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PRESS SEALING APPARATUS

3,290,134

Original Filed Feb. 18, 1960

2 Sheets-Sheet 1

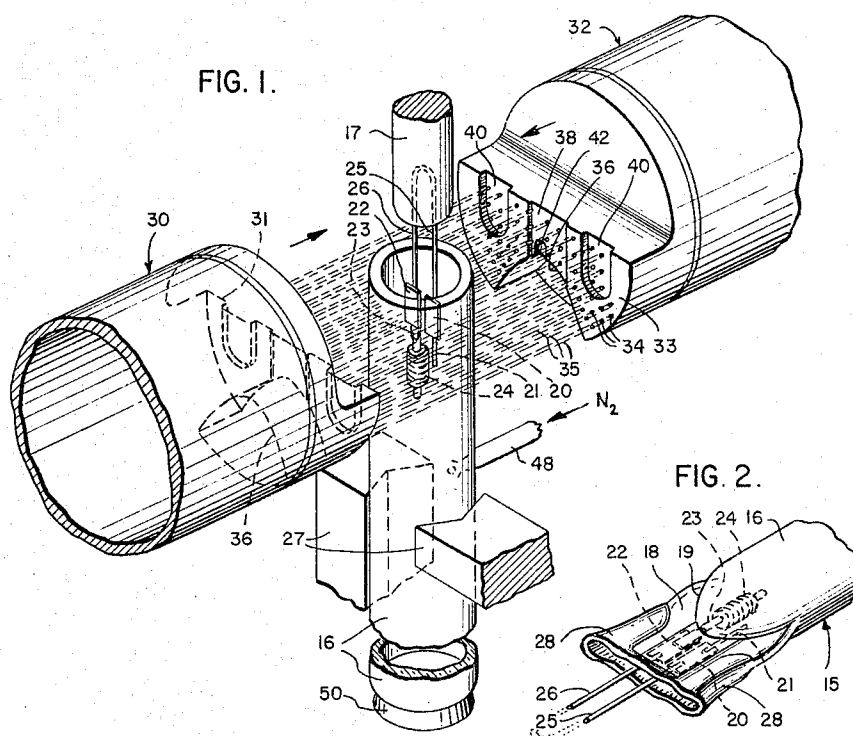


FIG. 3.

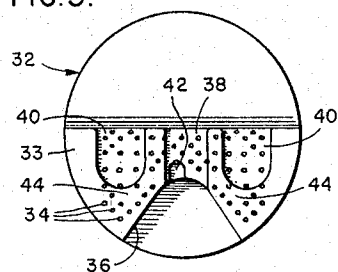


FIG. 4.

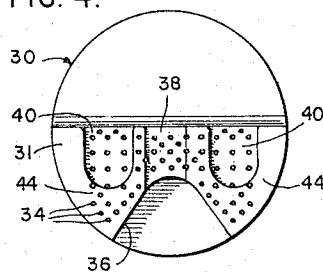


FIG. 5.

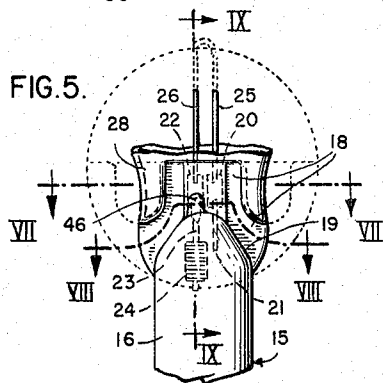
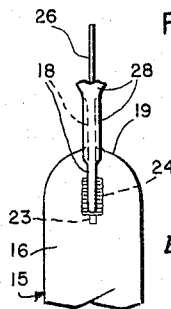


FIG. 6.



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FIG. 7.

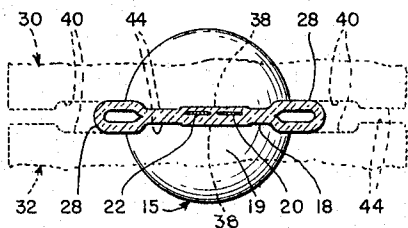


FIG. 8.

