Oct. 28, 1958 J. B. YODER ET AL 2,857,712

QUARTZ LAMP SEALING MACHINE

Filed June 24, 1957 3 Sheets-Sheet 1

Fig. 1.

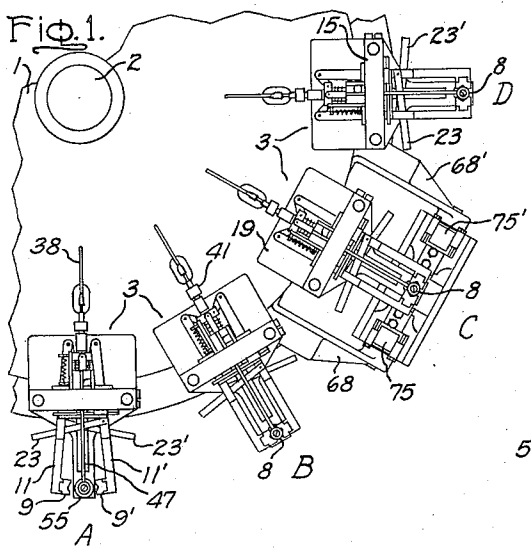


Fig. 2.

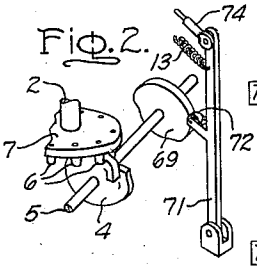


Fig. 3.

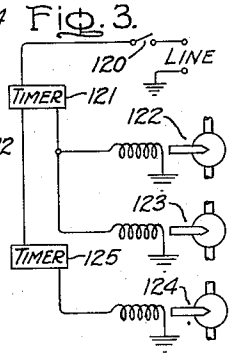
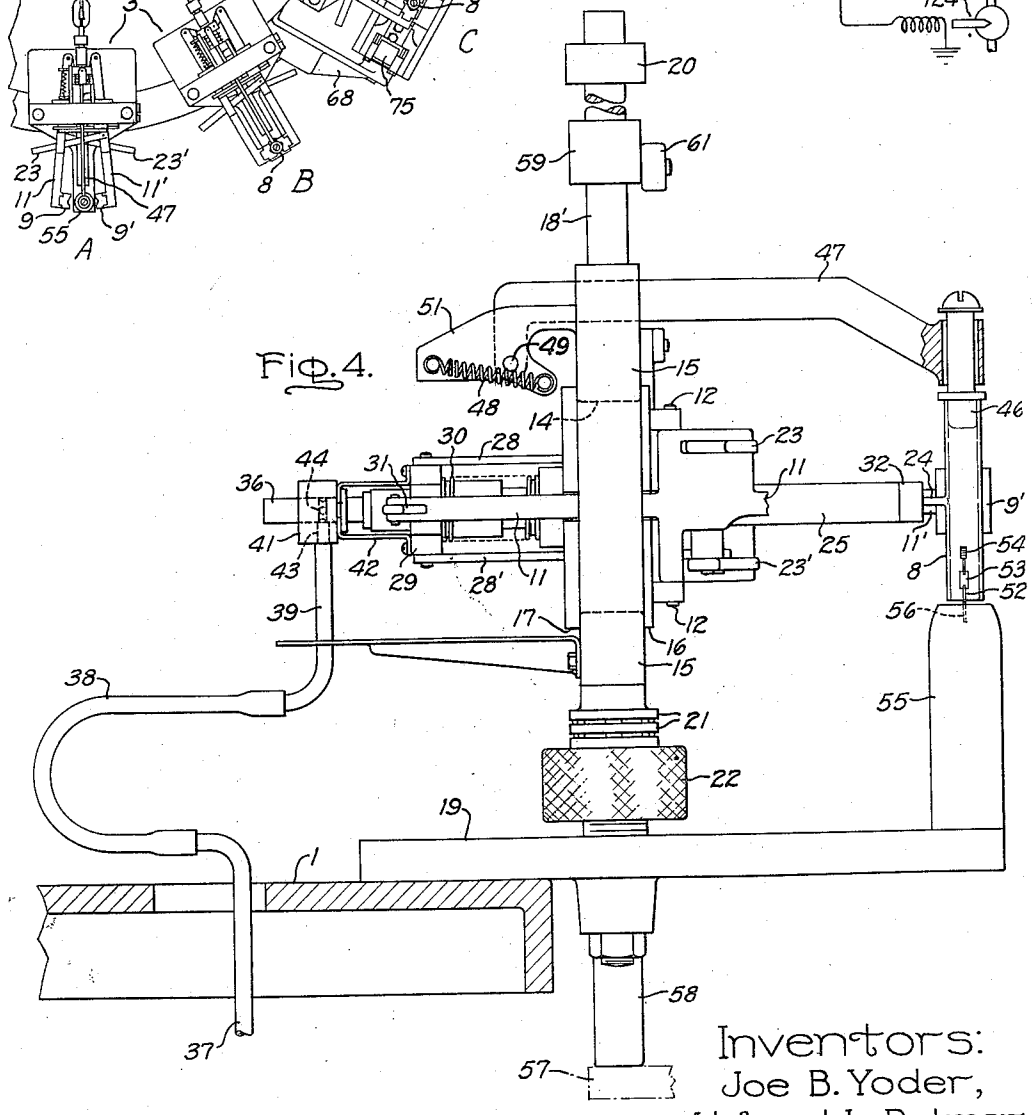


Fig. 4.



