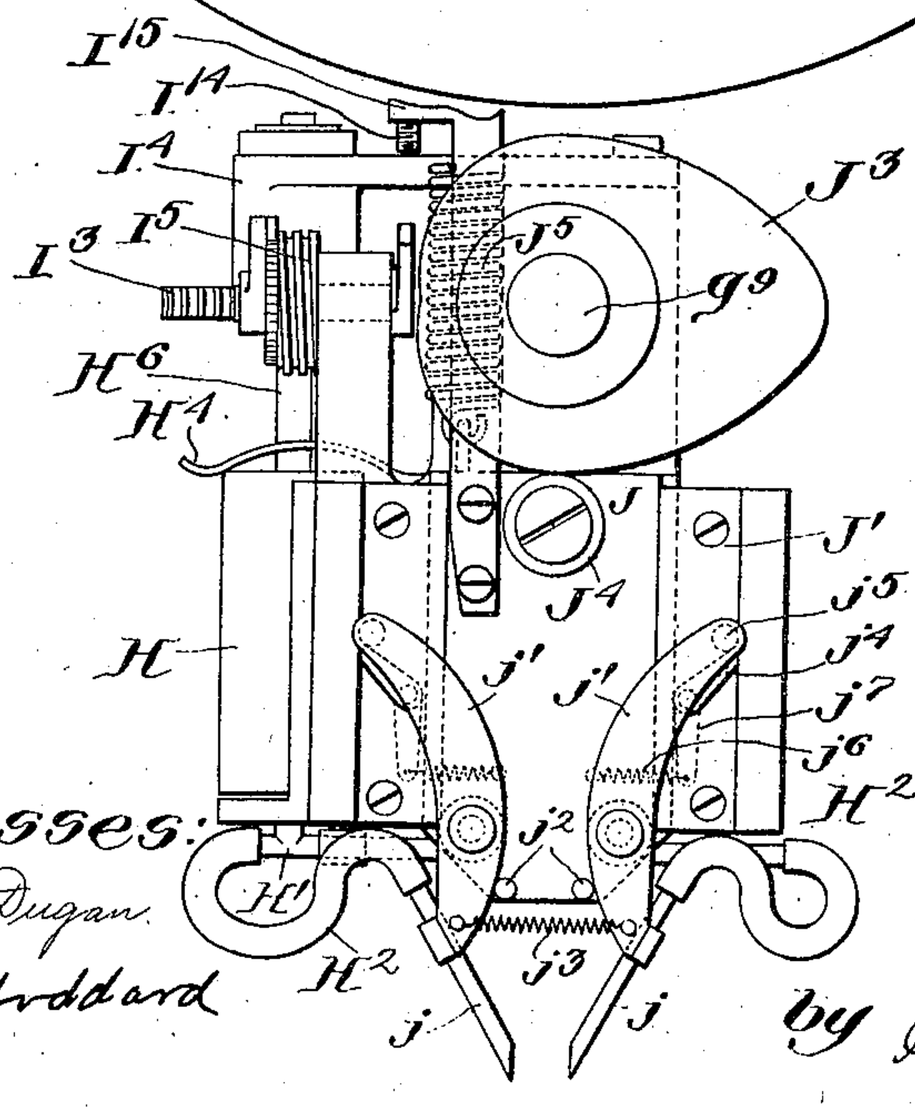

Fig. 18.

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5 SHEETS—SHEET 5.

Fig. 19.

