A. SWAN.

LAMP MAKING MACHINE.

APPLICATION FILED DEC. 19, 1908.

1,011,523.

Patented Dec. 12, 1911.

5 SHEETS—SHEET 1.

Fig. 1.

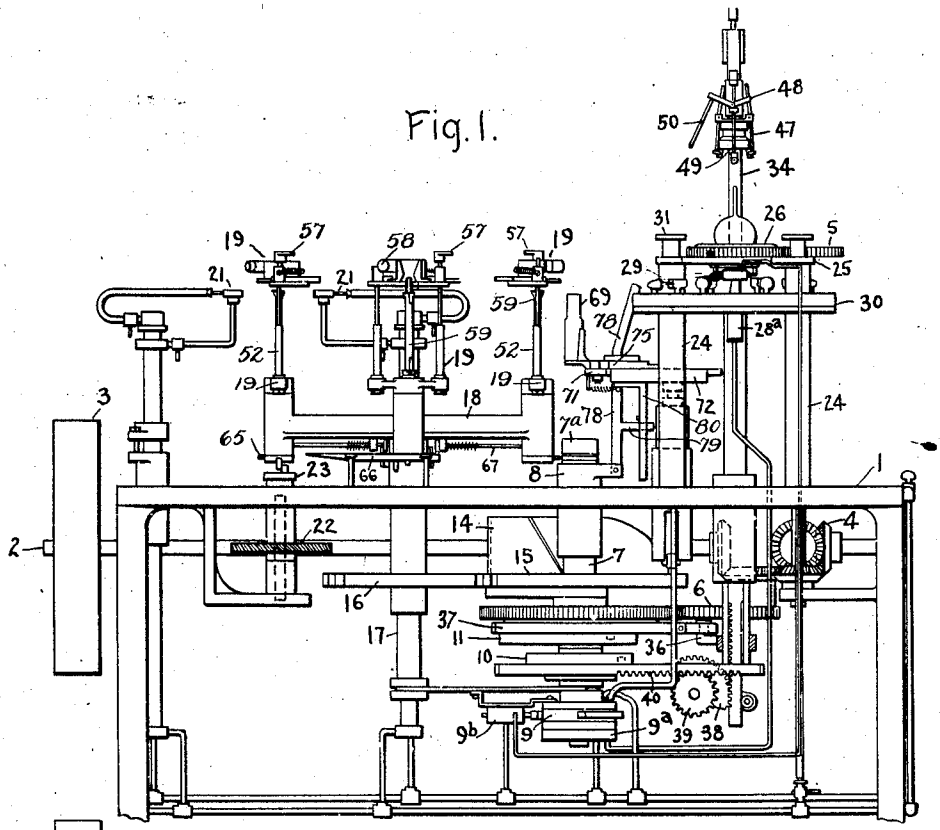
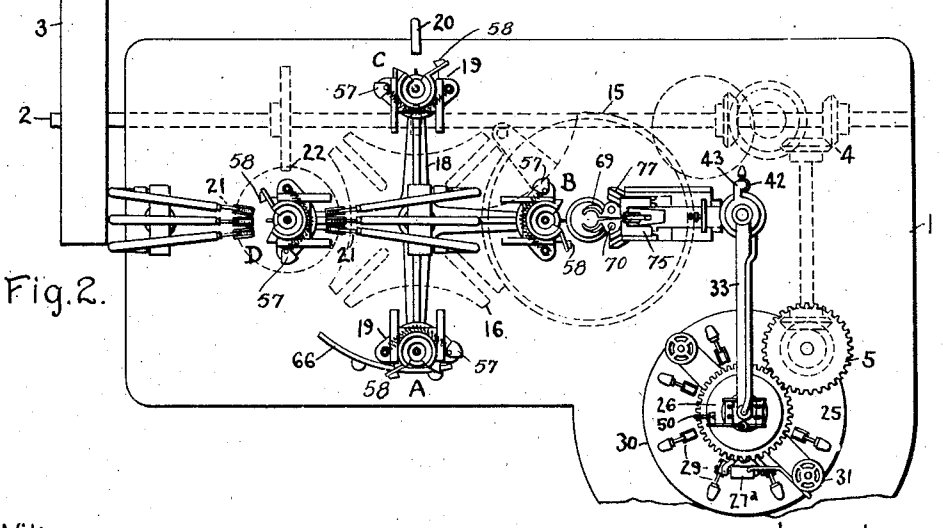


Fig. 2.



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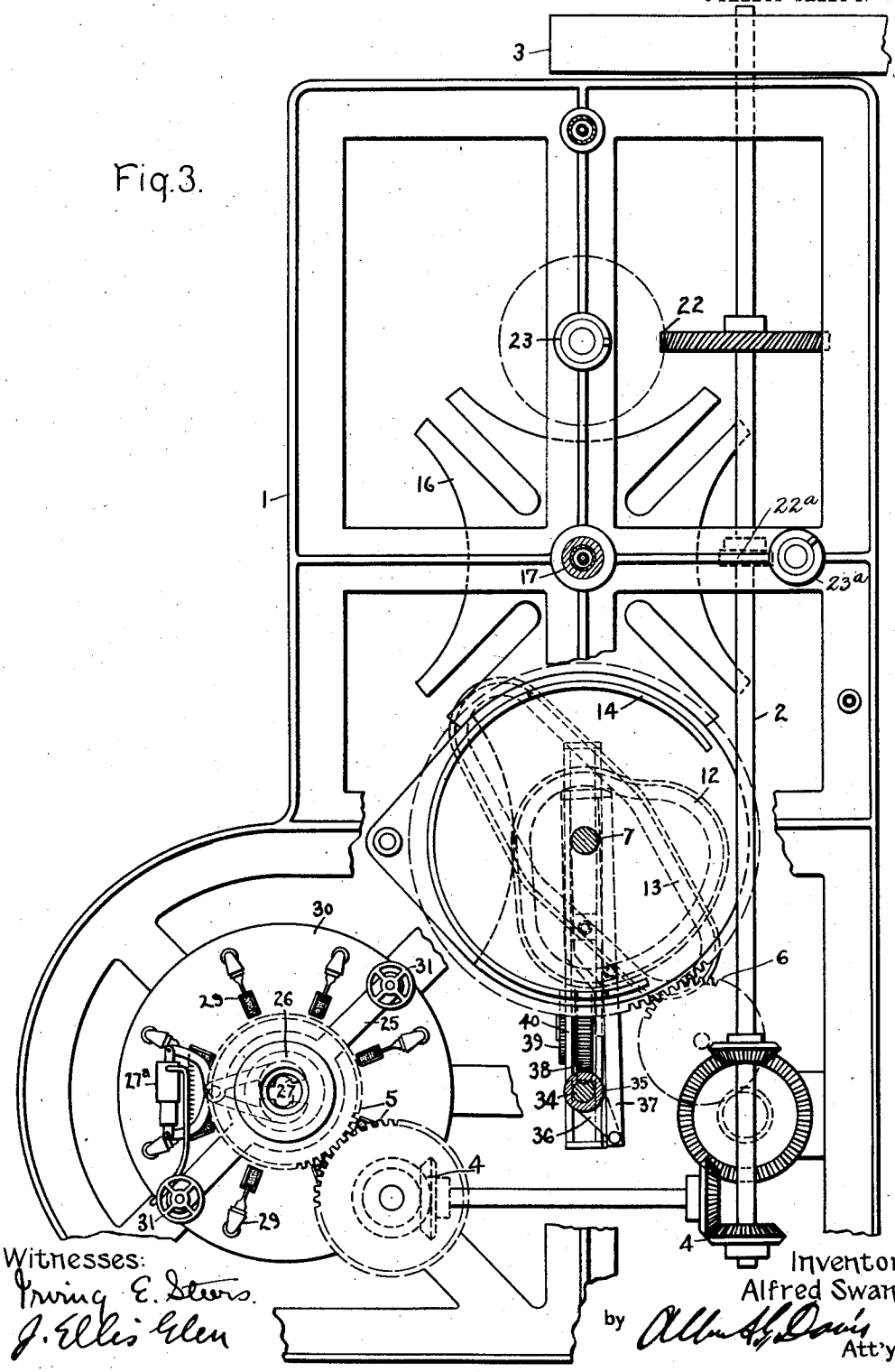
5 SHEETS—SHEET 2.

