No. 860,977. PATENTED JULY 23, 1907.

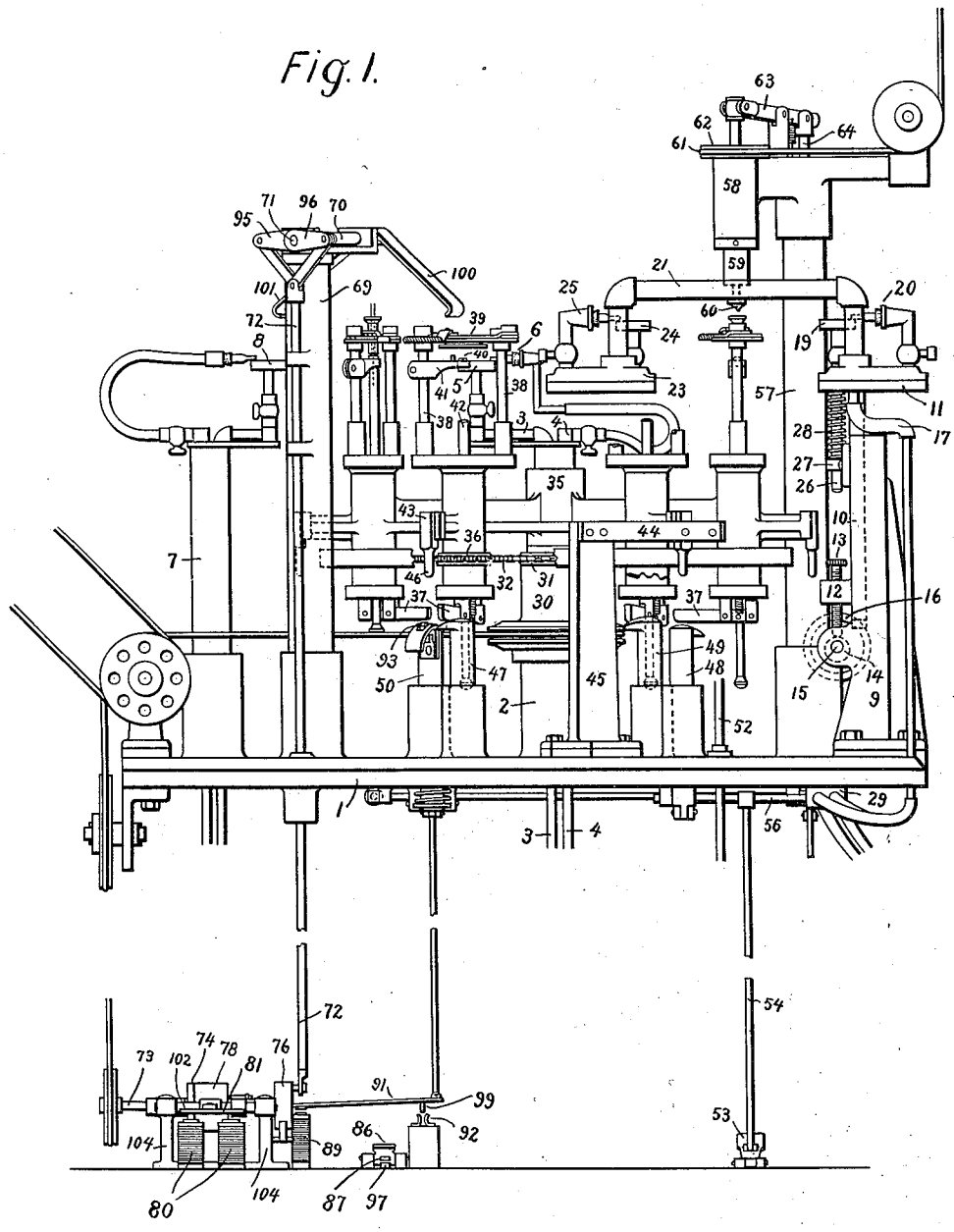
J. W. HOWELL & W. R. BURROWS.

MACHINE FOR MAKING STEMS FOR INCANDESCENT LAMPS.

