

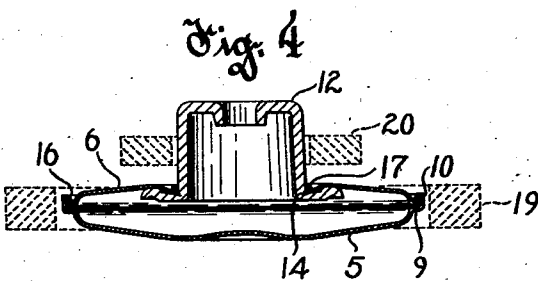
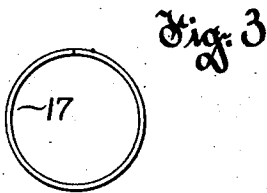
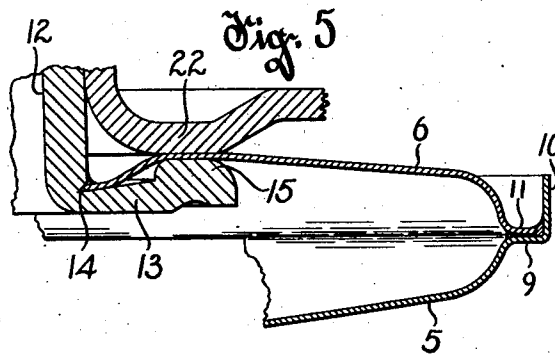
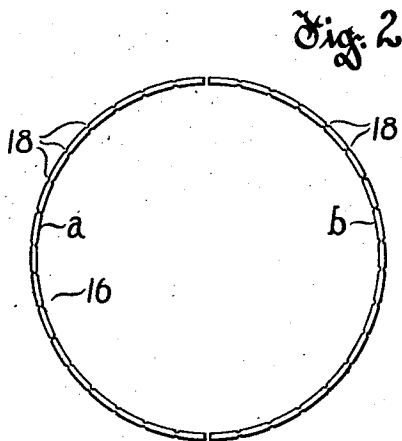
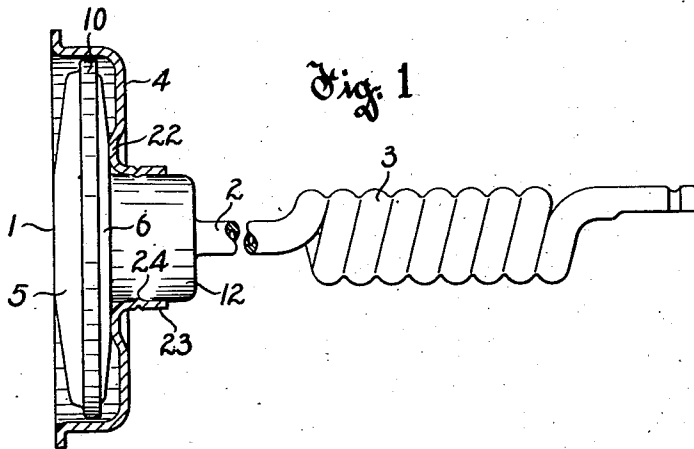
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PRESSURE RESPONSIVE ELEMENTS OF THE WAFER TYPE

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PRESSURE RESPONSIVE ELEMENT OF THE
WAFER TYPE

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8 Claims. (Cl. 297-9)

This invention relates to pressure responsive elements of the wafer type and to a method of making the same.

The application of C. W. Kuhn et al., Serial No. 157,988, filed August 7, 1937 now Patent No. 2,245,691, dated June 17, 1941, discloses an operating mechanism for refrigerator controllers including a gas containing element of the wafer type. Such element meets various requirements, as for example the same is of small diameter, sensitive, capable of movement through a relatively wide range, capable of supplying a substantial operating force, capable of functioning smoothly and with uniformity, and able to withstand many operations daily over a period of many years. To meet these requirements the wafer element has various novel structural features, and this invention involves certain of these features.

