

April 30, 1935.

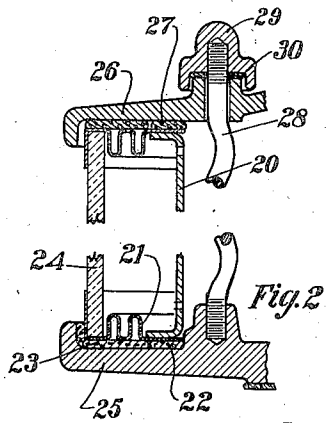
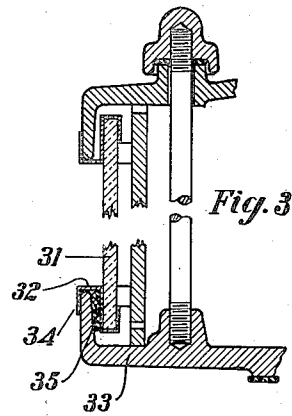
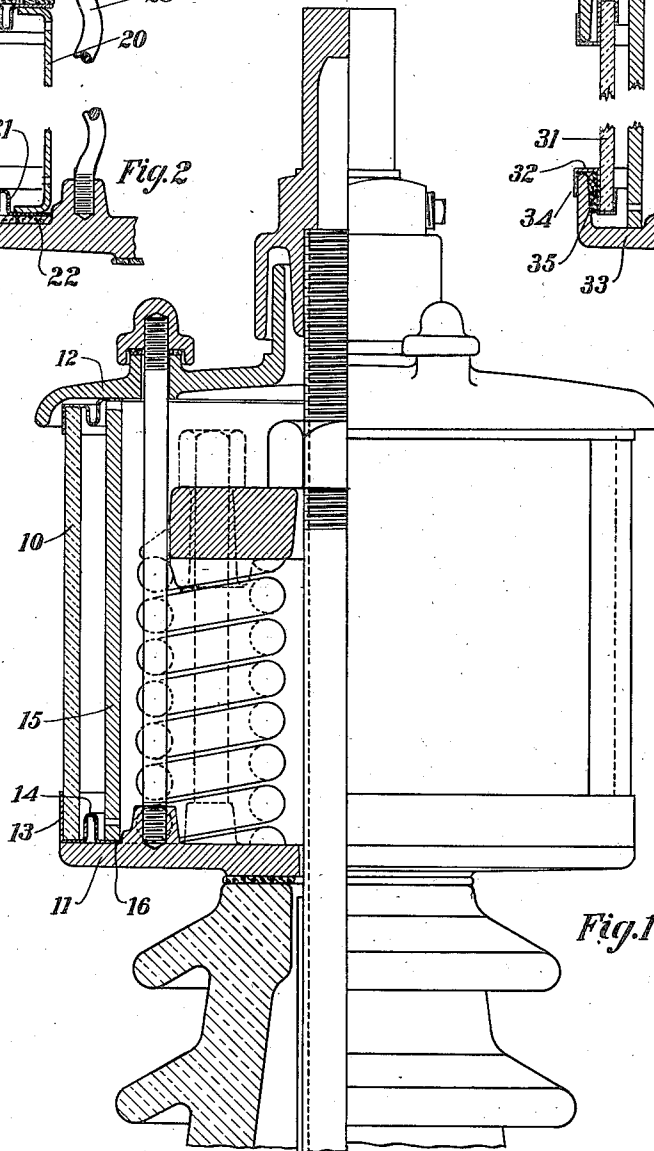
A. O. AUSTIN

1,999,271

SIGHT GLASS

Filed Jan. 30, 1932

2 Sheets-Sheet 1



INVENTOR
Arthur O. Austin.
BY *Alpheus J. Crane*
ATTORNEY

April 30, 1935.

