

June 30, 1953

R. K. BRAUNSDORFF

2,644,100

SEALED LIGHTING UNIT AND METHOD OF MANUFACTURE

Filed Dec. 28, 1945

4 Sheets-Sheet 1

FIG. 8

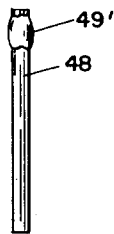


FIG. 1

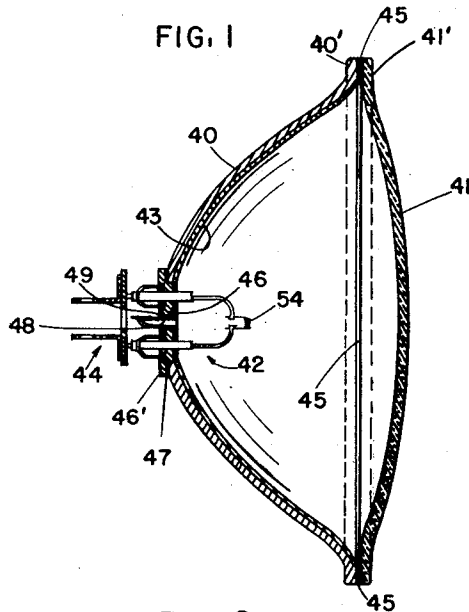


FIG. 2

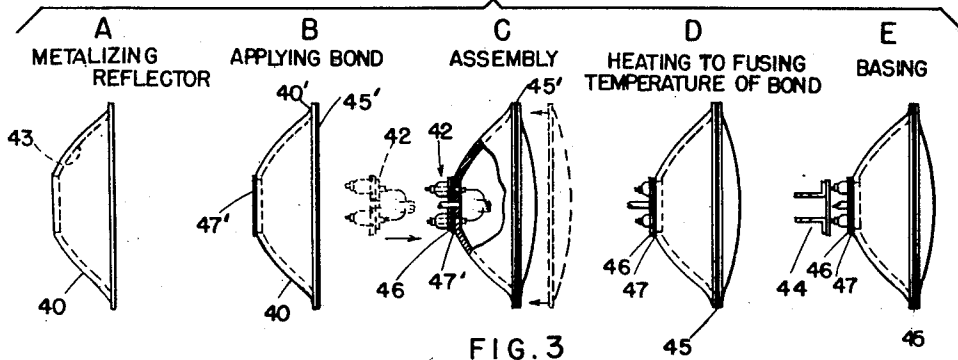
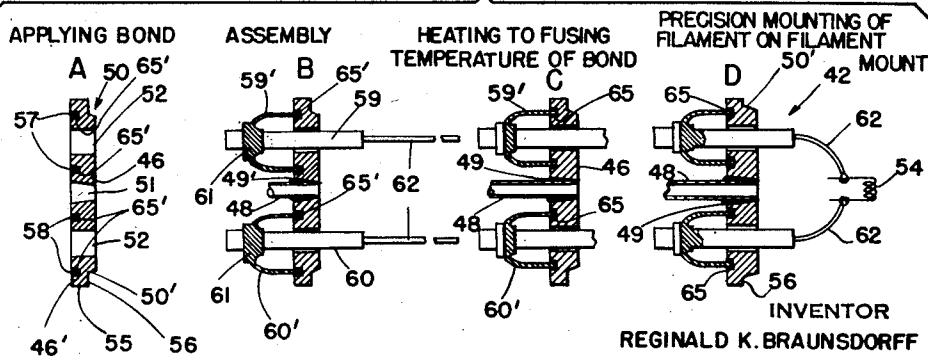


FIG. 3



INVENTOR
REGINALD K. BRAUNSDORFF

BY
Bartlett Eyre Keel & Wymouth
ATTORNEYS

June 30, 1953

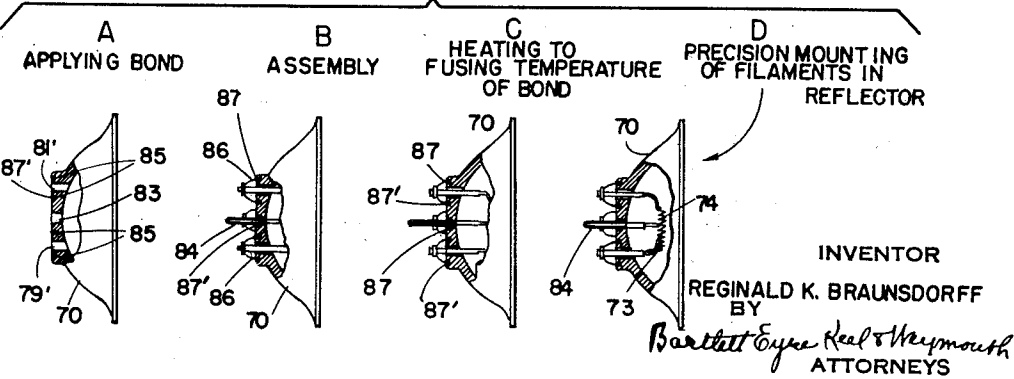
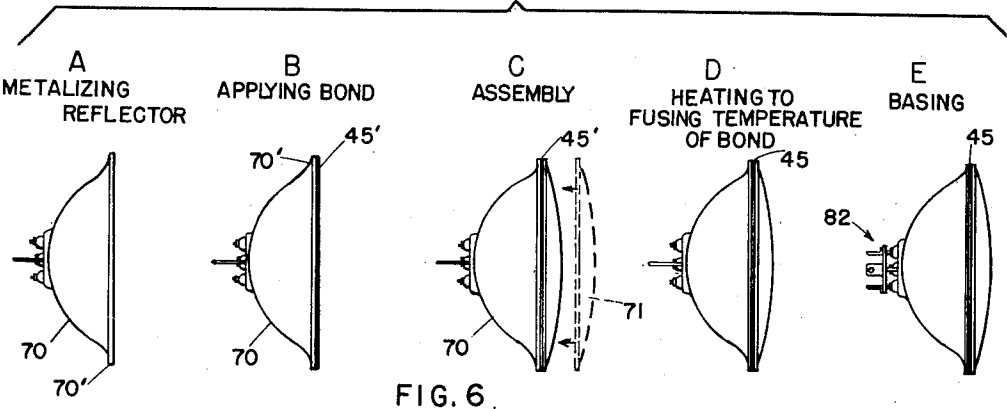
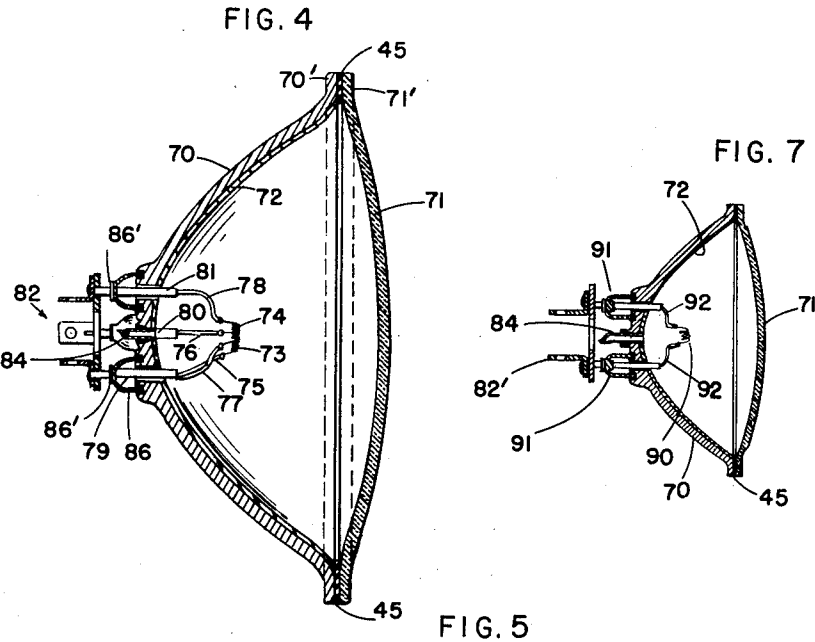
R. K. BRAUNSDORFF

