Oct. 24, 1933. J. M. LARSON 1,931,663

REGULATOR

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Fig. 1.

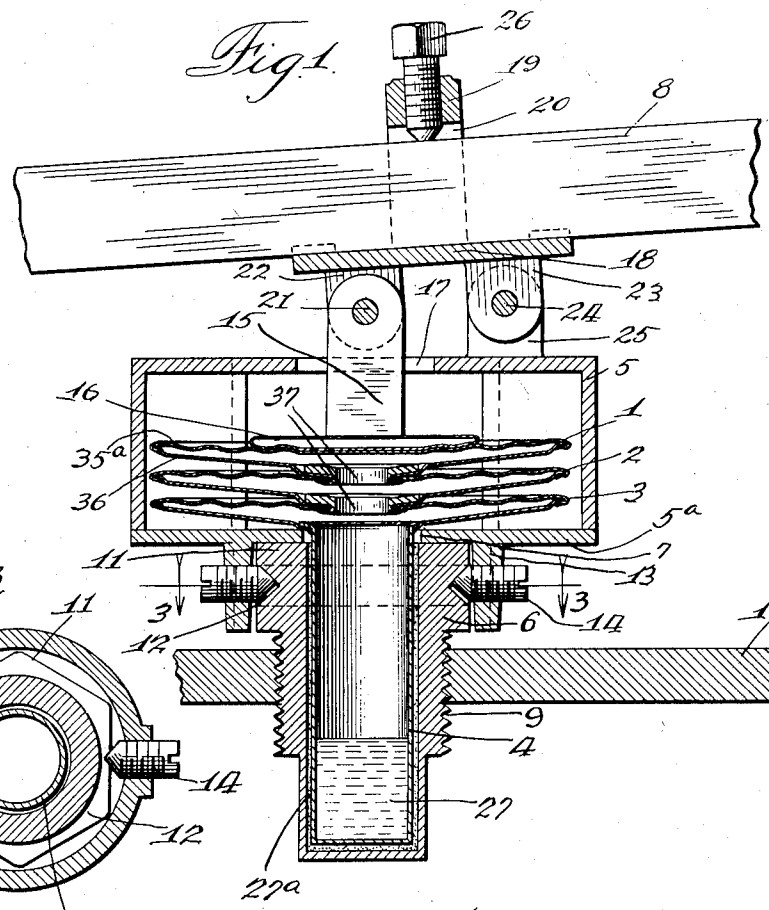

Fig. 3.

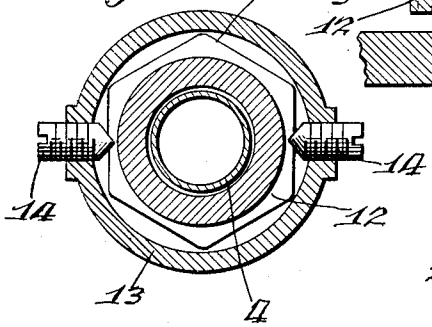

Fig. 2.