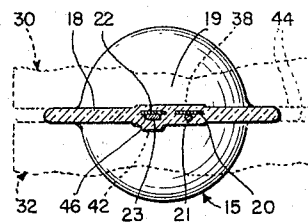


FIG. 9.

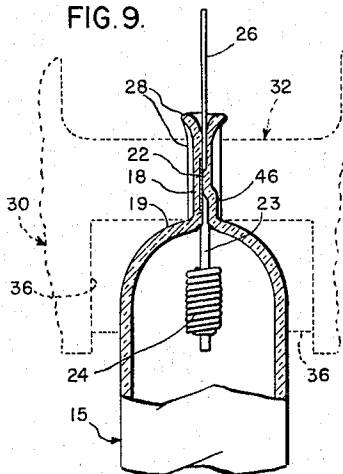


FIG. 10.

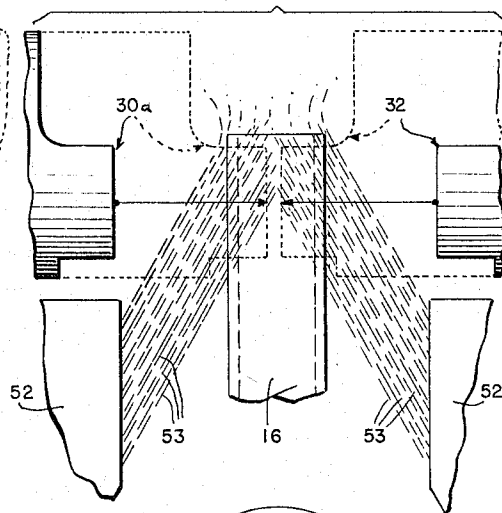


FIG. 11.

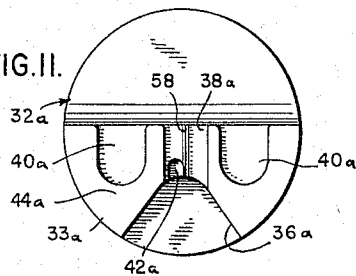


FIG. 12.

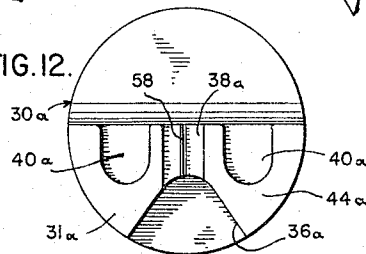


FIG. 13.

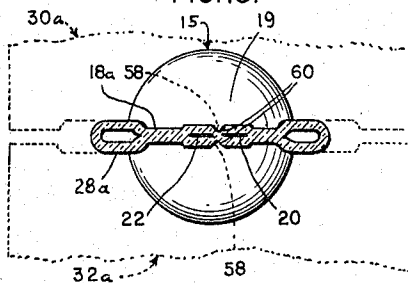
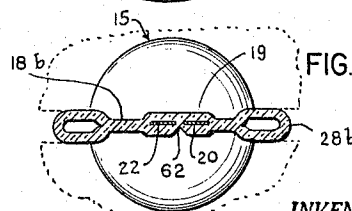


FIG. 14.



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3,290,134

PRESS SEALING APPARATUS

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Original application Feb. 18, 1960, Ser. No. 9,638, now Patent No. 3,025,426, dated Mar. 13 1962. Divided and this application June 19, 1961, Ser. No. 118,163
15 Claims. (Cl. 65-140)

This invention relates to sealing and, more particularly, to apparatus for forming a press seal in the arc tube of a high-pressure mercury-vapor lamp or the like and is a division of copending application Serial No. 9,638, filed February 18, 1960, entitled "Press Seal and Apparatus," now U.S. Patent No. 3,025,426.

It has heretofore been the practice in the manufacture of arc tubes for high intensity light sources, such as high-pressure mercury-vapor (HPMV) lamps for example, to attach constricted end sections to a length of quartz tubing and then collapse them onto the fragile lead-in conductors conventionally employed in such lamps. More recently there has been developed a so-called "full press" seal wherein the entire end segment of the quartz tubing is collapsed and sealed off thereby eliminating the need for the aforesaid constricted end sections and proportionately reducing the manufacturing cost of the arc tube.