2,644,100

SEALED LIGHTING UNIT AND METHOD OF MANUFACTURE

Filed Dec. 28, 1945

4 Sheets-Sheet 2



June 30, 1953

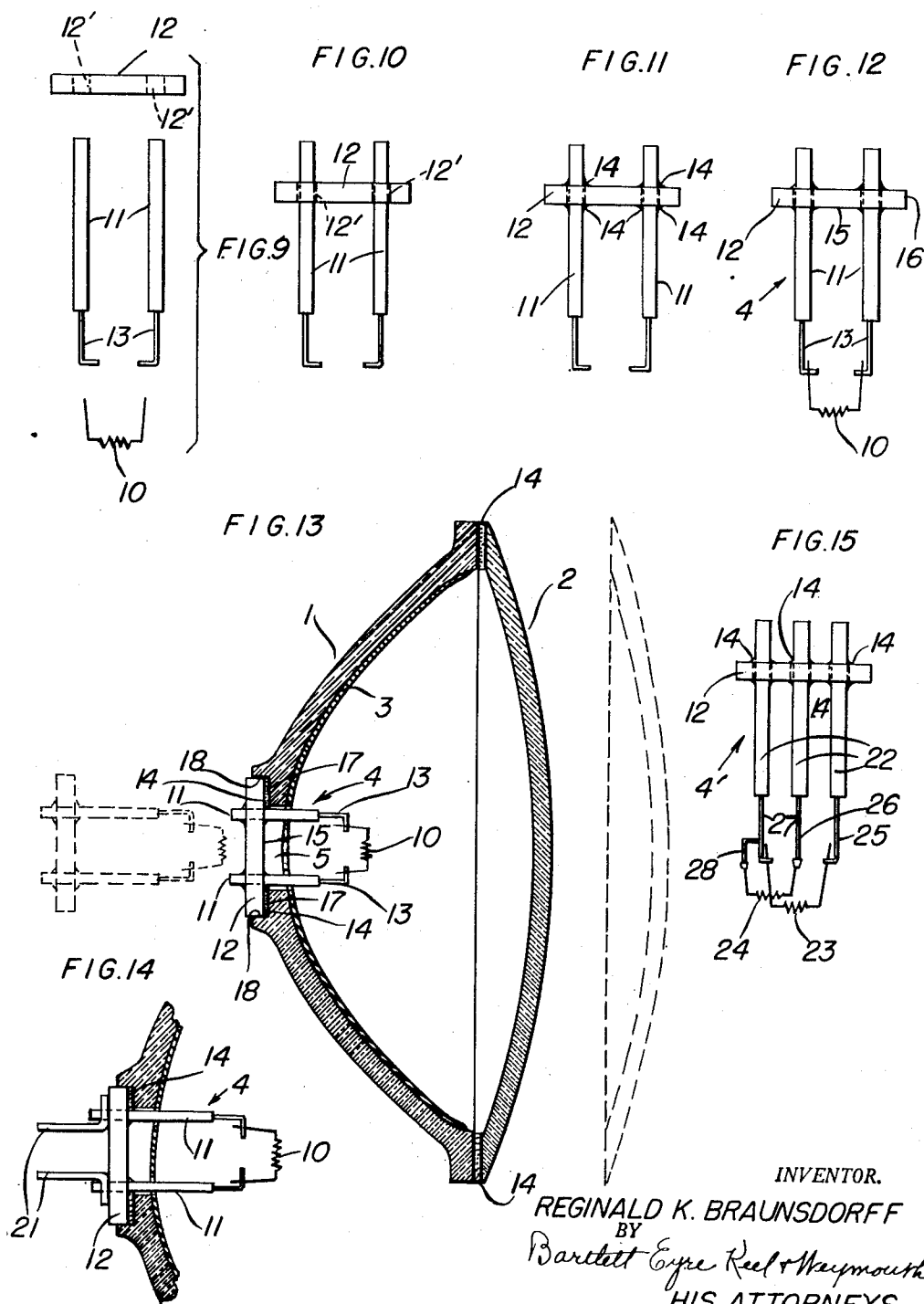
R. K. BRAUNSDORFF

2,644,100

SEALED LIGHTING UNIT AND METHOD OF MANUFACTURE

Filed Dec. 28, 1945

4 Sheets-Sheet 3



INVENTOR.

REGINALD K. BRAUNSDORFF

BY

Bartlett Eyre Reel & Weymouth
HIS ATTORNEYS

June 30, 1953

R. K. BRAUNSDORFF

2,644,100

SEALED LIGHTING UNIT AND METHOD OF MANUFACTURE

Filed Dec. 28, 1945

4 Sheets-Sheet 4

FIG. 16

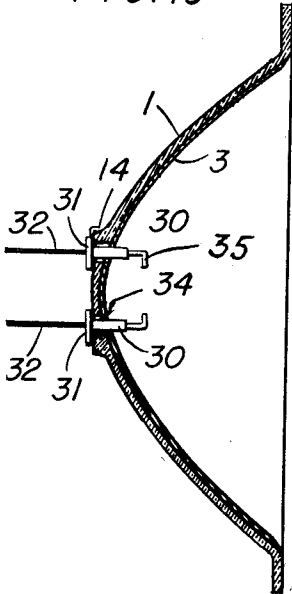


FIG. 17

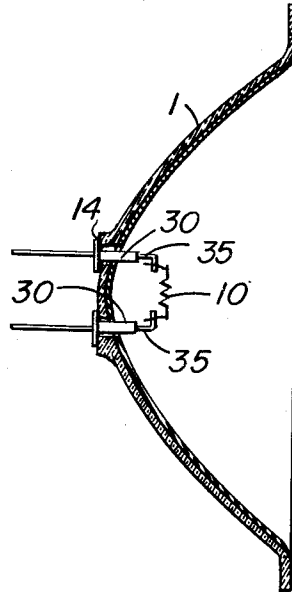


FIG. 18

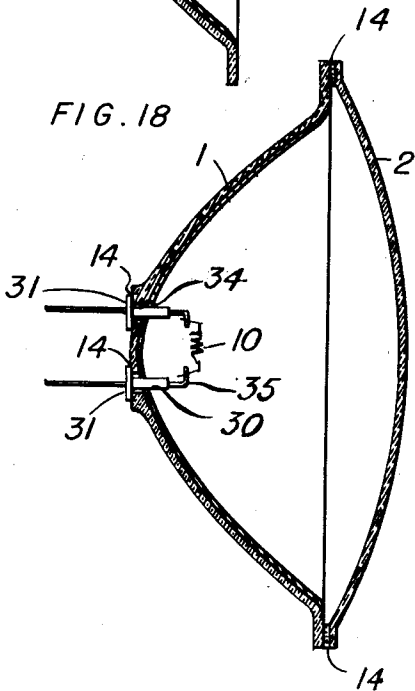
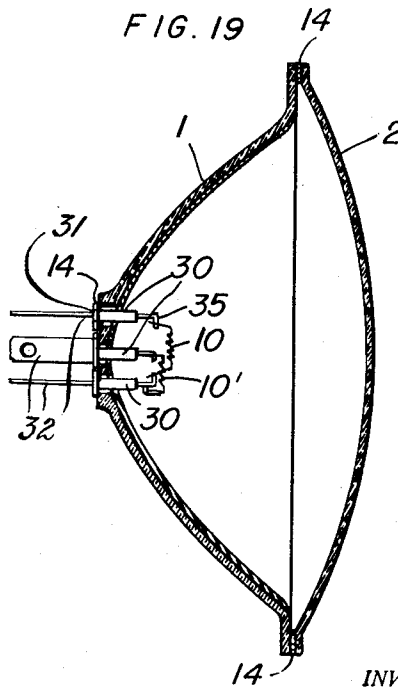


FIG. 19



INVENTOR.