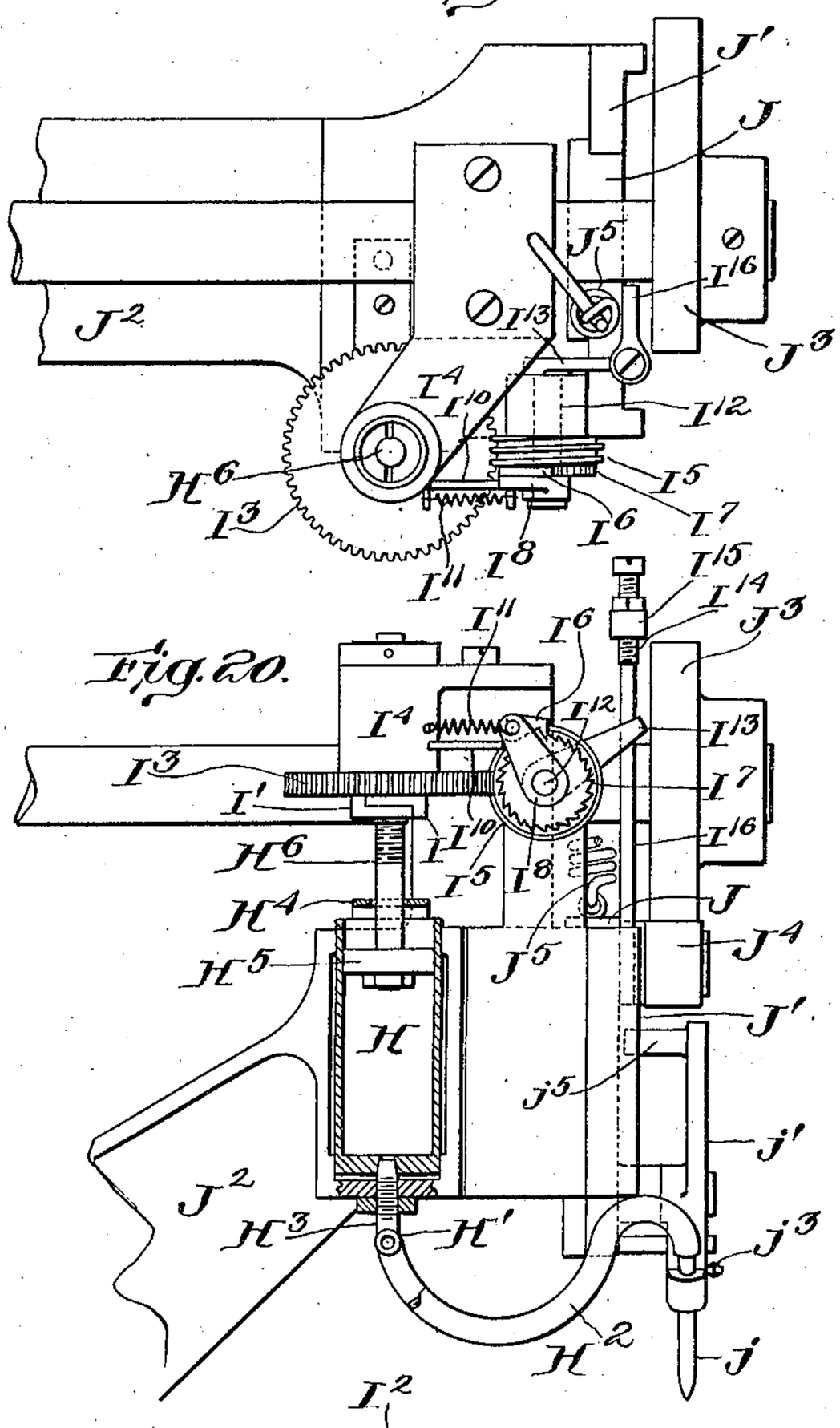

Fig. 20.

Fig. 21.

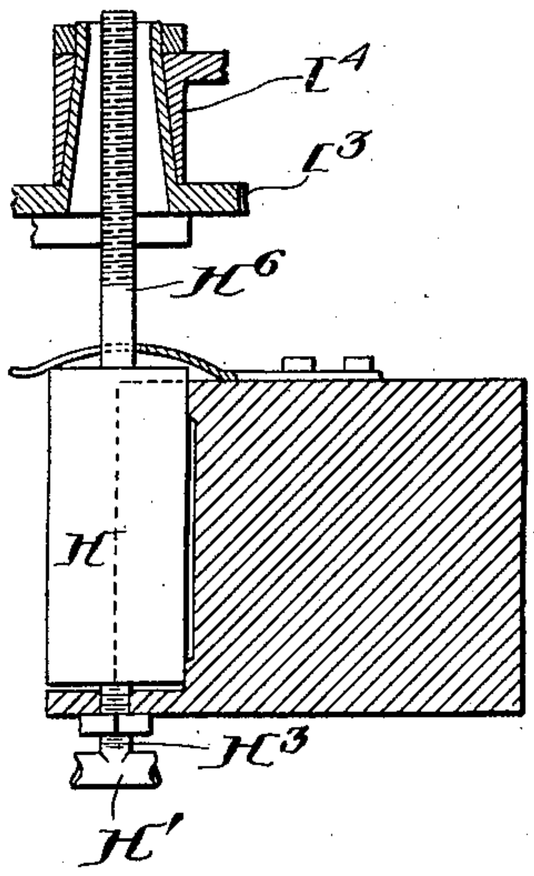

Fig. 22.

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UNITED STATES PATENT OFFICE.

NORMAN MARSHALL, OF NEWTON, MASSACHUSETTS.

