Jan. 7, 1936. J. P. LAICO 2,027,181

SEALING-IN MACHINE

Filed Dec. 1, 1934

FIG. 1

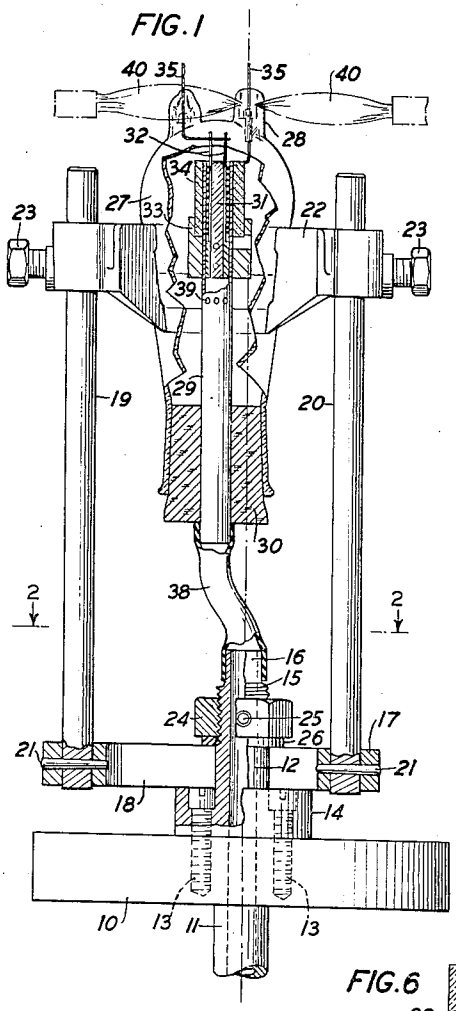


FIG. 3

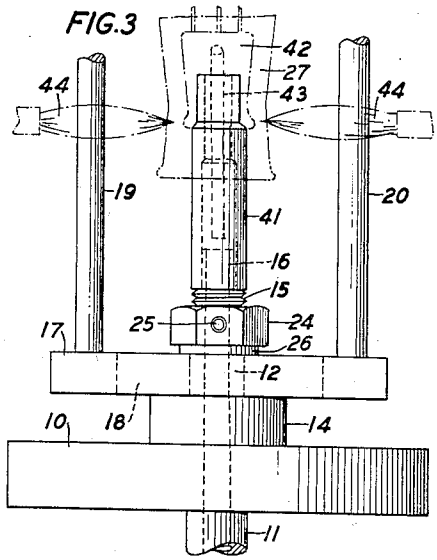


FIG. 4

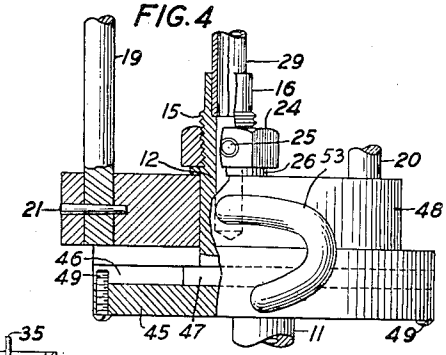


FIG. 6

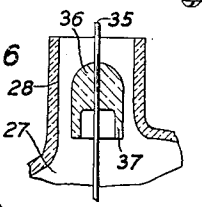


FIG. 2

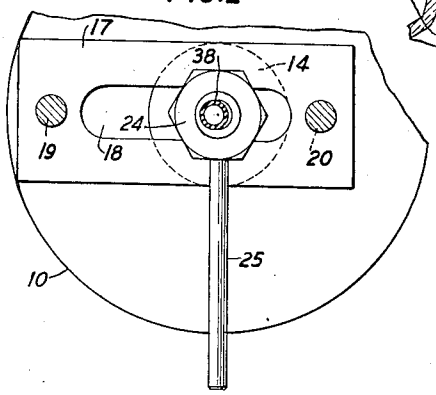
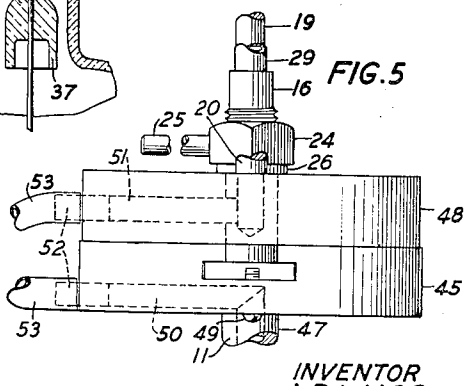


FIG. 5



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SEALING-IN MACHINE

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Application December 1, 1934, Serial No. 755,555

15 Claims. (Cl. 49—2)

This invention relates to glass sealing-in machines and more particularly to sealing-in heads for electric discharge devices.