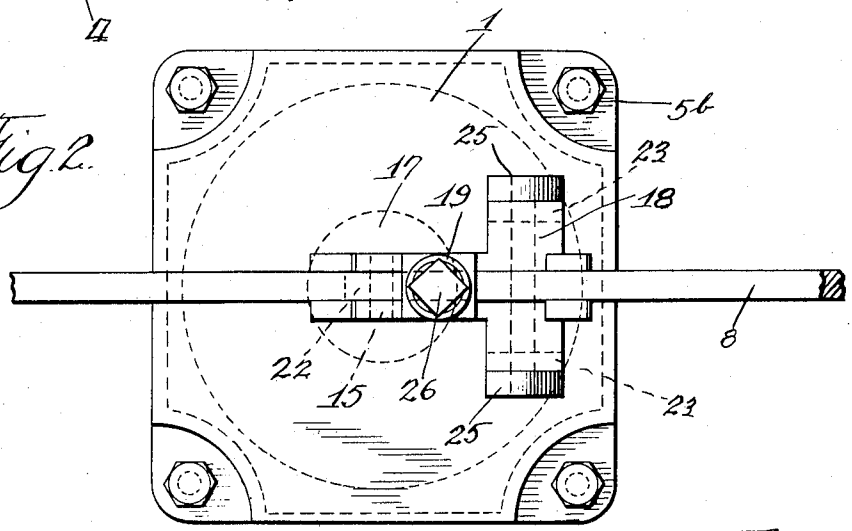

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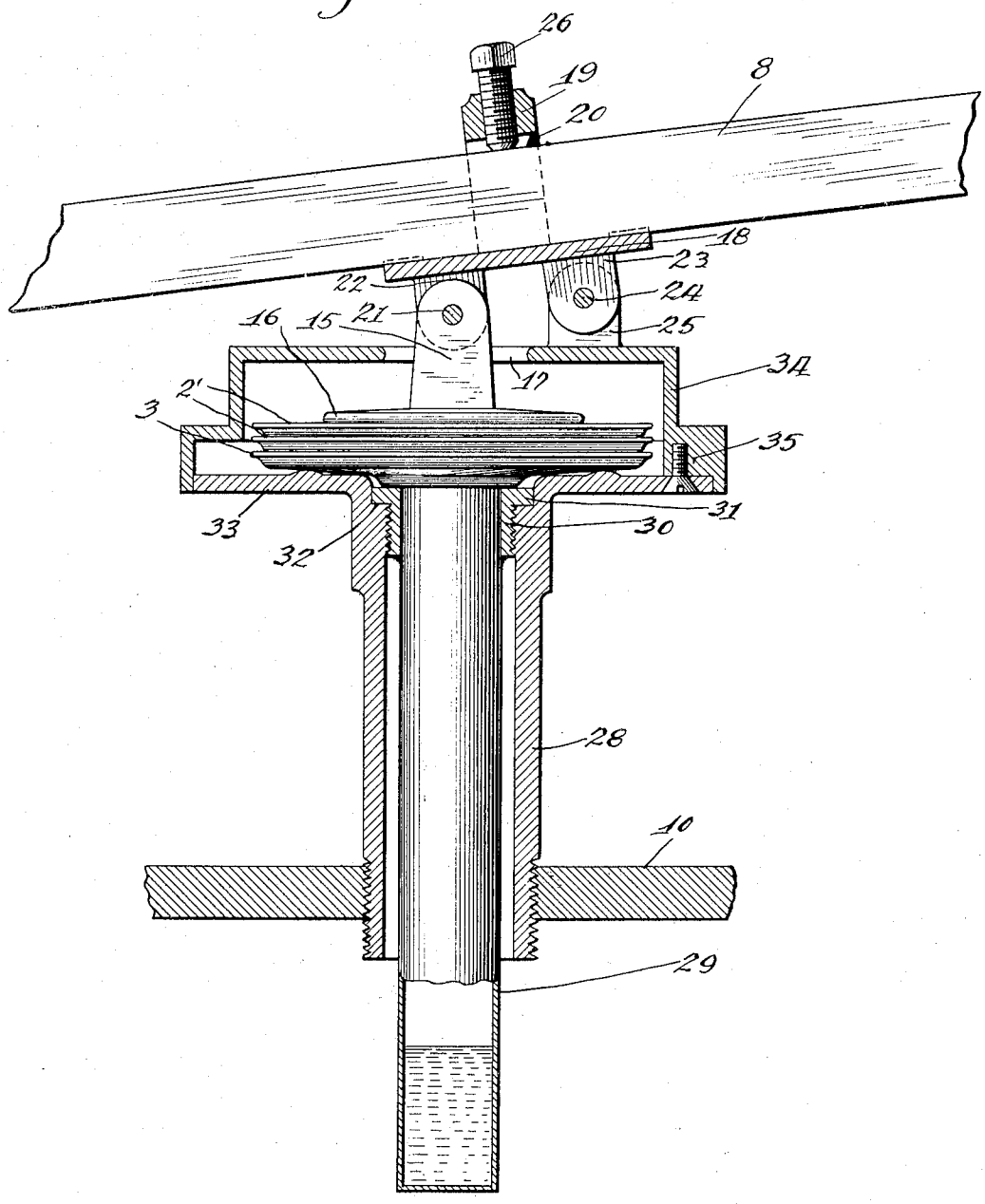
Fig 4