APPLICATION FILED SEPT. 19, 1903.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 2.

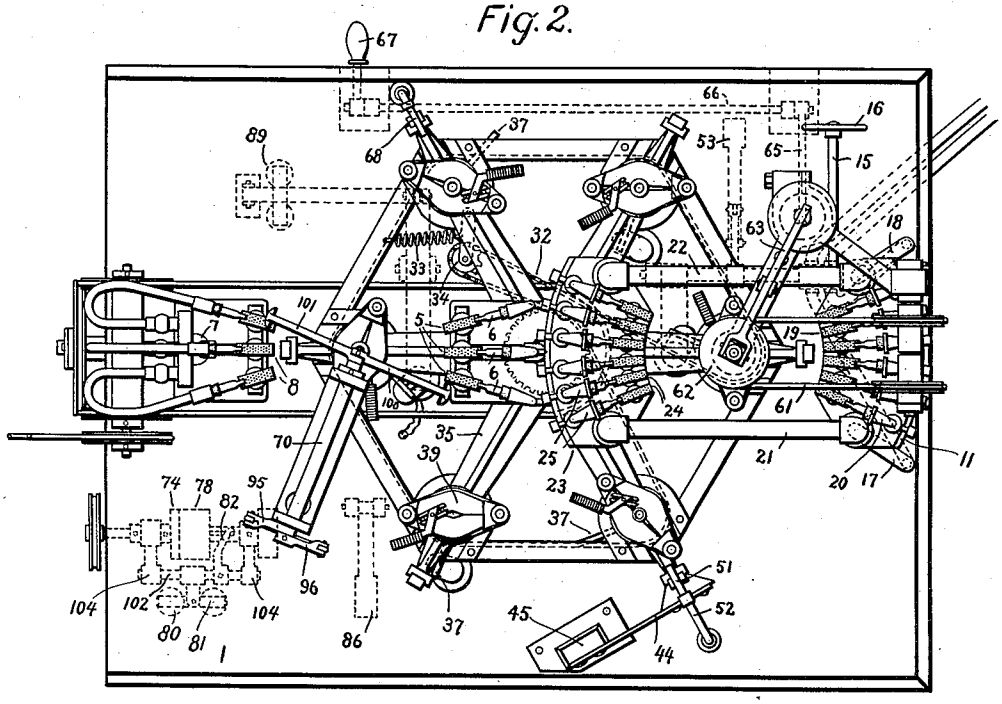
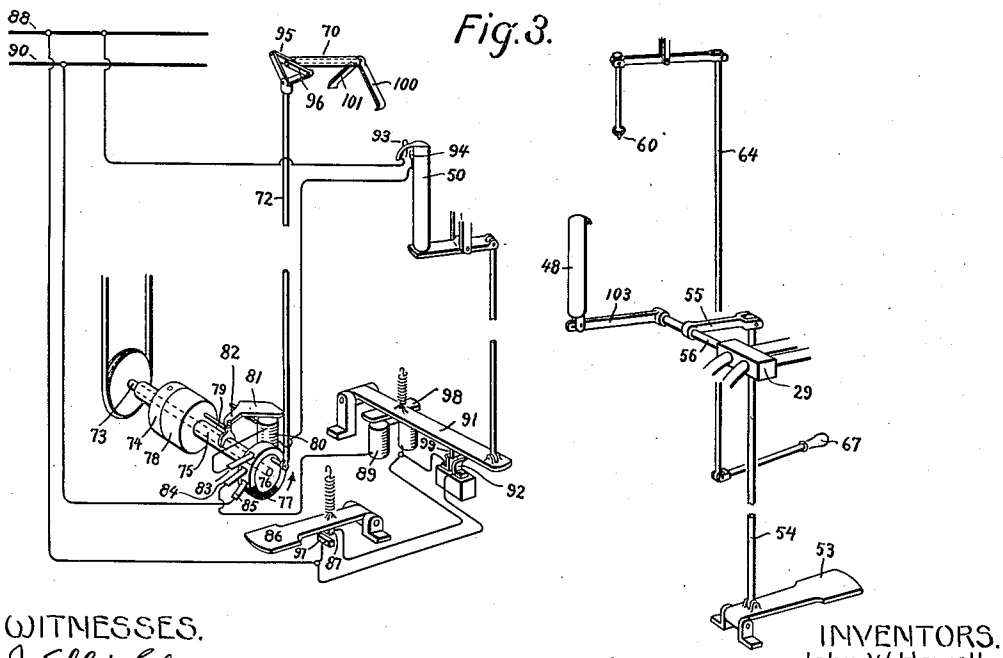