An object of the invention is to hermetically seal current conductors in an enclosing bulb of a discharge device by machine in which the conductors are eccentric with respect to the axis of the bulb.

A further object of the invention is to coordinate the sealing operations in a universal head which will accommodate bulbs having conductors arranged in symmetrical or unsymmetrical configurations.

In accordance with this invention the sealing head comprises a rotatable frame having a portion for supporting the bulb and a base including a standard which is interconnected with a jig for mounting an electrode or a plurality of electrodes with respect to the bulb, the electrode or electrodes having individual conductors which extend through the top of the bulb eccentric with respect to the axis of the bulb. The frame is mounted in a slidable condition with respect to the base portion which has a stable axis so that the axis of the frame may be changed at intervals to conform to the arrangement of conductors which are to be sealed in the bulb.

In one form of the invention the frame is connected to a rotatable base to support a bulb in relation to an air supply connection projecting through the base which is connected to the bulb by a flexible hose coupling. A jig mounted within the bulb supports an electrode or a plurality of electrodes in accurate position with their leading-in conductors projecting through apertures in the top of the bulb. This arrangement permits the sealing of the conductors of the electrodes in the bulb simply by aligning the conductors with the stable axis of the head by a slidable adjustment of the frame supporting the bulb, while rotating the frame and bulb in a burner flame to seal the conductors to the bulb.

In accordance with another embodiment of the invention, the rotatable frame is mounted on a compound base in which one portion is slidable with respect to the other and a flexible coupling is connected to both portions of the base for injecting a supply of air into the bulb. In this form, the frame, base and standard are slidable as a unit to inaugurate the sealing operations on a machine and the head is arranged for universal application to various arrangements or groups of conductors to be sealed in the bulb.

The several embodiments of the invention, containing various features, will be described in more detail in the following description which applies to the accompanying drawing:

Fig. 1 is a view in elevation of a sealing-in head embodying the features of this invention and showing the manner in which the sealing operation is performed, portions of the head and the associated parts being shown in cross-section;

Fig. 2 is a plan view of the structure of the head as shown in Fig. 1 and taken on the line 2—2;

Fig. 3 is a partial view in elevation of the same head as shown in Fig. 1, but illustrating the assembly for sealing the flared stem into the bulb;

Fig. 4 is a partial view in elevation of a modified sealing-in head according to this invention with portions shown in cross-section to illustrate the detail assembly;

Fig. 5 is another view in elevation of the head shown in Fig. 4, but rotated 90 degrees; and

Fig. 6 is an enlarged fragmentary view in cross-section showing the relation of the detail components prior to forming the seal at the top of the bulb.

As shown in Fig. 1 of the drawing, a sealing-in head, of this invention, may be provided with a rotatable base 10 having a central tubular spindle 11 adapted for application to a sealing-in machine, wherein it may be rotated by any suitable mechanism (not shown). Machines employing heads of similar character usually include a rotary conveyor upon which the heads are disposed in spaced relation and the conveyor is operated intermittently by suitable indexing mechanism. Thus, the heads are carried around from one station to another and while at certain stations, such, for example, as the position for applying heat to the bulb for the sealing-in operation, mechanism operates to rotate the head. The conveyor mechanism and the various parts thereof are not shown in the drawing inasmuch as machines of this type are well-known in the glass working art.

A central tubular standard 12 is rigidly attached to the base 10 by screws 13 passing through a circular flange 14 of the standard and the base 10. The standard 12 is provided with a threaded portion 15 and a nipple termination 16. The standard therefore forms a continuing passageway of the tubular spindle 11 and both the standard and base rotate about a stable axis passing through the center of the passageway. A rectangular plate 17 having an elongated central slot 18 fits over the standard 12 and is seated in a horizontal position on the circular flange 14. The plate 17 carries a pair of parallel bars or rods 19 and 20 which are secured at opposite ends

of the plate by pins 21. An adjustable bulb holder 22 extends between the rods 19 and 20 and is secured to the rods by set screws 23, the plate, bars and bulb holder forming a frame structure of the sealing-in head. The frame is secured to the standard by a lock nut 24 which engages the threaded portion 15 of the standard and which may be manipulated by a handle 25, a washer 26 being interposed between the lock nut and the plate 17. The assembly of the frame facilitates rapid and accurate adjustment for periodically changing the lateral relationship of the frame with respect to the base to offset the normal axis of the frame and cause the frame to rotate about an eccentric axis which is in allgnment with the stable axis of the rotatable base.