REGINALD K. BRAUNSDORFF

BY
Bartlett Eyre Keel & Weymouth

HIS ATTORNEYS

UNITED STATES PATENT OFFICE

2,644,100

SEALED LIGHTING UNIT AND METHOD OF
MANUFACTURE

Reginald K. Braunsdorff, East Orange, N. J., as-
signor to Tung-Sol Electric Inc., a corporation
of Delaware

Application December 28, 1945, Serial No. 637,684

4 Claims. (Cl. 313—115)

1

This application is a continuation-in-part of my applications Serial No. 590,321, filed April 26, 1945 and Serial No. 629,277, filed November 17, 1945.

This invention relates to electric lamps and particularly to sealed lighting units comprising glass reflector and lens elements with the lighting filament or filaments sealed inside the reflector lens unit.

One object of the invention is a novel and improved lamp of this general character.

A further object of the invention is a novel and improved method of manufacture of a lighting unit of this general character.

A conventional lamp of the above indicated character comprises a reflector and lens assembly of Pyrex glass with the filament or filaments mounted in the desired focal relation with respect to the reflector upon supporting wires or posts passing through and sealed to the reflector. A conventional filament support is in the form of an assembly of a post having an alloy cup brazed thereto with the flange of the cup embedded in the softened Pyrex glass about the opening through which the post or rod passes into the rear of the reflector.

In the manufacture of these conventional lamps the peripheral edges of the reflector and lens are heated to the high temperature required for fusing and joining the two elements and carbon rollers are utilized to shape or prevent too great a distortion of the peripheral edges during this high temperature fusing operation, but the reflector elements often become distorted from their true parabolic or other desired contour due to the softening of the glass for the attachment of the filament supporting posts and due to the imperfect shaping of the carbon rollers. Likewise the cover or lens element tends to lose its shape under the softening temperature. Also the high temperatures are injurious to the reflecting surface applied to the inside of the reflector element, requiring special precautions in the application of the heating flames and the protection of the reflecting surface. These and other manufacturing steps of the conventional lamps are comparatively expensive operations, and the filaments must be precision mounted upon the supports after the supports are sealed into the reflector which requires expensive filament mounting equipment.

A further object of the invention is a lamp which may be economically manufactured without subjecting the glass of the reflector and the lens to the high softening or fusing temperatures

2

with resultant freedom from distortion of the glass element contours and with injury to the reflecting surface minimized.

A further object of the invention is a novel and improved method of sealing and securing the lens and reflector elements in the desired relation.

A further object of the invention is a novel and improved method of sealing the filament supports into the reflector-lens unit.

A further object of the invention is an improved structure and method of manufacture of a sealed lighting unit whereby the filament mount may be formed as a unit and the filament precision mounted thereon prior to mounting within the reflector, with the filament being precision mounted with respect to the reflector by the mere act of assembling and attaching the elements together.

A further object of the invention is a lamp unit of the above indicated character which is characterized by an improved and simplified filament mount.

A further object of the invention is a lamp of the above indicated character whose reflector and lens elements may be made of those less expensive glasses known in the trade as soft glasses such, for example, as lead glass, lime glass, etc. which also lends itself to lower working temperatures and is capable of molding with greater precision in lens and reflector contours.

A further object of the invention is a lamp of the above indicated character which is characterized further by the simplicity of its structure, the economy with which it may be manufactured and by its ability to stand up and withstand the rough usage to which lamps of this general character are subjected.

Further objects of the invention will hereinafter appear.

For a better understanding of the invention, reference may be had to the accompanying drawings, wherein

Fig. 1 is a sectional view through a lighting unit embodying the invention;

Fig. 2 is a schematic view illustrating steps in the manufacture of the unit of Fig. 1;

Fig. 3 is a schematic view of certain steps in the manufacture of the filament mount of the unit of Fig. 1;

Fig. 4 is a sectional view of a modified form of lighting unit embodying the invention;

Fig. 5 is a schematic view illustrating the steps in the manufacture of the lighting unit of Fig. 4;

Fig. 6 is a schematic view of steps in the manu-

3

facture of the reflector element of the lighting unit of Fig. 4 with the posts and other parts of the element being exaggerated in size relatively thereto;

Fig. 7 is a sectional view of a modification of the lighting unit of Fig. 4 on a smaller scale with certain parts out of proportion with respect to the whole unit;

Fig. 8 is a view of an exhaust tube prepared for attachment to the reflector;

Figs. 9 to 15 illustrate diagrammatically another embodiment of the invention; and

Figs. 16 to 19 illustrate a further modification of the invention.

Referring to the embodiment of Fig. 1 of the drawings, the lighting unit comprises a glass reflector element 40, a glass cover or lens 41 and a filament mount element 42. The reflector and cover elements are provided at their peripheral edges 40' and 41' with abutting surfaces where the elements are firmly joined and united into a unitary structure. These elements are also sealed at the peripheries 40' and 41' against the entry of air when the interior is evacuated or is of lower pressure than atmosphere and against the escape of gas contained in the interior under pressure. The filament mount 42 is similarly sealed in an opening formed at the rear or apex of the reflector 40. The reflector 40 is provided with an interior reflecting surface 43 which may be of any suitable character as, for example, aluminum or other reflecting metallic surface or coating. A suitable electrical terminal block or base 44 is mounted upon the filament mount 42.

I have found that the fusing and softening of the peripheral edges or rims 40' and 41' of the conventional practice to a point where the glass tends to lose shape may be obviated and a perfect seal and rugged joint or union between the peripheral abutting and bearing surfaces of the two glass elements may nonetheless be obtained by interposing between and fusing to the abutting surfaces of the peripheral edges 40' and 41' a suitable bonding material, and moreover with advantages flowing from the lower temperature operations together with others in the manufacturing process. I have illustrated in somewhat exaggerated depth or thickness this bond at 45. I have further found that the reflector element 40 and the cover or lens element 41 may readily be formed of lead, lime and other soft glasses by this invention and a perfect seal and bond obtained notwithstanding the relatively high expansion coefficients of these glasses as compared with the Pyrex glass of the conventional lighting units. I utilize a bonding material which fuses at a temperature below the softening or melting temperature of the glass and having other desired characteristics as to coefficient of expansion, elasticity, etc. This bonding material may generally be described as a pulverized or granular imperfectly vitrified fritted mass formed by the partial fusion of sand and fluxes.