APPARATUS FOR CEMENTING THE FILAMENTS OF ELECTRIC LAMPS TO THE STEM-WIRES.

No. 869,318. Specification of Letters Patent. Patented Oct. 29, 1907.

Application filed February 8, 1906. Serial No. 300,055.

To all whom it may concern:

Be it known that I, NORMAN MARSHALL, a citizen of the United States, and a resident of Newton, county of Middlesex, Massachusetts, have invented certain new and useful Improvements in Apparatus for Cementing the Filaments of Electric Lamps to the Stem-Wires, of which the following is a specification.

My invention relates to an apparatus for cementing the filaments of incandescent electric lamps to the stem wires and its object is to provide means whereby the securing of the filaments to the stem wires may be accomplished quickly, conveniently and uniformly with a resulting reduction in the cost of this operation in manufacturing lamps.

In practicing my invention I employ devices for positioning the filament ends and stem wires in juxtaposition where the cement will serve to bind the parts together and combine these devices with cement applying means so that the filament ends and stem wires may be rapidly and accurately brought into position and the cement applied thereto thus materially reducing the time and expense incident to cementing the filaments and stem wires together. I also provide means for holding the stems and filaments in position so that they will be accurately maintained in proper relation while the cement is being applied and during the setting of the cement. In practicing the broad features of my invention the coöperating devices for positioning the stem wires and filament ends in proper position may be arranged in fixed relation to each other or the wires and filament ends may be brought into juxtaposition by the relative movements of the parts carrying and supporting the stems and filaments. In either case the stems and filaments may be placed in position either manually or automatically so far as the broader features of the invention are concerned.

For the purpose of illustration I have shown in the accompanying drawings an embodiment of my invention which is especially designed for the manual placing of the stems and filaments in position in the holding and positioning devices and in which the devices for positioning the stem wires and filament ends act to guide and position the wires and filament ends as the stems and filaments are introduced into the device by the operator.

In the manufacture of lamp stems as at present carried on, no provision is made for accurately determining the spacing of the stem wires so that the wires will be a uniform distance apart in all stems. There may therefore be a variation in the spacing of the stem wires in different stems. It is desirable therefore in devices in which two wires and two filament ends are simultaneously positioned that the positioning devices for the stem wires and filament ends should be so constructed that they may be readily adjusted to correspond to the spacing of the stem wires in the stems which are introduced into the wire positioning devices and one feature of the present invention consists in providing positioning devices which may be adjusted for differently spaced stem wires.

The devices for positioning the filament ends and stem wires in juxtaposition may be mounted and arranged and combined with the cement applying means in any convenient manner for facilitating the performance of the operations incident to securing the filaments and stem wires together. I prefer to employ a series of such devices and to so mount or arrange them that they may be successfully moved through the same path and brought in succession into position for receiving the filaments and stems and for the application of the cement. I also prefer to combine these devices with a drying device which acts upon the cement after it has been applied to quickly dry the same so that the successive operations may be more rapidly performed.

In embodying the features of my invention above outlined in an apparatus whereby the successive operations may be quickly and conveniently performed, I have employed certain further features of invention which may be used with advantage although they are not essential to the broader features of my invention.

The various features of my invention will be understood from the following detailed description of a construction in which I have embodied them and in which the devices for positioning the stem wires and filament ends are maintained in substantially fixed relation to each other, the stem wires and filament ends being brought into position by the act of introducing the stems and filaments into the positioning devices.

In the accompanying drawings—Figures 1, 2 and 3 are views showing a glass stem such as is employed in the construction of a common form of incandescent electric lamps. Fig. 4 is a side elevation of a device for positioning the stem wires and filament ends provided with means for adjusting the positioning devices for differently spaced stem wires. Fig. 5 is an end elevation looking toward the left in Fig. 4 with the holding device for the filament closed. Fig. 6 is a similar view with the holding device for the filament open or in position for the introduction of the filament. Fig. 7 is a plan view of Fig. 4. Fig. 8 is a sectional view on line 8—9 Fig. 7 looking toward the left the stem and filament being removed. Fig. 9 is a sectional view on line 9—9 Fig. 7 looking toward the right. Figs. 10, 11 and 12 are diagrammatic views illustrating the operation of a cement applying device. Fig. 13 is an elevation showing a machine in which the device or apparatus shown in Figs. 4—9 is combined with a cement applying means. Fig. 14 is a partial plan view of the carrier for the stem and filament carrying devices. Fig. 15 is a detail of the cement applying devices.