The sealing-in head of this invention accommodates a bulb or enclosing vessel 27 of a discharge device, such as a thermionic amplifier tube, in which a plurality of electrodes are suitably spaced and the electrodes are provided with leading-in conductors which are sealed to the wall of the bulb for connecting the electrodes to an external circuit. Generally, the leading-in wires for the electrodes are combined in a single press which forms part of the stem of the device and are connected to terminal prongs on a base attached to one end of the device. Various operating conditions may require a variation of the location of the leading-in wires of the electrodes, for instance, to increase the insulating paths between the various electrode leading-in wires or to decrease the length of the leading-in wires and realize negligible inductance in the conductors particularly for ultra-high frequency operation of the device.

In distributing the various leading-in wires of the electrodes, it has been found preferable to project the leading-in wire for the anode or grid or both through the top of the vessel 27. When a single leading-in wire is brought out through the top of the vessel or bulb along the axis of the bulb, the ordinary sealing head is adequate for performing the sealing operation of the leading-in conductor in this position. However, if the leading-in conductor is sealed through the top of the vessel in an offset position, it is necessary to perform this sealing operation by hand. Similarly, if two or more leading-in wires are sealed through the top of the vessel it is evident that these wires must be so spaced to obtain the greatest spacial relation in order to overcome leakage paths between the various electrodes. It is evident that manual sealing requires expert operators and materially decreases production due to the time and care required to produce the seals.

The sealing head of this invention overcomes these difficulties and in order to realize the facility of making these seals in accordance with this invention the various operations of sealing-in the conductors will be described.

For purposes of illustration, the drawing shows a device in which the leading-in conductors for a grid or control electrode and an anode project through the top of the bulb while an electron emitter or cathode has its leading-in wires sealed through the stem, the grid and anode leading-in wires being the sole supports of these electrodes. Such a device is disclosed and claimed in my co-pending application, Serial No. 753,447, filed November 17, 1934. The bulb 27 is of the usual pear-shaped form and is seated in the bulb holder 22 in the frame. The bulb is originally formed with a tubular sleeve 28, as shown in Fig. 6, at the point through which the seal is to be made. Since the electrodes in the device shown are independently supported by their leading-in wires it is necessary to mount the electrodes in a suitable gauge or jig to insure accurate alignment and spacial relation between the electrodes in the final assembly.

In accordance with this invention the electrode jig comprises an elongated tubular metallic member 29 which is held in the bulb by a closure member 30, such as a tapered stopper or plug. A cylindrical metallic gauge or insert 31 is positioned within the tubular member 29 and has a diameter slightly less than the internal diameter of a helical grid which is mounted on two parallel support wires 32 and located within the cylindrical orifice between the insert 31 and the tubular member 29. A metallic block 33 is positioned on the external surface of the tubular member 29 and is machined to receive an anode 34, the block and insert being pinned to the tubular member 29 to prevent movement. Each of these electrodes is provided with a leading-in conductor or wire 35 which carries a glass bead 36 having a depending skirt portion 37, the bead and skirt portion being preformed on the wire preliminary to inserting the electrode in the jig. It will be noted from Fig. 6 that the bead 36 is situated in the tubular sleeve 28 of the bulb so that the top thereof is slightly below the edge of the sleeve 28. A flexible hose 38 is connected to the tubular member 29 and the nipple 16 of the standard, to facilitate the passage of a non-oxidizing gas, such as nitrogen, or air, into the bulb 27 through the holes 39 in the tubular member 29 directly below the block 33.

In order to seal the leading-in wire, for instance; the anode leading-in wire, in the bulb 27, the lock nut 24 is turned in a counter-clockwise direction and the frame with the bulb held therein is shifted to one side until the conductor 35 is in alignment with the normal axis of the standard 12 and base 10 whereupon the nut 24 is tightened to prevent movement of the plate 17 from its altered position. When the head is advanced to the sealing position on the conveyor, it will be rotated about an axis passing through the standard, bulb sleeve 28 and conductor 35. Two opposed burner flames 40 are directed toward the sleeve 28 to render the glass plastic until it collapses about the bead 36 and the conductor 35 to form a homogeneous union with the bead. During the fusing operation, air or gas entering the bulb equalizes the internal pressure with respect to the external pressure to prevent puncturing of the plastic glass in the vicinity of the seal and to aid in the formation by avoiding undue strains in the glass. Since the hottest part of the flame is at the point where the sealing is performed no detrimental effects occur in the other seal which passes through the broad part of the flame during each revolution of the head.