Inventors:
Joe B. Yoder,
Alfred L. Palmer,
by Ernest Wagner
Their Attorney.

Oct. 28, 1958 J. B. YODER ET AL 2,857,712

QUARTZ LAMP SEALING MACHINE

Filed June 24, 1957 3 Sheets-Sheet 2

Fig. 6.

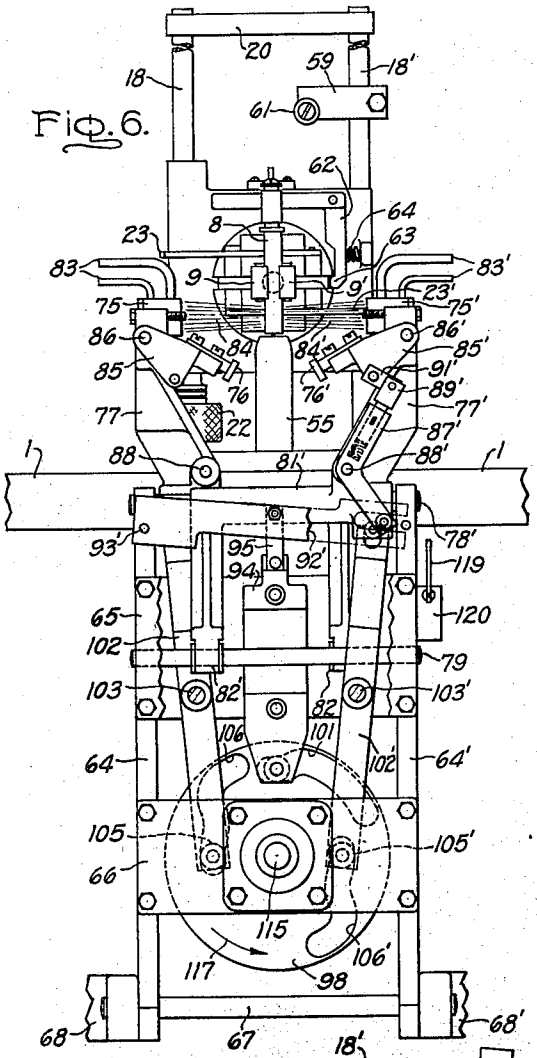


Fig. 7.

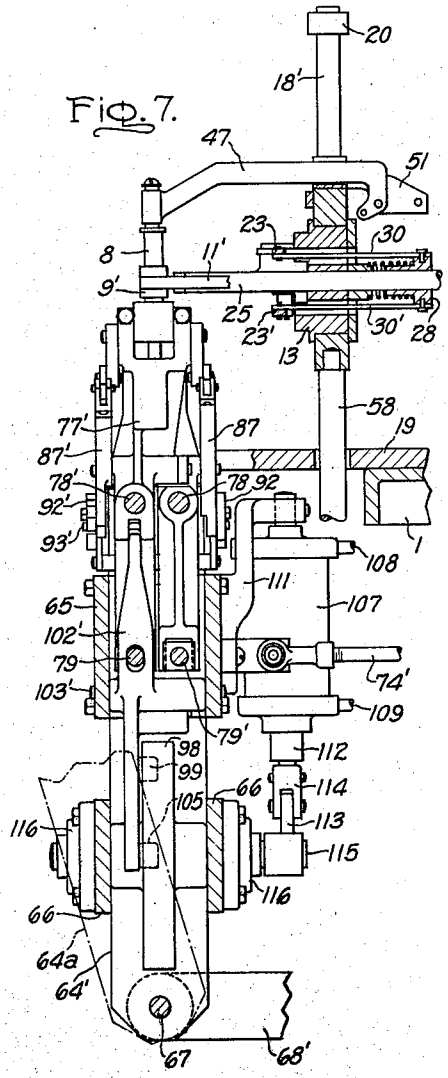
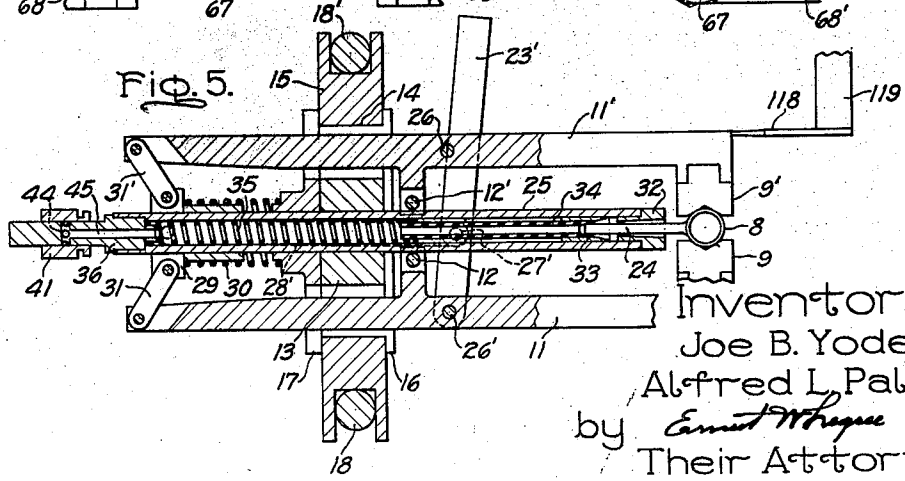


Fig. 5.