Fig. 3.



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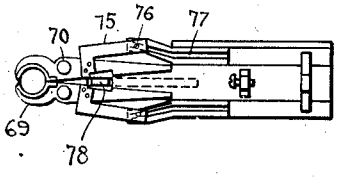
5 SHEETS—SHEET 3.

Fig. 5.



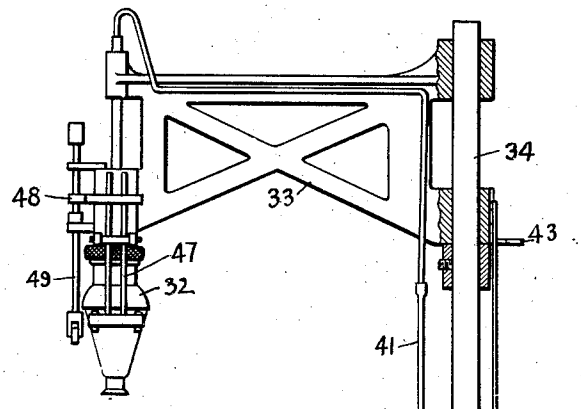
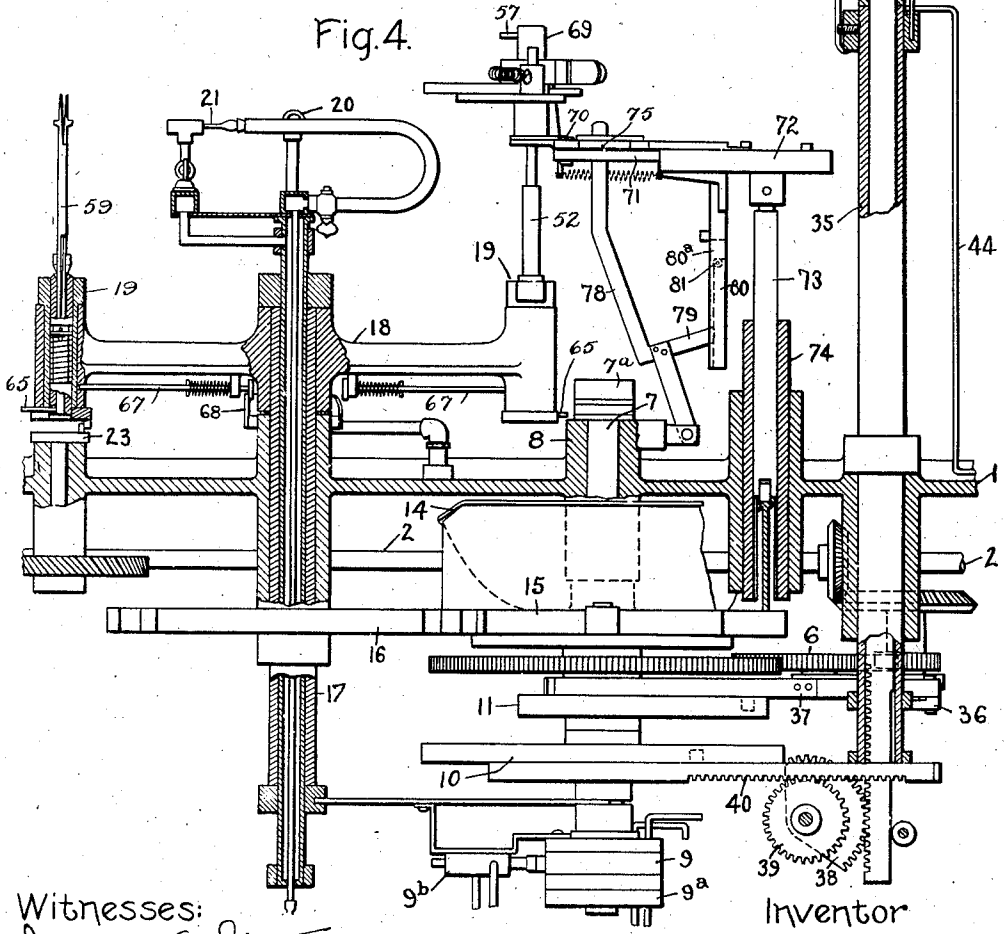


Fig. 4.



