L. E. MITCHELL AND A. J. WHITE.

STEM MAKING MACHINE.

APPLICATION FILED JUNE 24, 1920.

1,423,957. **Patented July 25, 1922.**

2 SHEETS—SHEET 1.

Fig. 1.

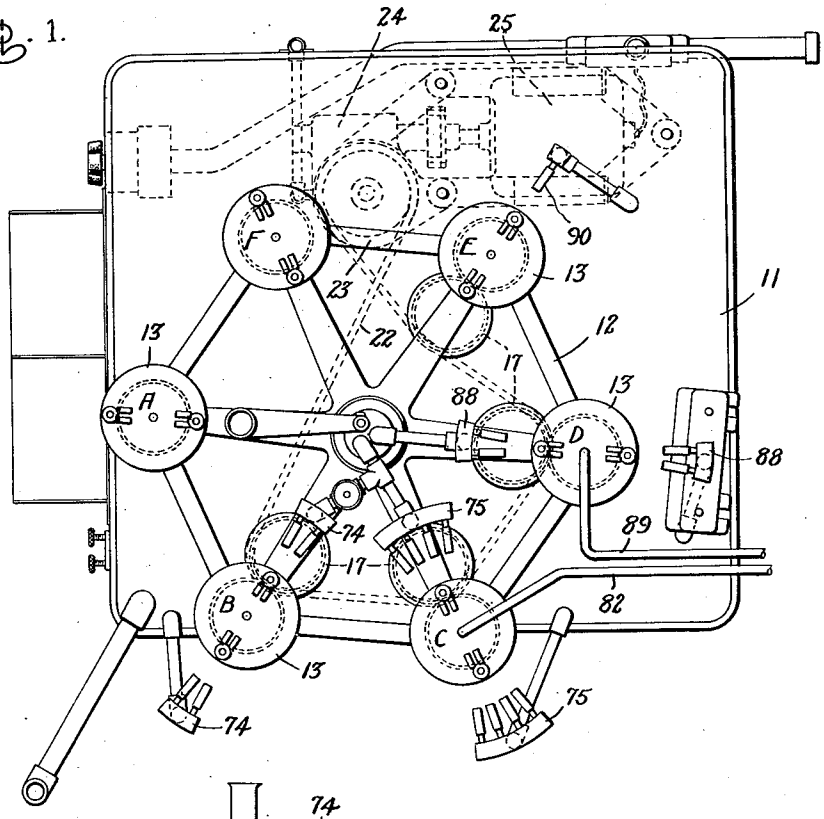
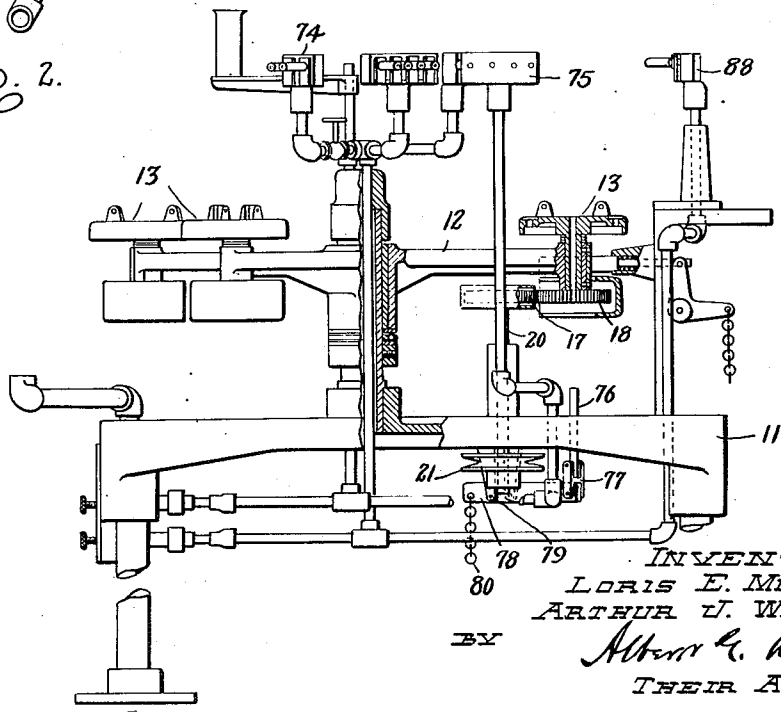


Fig. 2.



