Feb. 23, 1932. G. COBY ET AL 1,846,025

STEM MAKING MACHINE

Filed Dec. 11, 1925 2 Sheets-Sheet 1

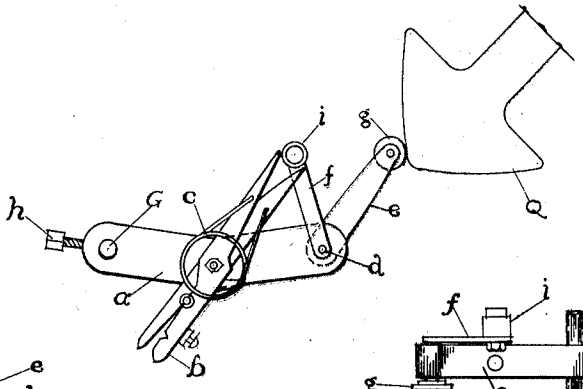

Fig. 3

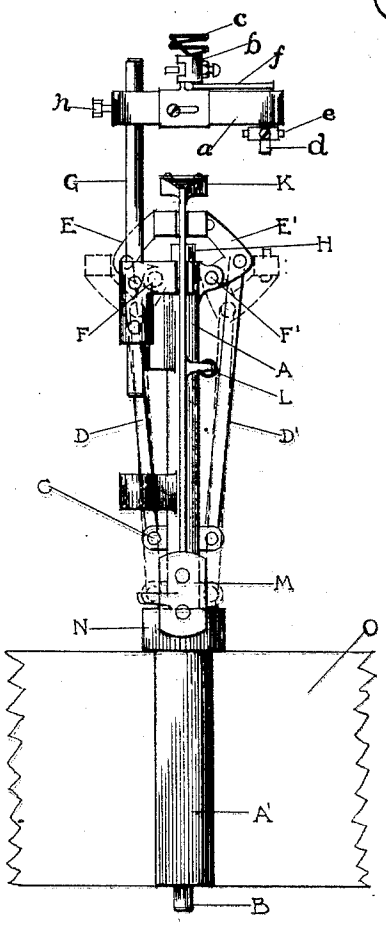

Fig. 1.

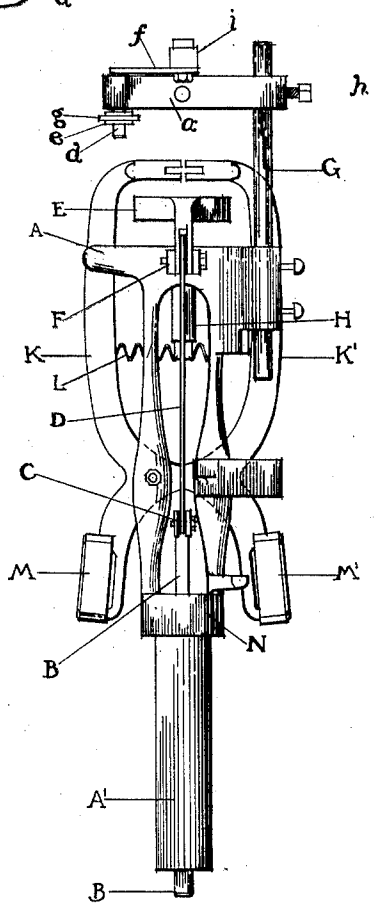

Fig. 2.

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STEM MAKING MACHINE

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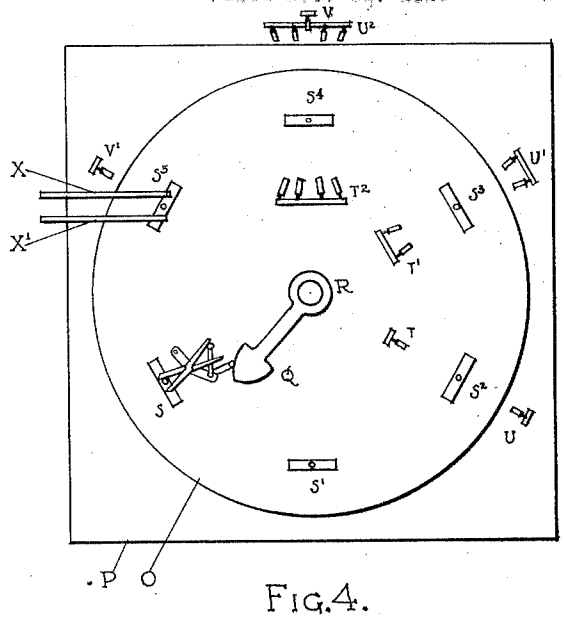

FIG.4.