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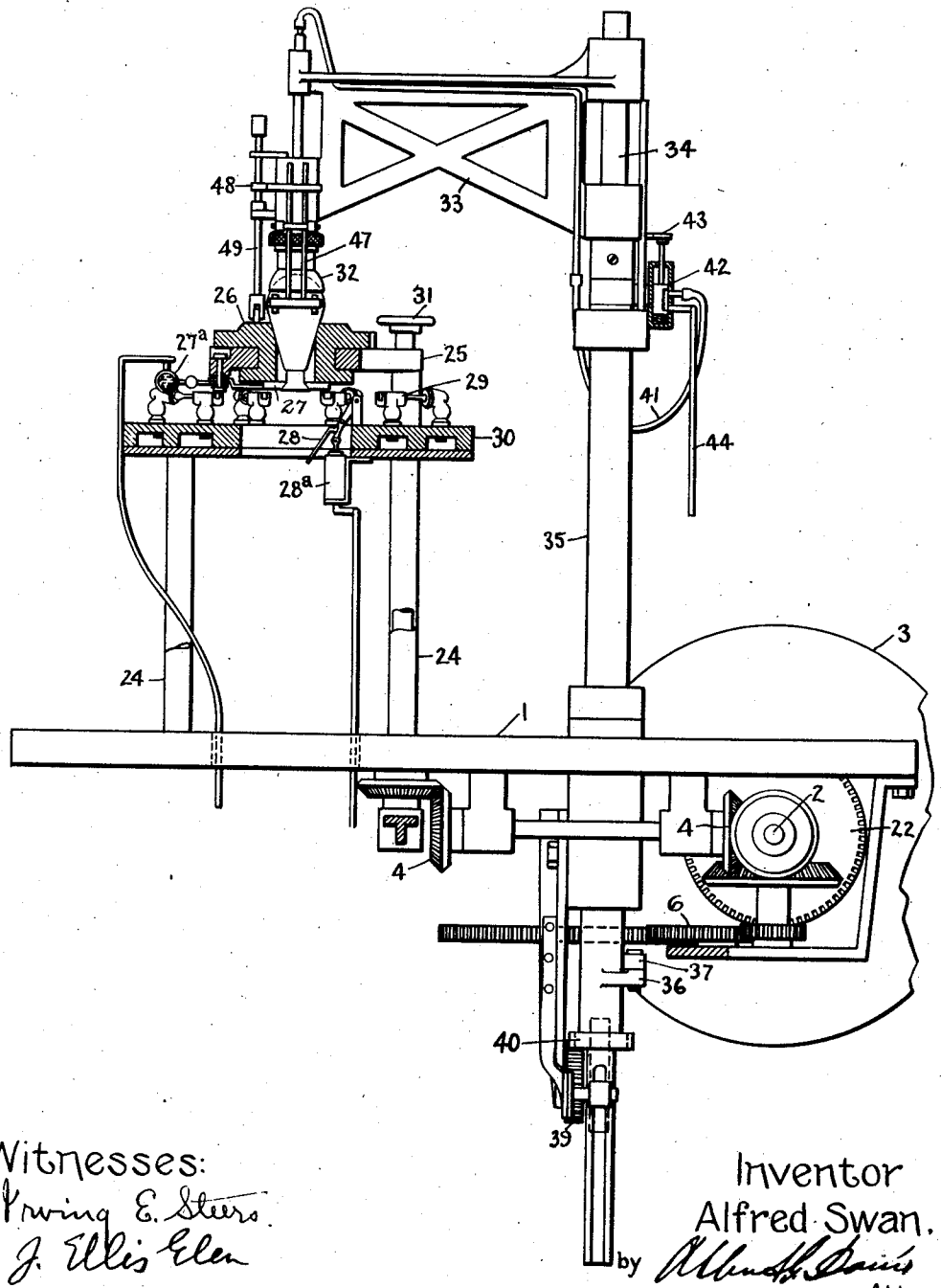
5 SHEETS—SHEET 4.

Fig. 6.



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5 SHEETS—SHEET 5.

Fig. 8.

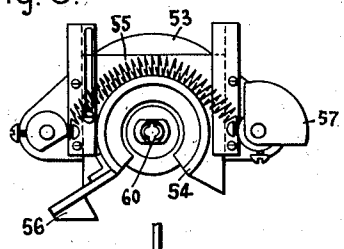


Fig. 7.

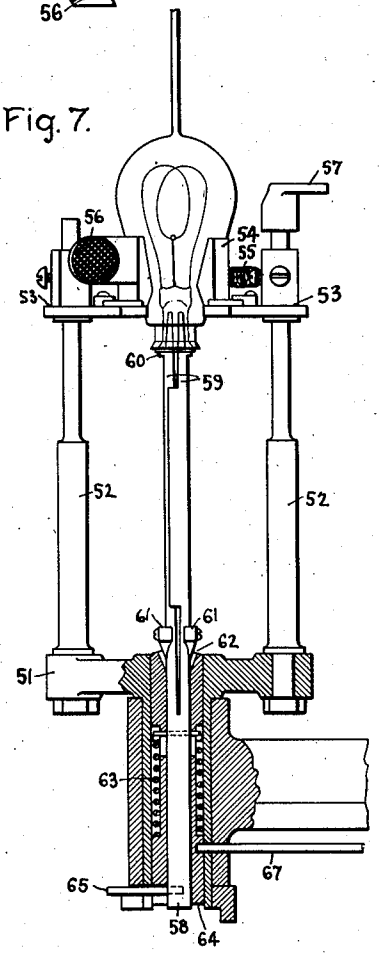


Fig. 9.

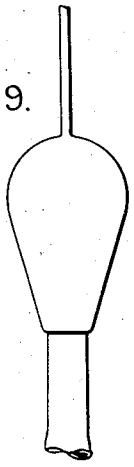


Fig. 10.

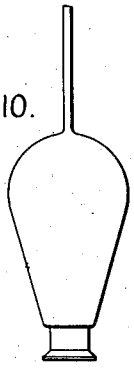
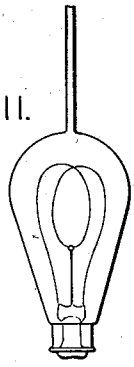


Fig. 11.



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UNITED STATES PATENT OFFICE.

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LAMP-MAKING MACHINE.

1,011,523. Specification of Letters Patent. Patented Dec. 12, 1911.

Application filed December 19, 1908. Serial No. 468,282.

To all whom it may concern:

Be it known that I, ALFRED SWAN, a subject of the King of Great Britain, residing at Upper Montclair, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Lamp-Making Machines, of which the following is a specification.

My invention relates to machines for making incandescent lamps and its object is to provide a lamp making machine in which the various steps of blowing off of the neck of a bulb to the proper length, the placing of the bulb in proper relation to a stem carrying the filament, and the sealing of the stem into the bulbs are carried out automatically without requiring any skill on the part of the operator.

In carrying out my invention an automatic blowing off device is provided in which the operator places a bulb, which is then rotated about its longitudinal axis while a flame is directed against its neck until the glass melts, whereupon automatic devices operate to cut or blow off the neck of the bulb in a plane at right angles to its longitudinal axis and to slightly flare the open end of the neck. The stem is sealed into the bulb by an automatic sealing-in device, and the only work required of the operator is to remove the finished lamp from the sealing-in device, replace it with a stem provided with a filament and with leading-in wires, and then place a bulb in the blowing off device, whereupon a transfer mechanism automatically actuated in definite relation to the blowing off device and to the automatic sealing-in device, picks up the blown off bulb and places it on the sealing-in device with the neck of the bulb in contact with the stem and the filament on the stem in proper position inside the bulb. In order to permit the filament to pass through the neck of the bulb without injury an automatic filament protector covers and protects the filament during its passage through the neck of the bulb, and is then automatically removed from around the filament after the bulb and stem are brought into proper relation to each other on the sealing-in device ready to be sealed together. The sealing-in device brings the bulb and stem within range of preliminary burners where the parts are slightly heated, then within range of the sealing-in burners, where the stem is fused into the neck of the bulb while both are rotated to insure an even heating and fusing of the parts, and finally within reach of the operator, who removes the lamp and places a new stem upon the stem holder, at the same time placing a new bulb in the blowing off device. The various parts of the machine are positively driven in definite relation to each other, and after the operator places a stem and a bulb in the machine, the succeeding steps take place without intervention on the part of the operator.