Inventors:
Joe B. Yoder,
Alfred L. Palmer,
by Ernest Wheyse
Their Attorney.

Oct. 28, 1958 J. B. YODER ET AL 2,857,712

QUARTZ LAMP SEALING MACHINE

Filed June 24, 1957 3 Sheets-Sheet 3

Fig. 8.

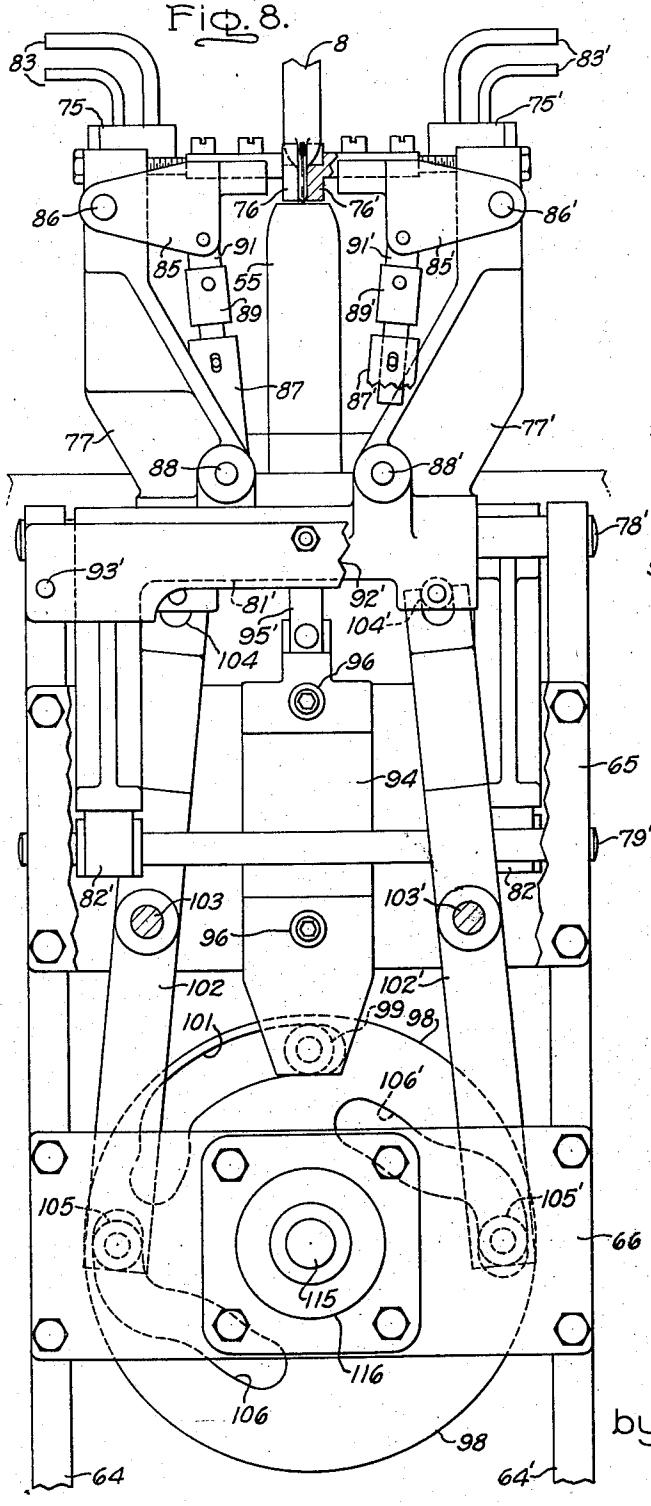


Fig. 10.

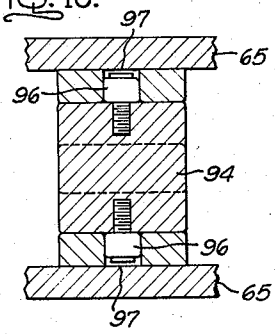
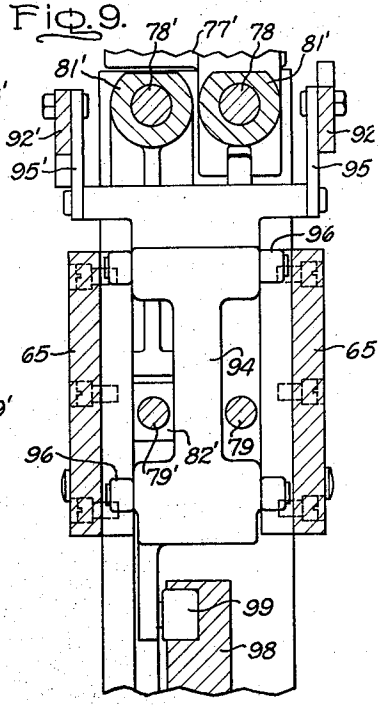


Fig. 9.



Inventors:
Joe B. Yoder,
Alfred L. Palmer,
by Ernest M. Hogue
Their Attorney.

United States Patent Office 2,857,712 Patented Oct. 28, 1958

2,857,712

QUARTZ LAMP SEALING MACHINE

Joe B. Yoder, Mayfield Heights, and Alfred L. Palmer, Lyndhurst, Ohio, assignors to General Electric Company, a corporation of New York

Application June 24, 1957, Serial No. 667,456

6 Claims. (Cl. 49—2)

This invention relates to the manufacture of quartz lamps and more particularly to a machine for sealing lead-in conductors through the ends of quartz tubes.