While the adoption of such full press seals permitted the quartz tubing to be made directly into arc tubes without preforming the ends or attaching constricted sections thereto, it also increased the total amount of heat and pressure required since the entire end segment of the relatively large diameter tube had to be collapsed and molded. This, in turn, required that the sealing fires and press jaws be precisely adjusted and constantly checked otherwise a prohibitive rate of shrinkage or poor quality seals would result. In addition, and of equal importance, the lateral flow of plastic quartz over the fragile lead-in conductors resulting from compressing such a large volume of quartz frequently placed the conductors under an excessive amount of tension during the sealing-in operation causing them to tear, thereby ruining the seal and increasing the rate of shrinkage.

It is accordingly the general object of the present invention to overcome and avoid the foregoing and other problems associated with the manufacture of full press seals.

Another object is the provision of press sealing apparatus capable of forming a full press seal with a minimum amount of heat and pressure and in a manner such that the fragile lead-in conductors are not damaged during the press-forming operation.

The aforesaid objects, and others which will become apparent as the description proceeds, are achieved in accordance with this invention by providing press jaws which tightly compress only the critical portion of the seal assembly, that is, the segment of the arc tube end that overlies that lead-in conductor or conductors and that extend laterally therefrom around the bulbous shoulder portion of the tube to the sides thereof. Thus, only a preselected part rather than the entire end segment of the tube is tightly compressed and hermetically sealed by the jaw. All of the benefits and advantages of a full press seal are, accordingly, obtained with only a fraction of the compressive force and machine maintenance heretofore required.

A better understanding of the invention will be obtained by referring to the accompanying drawings wherein:

FIG. 1 is a fragmentary perspective view of a seal assembly comprising an arc tube and a pair of electrode-conductor sub-assemblies held in sealing relationship be-

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tween a pair of burner-press jaws that incorporate the present invention;

FIG. 2 is a perspective view of the full press seal formed on the end of the arc tube by the apparatus shown in FIG. 1;

FIGS. 3 and 4 are front views of the work faces of the burner-press jaws shown in FIG. 1;

FIGS. 5 and 6 are front and side elevational views, respectively, of the full press seal shown in FIG. 2;

FIGS. 7 and 8 are cross-sectional views through the finished press seal along the lines VII-VII and VIII-VIII of FIG. 5, respectively, in the direction of the arrows, portions of the press jaws being shown in dotted outline;

FIG. 9 is a cross-sectional view through the seal along the line IX-IX of FIG. 5, in the direction of the arrows, the press jaws being shown in dotted outline;

FIG. 10 is a side view in elevation of an alternative form of the invention wherein separate press jaws and burners are employed;

FIGS. 11 and 12 are plan views of the work faces of an alternative set of press jaws according to the invention; and

FIGS. 13 and 14 are views corresponding to FIG. 7 but show alternative press seal embodiments formed by the alternative set of press jaws shown in FIGS. 11-12 and a different set of press jaws, respectively.

While the press sealing apparatus of the present invention may be advantageously employed to hermetically seal any vitreous article of relatively large diameter, it is particularly adapted for use in conjunction with the sealing of HPMV lamp arc tubes and accordingly has been so illustrated and will be so described.

With specific reference to the form of the invention shown in the drawings, in FIG. 2 there is illustrated one end of an arc tube 15 for an HPMV lamp which tube comprises a light-transmitting envelope of highly refractory vitreous material such as a length 16 of quartz tubing of relatively large and substantially uniform diameter, both ends whereof are hermetically closed by a full press seal 18 which constitutes part of a flattened end section. As shown, the press seal 18 is of generally Y-shaped configuration in that it has a riser segment that extends inwardly from the end of the quartz tube 16 centrally and axially thereof to the bulbous arcuate shoulder 19 of the tube where it branches into two arm segments that extend laterally around said shoulder to the sides of the aforesaid flattened end section. The aforesaid riser segment is of such width that it is not only overlies and is hermetically united with a pair of thin and extremely fragile lead-in conductors such as metal ribbons 20 and 22 but extends therebeyond and includes the adjoining quartz-to-quartz area of the seal assembly as well. The ribbon conductor 20 is connected at one end to an auxiliary electrode 21 sealed inside the quartz tube 16 and at its other end to an external terminal lead 25. The ribbon conductor 22, in turn, is connected at one end to the flattened end of a support rod 23 that carries a main electrode 24 and at its opposite end to another terminal lead 26. The ends of the aforesaid terminal leads, auxiliary electrode and support rod are embedded and thus anchored in the axially extending riser segment of the Y-shaped seal 18.