My invention will best be understood in connection with the accompanying drawings, which illustrate one of the many forms in which the invention may be embodied, and in which—

Figure 1 is a side view of a machine embodying the invention; Fig. 2 is a plan view of the machine shown in Fig. 1; Fig. 3 is a plan view similar to Fig. 2, with part of the mechanism removed to show the driving mechanism; Fig. 4 is an elevation partly in section showing details of the transfer mechanism, of the filament protector, and of the rotatable spider which carries the rotating heads; Fig. 5 is a plan view showing details of the filament protector; Fig. 6 is an elevation partly in section showing details of the blowing off device and transfer mechanism; Fig. 7 is a view partly in section showing details of one of the heads of the sealing-in device; Fig. 8 is a plan view showing the clamp on the head of Fig. 7; Fig. 9 shows the bulb as it is placed in the blowing off device; Fig. 10 the same bulb after it has been blown off; and Fig. 11 the lamp as it is removed from the sealing-in device.

In the form of machine shown in the drawings, the various parts of the device are mounted on a table or support 1 and are actuated in definite relation to each other from the driving shaft 2 journaled in suitable bearings on the table and rotated by the driving pulley 3. The driving shaft is connected through beveled gears 4 and spur gears 5 with the blowing-off device and through spur gears 6 with a vertical countershaft 7 provided at the upper end with a supporting shoulder 7^a and mounted in a bearing 8 on the table. The supply of air and gas to the blowing-off device is automatically controlled by a flat rotary valve 9 and the different parts of

the blowing off device are pneumatically operated in proper sequence by means of a controlling valve 9^a, both valves being mounted on the lower end of the countershaft 7, while the transfer mechanism is automatically operated in proper relation to the other parts of the machine to transfer the bulb from the blowing-off device to the sealing-in device by actuating mechanism comprising face cams 10 and 11 mounted on the countershaft 7, and provided with grooves 12 and 13 shaped as shown in Fig. 3. The filament protecting device is operated by an edge cam 14 driven by the countershaft 7 and mounted on a disk 15 which forms part of the actuating mechanism for giving an intermittent motion to the sealing-in device by means of an intermittent gearing, which, as best shown in Figs. 2 and 3, consists of the disk 15 and a coöperating member 16 arranged to drive the sealing-in device by means of a vertical shaft 17 extending through the table, as shown in Fig. 3, and carrying on the upper end the movable members of the sealing-in device comprising a spider 18 having four arms with a rotatable head 19 mounted on the outer end of each arm. The parts are so proportioned that in the operation of the machine, the spider is intermittently rotated to bring each head in succession, as shown in Fig. 2, to the position A where the operator places a stem on the stem holder carried by each head, then to the second position B where the bulb is automatically placed in position over the filament, then to the third position C where the preliminary burner 20 heats the joint between the bulb and stem and then to the fourth position D between the sealing-in burners 21, where the sealing-in is completed, the spider being held stationary for a short period of time in each of said positions. The rotatable head in the sealing-in position D is rotated from the driving shaft 2 through spiral gears 22 which drive a vertical shaft extending through the table and carrying on its upper end a clutch member 23 arranged to engage and rotate each head which comes into position D, similar gearing 22^a and clutch 23^a being provided to rotate each head as it comes into position C between the preliminary burners.

The tubulated lamp bulbs shown in Fig. 9 are placed by the operator in a blowing-off device which rotates them about their longitudinal axis while blowing-off burners direct a flame against the neck of the bulb at the proper point until the glass melts, whereupon the excess portion of the neck drops off, leaving the bulb sealed up by a thin film of glass across the neck. The burners are then cut down and air under pressure introduced into the bulb to blow said film into a bubble which eventually breaks leaving a ragged fringe on the edge of the neck. The preferred form of blowing-off device, as shown in Fig. 6, comprises hollow vertical pedestals 24 which are mounted on the table and carry at the upper end an annular support 25. A rotatable bulb holder 26 with teeth on the edge to mesh with the gear 5 is rotatably mounted in the support 25 with its lower end adjacent some suitable shaper which insures that the neck of the bulb will be cut off in a plane at right angles to the longitudinal axis of the bulb. The shaper is made of any suitable refractory material and is preferably constructed, as shown in Fig. 6, in the form of a stationary annulus, consisting of two semi-circular members 27 mounted on a stationary pivot on the support 25 and relatively movable like the jaws of a pair of pincers in a plane at right angles to the axis of the bulb holder. The members 27 are mounted very close to the lower end of the bulb holder and are provided with a flat surface in a plane at right angles to the axis of the bulb holder. The two semi-circular members closely surround the neck of the bulb when they are in engagement with each other, as shown in Fig. 6, and the opening in the shaper is slightly countersunk or beveled on the lower edge to permit the neck of the bulb to be flared out slightly when it is blown off. The semi-circular members are separated to permit the insertion of the bulb in the blowing off device and are then closed around the neck of the bulb during the operation of blowing off, by any suitable mechanism, preferably a pneumatic actuator 27^a operated by compressed air and automatically controlled by the valve 9^b which is operated by a cam or valve 9. The thin ragged fringe of glass remaining on the neck of the bulb after blowing off is broken off and the edge of the neck is smoothed by a coöperating stripper 28 movably mounted adjacent the rotatable bulb holder and automatically moved into engagement with the shaper 27 by any suitable mechanism driven in such relation to the bulb holder that the stripper is operated after the neck of the bulb has been blown off.