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN W. HOWELL AND WILLIAM R. BURROWS, OF NEWARK, NEW JERSEY, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MACHINE FOR MAKING STEMS FOR INCANDESCENT LAMPS.

No. 860,977. Specification of Letters Patent. Patented July 23, 1907.

Application filed September 19, 1903. Serial No. 173,765.

To all whom it may concern:

Be it known that we, JOHN W. HOWELL and WILLIAM R. BURROWS, citizens of the United States, residing at Newark, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Machines for Making Stems for Incandescent Lamps, of which the following is a specification.

This invention relates to machines for making stems for incandescent lamps and more particularly to improvements in machines of the type shown in our application Serial No. 115,183, filed July 11, 1902.

The improvements consist in arranging the machine to perform more operations, though the number of operators required is the same, and in making automatic certain operations which have hitherto been performed by hand, whereby the output of the machine is increased.

In the manufacture of incandescent lamps, the filament is mounted on a glass pillar or "stem", as it is technically termed, which is connected by an all-glass joint with the open end of the bulb, the leading-in wires which support the filament and serve to establish connection with the circuit through the base of the lamp and the anchor-wire which steadies the filament being sealed into the end of the stem. In the machine shown in the above-mentioned application these stems are made from glass "flares", that is short glass tubes which have, in a previous operation, been flared out at one end to form the enlargement by which the stem is sealed into the bulb. The pincers for effecting the seal about the leading-in and anchor-wires in that machine are operated by hand, it being necessary for the operator to raise the arm which carries the pincers into position and then press a button which closes the pincers.

By our improved machine, we eliminate the preliminary handling of the tubes for the purpose of flaring and make the stems from the short glass tubes, the flaring of the end of the tubes being accomplished by the machine before the leading-in wires are placed in position for sealing; and further we provide operating mechanism for the pincers so that effecting the seal is automatic and all that is required of the operator is to press a pedal or close an electric circuit in some other manner. In this way we have so perfected the construction of the machine that more operations are performed by it, less is required of the operators, the product is more uniform, and the output is increased.

In its general construction, our improved machine is similar to the stem-making machine shown in our application above referred to. It comprises a rotatable spider mounted on a hollow central post and rotary heads carried on the arms of the spider and driven by a chain from a power-driven gear on the central post. Each glass tube is held in a clamp on one of the rotary heads with its lower end resting on the apex of a perforated ridge on an arm carried by the head so that the leading-in and anchor-wires are properly positioned. A clutch connects each rotary head with its driving mechanism and stops are arranged in various positions to operate the clutches and bring the head to rest in a position convenient for the work which is done at that point. In the positions in which the glass is treated, the tubes rotate at the focus of a number of blow-pipe flames and in the positions preceding these they are preliminarily heated by ordinary Bunsen burners. In addition to these parts we employ an adjustable rotary tool for flaring the tubes and automatically-operated pincers for effecting the seal, so that the entire manufacture of the stems is performed at once and the duties of the operator are decreased. On account of the additional operation of flaring, we prefer to use six rotary heads instead of four as has been the practice heretofore, though it is obvious that the number may be varied as desired.

Our invention therefore comprises a machine by which stems for incandescent lamps are made from short glass tubes, the flaring of the tubes being performed by the machine; it also comprises a stem-making machine, by which the seal around the wires is effected automatically; it further comprises various novel features which will be more fully described hereinafter and definitely indicated in the claims appended hereto.