By virtue of the configuration of the full press seal 18 there is provided a partly compressed but unsealed and thus raised area 28 of generally U-shaped configuration on the end of the quartz tube 16 (see FIG. 2 and more particularly FIGS. 5-7 and 9). The aforesaid press seal and unsealed raised area together constitute the previously mentioned flattened section at each end of the quartz tube 16, which section is greater in width than the diameter of the tube and lies in the same plane that contains the ribbon conductors 20 and 22. The raised area 28

comprises the flattened but unsealed end and adjoining marginal segments of the tube end so that the press seal 18 is located inwardly therefrom and is partly surrounded thereby, as shown in FIGS. 2 and 5.

Only one end of the quartz tube 16 is provided with two electrodes 21 and 24 as here illustrated, the opposite end having only a main electrode as is customary. In order to facilitate locating the conductor-and-electrode assemblies in proper sealing relationship within the end of the quartz tube 16 the terminal leads 25 and 26 initially are joined together by a loop (as shown by the dotted lines in FIGS. 2 and 5) and thus comprise a unitary U-shaped pin. After the press seal 18 has been completed the aforesaid loop is cut off to provide the desired individual terminal leads 25 and 26.

The seal per se is the subject matter of and is claimed in the above-mentioned copending parent application Serial No. 9,638, now U.S. Patent No. 3,025,426.

In FIG. 1 there is illustrated a preferred apparatus for fabricating the full press seal 18 in accordance with this invention. As there shown, the two conductor-and-electrode assemblies are placed within the end of the quartz tube 16 to provide a seal assembly which is then compressed by a pair of press jaws 30 and 32, after the end of the quartz tube 16 is heated and made plastic. The work faces 31 and 33 of the jaws are specially contoured, as will be hereinafter described, to apply the differential sealing pressure required to form the press seal 18. The main and auxiliary electrodes, together with their respective lead-in and terminal conductor assemblies, are held in proper sealing relation within the end of the quartz tube 16 by means of a jig 17 in which the looped end of the pin connecting the terminal leads 25 and 26 is anchored, the tube in turn being held by a suitable holder 27. As will be understood, the aforesaid jig, tube holder, and press jaws comprise parts of an automatic sealing machine that includes suitable well-known means (not shown) for reciprocally moving the jaws toward each other in a direction perpendicular to the plane containing the ribbon conductors 20 and 22, as indicated by the arrows in FIG. 1.

When the aforementioned seal assembly consisting of the quartz tube 16, the auxiliary electrode 21, the main electrode 24, the support rod 23 and their respective lead-in and terminal conductors is indexed into position between the press jaws 30 and 32, it is centrally located therebetween as shown in FIG. 1. As shown in the latter figure, and more particularly in FIGS. 3 and 4, the work faces 31 and 33 of the aforesaid press jaws are both of generally semicircular configuration and are contoured to match one another except for one difference which will hereinafter be described. In this particular embodiment the jaws 30 and 32 comprise the heads of gas-burners and their work faces are provided with a plurality of fine holes 34 that communicate with the interior of the respective jaws which, in turn, are connected to a suitable gas supply (not shown), such as a mixture of oxygen and illuminating gas or hydrogen for example. Thus, according to this embodiment the jaws are adapted to apply both heat and differential sealing pressure to the end of the quartz tube 16, the heat being applied in the form of flame jets 35 when the work faces of the jaws are not in contact with the quartz.