Any suitable bonding material may be utilized having a coefficient of expansion approximating the coefficient of expansion of the soft glass elements, a fusing temperature substantially below the softening or melting temperature of the soft glass, the quality of forming a firm bond with the elements with a tensile strength sufficient to hold the parts firmly united, and other desired characteristics such as freedom from crazing, etc. I have obtained particularly good results by utilizing a low fusing material which

4

may be described generally as of the lead or lead oxide family of such materials available on the market, although it is understood that other bonding materials having the same general characteristics may be used. For example, I have obtained good results with a bonding material containing 50% or more of lead or lead oxide, and a suitable flux or fluxes and a suitable filler or fillers to compensate for any irregularity in expansion of the flux or mass when fused and set between and to the abutting surfaces of the peripheral edges 40' and 41' and to impart the other desirable characteristics. I have obtained particularly good results with a material of this general character containing approximately 50% lead, suitable fluxes and a filler whose elasticity compensates for irregularity in expansion of the flux or mass when fused and set between and to the surfaces. It has a coefficient of expansion around or close to that of the soft glass used, namely a coefficient of expansion of 90×10^{-7} . It melts or fuses at a temperature around or under 500°C . which is substantially below the softening or melting point of lead glass which is roughly 626°C . and of lime glass which is roughly 696°C . This bonding and sealing material when fused between the juxtaposed surfaces of the peripheral edges forms a firm union between the soft glass elements 40 and 41 which has been demonstrated by tests to be at least as strong, if not stronger, than the glass itself and further the bonding and sealing operation may be effected with little or no rejects or shrinkage. This fused bonding material appears to merge into and in effect form a part of the glass of the elements 40 and 41 though the bonding operation is carried on at a temperature well below the softening temperature of the glass, and with the film or layer of bond having tensile strength adequate not only to firmly unite the elements when the lamp is evacuated but also when the lamp is pressurized with gas. I have obtained particularly good results by using glass reflector and lens elements of lime glass.

The mount 42 comprises a button or disc 46 which is sealed and bonded within the opening formed in the apex of the reflector element 40 in any suitable manner, but I have found that this may be effected by utilizing a sealing and bonding material which forms a bond 47 between the flange 46' of the button or disc 46 and a corresponding sealing surface formed on the exterior of the reflector element 40 immediately surrounding the opening into which projects the reduced diameter part of the button 46. When the button 46 is made of soft glass, similar to the soft glass of the reflector 40, the seal and bond 47 may be formed of the same material of which the bond 45 between the elements 40 and 41 is formed. The bond 47 like the bond 45 forms a perfect seal and rugged joint which resists communication between the exterior and the interior of the unit and is capable of withstanding the rough usage to which the unit may be put. At 48 I have indicated a sealed off glass tube which may be fastened to an opening formed in the disc 46 in any suitable manner as, for example, by utilizing any suitable sealing and bonding material 49 and I have obtained good results by utilizing a bonding material similar to the material of which the bonds 45 and 47 are formed, as described below.

In the manufacture of the lighting unit of Fig. 1 the reflector and cover elements 40 and 41 are formed in any suitable manner and preferably

5

by pressing so as to be able accurately to obtain the desired curvatures. The reflector element is formed with the opening for the reception and mounting of the filament mount 42 and before the glass elements 40 and 41 are sealed and bonded together at their peripheries, the inner surface of the reflector element is provided with the reflecting surface 43.

Fig. 2 illustrates schematically the steps of applying the surface 43, assembly of the three elements 40, 41 and 42 and the sealing and bonding of these three elements to form the sealed lighting unit. Step A is the forming of the reflecting surface 43 on the reflector element 40. Step B is the application of the bonding materials 45' and 47'. The bonding material 45' may be applied to the annular sealing and bonding surface of either the reflector 40 or the cover element 41, namely to the rim 40' or the rim 41'. In step B of Fig. 2 the bonding material 45' is applied to the sealing and bonding surface of the rim 40' of the reflector. Likewise, the bonding material 47' may be applied to the sealing and bonding surface of the flange 46' of the mount element 42 or it may be applied to the corresponding sealing surface formed about the opening at the apex of the reflector element 40. In step B of Fig. 2 the bonding material 47' is illustrated as applied to the reflector element 40. These bonding materials 45' and 47' may be applied in the form of a paste or spray or by dipping the surfaces to be bonded into the bond in liquid form. With the layers of bonding materials 45' and 47' applied in the manner described, the reflector element 40, the cover element 41 and the mount element 42 are assembled together with the layers of bonding materials 45' and 47' disposed between the sealing and bonding surfaces of the three elements (step C). The latter are temporarily held in this assembled relation by any suitable means, omitted for convenience in illustration.

With the three elements thus assembled heat is applied to the sealing and bonding areas in any suitable manner to bring the temperature of these areas up to a point just above or around the fusing temperatures of the bonding materials 45' and 47' but well below the temperature of the glass elements 40, 41 and 46 at which these elements soften sufficiently to tend to lose shape. The perfect seal and union between the three elements described above is thereby obtained without the necessity of applying sufficient heat to fuse or soften the glass of the three elements, the bonding materials 45' and 47' being transformed into the bonds 45 and 47 which weld the elements together by unions equally as strong, if not stronger, than the glass itself. This heating and bonding step is illustrated schematically in step D of Fig. 2, the heating means being purposely omitted for convenience in illustration. The sealing and bonding zones or areas may be heated in any suitable manner as, for example, by local heating with gas or oxygen burners or by heating the whole unit in an oven. If the former method of heating is utilized it is desirable to apply conventional annealing operations as, for example, by an annealing machine, but these operations are simplified due to lower temperatures employed. These annealing operations may be obviated by heating the whole assembly unit in ovens and this is the preferred method of heating since it enables the temperatures to be better and more closely regulated, with reduced shrinkage, better and more uniform seals

6

and bonds and it is only necessary to gradually cool the assembly down without the necessity of special annealing operations.

In the step E of Fig. 2 the terminal block or base 44 is applied and the lamp unit is ready for mounting for use as a light projector as, for example, on a vehicle. This unit may be mounted in any conventional manner, such mounting means forming no part of this application.

This invention as indicated above has the advantages of a more durable sealed lighting unit and capable of rough usage without impairment, of a reflector and lens having the exact accurate curvatures originally formed (by pressing) which is rendered possible by the sealing and bonding temperatures well below the fusing and softening temperatures of the glass elements, of enabling the use of soft glasses such as lead and lime glass notwithstanding their high coefficients of expansion, and of reducing shrinkage and rejects resulting from manufacture as compared with conventional units and practices, etc. Moreover, the manufacturing operations and equipment are simplified, with reduced cost of production, while the soft and less expensive glasses may be utilized though having relatively high coefficients of expansion.