The accompanying drawing illustrates an embodiment of the invention which will now be described, it being understood that the embodiment illustrated is susceptible of modification without departing from the spirit and scope of the appended claims.

In the drawing:

Figure 1 is an enlarged side elevational view of a wafer element embodying the invention, a cup-shaped support associated with the element being shown in section;

Figs. 2 and 3 are enlarged plan views of solder rings which are employed in making the bellows shown in Fig. 1;

Fig. 4 is an enlarged sectional view illustrating the parts of the wafer element assembled for soldering, and

Fig. 5 is a greatly enlarged sectional view of a portion of the wafer element.

Referring to Fig. 1 the same illustrates a wafer element 1 having a pipe extension 2 which terminates in a gas-filled bulb portion 3 preferably of the spiral form illustrated, although it may assume other forms. As shown the wafer element also has a cup-shaped support 4 fixed thereto.

The wafer element 1 in a broad sense is of a well known form, but the same differs essentially from expansible wafers heretofore employed in devices of various types. It is designed for use in connection with refrigerator control devices and in order to meet the various requirements hereinbefore noted the same must be formed of very thin sheet metal parts and provided with joints which are exceedingly strong and durable. It has been found that it is very desirable if not

imperative to join the parts of the wafer element with silver solder and the problem is then presented by applying sufficient heat to melt such solder without warping or otherwise impairing the thin sheet metal parts. In accordance with the present invention the wafer element is provided with oppositely disposed circular cup-shaped elements 5 and 6 which are formed of partially annealed fine grain beryllium copper sheet of a thickness of about .005 inch. It has been found that such material is capable of withstanding the heat required for hard soldering without becoming warped or otherwise impaired, and is also desirable for other reasons.

Cup element 5 is formed to provide an outwardly extending flange 9 which is disposed at right angles to the axis of said element and said element is also formed to provide a circular flange 10 which surrounds said former flange and is disposed at right angles with respect thereto. Cup element 6 has an outwardly extending flange 11 which is disposed at right angles to the axis thereof and said flange is of slightly less diameter than the inside diameter of flange 10 on element 5.

Cup element 6 is also provided with a center opening for receiving a hollow cylindrical nipple 12 formed of drawn brass tubing and having an opening in one end thereof for receiving the tube 2 and an outwardly extending circular flange 13 on the opposite end thereof. Nipple 12 is slightly tapered to facilitate insertion thereof into the opening in cup member 6 and the same is provided with a surrounding groove 14 adjacent flange 13 for receiving the inner edge of said cup element. Flange 13 is shaped to provide an annular shoulder 15 and the diameter of nipple 12 is such that when cup element 6 is sprung over said shoulder as shown in Fig. 5 the inner edge of said element is driven into the groove 14.

Referring now to Figs. 2 and 3 the same illustrate soldering rings 16 and 17, the former being employed for soldering the joint between cup elements 5 and 6, and the latter being employed for soldering the joint between cup element 6 and nipple 12. Solder ring 16 is of such diameter as to fit snugly within flange 10 on cup element 5 and the same consists of two parts a and b, each of which is weakened at a plurality of spaced points by notches 18. As is apparent the notches 18 render the solder ring 16 relatively flexible at a plurality of points to facilitate engagement of said ring throughout its entire circumference with the inner surface of flange 10. Also during soldering the weakened portions of ring 16 ad-

jacent the notches 18 melt prior to the other portions to thereby prevent warping of said ring. Solder ring 17 is of such diameter as to snugly encircle nipple 12 on a line adjacent groove 14.

The aforementioned parts of the bellows are assembled in the following manner: Nipple 12 is inserted into the opening in cup element 6 and said element is sprung over the shoulder 15 to drive the inner edge thereof into groove 14. Cup element 6 is then placed upon cup element 5 so that flange 11 rests upon flange 9 and the parts are then sprayed with a suitable liquid flux. Solder rings 16 and 17 are next placed in position, care being taken to insure engagement of ring 16 with flange 11 on element 6 and engagement of ring 17 with the inner margin of said element. The parts are again sprayed with the liquid flux and then baked to dry the flux.