Fig. 16 is an elevation showing a machine embodying a modified construction of cement applying means. Fig. 17 is a plan view of the machine shown in Fig. 16. Fig. 18 is a detail elevation of the cement applying mechanism. Fig. 19 is an enlarged plan view of the cement applying mechanism shown in Fig. 17. Fig. 20 is a side elevation partly in section of the devices shown in Fig. 19. Fig. 21 is a sectional detail of certain of the parts shown in Fig. 20; and Fig. 22 is a detail of mechanism shown in Fig. 20.

The devices for positioning the stem wires and filament ends shown in the accompanying drawings are especially designed for simultaneously positioning the two stem wires and two filaments in manufacturing lamps in which the stems consist of a glass tube A sealed at its inner end and provided with two stem wires *a* which extend through the sealed end of the tube and project a short distance from the end of the stem. This stem is also provided with an anchor wire *a'* which extends from the end of the stem and is provided at its outer end with a hook for engaging and anchoring the loop of the carbon filament. It will be understood however, that the features of invention may be employed in constructions in which the positioning devices are designed to position a single wire and a single filament end, or designed to simultaneously position the stem wires of stems provided with more than two projecting wires and to position the ends of two filaments which are to be cemented to the stem wires.

The construction of the devices for positioning and holding the stem wires and filament ends in juxtaposition which are embodied in the machines illustrated, are shown in Figs. 4—9. As shown in these figures the positioning and holding devices are supported or formed upon a plate B which is provided at one end with a vertically extending supporting plate B'. This support B' is provided at its upper end with a recess B^{10} adapted to engage the stem A near its rear end and to position the stem. Arranged in front of the support B' is a plate B^2 provided with two recesses *b* in its upper edge. These recesses are provided with two converging side surfaces and are open at their upper ends so that the stem wires *a* may be quickly and readily introduced into these recesses and will be guided into position at the bottom of the recesses. The stem A is held in position with its front end against the plate B^2 and with the wires *a* in the bottoms of the recesses *b b* by a spring B^3 arranged to engage the rear end of the stem and two springs B^4 arranged to engage opposite sides of the stem. The spring B^3 forces the stem forward so that the front end is retained against the plate B^2 while the springs B^4 are shaped to retain the stem in the recess in the support B' and with the wires *a* in the bottoms of the recesses *b*. The upper ends of the springs B^3 and B^4 are bent outwardly so that the stem may be readily introduced into position.

The devices for positioning the ends of the carbon filament F comprise positioning recesses *b'* formed in two ribs or plates B^5 carried by the supporting plate B and provided with converging sides which act to guide the filament ends into the bottoms of the recesses. These recesses *b' b'* are in substantial alinement with the recesses *b* which position the stem wires, and the filament ends are held in position in these recesses by a clamping lever C provided with a clamping surface arranged to engage the filament ends and hold them against a supporting surface B^6 which is formed between the plates B^5 B^5 and is flush with the bottoms of the recesses *b' b'*. The clamping lever C is pivoted at C' to the block B^7 on which the ribs or plates B^5 are formed and to which the plate B^2 is secured. The clamping lever C is held in either open or closed position by means of a spring C^2 arranged to act upon either one side or the other of the pivot C' according to the position of the clamping lever. This spring C^2 is connected to a pin C^3 on the lever C and to a pin C^4 on the block B^7. When the clamping lever is closed the spring acts above the pivot C' as indicated in Fig. 5 and presses the clamping lever against the filament. When the clamping lever is open the spring acts below the pivot C' and holds the lever in the position shown in Fig. 6 against a stop C^5.

In case the positioning devices are to be used in connection with stems having anchor wires *a'*, recesses b^2 are formed in the plates B^2 and B^5 for the passage of these anchor wires.