As shown, each of the semicircular work faces 31 and 33 have a centrally located arcuate cavity such as a concave groove 36 that extends radially inward from the arcuate edge of the jaw and partly across the work face. This groove merges with a much shallower medial groove or depression 38 that extends from the apex of the concave groove 36 diametrically across to the oppositely-disposed straight edge of the respective work faces. As shown more particularly in FIGS. 3 and 4, the medial depressions 38 are located slightly off center with respect to their respective work faces and the concave grooves 36 to enable the rod 23 and main electrode 24

to be centered as closely as possible within the quartz tube 16 without positioning the auxiliary electrode 21 too close to the inner surface of the arcuate bulbous shoulder 19.

Each of the work faces 31 and 33 are also provided with a pair of elongated marginal depressions 40 that are disposed laterally and on either side of the medial depressions 38 and extend parallel thereto from the straight edges of the work faces. The marginal depressions 40, as shown in FIG. 1, are deeper than the medial depressions 38 but much shallower than the concave grooves 36. The marginal depressions are also located on either side of the respective grooves and extend beyond the apex thereof.

The work faces 31 and 33 are identical in every respect except that the one which faces the end of the support rod 23 adjoined to the ribbon conductor 22 (as here shown it is the work face 33 of the jaw 32) is provided with an auxiliary depression 42 that communicates with and extends inwardly from approximately the apex of the concave groove 36 proximate and parallel to the more centrally located edge of the medial depression 38. The aforesaid auxiliary depression is dimensioned and located to overlie the flattened end of the support rod 23 that is connected to the ribbon conductor 22 and thus provide a relief cavity therefor.

As shown in FIGS. 1, and 7 and 8, the medial depressions 38 are disposed and dimensioned to overlie and provide relief cavities for the ribbon conductors 20 and 22, whereas the deeper marginal depressions 40 are disposed and dimensioned to overlie the corresponding marginal or quartz-to-quartz portions of the seal assembly. The length of the medial depressions 38 is such that the outermost end segment of the tube 16 is not contacted thereby and is thus flattened but not compressed or sealed during the press-forming operation. By virtue of the configuration and location of the aforesaid grooves and depressions there is provided in each work face a pair of generally U-shaped lands 44 which, together with the planar recessed surfaces of the medial depressions 38, define the areas of greatest compression and mold the plastic quartz to form the generally Y-shaped press seal 18.

The press-forming operation is accomplished by heating the end of the quartz tube 16 until it becomes plastic and then advancing the burner-press jaws 30 and 32 toward each other a predetermined distance to partially flatten the tube end. The jaws are then returned to their original open position to allow the flame jets 35 to reheat the quartz. When this has been accomplished, the jaws are again advanced until the motion thereof is stopped by the pressed quartz.

As shown in FIGS. 7 and 8, when the jaws close the medial depressions 38 form a shallow pocket for the ribbon conductors 20 and 22 thereby not only taking the pressing shock off the ribbons but minimizing the lateral flow of molten quartz in this region during the pressing operation—both of which serve to prevent tearing of the ribbons. The press seal 18 is accordingly slightly thicker in this region by an amount at least equal to and preferably slightly in excess of the maximum ribbon thickness. The marginal depressions 40, on the other hand, form relatively deep cavities for the corresponding portions of the tube 16 which are thus merely flattened and left substantially unsealed as shown in FIG. 7. This latter feature drastically reduces the amount of pressure required to form the seal insofar as the aforesaid marginal portions of the tube, due to the tube curvature, are not heated to as high a temperature as the central portion of the tube and are thus not as plastic and harder to compress.

It should also be noted that while each of the lands 44 are of generally U-shaped configuration only the centrally located portions thereof actually contact the end of the quartz tube 16 and are used in molding the seal, as shown in FIGS. 7 and 8. Thus, the effective or operative areas of the aforesaid lands, together with the recessed planar

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surfaces of the medial depressions 38, form a pressing surface that is actually of Y-shaped configuration. As will be noted in FIGS. 3 and 4, the grooves 36 are located between the arm segments of the respective Y-shaped pressing surfaces, whereas the riser segments of the aforesaid surfaces extend from the apex of the grooves and thus overlie the central portion of the quartz tube.

As shown in FIGS. 8 and 9, when the jaws are closed the auxiliary depression 42 in the work face 33 of the jaw 32 overlies and forms a pocket for the end of the support rod 23 connected to the ribbon conductor 22. As a result there is provided a reinforcing knot or knob 46 of quartz in this critical area that serves to inhibit the formation of cracks in the finished seal as it cools.