The joints of the wafer element are soldered simultaneously, in a soldering device, which does not enter into this invention. The soldering device employed is provided with a pair of horizontally arranged ring shaped heater elements 19 and 20 illustrated in dotted lines in Fig. 4. The wafer assembly is inserted within the soldering device with its nipple 12 extending upwardly and during soldering the assembly is maintained with its axis in a vertical position. Upon insertion of the wafer assembly within the soldering device, heater element 19 closely surrounds flange 10 and heater element 20 closely surrounds nipple 12 and is located adjacent the solder ring 17. Under the action of heater elements 19 and 20 the solder rings 16 and 17 are melted simultaneously and within a relatively short interval without undue heating of the cupped portions of wafer elements 5 and 6. The solder of ring 16 adheres to the inner surface of flange 10 and is also drawn inwardly by capillary attraction between the flanges 9 and 11. As is apparent from Fig. 5 the flanges 9 and 11 are thus connected by a continuous ring of hard solder to provide a very strong and durable joint with but slight increase in the diameter of the wafer as compared with the diameter of the cup portion and without stiffening of either cup portion by a flow of solder inwardly beyond the flanges 9 and 11. Solder ring 17 when melted adheres to nipple 12 and to the inner marginal portion of cup element 6 to form a continuous ring of solder between the inner edge of said element and nipple 12.

After soldering the wafer element is heat treated to harden the beryllium bronze cup elements 5 and 6. The same is then thoroughly cleaned and tube 2 is soldered to nipple 12, a small ring of hard solder such as silver being used for this purpose. The bellows assembly is then evacuated and filled under pressure with a suitable fluid, as for example methyl chloride, and after filling the outer end of tube 3 is sealed and the entire unit is plated for protection against corrosion.

The joint between cup element 6 and nipple 12 would not be durable if left unprotected, and for its protection support 4 is provided with an annular bead 22 which coats with the annular shoulder 15 on the nipple to clamp the interposed wall of the wafer element 6 along a line encircling the joint. Thus flexing of the cup element 6 is limited to points spaced from the solder joint and the clamping parts are curved to insure against sharp curvature of said element upon flexing thereof. Casing 4 is provided with a sleeve 23 which fits closely over nipple

12 and said casing is secured to said nipple by striking the metal of the sleeve inwardly at a number of points circumferentially thereof as shown at 24 in Fig. 1.

What is claimed as new and desired to be secured by Letters Patent is:

1. An expansible wafer comprising two circular cupped elements of thin sheet metal having peripherally thereof a continuous soldered joint lying in a plane from which the cup portions of said elements project in opposite directions, one of said elements having its marginal portion formed to provide a radially extending flat annulus and a ring upstanding from such annulus and the other element having its marginal portion formed to provide a radially extending flat annulus to fit within said upstanding ring of the former element, said soldered joint comprising said marginal portions of said elements and solder bonding together the inner surfaces of the annuli of said elements, the wafer exterior surfaces contiguous to said annuli being free of solder and said ring being permanently upstanding.

2. An expansible wafer comprising two circular cupped elements of thin sheet metal having peripherally thereof a continuous soldered joint lying in a plane from which the cup portions of said elements project in opposite directions, one of said elements having its marginal portion formed to provide a radially extending flat annulus and a ring upstanding from such annulus and the other element having its marginal portion formed to provide a radially extending flat annulus to fit within said upstanding ring of the former element, said soldered joint comprising said marginal portions of said elements and solder bonding together the inner surfaces of the annuli of said elements, and also bonding to said inner surface of the ring the outer surface of the annulus inserted into said ring, the wafer exterior surfaces contiguous to said annuli being free of solder and said ring being permanently upstanding.