In case the positioning devices are to be employed in connection with stems in which the spacing of the stem wires varies, the positioning devices are provided with means for varying the distance between the positioning recesses *b b* and for effecting a corresponding variation in the distance between the coöperating positioning recesses *b' b'*. A simple and efficient construction for readily and conveniently effecting such adjustment or variation in the positioning devices for the stem wires and filament ends is that embodied in the construction shown in the drawings. In this construction provision is made for this adjustment by forming the plates B^2 and B^5 B^5 in sections so that the sections may be relatively adjusted to bring the positioning recesses *b b* and the positioning recesses *b' b'* the proper distance apart to correspond with the spacing of the stem wires *a*. In order that the adjustment of the positioning recesses *b'* may correspond to the adjustment of the positioning recesses *b* I prefer to connect the sections of the plates B^2 and B^5 B^5 together so that the sections of the plates may be adjusted in unison. To this end I form the plate B^7 in two sections, the sections B^{70} being secured in fixed position on the plate B and the sections B^{71} being pivoted to the section B^{70} and forced yieldingly toward the section B^{70} by the action of the spring C^2. For the purpose of forcing the section B^{71} away from the section B^{70} and thus increasing the distance between the positioning recesses *b b* and *b' b'* I provide a lever B^8 which is pivoted to the section B^{70} of the block B^7 and is so arranged that its inner end acts against a surface B^9 on the section B^{71} to determine the position of the section B^{71} with relation to the section B^{70}. The parts are so arranged that by movement of the lever B^8 the section B^{71} may be moved to determine the distance between the positioning recesses *b b* and *b' b'* and when so moved the parts will remain in the adjusted position until the position of the lever B^8 is varied.

In introducing the stem A the operator will introduce one of the wires *a* into the recess *b* in the fixed section of the plate B^2 and will then turn the stem A to carry the other wire *a* into the recess *b* in the movable section of the plate B^2 at the same time moving the lever B^8 to bring the recess *b* into proper position

in case the recess is not in such position that the wire *a* will engage the bottom of the recess without being deflected to one side or the other. This adjustment of the positioning recess *b* to correspond with the spacing of the stem wires *a* may be readily and quickly effected without increasing the time required for introducing the stem, the operator making the adjustment simultaneously with the introduction of the wires into the recesses. By the same movement the recesses *b'* in the adjustable section of the plate B^5 B^5 are also adjusted so that the alinement of the positioning recesses for the stem wires and filament ends is maintained.

In combining the devices for positioning the stem wires and filament ends in juxtaposition with cement applying means, I mount the positioning devices upon a rotary carrier G, (Figs. 13, 14) the devices being arranged in a circular series so that by the rotation of the carrier they will be caused to travel through the same path and will be brought in succession into position for the applying of the cement by the cement applying means. As shown in these views the devices for applying cement to the stem wires and filament ends comprise two cement carrying fingers *h h'* mounted upon a reciprocating slide H^{10} which is arranged above the path of travel of the stem and filament carrying devices and is guided in vertical ways H^{20} formed upon a supporting bracket H^{30}. The slide H^{10} is operated upon by a cam H^{40} secured to a rotary shaft H^{50} and operating upon a roll H^{60} which is mounted upon the slide H^{10} and is held in engagement with the cam by a spring H^{70}. By the action of the cam H^{40} the slide H^{10} and cement carrying fingers *h h'* are reciprocated at each rotation of the shaft H^{50}, the slide H^{10} completing the reciprocation during a half revolution of the shaft H^{50} and then remaining at rest at the upper end of its stroke during the subsequent half revolution of the shaft H^{50}. During the time that the slide H^{10} is at rest at the upper end of its stroke, the table G is moved a step forward by mechanism which will be hereinafter described. For the purpose of supplying cement to the cement carrying fingers *h h'* a series of cement receptacles I are mounted upon the table G, these cement receptacles alternating with the devices for carrying the stems and filaments as indicated in Fig. 14.

During the rotation of the table G the devices for positioning and carrying the stems and filaments are brought in succession into position for the introduction of the stems and filaments and are then brought into position beneath the cement applying devices. Previous to the bringing of one of the devices for positioning and carrying the stems and filaments under the cement applying fingers, one of the cement receptacles I has been brought into position under such fingers and while the receptacle is in this position the fingers have been carried down into the cement and have then been raised into their upper position, carrying globules of cement on the ends of the fingers. When the stem and filament carrying devices are brought into position under the cement carrying fingers, these fingers are again carried downward and transfer the cement carried upon their ends to the stem wires and filament ends. The filament and stem carrying devices are then advanced a step bringing another cement receptacle beneath the cement carrying fingers. After the cement has been applied the filament and stem carrying devices may move into position where the cement is acted upon by drying devices so that the rapidity of operation may be increased.

In case the stem and filament positioning and carrying devices are adjustable for differently spaced stem wires, the cement carrying finger *h'* may be so mounted and controlled that it will be moved during its downward movement into proper position to register with the stem wire and filament end, the position of which is determined by the adjustable positioning devices. For this purpose the finger *h'* may be pivoted upon the slide H^{10} and held in position against a stop h^2 by a spring h^3. In such case an arm h^4 is secured to the finger *h'* and the lower end of the arm is arranged to engage the side of the movable section B^{71} of the block B^7 so that the position of the arm and cement carrying finger *h'* is determined by the position of the movable section B^{71} of the block B^7 which carries the adjustable positioning recesses *b b'*. When the cement carrying fingers are carried down into the receptacles I the arm h^4 passes outside of the receptacle.

