May 22, 1962 C. H. KIRK, JR 3,035,614

EXPANSION TANK

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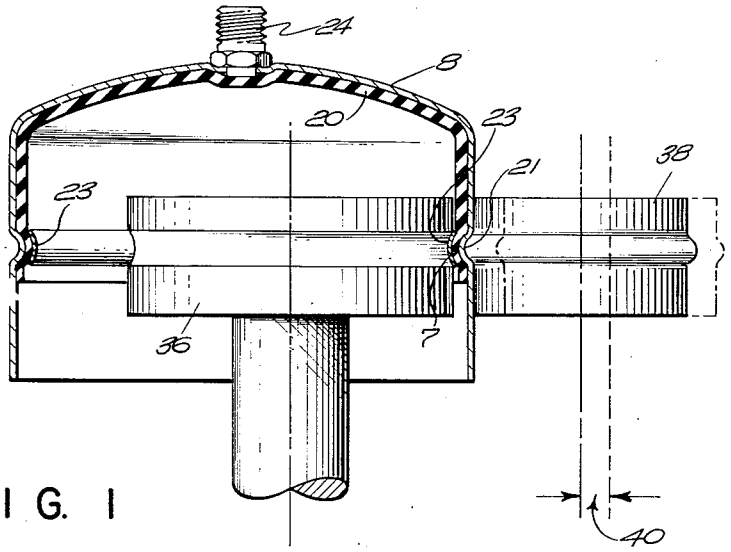