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THEIR ATTORNEY.

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2 SHEETS—SHEET 2.

Fig. 3.

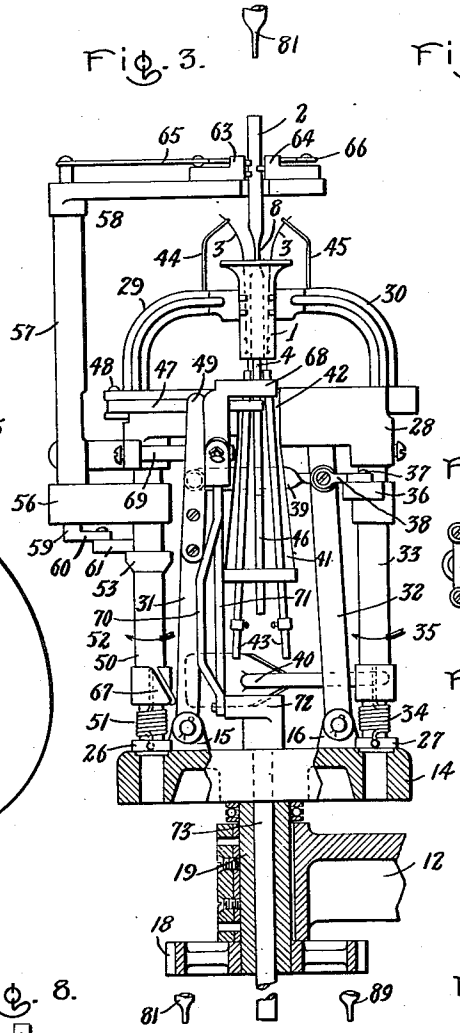


Fig. 13.

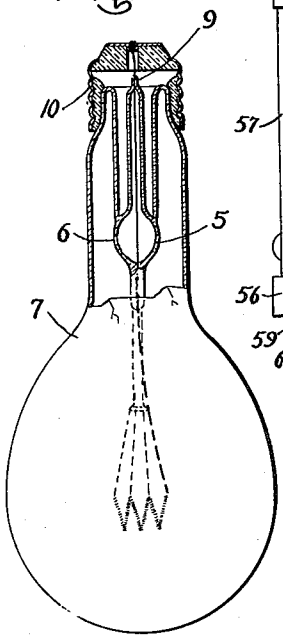


Fig. 6.

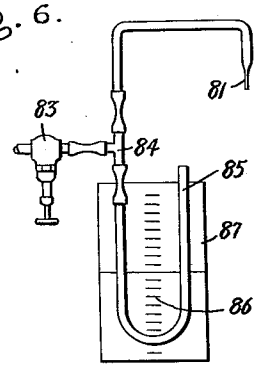


Fig. 5.

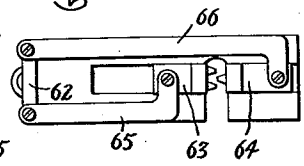


Fig. 4.

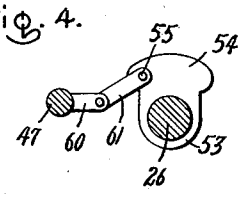


Fig. 7.

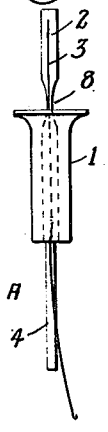


Fig. 8.

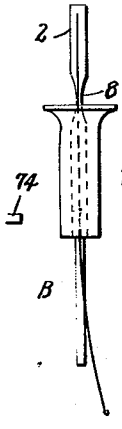


Fig. 9.

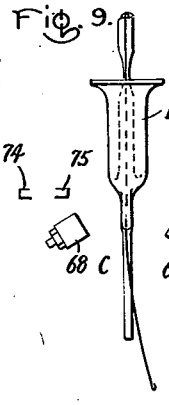


Fig. 10.

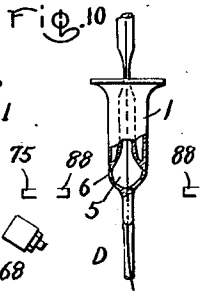


Fig. 11.

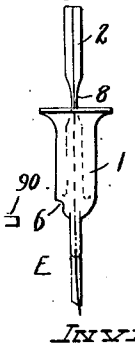
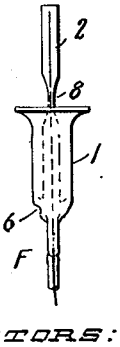


Fig. 12.