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UNITED STATES PATENT OFFICE

1,931,663

REGULATOR

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Application April 11, 1931. Serial No. 529,491

6 Claims. (Cl. 297—8)

This invention relates to regulators and has particular reference to regulators actuated by temperature and pressure.

More particularly, this invention relates to a regulator comprising a cup-like plug for connection with the top of a hot fluid container and extending therein, a casing having a hole in the bottom thereof attached to the plug so that there is direct communication from the chamber to the plug, a series of superposed expansible diaphragm cells positioned in the casing and having a volatile liquid container in communication therewith and depending from said cells into the plug, and connecting means between the expansible diaphragm cells and a pivoted lever whereby as the pressure in the volatile liquid container and the diaphragm cells increases one end of the lever is pivoted upwardly while when the pressure is decreased due to a drop in temperature the opposite result occurs.

One of the objects of my invention is to provide an improved regulator construction comprising a hollow member for insertion into a hot fluid container and having a volatile liquid container therein, depending from and in connection with a series of diaphragm cells about which is a casing having an operating arm thereon for actuation by the expansion and contraction of said cells.

Another object is to provide an improved regulator construction in which the casing about the cells is mounted by a swiveled connection and may be secured in any swiveled position to cause the operating arm to extend in any desired direction.

A further object is to provide an improved regulator construction having filling material between the volatile liquid container and the hollow member in which it is seated, which will insure a good and uniform conductivity of heat from the hot fluid in the heater to the volatile liquid in the volatile liquid container.

A still further object is to provide a diaphragm cell for use in a regulator of the above referred to type, having the lower surface thereof made of substantially rigid material, not materially affected by change of pressure in the cell, with a slight upward slope toward the outer edges to prevent the collection of any liquid therein, and having the upper surface thereof formed of flexible material which will be distorted by change in pressure in the cell.

Further objects and advantages will be apparent from the following description when taken together with the accompanying drawings, in which latter:

Figure 1 is a central vertical cross sectional view of a regulator embodying the present invention;

Fig. 2 is a top plan view of Fig. 1;

Fig. 3 is a cross sectional view taken on the line 3—3 of Fig. 1; and

Fig. 4 is a central vertical cross sectional view partially in elevation showing another form of construction embodying the present invention.

Referring more particularly to the drawings, the construction shown comprises a series of superposed expansible diaphragm cells 1, 2 and 3 having a volatile liquid container 4 depending therefrom and in communication therewith. The diaphragm cells are enclosed within a casing comprising an upper portion 5 and a base 5a which is connected to a cup-like plug member 6. The two portions 5 and 5a may be secured together as by bolts 5b. The casing base 5a is provided with an opening 7 in the bottom thereof through which the volatile liquid container 4 extends to be positioned within the plug 6. A pivotally mounted lever 8 is actuated by connecting means between the upper diaphragm 1 and the lever 8.

The cup-like plug 6 is screw threaded at 9 so that it may be screwed into the top 10 of a hot fluid container, such as a hot water boiler, with a portion of the plug extending within the hot fluid container. The plug 6 is formed with a wrench engaging portion 11 adjacent the upper end so that the plug may be easily threaded into the top of the hot fluid container. The wrench engaging portion 11 is provided with an annular channel 12.