The embodiment of the invention of Fig. 1 has the additional and important advantage of the three-element assembly comprising the reflector element 40, the cover or lens element 41 and the mount element 42 whereby the filaments are precision mounted with respect to the focal point of the reflector by the mere act of assembling the three elements together and sealing and bonding them in this assembled position. The conventional practice of first mounting and sealing the filament posts in openings formed in the reflector element and then precision mounting of the filaments on the supports prior to the joining of the cover or lens element to the reflector element is entirely obviated. This is effected by first forming the mount 42 as a unit with the filament or filaments precision mounted thereon before the assembly upon the reflector element. The steps of forming the mount 42 are illustrated in Fig. 3. Referring to this figure, the button or disc 46 is provided with an opening 51 for the reception of the end of an exhaust tube 48. It is provided with two or more openings 52 for the reception of the filament mounts, terminal posts or supports, the number depending upon the filaments contained in the unit. One filament requires only two openings 52, while two filaments would require three openings and a three-filament unit would require at least four openings 52. In the particular embodiment shown, there is only one filament 54 and accordingly only two openings 52 are illustrated. The button or disc 46 is also provided with a reduced diameter part 50 on one side for fitting into the opening formed in the apex of the reflector, thereby forming a peripheral flange 46' having a peripheral edge or surface 55 and a sealing or bonding surface 56, the latter being sealed and bonded to a corresponding sealing and bonding surface formed on the exterior of the reflector element 40 about the opening formed therein. The button or disc 46 is provided with annular grooves 57 and 58 on the side thereof opposite the reduced diameter portion 50, these annular grooves 57 and 58 being formed respectively about the two openings 52 for the reception of the filament terminal posts or supports. In the particular embodiment shown the filament ter-

7

minals or supporting posts are indicated at 59 and 60 and these are provided with conventional cup or thimble-like elements 59' and 60', these thimble-like elements being mounted upon and fastened to the posts 59 and 60 respectively in an air-tight manner as, for example, in the conventional manner of brazing the hub structure 61 of the metallic elements on to the posts 59 and 60. These posts 59 and 60 are provided with wire supports 62 which are welded at one end to the posts 59 and 60 respectively and at the other end are adapted to carry the filament 54. The post units are assembled with the rims of the thimble or cup-like members 59' and 60' disposed in the annular grooves 57 and 58 and are there firmly sealed in position in any suitable manner. In the particular embodiment shown the sealing and bonding is illustrated in steps A, B and C of Fig. 3. In step A a sealing and bonding material 65' is applied to the annular grooves 57 and 58 and this bonding material is preferably like the bonding material 45' and 47' above described while the disc or button 46 is formed of a material such as lead or lime glass or other soft glass having a fusing or softening temperature well above the fusing temperature of the bonding material 65'. With this bonding material applied as shown in step A, the parts are assembled as shown in step B with the rims of the cup-like members 59' and 60' disposed in the grooves 57 and 58 and embedded in the bonding material 65' while the posts 59 and 60 freely pass through the openings 52 formed in the disc. With the parts assembled as shown in step B the bonding material 65' is fused by heating the same to a temperature around or above the fusing temperature of the bonding material and at a temperature well below the fusing temperature of the button or disc 46. This operation is illustrated in step C of Fig. 3. The cup elements 59' and 60' are thus thoroughly sealed and tightly bonded to the button or disc 46 to form an air-tight seal about the openings 52, the bonding material 65' being transformed into a tight and secure bond 65. The heating and fusing of the bonding material 65' may be effected in any suitable manner as, for example, by applying burners to the grooves 57 and 58 and the bonding material 65' therein or the whole assembly may be heated in an oven. The latter is preferred since the temperature may be more accurately controlled to limit the temperatures to values well below the fusing temperatures of the material of which the button or disc 46 is made. The disc 46 is preferably of glass as described above but it may be of a suitable metal capable of being sealed and bonded to the cups 59' and 60' as described.

After the filament terminal posts 59 and 60 are thus sealed and united to the disc 46 the filament 54 is precision mounted on the support wires 62. The filament is mounted to occupy a predetermined relation with respect to suitable reference lines or surfaces on the disc 46. For example, the supporting wires 62 may be bent or manipulated to bring the filament 54 in predetermined relation with respect to the annular surface 50' of the button and with respect to the surface 56. By thus precision mounting the filament 54 with respect to these guides or reference lines 50' and 56, which engage predetermined parts of the reflector element 40 bearing a definite relation to the focal point of the reflector, the filament 54 when the mount is assembled in the reflector 40 and sealed in posi-

8

tion will bear the desired focal relation with respect to the reflector.

The exhaust tube 48 may be attached within the opening 51 of the button or disc 46 and sealed thereto in any suitable manner. In the preferred method this exhaust tube is fastened and sealed within the opening 51 by means of a bonding material 49' similar to the bonding material 65' whereby the tube may be attached by merely heating sufficiently to fuse the bonding material 49' without fusing or softening the button 46 or the tube 48. By this method the material 49' is transformed into a tight seal and bond 49 and by limiting the temperature so as to keep it below the softening or melting point of the disc 46 distortion of the latter may be prevented. The assembly of the exhaust tube 48 and the attachment and sealing of the same within the opening 51 of the disc are illustrated in steps B and C of Fig. 3 and the sealing and bonding operation may be carried on simultaneously and at the same time the filament post units are sealed and bonded to the disc or button 46.

In the embodiment of Fig. 4 the filament supporting posts and terminals are mounted directly on the reflector element instead of first forming a filament mount unit element and then mounting the unit upon the reflector element. The reflector element is indicated at 70 and the cover or lens element at 71 and these are bonded together at their peripheries 70' and 71' by means of a seal and bond 45 similar to the seal and bond 45 of Fig. 1. The reflector element 70 is provided with a surface 72 of a reflecting material which may be of any suitable reflecting material such as a metallic coating of aluminum. In this embodiment there are two filaments 73 and 74 mounted respectively on supporting wires 75, 76 and 77, 78. The support wires 75 and 77 are carried by a post unit 79 and the support wires 76 and 78 are carried by post assemblies 80 and 81 respectively. The post assemblies 79, 80 and 81 are mounted upon and sealed to the reflector element 70 in any suitable manner but preferably as described below. At 82 is illustrated a terminal block or base suitable for this general type of lamp.

The reflector element 70 and the cover or lens element 71 are of lead or lime glass or other suitable soft glass and may be formed into the desired curvature in any suitable manner as, for example, by forming them in suitable molds or presses. The reflector element is originally formed with openings 79', 80' and 81' for the reception of the filament post terminals 79, 80 and 81. The reflector is also formed with an opening 83 for the attachment of an exhaust tube 84.

Fig. 5 illustrates the steps of metalizing the reflector to form the reflecting surface 72 and the sealing and bonding of the reflector element 70 and the cover or lens element 71 about their peripheries. In step A is illustrated the metalizing step. This may be effected in any conventional or desired manner either before or after the assembly and attachment of the filament supporting posts and terminals 79, 80 and 81 but preferably before these operations. Prior to the sealing and bonding of the reflector element 70 and the cover or lens element 71 together, the reflector element is provided with the reflecting surface 72 on the interior thereof and with the post assembly 79, 80 and 81 and also with the filaments 73 and 74 precision mounted thereon. The step A of Fig. 5 is the metalizing step to

provide the reflecting surface 72. In step B the bonding material is applied to the bonding surface of either the reflector 70 or the cover or lens element 71. In step C the reflector element 70 and the cover or lens element 71 are assembled with the abutting surfaces of their peripheries 70' and 71' brought together with the bonding material 45' interposed therebetween. This may be effected in any suitable manner as, for example, by applying the bonding material 45' to the bonding area of one of the elements and then bringing the two elements together with the bonding material between the bonding surfaces. In the particular embodiment illustrated in step B a layer of bonding material 45' is applied to the bonding surface of the periphery 70' of the reflector element and in step C these elements are assembled and brought together into proper position for sealing and bonding as shown in step C of Fig. 5. In step D the elements 70 and 71 are sealed and bonded by heating the sealing and bonding area or periphery of the unit to a temperature at or just above the fusing temperature of the bonding material 45' but well below the fusing or softening temperature of either of the elements 70 and 71 as indicated schematically in step D of Fig. 5. The description above with respect to the sealing and bonding of the peripheral edges of the reflector and lens elements of Fig. 1 applies to this step D. At step E in Fig. 5 the terminal block or base connection 82 for this type of lamp is attached to the terminal posts 79, 80 and 81.