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UNITED STATES PATENT OFFICE.

LORIS EDWIN MITCHELL AND ARTHUR JAMES WHITE, OF CLEVELAND, OHIO, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

STEM-MAKING MACHINE.

1,423,957. Specification of Letters Patent. Patented July 25, 1922.

Original application filed March 20, 1919, Serial No. 283,801. Divided and this application filed June 24, 1920. Serial No. 391,503.

To all whom it may concern:

Be it known that we, LORIS EDWIN MITCHELL and ARTHUR JAMES WHITE, citizens of the United States, residing at Cleveland, in the county of Cuyahoga, State of Ohio, have invented certain new and useful Improvements in Stem-Making Machines, of which the following is a specification.

Our invention relates to so-called tipless incandescent lamps and, more particularly, to apparatus for manufacturing the same. This application is a division of our application, Serial Number 283,801, filed March 20, 1919, in which we have described a tipless incandescent lamp and a method and apparatus for its manufacture.

According to the invention disclosed in our aforesaid application, the exhaust tube is joined to the stem tube at the inner end thereof. We use the expression "inner end" with reference to the stem to indicate that end of the said tube to which the filament support is attached and in which the leading-in wires are sealed, while the expression "outer end" is used to indicate the end which is united to the bulb. The corresponding ends of the exhaust tube are similarly designated. The aperture or passage through which the exhaust tube communicates with the interior of the bulb is preferably lateral or transverse with reference to the stem tube and thus allows the mounting of a filament supporting rod which may be of cane glass at the top of the stem. Such passage is preferably formed by applying air pressure to the mass of fused glass which is formed around the inner end of the exhaust tube during the operation of sealing-in the leading-in wires. The customary method of sealing in these leading-in wires is to extend them through the stem tube, to fuse the inner end of the stem tube and to compress by clamping the fused glass around the said wires. This results in a flat, solid mass of glass at the inner end of the stem tube. When this method is applied in connection with our invention, the inner end of the exhaust tube is fused at the same time as the inner end of stem tube and is clamped with the latter. Air pressure is applied through the exhaust tube and, preferably, additional heat is supplied to thoroughly fuse the glass around the inner end of the exhaust tube, and this causes the mass of glass to swell and become bulb-shaped. As the air pressure is continued, a passage is blown through the glass at the point of least resistance, which passage is usually at an angle to the flat surface of the clamp portion and usually substantially normal thereto. Inasmuch as the plane of the leading-in wires is in the direction of the flat surface, the passage is formed between them and does not interfere with their seal.

A notable result of our method is the elimination of strains in the glass adjacent to the exhaust tube union. This is due to the distribution of the glass by the blowing operation and also the completeness of the union between the exhaust tube and the stem tube. Our method results in a very low percentage of cracked seals and is commercially reliable.

In certain cases, it may be desirable to supply air pressure through the exhaust tube during the fusing and clamping operation so as to prevent, to a certain extent, the collapse of the walls of the exhaust tube. This will cause the passage to be later blown at a point closer than otherwise to the inner end of the seal. In most cases, however, this supplemental blowing operation is unnecessary.

The pressure of the air supplied through the exhaust tube should be sufficiently low to prevent too quick a blow out and to allow a gradual spreading of the glass to form a bulb-shaped thin-walled rather than a narrow thick-walled orifice or passage. The amount of pressure is a matter which can be determined by trial. It was found in certain cases that when too great a pressure was applied, a narrow passage and small aperture resulted probably due to imperfect fusion of the glass. We have hereinafter set forth specifically a pressure which we have found suitable for stems to be used in 75-watt lamps and also a convenient means for gauging this pressure.

Various other advantages and features of our invention will appear from the detailed description which follows and from a reference to the accompanying drawing.

Fig. 1 is a top plan view of a machine em-

bodying our invention; Fig. 2 is a side elevation of the same partially in section; Fig. 3 is a front elevation of the rotating head which serves to hold the stem parts; Figs. 4 and 5 are sectional views of details thereof; Fig. 6 is a diagram showing means for gauging pressure; Fig. 7 is an elevation showing the way in which the parts of the stem are preliminarily assembled in position A on the machine; Fig. 8 shows the heating operation in position B; Fig. 9 shows the heating and clamping operation in position C; Fig. 10 shows the aperture forming operation in position D; Fig. 11 shows the annealing operation in position E; Fig. 12 is a front elevation of the finished stem as it is removed from the cooling operation of position F; and Fig. 13 is an elevation partially in section of a lamp made according to our invention.