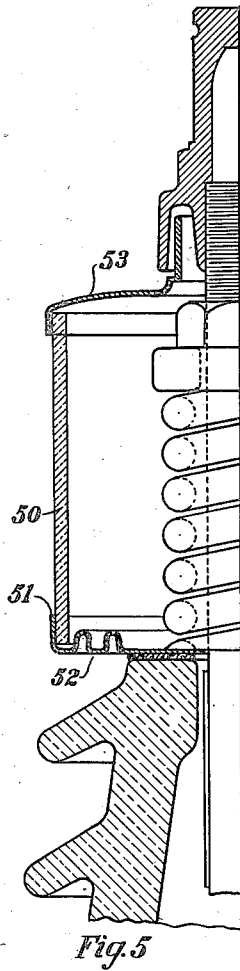
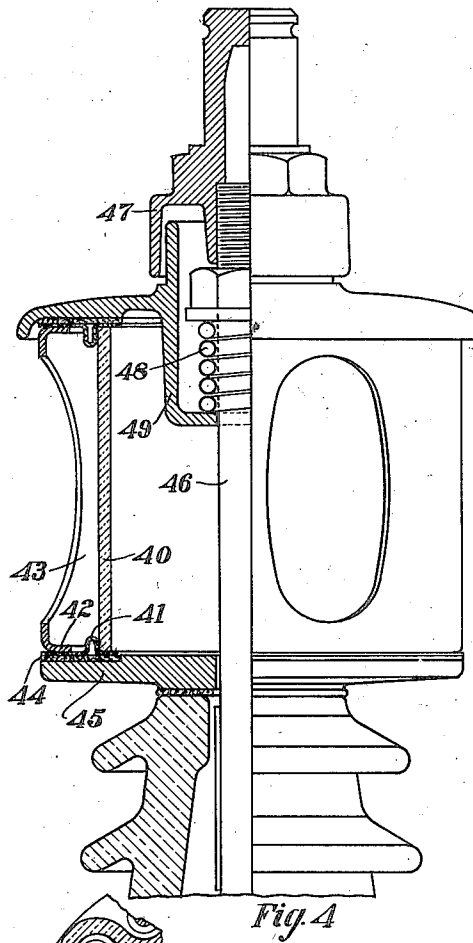
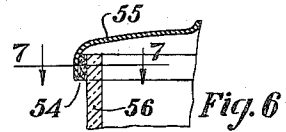
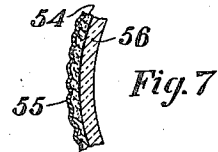
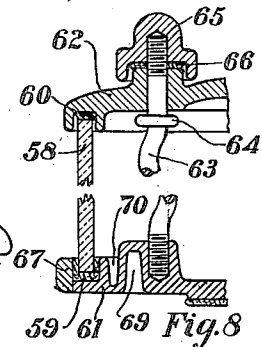
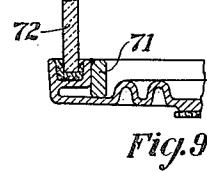
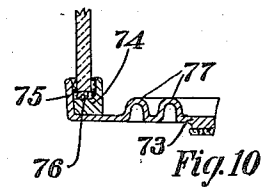
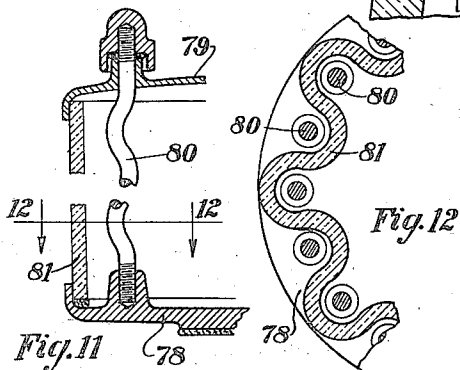
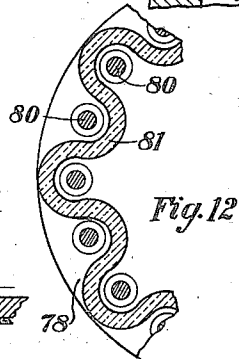
A. O. AUSTIN