The terminal post units 79, 80 and 81 may be assembled with and attached to the reflector element 70 in any suitable manner but I prefer that this be done in accordance with the method and structure shown in Figs. 4 and 6. The reflector element 70 is as above indicated provided with openings 79', 80' and 81' disposed in proximity to and about the apex of the reflector and on the outside of the reflector there is disposed about each of these openings an annular groove 85 for the reception of the rim of a cup or thimble element 86 forming a part of each post unit 79, 80 and 81. These cup elements 86 are sealed and attached to the posts in any conventional manner as for example by means of swaging the hubs 86' of the cups to the posts. In assembling these post units upon the reflector element 70 the rims of the cups 86 are sealed and bonded into the grooves 85 by means of a suitable bonding material 87'. Any suitable material may be utilized for this purpose but I prefer a bonding material 87' which is similar to the bonding material 45' above described. The post units and the reflector element 70 are assembled with the rims of the cups 86 disposed within the grooves 85 and with the bonding material 87' disposed about the rims of the cups and inside the grooves. This material is heated and fused to form a tight seal and firm union between the cup elements 86 and the reflector. The assembly may be effected in any suitable manner as, for example, by first assembling the posts upon the reflector with the posts projecting through the openings and the rims of the cups resting in the grooves 85 and then applying the bonding material 87', or the latter may be applied to the grooves 85 first as indicated schematically in step A of Fig. 6 and the assembly of the posts with the rims of the cups disposed therein as indicated in step B of Fig. 6. The rims of the cups 86 are heated to the fusing temperature of the bonding material 87' but at a temperature below the fusing

or softening temperature of the glass of the reflector element 70 with resulting transformation of the fused bonding material 87' into a tight seal and bond 87 between the reflector 70 and the cups 86 (step C). This may be effected by locally heating the sealing and bonding areas at the grooves 85 or this may be effected by heating the whole reflector element and post assembly in an oven. The latter is preferred because of the greater ease of limiting the temperature to a temperature below the fusing or softening temperature of the element 70 and also because of the advantages to be gained by the uniform heating of the whole assembly and the ease of annealing or avoidance of the necessity for special annealing. The reflector element 70 by this invention thereby retains its original curvature applied thereto and the low temperature operations result in less shrinkage and fewer rejects. After the assembly and the mounting of the post units for supporting the filaments the latter are then mounted on the supporting wires 75, 76, 77 and 78 and during this mounting or thereafter the filaments are precision mounted with respect to the focus of the reflector element in any conventional manner (step D). The reflecting surface 72 may as indicated above be applied to the interior of the reflector either before or after the mounting of the post assemblies, but preferably before.

The exhaust tube 84 is sealed into the central opening 83 of the reflector in any suitable manner as, for example, by utilizing a bonding material similar to the bonding material 87' utilized for sealing the post assemblies, the bonding material being heated to the fusing point of the material but below the fusing point of the soft glass of the elements 70. This operation may be effected simultaneously with the sealing of the post assemblies in step C of Fig. 6.

The reflecting surface 72 as indicated above may be applied in any conventional manner without reference to the sealing and bonding operations without the risk of injuring or impairing this surface when previously formed by the bonding and sealing operations since these operations are carried on at such a low temperature as not to materially affect the metal surface.

The embodiment of Fig. 7 is generally similar to the embodiment of Fig. 4 and differs therefrom mainly in that it has a single filament 90 and accordingly there are only two post assemblies 91 and the base 92' is formed to correspond thereto. The post assemblies for the filament support wires 92 are sealed to the reflector as described with respect to the embodiment of Figs. 4 and 6.

In the embodiment of Figs. 9 to 15, Figs. 13 and 14 illustrate the completed lamp unit. The glass reflector element is schematically illustrated at 1 and the glass lens element is schematically illustrated at 2. The reflector element 1 has a conventional reflector surface 3, being formed, for example, of a coating of any conventional material for forming a reflecting surface. The reflector element 1 may be of any conventional form, such as a parabola and it is understood that the lens 2 may be of any suitable construction for directing the reflected beam in the desired manner. The glass of the reflector element 1 and the lens element 2 is of the character of glass which is known in the trade as soft glass, such as lead glass, lime glass, etc.

In the embodiment (Figs. 13 and 14) the filament mount 4 is first formed as a unit and is

11

then inserted through an opening 5 formed in the rear of the reflector 1 and sealed to the outer surface of the reflector unit in a manner above described with respect to Fig. 1. The mount 4 in the particular embodiment shown in Figs. 13 and 14 comprises a filament 10, a pair of supporting posts or rods 11, a disc 12 to which the rods or posts 11 are fastened and the support wires 13 intermediate the filament legs and the posts 11. These parts of the mount are shown in exploded view in Fig. 9. The disc 12 may be of any suitable material as, for example, glass or metal and glass is preferred as, for example, a glass of the same kind of which the reflector 1 is made. The mount comprises two or more supporting posts 11 depending upon the number of filaments contained in the mount, in the particular embodiment shown there being only one filament, only two posts are required. These posts may be of any suitable metal, preferably iron, and they may be of the simple structure and conformation shown, namely simple rods of uniform dimensions. The disc 12 is formed with openings 12' of slightly larger cross-sectional dimension than that of the rods 11. These openings 12' and the rods 11 may be of any desired conformation as, for example, of a circular cross section. The support wires 13 may be a part of the rods 11 or they may be separate wires welded to the ends of the rods 11. The first step in the assembly of the mount is indicated in Fig. 10 which shows the disc 12 assembled over the rod supports 11, the latter passing through the openings 12'. In the position shown in Fig. 10 and the parts held in that position as, for example, by means of any suitable jig, the support rods or posts 11 and the discs 12 are firmly mechanically fastened together and securely sealed against leakage between the rods or supporting posts 11 and the walls of the openings 12'. For this purpose I utilize a suitable frit material which may generally be described as a pulverized or granular imperfectly vitrified mass formed by the partial fusion of sand and fluxes, which is capable of introduction into the openings 12' about the posts or rods 11 and there melted to form a firm union and seal between the posts and the disc 12. Any suitable ceramic frit material may be utilized in sealing the posts 11 to the disc 12, as for example, the ceramic frit materials available in the trade, having suitable coefficient of expansion to conform to the soft glasses and metals and alloys used. I have obtained particularly good results with a frit of this general character containing approximately 50% lead and suitable fluxes, etc.

Fig. 11 illustrates this step wherein the melted frit material is indicated generally at 14, it being understood that this frit material is also disposed inside the openings 12' about the posts 11 so as to form a seal against differences in pressure between the outside and the inside of the reflector.

The assembly thus shown in Fig. 11 may if desired be mounted and sealed in the reflector element 1 before the filament 10 is mounted thereon but it is preferred that the filament be precision mounted prior to the assembly of the mount in the reflector and Fig. 12 illustrates the completed mount ready for assembly in the reflector element 1. The step of mounting the filament 10 on the support wires 13 and the supporting posts 11 is omitted for convenience in illustration since any conventional precision mounting practice may be employed. In the

12

precision mounting of the filament 10 any plane of the disc 12 as, for example, the plane face 15 and a reference point as, for example, 16 on the periphery of the disc 12 may be utilized as the guides for precision mounting of the filament. In this step of mounting the filament 10 the supporting wires 13 may be manipulated and bent to bring the filament 10 into the correct relation with respect to the reference plane 15 and the point 16.