We will first describe the construction and method of manufacture of our tipless lamp as set forth in our application heretofore referred to. Referring to Figs. 3 and 7 of the drawing, the stem tube 1, exhaust tube 2, and the leading-in wires 3 are assembled as shown with the exhaust tube between the leading-in wires and the inner end thereof substantially in line with the inner end of the stem tube. In types of lamps requiring a filament support rod the latter is included as shown at 4, with its end substantially abutting against the end of the exhaust tube so as to allow all these parts to be fused together. The application of a flame results in the formation of a mass of fused glass and this glass is compressed in a direction substantially normal to that of the plane of the leading-in wires. During this fusing and clamping operation, it may be desirable to introduce air pressure through the exhaust tube 2 to overcome, to a certain extent, the tendency of the walls to collapse. In any event, air pressure is introduced after the clamping operation and it is preferable to preliminarily and simultaneously apply heat adjacent to the clamped portion. This results in a formation of the stem such as shown in Figs. 12 and 13 in which the end of the exhaust tube 2 merges into that of the stem tube 1 and in which a substantially bulb-shaped portion 5 is formed communicating by a passage or aperture 6 with the interior of the lamp bulb. After the formation of the stem, as shown in Fig. 12, it may be introduced in the usual manner into a lamp bulb 7 and the bulb exhausted according to the usual practice, being sealed off after the exhaust at the contraction 8. The exhaust may be accomplished in any of the ordinary machines which are used in lamp factories for this purpose. Afterwards, the lamp may be based and otherwise handled in the usual manner. As shown in Fig. 13, the bulb 7 is tipless, the seal 9 being in the exhaust tube 2 and being covered by the base 10.

The present application has to do, more particularly, with the apparatus by means of which the above described method may be practiced and a specific form thereof is shown in the accompanying drawing. The machine illustrated is of the general type disclosed in Patents No. 843,750—Feb. 12, 1907—Howell and Burrows and No. 860,977—July 23, 1907—Howell and Burrows. On the bed 11 is mounted a rotatable frame 12 which carries several rotatable heads 13. In the machine shown, there are six heads and the position of each represents a separate step in the stem-making operation.

As shown in detail in Fig. 3, each rotatable head 13 consists of a base 14 with the pivot projections 15 and 16. The head is rotated in positions B, C, D and E by power transmitted by the similar gears 17 (see Fig. 1) to the gear 18 (see Fig. 3) fastened to the base 14 through the tubular shaft 19, which is held in the rotatable table 12. The gears 17 are similarly carried on shafts 20 (see Fig. 2) which are supported in the bed 11 and which have pulleys 21 attached to their lower end over which runs the belt 22 (Fig. 1) driven by the pulley 23 connected through the speed-reducing gearing 24 to the motor 25.

Upon the base 14 are mounted the supporting rods 26 and 27 (Fig. 3) which carry on their top the guide bed 28 in which is slidably held the clamping jaws 29 and 30 which are connected by links 31 and 32 respectively to the pivot projections 15 and 16 respectively. A sleeve 33 mounted on the supporting rod 27 has a spring 34, between its lower end and the base 14, which acts to turn the sleeve in the direction indicated by the arrow 35. At the upper end of the sleeve 33 is a T-shaped collar 36 having a pin on each wing. As shown in the drawing, the pin 37 on the front wing of the collar is connected to the link 32 by a short link 38. The pin on the back wing of the collar is connected to the link 31 by the long link 39. A handle 40 attached to the lower end of the sleeve 33 permits a turning movement to be applied to the sleeve in the direction opposite to that of the arrow 35 which acts through the collar 36 to actuate links 38 and 32 on the one hand and 39 and 31 on the other to cause clamping jaws 30 and 29, respectively, to be separated to permit the insertion of the stem tube.

A plate 41 carried by the guide bed 28 in a wide vertical slot 42 in the center of the guide bed, supports the metal tubes 43 which hold the lower ends of the leading-in wires 3 so as to be in proper position for making the seal. The upper ends of the leading-in wires 3 are held in supports 44 and 45 mounted respectively on the clamping

jaws 29 and 30. The plate 41 also carries a vertical rod 46 which serves to support the filament support rod 4 which is retained in the space between the tubes 43 by a finger 47 pivoted at 48 in the clamping jaw 29 and held against the filament support rod by a spring clip 49 fastened to the vertical link 31.