In the accompanying drawings which illustrate one embodiment of our invention, Figure 1 is a side elevation of our improved stem-making machine, broken away in part; Fig. 2 is a plan view of the same; and Fig. 3 is a diagrammatical view of the operating parts.

In the drawings, 1 represents the base or table of the machine, in the center of which is a hollow post 2 through which extend a gas-supply pipe 3 and an air-supply pipe 4 feeding a plurality of burners 5 and blow-pipes 6. To the left of the post 2 is a similar arrangement of pipes and burners mounted on the hollow post 7 feeding a plurality of burners 8. The burners 8 and 5 are so arranged that their flames meet at a common point or focus where the flare is stopped during the operation of sealing the wires in the end of the stem. On the opposite side of the center post is a standard 9 in one side of which is an undercut groove in which is slidingly mounted a post 10 carrying a burner-support 11. On the post 10 is a lug 12 through which is threaded a screw 13 bearing on a cam 14 keyed to a shaft 15, the latter being mounted in bearings on standard 9 and provided with a hand-wheel 16. Flexible gas and air pipes 17 and 18 respectively communicate with ducts in the burner-support 11 and mounted thereon in com-

munication with the ducts are a plurality of burners 19 and blow-pipes 20. Rigidly secured to the burner-support 11 and communicating with the gas and air-ducts are two pipes 21 and 22 which extend toward the center of the table and carry at their ends a similar burner-support 23 having gas and air-ducts with which the pipes communicate. Mounted on this support are a plurality of burners 24 in horizontal alinement with the burners 19 and connected to the gas duct within the support, and a plurality of blow-pipes 25 connected with the air-duct. The burners 19 and 24 are arranged to meet at a common point or focus where the glass tube is stopped for the purpose of flaring. On account of the uneven distribution of the weight of the parts supported on the post 10 we secure a rod 26 to the under side of the burner-support 11, extending downward through an opening in a lug 27 on the post 10 and around this rod and between the lug and the support is a coiled extension spring 28. With this construction the two sets of burners can be adjusted vertically by turning the hand-wheel 16 on the shaft of cam 14 to adapt the machine for the manufacture of stems of different lengths. The supply of gas and air is controlled by a valve 29 on the under side of the table to which the pipes 17 and 18 are connected, as will be hereinafter more fully explained.

On the center post 2 is a sleeve 30 driven by a belt and pulley from any suitable source of power. On this sleeve is a gear 31 driving a chain 32 kept tight by the spring 33 and idler 34, which chain and gear communicate rotary motion to a plurality of heads, six in the machine shown in the drawings, which support the glass tubes. These heads are carried on the arms of a spider 35 which is rotated by hand on the center post 2. In each head is a sleeve adapted to be connected with the chain-driven gear 36 by a clutch operated by a lever 37 and at its upper end this sleeve carries two vertical rods 38 38. On the upper ends of these rods is mounted a clamp 39 in which the tube is held with its lower end resting on the apex of a perforated ridge 40 on an arm 41 secured to one of the rods 38. Within the sleeve is a vertically adjustable anchor-rod 42 having a central bore in its upper end in which the anchor wire is inserted and by which it is supported in place with its end extending upward through the perforation in arm 41 and ridge 40 and into the end of the tube. On each of the rotary heads is a stop 43 which coöperates with the spring-arm 44 on a standard 45 to arrest the movement of the spider 35 in the successive positions. These stops 43 are extended downward to form finger pieces 46 by which the spider and the parts carried thereby are rotated intermittently by hand.