The next step in the assembly of the unit is the mounting of the completed mount of Fig. 12 on the reflector. During the pressing or molding of the reflector element 1 a plane surface 17 is formed thereon corresponding to the plane surface 15 of the disc 12 which forms the reference plane for precision mounting of the filament. Also at the same time an annular shoulder 18 is formed in the reflector 1 which corresponds to the periphery of the disc 12 so that when the disc 12 is fastened and sealed to the plane surface 17 of the reflector, the filament 10 is thereby automatically precision located with respect to the focal point of the reflector 1. The disc 12 is fastened and sealed in position by means of a suitable frit material 14 which may be identical with the frit 14 used in the step illustrated in Fig. 11 or it may be any other suitable frit.

The lens 2 is also fastened and sealed to the reflector 1 by means of a suitable bonding material 14, the latter being positioned between the peripheral sealing surfaces of the two elements, in the particular embodiment shown these mating surfaces being illustrated as plane surfaces. The bonding material 14 for joining the cover and reflector elements is preferably the bonding material 45 described above with respect to Figs. 1 and 4.

The sealing of the mount to the reflector element 1 and the seal between the reflector element 1 and the lens 2 may be simultaneously effected. The sealing of the lens to the reflector and the sealing of the disc 12 to the reflector may be effected in simple ovens or annealing conveyors in contrast with the conventional practice referred to above wherein the Pyrex glass requires that this be done in a special machine employing intense fires. The working with the soft glass of the reflector 1 and the lens 2 is effected at temperatures much lower than in the conventional practice wherein the Pyrex glass is utilized. For example, the melting point of lead glass is around 626° C. whereas the melting point of Pyrex glass is around 780-820° C. The melting of the bonding material 14 is around or under 500° C. and the working at these lower temperatures results in practically no or considerably reduced disturbance of the pressed glass contour, and with considerable less strain being set up. The temperatures reached in the sealing operation need not be sufficient to soften the glass, with resultant reduced distortions and internal strains. Tests have shown that the fastening and seal effected between the soft glasses by the use of the material 14 are at least as strong, if not stronger, than the glass itself.

These same considerations apply to the fastening and sealing of the glass disc 12 centrally of and to the rear of the reflector 1. The same generally applies to the seal effected between metal and the soft glass as, for example, where the disc 12 is made of metal and where the supporting posts 11 are sealed within the openings

13

12' of the disc 12 where made of glass or metal. After the reflector 1 and the lens 2 are fastened together by sealing them around their peripheral edges as above described, the lamp unit may be exhausted in the conventional manner as by fixing an exhaust tube (omitted for convenience in illustration) to an opening formed in the disc 12, the drawings being schematic as above described.

The outer ends of the supporting posts 11 may be fitted with conventional terminals for use in conventional sockets such, for example, as the lugs or terminals 21 (Fig. 14) which are soldered to the outer ends of the supporting posts 11. Thus these lugs 21 may be utilized for connecting with a conventional socket.

In Fig. 15 I have illustrated a mount 4' having three supporting posts 22 to accommodate a pair of filaments 23 and 24. The supporting posts 22 carry support wires 25, 26, 27 which are suitably fastened thereto as by welding and the support wire 27 carries an angle wire support 28 which together with the support wire 26 supports the filament 24 while the filament 23 is supported by the support wires 25 and 27. The supporting posts 22 are sealed into openings formed in the disc 12 by means of a suitable ceramic frit material 14 just as described with respect to the partially completed mount of Fig. 11. After the posts 22 are thus fastened and sealed to the disc 12 the filaments 23 and 24 are precision mounted in pre-focus position with reference to a plane of the disc 12 and the maximum diameter of the disc 12 as described above with respect to the mounting of the filament 10 in Fig. 12. The sealing of the completed mount shown in Fig. 15 into the opening 5 formed in the rear of the reflector 1 by the utilization of a suitable ceramic frit material as described with respect to the mount 4 in Fig. 13, and the soft glass lens 2 and the reflector 1 are fastened and sealed together by a similar suitable material as described above. The lamp may be exhausted in any suitable manner as, for example, by forming an opening in the disc 12 and attaching an exhaust tube thereto as described more particularly above. When the disc 12 is of metal the supporting posts 22 or certain of them must be insulated from the disc. The frit material 14 may be sufficient to insulate the supporting posts but if desired these supporting posts 22 may be fastened to the openings in the disc 12 and insulated from the disc 12 by glass. The disc 12 would then be fastened and sealed to the reflector element as illustrated in Fig. 13. The common support 22 may be grounded directly to the disc 12 and lugs similar to lugs 21 of Fig. 14 may be mounted for insertion into the conventional socket, one of the lugs being grounded to the disc while the other lug or lugs would be insulated from the disc.

In the embodiment of Figs. 16 to 19 the filament supporting rods or posts for the filament or filaments are individually and separately fastened and sealed in individual openings formed in the rear of the reflector 1 and the filament 10 is mounted after the supporting posts or rods are thus mounted. But in this embodiment the reflector element 1 and the lens element 2 are both formed of soft glass such, for example, as the lead and lime glasses above referred to and both the filament supporting posts and the lens 2 are mounted and sealed in position by the utilization of a suitable low melting temperature

14

ceramic frit material as described above with respect to the embodiment of Figs. 9 to 15.

Figs. 16 to 18 illustrate this embodiment of the invention as applied to a single filament. The binding and supporting posts for the filament 10 are designated by the numeral 30 and in the particular embodiment each of these posts is provided with a flanged collar 31 and a flattened end 32 to act as a contact strip. These binding posts 30 are fritted into holes in the reflector 1 by the use of a suitable frit material 14 of the character above described. The holes or openings in the reflector 1 are indicated by the numeral 34, it being observed that these openings 34 are slightly larger in dimensions than the corresponding cross-section of the binding post 30 whereby the pulverized or granular ceramic frit material upon the heating or melting of the same flows into the small space between the post 30 and the walls of the openings, as well as between the flanged collars 31 and the exterior surface of the reflector element. The binding posts 30 are thus firmly joined and sealed through the reflector 1 against differences in pressure inside and outside of the completed lamp.

After the binding posts 30 are thus mounted the next step is the mounting of the filaments 10 upon the support wires 35 which are fastened to the binding posts 30 in any suitable manner, as, for example, by welding. Any suitable or conventional practice may be employed for mounting the filament 10 in the desired focal relation with respect to the focus of the reflector 1. After the mounting of the filaments 10 the lens 2 may then be fastened and sealed to the reflector element 1 and this is effected by the utilization of a low melting point bond material 14 of the above described character, preferably like the bond 45 of Figs. 1, 4 and 7, a layer of this material being disposed between the abutting surfaces of the reflector 1 and the lens 2 at the fastening and sealing area and then heated to effect the seal and junction. This may be effected in simple ovens or annealing conveyors as described above with respect to the modification shown in Fig. 13. The lamp shown in Fig. 18 may be exhausted in any suitable manner as, for example, by forming an opening in the reflector 1 and attaching an exhaust tube thereto, this being omitted for convenience in illustration.

