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APPARATUS FOR HEATING EXHAUST TUBES

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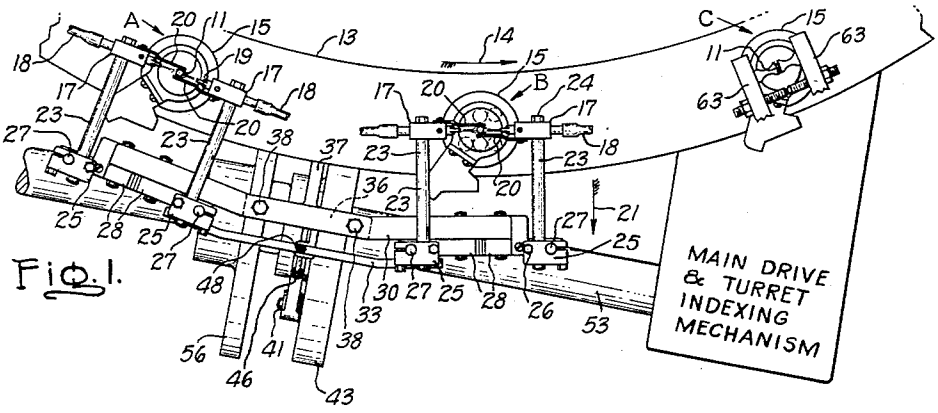


Fig. 1.

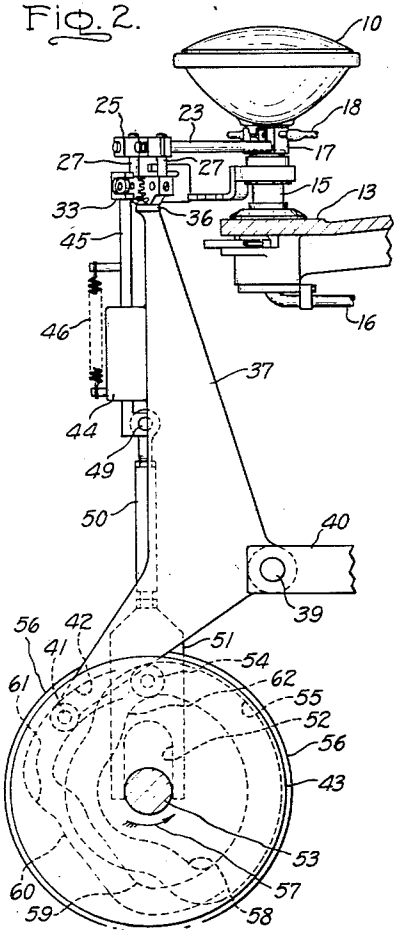


Fig. 2.

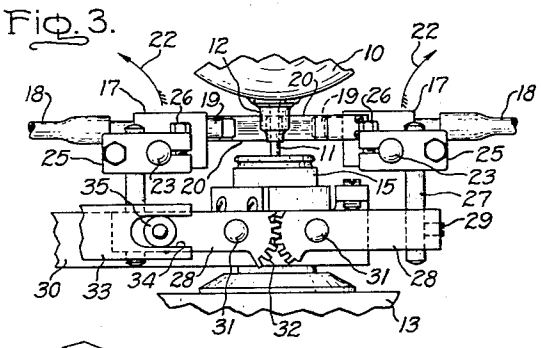


Fig. 3.

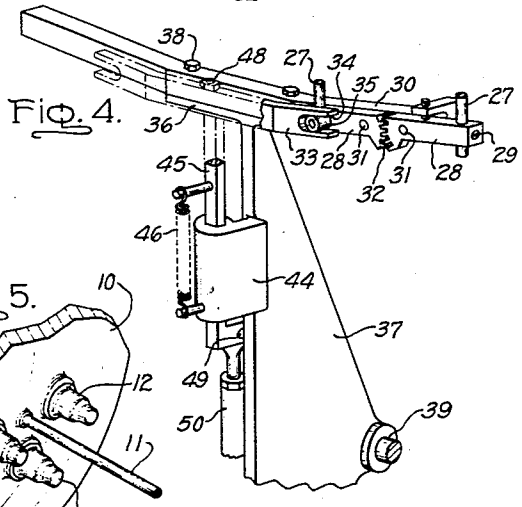


Fig. 4.