3. An expansible wafer comprising two circular cupped elements of thin sheet metal having peripherally thereof a continuous soldered joint lying in a plane from which the cup portions of said elements project in opposite directions, one of said elements having its marginal portion formed to provide a radially extending flat annulus and a ring upstanding from such annulus and the other element having its marginal portion formed to provide a radially extending flat annulus to fit within said ring of the former element, said soldered joint comprising said marginal portions of said elements and a ring of solder bonding the exposed peripheral edge of the annulus of the second mentioned element to the ring of the other element, the wafer exterior surfaces contiguous to said annuli being free of solder and said ring being permanently upstanding.

4. A gas containing wafer comprising two circular cupped elements of thin sheet metal having peripherally thereof a continuous soldered joint lying in a plane from which the cupped portions of said elements project in opposite directions, one of said elements having its marginal portion formed to provide a radially extending flat annulus and a ring upstanding from such annulus and the other element having its marginal portion formed to provide a radially extending flat annulus to fit within said ring of the former element, said soldered joint com-

prising said marginal portions of said elements and a ring of solder bonding the exposed peripheral edge of the annulus of the second mentioned element to the ring of the other element, said soldered ring also extending between the inner surfaces of the annuli of said elements, the spacing of said surfaces being such as to afford flow of the solder by capillarity between said annuli, the wafer exterior surfaces contiguous to said annuli being free of solder and said ring being permanently upstanding.

5. A gas containing wafer comprising two circular cupped elements of thin sheet metal having peripherally thereof a continuous soldered joint lying in a plane from which the cupped portions of said elements project in opposite directions, one of said elements having its marginal portion formed to provide a radially extending flat annulus and a ring upstanding from such annulus and projecting beyond said soldered joint and the other element having its marginal portion formed to provide a radially extending flat annulus to fit within said ring of the former element, said soldered joint comprising said marginal portions of said elements and a ring of solder bonding the exposed peripheral edge of the annulus of the second mentioned element to the ring of the other element, said soldered ring also extending between the inner surfaces of the annuli of said elements, the spacing of said surfaces being such as to afford flow of the solder by capillarity between said annuli, and said annuli being of a breadth sufficient to prevent flow of solder onto the cupped portions of said elements.

6. An expansible wafer comprising a cupped disk and a cupped annulus, both of thin sheet metal and having peripherally thereof a continuous soldered joint, and a nipple with which said annulus has a continuous soldered joint, said nipple having a cylindrical portion terminating in an annular end flange forming an abutment for said annulus which permits the central portion of said annulus to be sprung inwardly along said nipple and said cylindrical portion of said nipple having adjacent its juncture with said flange an encircling groove re-

ceiving the edge of the inner marginal portion of said annulus when said annulus is sprung inwardly along said nipple, the solder of said joint between said nipple and annulus bonding said elements externally and extending into said groove.

7. An expansible wafer comprising a cupped disk and a cupped annulus, both of thin sheet metal and having peripherally thereof a continuous soldered joint, a nipple for said annulus having a cylindrical portion terminating in an annular end flange forming an abutment for said annulus which permits the central portion of said annulus to be sprung inwardly along said nipple, said cylindrical portion of said nipple having adjacent its juncture with said flange an encircling groove into which the edge of the inner marginal portion of said annulus is driven when said annulus is sprung inwardly along said nipple, said inwardly sprung portion of said annulus forming with said nipple an external circular groove, and a continuous solder ring formed in said groove to join said annulus and nipple.

8. An expansible wafer comprising a cupped disk and a cupped annulus, both of thin sheet metal and having peripherally thereof a continuous soldered joint, a nipple for said annulus having a cylindrical portion terminating in an annular end flange forming an abutment for said annulus which permits the central portion of said annulus to be sprung inwardly along said nipple, said cylindrical portion of said nipple having adjacent its juncture with said flange an encircling groove into which the edge of the inner marginal portion of said annulus is driven when said annulus is sprung inwardly along said nipple, said inwardly sprung portion of said annulus forming with said nipple an external circular groove, and a continuous solder ring formed in said groove to join said annulus and nipple, said solder ring being confined to a radius less than that of the inwardly sprung portion of said annulus.

BEATRICE L. GIARD,

Special Administratrix of the Estate of Eugene Armand Giard, Deceased.