Mounted on the base are the stops 47, 48, 49 and 50, each having a cam surface on which the levers 37 ride to operate the clutches and disconnect the heads from the chain-driven gears 36. The stop 47 arrests the rotary motion of the head in the position next after that in which the stem was operated on by the pinching device. This stop is stationary and is so positioned on the base that it brings the rotary head to a stop in a position convenient for the operator to remove the completed stem and insert a new tube in clamp 39 and a new anchor-wire in the anchor-rod 42. In the next position, the rotary motion of the head is not arrested; the tube rotates with its upper end in a gas flame supplied by a Bunsen burner 51 fed by a gas-pipe 52. In Fig. 1 of the drawings the lower part of this head is broken away to show the position of the cam and clutch of the head which is directly back of it. In the next position, the rotation of the head is arrested by stop 48 for the purpose of flaring. In this position it is not desired to stop the rotation of the head until the glass is brought to the proper degree of softness by the blow-pipe flames 19 and 24; hence, stop 48 is made adjustable vertically, its normal position being below the level of lever 37. When the upper end of the tube has been properly softened, the operator raises the stop 48 by pressing on pedal 53 to which stop 48 is connected by rod 54, arm 55, shaft 56, and slotted arm 103, as shown in Fig. 3. The shaft 56 is mounted in bearings on the under side of the table and carries the movable member of the valve 29 to which gas and air supply pipes are connected and from which pipes 17 and 18 lead to the burners 19 and 24. By this construction when the end of the glass tube has been properly heated by the burners 19 and 24, the operator presses pedal 53, thus raising stop 48 into the path of lever 37 and arresting the rotary motion of the head, and cutting down the supply of air and gas to the burners 19 and 24. The glass tube is then in readiness for flaring. Mounted on the table 1 is a hollow post 57 having at its upper end a lateral arm 58 in which is a bearing for an adjustable rotary head 59 carrying the flaring tool 60. The head 59 is driven by a belt 61 and pulley 62 from any suitable source of power and being splined in a sleeve at the end of arm 58, may be driven by the belt in any of its positions of adjustment. This adjustment is accomplished by a lever 63 fulcrumed in a standard on the arm 58 and having one end swiveled to the head 59 and the other end connected to a rod 64 extending down through the post 57 and table 1 and connected by a lever 65 with a shaft 66, to which an operating handle 67 is secured at a convenient point. By this construction depressing the handle 67 brings the flaring tool 60 down into the end of the glass tube spreading out its sides to form the desired enlargement or flare.

In the next position the rotation of the head is arrested by the stop 49 which like stop 47 is stationary and is so positioned that it brings the head to rest in a position convenient for the operator to insert the leading-in wires in the flare with their ends on opposite sides of ridge 40 and to true up the anchor-wire. On movement to the next position, the glass tube rotates in the flame of a Bunsen burner 68 where the lower end of the glass tube is heated preparatory to sealing the end of the tube about the wires. After being preliminarily heated by the burner 68 the next movement of the spider brings the flare to the focal point of the burners 5 and 8 and under the pinching device. This latter is carried by a standard 69 on the table 1 having an arm at its upper end in which are bearings for a sleeve 70 to the end of which one arm 101 of the pincers is secured.

Within sleeve 70 is a shaft 71 to the end of which the other pincer arm 100 is secured, as shown in the drawings. A laterally-extending arm 95 is secured to the outer end of the sleeve 70 and a similar arm 96 to the outer end of shaft 71 and both of these arms are connected by links to a rod 72, forming a lever system such that when rod 72 is lowered the shaft and sleeve

are rotated in opposite directions and the pincer arms drawn together and when rod 72 is raised the reverse movement occurs and the arms are separated to the position shown in Fig. 1. When the head is first moved to this position under the pinching device, it is not desired to stop its rotation as the end of the glass flare is not yet soft; hence stop 50, which coöperates with the lever 37 of the heads when under the pinching device, is adjustable vertically, its normal position being below the path of movement of lever 37. When the lower end of the glass tube has been properly softened by the blow-pipe burners 5 and 8, the stop 50 is raised so that the end of lever 37 rides on the cam surface disconnecting the clutch and arresting the rotation of the head in a position convenient for sealing. The rod 72 is then drawn down causing the pincer arms to press the walls of glass together about the wires. The mechanism for doing this will now be described.