FIG. 1

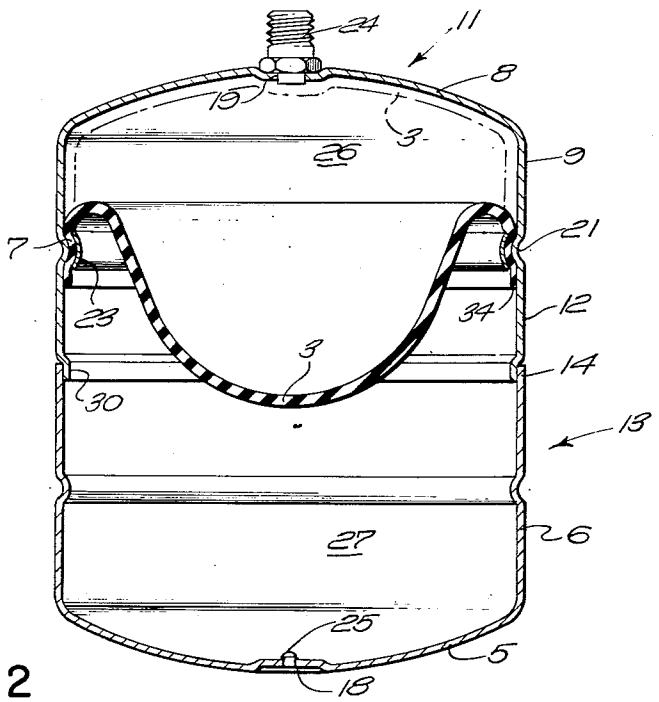


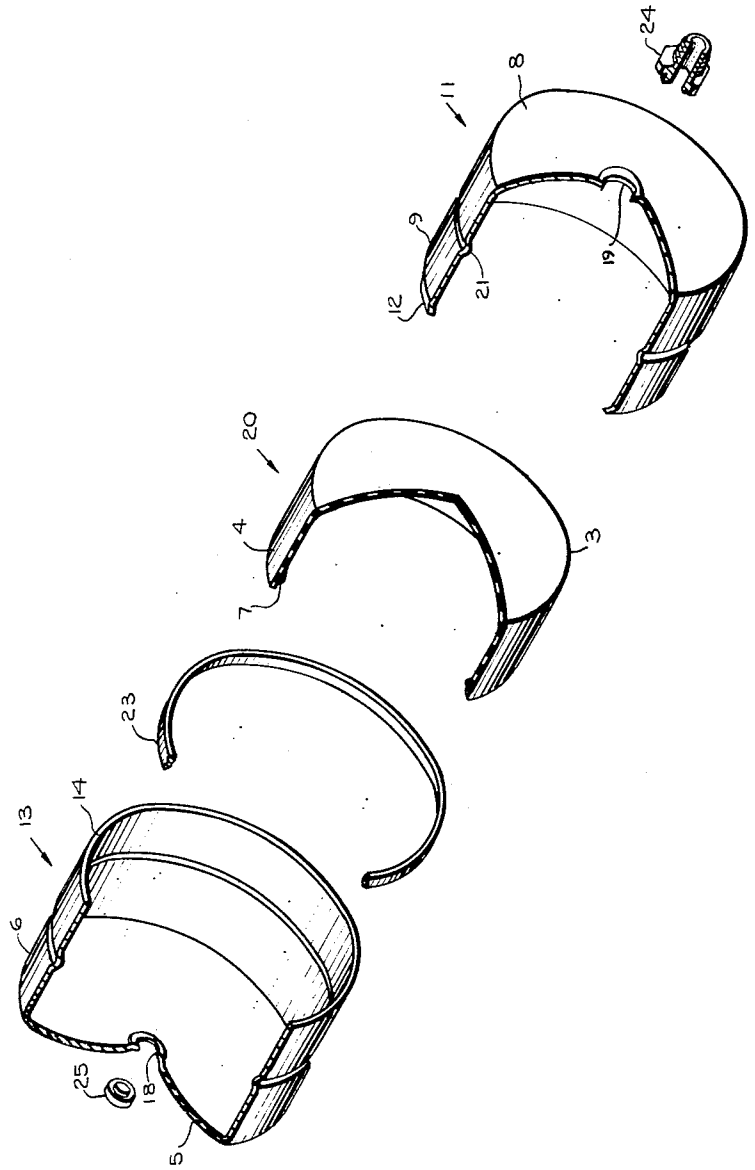
FIG. 2

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FIG. 3



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EXPANSION TANK

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6 Claims. (Cl. 138—30)

This invention relates to closed hot water heating systems and more particularly to the construction of an expansion tank forming part of the system.

An object of the present invention is to provide an improved storage device in the form of an expansion tank for use in hot water heating systems wherein the expansion tank has a diaphragm which divides the tank into two sections. One section is precharged with gas under pressure. The other section is connected to the hot water heating system. The present invention is an improvement over U.S. Patent #2,695,753 which issued on November 30, 1954 to Chester H. Kirk, Jr.

Another object of the present invention is to provide an improved storage device in a hot water heating system for the expanded hot water wherein the storage device is an expansion tank provided with a deformable diaphragm which divides the tank into two sections in a ratio of approximately two-thirds to one-third by volume. The larger volume section of the tank is precharged with a gas under pressure whereby the diaphragm will be compressed or expanded according to the variations of the volume of water in the lesser volume section. The variation in volume is created by the volume of boiler water and the increase and decrease in the temperature of the boiler water as it is heated and cooled in the normal cyclic operation of the heating system.

It is a well known fact that water contains air in the absorbed state in nearly inverse proportion to its temperature. This air is liberated into the system when the water is heated and accumulates in the compression tank and other portions of the heating system. A reduction in heating efficiency results, making continuous venting of radiators or convectors necessary. The water as it is heated expands and moves into the compression tank which is connected to the piping through which the water is circulated. When the temperature of the boiler water reaches the desired degree, the firing of the boiler ceases. The water begins to cool and contract. As it cools, that part of the boiler water in direct contact with the air in the compression tank absorbs some of the air in the tank. Through thermal circulation this air-charged water in the compression tank is changed continually so that in the next heating cycle this re-absorbed air is liberated into the system. This reversible process is repeated as often as the firing cycle is repeated and the boiler water is heated and cooled. As a result of this process the pressure in the system varies considerably and eventually the system may cease to function. It is an object of the present invention to provide an improved expansion tank in both construction and function so that the undesirable features of prior compression tanks are entirely eliminated.

Expansion tanks in domestic water systems in use today, provide an air cushion for the supply water. The air and water are in direct contact. Air being soluble in water, the water absorbs air. The water in the system may eventually absorb the air cushion in the expansion tank, leaving a static water system which necessitates the constant operation of a pressure pump. Accordingly, it is an object of the present invention to provide an air surge chamber which is not in direct contact with the water, thereby eliminating the need of the pressure pump operating every time a faucet is turned on.

And still another object of the present invention is to provide an expansion tank which is tamper proof in

operation, inexpensive to manufacture and provided with a new concept in diaphragm manufacture and assembly.

Other objects of the present invention will be pointed out in part and become apparent in part in the following specification and claims.

Referring to the drawings in which similar characters of reference refer to like parts:

FIGURE 1 is a vertical sectional view of one tank body member showing the method of forming the rib in the body member;

FIGURE 2 is a vertical sectional view through a completed expansion tank made in accordance with the present invention;

FIGURE 3 is an exploded perspective view of the component parts thereof.

In proceeding with this invention there is provided an upper cylindrical body member, generally indicated by reference numeral **11**, consisting of a side wall **9** and an end wall **8** in the form of a dome **8**. The side wall **9** provides a cylindrical skirt **12** open at its end edge **30**. An orifice **19** is located in dome **8**. A lower cylindrical body member is provided, generally indicated by reference numeral **13**, consisting of a side wall **6** and an end wall **5** in the form of a dome. The side wall **6** is open at its end edge **14**. The open end edge **14** is adapted to be fixed to cylindrical skirt **12** at the offset end edge **30** by means of welding, brazing or soldering to form a completed tank. An orifice **18** is formed in the dome **5**.

Upper cylindrical body member **11** and lower cylindrical body member **13** are formed by means of deep draw punch and die stampings, the design of the body members being such that they can be initially formed on the same tools.