The preferred form of stripper actuating mechanism is a pneumatic actuator 28^a operated by compressed air, which is automatically supplied at the proper time by the valve 9^a. The stripper 28 has a flat surface which is brought parallel to the flat surface of the shaper 27, and breaks off the ragged edge or fringe of the neck of the blown off bulb, thereby insuring that the edge of the neck of the bulb is in a plane at right angles to the axis of the bulb. The bulb is heated immediately below the shaper 27 along the line where it is to be cut off by a ring of burners 29 mounted upon the annular

bracket 30 on the pedestals 24. The burners 29 are supplied with gas and air by pipes which pass up through the interior of the pedestals 24 and the exact point at which the neck of the bulb is cut off can be varied by changing the relation of the support 25 to the annular bracket 30 by any suitable mechanism, such as adjusting screws arranged to raise and lower the support 25, and operated by hand wheels 31. As the flame from the burners 29 softens the glass of the neck of the bulb, and the walls of the neck gradually collapse the lower portion of the neck drops off, leaving across the open end of the neck a thin film of glass which is blown off and removed, while at the same time the edge of the neck is flared into the desired form by means of air introduced under pressure into the bulb to blow the film across the neck of the bulb into a bubble which eventually breaks. Air under pressure may be introduced into the bulb at the proper moment by any suitable mechanism, but in the preferred form is automatically introduced by means of an inverted cup 32 which is shaped to make an air tight joint with the upper end of the bulb and is brought into engagement with the bulb in the bulb holder 26 by means of the transfer or bulb positioning mechanism which transfers the bulb from the blowing-off device to the sealing-in device. The cup 32 is mounted on the transfer mechanism on the end of a bracket 33 secured to a transfer rod 34 which is mounted to rotate and also to slide longitudinally along its axis of rotation. This movement may be given to the rod in various ways, preferably by slidably mounting the rod in a rotatable sleeve 35 carried in suitable journals on the table 1 and rotated in definite relation to the other parts of the machine from the face cam 11 by a crank 36 mounted on the lower end of the sleeve and actuated by a rod 37 which is provided with a roller to engage the groove in the face cam 11. The longitudinal movement of the rod 34 is secured by forming on the lower end of the rod a rack meshing with a pinion 38, which in turn is rotated in definite relation to the remainder of the mechanism by means of a pinion 39 in mesh with a rack 40 which is driven by the face cam 10. The cams 10 and 11 are timed to swing the inverted cup 32 into alinement with the bulb in the bulb holder of the blowing off device by the rotation of the rod 34 and then into engagement with the upper end of the bulb by the longitudinal movement of the rod. As the cup 32 engages the bulb air under pressure is automatically supplied to the interior of the cup through a flexible pipe 41 controlled by a slide valve 42 mounted on the upper end of the sleeve 35 and operated by a projection 43 on the rod 34, when the rod 34 is in its lowest position, to connect the pipe 41 with a pipe 44, which is connected with a source of air under pressure. The slide valve 9^b which controls the members of the shaper 27 is operated in any suitable way, preferably by means of a cam mounted on the valve 9, which has its ports arranged to cut down the supply of air and gas to the blowing-off burners at the time the slide valve 42 is actuated to admit air under pressure to the interior of the bulb in the bulb holder 26. The air in the bulb blows the film of glass across the neck of the bulb into a bubble which eventually bursts, whereupon the stripper 28 is brought into engagement with the shaper 27, breaking off the ragged fringe of glass and smoothing the rough edges of the neck of the bulb, thereby causing the edge of the neck of the bulb to be straight and smooth and of the desired flare.

After the bulb has been blown off by the mechanism above described, the shaper 27 is opened by the action of piston 27^a operated by valve 9^b and the bulb is lifted from the bulb holder 26 by any suitable form of transfer or bulb positioning mechanism which preferably comprises, in addition to the mechanism above described for bringing the cup 32 in engagement with the bulb, a gripping device mounted on the bracket 33 to grip the bulb and carry it from the blowing off device to the sealing-in device. Various forms of gripping device may be used, but a satisfactory form is that shown in the drawing in which gripping arms 47 provided at their lower ends with clamps for engaging the bulb are pivoted to the bracket 33 and moved by a control mechanism consisting of a toggle 48 connected to the gripping arms above their pivots. When the toggle 48 is straightened out the gripping arms are actuated to bring the clamps into engagement with the bulb, and when the toggle is broken, as shown in Fig. 1, the gripping arms release the bulb. The toggle is straightened by a control rod 49 slidably mounted on the bracket 33 and having a roller or other suitable engaging surface at its lower end, and is broken by means of a control projection 50 mounted on one of the links of the toggle. The parts are so proportioned that when the bracket 33 is moved to bring the cup 32 into engagement with the bulb, the roller on the sliding control rod 49 engages the bulb holder 26, whereupon further movement of the cup causes the control rod to straighten the toggle 48 and move the gripping arms to engage and hold the bulb. After the bulb has been blown off, a longitudinal movement of the rod 34 lifts the bulb out of the bulb holder, after which the rod is rotated on its axis to swing the bulb into position over a stem which is carried on

the stem support of that particular head 19 of the sealing-in device which at this time happens to be in the second position B.

Each of the heads 19 of the sealing-in device is rotatably mounted on the end of an arm of the spider 18 and is arranged to hold the stem and the bulb in proper relation to each other during the operation of sealing-in. The head may assume various forms, but in the preferred arrangement it comprises a T shaped base block 51, suitably journaled in a boss on the end of an arm of the spider 18, and carrying the two vertical rods 52, on the upper end of which a saddle piece 53 is adjustably mounted by means of set screws, as best shown in Fig. 7, so that the saddle piece may be moved up and down on the rods. A cup shaped bulb support or yoke 54, properly shaped to receive and hold the bulb, is slidably mounted on the saddle piece 53 in guides, as clearly shown in Fig. 8, and is normally held in the position shown by means of a spring 55 secured at each end to the saddle 53. The bulb support, being yieldingly held in normal position is self adjusting along its guides to receive the bulb being placed in it by the transfer mechanism, thereby insuring the proper seating of the bulb in the bulb support. The operator can also slide the bulb support back out of the way against the tension of the spring 55 by pressing upon a thumb piece 56 made of fiber or other similar material which will not become too hot to handle.

The bulb grippers on the transfer mechanism are actuated in proper relation to the sealing-in device to release the bulb when it is in position in the bulb support by means of any suitable gripper actuating device which is preferably made in the form of a quadrant shaped lug 57 mounted on the upper end of one of the rods 52 in a position to be engaged by the control projection or rod 50, whereby the rod 50 is moved and the bulb gripper is actuated at the proper time to release the bulb.