1,999,271

SIGHT GLASS

Filed Jan. 30, 1932

2 Sheets-Sheet 2



INVENTOR
Arthur O. Austin.
BY *Alfred J. Crane*
ATTORNEY

UNITED STATES PATENT OFFICE

1,999,271

SIGHT GLASS

Arthur O. Austin, near Barberton, Ohio, assignor,
by mesne assignments, to The Ohio Brass
Company, Mansfield, Ohio, a corporation of
New Jersey

Application January 30, 1932, Serial No. 589,945

7 Claims. (Cl. 220—82)

This invention relates to chambers for containing liquid such as expansion chambers commonly used on the top of bushing insulators, and has for one of its objects the provision of a device of the class named in which the surface level of the liquid within the chamber may be readily observed and in which the glass wall of the chamber will not be injured by differential expansion and contraction of the metal and glass parts.

A further object is to provide a chamber for containing liquid having tight joints which will prevent leakage of the contained liquid.

A further object is to provide a device of the class named which shall be of improved construction and operation.

Other objects and advantages will appear from the following description.

The invention is exemplified by the combination and arrangement of parts shown in the accompanying drawings and described in the following specification, and it is more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is an elevation with parts in section showing an expansion chamber for a bushing insulator having one form of the present invention applied thereto.

Figs. 2 and 3 are fragmentary sections showing modifications of the invention.

Fig. 4 is a view similar to Fig. 1 showing a further modification.

Figs. 5 and 6 are fragmentary sections showing other modifications.

Fig. 7 is a section on line 7—7 of Fig. 6.

Figs. 8, 9, 10 and 11 are fragmentary vertical sections showing other modifications.

Fig. 12 is a section on line 12—12 of Fig. 11.

In bushings, particularly those composed of an outer shell and a series of insulating baffles, it is common practice to fill the intervening space between the shell and baffles with insulating oil or compound. This filling is desirable in order that electrical discharge will not take place over the baffles inside of the outer insulating shells and cause the bushing to burst. In general, the flashover voltage is much lower over the baffles than over the outside shell. It is therefore necessary either to subject the bushing to internal air or gas pressure or to fill the interior of the bushing with an insulating medium which has a higher dielectric strength than air. It is general practice to use an insulating oil or compound for this purpose but where insulating oils or thin compounds are used, these may leak from the

bushings and some means of insuring that the bushings are properly filled at all times is advisable. A common method is to provide the bushing with an expansion chamber which will provide for variations in the volume of the compound used to fill the intervening space between the outer shell and insulating baffles or conductor rod.

It has been common practice to use glass cylinders for the side walls of the expansion chamber. Where the bushings are large, the intervening space between the outer shell and the insulating baffles may be very considerable and since most of the filling compounds, such as transformer oil, have a rather large volumetric expansion for changes in temperature, it is necessary to provide very large expansion chambers. Where the glass members are large, the longitudinal or transverse movement between the gage glass and the metal members terminating the ends of the gage glass may be such as to break the seal or to cause failure of the glass member.

With the improved type of construction, the stress upon the gage glass or upon the gaskets holding it is reduced to a minimum and tightness is maintained for the differential longitudinal movement which may tend to loosen the joints or set up an undue stress upon the gage glass.

Fig. 1 shows one form of the invention in which the gage glass 10 forms a tight compartment with a lower flange 11 and an upper flange 12. In order to provide a tight connection between the gage glass 10 and the flanges 11 and 12 while permitting the flanges to expand and contract relative to the glass in a radial direction, the gage glass has a thin metal flange 13 soldered or welded to it by any convenient method, such as the well known hydrogen process. Where the member 13 is soldered to the glass, the glass is first prepared with a gold, platinum or silver coating, by methods well known to those familiar with the art. The member 13 forms a diaphragm or dam bridging the space between the side glass 15 and the bottom member 11.

The member 13 may be fastened either inside or outside the glass as desired. In general, however, where the linear coefficient of expansion for changes in temperature of the flange 13 is greater than that of glass, it is preferable to fasten this material to the outside of the glass so that it will tend to contract onto the glass. By making the material thin, it is possible to reduce any stress due to differential expansion and con-

traction to a value which will not cause damage to the gage glass. This flange may be made of any suitable material or may be made of material which has approximately the same linear coefficient of expansion as the glass itself.