The supporting rod 26 carries a sleeve 50 resting on the spring 51 tending to turn the sleeve in the direction indicated by the arrow 52. At the upper end of the sleeve is a collar 53 having an arm 54 (Fig. 4) upon which is mounted the pin 55. Above the collar 53 and fastened to the rod 26 is an arm 56 (Fig. 3) carrying the vertical supporting tube 57 which carries the horizontal arm 58. Extending through the tube 57 is a rod 59 having an arm 60 at its lower end which is connected to the arm 54 through the link 61 (see also Fig. 4). To the upper end of the rod (see Fig. 5) is attached a cross-bar 62 which is linked at opposite ends with the slidable clamp jaws 63 and 64 through the links 65 and 66 respectively. A turning movement applied to the handle 67 (Fig. 3) of the sleeve 50 in the direction opposite to the arrow 52, through the mechanism just described, causes the jaws 63 and 64 (see Fig. 5) to be separated to permit the insertion of the exhaust tube 2.

The glass seal is accomplished by the two clamps 68 (Fig. 3) (only one of which is shown) pivoted on the pin 69 attached to guide bed 28 and connected through the links 70 and 71 to the collar 72 on the rod 73 which is given an upward motion at the proper point in the rotation of table 12 sufficient to cause the clamps to close upon the fused glass, as hereinafter described.

The assembly of stem parts takes place at position A (Figs. 1, 3 and 7) the rotatable head 13 not being driven in this position. To begin with, the filament support rod 4 is placed in position; the stem tube 1 is placed between the clamping jaws 29 and 30 with its lower edge preferably in line with the top of the rod 4; the two leading-in wires 3 are extended through the stem tube and into the tubes 43 and the exhaust tube 2 is inserted into the stem tube with its lower end preferably in line with the rod 4 and held by the clamping jaws 63 and 64. At B, the gas jets 74 (Figs. 1 and 8) give a preliminary heat to the juxtaposed parts of the stem, while the head 13 is rotated. At C, while the head 13 is rotated, the gas jets 75 (Figs. 1 and 9) fuse these parts and the fused glass is compressed to form a solid flat union by the clamps 68 (Fig. 3) which are closed by an upward movement imparted to the rod 73 by the rod 76 (Fig. 2) vertically supported in the bed 11 with its lower end connected through a link 77 with the crank 78 pivoted in an arm 79 on the lower side of the bed 11 and in turn connected through a chain 80 with a foot pedal not shown.

While in the position C, we preferably direct air under low pressure from the nozzle 81 (Figs. 3 and 9) attached to the pipe 82 (Fig. 1) into exhaust tube 2, the nozzle 81 being a short distance above the exhaust tube 2 and centered therewith as shown in Fig. 3. This is for the purpose of lessening the tendency of the walls of the exhaust tube to collapse.

Fig. 6 shows in diagram, the means we use for regulating the pressure of the air leaving the nozzle 81. For a nozzle, we preferably use one having a contraction as shown and having the smaller orifice drilled by a number 54 drill. The valve 83 controls the compressed air supply and is attached through a T-shaped connection 84 to the nozzle 81 and to the U-shaped glass tube 85 which is filled with water. A scale 86 is laid out on a cardboard 87 rigidly attached to the tube 85. When the valve 83 is opened the difference in the height of the water in the two arms of the tube 85 is an indication of the pressure of air leaving the nozzle 81.

The head 13 then passes to the position D (Figs. 1 and 10) where it is rotated while the gas jets 88 extend the zone of fusion upwardly to a slight extent. At the same time, low pressure air from a nozzle on pipe 89 (Fig. 1) positioned similarly to nozzle 81, enters the tube 2 and produces the bulb portion 5. At this point we preferably use a pressure of air sufficient to cause a difference in height of the water in the arms of the tube 85 equal to approximately 12 to 16 inches. As the bulb portion enlarges, the wall thereof becomes so thin as to blow out. The aperture 6 thereby produced may occur on either side of the bulb-portion 5 as the latter is shown in Fig. 13 but is prevented from occurring elsewhere by the presence of the leading-in wires 3 which cool and prevent the glass immediately adjacent thereto from being blown thin. As soon as the aperture 6 is formed, the head 13 is brought into position E (Figs. 1 and 11) where the gas jet 90 glazes the edges of the said aperture and anneals the glass of this portion of the stem. However, the head 13 may remain at position D for annealing. Position F (Figs. 1 and 12) is a cooling position and the stem as shown in Fig. 12 is removed from the head in position A and is replaced by a new assembly of stem parts.