In Figs. 16—22 I have shown a modified construction of machine embodying the features of my invention and provided with a different construction of cement applying means and a construction which I prefer to employ in practicing the various features of my invention. In this construction the devices for positioning and carrying the stems and filaments are mounted in a circular series upon a table G' similar to the table G. The mechanism shown for intermittently rotating the tables G G' are the same and are of a well known construction. A crank pin *g* and locking segments *g'* are carried by a continuously running shaft g^2 and coöperate with a series of radial slots g^3 and locking segments g^4 formed on a disk g^5 which is secured to the under surface of the table. The shaft g^2 is driven through gearing g^6 from a vertical shaft g^7 which is in turn driven through bevel gears g^8 from a drive shaft g^9. By the rotation of the shaft g^9 and the connections described the table is intermittently rotated, being advanced the distance between successive devices for carrying the stems and filaments at each revolution of the shaft g^9.

By the intermittent rotation of the table G' the devices for positioning and carrying the stems and filaments are brought in succession into position for the introduction of the stems and filaments and then in succession into position for the application of the cement by the cement applying means and then in succession into position beneath the drying means whereby the cement which was applied by the cement applying means is quickly dried, and then into position for the removal of the stems with the attached filaments. In this construction the cement applying means comprise two cement carrying fingers *j* which are in the form of tubes through which the cement is supplied and by which the cement forced out of the end of the tubes is transferred to the wires and filament ends carried by the stem and filament carrying devices. These cement carrying tubes are secured in arms *j'* pivoted to a slide J which is arranged above the path of travel of the stem and filament carrying devices and is guided in ways J' formed upon a bracket J^2. The carrier arms *j'* for the cement carrying fingers are held yieldingly in position against stops j^2 by a spring j^3

connecting the lower ends of the arms. During the downward movement of the slide J the cement carrying fingers are swung outward away from each other by means of latch cams j^4 arranged in the path of pins j^5 which project inward from the upper ends of the arms j'. These latch cams j^4 are pivoted in the bracket J^2 and are held in normal position indicated in Fig. 18, by means of springs j^6 connected to arms j^7 which are secured to the pivot shafts on which the latch cams are mounted. As the slide J moves downward the pins j^5 ride against the upper sides of the latch cams j^4 causing the upper ends of the arms j' to move inward and thus carrying the cement carrying fingers j outward away from each other so that they pass freely down below the stem wires and filament ends. As the pins j^5 pass beyond the inner lower ends of the latch cams j^4 the cement carrying fingers j move inward toward each other into position corresponding to the position indicated in Fig. 18, the path of movement of the lower ends of the cement carrying fingers being indicated in dotted lines in Fig. 11. When the slide J moves upward the lower ends of the cement carrying fingers pass close to or against the outer sides of the stem wires, the cement which has been forced out of the ends of the tubes being wiped off the ends of the tubes as indicated in Fig. 12. During this upward movement of the slide J the pins j^5 on the carrying arms j' pass back of the latch cams j^4, the cams yielding to allow the passage of the pins and immediately returning into position below the pins after the pins have passed the ends of the latch cams.

In order that the cement may shed freely off of the ends of the cement carrying tube fingers j, I prefer to arrange these fingers so that they are inclined, as indicated in Fig. 18 and to so shape the end of the finger that the surface which travels past the stem wires, is substantially vertical. With the fingers thus arranged and shaped the lower ends of the fingers terminate in points off which the cement globules forced out of the fingers will be shed readily as the fingers pass up by the stem wires and the cement is applied to these wires as indicated in Fig. 12.

The slide J is reciprocated at proper intervals by means of a cam J^3 secured to the end of the shaft g^9 and arranged to engage a roll J^4 mounted on the slide, the roll being held in engagement with the cam by a spring J^5.