This embodiment of the invention lends itself readily to variations in the binding post connection, such as snap connectors or screw terminals connected directly to the post in place of the present lug structure for connectors. The binding post 30 may be of any desired form or construction. One or more of the binding posts 30 may be solid or they may be hollow and in the latter case a hollow post may be used for exhaust purposes and the exhaust may be effected in the gas filling arranged at pressures above or below atmospheric through a hollow post. Two of the posts may be hollow in which case one post may act as inlet for the gas supply and the other hollow post functioning as the outlet. Gases of suitable nature may be forced into the enclosure displacing air present. Hydrogen may be introduced through these hollow posts for light-up and clean-up of the elements, later displacing with nitrogen for purging of the hydrogen atmosphere, followed by final purging and filling with argon gas to a pressure in excess of atmosphere. This could be regulated by pinching off the outer terminal and admitting gas to line pressure

through the inlet terminal at which time the inlet terminal would then be closed to the pressure desired. The gas purging method of flushing may be used instead of the conventional vacuum exhaust.

The embodiment of Fig. 19 is the same as that of Figs. 16 to 18 except that the former utilizes a pair of filaments 10, 10' which necessitates the use of three binding posts 30 and three separate wires 35.

As above described any suitable ceramic frit may be employed in the joining and sealing of the support posts 11 (Figs. 9 to 14) and posts 22 to the disc 12 (Fig. 15) and the support posts 30 to the reflector element 1 of Figs. 16 to 18, and likewise any suitable bond material may be employed for joining and sealing the disc 12 to the reflector element 1 and for joining and sealing the lens element 2 to the reflector element 1. I have obtained particularly good results with a bond material like the bond material 45 of Figs. 1, 4 and 7 above particularly specified. By the use of this material the soft glass reflector element 1 and lens or cover element 2 may be readily joined and sealed with the advantages of low temperature operations, little or no disturbance of the contour of the lens and with a minimum of strains set up in the glass itself. This applies to the fastening and sealing of the disc 12 to the reflector element when the disc is made of glass as, for example, of soft glass, like lead and lime, glasses.

Good results are obtained also with the fastening and sealing of metal to glass by the use of this bonding material and particularly when the metal is an alloy, such, for example, as the alloys available on the market, it having been found that the ceramic bond material readily wets such an alloy and takes well to such an alloy. It also takes well to stainless steel such, for example, as that known on the market as U. S. S. 18-8 and particularly when the surface of said stainless steel is oxidized, and also alloy #303. These metals are mentioned merely as examples of the metal of which the disc 12 and the support posts 11, 22 and 30 may be formed and it is understood that the invention is not limited to these particular metals. I also find that the bond wets and adheres more readily to roughened surfaces as distinguished from polished metal surfaces.

Thus by my invention I am able to produce a sealed beam head lamp or the like which is of markedly better quality, is of simpler structure and can be more economically manufactured than the conventional sealed beamed lamps heretofore used. The invention is applicable to lamps of the general character illustrated of any size. The invention has a marked salvage value and also flexibility in manufacture. When a filament mount is broken or injured, a new one may be substituted therefor and readily mounted. The button units or preformed mounts may be manufactured for different sizes of lamps ready for assembly with the particular reflector elements desired.

Another advantage of the invention is that the reflector and the lens elements, and the reflector and filament mount structures, may be sealed without injuring the aluminized surface of the reflector, this problem also being serious in the manufacture of conventional Pyrex glass sealed units.

Certain advantages of the invention are also applicable to conventional incandescent lamps wherein the filament or filaments may be mount-

ed on a button such, for example, as of glass (or metal) and fastened and sealed by a butt seal or otherwise to the open end of the neck of the bulb. The filament support wires may likewise be frit fastened and sealed to the button.

In application Serial No. 629,277, filed November 17, 1945 I have set forth the invention as embodied in a sealed lighting unit having reflector and cover elements of soft glass which are bonded and sealed together at their peripheries by a bonding material 45' like that described above, but with the filament mounts supported by terminal supports passing through the bond between the reflector and cover elements at their peripheries. It is understood that the various disclosures of the embodiments of application Serial No. 629,277 are included in the present application as a part hereof.

The bonding material may, as above described, be applied between the surfaces to be united and sealed in any suitable form and manner. In Fig. 8 I have shown the bonding material 49' as applied to the exhaust tube 48 in paste or liquid form and then set thereto by fusing the material, the tube now being ready for assembly into the exhaust opening of the button or reflector and refusing the material in situ. This pre-fusing and setting before assembly is not essential as is above set forth.

As above indicated I am able by my invention to prevent or at least minimize injury to the aluminized or other metallic reflecting surface of the reflector, to prevent distortions of the reflecting and lens elements from their desired forms during the process of making the unit, to use soft glasses instead of the Pyrex glass which is conventionally used, to reduce rejects and shrinkage in the manufacturing operations and to render the manufacture more economical and less expensive. The annealing operations are simplified with less annealing and without the need for expensive annealing machines. The carbon rolling mechanism of the conventional equipment together with their special shaping operations are avoided. The special means and conventional equipment for protecting the metalized surfaces against the high temperatures (sometimes as high as 1100° C.) are not needed in the practice of my invention and other conventional equipment in the manufacture of the units of Pyrex glass in the conventional practice are either entirely obviated or simplified and both the machine and hand operations are substantially simplified by my invention. The precision mounting of the filaments after the mount supports are fastened to the reflector element and the equipment required therefor are obviated when the embodiments of Figs. 1 and 13 of the invention are used.

The embodiments of Figs. 16 to 19 show the reflector element as of smaller diameter than that of the cover or lens and as having a wide outwardly extending flange at the periphery, but it is understood that the diameters may be the same, with their peripheries fitting together similarly, as is shown in Figs. 1, 4, 7 and 13.

I claim:

1. A lamp of the character set forth comprising a reflector element of soft glass, said element having a filament locating plane surface at right angles to the axis thereof and centrally thereof on its rearward part and a mount having a pre-focused filament and a soft glass plate having a plane surface corresponding to said locating plane surface on the reflector element,

17

said plate being joined and sealed to the reflector element against its plane surface by means of a ceramic frit seal.

2. An electric lamp comprising a vitreous reflector portion having a concave surface with a reflecting coating, a translucent vitreous cover hermetically sealed to the rim of said reflector portion and forming an enclosure therewith, a vitreous filament support member sealed to said reflector portion by vitreous material having a softening point about 200° C. lower than that of the parts sealed together, leads extending through and hermetically sealed to said support member, and a light source supported on said leads and positioned in said enclosure in definite optical relationship to said reflecting surface.

3. An electric lamp comprising a soft glass reflector portion having a concave surface with a reflecting coating, a soft glass cover hermetically sealed to the rim of said reflector portion and forming an enclosure therewith, a soft glass filament support member sealed to said reflector portion by glass of considerably lower softening point, leads projecting from said support member, and a light source supported on said leads and positioned in said enclosure in definite optical relationship to said reflecting surface.

18

4. An electric lamp comprising a soft glass reflector portion having a concave surface with a reflecting coating, a soft glass filament support member sealed to said reflector portion by glass having a softening point of about 200° C. lower than that of the parts sealed together, leads projecting from said support member, and a light source supported on said leads in definite optical relationship to said reflecting surface.

REGINALD K. BRAUNSDORFF.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,861,167	Vello -----	May 31, 1932
2,169,194	Geyer -----	Aug. 8, 1939
2,301,940	Fries -----	Nov. 17, 1942
2,317,031	Cotman -----	Apr. 20, 1943
2,324,972	Wright -----	July 20, 1943
2,362,171	Swanson(B) -----	Nov. 7, 1944
2,362,172	Swanson(A) -----	Nov. 7, 1944
2,366,292	Smith -----	Jan. 2, 1945
2,377,317	Blume -----	June 5, 1945
2,398,971	Singer -----	Apr. 23, 1946
2,404,904	Collins -----	July 30, 1946