The stem thus produced is then subjected to the usual lamp making operations including the insertion of the filament support hooks, the drawing of the filament and the final insertion of the mount in the bulb, the neck of the bulb being fused to the flange on the stem. The exhaust of the bulb or the filling thereof with gas may then be

accomplished in the usual manner. Upon the completion of this operation, the exhaust tube is fused at the contraction 8 (see Fig. 13) forming the closure 9 which effectually seals the bulb. The attachment of the base 10 and the connection thereto of the leading-in wires is accomplished according to well-established practice.

While we have shown a specific embodiment of our invention, we do not wish to be limited thereto as various modifications will readily suggest themselves to those skilled in the art.

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

1. In a machine for making parts for lamps and similar articles, the combination of means for supporting a stem tube, means for supporting an exhaust tube within said stem tube, means for fusing together a portion of said exhaust tube and of said stem tube adjacent to their inner ends, and means for directing a flow of gas into said exhaust tube to expand and form an aperture in the mass of glass formed by said fusion.

2. In a machine for making parts for lamps and similar articles, the combination of means for supporting a stem tube, means for supporting an exhaust tube within said stem tube, means for supporting a glass rod with an end thereof aligned with the inner ends of said stem tube and said exhaust tube, means for fusing together said parts at said aligned ends, and means for directing a flow of gas into said exhaust tube to expand and form an aperture in the mass of glass formed by said fusion.

3. In a machine for making parts for lamps and similar articles, the combination of means for supporting a stem tube, means for supporting an exhaust tube within said stem tube, means for fusing together a portion of said exhaust tube and of said stem tube adjacent to their inner ends, means for clamping said fused portion, means for fusing said exhaust tube and stem tube adjacent to said clamped portion, and means for directing a flow of gas into said exhaust tube to expand and form an aperture in said fused portion.

4. In a machine for making parts for lamps and similar articles, the combination of means for supporting a stem tube, means for supporting an exhaust tube within said stem tube, means for supporting a glass rod with an end thereof aligned with the inner ends of said stem tube and said exhaust tube, means for fusing together said parts at said aligned ends, means for clamping said fused portion, means for fusing said exhaust tube and said stem tube adjacent to said clamped portion, and means for directing a flow of gas into said exhaust tube to expand and form an aperture in said fused portion.

5. In a machine for making parts for lamps and similar articles, the combination of means for supporting a stem tube, means for supporting an exhaust tube within said stem tube, means for supporting leading-in wires between said exhaust tube and said stem tube, means for supporting a glass rod with an end thereof aligned with the ends of said stem tube and said exhaust tube, means for fusing said parts at said aligned ends, means for clamping the fused mass thus produced to form a seal about said leading-in wires, means for fusing said tubes adjacent to said seal, means for directing a flow of gas into the open end of said exhaust tube to expand and form an aperture in said fused portion.

6. The combination in a glass working machine of means for supporting a stem tube, means for supporting an exhaust tube within said stem tube, means for supporting leading-in wires between said exhaust tube and said stem tube and means for supporting a glass rod with an end thereof aligned with the ends of said stem tube and said exhaust tube.

7. In a machine for making parts for lamps and similar articles, the combination of a rotatable carrier, a head thereon for supporting tipless stem parts comprising means for supporting a stem tube, means for supporting an exhaust tube within said stem tube, means for supporting leading-in wires between said exhaust tube and said stem tube and means for supporting a glass rod with an end thereof aligned with the ends of said stem tube and said exhaust tube, means for fusing said parts at their aligned ends, means for clamping the fused mass thus produced to form a seal about said leading-in wires, means for fusing said tubes adjacent to said seal, and means for directing a flow of gas into the open end of said exhaust tube to expand and form an aperture in said fused portion.