The member 13 must provide for the transverse movement and also for any longitudinal movement if stress or strain upon the gage glass is to be relieved materially. This is readily brought about by using a thin member and by placing in it corrugations 14. The inner edge of the metallic flange 13 is held beneath the lower edge of a cylindrical compression or strut member 15. This member may be made up in a single piece or in a series of pieces. If made up of relatively thin material, it may have flanges spun or formed on its ends, as shown in Fig. 2, which provides a certain amount of resiliency. By using a longitudinally split piece 15, it is also possible to slip the two adjacent edges formed by the slit, past each other to permit insertion inside of the projecting edge 16 of the piece 13.

In the construction shown in Fig. 2 the sleeve 20 bears upon the inner edge of the thin metallic member 21. A gasket 22 is placed below the member 21 and the gasket 22 may be integral with a gasket 23 extending beneath the glass cylinder 24, or the gasket 22 may be a separate member. The gasket 23 is used to cushion the glass and hold the parts together and should be of such resiliency as to permit the necessary movement between the terminal flange 25 and the gage glass 24. Pressure holding the parts together and insuring bearing between the member 20, gaskets 22 and 23 and end plates 25 and 26 is produced by tension on the longitudinally resilient member 28. The construction at the upper end of the cylinder 24 is similar to that at the lower end. It is advisable, however, to use a blind nut 29, together with a gasket 30, to insure tightness where the member 28 passes through the upper flange 25. This arrangement insures tightness and, at the same time, relieves the stress due to differential expansion or contraction between metal and glass. Provision is also made for limiting or eliminating the longitudinal stress as well as the radial stress upon the gage glass, regardless of the pressure placed upon the tightening gaskets. This construction permits of the use of a gage glass of maximum size. If desired, the gasket 22 may be replaced by a soldered joint if sufficient resiliency is provided in the washer 23 between the end of the glass and the end shield 25.

In the construction shown in Fig. 3, the gage glass 31 has a sheet metal channel piece 32 soldered, welded or amalgamated to it. The outer edge of this channel piece is soldered to an end plate 33 at the point 34. If desired, the space 35 may be filled with a soft gasket which will tend to prevent accumulated movement due to differential expansion. The member 32 may be made in various forms and, if desired, the soldered edge may be inside of the glass member 31 with attachment to the glass on either the inside or outside surface or to both if desired, as shown in Fig. 3.

The clamping cage or sleeve may be placed outside of the glass cylinder, as shown in Fig. 4, in which the glass 40 is provided with a thin metal member 41 soldered or welded to the glass member. This member is made in such a form that it will have some resiliency between the point of attachment to the glass and the bearing face 42 under the clamping cage or sleeve 43. The clamp-

ing sleeve or cage 43 presses upon the outer edge of the thin member 41 soldered to the glass 40 and compresses the member 41 upon a gasket 44 between the member 41 and the end flange 45, thereby insuring a tight joint between the inside of the glass and the end flange 45. The upper portion of the chamber may be arranged the same as the lower portion or it may be vented to the air if desired, but it is necessary to provide clamping means so that the member 27 will tend to seal the joint at the lower end of the chamber. In order to be able to indicate the oil level, the member 43 is provided with windows which will preferably have rounded edges and will be of such shape that they will not cause electrical discharge. Where a central clamping means is used, the metal of the expansion chamber of this type may be made of pressed or spun sheet material. With this class of construction, the conductor rod 46 is provided with a weather cap 47 and a spring member 48 which bears on the upper plate 49. By placing the spring 48 in a recessed pocket, the over-all height of the bushing is reduced and sufficient resiliency may be developed so that any extension of the center rod will not loosen the joints.

Where the end flanges are soldered to the glass forming the walls of the expansion chamber, a very different class of construction may be used from that where it is necessary to maintain a very considerable pressure in order to insure tightness for the gaskets.