The machine of the present invention is designed specifically for sealing the lead-in conductors and electrodes in the ends of quartz tubes used for high-pressure mercury arc discharge tubes having a filling of mercury and an inert gas. However, many of its principles and features are equally applicable in the manufacture of elongated quartz incandescent lamps such as tubular heat lamps having a coiled tungsten filament extending through a fused quartz tube.

The mercury arc tubes with which the invention is concerned comprise electrodes supported on the inner ends of lead-in wires of refractory metal such as tungsten or molybdenum having a foliated or foil-like central portion which is hermetically sealed through the quartz. The quartz tube is closed or sealed by pressing its ends in a heat-softened condition between a pair of opposed jaws which are moved in a direction substantially perpendicular to the plane of the foliated sections of the lead-in wires to press or pinch the quartz flat about them. Up to the present time, this operation has generally been done on bench-type apparatus such as is described, for instance, in copending application Serial No. 607,005, filed August 30, 1956 of Klaus Gottschalk, entitled "Quartz Tube Pinch Seal" and assigned to the same assignee as the present invention.

The object of the invention is to provide a machine for sealing the ends of quartz tubes automatically with a minimum of labor and supervision.

A more specific object of the invention is to provide a machine for automatically sealing electrode and lead-in conductor assemblies into the ends of quartz tubes.

In a preferred embodiment of the invention, the quartz tube pinch sealing machine comprises an indexing turret having a plurality of work-holding heads each comprising a pivotable chuck which permits rotating the tube end for end to allow successive sealing of both ends. The exhaust tubulation of the quartz tube is accommodated in a gas supply port which supplies nitrogen or other suitable inert gas to the tube to prevent oxidation of the leads and electrodes during the sealing operation. A floating stopper is used to seal the open end of the quartz tube when neither end has as yet been sealed. The sealing operation proper is performed at a pinching station where a heating and pinching apparatus, normally tilted out of the path of movement of the heads during rotation of the turret, is pivoted back into encompassing relation with the quartz tube. This apparatus comprises oxyhydrogen burners which heat the lower end of the quartz tube to a plastic state and a pair of pinching jaws along with an actuating mechanism therefor. The jaws are moved firstly up into alignment with the lower end of the quartz tube, and then forced horizontally in against the sides of the tube. These movements of the pinching jaws are effected through a vertically moving crosshead and associated links which cause the initial pivoting of the jaws, and through a pair of horizontally moving crossheads which cause the horizontal translation. These crossheads, in turn, are moved by a cam which is actuated at an adjustably predetermined time interval after the heating of the quartz tube has begun.

For further objects and advantages and for a detailed description of a preferred embodiment of the invention, attention is now directed to the following description and accompanying drawings. The features of the invention believed to be novel will be more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a plan view of a segment of the turret of a machine embodying the invention and showing the work holding heads at a series of four consecutive stations.

Fig. 2 illustrates diagrammatically the indexing drive of the turret and a cam controlling the tilting of the heating and pinching apparatus.

Fig. 3 is a schematic diagram illustrating the electrical control system associated with the pinching apparatus.

Fig. 4 is a side elevation view of one of the work-carrying heads shown with a quartz tube in place.

Fig. 5 is a sectional plan view through the center of the work-carrying heads and showing the pivotable chuck which holds the quartz tube.

Fig. 6 is a vertical front elevation of the pinching apparatus shown in conjunction with a work-carrying head indexed in place.

Fig. 7 is a side vertical elevation, partly in section, corresponding to Fig. 6.

Fig. 8 is a front elevation of the pinching apparatus show on a larger scale and with the pinching jaws closed about the lower end of the quartz tube.

Fig. 9 is a transverse vertical section through part of the pinching apparatus of Fig. 8.

Fig. 10 is a horizontal section through the vertical crosshead and associated guideways of the pinching mechanism of Fig. 8.

Referring to the drawings and more particularly to Fig. 1, there is shown a fragment slightly in excess of a quarter of the total arc of a rotary turret **1** borne on a shaft **2**. A series of work-carrying heads **3** are disposed about the periphery of the turret. The complete machine has twelve heads and four are illustrated in the drawing disposed at stations A to D. The turret is driven in intermittent fashion so as to index the heads from station to station with a dwell interval at each station in order to permit the operator to load or otherwise adjust the quartz tubes in the heads at loading station A. The intermittent rotation of the turret may be effected in the usual way by means of a cam **4** on a power shaft **5** engaging pins **6** on the underside of a driving disc **7** fast to shaft **2** which in turn supports main turret **1**.

The details of the head **3** which accommodate the quartz tube **8** are shown principally in Figs. 4 and 5 and also partly in Figs. 6 and 7. The tube is gripped on opposite sides by a pair of jaws **9**, **9'** on the forward ends of a pair of arms **11**, **11'** which are pivotally mounted at **12**, **12'** on a rotatable chuck body **13**. Chuck body **13** is retained in a circular well **14** in block member **15** by means of overlapping flange portions **16**, **17**. Block member **15** in turn is slidably mounted on columns **18**, **18'** extending vertically upward from a bed or table member **19** fastened to turret **1** and braced at their upper ends by member **20**. Block member **15** normally slides down of its own weight on columns **18**, **18'** to the lowermost extent permitted by spacers **21** as determined by manually adjustable knurled knob **22**.