The lower portion 5a of the casing is provided with a depending annular portion 13 which is adapted to fit over the wrench engaging portion 11 and be rotatable thereabout. Securing means, such as the screw plugs 14, are threaded into the annular portion 13 and register with the annular channel 12. By this means, the casing may be swiveled about the plug 6 and secured in any desired position by the screw plugs 14 when the latter is tightened to engage the sides of the annular channel 12. A lifting post 15 having a base portion 16 adapted to rest on the upper central portion of the diaphragm 1 extends up through the opening 17 in the top of the casing, the upper end of the lifting post 15 being preferably bifurcated. A lever support comprising a base 18 and a securing member 19

having an aperture 20 through which the lever 8 is slidably inserted, is pivoted at one end of the base 18 to the upper end of the pivot post 15 by means of a pivot 21 extending through the bifurcated portions of the lifting post 15 and the downwardly extending base portion 22. Two downwardly extending side portions 23 adjacent the other end of the lever supporting member 18 are pivotally connected by means of the pivot 24 to the supporting members 25 extending upwardly from the top of the casing portion 5.

A screw bolt 26 is threaded through the top of the lever securing member 19 and when tightened engages the top of the lever 8 to prevent longitudinal movement thereof and to hold it in the desired position. The ends of the lever 8 may be operatively connected to the draft door and the check damper so that when one end of the lever is raised by the action of the lifting post 15 the draft door will be closed after which the check draft will be opened.

A quantity of volatile liquid is placed in the volatile liquid container 4, as shown at 27. As the lower end of the plug 6 extends within the hot fluid container, the same will be heated as the temperature of the fluid in the hot fluid container rises. The heat absorbed by the plug 6 is transferred to the volatile liquid container 4 and volatilizes the liquid therein forming a vapor in the volatile liquid container and in the interior of the expansible diaphragms. As the temperature increases more of the liquid is volatilized and the pressure in the volatile liquid container and the diaphragm cells increases therewith. When all the liquid has been volatilized the increase in temperature thereafter does not produce the same increase in pressure as would occur before all the liquid was volatilized but follows the laws of expansion of gases. Therefore, only sufficient liquid is placed in the container 4 so that the pressure produced by the volatilization due to the increase in temperature will not be great enough to burst the diaphragms in the use for which the device is intended.

As a safety precaution it has been found desirable to put in only enough volatile liquid so that it will all be transformed into vapor at approximately 212° Fahrenheit. As this device is primarily designed for use in hot water furnaces and hot water heaters, a temperature of 212° F. is as high as the temperature of the water should ever be heated. However, the amount of liquid in the container 4 may be varied according to the use to which the regulator is to be put. In order to adjust the regulator, slidable weights are placed on the lever 8 on each side of the pivot 24 and these may be adjusted so that the lever will be tilted about the pivot 24 at any particular temperature desired. A filler 27*a*, such as graphite, may be inserted between the volatile liquid container 4 and the plug 6 to insure a good and uniform conductivity of heat from the hot fluid in the heater to the volatile liquid in the container. This, however, is not necessary for a proper operation of the regulator.

The construction shown in Fig. 4 is substantially the same as that shown in Figs. 1, 2 and 3 except that the tubular member 28 is open at the bottom so that the volatile liquid container 29 may extend directly within the hot fluid container. In this form, in order to prevent the escape of hot vapor and heat up through the tubular member 28 between the sides thereof and the volatile liquid container 29, an annular plug 30 having the outer face threaded, is secured to the volatile liquid container 29 adjacent the upper end thereof by any desirable means such as a sweated joint to form a tight connection.

The plug 30 is threaded into the upper end of the tubular portion of the plug 28 with the annular flange 31 fitting into an annular groove 32 in the tubular member 28. In this form, the bottom 33 of the casing 34 is formed integrally with the tubular member 28 with screws 35 holding the casing 34 to the bottom 33.