The means for supplying cement to the cement applying tubular fingers j so that the proper amount of cement is forced out upon the ends of the fingers at the proper time, may be of any suitable construction. The mechanism which I prefer to use for this purpose is that illustrated in the drawings, in which the cement is carried in a reservoir H and is conducted from the reservoir to the cement applying fingers through a pipe H′ and flexible tubes H^2 leading from the ends of the pipe H′ to the upper ends of the tubular fingers j, these flexible pipes being of sufficient length to accommodate the vertical movements of the cement applying fingers. As shown in Fig. 20 the pipe H′ is provided with a vertical branch H^3 which extends into a recess formed in the bracket J^2 and is provided with a conical upper end arranged to fit within a corresponding opening in the bottom of the reservoir H. The reservoir is held within the recess in the bracket J^2 by means of a spring H^4 (Fig. 21) which extends over the upper end of the reservoir and engages its outer edge, thus forcing the reservoir downward and inward so that it is efficiently held in position in the recess and firmly seated upon the upper end of the branch pipe H^3.

The cement within the reservoir H is forced out through the pipes H^3 H′ and flexible tubes H^2 by means of a piston H^5 fitting within the reservoir and connected to a screw-threaded piston rod H^6. The piston rod extends up through a split nut, the sections I I′ of which are held together by a latch I^2 so that the threads in the split nut engage the screw threads on the piston rod (Fig. 22). The sections of the split nut are pivotally secured to the lower side of a worm-wheel I^3 which is mounted in a bearing I^4 and is engaged by a worm I^5. The worm-wheel I^3 is provided with a hollow hub extending through the bearing I^4 and the bore within this hub is sufficiently large to allow of the removal and insertion of the screw piston rod H^6 when it is desired to remove an empty reservoir H and insert a new reservoir filled with cement. When the reservoir is to be removed the sections I I′ of the split nut are swung away from each other and the reservoir is then lifted to disengage the recess in its lower end from the upper end of the pipe H^3 when the lower end of the reservoir may be swung outward until it may be withdrawn, the spring H^4 yielding to allow the withdrawal of the reservoir.

The worm I^5 is rotated as the slide J carrying the cement applying fingers j reaches the lower end of its stroke. The cement is thus forced out of the tubes j on to the ends of the tubes as the tubes reach their lower position and is immediately transferred to the stem wires as the tubes rise. Thus the cement is removed from the ends of the fingers immediately after it is forced out of the ends of the tubes and does not become dried or hardened and thus collect upon the ends of the tubes. The worm-wheel I^5 is thus operated to force the proper amount of cement out of the cement applying tubular fingers j by the action of a pawl I^6 arranged to engage the ratchet wheel I^7 secured to the side of the worm I^5. The pawl is pivoted upon a pawl carrying arm I^8 which is held normally against a stop I^{10} by a spring I^{11}. The pawl carrying arm is secured to the shaft I^{12} on which the worm I^5 is loosely mounted and this shaft is provided at its opposite end with an arm I^{13} extending into the path of a shoulder I^{14} carried by the slide J. The shoulder I^{14} is in the form of an adjustable screw threaded through a lug I^{15} which projects laterally from a bar I^{16} secured to the slide J which carries the cement applying fingers. As the slide J reaches the lower end of its stroke the screw I^{14} acts upon the arm I^{13} thus advancing the pawl 16 and rotating the worm I^5 to force the required amount of cement out upon the ends of the cement applying fingers. The amount of cement thus forced out upon the ends of the fingers will depend upon the adjustment of the screw I^{14} which may be adjusted to cause the pawl I^6 to advance the ratchet wheel the distance of one tooth, two teeth or more, according to the requirements for the proper application of the cement.

After the cement has been applied to the stem wires and filament ends carried by the stem and filament carrying devices, successive movements of the carrying table G′ bring these devices under a drying device arranged to direct hot air or other drying agent against the cement. This drying device in the construction

shown comprises a pipe K arranged above the path of travel of the stem and filament carrying devices and provided with openings or nozzles *k* arranged to direct heated air against the cement on the filament ends and stem wires as these parts are brought successively into position beneath the successive discharge nozzles.

In operating this machine the stems and filaments are introduced manually by operators stationed in position where they may conveniently introduce the stems and filaments into the stem and filament carrying devices as these devices are brought in succession to them by the movements of the carrier table G′ and these stems and filaments are then presented to the cement applying device where the cement is quickly and automatically applied and are then presented to the drying devices where the cement is caused to quickly become set so that the stems and the connected filaments may be removed with only a short interval between the application of the cement and the removal of the stem and attached filament. Thus the filaments and stem wires may be rapidly and uniformly secured together.

Without attempting to set forth in detail the various forms and arrangements in which the features of invention may be embodied, what I claim and desire to secure by Letters Patent is:—

1. An apparatus for cementing the filaments of electric lamps to the stem wires comprising devices for holding a stem, devices for holding a filament with a filament end in juxtaposition with a stem wire and cement applying means.