A quartz tube is loaded into a head by drawing forward the end of one of the hand levers **23**, **23'** and

inserting the laterally projecting exhaust tubulation 24 of the tube into the end of the sleeve 25 until the tube is centered between jaws 9, 9'. The forward movement of hand lever 23' (Fig. 5) which is pivotally fastened at 26' to arm 11 and at 27' to a link 28' draws the link outwardly, that is radially outward from the turret. The inner end of the link is fastened to a bushing 29 which is thereby drawn outwardly. The bushing is normally urged inwardly (referring to the axis of the turret) by a helical spring 30 compressed between it and a portion of chuck body 13. Links 31, 31' pivotally connected between the bushing and the inner ends of arms 11, 11' cause the outer ends of the arms to swing apart when either hand lever is drawn outward, but at other times resiliently pivot the outer ends of the arms inwardly to cause jaws 9, 9' to grip quartz tube 8.

Sleeve 25 also forms part of a port assembly for flushing nitrogen through the quartz tube during heating and pinching. Exhaust tubulation 24 of the quartz tube is inserted into the sleeve through the conical aperture in end cap 32 which guides the end of the tubulation to facilitate its seating in the conical end 33 of inner tube 34. Inner tube 34 is urged outward by a helical spring 35 compressed within the bore of sleeve 25 between inner end plug 36 and the inner end of the tube. Thus the conical end 33 of inner sleeve 34 bears against the end of the exhaust tubulation and makes a seal tight enough for flushing purposes. At the same time, the arrangement accommodates slight variations in the length of the exhaust tubulation occurring between different quartz tubes.

Nitrogen is admitted into the system from a supply tube 37 (Fig. 4) through a flexible rubber coupling tube 38 leading to an admitting tube 39 depending from a valve collar 41 fitted around the inwardly projecting end of end plug 36. Valve collar 41 is attached to bushing 29 by a bracket 42 so that the valve collar slides on end plug 36 when hand levers 23 or 23' are actuated. A radial hole at 43 in the valve collar communicating with admitting tube 39 becomes aligned with a circumferential groove and radial holes at 44 in the end plug which lead into an axial passage 45 communicating with the interior of sleeve 25. Thus, when a quartz tube 8 is gripped between jaws 9, 9', the gas supply passages are open to allow flushing of nitrogen through the quartz tube; at other times, the port of valve collar 41 is out of alignment with the ports of end plug 36 and the passage is closed to prevent waste of nitrogen.

When both ends of the quartz tube are open and the first pinching and sealing of an end is being made, it is necessary to close the upper end in order to prevent rapid loss of the nitrogen flushing gas. For this purpose, there is provided a floating stopper 46 on the end of a pivotally mounted arm 47 which may be swung over the quartz tube. At the time of the second sealing operation on the quartz tube, the rotatable chuck body is turned around and the previously sealed end of the quartz tube is now uppermost so that stopper 46 is not needed. Arm 47 is accordingly upswung out of the way and it is maintained in such position by the over-center mounting of spring 48 relative to the pivot point 49 of the arm on supporting bracket 51.

The electrode assembly comprising inlead wire 52, molybdenum foil 53 and electrode 54 is supported upright in position for sealing into the lower end of the quartz tube by a vertical spindle 55 fastened on bed member 19 in alignment with the gripping faces of the jaws 9, 9'. The electrode assembly is supported in place by inserting inlead 52 into a vertical well 56 in the upper face of the spindle. In actual practice, spindle 55 and also block member 15 have passages bored therethrough for the circulation of cooling water. Since such cooling systems are conventional in this art, these features have not been illustrated in order not to complicate the drawings excessively.

In the operation of the machine, an operator loads a quartz tube and an electrode assembly into the head at a loading station such as station A in Fig. 1. First the operator lifts the chuck assembly including block member 15 on columns 18, 18' by depressing a foot pedal arranged to impart an upward motion to member 57 (Fig. 4). Member 57 presses against stud 58 (Figs. 4 and 7) depending from the underside of block member 15. The upward movement of the block member raises the chuck assembly so that it is readily accessible and also so that the quartz tube may be inserted without interference with spindle 55 or with the electrode assembly which may be present therein. If the chuck assembly was initially empty, the operator then merely operates the accessible hand lever, that is uppermost hand lever 23 in Fig. 6, thereby opening the jaws and allowing the quartz tube to be inserted in place and its exhaust tubulation to be inserted into sleeve 25 as previously explained. At the same time, an electrode assembly is inserted into spindle 55. The operator then, by means of the foot pedal, lowers the chuck assembly so that the quartz tube surrounds the electrode assembly. The precise height of the quartz tube is adjusted by turning knurled knob 22 as required to obtain a slight clearance between the upper face of spindle 55 and the lowermost edge of the quartz tube. However, if the chuck assembly already contained a quartz tube of which the lower end has previously been sealed, then the operator merely rotates the chuck assembly 180° in block member 15 so as to turn the quartz tube end for end.

The present machine may be used to pinch seal both ends of the arc tubes by employing one loading operator at a first loading station A to load completely unsealed quartz tubes into the heads (and unload completely sealed arc tubes completing their course around the machines), and another operator at a second loading station located diametrically opposite the first. In such use of the machine, six stations are used in connection with the sealing of one end of the quartz tube and the other six stations are used for sealing the other end.