A preformed flexible diaphragm, generally indicated by reference numeral **20**, is provided with a side **4** (see FIGURE 3) adapted to conform to the shape of side wall **9**, and a dome **3** adapted to conform to the shape of dome **8**. A bead **7** is provided on the inside surface **32** of side **4** adjacent its free edge **34**. A concave retaining ring **23** is provided to mate with bead **7** and anchor preformed flexible diaphragm **20** to side wall **9**.

A pipe connection **24** is secured to dome **8** at orifice **19**. A pressure charge seal **25** is secured to dome **5** to cover orifice **18**.

In the distended position shown in FIGURE 2, flexible diaphragm **20** divides the tank into two non-communicating chambers **26, 27**.

The new and improved expansion tank is assembled in the following manner.

The bead **7** of the diaphragm **20** is stretched into position on the concave retaining ring **23**. The ring **23** with the diaphragm **20** thereon are then positioned adjacent the inside surface of side wall **9**. A back up tool **36** is placed against the ring **23** while a sharp blow or other form of pressure is applied to side wall **9** by the tool **38**, which moves relative to the tool **36** by the amount of travel shown at **40**, to form a rib **21** whereby to squeeze or crimp the bead **7** of flexible diaphragm **20** between the rib **21** and the retaining ring **23**.

Lower cylindrical body member **13** is then placed in position to engage the offset edge **30** of skirt **12**. It is then seam welded to form an air tight joint.

Dry Ice in a ratio of six grams per gallon volume of the annular chamber is passed through orifice **18**, into section **27** of the annular chamber. The gas charge seal **25** is then placed over orifice **18** and is secured to dome **5** by means of brazing, welding, soldering or the like. A pipe fitting **25** is then secured to dome **8** through orifice **19**.

The Dry Ice will melt producing a gas having a pressure of twelve pounds per square inch on flexible dia-

phragm 20. Pipe connection 24 may then be connected to a hot water heating system or a pressurized well water system.

An air valve may be substituted for gas charge seal 25, in which event air would be used to pressurize section 27 instead of the gas from the Dry Ice. The gas charge seal 25 has the advantage of being tamper proof.

Having shown and described a preferred embodiment of the present invention, by way of example, it should be realized that structural changes could be made and other examples given without departing from either the spirit or scope of this invention.

What I claim is:

1. An expansion tank comprising a hollow body member having a side and end walls, a flexible diaphragm in and spanning said body member between said end walls and having a peripheral portion in peripheral engagement with said side, a continuous ring having a groove in its outer periphery engaging and receiving said peripheral portion and an inwardly extending peripheral rib in said side engaging said peripheral portion of said diaphragm and compressing it into said groove to secure said ring and diaphragm against movement and seal said diaphragm to said side.

2. An expansion tank comprising a hollow body member having a side and end walls, a flexible diaphragm in and spanning said body member and having a peripheral portion peripherally engaging said side, a thickened bead on said peripheral portion, a continuous ring having a groove in its outer periphery receiving said bead and retaining said peripheral portion in engagement with said side, and a peripheral indentation in said side engaging said bead and compressing it into said groove to retain said ring and diaphragm against movement and effect a seal between said side and said diaphragm.

3. An expansion tank comprising a pair of hollow body members, each having an end and a tubular skirt portion, said skirt portions being united in end-to-end relation to form a tank, a flexible diaphragm in and spanning said tank and having a peripheral portion in peripheral engagement with the skirt of one of said body members, a continuous retaining ring engaging said peripheral portion and retaining it in engagement with said skirt of said one body member, a groove in the exterior of said ring and a substantially complemental corrugation in said skirt of said one body member compressing said peripheral portion into said groove to secure said diaphragm against movement endwise of said tank and seal said diaphragm to said skirt.

4. The expansion tank according to claim 3 wherein said hollow body members are substantially similar.

5. A method of making an expansion tank comprising inserting into the peripheral portion of a substantially dome-shaped diaphragm a continuous ring, inserting said diaphragm and ring into a first hollow body member having an end and a skirt projecting therefrom and terminating in an edge to dispose said peripheral portion of said diaphragm and said ring in said skirt in spaced relation to the edge of said skirt with said peripheral portion between said ring and said skirt, deforming said skirt inwardly in alignment with said ring to form an inwardly extending peripheral rib compressing the peripheral portion of said diaphragm against said ring and securing said diaphragm in said skirt in leak-proof relation thereto, and uniting said skirt of said first body member at its edge with the skirt of a second body member to form a tank.

6. A method of assembling an expansion tank comprising the steps of inserting a circular retainer ring within the annular peripheral portion of a flexible diaphragm so as to support the diaphragm on the ring, positioning the ring and diaphragm carried thereby into a first tank section having a skirt so as to locate the ring and diaphragm against the interior surface of said skirt, applying pressure to said skirt and the ring to form a sealing and locating joint having a rib formation on the skirt and a groove on the ring with said diaphragm peripheral portion interposed therebetween, and mounting a second tank section on said first tank section and sealing the joint therebetween.

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