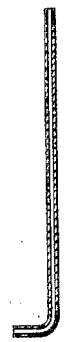

FIG.6.

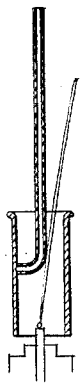

FIG.7.

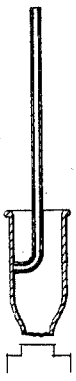

FIG.8.

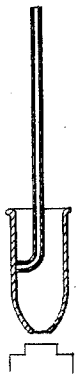

FIG.9.

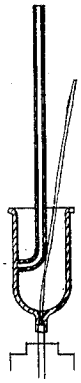

FIG.10.

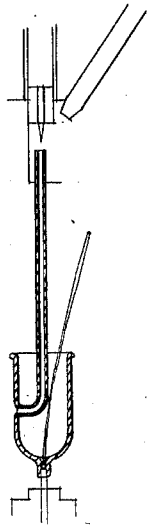

FIG.11.

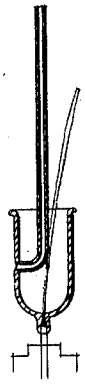

FIG.12.

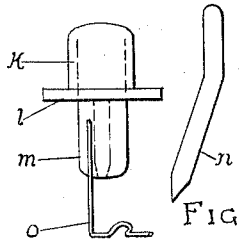

FIG.5.

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UNITED STATES PATENT OFFICE

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STEM MAKING MACHINE

Application filed December 11, 1925. Serial No. 74,681.

Our invention relates to the manufacture of tipless radio vacuum tubes, incandescent lamps and other sealed electrical devices and more particularly to stem heads of machines used in such manufacture. The invention may, in fact, be used in combination with or as an attachment to any of the well known types of stem making machines now in use. The invention is adapted to hold and support the assembly of parts from which are made the stems of such tipless lamps and radio tubes and to perform the operations of heating and pressing the glass of the stem tube about the lead wires and formation of a union between the exhaust tube and the stem tube and of a passage through the stem tube communicating with the exhaust tube. In addition to this it comprises means for glazing the end of the exhaust tube simultaneously with, and as a part of the operation by which the passage through the stem tube is formed.

The stems of incandescent lamps and tubes are manufactured upon so-called stem making machines. These machines are of various types, but all comprise a revolving table or frame, upon which are mounted, one or more "heads" adapted to hold the assembly of stem parts and to move the said assembly into various positions of the machine where the operations comprised in stem making are performed. A very generally used type of stem making machine has six heads so mounted and the rotating table moves each head through six positions. The parts from which the stem is to be made are placed upon the head when it is in the first and second positions. These parts consist of a piece of flared tubing, called the stem tube, the lead wires and in case of stems for tipless devices, a tube of smaller diameter than the stem tube arranged concentrically within the stem tube. The head itself comprises a frame mounted on a sleeved post. Supported upon this frame are a die block adapted to hold the assembled parts from which the stem is to be made, a pair of jaws to clutch the stem glass and hold it in place on the die block and a second pair of jaws, called press jaws, set at right angles to the clutching jaws. The function of the press jaws is to clamp the softened glass of the stem into an air tight seal about leads. In the case of stems for tipless devices, the machine also includes a post mounted at the top of the frame, supporting a clutch adapted to hold the exhaust tube concentrically within the stem tube. This clutch is operated by hand and requires an operator to open it and insert the exhaust tube when the head is in the first position. Another operator is required to open it and remove the finished stem when the head is in the last position.