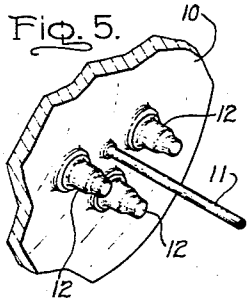


Fig. 5.

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APPARATUS FOR HEATING EXHAUST TUBES

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This invention relates to apparatus for heating exhaust tubes and more particularly to apparatus for heating vitreous exhaust tubing extending from the envelopes of electric lamps, radio tubes, or other electrical devices, which heated tubing is closed or tipped-off by deformation or rupture to seal the interior of the envelope.

In the manufacture of electrical devices utilizing a sealed envelope, for example, electric lamps, it is customary to provide a vitreous exhaust tube for evacuating the envelope and possibly for filling the envelope with a suitable gas after which the exhaust tube is heated and tipped-off to close its end. When such lamps or other electrical devices are made on high speed machinery requiring movement of the device in a step-by-step manner to a plurality of work stations, the aforementioned heating of the exhaust tube must take place at one or more of the work stations and must not interfere with movement of the device. Other elements of the electrical device, for example, contact terminals or ferrules, may extend from the envelope at points closely adjacent to the exhaust tube making it necessary to position accurately the heating means to direct heat against the exhaust tube to soften it without damage to any neighboring elements of the device.

Accordingly, it is an object of the invention to provide a new and improved heating apparatus for directing flames of burners against an exhaust tube in which the burners are withdrawn from the path of movement of the exhaust tube as it is moved along a work path until such time as the tube reaches a work station and, further, in which the burners are rotated out of the plane of the exhaust tube to prevent damage or heating of adjacent parts until such time as the burners can be accurately located to direct flames against the tube at the work station.

To this end, heating means including a pair of burners is provided to direct fires against opposite sides of the exhaust tube at one or more of the work stations of the machine on which the electrical device is being processed for sealing or tipping-off the tube. Mechanism is incorporated into the machine to pivot the burners out of the path of movement of the exhaust tube, in a direction perpendicular to the path, during indexing of the exhaust tube from station to station; the mechanism then returns the flames against the tube during the time interval when the tube remains stationary at a work station. In addition, the burners of each pair are pivotally mounted on the mechanism to rotate in a plane parallel to the path of movement of the exhaust tube so that the burners may be swung out of the way of other parts on the electrical device immediately adjacent the exhaust tube. At a work station the burners are then pivoted to bring flames against opposite sides of the exhaust tube in a direction perpendicular to the tube and the flames are then confined around the tube to prevent undue heating or damage to adjacent parts. More than one pair of burners can be mounted on the mechanism to provide heating of the exhaust tube at a plurality of the work stations or, alternatively, to provide heating of several exhaust tubes at the same time.

The subject matter of the invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. Further objects and advantages of the invention will be better understood by reference to the following description taken in connection with the accompanying drawing in which:

Fig. 1 is a plan view of the heating apparatus showing its application to a conventional machine for exhausting and tipping-off electrical devices, such as lamps;

Fig. 2 shows an elevation of details of the heating apparatus;

Fig. 3 shows details of the arrangement for rotating the burners;

Fig. 4 is a detailed perspective view showing other parts of the mechanism for positioning and rotating the burners; and

Fig. 5 is a perspective view of part of an electric lamp provided with an exhaust tube adapted to be heated by the apparatus of the invention.