As is illustrated in FIG. 1, in order to prevent excessive oxidation of the ribbon conductors 20 and 22 during the preheating and press-forming operations, nitrogen or other suitable inert gas is passed through the quartz tube 16 through a tubulation 48 thereon, the other end of the tube being closed off by a stopper 50 in the manner illustrated.

As shown in FIG. 10, separate burners 52 may be employed, if desired, to heat the quartz. The burners are designed to angularly direct their flame jets 53 onto the end of the quartz tube 16 from a location adjacent to but out of the line of movement of the press jaws 30a and 32a. According to this embodiment the work faces of the press jaws would accordingly only be used for compressing and not heating the quartz and thus would not have gas openings therein, as illustrated in FIGS. 11 and 12. As there shown, the work faces 31a and 33a are identical in every respect to those of the combination burner-and-press jaws 30 and 32 described above except that they are devoid of the aforesaid gas openings. In addition, it will be noted that the medial depressions 38a are partitioned by centrally located and axially extending rib-like projections 58. The projections 58 are not as high as the lands 44a but are of sufficient height to produce and define a region of increased compression in the molten quartz between the ribbon conductors 20 and 22 when the jaws 30a and 32a are advanced into sealing position, as shown in FIG. 13. This, in turn, generates lateral oppositely-directed forces in this region during the pressing operation that forces the ribbons apart and maintains a predetermined spacing therebetween sufficient to prevent them from shorting out and causing an internal arc that would ruin the arc tube. The resulting indentation of the quartz in this area, of course, forms two aligned grooves 60 (FIG. 13) that extend axially of the riser segment of the press seal 18a.

As shown in FIG. 14, only a single rib or projection may be provided in one of the jaws to provide a press seal 18b having a riser segment with only one groove 62 therein. This is sufficient to produce the desired lateral pressure in the inter-ribbon area and effect the resultant automatic separation of the ribbons without any possibility whatever of dangerously weakening the seal.

Experience has shown that the reduction in the criticality of the sealing operation achieved by tightly compressing and closing only the preselected and necessary portions of the end of the quartz tube required to seal-in the ribbons and seal off the tube in accordance with this invention has decreased the percent shrinkage due to torn ribbons, leaky seals, etc. by about 80% compared to the previous practice of compressing and sealing the entire end segment of the tube.

It will be apparent from the foregoing that the objects of the invention have been attained by providing an improved press sealing apparatus wherein only a preselected part rather than the entire end of the quartz tube is compressed and sealed off by the press jaws, thereby not only reducing the total amount of pressure required and rendering the press-forming operation less critical but providing a tighter and more durable seal with less shrinkage.

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While several apparatus embodiments have been described in detail, it is to be understood that various modifications and refinements therein may be made without departing from the spirit and scope of the invention.

I claim:

1. In apparatus for forming a press seal across a vitreous tube,

a pair of press jaws having opposed work faces that are spaced to receive therebetween the heated segment of a tube across which the seal is to be formed and have

an arcuate groove therein that extends partly across the respective work faces from an edge thereof, and a pair of elongated marginal depressions disposed on either side of and beyond said groove,

the portions of said work faces between said grooves and the respective marginal depressions comprising lands that define matching generally Y-shaped pressing surfaces which, when said press jaws are in a closed position, are adapted to tightly compress only preselected portions of the interposed heated tube segment and form a seal thereacross.

2. Press sealing apparatus as set forth in claim 1 wherein said pair of press jaws constitute gas-burner heads and the work faces thereof are provided with a plurality of apertures that communicate with the interior of said press jaws.

3. Press sealing apparatus as set forth in claim 1 wherein;

said arcuate grooves are located between the arm segments of the respective Y-shaped pressing surfaces, and

the riser segments of said Y-shaped pressing surfaces extend from the apex of the respective grooves.

