

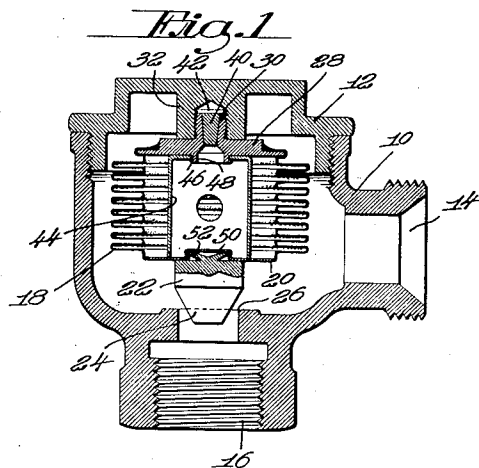
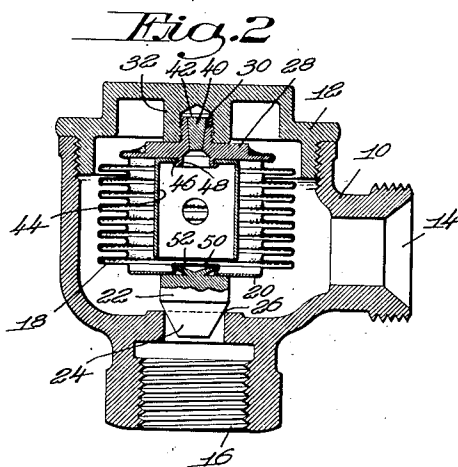
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STEAM TRAP

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STEAM TRAP

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The present invention relates to steam traps, and more particularly to devices of this character employing a flexible, metallic bellows or diaphragm containing temperature-responsive fluid.

The object of the invention is to improve and simplify apparatus of this kind with a view to long life and uniformity of operation under the varying conditions normally encountered in service.

With this object in view, the various features of the invention consist in certain novel features of construction, combinations and arrangements of parts, hereinafter described and claimed, the advantages of which will be obvious to those skilled in the art from the following description.

In the accompanying drawings illustrating the preferred form of the invention,

Fig. 1 represents a section in elevation of a trap embodying the features of the invention and illustrating the valve in retracted or open position; and

Fig. 2 is a similar view showing the valve in extended or closed position.

The trap shown in the illustrated embodiment of the invention is provided with a body portion 10 of conventional form which may be either a casting or forging surmounted by a cap 12 to which the thermostatic unit is attached. The inlet portion of the body is indicated at 14, and the outlet at 16, threaded in the usual manner for attachment to the steam line. The thermostatic element, as illustrated, is in the form of a metallic bellows 18 having an integrally closed bottom 20 to which is attached a valve member 22 having a conical end 24 adapted to engage with the seat edge 26. The opposite end of the bellows unit is provided with an attached head 28 having a stem 30 threadably received within a boss 32 formed on the cap 12. The interior of the bellows unit is completely exhausted of air, leaving water and water vapor only under a vacuum which is as nearly perfect as it is commercially practical to obtain. In the filling of the bellows unit, a small amount of water is first inserted, the interior is connected to a vacuum line through the stem

30 which has not been sealed, and the air exhausted from within until a vacuum is created which closely approximates an absolute vacuum at the barometric pressure prevailing; for example, if the barometric pressure when exhausting is 30" of mercury, the vacuum obtained within the bellows unit will approximate 29 $\frac{1}{10}$ " plus, and will result in substantially complete exhaustion of air. Thereafter and while maintaining the vacuum, the tapered sealing plug 40 is inserted in the stem and soldered over the top at 42 to maintain the seal. Located within the bellows unit and serving to limit the contracting movement under the influence of the vacuum is a limiting stop 44 in the form of a cup of the proper length having the closed end pierced and secured to the head 28 by the flanged end 46 of an inwardly extending neck 48. In actual practice the stop and head are secured together prior to attachment of the head to the bellows unit itself. The valve member 22 is conveniently secured to the opposite closed end of the bellows by indenting the closed end at 50 with a reentrant depression into which are inserted a resilient finger or fingers 52 formed on the attaching end of the valve and adapted to enter the recess and spring outwardly to lock therewithin. The attachment is preferably made secure by soldering the space between the valve and the closed end of the bellows.

It will be evident to those skilled in the art that a bellows unit such as 18, if pressure is balanced on both inner and outer sides, will tend to assume a definite length which may be considered as the normal free length of the bellows. With the bellows exhausted and a vacuum created therein, atmospheric pressure on the outside obviously maintains the bellows contracted against the stop 44. This condition persists so long as the space within the trap and about the bellows is filled with air or water of condensation which it is desired to exhaust from the trap. During this period the valve 22 is maintained in the open position shown in Fig. 1, with the trap free to discharge the air and condensate. When steam enters the chamber surrounding the bellows, however,