Referring to Fig. 5 of the drawing, an electric lamp of the sealed-beam type used in automobiles has been illustrated as showing one form of an electrical device particularly suited for manufacture by the instant apparatus. During manufacture the envelope **10** of the lamp is provided with a vitreous exhaust tube **11** which extends between contact ferrules **12** sealed to the lamp envelope, the ferrules, in turn, carrying a plurality of filaments (not shown) in the interior of the envelope. With some types of heating apparatus for softening the vitreous exhaust tube the flames of the heating burners have a tendency to play about or impinge on the ferrules **12** causing oxidation of the ferrules making it difficult to solder or otherwise secure contact terminals to these ferrules at a later stage in the manufacture of the lamp; also crazing of the seals between the ferrules and envelope may occur causing a defective lamp. The heating apparatus of the instant invention is designed to prevent the flames from reaching or damaging the contact ferrules during manufacture of the lamp the arrangement being such that the flames are directed accurately on opposite sides of the exhaust tube between the ferrules, as illustrated in Fig. 1.

In manufacture, the lamp envelopes **10** are mounted base down on a conventional exhaust machine **13** which operates to exhaust and flush the envelope and possibly fill it with a suitable inert gas all through the exhaust tube **11**. In the type of exhaust machine illustrated by Fig. 1, the lamps are carried by a rotatable turret having a main drive and turret indexing mechanism and the lamps move along a circular path in the direction shown by the arrow **14** in a step-by-step movement as they are indexed through a plurality of work stations A, B and C. As shown in Fig. 3, the lamps are mounted on the exhaust machine by means of a collar **15** which surrounds and closely grips the exhaust tube **11** to hold the lamp in mounted position. As shown in Fig. 2, the collar **15** is connected to an exhaust pump (not shown) by piping **16** so that at appropriate points in the manufacturing cycle the lamp envelope may be exhausted, flushed and filled with inert gases in a manner well understood in the art.

To seal off the exhaust tube after flushing and filling, it is necessary to heat the tube at one or more of the work stations. In the form of the apparatus illustrated, the exhaust tube is heated at stations A and B and is then sealed or tipped-off at station C. To heat the exhaust tube a gas fired burner **17** is located on each side of the tube, the burners being arranged in pairs at each of the work stations A and B. Combustible gas is furnished through supply lines **18** connected to each burner. Each burner is provided with a nozzle **19** which provides a flame pattern of a generally thin rectangular shape, as shown in Fig. 3, so that the flames may be positioned accurately against the side walls of the exhaust tube. At the same time, the narrow pattern of the flame makes it possible to direct it between the lamp ferrules **12** so that the flames do not impinge on the ferrules to oxidize

them. As further precaution each burner carries a baffle or guide plate 20, best shown in Fig. 1, which further serves to confine the flames against the exhaust tube and prevent them from being deflected or blown against the ferrules by air currents circulating around the machine. The arrangement is such that the flames may be directed very accurately against the exhaust tubes between any chosen arrangement of ferrules extending from the base of the lamp.

However accurately the flames are positioned at the respective work stations, it is necessary to move the burners and flames out of the path of movement of the lamp to permit indexing of the lamp from station to station. To this end, the pairs of burners are moved out of the path of the lamp in a direction perpendicular to the path of movement, as shown by the arrow 21 in Fig. 1; this permits the lamps to be moved freely from station to station. In addition, the burners are pivotally mounted to move first upwardly away from each other in the directions shown by the arrows 22 in Fig. 3 before indexing movement begins. This means that as the pairs of burners are moved in the direction of arrow 21 on lamp indexing, the flames do not sweep across the ferrules as would be the case if the burners are simply moved into and out of the path of the lamp without upward rotation.

To rotate the pairs of burners out of the plane of the exhaust tube, each burner is carried by an elongated rod 23 one end of the rod being secured to the burner by a bolt 24 and the other end being clamped in a block 25 by means of a locking bolt 26. Adjustment of rod 23 in the block 25 will provide for proper positioning of the burner in alignment with the exhaust tube at a work station. Block 25, in turn, is carried by an upstanding rod 27, best shown in Fig. 3, the rod being slidably mounted in a lever 28 to which it is held in position by a set screw 29. Adjustment of rod 27 on the lever 28 provides for proper positioning of the burner along the vertical length of the exhaust tube. To provide for rocking or pivotal movement of the burner, lever 28 is pivotally mounted on one end of an elongated supporting bar 30 by means of a pivot pin 31. The elongated bar 30, and the pairs of burner mechanisms carried thereon, are moved toward and away from the paths of movement of the lamp in a direction perpendicular to that path by mechanism to be described later.