Below the table in suitable bearings is a shaft 73 driven by a belt and pulley from a suitable source of power. Keyed to shaft 73 is a wheel 74 and loosely mounted on the shaft is a sleeve 75 on which is keyed a wheel 78 and a rotary circuit-breaker 76, the latter being a disk of conducting material having an insulating segment 77 in its periphery. The wheel 78 is mounted on the sleeve 75 in close proximity to wheel 74 on shaft 73 and is provided with an opening parallel to its axis in which a pin 79 slides. This pin 79 is pressed by a spring to enter one of a number of openings in the face of wheel 74 and causes sleeve 75 to rotate with shaft 73. Mounted in proximity to the parts just described is an electromagnet 80 having a spring-retracted armature 81 secured to a rod 102 which is mounted in suitable bearings 104. Also secured to rod 102 is a finger 82 which extends into engagement with the head of the clutch pin 79 and governs the engagement of the pin with the wheel 74. For this purpose finger 82 is provided with an inclined side on which the head of the pin rides and by which the pin is drawn from engagement with wheel 74 against the tension of its spring, and a hooked end which holds the head of the pin at the end of this movement. Bearing on the periphery of the rotary circuit-breaker 76 are three brushes 83, 84 and 85 and mounted eccentrically on the face of the breaker is a pin to which the pincer-operating rod 72 is pivotally connected.

In a position convenient for the operator is a spring-retracted pedal 86 carrying a contact 87 adapted to engage a stationary contact 97 and close a circuit from the positive main 88 of any source of electric supply through a pair of electromagnets 89 to brush 84 from which the return to the negative main 90 is made over the conducting segment of the circuit-breaker 76 and brush 85 which is connected to the negative main as shown. The armature 98 of the magnets 89 is secured to a pivoted arm 91 carrying a conducting piece 99 adapted to bridge the stationary contacts 92, when arm 91 is drawn down by the magnets, to close a circuit around contacts 87 and 97 so that when pedal 86 is pressed down by the operator the magnets 89 are energized and are not disconnected from the circuit until the proper time even if pedal 86 is released immediately. The movable end of arm 91 is connected by a rod and lever to the stop 50, as shown in Fig. 3, and when arm 91 is drawn down by the magnets 89 the stop 50 is raised into the path of clutch lever 37 to stop the rotation of the head.

Extending through an opening in the cam surface of stop 50 is a spring finger 93 connected to the positive main 88 and adapted to be pressed by the lever 37 into engagement with an insulated contact 94 on stop 50 to close circuit from the positive main to magnets 80 which are connected to brush 83 bearing on the circuit-breaker. Thus, when the operator in charge of the sealing decides that the lower end of the glass flare has been brought to the proper degree of softness by the burners 5 and 8, she presses pedal 86 closing circuit from main 88 through magnets 89 to brush 84, circuit-breaker 76 and brush 85 to main 90, drawing down arm 91 attached to the magnet armature and maintaining the circuit closed even though pedal 86 is releasd by bridging the contacts 92 connected in shunt around contacts 87 and 97. The movement of arm 91 raises stop 50, and clutch lever 37 of the head rides on the cam surface, stopping the rotation of the head and pressing finger 93 into engagement with contact 94. This closes circuit from main 88 through magnets 80 to brush 83 through circuit-breaker 76 to brush 85 and back to main 90. Magnets 80 being energized rock the armature 81 and its pivoted support, raising finger 82 until the hooked end of the finger releases the head of pin 79. The pin is then pressed by its spring into the opening in the face of wheel 74 clutching wheel 78 to wheel 74 and causing sleeve 75 and circuit-breaker 76 to rotate with shaft 73 in the direction of the arrow. The rotation of circuit-breaker 76 draws rod 72 down bringing the pincer arms together and pressing the glass walls at the end of the flare in around the leading-in and anchor-wires. After a half revolution of circuit-breaker 76 further movement raises rod 72 and opens the pincer arms. Near the beginning of this upward movement, insulating segment 77 of circuit-breaker 76 comes under brush 83 breaking circuit through magnets 80. Armature 81 being released is retracted by its spring and finger 82 is returned to its normal position. On further movement, the insulating segment 77 comes under brush 84 and circuit through magnets 89 is broken, arm 91 is released and is retracted by its spring, and stop 50 is lowered to its normal position below the path of movement of lever 37. When the circuit-breaker has made almost a complete revolution the head of pin 79 comes up against the inclined side of finger 82 and by riding up the incline is drawn out of engagement with wheel 74 whereby the sleeve 75 and the parts carried thereby come to rest in their original position after having made one complete revolution. Near the end of the revolution, but after all circuits have been opened at the various contacts, the insulating segment 77 passes out from under the last brush 85 so that the parts are in readiness for effecting another seal.