The operator at the second loading station likewise uses the foot pedal to raise block member 15 and the chuck assembly, thereby drawing inlead 52 of the sealed end of the quartz tube clear of spindle 55. The upper limit of movement of block member 15 is determined by stop 59 on column 18'. At the same time, roller 61 on the stop engages the horizontal portion of L-shaped lever 62 whose vertical portion is provided with a hooked end 63 which is urged by a spring 64 into one of two recesses on diametrically opposite sides of flange 17 on rotatable chuck body 13. The hooked end on the L-shaped lever thus serves as a latch which normally locks the rotatable chuck body to maintain the quartz tube in vertical alignment. At the upper limit of movement of the block member 15, the chuck body is released as explained, and the operator turns the quartz tube around end for end by grasping and swinging the accessible hand lever 23. The operator then inserts a new electrode assembly into the spindle and lowers the block member with the foot pedal. If necessary, knurled knob 22 may be used again to adjust the vertical elevation of the chuck assembly and the clearance of the lower end of the quartz tube with the upper face of spindle 55.

After a lamp has been loaded into the head at station A (or correspondingly inverted at diametrically opposite loading station A) the head and lamp are indexed successively through the series of work stations. At station B, the nitrogen gas being flushed through the quartz tube completely eliminates any air originally present. At station C, the quartz tube is heated to the fusion point and pinch sealed by a mechanism to be described in detail shortly. At station D, the quartz tube begins to cool and the cooling continues at two subsequent stations E and F not shown in the drawing. A reduced flow of nitrogen or other inert gas is maintained at stations E and F to

prevent oxidation of the electrode and lead-in conductor during cooling. The quartz tube next reaches station A where it is unloaded if both ends have been sealed, or turned end for end as previously explained if only one end has yet been sealed.

The heating and pinching mechanism located at station C is shown primarily in Figs. 6 and 7 with some additional details illustrated in Figs. 8 to 10. The entire heating and pinching mechanism is mounted on a tilting frame comprising vertical members **64**, **64'** and transverse plates **65** and **66**. The vertical members are pivotally mounted at their lower ends by means of a shaft **67** on brackets **68**, **68'** fastened to the frame of the machine. During the indexing, that is during the rotary movements of the turret, the frame is tilted out at an acute angle to the vertical, as shown in broken lines at **64***a* in Fig. 7. In this position, the burners and pinching jaws and associated parts are drawn clear of the path of movement of the heads. During the dwell intervals, the frame is tilted back into the vertical position as shown at **64'** in Fig. 7 and the heaters and pinching jaws then encompass the quartz tube carried in the head. The tilting movement of the frame is effected through a cam **69** fast on power shaft **5** (Fig. 2) which actuates a lever **71** through a roller **72**, the lever being drawn against the cam by a spring **73**. The motion of the lever is transmitted to the tilting frame by a suitable linkage comprising link fragment **74** shown in Fig. 2 and link fragment **74'** shown in Fig. 7.

Burners **75**, **75'** and pitching jaws **76**, **76'** are carried at the upper ends of opposed crossheads **77**, **77'** slidably mounted for horizontal translation on transverse slide bars **78**, **79** attached to the tilting frame. The elongated bushing portions **81** of each crosshead sliding on upper transverse rods **78**, **78'** assure rigidity of mounting and lower bushings **82** at the ends of the dependent leg portions of the crossheads sliding on lower transverse rods **79**, **79'** assure lateral stability. The crossheads have bifurcated upper ends between which are fastened the oxyhydrogen premixing type burners **75**, **75'**. Oxygen and hydrogen are supplied to the burners through flexible hoses which are coupled to the supply tubes **83**, **83'**. The burners are fixed in position to direct their flames horizontally against the lower end of the quartz tube as indicated at **84**, **84'** (Fig. 6). For pinch sealing larger sizes of quartz tubing, two additional burners mounted on the tilting frame at right angles to the first two, may be provided. The rear burner in such case may be pivotally mounted and swung aside by a lever, when the frame tilts, in order to avoid the quartz tube or spindle **55**.

Pinching jaws **76**, **76'** are carried on the ends of brackets **85**, **85'** pivotally mounted at **86**, **86'** on crossheads **77**, **77'**. During the heating part of the cycle while the burners are turned on, the jaws are tilted down out of the way as shown in Fig. 6; during the pinching part of the cycle, the burners are shut off and the pinching jaw brackets are first tilted up as shown in Fig. 8. The uptilting of the jaw brackets locates jaws **76**, **76'** horizontally in front of the burners on opposite sides of the lower end of the quartz tube. Crossheads **77**, **77'** then move horizontally together in unison to cause the jaws to squeeze the white-hot plastic quartz and form the pinch seal. The jaws are then withdrawn and thereafter tilted down to their rest position to await the next cycle of operation.

The tilting movement of the jaw brackets is effected through bell crank levers **87**, **87'** pivotally mounted at **88**, **88'** on crossheads **77**, **77'** respectively. Spring-loaded and pin-restrained plungers **89**, **89'** and links **91**, **91'** couple levers **87**, **87'** to the jaw brackets **85**, **85'**. Bell crank levers **88**, **88'** are actuated by levers **92**, **92'** pivotally mounted at **93**, **93'** on vertical frame members **64**, **64'**. Levers **92**, **92'** in turn are actuated by a single vertically reciprocating crosshead **94** through coupling links **95**, **95'**. The crosshead, of the general configuration of an I-beam as seen in Fig. 9, is guided by rollers **96** riding in guideways at **97** between transverse plates **65** (Fig. 10). Crosshead **94** in turn is actuated by cam wheel **98**, having a roller **99** fast thereto which rides in a suitably curved channel **101** in the cam wheel.