the water within the bellows, due to the elevation of temperature, is likewise converted into steam and the pressure is balanced both inwardly and outwardly of the bellows. This relief of the unbalanced pressure permits the bellows to assume its normal free length. In the present assembly the normal free length which the bellows tends to assume is a length which may be on the order of $\frac{1}{16}$ " greater than the length of the bellows with the valve in the closed position shown in Fig. 2. In other words, if the pressure is balanced inwardly and outwardly of the bellows, the natural tension of the metal walls tends to immediately close the valve and exert a seating pressure due to the normal tendency of the bellows to expand and move the valve still further in a closed direction, namely, an amount approximating the normal free length of the bellows. If the air is substantially completely exhausted from such a unit, it is found that it operates very satisfactorily and closes the valve within the desired range. Obviously inasmuch as the tension of the metal wall is the motivating force which closes the valve rather than an internal pressure, the greater the difference between the normal free length of the bellows and the actual length in closed position of the valve, the quicker the valve will be closed upon elevation in temperature with a correspondingly greater spread between the boiling point of water, namely, 212° F., and the point at which the valve closes. It is found that in actual practice with the valve seated in such a manner that the closed position causes the bellows to assume a length approximately $\frac{1}{16}$ " under the normal free length, and with air completely exhausted at the necessary high vacuum, the valve will close at temperatures from 190° to 200° F. which is entirely satisfactory for practical purposes. By completely exhausting the air and adjusting the travel in such a manner that the closed position of the valve is much closer to the normal free length of the bellows, the trap may be caused to close at a range exceedingly close to steam temperatures and become very sensitive to the differences between steam and water surrounding the bellows. However, such a close regulation is not necessary in actual practice and may in fact be undesirable, due to the tendency of the valve to teeter on its seat under these conditions.

The use of water within the bellows unit rather than expansible fluids, such as alcohol, has the distinct advantage that the vapor pressure curve of the water is identical with that of the steam, which actuates the trap so that the use of varying steam pressures, even up to 100 or 125 pounds, does not affect the performance of the trap and create excessive and disruptive unbalanced pressures within the bellows unit. In the case of other

expansible fluids, such as alcohol, the pressure curve does not conform to that of steam, and if it is attempted to use the trap with considerable steam pressures, the unbalanced pressure within the bellows unit becomes abnormal and tends to soon destroy it.

What is claimed is:

1. A thermostatically controlled unit for steam lines comprising a casing having an outlet port, a hermetically sealed bellows containing water under a vacuum, means for limiting the contracted position of the bellows under the influence of the vacuum, means for anchoring the bellows at one end in a predetermined position within the casing, a valve connected with the opposite free end of the bellows and normally seating to close the port upon an expansion of the bellows to a length less than the normal free length of the bellows and cause the tension of the bellows wall to exert a seating pressure on the valve in closed position.

2. A thermostatically controlled unit for steam lines comprising a casing having an outlet port, a metallic bellows supported within the casing and anchored thereto at one end, a valve connected with the free end of the bellows to open and close the port, the bellows containing water and having air exhausted therefrom, and the normal free length of the bellows being such as to normally expand the bellows beyond the closed position of the valve and exert a seating pressure thereon when the pressures within and without the bellows are balanced.

3. A thermostatically controlled unit comprising a bellows having an integral end wall provided with a centrally disposed reentrant recess, a member having a resilient portion seated within the recess and locked thereto, and a head connected to the opposite open end of the bellows.

4. A thermostatically controlled unit for steam lines comprising a trap chamber having inlet and outlet ports, a hermetically sealed bellows unit containing water under a sufficient vacuum to normally maintain the bellows unit at atmospheric conditions in contracted position, a stop for predetermining the contracted position of the bellows unit, a valve connected to the free end of the bellows unit and adapted on seating to close the outlet port of the chamber, and means for anchoring the opposite end of the bellows unit within the chamber in a predetermined position such that the separation between the valve and port in contracted position of the bellows is less than the difference between the normal free length of the bellows when pressure is balanced within and without and the actual contracted length of the bellows as determined by the stop to cause the resilience of the bellows wall to exert a seating pressure on the valve in closed position.

5. A thermostatic unit adapted for in-

corporation in a steam trap comprising a bellows having an integral recessed bottom portion, a valve mounted within the recess in the bottom portion and connected thereto, and a head mounted upon the bellows at the open end and adapted for connection with a supporting member.

6. A steam trap comprising inlet and outlet ports communicating with a trap chamber, a valve seat for the outlet port, sealed bellows unit containing water under a vacuum such that the bellows unit is maintained contracted below its normal free length at atmospheric pressures and temperatures, a valve connected with the bellows unit for cooperation with the valve seat, means for anchoring the opposite end of the bellows unit in a predetermined position such that the valve contacts with the seat upon expansion of the bellows to less than its normal free length, and accordingly balancing the pressure within and without the bellows serves to close the valve and exert seating pressure thereon through the tension of the bellows wall.

7. A steam trap comprising a casing having inlet and outlet ports communicating with a trap chamber, a valve seat for the outlet port, a sealed bellows unit containing water under a vacuum and contracted by atmospheric pressure within its normal free length, means for fixedly supporting the bellows unit at one end, and a valve connected to the free end of the bellows unit in such a relation to the seat that balancing of pressures within and without the bellows causes seating of the valve through the natural expansion of the bellows wall.

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