At the first position the operator feeds the parts to make the stem. When this is completed the head moves to the next position where it pauses between two or more blow pipe fires, the flames of which meet and focus on the lower portion of the stem tube. After a suitable heating here the table revolves and carries the head to the next position where a further heating takes place, the stem head pausing between two groups of fires, one group on each side. In the fourth position four or more blow pipes on each side focus upon the lower portion of the stem tube. In this position the glass of the heated portion of the stem tube has become soft and almost fluid and two pressing jaws attached to the stem head clamp this soft glass, pressing it into a flat air tight seal about the lead wires. In the fifth position a single fire prevents the too sudden cooling of the glass and it is in this position ordinarily that, in the case of stems for tipless devices, an air jet arranged so as to come in alignment with the exhaust tube which is held by a clutch within the stem tube, blows a current of air through the exhaust tube and through the softened glass of the stem tube thus forming an open passage through which the device may later be exhausted of air. In the last position the operator removes the finished stem from the head.

It is the object of the present invention to provide a clutch adapted to hold the exhaust tube concentrically within the stem tube and automatic means for opening the same in order that the finished stem may be removed at the end of the stem making operations.

It is a further object to provide a means by which the exhaust tube may be sealed to the stem tube, a passage blown through the stem tube communicating with the exhaust tube and glazing or smoothing the glass about said passage and about the lower end of the exhaust tube which fits into the rubber pump connections.

The instrumentalities embodying this invention comprise a clutch of a novel construction mounted upon the stem head and a cam affixed to the central post about which the table revolves. Gas and air ducts arranged at the sixth position so as to blow a sharp jet of flame through the exhaust tube and a soft flame against the portion of the stem tube wall where the exhaust tube has been sealed on, perform the operations of smoothing the outer end of the exhaust tube, puncturing the wall of the stem tube and glazing the joint.

The invention will be clearly understood by reference to the drawings in which Fig. 1 represents partly diagrammatically a stem head complete with the exhaust tube clutch of our invention attached; Fig. 2 is a view of the stem head and clutch taken at right angles to the view in Fig. 1; Fig. 3 diagrammatically shows a detail of the exhaust tube clutch and the cam by which it is opened; Fig. 4 diagrammatically shows a plan view of the bed of the stem making machine with the revolving table having six stem heads mounted thereon; Fig. 5 is a detail of the flame nozzle; Fig. 6 shows the exhaust tube in the preferred form; Fig. 7 is an elevation showing the assembly of stem parts in place on the stem head in position S'; Fig. 8 shows the assembly in position S^2; Fig. 9 shows the heating operation in position S^3; Fig. 10 shows the operations of heating and sealing the exhaust tube to the inner wall of the stem tube and the pressing of the seal which are simultaneously formed in position S^4; Fig. 11 shows the operations of glazing, annealing and formation of the passage of the exhaust tube through the stem tube which are simultaneously conducted at position S^5. Fig. 12 shows the finished stem as it is released from the exhaust tube clutch in position S.

Referring now to the drawings, A is a frame terminating at the lower end in the sleeve, A′, through which the rod, B, moves. At the top of the rod, B, is fixed the double link, C, to which are pivoted the arms, D and D′. The clamping jaws, E and E′, are pivoted to the lugs, F and F′, which are fixed to the upper part of the frame, A. To the clamping jaws, E and E′, are also pivoted the arms, D and D′. A post, G, set in the frame, A, supports the exhaust tube holding apparatus which is shown in detail in Fig. 3. A die block, H, is set into an orifice in the top of the frame, A, and there fastened, by means of a set screw or other means.

On the stem head, as will be seen by reference to Fig. 2, stem holding jaws, K, are affixed. A spring, L, serves to hold the jaws closed and they may be opened by pressure exerted upon the pressure pieces, M and M′. The stem head either singly or with a number of other similarly constructed stem heads is set into the revolving table of the stem making machine, the shoulder, N, resting upon the table and the sleeve, A, being set into an opening adapted to receive it through the table, O, so that the end of the rod, B, protrudes below. At the pressing position, shown in Fig. 4, at S^4, a cam beneath the table, O, causes the rod, B, to rise, thus closing the clamping jaws, E and E′, so as to form the press of the stem. After the press is so formed the cam permits the jaws C and E′ to open again.