8. In a machine for making parts for lamps and similar articles, the combination of a rotatable carrier, a rotatable head thereon for supporting tipless stem parts comprising means for supporting a stem tube, means for supporting an exhaust tube within said stem tube, means for supporting leading-in wires between said exhaust tube and said stem tube and means for supporting a glass rod with an end thereof aligned with the ends of said stem tube and said exhaust tube, means for rotating said head, means for fusing the aforesaid parts at their aligned ends, means for clamping the fused mass thus produced to form a seal about the leading-in wires, means for fusing said tubes adjacent to said seal, and means for directing a flow of gas into the open end

of said exhaust tube to expand and form an aperture in said fused portion.

9. In a machine for making parts for lamps and similar articles, the combination of a rotatable carrier, a head thereon for supporting a stem tube, an exhaust tube, and a glass support rod with their ends aligned and leading-in wires, means for fusing said parts at their aligned ends, means for clamping the fused mass thus produced to form a seal, means for fusing the stem thus produced adjacent to said seal, and means for directing a flow of gas into the open end of the exhaust tube to expand and form an aperture in said fused mass.

10. In a machine for making parts for lamps and similar articles, the combination of a rotatable carrier, a rotatable head thereon for supporting a stem tube, an exhaust tube, and a glass support rod with their ends aligned, and leading-in wires, means for rotating said head, means for fusing said parts at their aligned ends, means for clamping the fused mass thus produced to form a seal, means for fusing the stem thus produced adjacent to said seal, and means for directing a flow of gas into the open end of the exhaust tube to expand and form an aperture in said fused mass.

11. In a machine for making parts for lamps and similar articles, the combination of means for supporting a stem tube, means for supporting an exhaust tube within said stem tube, means for supporting leading-in wires between said exhaust tube and said stem tube, means for supporting a glass rod with an end thereof aligned with the ends of said stem tube and said exhaust tube, means for releasing the aforesaid supporting means for the insertion of the aforesaid stem parts or the removal of the completed stem, means for fusing said parts at their aligned ends, means for clamping the fused mass thus produced to form a seal about said leading-in wires, means for fusing said tubes adjacent to said seal, and means for directing a flow of gas into the open end of said exhaust tube to expand and form an aperture in said fused mass.

12. In a machine for making parts for lamps and similar articles, the combination of a rotatable carrier, means on said carrier for supporting in alignment tipless stem parts including a stem tube, an exhaust tube, leading-in wires and a glass support rod, means for fusing the adjacent ends of said stem parts, means for clamping the fused mass thus produced to form a seal, means for fusing said stem adjacent to said seal, and means for directing a flow of gas into the open end of said exhaust tube to expand and form an aperture in said fused mass.

13. In a machine for producing parts for incandescent electric lamps and similar devices comprising a filament or other conductor, the combination of means for producing a fused glass mass uniting an element furnishing support for said conductor and an exhaust tube and means for directing gas pressure into said exhaust tube to blow out an aperture in said fused glass mass.

14. In a machine for producing parts for incandescent electric lamps and similar devices comprising a filament or other conductor, the combination of means for supporting an element furnishing support for said conductor and an exhaust tube with their ends juxtaposed, means for producing a fused glass mass uniting said ends and means for directing gas pressure into said exhaust tube to blow out an aperture in said fused glass mass.

15. In a machine of the character described, the combination of means for supporting a glass stem tube and an exhaust tube with their ends juxtaposed, means for producing a fused glass mass uniting said ends, means for directing gas pressure into said exhaust tube to blow out an aperture in said fused glass mass and means whereby said last-named means is automatically brought into operation after the production of said fused mass.

16. In a machine of the character described, the combination of a movable carrier having thereon a head comprising means for supporting a stem tube and an exhaust tube with their ends juxtaposed, means automatically brought into operation for producing a fused glass mass uniting said juxtaposed ends and means disposed in the path of travel of said carrier and automatically brought into operation for directing gas pressure into said exhaust tube to blow out an aperture in said fused mass.

17. In a machine of the character described, the combination with a movable carrier having thereon a supporting means for an assembly of glass stem parts including a projecting exhaust tube and a blowing device comprising a nozzle disposed in the path of travel of said carrier and automatically brought into operation to direct gas pressure into said exhaust tube.

18. In a machine of the character described, the combination of supporting means for axially aligning an exhaust tube within a stem tube, means for thereafter fusing said parts together to form a fused mass uniting their juxtaposed inner ends and means automatically brought into operation to direct gas pressure into the outer end of said exhaust tube to blow out an aperture in said fused mass.

In witness whereof, we have hereunto set our hands this 21st day of June 1920.

LORIS EDWIN MITCHELL.
ARTHUR JAMES WHITE.