As previously mentioned, the burners forming each pair are arranged on opposite sides of the exhaust tube, are identical in construction, and are mounted for pivotal movement on the elongated bar 30 by the structure already described. In order to rock each burner in synchronism on the elongated bar, and in the directions shown by the arrows 22 of Fig. 3, each lever 28 is provided with arcuate teeth 32 which mesh together so that as the left hand lever 28 in Fig. 3 is rotated the opposite lever 28 will be pivoted in synchronism an equal amount. Left hand lever 28 is rotated by means of an arm 33 provided with a slot 34 fitting over a guide roller 35 carried by the lever. As the arm 33 moves downwardly with respect to the elongated bar 30, by mechanism to be hereinafter described, the left hand lever 28 in Fig. 3 is rotated in a counter clockwise direction to lift its corresponding burner 19 out of the plane of and away from the exhaust tube. By means of the interengaging teeth 32 the right hand lever 28 is rotated clockwise to lift its burner a corresponding amount. This means that flames from both burners are directed upwardly away from the metallic ferrules prior to withdrawal of the heating mechanism.

As best shown in Fig. 1, two pairs of burners are incorporated into the heating mechanism so that exhaust tubes may be heated at two work stations. So that each pair of burners may be located substantially parallel to and in the curved path along which the lamps move, the opposite ends of the elongated rod 30 are constructed at a slight angle to the central portion 36 to position the burners properly along the curved work path. Fine adjustment of the burners in exact heating alignment with the exhaust tube is accomplished by the aforementioned burner adjusting means.

To move the elongated bar 30 supporting the associated burners toward and away from the work path, the bar is mounted on one end of a lever 37 (Figs. 2 and 4) by means of bolts 38; the lever rocks on a pin 39 carried by a part 40 of the exhaust machine. The opposite end of lever 37 is provided with a guide roller 41 sliding in a guideway 42 on a cam 43. Lever 37 is provided with an offset portion 44 drilled to receive a rod 45 which slides up and down with respect to lever 37 in a vertical direction, as shown in Fig. 2. A spring 46 is stretched between pins carried by the lever and rod and biases the rod downwardly. Inasmuch as arm 33 is secured to the upper end of slidable rod 45 by means of a bolt 48 (Fig. 4) relative movement between rod 45 and lever 37 provides for the aforementioned relative movement between elongated bar 30 and arm 33 to rotate the burners. The lower end of slidable rod 45 is fastened by a pivot pin 49 to an adjustable connecting rod 50 having an enlarged end 51 provided with a slot 52 extending over and riding on a cam shaft 53. As shown by Fig. 1, cam shaft 53 is driven by and rotates in synchronism with the drive mechanism of the exhaust machine. Slot 52 permits the connecting rod 50 to ride freely over the cam shaft as the sliding rod 45 moves up and down. The connecting rod carries a guide roller 54 riding in a guideway 55 cut into a cam 56. The lower end 51 of the connecting rod extends between the two cams 43 and 56. Cams 43 and 56, which are fastened to and rotate with shaft 53, serve to control the two different movements of the burners in synchronism with the operation of the exhaust machine as the lamp is indexed from station to station.

With the lamps at the work stations in the position shown by Fig. 1, and the lever 37, sliding rod 45 and cams 43 and 56 in the relative positions shown by Fig. 2, the burners are located at the start of a heating cycle in which the flames from the burners play against opposite sides of the exhaust tube. Both cams 43 and 56 will rotate with shaft 53 in the counter clockwise direction shown by the arrow 57, in Fig. 2. In the description to follow this start of the heating cycle will be considered to be the 0° position in a 360° rotation or complete revolution of the cams and cam shaft.