The stem is held in proper relation to the bulb by any suitable stem support which will hold the stem in alinement with the longitudinal axis of the bulb and maintain it in proper relation to the bulb during the operation of sealing in. In the preferred form of device the stem support is made in the form of a rod 58, mounted in the base block 51 to slide longitudinally and split at one end to form two coöperating spring jaws 59, normally tending to spring apart and shaped at the upper end into stem supports 60, which may be inserted in the interior of the stem and by springing apart will firmly grip the stem. The stem is released at the proper time by any suitable mechanism which automatically moves the spring jaws 59 toward each other and thereby moves the stem holders out of engagement with the walls of the stem. The preferred form of mechanism for accomplishing this result is actuated by the longitudinal movement of the stem support and comprises conical stem releasing cams 61 secured to the spring jaws 59 in a position to enter a taper socket 62 in the base block 51 when the stem support is moved downward. The stem support 58 is normally yieldingly held in the position shown in Fig. 7, by a spring 63 secured at one end to the support 58 and at the other end to a block 64 firmly secured within the base block 51. As the head 19 is carried toward the final position A, the stem support 58 and the bulb support 54 are automatically moved away from each other for the purpose of drawing down the stem, thereby straightening the stem in the bulb, making a more perfect seal between the bulb and the stem, and giving the neck of the lamp the form shown in Fig. 11. In the method heretofore used this relative movement of the bulb and the stem is produced by the operator pulling on the leading-in wires, but in accordance with my invention may be produced by any suitable mechanism, preferably by means of a stationary cam 66 which is mounted in such a position near the first position A, as shown in Fig. 1, that as the head carries the lamp from position D toward position A and while the glass is still plastic from the sealing-in operation, the pin 65 catches under the stationary cam 66, which draws the stem support 58 down against the tension of the spring 63 into the position shown in Fig. 1. During the first part of this movement of the stem support 58, the stem holder 60 grips the stem with sufficient force to pull the stem down into the position shown in Fig. 11, while further movement of the stem support brings the stem releasing cam 61 into engagement with the socket 62 whereby the spring jaws 59 are pressed together and the stem is released. Each head 19 is held against rotation in positions A and B by means of a locking rod 67 slidably mounted on the spider 18 with its outer end extending through the boss on the end of the arm of the spider and the base block 51 into a recess in the block 64, while its inner end is shaped into a head for engaging a stationary cam 68 mounted adjacent the hub of the spider and arranged to move the locking rods toward the axis of the spider thereby leaving the heads 19 free to rotate while in positions C and D.

During the downward movement of the bulb into the holder 54, the edge of the neck of the bulb is apt to strike and break the filament, and some suitable form of filament sheath or protector is therefore provided to prevent the bulb coming in contact with the

filament. The filament sheath is preferably made in the form of a tube and automatic mechanism is provided to place said tube around the filament during the downward movement of the bulb. The operating mechanism for the filament sheath may assume various forms but in the specific form of device shown in the drawings, the filament sheath 69 is made in the form of a tube split longitudinally, and with the two halves mounted on pivoted arms 70, which may be moved to separate the halves of the tube and thereby permit the tube to be placed around the stem support. The pivoted arms 70 are carried by a base 71 which is mounted to slide at right angles to the axis of the stem support and is carried upon a movable support 72 mounted to move parallel to the axis of the stem support. The movable support 72 is preferably carried on a rod slidably mounted in any suitable guide 74 on the table 1 and actuated at the proper time by the edge cam 15, as shown in Fig. 4.

The pivoted arms of the filament sheath may be moved by any suitable mechanism but in the preferred construction, as shown in the drawings, extensions 75 on the arms carry pins 76 which engage grooves in a cam 77 mounted on the movable support 72. The grooves in the cam 77 are shaped to cause the halves of the filament sheath to separate when the sliding base 71 is moved toward the rod and to come into engagement with each other and form a closed tube around the filament when the sliding base is moved in the other direction into the position shown in Figs. 4 and 5. The sliding base 71 is moved relatively to the support 72 by a pivoted actuating arm 78 which extends through a slot in the sliding base 71 and is pivoted at the lower end as shown in Fig. 4 to a fixed point on the table 1. The actuating arm 78 is bent as shown in Fig. 4 and is provided with an extension 79 which normally slides in a groove in a block 80 carried by the movable support 72. As the block 80 drops down with the movement of the support 72, the projection 79 slides along groove until the movable support 72 reaches its lowermost position at which point the extension 79 enters a slot 80^a over the roller 81 and causes the actuating arm 78 to swing about its pivot in a clockwise direction thereby moving the sliding base 71 toward the slidable rod 73 and causing the halves of the filament sheath to separate and to move back from the head 19. Since the upper portion of the actuating arm is parallel to the rod 73, the first portion of the downward movement of the movable support 72 moves the filament sheath longitudinally of the stem support until the sheath is below the stem. The next movement of the filament sheath toward the rod 73 causes the halves of the sheath to separate and thereby permits it to be removed from around the stem support.

The operation of the device is as follows: When one of the heads 19 is in the first position A the stem support is automatically drawn down and the stem holders 60 are thereby brought close together. The operator places a tubulated bulb on the blowing-off device, and then places the stem on the stem support, the operation of placing the stem on the stem support being facilitated by the operator pushing the bulb support 53 back out of the way by pressing on the fiber button 56. After the stem is in position the bulb support is released and is returned to normal position by the spring 55. The bulb in the blowing off device is rotated about its longitudinal axis while the neck is being heated, the cap 32 is brought into engagement with the bulb, and the bulb is blown off without any further attention on the part of the operator. The movement of the cap 32 into engagement with the bulb causes the gripping device to seize the bulb and the face cams 10 and 11 first lift and then rotate the rod 34 about its axis until the bulb held by the gripping device is brought into alinement with the second position B. During the operation of the blowing off device the intermittent gearing has caused the spider to make one-quarter of a revolution and the head 19 on which the operator placed the stem has been moved into the second position B, where the locking rod 67 locks the head with the lug 57 in position to cause the gripping device to release the bulb. At about the time the head 19 reached the second position B, the edge cam 15 began to raise the movable support 72, thereby causing the sliding base 71 to move away from the slidable rod 73 and to bring the filament sheath around the stem support of the head 19. By the time the movable support 72 has accomplished about one-half of its upward movement, the filament sheath has been automatically placed in position around the stem support and the two halves of the filament sheath are in engagement with each other as shown in Fig. 5. The continued upward movement of the movable support 72 moves the filament sheath longitudinally of the stem support and as the sheath passes up over the stem and over the filament, the filament is compressed within the filament sheath until when the movable support 72 reaches its uppermost position as shown in Fig. 4 the filament is completely within the filament sheath. By this time the face cam 10 is lowering the rod 34, and thereby bringing the bulb toward the head 19. As the edge of the neck of the bulb approaches closely to the filament sheath 69, the edge cam 15 begins to lower the movable support 72 and the filament sheath at the same rate

as the bulb is lowered, thereby protecting the filament until the edge of the neck of the bulb is below the filament, whereupon the filament sheath drops longitudinally of the stem support and moves away from around the stem before the edge of the neck of the bulb comes in contact with the stem. The gripping device releases the bulb which it placed in the bulb holder 54 in proper relation to the stem because the lug 57 on the head is engaged by the sliding control rod 50 on the gripping device, which moves and breaks the toggle 48 and thereby causes the gripping device to release the bulb, whereupon the rod 34 is lifted by the face cam 10 and the bulb and stem are left on the head 19 in proper relation to each other to be sealed in. The intermittent gearing then acts to carry the bulb and stem to the next position C within range of the preliminary burners, where the cam 68 withdraws the locking rod 67, leaving the head free to be rotated by the clutch 23^a with the joint between the stem and the edge of the neck of the bulb in alinement with the flame of the preliminary burners, and then on the next portion D, where the locking rod 67 is still drawn back and the head is rotated between the sealing in burners from the driving shaft 2 by the clutch member 23 and the sealing-in is accomplished. During the next movement of the spider, while the lamp is moving toward the first position A and the glass is still plastic, the stem is pulled down by the downward movement of the stem support 58 caused by the pin 65 engaging the inclined part of the stationary cam 66. This movement straightens the stem in the bulb and also produces a better joint between the stem and the bulb. As the stem support is pulled farther down the spring jaws 59 are forced toward each other, whereby the stem is released from the stem holders 60 and the lamp is ready to be removed from the head by the operator, who then places a new stem on the stem holder and a new bulb in the blowing off device, whereupon the operation above described is repeated.