An arrangement of this kind is shown in Fig. 5 in which a portion if not all of the side walls of the expansion chamber are formed by a gage glass 50. The glass is preferably formed with a metallized surface 51 which may be readily soldered or bonded. Under some conditions the end shields 52 and 53 may be welded or amalgamated directly to the glass forming a tight chamber. Where the glass has previously been prepared for soldering, it will be comparatively simple to solder the metal end pieces directly to the plated glass surface, thereby forming a tight seal. With this arrangement it is possible to use very thin metal end sections having a straight or corrugated surface as the end shields need support only the weight of the glass and the contained fluid.

This arrangement provides a very cheap and efficient expansion chamber. If desired, the end shields may be extended so as to cover the outer surface of the glass, windows being provided to disclose the liquid level. If desired, only the lower joint 51, between the end plate and glass, need be soldered or amalgamated; the upper plate being removable. If the upper plate is provided with a thin gasket and the glass or metal tapered, the end plate may be forced over the glass particularly if the end plate is heated, which will usually insure a tight joint. This construction is shown in Figs. 6 and 7 in which the gasket 54 forms a seal between the end plate 55 and the glass cylinder 56. The glass, if desired, may be tapered or the end rounded in any convenient way so as to permit the metal end shield to be readily slipped into position. Increased resiliency may be provided for this arrangement by longitudinal flutes or crimping in the side wall or flange of the end plate 55, as shown in Fig. 7. Where the gasket is well coated with an oil proof paint or varnish, an efficient joint may be formed by simply forcing the upper plate into position. As the metal is light and will yield readily, there will be little tendency to break the joint formed by the gasket and glass or to set up a high stress

due to the differential expansion of the metal forming the end plate and the glass.

In the construction shown in Fig. 8 the glass cylinder 58 is held at the ends by the gaskets 59 and 60 between end plates or flanges 61 and 62. The end plates may be clamped in any convenient way, one preferable method being that shown where a resilient rod 63 is used to apply the necessary pressure. This rod may be provided with a shoulder or flange 64 so that in case the glass is broken the metal parts may be held in approximate position. The rod may be so constructed that the upper end will bottom in the head of the nut 65 at a predetermined tension on the rod. This will limit the maximum stress that may be placed upon the glass cylinder 58 and thus tend to prevent damage. The resiliency provided by the member 63 will insure tight gaskets 59 and 60 at all times. A gasket 66 is provided under the nut 65 so that a tight chamber is provided for all conditions. While the resilient rod 63 will provide for any differential longitudinal expansion or contraction, differential radial expansion or contraction is not provided for by this rod. Most end flanges are made of non-magnetic material in order to reduce eddy current losses. Most materials of this kind have a relatively high linear coefficient of expansion for changes in temperature compared to the glass. In order to reduce the stress and tendency for movement on the gaskets forming the seal, it is highly advisable that the end flanges and the glass tend to move at the same rate for changes in temperature. One construction which makes this possible is shown in Fig. 8. The lower flange 61 is so constructed that it will not be too rigid in a radial direction. By applying a band 67 having a lower linear coefficient of expansion for changes in temperature than the glass, it is possible to form a combination with the metal of the flange, such that the movement due to temperature changes can be controlled. The size of the temperature compensating band 67 will depend upon the construction and the effective areas as well as on the linear coefficients of expansion and rigidity of the various materials used. One material that may be used for the band 67 is invar, a well known nickel steel alloy having a low coefficient of expansion.

In some cases the danger of leakage at the gasket 60 may be rather small. Where a rather soft gasket or one which will permit of small radial movement can be used, it is possible that the compensating ring may be omitted. This is particularly true if the metal section is very light. The flange plates may be provided with grooves 69 and 70 or made in any other convenient form which will reduce the radial stiffness, thus permitting a smaller section for the compensating band 67.

In the construction shown in Fig. 9, the compensating band 71 is placed on the inside of the glass cylinder 72. The upper flange and the lower flange may be made up in the same way if desired and the parts may be held together by a central clamping system with a spring. These types of construction are particularly applicable where the cylinders are of large diameter.