As will be seen by reference to Fig. 3 the exhaust tube holding apparatus consists of a supporting bar, *a*, on which is mounted a pair of jaws, *b*, operating in scissors fashion which are held shut by the spring, *c*. The supporting bar, *a*, is affixed to the post, G, of the stem head by the set screw, *h*, as shown in Figs. 1 and 2, and at the opposite end of the bar is a pivot, *d*. The arms, *e* and *f*, are rigidly connected in angular relation to each other and pivoted at the point of union to the supporting bar, *a*, by the pivot, *d*. The arm, *e*, carries at its outer end a roller, *g*. At the extremity of the arm, *f*, is fixed a post, *i*. In Fig. 3, the roller, *g*, is shown contacting with the cam, Q, which is affixed to the center post of the machine (see Fig. 4).

In Fig. 4 which represents a plan view of the stem making machine, the table, O, revolves above the bed, P, about the center post, R; stem heads are mounted on the table, O, at the positions, S, S′, S^2, S^3, S^4, and S^5. Focusing blow pipe fires are mounted at the positions S^2, S^3, and S^4. At S^2, the fires, T and U, consist of single blow pipes placed on opposite sides of the position. At S^3, double blow pipes T′ and U′ are placed oppositely and at S^4, quadruple blow pipes are similarly positioned. The fires of all these blow pipes focus at the lower extremity of the stem tube supported on the die block, H, of the stem head and the revolving table, O, causes the heads to pass between them. Two additional fires, one, V, preferably at position, S^4, and one, V′, preferably at position S^5, are positioned a little higher than the other fires so that their flames impinge against the wall of the stem tube at a point above the press, which is formed at position, S^4. At position, S^5, a pipe, X, carries air and gas under light pressure to a nozzle over the exhaust tube of the stem upon the head in that position. The pipe, X′, carries gas to a pilot light provided to keep the gas burning constantly at the nozzle of X. This nozzle and the pilot light are shown in detail in Fig. 5.

In Fig. 5, a length of rubber tubing, *k*, connects with the gas and air pipe, X, shown in Fig. 4 at position S^5. A burner, *m*, at the end of the rubber tubing, *k*, carries a flame constantly burning and the metal disc, *l*, serves as a shield preventing the flame at the end of the burner, *m*, from melting or burning the rubber. A gas line, *n*, is kept burning so as to relight the flame at *m* in case it should become extinguished. Projecting down from the burner, *m*, a locating device consisting of a wire hook, *o*, engages the end of exhaust tube of the stem and brings it in line with the fire of the burner, *m*.

Having thus described the various parts of our invention we will now explain its operation. An operator at position, S, of the revolving table, inserts the lead wires into holes in the die block H, of the stem head which at the moment is in that position. The table then moves, bringing this stem head to position, S′, where it stops. Another operator at this position, places the stem tube, a piece of flared glass tubing about the lead wires with the flared end of the stem tube up. This operator then forces a glass exhaust tube of smaller diameter than the stem tube and preferably bent at one end as shown in Fig. 6 into the jaws, *b*, of the exhaust tube holding apparatus. The operator then pushes the exhaust tube into the stem tube, thus forming the assembly of parts shown in Fig. 7 and the head moves successively through positions, S^2, S^3, and S^4. In these positions the fires, T and U, T′ and U′ and T^2 and U^2, soften the glass of the lower end of the stem tube. At position S^4, the lower part of the stem tube has become so soft that it has begun to fall in against the lead wires. In this condition, a cam under the table, O, causes the rod, B, to rise and fall back. In rising, the rod, B, lifts the arms D and D′, and these clamp the jaws, E and E′, against the soft part of the glass stem tube, thus forming a flat glass seal or press about the lead wires. The operation performed at positions S^2, S^3 and S^4 are illustrated in Figs. 8, 9 and 10.