The horizontal translation of crossheads **77**, **77'** is effected through levers **102**, **102'** pivotally mounted at **103**, **103'** on transverse plates **65**. The levers have slot and pin connections **104**, **104'** at their upper ends with crossheads **77**, **77'** respectively. At their lower ends, the levers are provided with rollers **105**, **105'** which ride respectively in suitably curved channels **106**, **106'** in cam wheel **98**.

Cam wheel **98** is actuated by a double-acting pneumatic cylinder **107** to which compressed air is admitted through supply tubes **108**, **109**. The cylinder is supported on the rear of the tilting frame by a bracket **111** fastened to rear transverse plate **65**. The piston rod **112** of the cylinder imparts a rotary movement to the cam wheel through a crank **113** to which it is connected by a link **114**. Both the cam wheel **98** and crank **113** are fast to a shaft **115** journalled in bearings **116** fastened to lower transverse plates **66**.

During the pinching cycle, compressed air is admitted first to the upper side of pneumatic cylinder **107** through tube **108** to impart a counter clock-wise rotation to cam wheel **98**, as indicated by arrow **117** in Fig. 6. Cam channel **101** is shaped to assure first the upward movement of vertical crosshead **94**, thereby pivoting jaws **76**, **76'** into their horizontal positions. Cam channels **106**, **106'** are so shaped that in the initial portion of the rotation of the cam wheel, levers **102**, **102'** remain stationary. During the later portion of the rotation of the cam wheel, they are actuated and the crossheads are thereby moved horizontally together to effect the pinching of the quartz tube. On the reverse stroke, compressed air is admitted through supply tube **109** to the lower side of pneumatic cylinder **107**; the cam wheel as a result rotates clockwise and the jaws first move apart then tilt down.

The operation of the heating and pinching mechanism may be controlled by the system schematically illustrated in Fig. 3. During the dwell period of the turret, the heating and pinching mechanism is tilted into its vertical position. It is desired that the heating and pinching cycle of the burners and jaws take place only if a quartz tube is present in the head. If a quartz tube is located between the jaws **9**, **9'** arms **11**, **11'** will be spaced further apart than if there is no tube. A feeler **118** at the end of a lever **119** pivotally supported on the pinching mechanism frame engages the corner of arm **11'** (Fig. 5) when the frame is tilted in, provided a quartz tube is present in the head. Lever **119** in turn actuates control switch **120** (Figs. 3 and 6). Switch **120** energizes a first timer **121** (Fig. 3) which, by means of suitable solenoid valves indicated at **122** and **123**, increases the flow of nitrogen into the quartz tube and turns on the oxyhydrogen burners. Timer **121** is adjustable to permit variation of the heating time depending upon the quality and thickness of quartz tubing being processed. After a predetermined time period, timer **121** shuts off solenoid valves **122** and **123**. This reduces the nitrogen flow to normal in order to prevent blowing out of the now white-hot plastic quartz, and shuts off the oxyhydrogen burners. The heating time period may in practice vary up to 24 seconds. At the end of the period of timer **121**, solenoid valve **124** and a second timer **125** are actuated. Solenoid valve **124** sets pneumatic cylinder **107** in operation. Timer **125** determines the delay interval controlling the reverse operation of solenoid **124** for reopening the jaws. In practice, the jaw closure time is less than one second.

It will be appreciated that the machine may be set up to operate at fixed time intervals, that is so that the heads are indexed from station to station at predetermined intervals of time. Alternatively operator controls may be used, if desired one for each operator at the two loading stations, whereby the machine will not index until both

operators have signaled the completion of their respective tasks. This latter method of control is usually preferable with newly trained operators whereas the former may be preferable with experienced operators.

While the present invention has been described with particular reference to a specific preferred embodiment of same, the details of construction described are intended as exemplary and not in order to limit the invention thereto, except insofar as included in the appended claims.

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

1. Apparatus for pinch sealing the ends of a quartz tube comprising a rotary indexing turret carrying a plurality of heads each having jaws for holding the quartz tube vertically and a spindle for holding a lead-in wire in alignment with the lower end thereof, and a heating and pinching mechanism comprising a frame normally positioned out of the path of movement of said heads during the index of the turret, means for moving said frame radially in towards the turret in order to encompass the quartz tube in a head during the dwell periods, burners carried on said frame for directing flames on the lower end of said quartz tube, a pair of opposed pinching jaws carried on said frame normally positioned clear of said flames, means for positioning said jaws in alignment with the lower end of said quartz tube, and means for moving said jaws together to pinch the heated lower end of said quartz tube therebetween.

2. Apparatus for pinch sealing the ends of a quartz tube comprising a rotary indexing turret carrying a plurality of heads each having jaws for holding the quartz tube vertically and a spindle for holding a lead-in wire in alignment with the lower end thereof, and a heating and pinching mechanism comprising a pivotally mounted frame normally tilted out of the path of movement of said heads during the index of the turret, means for tilting said frame radially in towards the turret in order to encompass the quartz tube in a head during the dwell periods, burners carried on said frame for directing flames on the lower end of said quartz tube, a pair of opposed pinching jaws pivotally mounted on said frame and normally positioned clear of said flames, means for pivoting said jaws into alignment with the lower end of said quartz tube simultaneously with the shutting off of said burners, and means for moving said jaws together to pinch the heated lower end of said quartz tube therebetween.