The operation of the machine will be plain from the foregoing description. Two operators are necessary, one on either side of the table, the first operating the pinching device on each flare as it is brought around by the spider when the glass has been properly heated, removing the completed stem from the head in advance of that under the pincers, substituting for it a new tube and a new anchor-wire and then pushing the spider around to the next position where it is held by

the spring arm 44 and one of the stops 43; during this time the assistant operates the flaring mechanism on the tube that is under the flaring tool, inserts the leading-in wires in the flare on the head in advance of the one under the flaring device and raises the anchor-rod until the anchor-wire is in the proper position. Each tube is carried before the burner 51 where its upper end is preliminarily heated, then before the vertically adjustable blow-pipe flames 19 and 24, and when the glass is softened the assistant operator presses pedal 53 thereby raising stop 48, which arrests the rotation of the head, and cutting down the blow-pipe flames. Then by operating the handle 67, the rapidly-revolving flaring tool is brought down upon the soft glass walls spreading them out to form a flare. After all the wires have been properly positioned the flare comes before the burner 68 where its lower end is heated after which it is brought before the blow-pipe flames 5 and 8. When the lower end is softened, the principal operator presses pedal 86 which, by closing circuit through magnets 89, raises stop 50 to arrest the rotation of the head under the pincers. In stopping, the lever 37 on this head closes circuit through magnets 80 which by attracting their armature release pin 79. This pin locks wheel 78 in engagement with wheel 74 causing the circuit-breaker 76 to make one revolution, thus drawing rod 72 down and operating the pincers to make the seal. On the completion of such revolution, rod 72 is raised and insulating segment 77 on the circuit-breaker opens all circuits. The finger 82 falls to its original position when magnet 80 is deënergized and pin 79 is drawn from engagement with wheel 74 by its head riding up the incline on the side of finger 82. At the end of the revolution, the head of the pin is held by the hook in the end of finger 82 and further movement is impossible, but the insulating segment 77 has passed from under the brushes so that all parts are in readiness for the next operation.

The rod 72 may be in two parts connected by a tightening link to make its length adjustable, so that the thickness of the seal about the wires can be regulated as desired. As the pincer arms are automatically operated, they remain closed about the glass the same length of time in every case and the seals are all uniform. The use of the Bunsen burners for the preliminary heating results in a great saving of time, as it is not necessary to leave the tubes in the blow-pipe flames so long before they are ready for the flaring or sealing. As a greater length of the tube must be softened for flaring than for sealing, we prefer to use a greater number of blow-pipe burners in preparing the tubes for flaring than in preparing the flares for sealing.

In practice, we find that if twelve burners are employed at the flaring position and six at the sealing position, the time required for softening the glass will be just sufficient to permit the operators to attend to their other duties. Thus, the two operators are kept busy continuously and as their duties are simple and easily learned, unskilled labor may be employed to operate the machine at small cost.

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

1. A stem-making machine comprising a support for the glass flare and the wires to be sealed in, a heater for softening the glass, pincers opening in a vertical plane supported above the flare for pressing the glass walls together to form a seal, and electrically-operated means for closing and opening said pincers.

2. A stem-making machine comprising a support for the stem parts, means for rotating the support, a heater for softening the glass, pincers for pressing the glass walls together to form a seal, operating mechanism for said pincers, and means controlled by the operator for simultaneously arresting the rotary motion of the support and throwing said operating mechanism into action.

3. A stem-making machine comprising a support for the stem parts, a heater for softening the glass, a pinching device for effecting the seal, electrically-operated mechanism for said device, an electric circuit for said operating mechanism, a contacting means for controlling said circuit, and means whereby when said circuit is closed it remains so for a definite period of time.