While the head is in position S^4, the fire, V, which as has been stated is raised slightly above the fires, U^2, impinges against the stem tube a little above the press and at the point where the bent end of the exhaust tube touches the wall of the stem tube. The effect of this fire is slightly to soften the glass of the stem tube and the end of the exhaust tube and seal them together (Fig. 10). It does not, however, unless desired, puncture the stem tube wall so as to form a passage through communicating with the exhaust tube. This passage is formed at the next position S^5, where the pipes, X and X′, blow a flame down through the exhaust tube and against the stem tube wall from the inside while the fire, V′, projects against the outside of the stem tube wall at the same spot (Fig. 11).

These two flames, X′ and V′, cooperate to form a puncture through the wall of the stem tube communicating with the passage of the exhaust tube. Moreover the flames from the pipes, X′, and the fire V′ each perform additional individual functions of importance. The flames from the pipes, X′, striking against the upper lip of the exhaust tube as it is blown into that tube, smoothes or glazes the lip. This is a matter of importance when the lamp or radio tube is connected with the pumps for the exhausting operation as it enables the operator to insert the exhaust tube into the rubber pump connections without cutting them. On the other hand, the fire from V′ anneals the glass of the stem. By means of an economizer synchronized with the revolving table, O, the fires, X′ and V′, may be timed and the period during which they play may be lengthened or shortened as required.

The stem head then moves to position S, from which it started. At this position the roller, *g*, of arm, *e*, of the exhaust tube holding device, comes in contact with the cam, Q, which is fixed to the center post, R of the machine. The roller, *g*, rides on the cam, Q, and the arm, *e*, is forced back by the cam, turning on the pivot, *d*, and forcing the post, *i*, of the arm, *f*, between the two elements comprised in the clutch, *b*, thus opening the jaws of the clutch and releasing the stem tube. The operator at position S then opens the clutch, K, by pressure upon the pressure pieces, M and M′, and removes the completed stem from the head, which is now ready to repeat the operation.

The invention, comprising as it does a means of automatically operating the exhaust tube clutch and automatically sealing the exhaust tube to the stem tube and forming the exhaust passage through the stem tube walls, is adapted for use in combination with any of the types of stem making machines now in use. It is obvious that the elements of this invention may be differently arranged upon machines of different types without departing from the principle illustrated. We have set forth hereinabove the application of the invention to one well known type of stem making machine, but desire it to be understood that it may have other embodiments and we do not desire to be limited to the construction shown in the drawings.

Having thus described our invention what we claim is:—

1. In a machine for making stems for incandescent lamps and similar articles, the combination of a rotating stem head mounted upon said machine; a clutch comprising two members pivoted in scissors fashion and mounted on said stem head, said clutch being adapted to hold an exhaust tube in position in an assembly of stem parts supported upon said stem head; a pair of arms rigidly fixed

in angular relation to each other and pivoted upon the clutch mount, one of said arms carrying a post adapted to force apart the members comprising the clutch, and a cam adapted to move said arms on their pivot and force said post within the clutch members when the said clutch is brought into operative position with respect to said cam by the rotation of the stem head.

2. In a head of a stem making machine, the combination of a clutch adapted to hold an exhaust tube, said clutch being mounted on a support and consisting of two members, pivoted in scissors fashion to said support, and a spring holding said members shut; and a pair of arms rigidly united in angular relation to each other and pivoted to said clutch support at the point of union of said arms, one of said arms carrying a post adapted to enter between the ends of the pivoted members of said clutch.

3. In a stem making machine, the combination of a revolving table; a plurality of stem heads mounted upon said revolving table, each stem head having means to support an assembly of stem parts comprising a stem tube and an exhaust tube; a system of fires so positioned as to focus upon the lower portion of the said stem tube as the stem heads rotate between them; a second system of fires so positioned as to impinge against said stem tube at a desired point above said first system of fires; and a fire nozzle adapted to direct a flame through said exhaust tube.