A new and improved type of diaphragm cell is employed in the various forms of regulators within the scope of this invention. Each of the cells 1, 2 and 3, is formed with an upper portion 35ª and a lower portion 36, the outer edges of the portions being tightly secured together and rolled under as shown in Fig. 1 to insure an absolutely tight jointure. The lower portion 36 is given a comparatively small upward slope toward the outer edges and is made of comparatively rigid material, the contour of which will remain practically unaffected by any change of pressure in the cells. Due to the material used in the construction of the lower portion 36, and the slope thereof, all of the liquid in the cells will drain down toward the center and from thence into the volatile liquid container depending therefrom. The upper portion 35 of the cells is formed of comparatively flexible material which is corrugated or the like so that when the pressure in the cell fluctuates, the upper portion 35 will rise and fall, thereby actuating the operating arm 8.

The lowermost cell, of which any number may be employed, is formed with a center aperture in the bottom, which is of substantially the same size as the volatile liquid container which depends therefrom. The uppermost cell is formed with a solid upper surface and a perforated lower surface, while the intermediate cells all have centrally located apertures in both surfaces so that all the cells may be communicatingly secured together as by means of eyelets 37. Thus the vapor formed by the volatile liquid in the container creates an equal pressure in all the cells.

While I have shown and described but two embodiments of this invention, it will be apparent to those skilled in the art that various modifications may be made without departing from the spirit and scope of this invention and, therefore, I wish to be limited only by the scope of the prior art and the appended claims.

I claim:

1. A regulator construction comprising a series of superposed expansible diaphragm cells, a container for a volatile liquid depending from said cells and in communication therewith and of smaller diameter than said cells, a cup-like well for receiving said depending container having provisions for connection with the wall of a hot fluid container so that a portion of the volatile liquid container will be within the hot fluid container, and a housing for the diaphragm cells having an opening in its bottom of smaller diameter than said cells through which said volatile liquid container extends, said housing having a swivel connection with said cup-like well.

2. A regulator construction comprising a series of superposed expansible diaphragm cells, a container for a volatile liquid depending from said cells and in communication therewith and of

smaller diameter than said cells, a cup-like well for receiving said depending container having provision for connection with the wall of a hot fluid container, and conducting filler material in said cup-like well between the sides thereof and the volatile liquid container, whereby there results a uniform conductivity of heat from the hot fluid in the hot fluid container to the volatile liquid.

3. A regulator construction comprising a series of superposed expansible diaphragm cells, a container for a volatile liquid depending from said cells and in communication therewith and of smaller diameter than said cells, a cup-like well for receiving said depending container having provision for connection with the wall of a hot fluid container, and graphite in said cup-like well between the sides thereof and the volatile liquid container, whereby there results a uniform conductivity of heat from the hot fluid in the hot fluid container to the volatile liquid.

4. A regulator construction comprising an expansible diaphragm cell, a container for a volatile liquid depending from said cell and in communication therewith and of smaller diameter than said cell, a tubular connecting and supporting member having provisions for connection with an opening in the wall of a hot fluid container, a housing for said diaphragm cell carried by said tubular member, said volatile liquid container extending into said tubular supporting member and into said hot fluid container, and said tubular member having its lower end closed to prevent the hot fluid from entering said housing.

5. A regulator construction comprising an expansible diaphragm cell, a container for a volatile liquid depending from said cell and in communication therewith and of smaller diameter than said cell, a tubular connecting and supporting member having provisions for connection with an opening in the wall of a hot fluid container, a housing for said diaphragm cell carried by said tubular member, said volatile liquid container extending into said tubular supporting member and into said hot fluid container, said tubular member having its lower end closed to prevent the hot fluid from entering said housing, and said housing having a swivel connection with said tubular member.

6. A regulator construction comprising a series of superposed communicating expansible, self-draining diaphragm cells, each of said cells comprising a rigid funnel-like bottom portion and a flexible top portion, said top and bottom portions being secured together adjacent their periphery, and means for connecting the lower rigid bottom portion of one cell to the upper flexible top portion of the cell underneath and providing communication between said cells, the rigid bottom portion of one cell being so closely connected to the flexible top portion of the cell underneath that said rigid portion engages said flexible portion throughout a substantial portion of its extent when the cells are collapsed.

JOHN M. LARSON.