After the completion of the seal as described above, the head is moved to an inactive position so that the operator may adjust the head for sealing the other conductor in the top of the bulb. To accomplish this, the operator loosens the nut 24 and shifts the frame to a position wherein the conductor 35 of the grid is in alignment with the normal axis of the standard and base and when this adjustment is made the operator tightens nut 24 to maintain the adjustment. The head is advanced to a second sealing position and is rotated to seal the grid leading-in conductor 35 in the bulb in the same manner as described in connection with the anode leading-in conductor.

After the seals are completed at the top of the bulb the frame may be shifted to a central position as shown in Fig. 3. In this position the electrode jig may be removed by releasing the hose coupling 38 from the nipple 16 and withdrawing the plug 30 from the bottom of the bulb. In removing the jig care should be exercised, to prevent damage to the grid and alteration of the spacing between the grid and the anode which remain in position in the bulb due to their attachment to the supporting leading-in conductors. The completion of the sealing-in process consists in mounting a stem holder 41 on the nipple 16 of the standard 12. A glass stem 42 supporting a cathode or electron emitter (not shown) is mounted on the holder 41 with the exhaust tube 43 extending through the center of the holder. The head is then advanced to a third position on the conveyor and rotated in the flames of two opposed burners 44, to seal the neck of the bulb to the flare of the stem 42.

In the form of the invention shown in Fig. 1 the standard is rigidly fastened to the rotatable base and only the frame is moved so that it is necessary to provide a flexible coupling between the bulb and the standard. In a modification of the invention shown in Fig. 4 the tubular member 29 which forms part of the electrode jig may be directly mounted on the top of the standard. In this construction, a rotatable sub-base 45 is provided with a diametrical groove or slot 46. The standard 12 is provided with a circular flange termination 47 which slides in the groove 46 while the stem of the standard extends through a central aperture in a connecting block or base portion 48 which supports the upright posts 19 and 20. At the ends of the diametrical slot 46 are stop pins 49 which extend through the bottom of the rotatable sub-base 45. In this construction the frame of the head which includes the upright posts, standard and block 48, may be reciprocally shifted in a horizontal direction and adjusted in position by the nut 24, to align the conductor to be sealed in the top of the bulb along the axis of the sub-base 45, the axis of the conductor being normally eccentric with respect to the axis of the bulb. Since the standard is shifted with the frame it is necessary to by-pass the air passageway around the slot 46 and this is accomplished by forming parallel passageways 50 and 51 in the sub-base 45 and base portion 48, respectively, to communicate with the orifices in the spindle 11 and standard 12. The passageways 50 and 51 are provided with nipples 52, to receive the ends of a hose connection 53 whereby air or gas projected through the spindle 11 is conveyed to the interior of the bulb to perform the same function as described in connection with Fig. 1. This arrangement permits the location of a stem mount or a separate jig directly on the standard to align the electrodes with respect to the bulb prior to completing the sealing operations of the leading-in wires in the top of the bulb and the stem to the lower end of the bulb.

While the invention has been disclosed as applied to a discharge device with two eccentric conductors, it should be understood that the heads of this invention are not limited to such a specific application since it is obvious that the invention may be applied to other forms of bulbs in which one or more than two conductors are sealed in eccentric positions with respect to the axis of the bulb and therefore the invention is only to be limited within the scope of the appended claims.

What is claimed is:

1. A head for a sealing-in machine comprising a bulb holder, a rotatable base supporting said bulb holder, and means for offsetting said bulb holder with respect to the axis of said base.

2. The combination in a sealing-in machine comprising a holder adapted to support a bulb having an aperture eccentric with respect to the axis of the bulb, an electrode supporting member associated with said holder and adapted to be inserted into the bulb in said holder for aligning a conductor on an electrode with respect to the eccentric aperture, a rotatable base, and a slidable coupling between said holder and base for locating the bulb aperture and electrode conductor in alignment with the axis of said base.

3. The combination in a sealing-in machine comprising a head including a holder for supporting a bulb having an aperture eccentric with respect to the axis of the bulb, an electrode mount adapted to be inserted into the bulb for aligning a conductor on an electrode with respect to the eccentric aperture, a rotatable base, a slidable coupling between said holder and base for locating the bulb aperture and electrode conductor in alignment with the axis of said base, and a tubular standard associated with said base and holder for injecting an air supply into said bulb.