4. In apparatus for forming a quartz-to-metal seal on the end of a quartz tube and simultaneously hermetically embedding a conductor and the end of an adjoined electrode assembly therein,

a pair of press jaws having opposed work faces that are of generally semicircular configuration and spaced to receive therebetween the heated end of a quartz tube having a lead-in conductor and adjoined electrode assembly disposed therein,

each of said work face having

a centrally-located concave groove therein that extends radially inward from its arcuate edge,

a medial depression that extends from the apex of said groove to the straight edge of said work face, and

a pair of elongated marginal depressions located on either side of said medial depression and spaced from said concave groove distances such that they are adapted to overlie marginal portions of an interposed tube end,

the portions of said work faces between said grooves and the respective marginal depressions comprising lands that define matching generally Y-shaped pressing surfaces which, when said press jaws are in a closed position, are adapted to tightly compress only preselected portions of the interposed tube segment and form a seal thereacross,

said medial depressions being located so as to overlie the lead-in conductor disposed within the interposed tube end and thus provide a relief cavity therefor.

5. Press sealing apparatus as set forth in claim 4 wherein at least one of the work faces of said press jaws is provided with an auxiliary depression that communicates with the concave groove therein and is adapted to define a pocket for the part of the interposed tube end that overlies the end of the electrode assembly adjoined to the lead-in conductor.

6. In apparatus for forming a quartz-to-metal seal on the end of a quartz tube and simultaneously hermetically embedding a pair of fragile lead-in conductors in spaced apart longitudinally extending position therein,

a pair of press jaws having opposed work faces that are spaced to receive therebetween the heated end of a quartz tube and a pair of spaced lead-in conductors disposed therein,

each of said work faces having

an arcuate groove therein that extends partly across the respective work faces from an edge thereof,

a medial depression that extends from said arcuate groove toward the opposite edge of the work face,

a pair of elongated marginal depressions located on either side of said medial depression and spaced from said arcuate groove distances such that they are adapted to overlie the marginal quartz-to-quartz portions of the seal on opposite sides of the enclosed pair of spaced lead-in conductors,

the portions of said work faces between said grooves and the respective marginal depressions comprising lands that define generally Y-shaped pressing surfaces which, when said press jaws are in a closed position, are adapted to tightly compress the interposed tube segment onto the lead-in conductors and seal it off,

said medial depressions extending along the riser segments of the respective Y-shaped pressing surfaces and defining a relief cavity for the conductor-to-quartz portion of the seal,

at least one of the work faces of said press jaws having a projection thereon that extends longitudinally of the medial depression and is adapted to overlie the quartz-to-quartz portion of the seal located between the pair of lead-in conductors.

7. Press sealing apparatus as set forth in claim 6 wherein;

said grooves are of concave configuration and centrally located with respect to the work faces, and

said medial depressions extend from and are slightly off-center with respect to the apex of the concave grooves.

8. In apparatus for forming a quartz-to-metal seal on the end of a quartz tube and simultaneously hermetically embedding a ribbon lead-in conductor in and approximately centrally within the seal,

a pair of press jaws having opposed work faces that are of generally semicircular configuration and spaced to receive therebetween the heated end of a quartz tube having a ribbon lead-in conductor substantially centrally disposed therein,

each of said work faces having

a centrally-located concave groove that extends radially inward from the arcuate edge toward the straight edge of the work face,

a medial depression that is shallower than said groove and extends from the apex thereof to the straight edge of the work face,

a pair of elongated marginal depressions located on either side of said medial depression and extending in substantially parallel relationship therewith to the straight edge of said work face,

said marginal depressions having a depth greater than said medial depression and being spaced therefrom distances such that they are adapted to overlie the marginal portions of the interposed tube end on opposite sides of the enclosed lead-in conductor,

the area between said concave groove and the respective marginal depressions comprising a pair of generally U-shaped lands the operative surfaces whereof together with the surface of the medial depression therebetween define a pressing surface of generally Y-shaped configuration in each of the press jaws which, when said press jaws are in a closed position, are adapted to tightly compress (1) the central portion of the interposed tube end onto the enclosed ribbon-lead-in conductor and (2) adjacent marginal portions of the tube that extend laterally therefrom to the sides of the tube and thereby hermetically seal-off the tube

at a point remote from the end thereof and simultaneously embed the lead-in conductor in the seal,

the riser segments of said Y-shaped pressing surfaces being disposed to overlie the quartz-to-conductor portion of the seal, and

the arm segments being disposed to extend laterally around the tubular body portion of the interposed tube end and thereby provide a bulbous arcuate shoulder thereat.