Another arrangement which has material advantages is that shown in Fig. 10. The end flange 73 is made of pressed metal such as copper, brass or aluminum. A low coefficient compensating ring 74 is placed inside the up-turned lip 75 on the end flange, the seal being effected by a gasket 76. The ring 74 and end flange 75 may be forced together with the necessary pressure or

by assembling at the proper temperature a combination will be obtained which will stay tight throughout the working range. If desired, the member 74 may be soldered, galvanized or welded to the end member which will insure a tight joint at all times. With this combination it is possible to use glass of very large diameter without setting up excessive stresses due to differential expansion. Where thin end members are used, these may have circumferential corrugations or grooves 77 which will increase the resiliency in both a longitudinal and radial direction. By providing sufficient resiliency in these members they may be used for maintaining a tight joint between gaskets and glass at all times throughout the working range of temperatures or, if desired, a resilient clamping system may be used which will provide for greater latitude.

Another form for reducing the strain due to different linear coefficients of expansion between the glass and end flanges is shown in Fig. 11 in which end flanges 78 and 79 may be made of either pressed metal or cast material as desired. These may be clamped together by resilient members 80 which may be placed either inside or outside the glass chamber 33, or the glass may be fluted as shown in Fig. 12.

With this arrangement a radial movement inward or outward of the glass 81 will tend to set up a bending moment in the fluted walls. A slight strain due to this bending moment will permit of considerable radial movement, therefore the construction will greatly reduce the stress, tending to cause movement between the cylinder 81 and the end shields 78 and 79. The clamping members 80 may be placed inside the flutes, or outside, or both inside and outside. If located on the outside, they may be used as a guard or protection to prevent mechanical damage or to prevent damage from a power arc following flashover.

I claim:

1. A sight glass for a liquid containing vessel and a thin metal diaphragm having one portion thereof sealed to said glass and another portion thereof sealed to said vessel to form a tight joint between said glass and said vessel while permitting relative movement of said glass and vessel.

2. A sight glass for a liquid containing vessel having a metal coating on a portion of the surface thereof, a thin metal diaphragm having a portion thereof sealed to said metal coating, and another portion thereof sealed to said vessel, said diaphragm forming an imperforate connection between said glass and vessel to form a liquid tight joint, and having a yielding portion interposed between said glass and vessel to permit relative movement of said glass and vessel.

3. A vessel for containing liquid comprising a glass side wall enclosing a chamber, a metallic coating on a portion of the surface of said side wall, top and bottom members for said chamber, and a thin metal diaphragm having one portion thereof sealed to the metallic coating on said side wall and having another portion thereof sealed to the bottom of said chamber and having a yielding portion forming a liquid tight joint between said side wall and bottom and permitting relative movement between said side wall and bottom.

4. A vessel for containing liquid comprising a glass side wall, a metallic coating on a portion of the surface of said side wall, and a resilient bottom member for said vessel, said bottom member being sealed to the metallic coating on said side wall to form a liquid tight joint therewith and being sufficiently resilient to compensate for dif-

ferential expansion and contraction of said side wall and bottom due to temperature changes so as to avoid injury to said side wall.

- 5 A vessel for containing liquid comprising top and bottom members, a spacer interposed between said top and bottom members, a sight glass interposed between said top and bottom members, a diaphragm having a portion thereof sealed to said sight glass and another portion held in
10 liquid tight connection with said bottom member by said spacer, said diaphragm forming a liquid tight joint between said bottom member and said sight glass and having a yielding portion connecting said sight glass and said bottom member
15 for permitting relative movement of said glass and said bottom member due to temperature changes.

6. A vessel for containing liquid comprising side and bottom portions, a portion of said vessel being formed of vitreous material and an adjacent portion of metal, and a flexible diaphragm connecting said metal and vitreous portions and forming a liquid tight joint between said portions while permitting relative movement thereof. 5

7. A vessel for containing liquid comprising bottom and side walls, a sight glass communicating with the interior of said vessel, and a thin metal diaphragm having one portion thereof sealed to said sight glass and another portion thereof sealed to said vessel to form a tight joint between said glass and said vessel while permitting relative movement of said glass and vessel. 10 15

ARTHUR O. AUSTIN.