As cam 56 rotates, guide roller 54 on connecting rod 50 follows the cam guideway 55 along the outer periphery of the cam maintaining the raised position of rod 45 and keeping the burners in position to heat the exhaust tube. At approximately the 140° point in rotation of the cam, guide roller 54 reaches the sloping portion 58 of the guideway 55. At this point, it travels down the slope during a further approximate 26° rotation of the cam pulling the connecting rod 50 downwardly over the shaft. This lowers the slidable rod 45 carrying the transverse arm 33 opposite ends of which, in turn, move the toothed levers 28 to rotate the burners 26 out of parallelism with the exhaust tube and spread them apart in the directions shown by the arrows 22 in Fig. 3. The burners remain in this position during a further approximate 134° rotation of the cam. With the flames removed from the exhaust tube, the burners are in a position to be retracted away from and in a direction perpendicular to the exhaust machine in the direction shown by the arrow 21 in Fig. 1. This retraction of the burners is accomplished during the aforementioned 134° dwell period by pivotal movement of lever 37.

As will be seen from Fig. 2, shortly after guide roller 54 has moved along the sloping surface 58 to pivot the burners away from the exhaust tube the guide roller 41 on lever 37 will reach the sloping portion 59 of the guideway 42 at approximately the 166° point in rotation of the cams. Guide roller 41 follows the sloping surface 59 through a further 45° rotation of cam 43; this rotates the burner mechanisms including lever 37, sliding rod 45

and the elongated bar 30 carrying the burner mechanisms counter clockwise (when viewed in Fig. 2) so that the burners are moved out of the path of lamp travel. During further rotation of cam 43 through approximately 45° guide roller 41 travels along the inner flat portion 60 of the guideway 42 to maintain lever 37 in retracted position away from the exhaust machine. This permits indexing of the lamp envelopes 10 to the next work station.

By first moving the burners in a vertical direction upwardly away from the exhaust tube 11 and the adjacent ferrules 12, there is no danger that flames from the burners will sweep across the ferrules to damage them as the entire burner mechanism is retracted away from the path of travel of the lamp by action of pivoted lever 37. This preliminary movement of the burners also serves to remove the baffles 20 from positions immediately adjacent the exhaust tubes so that there is no interference between the baffles and the exhaust tubes as the burner mechanism is retracted. As shown by Fig. 1 when in heating position the baffles 20 overlap around the exhaust tube to better focus the flames on the tube.

Once the lamp envelopes 10 have been moved to the next work station, guide roller 41 travels along a second sloping path 61 in the guideway 42 through a further approximate 45° rotation of cam 43; this moves lever 37 and the associated burner mechanism clockwise to advance the lever toward the exhaust machine and position the burners in the path of travel of the lamps. The total 135° angular rotation of cam 43 as guide roller 41 travels along paths 59, 60 and 61 corresponds approximately to the aforementioned 134° time interval during which the burners remain spread apart. At this point after the burner mechanisms are advanced into the lamp path, guide roller 54 reaches a second sloping portion 62 of guideway 55; as the roller moves along slope 62 upon further 60° rotation of cam 56, the connecting rod 50 is moved upwardly, when viewed in Fig. 2, to pivot the burners downwardly to direct flames against the exhaust tube to start a new heating cycle.

When a lamp has been indexed into position at work station C (Fig. 1), the exhaust tube 11 is subjected to a final heating step and then sealed or tipped off by means of a pair of pinchers 63. The tipping-off mechanism itself forms no part of the present invention and is shown in schematic form in Fig. 1.

The invention provides a mechanism for accurately controlling heating of the exhaust tube at one or more work stations and for narrowly directing the flames of the burners in a precise path between the lamp ferrules against the exhaust tube.