4. In a stem making machine, the combination of a revolving table; a plurality of stem heads mounted upon said revolving table, each stem head having means to support an assembly of stem parts comprising a stem tube and lead in wires; a clutch mounted upon said stem head adapted to hold an exhaust tube; automatic means for releasing said exhaust tube from said clutch; a system of fires so positioned as to focus upon the lower portion of said stem tube as the stem heads rotate between them; a second system of fires so positioned as to impinge against said stem tube at a desired point above said first system of fires and a fire nozzle adapted to direct a flame through said exhaust tube.

5. In a stem making machine a system of fires so positioned as to focus upon the lower portion of an assembly of stem parts supported upon a die block of a stem head of said machine; a second system of fires adapted to seal the bent end of an exhaust tube to the inner wall of a stem tube in said assembly; a fire nozzle adapted to direct a flame through said exhaust tube and automatic means for controlling the time during which said second system of fires and said fire nozzle operate.

6. In a machine for making stems for radio vacuum tubes and similar articles, the combination of means for supporting a stem tube; means for holding within said stem tube a bent exhaust tube of smaller diameter in contact with the inner side wall of said stem tube; heating means for fusing said stem tube at and below the point of contact of said exhaust tube with said stem tube; means for sealing the lower end of said fused portion of said stem tube to form a press and causing the bent end of said exhaust tube to protrude through the softened wall of said stem tube above said press; separate heating means for fusing the protruding end of said exhaust tube with said stem tube; and means for opening the passage through said exhaust tube.

7. In a glass working machine, the combination of means for holding a glass tube; means for holding a second glass tube of smaller diameter in such a position within said first tube that the end of said second tube contacts with the inner wall of said first tube; heating means for fusing the outer wall of said first tube opposite the point of said contact, by causing the walls of said first tube to soften and collapse against the bent end of said first tube and permitting said bent end to protrude through said first tube; separate heating means for fusing the protruding end of said second tube with the wall of said first tube.

8. In a stem making machine, a clutch for holding a stem tube; a clutch for holding an exhaust tube in contact with the inner wall of said stem tube; means for forming a press in said stem tube; means for sealing said exhaust tube to said stem tube at a point outside said press and means for glazing the unsealed end of said exhaust tube.

9. In a head of a stem making machine a clutching device adapted to hold an exhaust tube having a bent end in such a manner that said bent end is positioned within and in contact with the inner wall of a stem tube supported upon said head, said clutch being mounted on a support and consisting of two members, pivoted in scissors fashion to said support; a spring holding said members shut; two arms rigidly connected in angular relation to each other and pivotally mounted at the point of union to said support; at the extremity of one of said arms a post acting between the pivoted scissor members and at the extremity of the other of said arms a roller adapted to ride upon a cam affixed in a definite position to a post at the center of said stem making machine; and means to rotate said stem head so as to bring the roller at the extremity of said arm into operative position with said cam.

10. In a head for a stem making machine, the combination of a clutch comprising two members pivoted in scissors fashion and mounted on said head, said clutch being adapted to hold an exhaust tube in position in an assembly of stem parts supported upon said head; a pair of arms rigidly fixed in angular relation to each other and revolving

around a pivot at the junction thereof said pivot being fixed upon said clutch mount; one of said arms carrying a post adapted to force apart the members comprising said clutch when the other of said arms moves in a direction toward said clutch around said pivot.

11. In a stem making machine, the combination of a circular table, means for revolving said table about its central points, a plurality of stem heads mounted about the periphery of said table, each stem head having means to support an assembly of stem parts comprising a glass stem tube and an exhaust tube positioned within said stem tube so as to contact with the inner wall of said stem tube; a plurality of heating elements mounted on a stationary frame beyond the periphery of the rotating table adapted to fuse the lower portion of said stem tube; a second system of heating elements adapted to project fires so as to impinge against said stem tube at the point where said exhaust tube contacts with the inner wall of said stem tube; and means adapted to direct simultaneously a flame through said exhaust tube in opposition to said second system of heating elements.

In witness whereof, we hereunto subscribe our names this 19th day of November, 1925.

GEORGE COBY.
ERNEST KAUER.