4. A head for a sealing-in machine, comprising a bulb frame including parallel upright members and a slotted connecting member, a rotatable base, means coupling said connecting member to said base, a hollow standard extending through said slotted connecting member, an electrode jig adapted to be enclosed in the bulb, and an air supply coupling member connecting said jig to said standard.

5. A head for a sealing-in machine comprising a bulb frame including parallel upright members and a connecting member, a rotatable base, means coupling said connecting member to said base, a hollow standard extending through said connecting member, a jig adapted to be enclosed in the bulb, an air supply coupling member connecting said jig to said standard, and means for adjusting said frame laterally with respect to said base.

6. A head for a sealing-in machine comprising a bulb frame including parallel upright members and a connecting member, a rotatable base, means coupling said connecting member to said base, a hollow standard extending through said connecting member, an electrode jig adapted to be enclosed in the bulb connected to said standard, means for shifting said frame with respect to said base, and locking means on said standard for said frame.

7. The art of machine sealing a conductor in an offset position in a fragile bulb by means of a rotary head including a frame for the bulb and a base supporting the frame, which involves the method of mounting the bulb having an eccentric aperture in the top thereof in said frame, positioning a conductor having a preformed bead seal within said bulb with the bead seal positioned in said eccentric aperture, shifting said frame to locate said aperture and conductor in the same axis of said base, and fusing said bead seal in said bulb by the rotary action of said head in a burner flame adjacent the junction of said bead seal and apertured bulb.

8. The art of machine sealing a conductor in an offset position in a fragile bulb by means of a rotary head including a frame for the bulb and a base supporting the frame, which involves the method of mounting a bulb having an eccentric

aperture in the top thereof in said frame, positioning a conductor having a preformed bead seal within said bulb with the bead seal extending through said eccentric aperture, shifting said frame to locate said aperture and conductor in the same axis of said base, fusing said bead seal to said bulb by the rotary action of said head in a burner flame adjacent the junction of said bead seal and apertured bulb, and supplying air to said bulb during the sealing operation.

9. The manufacture of a discharge device in which a plurality of electrodes are held in spaced relation by rigid leading-in conductors sealed in spaced offset positions in the top of the bulb, the method which comprises mounting the respective electrodes in proper relation in a jig, said electrodes having their conductors with preformed bead seals thereon projecting upwardly in spaced relation, placing said jig on a central standard of a frame on a rotatable base, supporting a glass bulb on said frame to enclose said electrodes with the conductors extending through offset apertures in the top thereof, shifting said frame to align one of said conductors with the axis of said base, rotating said frame, fusing the aligned apertured bulb and bead seal on one conductor, shifting said frame to align the other conductor with the axis of said base, fusing said last mentioned aligned apertured bulb and conductor, and removing said bulb and electrodes from said frame and jig.

10. A head for a sealing-in machine comprising a bulb support, a mount support adapted to position an electrode within the bulb, a leading-in conductor extending from the electrode eccentric with respect to the axis of the bulb and projecting through said bulb, a rotatable base connected to said bulb support, and means for slidably shifting said bulb support with respect to said base to align the leading-in conductor extending through the bulb with the stable axis of said base.

11. A rotatable head for a sealing-in machine comprising a frame having a slotted portion, a standard extending through said slotted portion and positioned within said frame, and means for locking said standard in said frame eccentric with respect to the normal axis thereof.

12. A rotatable head for a sealing-in machine comprising a frame having a base portion, a standard projecting from said base portion, a sub-base portion adjacent said base portion, and interconnecting means joining said base and sub-base portions for slidably adjusting said base portion transversely with respect to said sub-base portion.

13. A rotatable head for a sealing-in machine comprising a frame having a slotted portion, a rotatable base, a standard extending from said base through the slotted portion of said frame, and means for locking said frame in various eccentric positions with respect to said standard.

14. A rotatable head for a sealing-in machine comprising a base having a diametrical channel, a frame superimposed on said base, a central standard attached to said frame and having an enlarged end portion slidable in said channel, means for adjusting the position of said frame with respect to said base, and a flexible tubular connection between said base and frame.

15. A rotatable head for a sealing-in machine comprising a base having an elongated channel, a frame superimposed on said base, a central standard attached to said frame and having an enlarged end portion slidable in said channel, means for adjusting the position of said frame with respect to said base, and a lock-nut on said standard adjacent said frame for adjusting said frame eccentric with respect to said base.

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