4. In a stem-making machine, a support for the stem-parts, a heater for softening the glass, a pinching device for effecting a seal, means controlled by the operator for closing a circuit whereby said pinching device is operated, and means whereby said circuit is automatically opened when the seal has been effected.

5. In a stem-making machine, a support for the stem-parts, a pinching device for effecting a seal, operating mechanism for said pinching device, an electro-magnetic releasing device for said mechanism, means controlled by the operator for closing circuit through said electromagnetic device, and means whereby said circuit remains closed until after the seal has been effected.

6. In a stem-making machine, a squeezing device for effecting a seal, comprising two shafts, a pincer arm carried by each shaft, an operating arm secured to each shaft, a rod linked to said operating arms and connected eccentrically to a rotatable member, and means controlled by the operator for causing said member to make one revolution.

7. In a stem-making machine, a squeezing device for effecting a seal, comprising two concentric shafts, a pincer arm carried by each shaft, an operating arm secured to each shaft, an operating rod linked to said operating arms, and means for reciprocating said rod to close and open the pincer arms.

8. A stem-making machine comprising a tube support, means for directing flames on the ends of a tube held in the support to soften the glass, a flaring tool in operative relation to one end of a tube held in said support, and a squeezing device in operative relation to the other end of the tube.

9. A stem-making machine comprising a tube support, blow-pipe burners for heating the ends of a tube in said support, a flaring tool in operative relation to one end of a tube held in said support, driving mechanism for said tool, a squeezing device in operative relation to the other end of the tube, and means for operating said device.

10. A stem-making machine comprising a rotatable frame, a plurality of tube-supports carried thereby, means for arresting the frame at definite positions, heaters for softening the ends of the tubes held in said supports, a flaring tool in operative relation to one end of a tube in one of said supports when the frame is arrested, and a squeezing device in operative relation to the other end of a tube in one of said supports when the frame is arrested.

11. In a stem-making machine, a rotary support for a glass tube, driving mechanism therefor, a rotary tool, in co-operative relation to said tube, means controlled by the operator for disconnecting the support from its driving mechanism, and means also controlled by the operator for adjusting the tube and tool relatively to each other.

12. A stem-making machine comprising a rotatable frame, a plurality of tube-supports carried thereby at different angular positions, means for imparting rotary motion to said supports, means for directing a plurality of blow-pipe flames on a tube when the support which carries it is in a definite position, and means controlled by the operator for arresting the rotary motion of said support and simultaneously cutting down the blow-pipe flames.

13. A stem-making machine comprising a rotatable

frame carrying a plurality of rotary tube-supports at different angular positions, means for arresting the frame at definite positions, a heater for softening the glass, a flaring tool in alinement with one of the supports when the frame is arrested, and means for adjusting the tool and support relatively to each other.

14. A stem-making machine comprising a rotatable frame, a plurality of tube-supports carried thereby, means for arresting the frame at definite positions, heaters for softening the tubes, a flaring tool in alinement with one of the supports when the frame is arrested, means for adjusting the tube and support relatively to each other, a pinching device in alinement with another support, and means for operating said pinching device to squeeze the walls of the tube together.

15. A stem-making machine comprising a rotatable frame, a plurality of tube-supports carried thereby, mechanism for rotating said supports, a set of burners for directing flames on one end of the tubes held in said supports, and a set of burners for directing flames on the other end of the tubes, the position of one of said sets being adjustable to adapt the machine for making stems of different sizes.

16. A stem-making machine comprising a rotatable frame, a plurality of tube-supports carried thereby at different angular positions, means for arresting the frame at definite positions, a heater for softening each glass tube when its support is in a definite position, a rotary flaring tool in alinement with the tube when in this position, a heater for softening each glass tube when its support is in another position, a pinching device in operative relation to the tube when its support is in this position, and burners for heating the tubes preliminarily before they are brought by the frame to the two named positions.

In witness whereof we have hereunto set our hands this sixteenth day of September 1903.

JOHN W. HOWELL.
WILLIAM R. BURROWS.

Witnesses:
JOHN E. MITCHELL, Jr.,
MONTGOMERY MAYNARD.