2. An apparatus for cementing the filaments of electric lamps to the stem wires comprising coöperating devices for positioning a stem wire and filament end in juxtaposition, a cement applying device, and means for causing a relative movement between the cement applying device and positioning devices to apply the cement.

3. An apparatus for cementing the filaments of electric lamps to the stem wires comprising coöperating devices for positioning and holding a stem wire and filament end in juxtaposition, a cement applying device, and means for causing a relative movement between the cement applying device and positioning and holding devices to apply the cement.

4. An apparatus for cementing the filaments of electric lamps to the stem wires comprising devices for holding a stem with a stem wire in definite position, means for holding a filament with one of the filament ends in juxtaposition to the stem wire, and means for applying cement to the wire and filament end.

5. An apparatus for cementing the filaments of electric lamps to the stem wires comprising devices for holding a stem and determining the position of one of the stem wires, devices for determining the position of one of the filament ends, and means for applying cement to the wire and filament end.

6. An apparatus for cementing the filaments of electric lamps to the stem wires comprising devices for holding the stems and determining the positions of the stem wires, devices for holding the filaments and determining the positions of the filament ends, and cement applying means.

7. An apparatus for cementing the filaments of electric lamps to the stem wires comprising devices for guiding a stem wire into definite position and holding it therein, devices for guiding a filament end into a corresponding definite position and holding it therein, and cement applying means.

8. An apparatus for cementing the filaments of electric lamps to the stem wires comprising coöperating devices for positioning the stem wires and filament ends in juxtaposition and means for adjusting said devices for differently spaced stem wires.

9. An apparatus for cementing the filaments of electric lamps to the stem wires comprising coöperating devices for positioning and holding the stem wires and filament ends in juxtaposition, and means for adjusting said devices for differently spaced stem wires.

10. An apparatus for cementing the filaments of electric lamps to the stem wires comprising adjustable devices for engaging and positioning the stem wires, and adjustable devices for engaging and positioning the filament ends whereby differently spaced stem wires and the filament ends may be brought into juxtaposition.

11. An apparatus for cementing the filaments of electric lamps to the stem wires comprising a positioning device provided with relatively adjustable recesses for engaging and positioning the stem wires, and a positioning device provided with corresponding adjustable recesses for engaging and positioning the filament ends in juxtaposition with the wires.

12. An apparatus for cementing the filaments of electric lamps to the stem wires comprising a series of devices for positioning and holding the stem wires and filament ends in juxtaposition, means for moving the series of devices along the same path, and a cement applying means to which said devices are brought in succession.

13. An apparatus for cementing the filaments of electric lamps to the stem wires comprising a series of devices for positioning and holding the stem wires and filament ends in juxtaposition, a cement applying means, a drying device and means for bringing the holding devices successively to the cement applying means and to the drying device.

14. An apparatus for cementing the filaments of electric lamps to the stem wires comprising devices for carrying the stem wires and filaments, a cement applying means, means for bringing the carrying devices to the cement applying means, and means for operating the cement applying means to apply cement to the stem wires and filament ends.

15. An apparatus for cementing the filaments of electric lamps to the stem wires comprising devices for carrying the stem wires and filaments, a cement applying means, a drying device, and means for bringing the carrying devices to the cement applying means and then to the drying device.

16. An apparatus for cementing the filaments of electric lamps to the stem wires comprising a carrier, a series of carrying devices for the stems and filaments mounted thereon, a cement applying means, and mechanism for advancing the carrier to bring the carrying devices successively to the cement applying means.

17. An apparatus for cementing the filaments of electric lamps to the stem wires comprising a carrier, a series of carrying devices for the stems and filaments mounted thereon, a cement applying means, a drying device, and mechanism for advancing the carrier to bring the carrying devices successively to the cement applying means and to the drying device.

18. An apparatus for cementing the filaments of electric lamps to the stem wires comprising stem holding devices, a positioning device for engaging and determining the position of a stem wire, devices for holding a filament, a positioning device for positioning an end of the filament, and means for supplying cement to the wire and filament end.

19. An apparatus for cementing the filaments of electric lamps to the stem wires comprising stem holding devices, a filament holding device, positioning devices for guiding a stem wire and filament end into juxtaposition, and means for applying cement to the wire and filament end.

20. An apparatus for cementing the filaments of electric lamps to the stem wires comprising a stem holding device, and means for applying cement to the stem wires.

In witness whereof, I have hereunto set my hand, this 6th day of February 1906.

NORMAN MARSHALL.

In the presence of—
IRA L. FISH,
KATHARINE A. DUGAN.