My invention may be embodied in many other forms than that shown and described, and I do not wish to be restricted to the specific arrangement disclosed, but intend to cover by the appended claims all changes and modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In a lamp making machine, the combination with an automatic sealing-in device for fusing a stem into the neck of a bulb, of means actuated in definite time relation to said device whereby a relative movement is produced between said bulb and said stem while the joint between them is plastic.

2. In a lamp making machine, the combination with an automatic sealing-in device for fusing a stem into the neck of a bulb, of means whereby said stem is moved longitudinally of said bulb, said means being actuated by said device to move said stem while the joint between said stem and said bulb is plastic.

3. In a lamp making machine, the combination with an automatic sealing-in device for fusing a stem into the neck of a bulb, of a stem support arranged to grip said stem and mounted to move relatively to said bulb, and operating means controlled by said device to move said support relatively to said bulb while the joint between said stem and said bulb is plastic.

4. In a lamp making machine, the combination with a sealing-in device comprising a head for positioning a bulb and a stem in proper relation to each other, burners mounted to direct the flame toward said head to fuse the stem into the bulb, and actuating means for said device arranged to cause the effect of said burners to decrease when fusion has been effected, of means controlled by said actuating means for producing a relative movement between the stem and the bulb held in said head while the joint between them is plastic.

5. In a lamp making machine, the combination with a bulb holder and a stem support movable relatively to each other and arranged to normally hold the stem and bulb in position for sealing in, of burners for fusing the stem into the neck of the bulb, and actuating means arranged to move said bulb holder and said stem support away from each other while the joint is plastic.

6. In a lamp making machine, the combination with a bulb holder, of a stem support normally in position to hold the stem in contact with the neck of a bulb held immovable in said holder, said support being mounted to move longitudinally of said bulb, means for holding a stem immovable on the said support, burners mounted to fuse said stem and said bulb together, and actuating means for said stem support arranged to automatically move said support away from said bulb holder while the joint between the stem and the bulb is plastic.

7. In a lamp making machine, the combination with a movable carrier, of a sealing-in head mounted on said carrier comprising a bulb holder and a stem support movable relatively to each other, burners mounted adjacent the path of said head to fuse a stem in said support into a bulb in said holder, and means for producing a relative movement between said holder and said support, said means being controlled by said carrier at a definite point in the path of said head.

8. In a lamp making machine, the combi-

nation with a movable carrier, of a sealing-in head mounted on said carrier comprising a bulb holder and a stem support mounted to reciprocate, burners mounted adjacent the path of said head to fuse a stem on said support into a bulb in said holder, and means whereby said stem support is moved away from said holder as said carrier moves said head away from said burners.

9. In a lamp making machine, the combination with a movable carrier, of a sealing-in head mounted on said carrier comprising a bulb holder and a stem support mounted to reciprocate, burners mounted adjacent the path of said head to fuse a stem on said support into a bulb in said holder, and a cam mounted adjacent said carrier to engage said stem support and move it away from said bulb holder as said carrier moves said head away from said burners.

10. In a lamp making machine, the combination with a movable carrier, of a rotatable sealing-in head mounted on said carrier and comprising a bulb holder, a stem support splined in said head to move relatively to said bulb holder, a projecting pin secured to said support, burners for sealing a stem on said stem support into a bulb in said holder, a stationary cam mounted adjacent said burners in the path of said pin to draw said stem support away from said holder as said head is carried away from said burners, and locking means controlled by said carrier to lock said head against rotation with said pin in position to engage said cam.

11. In a blowing-off device for lamp bulbs, the combination with means for rotating a bulb about its longitudinal axis, burners for heating the neck of the bulb to sever it, and means for supplying air under pressure to said bulb, of a shaper arranged to engage the neck of said bulb where the neck is heated.

12. In a blowing-off device for lamp bulbs, the combination with means for rotating a bulb about its longitudinal axis, burners for heating the neck of the bulb to sever it, and means for supplying air under pressure to said bulb, of an annular shaper mounted to surround the neck of the bulb and provided with a flat surface at right angles to the axis of rotation of the bulb, and means coöperating with the flat surface of said shaper to remove the excess glass from the neck.

13. In a blowing-off device for lamp bulbs, the combination with a rotatable holder arranged to rotate a bulb about its longitudinal axis, and burners for heating the neck of said bulb to sever it, of a shaper comprising semicircular members movable relatively to each other and arranged to surround the neck of said bulb at the point where the bulb is heated, and controlling mechanism actuated in definite relation to said holder to move said members into and out of engagement with the neck of the bulb.

14. In a blowing-off device for lamp bulbs, the combination with a rotatable holder arranged to rotate a bulb about its longitudinal axis, and burners for heating the neck of said bulb to sever it, of an annular shaper surrounding the neck of said bulb adjacent the point of heating and in a plane at right angles to the axis of rotation of the bulb, and a movable coöperating member having a flat surface movable into engagement with said shaper to smooth the ragged edge of said neck.

15. In a lamp making machine, the combination with a sealing-in device comprising a holder for maintaining a bulb and a stem in fixed relation to each other, said holder being mounted to move bodily and thereby carry the bulb and stem into different positions in succession, and burners mounted adjacent one of the positions of said holder to seal the stem into the bulb, of an automatic bulb-positioning device mounted adjacent another position of said holder and arranged to place a bulb in position in said holder, and common actuating means for said devices.

16. In a lamp making machine, the combination with a sealing-in device comprising a holder for maintaining a bulb and stem in fixed relation to each other, said holder being movable into different positions in succession, and burners mounted adjacent one of the positions of said holder to seal the stem into the bulb, of an automatic bulb-positioning device comprising a bulb-carrying member movable relatively to said holder, gripping means mounted on said member, and common actuating means for said devices arranged to bring said member and gripping means into operative relation to a bulb and to said holder in succession and thereby place the bulb in position in said holder.

17. In a lamp making machine, the combination with a sealing-in device comprising a holder for maintaining a bulb and stem in fixed relation to each other, said holder being movable into different positions in succession, and burners mounted adjacent one of the positions of said holder to seal the stem into the bulb, of an automatic bulb-positioning device mounted adjacent said holder to place a bulb in said holder in definite relation to a stem, a filament protector mounted adjacent said bulb-positioning device and arranged to shield the filament from contact with the neck of the bulb, and common operating means for actuating said devices in definite time relation to one another.