What I claim as new and desire to secure by Letters Patent is:

1. Apparatus for heating exhaust tubes extending from envelopes comprising, in combination, means for moving the exhaust tubes along a path in step-by-step movement to a plurality of work stations, heating means including a plurality of pairs of burners adapted to direct fires against opposite sides of the exhaust tubes at said stations, a supporting bar, pivot means for mounting one pair of burners at one end of said supporting bar, pivot means for mounting a second pair of burners at the opposite end of said supporting bar, means for moving said supporting bar and said burners out of said path during movement of the exhaust tubes from station to station and into said path when the exhaust tubes are located at a station and means for simultaneously actuating the pivot means at opposite ends of said supporting bar to pivot said burners on said supporting bar so that the fires play against opposite sides of exhaust tubes at a work station.

2. Apparatus for heating an exhaust tube extending from an envelope comprising, in combination, means for moving the exhaust tube along a path in step-by-step movement to a plurality of work stations, a pivoted lever, a supporting bar carried by said lever, a pair of rotatable shafts, means mounting said rotatable shafts on said bar, a burner carried by each shaft adapted for rotation to direct a fire against the exhaust tube, interengaging means carried by said shafts for rotating said burners in synchronism, means for rocking said lever to move the burners into the path of the exhaust tube when the exhaust tube is located at a station to position the burners on opposite sides of the exhaust tube and means carried by said lever and including a sliding rod connected to said interengaging means to rotate the burners in synchronism so as to direct fires against the exhaust tube.

3. Apparatus for heating exhaust tubes extending from envelopes comprising, in combination, means for moving the exhaust tubes along a path in step-by-step movement to a plurality of work stations, a pivoted lever, a supporting bar carried by said lever, pairs of rotatable shafts mounted on opposite ends of said bar, a burner carried by each shaft adapted for rotation to direct a fire against an exhaust tube, interengaging means carried by respective pairs of said shafts for rotating pairs of said burners in synchronism, means for rocking said lever to move the pairs of burners into positions parallel with the exhaust tubes when the tubes are located at a station to position the burners of a pair on opposite sides of an exhaust tube, and means carried by said lever and connected to the respective interengaging means to rotate the pairs of burners in synchronism so as to direct fires against the exhaust tubes.

4. Apparatus for heating an exhaust tube extending from an envelope comprising, in combination, means for moving the exhaust tube along a path in step-by-step movement to a plurality of work stations, a pivoted lever, a supporting bar carried by said lever, a pair of rotatable shafts mounted on said bar, a burner carried by each shaft adapted for rotation to direct a fire against the exhaust tube, interengaging means carried by said shafts for rotating said burners in synchronism, a rod mounted for sliding movement on said lever, means connecting said rod to said interengaging means to rotate said burners upon relative movement between said rod and lever, and cam means for rocking said lever to move the burners into the path when the exhaust tube is located at a station to position the burners on opposite sides of the exhaust tube and simultaneously move said rod to rotate the burners in synchronism so as to direct fires against the exhaust tube.

5. Apparatus for heating exhaust tubes extending from envelopes comprising, in combination, means for moving the exhaust tubes along a path in step-by-step movement to a plurality of work stations, a pivoted lever, a supporting bar carried by said lever, pairs of rotatable shafts mounted on opposite ends of said bar, a burner carried by each shaft adapted for rotation toward and away from each other to direct fires against the exhaust tubes, interengaging means carried by the respective pairs of shafts for rotating said burners in synchronism with each other, a rod mounted for a sliding movement on said lever, a member carried by and movable with said rod, means connecting opposite ends of said member to said interengaging means so as to rotate said burners upon relative movement between said rod and lever, and means including a plurality of cams engaging said pivoted lever and rod for rocking said lever to move the burners into the path when the exhaust tubes are located at a station to position the burners on opposite sides of the exhaust tubes and move said rod in sequence to rotate the burners together so as to direct fires against the exhaust tubes.

References Cited in the file of this patent

UNITED STATES PATENTS

2,247,513	Marshaus	July 1, 1941
2,604,732	Bocast	July 29, 1952