9. Apparatus for forming a press seal across a vitreous tube comprising;

a pair of press jaws having opposed work faces spaced to receive therebetween the segment of a tube across which the seal is to be formed,

means for holding said tube and positioning a predetermined segment thereof between and centrally of said press jaws,

means for actuating said jaws and moving them into compressive engagement with the interposed tube segment, and

gas burners located adjacent to but out of the line of movement of said press jaws for heating the interposed tube segment,

each of the work faces of said press jaws having an arcuate groove and a pair of marginal depressions therein that extend partly across the respective work faces from opposite edges thereof,

the portions of said work faces between said grooves and marginal depressions comprising lands that define generally Y-shaped pressing surfaces which, when said press jaws are in a closed position, are adapted to tightly compress only preselected portions of the interposed tube segment and form a seal thereacross.

10. In apparatus for forming a press seal across a vitreous tube,

a pair of movable press jaws having opposed work faces spaced to receive a segment of said tube therebetween when said press jaws are in their open position and to apply sealing pressure to the interposed tube segment when said jaws are actuated,

means for holding said tube and positioning a preselected segment thereof between and centrally of the work faces of said press jaws,

means for heating the interposed segment of said tube, and

means for actuating said press jaws,

each of the work faces of said press jaws having (1) a matching arcuate groove therein that extends inwardly from the periphery of the respective work face, and (2) a pair of matching depressions that are spaced from and disposed on either side of the respective grooves,

the portions of said work faces between said grooves and depressions comprising lands which define a pair of matching generally Y-shaped pressing surfaces which, when said press jaws are actuated, tightly compress only preselected portions of the interposed heated tube segment and form a seal that extends completely across and closes off said tube.

11. Press sealing apparatus as set forth in claim 10 wherein; the riser portions of said generally Y-shaped pressing surfaces constitute the central portions of the respective work faces, and the arm portions of said Y-shaped pressing surfaces constitute marginal portions of the respective work faces that overlie the marginal portions of the interposed tube segment and extend to the sides of the tube.

12. Press sealing apparatus as set forth in claim 10 wherein at least one of the work faces of said press jaws is provided with an elongated projection that extends longitudinally of the riser segment of the generally Y-shaped pressing surface.

13. Press sealing apparatus as set forth in claim 10 wherein said press jaws comprise apertured gas-burner

heads and thus also serve as the means for heating the interposed tube segment.

14. In apparatus for forming a press seal on the end of a quartz tube and simultaneously hermetically embedding a fragile lead-in conductor and the end of an adjoined electrode assembly in said seal, 5

a pair of movable press jaws having opposed work faces spaced to receive therebetween the end of the quartz tube across which the seal is to be formed,

means for holding said quartz tube between and centrally of said press jaws and the lead-in conductor and adjoined electrode assembly in sealing relationship within the end of said tube, 10

means for heating the end of said quartz tube, and means for actuating said press jaws and moving them into compressive engagement with the interposed end of the tube, 15

each of the work faces of said press jaws having (1) a matching concave groove that extends inwardly toward the center of the respective work face from the periphery thereof, (2) a matching medial depression that extends from said concave groove to the opposite edge of the work face, and (3) a pair of matching marginal depressions spaced from and located on opposite sides of the aforesaid medial depression and groove, 20

said marginal depressions having a depth greater than 25

said medial depressions and being disposed to overlie the side edges of the interposed tube end,

the portions of said work faces between the concave grooves and marginal depressions comprising lands which, together with said medial depressions, define matching generally Y-shaped pressing surfaces that are adapted to compress only preselected portions of the interposed tube end, including the portion that overlies the fragile lead-in conductor and adjoined end of the electrode assembly, and form a generally Y-shaped seal on the end of the tube.

15. Press sealing apparatus as set forth in claim 14 wherein the work face of one of said press jaws has a depression therein that merges with the concave groove and defines a relief cavity for the portion of the quartz tube that overlies the end of the electrode assembly attached to the fragile lead-in conductor.

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