18. In a lamp making machine, the combination with a holder for maintaining a bulb and a stem in definite relation to each other, of a bulb-positioning device mounted adjacent said holder to place a bulb therein, a filament sheath mounted adjacent said bulb-positioning device and arranged to inclose the filament on the stem in said holder, thereby permitting the filament to be introduced into the neck of the bulb, and means for maintaining said filament sheath in protecting position during the operation of said bulb-positioning device.

19. In a lamp making machine, the combination with a holder for maintaining a bulb and a stem in definite relation to each other, of a bulb-positioning device mounted adjacent said holder to place a bulb therein, and a filament protector comprising a sheath mounted adjacent said holder and arranged to inclose the filament on the stem in said holder when actuated.

20. In a lamp making machine, the combination with a holder for maintaining a bulb and a stem in definite relation to each other, of a bulb-positioning device mounted adjacent said holder to place a bulb therein a tubular filament sheath of less diameter than the neck of the bulb, and means for placing said sheath around the filament on the stem in said holder whereby the filament is protected from injury by contact with the neck of the bulb.

21. In a lamp making machine, the combination with a holder for maintaining a bulb and a stem in definite relation to each other, of a bulb-positioning device mounted adjacent said holder to place a bulb therein, a filament protecting device comprising a tubular sheath and arranged to inclose the filament on the stem in said holder, and common actuating means for said devices arranged to maintain said sheath around said filament while the bulb is being placed in position and to afterward withdraw said sheath.

22. In a transfer mechanism for lamp machinery, the combination of a bulb gripper mounted to be lifted out of one position swung into alinement with a second position, and then lowered into said second position, actuating means for said gripper responsive to movement of said gripper into either of said positions, and means for lifting said gripper out of either position and lowering it into the other position.

23. In a transfer mechanism for lamp machinery the combination of a bulb gripper, a transfer member connected to said gripper, actuating means for moving said member to lift said gripper from one extreme position, swing it into alinement with another extreme position and finally lower it into said other extreme position, and means for automatically actuating said gripper during the movement of said gripper into either of said extreme positions.

24. In a transfer mechanism for lamp machinery, the combination of a bulb gripper mounted to swing about an axis of rotation between two extreme positions and to move in a direction perpendicular to its plane of rotation into and out of said extreme positions, and actuating means rotating said gripper and for moving it perpendicular to its plane of rotation whereby said gripper is moved from one extreme position to the other.

25. In a transfer mechanism for lamp machinery, the combination of a transfer member mounted to rotate about an axis and to reciprocate along said axis of rotation, a bulb gripper mounted on said member eccentric to said axis of rotation, actuating means for reciprocating said member to carry said gripper into and out of either of its extreme positions and for rotating said member to swing said gripper out of alinement with one extreme position and into alinement with the other extreme position, and actuating means for said gripper responsive to the movement of said gripper into either of said extreme positions.

26. In a transfer mechanism for lamp machinery, the combination of a transfer member mounted to rotate and to reciprocate along its axis of rotation, a gripper movable between two extreme positions, and mounted on said member eccentric to the axis of rotation thereof, an actuator for rotating said transfer member to swing said gripper out of alinement with one of said extreme positions and into alinement with the other extreme position, a second actuator for reciprocating said member to move said gripper perpendicularly to its plane of rotation and into or out of either of said extreme positions, and driving means for driving said actuators in definite relation to each other.

27. In a lamp making machine, the combination with a holder comprising means for engaging a stem and means for engaging a bulb to maintain the stem and bulb in definite relation to each other, of a bulb-positioning device comprising a bulb-carrying member movable relatively to said holder, and means actuated by the movement of said member toward said holder to release a bulb from said member.

28. In a lamp making machine, the combination with a holder comprising means for engaging a stem and means for engaging a bulb to maintain the stem and bulb in definite relation to each other, of a bulb-positioning device comprising a bulb-carrying member movable into position to place a bulb in said holder, and means on said

holder engaged by said member to release a bulb from said member.

29. In a lamp making machine, the combination with a holder comprising means for engaging a stem and means for engaging a bulb to hold the stem and bulb in definite relation to each other, of a bulb-positioning device comprising a movable arm, a bulb clamp mounted on said arm, actuating means for moving said arm toward said holder to place a bulb therein, and releasing means for said clamp actuated by contact with said holder.

30. In a lamp making machine, the combination with a holder for maintaining a stem and a bulb in definite relation to each other, of a bulb-positioning device comprising a bulb-carrying member movable relatively to said holder, a filament protector comprising a tubular sheath mounted to move longitudinally of the stem, and actuating means for moving said sheath into position around said filament during the movement of said bulb-carrying member.

31. A head for lamp making machines comprising a stem support and a bulb support for holding a bulb in sealing-in relation to a stem on said stem support, said bulb support being mounted to move transversely of said stem support.

32. A head for lamp making machines comprising a stem support, a bulb support for holding a bulb in sealing-in relation to a stem on said stem support, said bulb support being mounted to move transversely of said stem support, and resilient means for normally holding said supports in definite relation to each other.

33. A head for lamp making machines comprising a frame, a bulb support for holding a bulb in sealing-in relation to a stem on said stem support, said bulb support being mounted in guides on said frame to slide transversely of a stem held on said stem support, and a spring engaging said bulb support and said frame to normally hold said bulb support in definite relation to said stem support.

34. In a lamp making machine, the combination with a bulb transfer mechanism, of a bulb support for holding a bulb in sealing-in relation to a stem on said stem support, said bulb support being yieldingly mounted to move transversely of the longitudinal axis of a bulb held therein, and actuating means whereby said transfer mechanism moves a bulb in the direction of the longitudinal axis of said bulb to place it in said support.

35. In a lamp making machine, the combination with a bulb transfer mechanism, of a bulb support for holding a bulb in sealing-in relation to a stem on said stem support, said bulb support being yieldingly mounted to move transversely of the longitudinal axis of a bulb held therein, a spring for resiliently holding said bulb support in normal position, and actuating means whereby said transfer mechanism moves a bulb in a direction parallel to the longitudinal axis of a bulb held in said support and thereby brings the bulb into place in said bulb support.

36. In a lamp making machine, the combination with a bulb transfer mechanism, of a stem support, a bulb support for holding a bulb in sealing-in relation to a stem on said stem support, said bulb support being mounted to move transversely of a stem held on said stem support, resilient means for holding said supports in definite relation to each other, and actuating means whereby said transfer mechanism moves a bulb longitudinally of the stem in said stem support to place said bulb in said bulb support.

In witness whereof, I have hereunto set my hand this 17th day of December, 1908.

ALFRED SWAN.

Witnesses:
J. H. ELKINS,
W. G. PRICE.