3. Apparatus for pinch sealing the ends of a quartz tube comprising a rotary turret carrying a plurality of heads each comprising a rotatable chuck having jaws for holding the quartz tube vertically and allowing the tube to be turned end for end, and a spindle for holding a lead-in wire in alignment with the lower end of said tube, an intermittent drive mechanism for said turret to index the heads to consecutive stations, and a heating and pinching mechanism located at a station and comprising a pivotally mounted frame normally tilted out of the path of movement of said heads during the index of the turret, a linkage to said drive mechanism for tilting said frame radially in towards the turret in order to encompass the quartz tube in a head during the dwell periods, burners carried on said frame for directing flames on the lower end of said quartz tube, a pair of opposed pinching jaws pivotally mounted on said frame and normally pivoted down to position the jaws clear of said flames, means for pivoting said jaws upwardly into alignment with the lower end of said quartz tube simultaneously with the shutting off of said burners, and means for moving said jaws together whereby to pinch the heated lower end of said quartz tube therebetween.

4. Apparatus for pinch sealing tubular quartz envelopes with a lead-in wire extending through the seal comprising a rotary indexing turret having a plurality of heads mounted thereon, each head comprising a rotatable chuck having a pair of tube-gripping jaws for holding the tube vertically and arranged to pivot for turning the tube end for end, and a spindle for holding a lead-in wire in alignment with the lower end of said tube, and a heating and pinching mechanism comprising a pivotally mounted frame normally tilted out of the path of movement of said heads during the index of the turret, means for tilting said frame radially in towards the turret in order to encompass the quartz tube in a head during the dwell periods, a pair of horizontally translating crossheads carried on said frame, gas burners mounted at the upper ends of said crossheads and aimed to direct flames on the lower end of the tube held in said head, a pair of pinching jaws attached to tilting brackets carried on said crossheads, a vertically reciprocating crosshead and linkages therefrom to said brackets for pivoting the brackets upwardly whereby to bring the jaws into horizontal alignment with the lower end of the tube, and means for operating said horizontally translating crossheads while the jaws are horizontally aligned in order to move the jaws into opposing relationship for pinching the heated lower end of the quartz tube.

5. Apparatus for pinch sealing tubular quartz envelopes with a lead-in wire extending through the seal comprising a rotary indexing turret having a plurality of heads mounted thereon, each head comprising a rotatable chuck having a pair of tube-gripping jaws for holding the tube vertically and arranged to pivot for turning the tube end for end, and a spindle for holding a lead-in wire in alignment with the lower end of said tube, an intermittent drive mechanism for said turret to index the heads to consecutive stations, and a heating and pinching mechanism located at a station comprising a pivotally mounted frame normally tilted out of the path of movement of said heads during the index of the turret, a linkage to said drive mechanism for tilting said frame radially in towards the turret in order to encompass the quartz tube in a head during the dwell periods, a pair of horizontally translating crossheads carried on said frame, gas burners mounted at the upper ends of said crossheads and aimed to direct flames on the lower end of the tube held in said head, a pair of pinching jaws attached to tilting brackets carried on said crossheads, a vertically reciprocating crosshead and linkages therefrom to said brackets for pivoting the brackets upwardly whereby to bring the jaws into horizontal alignment with the lower end of the tube, a pair of levers for operating said horizontally translating crossheads whereby to move the jaws horizontally together into opposing relationship for pinching the heated lower end of the quartz tube, a rotary cam for actuating said vertically reciprocating crosshead and said pair of levers, and means for actuating said cam after a predetermined time period of heating of the quartz tube by said burners.

6. Apparatus for pinch sealing tubular quartz envelopes with a lead-in wire extending through the seal comprising a rotary indexing turret having a plurality of heads mounted thereon, each head comprising a rotatable chuck having a pair of tube-gripping jaws for holding the tube vertically and arranged to pivot for turning the tube end for end, a spindle for holding a lead-in wire in alignment with the lower end of said tube and a port for supplying an inert gas to said tube through an exhaust tubulation extending laterally therefrom, an intermittent drive mechanism for said turret to index the heads to consecutive stations, and a heating and pinching mechanism located at a station comprising a pivotally mounted frame normally tilted out of the path of movement of said heads during the index of the turret, a linkage to said drive mechanism for tilting said frame radially in towards the turret in order to encompass the quartz tube in a head during the dwell periods, a pair of horizontally translating crossheads carried on said frame, gas burners mounted at the upper ends of said crossheads and aimed to direct flames on the lower end of the tube held in said head, a pair of pinching jaws attached to tilting brackets pivot-

ally mounted on said crossheads and normally pivoted down to position the pinching jaws clear of said flames, a vertically reciprocating crosshead and linkages therefrom to said brackets for pivoting the brackets upwardly whereby to bring the jaws into horizontal alignment with the lower end of the tube in front of said burners, a pair of levers for operating said horizontally translating crossheads whereby to move the jaws horizontally together into opposing relationship for pinching the heated end of the quartz tube, a rotary cam for actuating firstly said vertically reciprocating crosshead and then said pair of levers, and a control system for operating said cam after

a predetermined time period of heating of said quartz tube by said burners in order to close the pinching jaws and reopen them after a predetermined time period of closure.

References Cited in the file of this patent

UNITED STATES PATENTS

1,640,442	DeJong	Aug. 30, 1927
2,273,439	Freeman	Feb. 17, 1942
2,775,070	Burroughs	Dec. 25, 1956
2,816,398	Pearson	Dec. 17, 1957