July 4, 1950 H. L. JOHNSON 2,513,875

THERMOSTATIC STEAM TRAP

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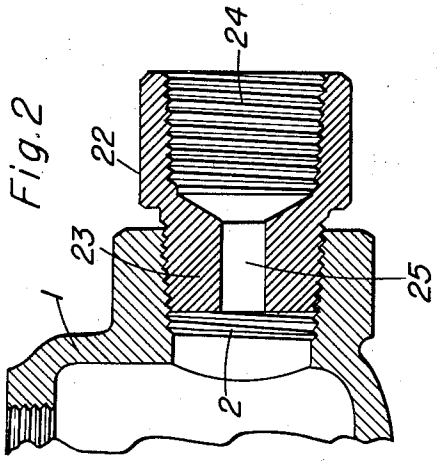

Fig. 2

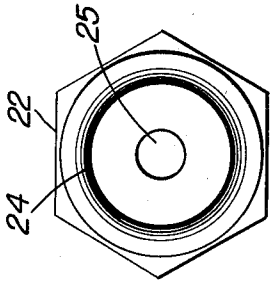

Fig. 3

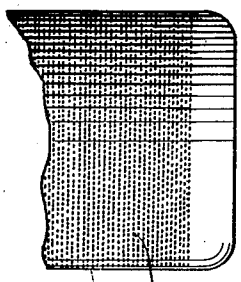

Fig. 5

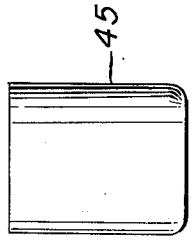

Fig. 4

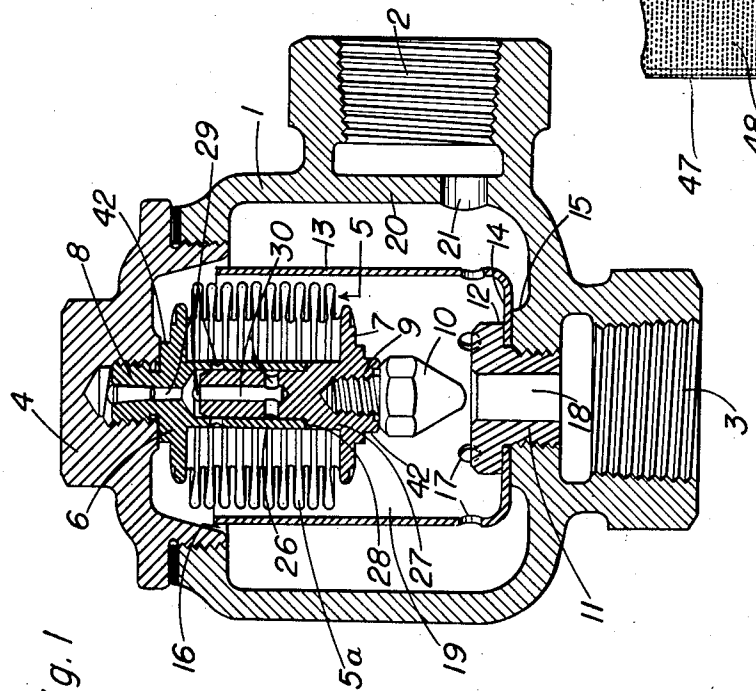

Fig. 1

Inventor
Harold L. Johnson
BY HIS ATTORNEYS
Howson and Howson

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THERMOSTATIC STEAM TRAP

Harold L. Johnson, Wilkes-Barre, Pa., assignor to W. H. Nicholson & Company, Wilkes-Barre, Pa., a corporation of Pennsylvania

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2 Claims. (Cl. 236—56)

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This invention relates to thermostatically controlled steam traps. It is an object of the invention to provide an improved trap of the thermostatic type suitable for draining apparatus supplied with steam under high pressure and temperature. In traps of the type described, the thermal unit, unless protected, would be subjected to erosion caused by the impact of high velocity steam, water, particles of dirt, scale and other foreign matter striking directly against the thermal unit. Therefore it is another object of this invention to provide in a trap of the type described means to protect the thermal unit from erosion by impact of scale, dirt, or high velocity steam or water there against. Other objects and advantages of this invention will appear as it is described in connection with the accompanying drawing.

In the drawing:

Fig. 1 is a vertical sectional view of a steam trap in accordance with this invention;

Fig. 2 is a fragmentary vertical sectional view of a modified construction;

Fig. 3 is a view in elevation, looking from the right of the inlet reducing connection shown in section in Fig. 2; and

Figs. 4 and 5 are a view in elevation and a partial view in elevation, respectively of modified constructions of the means for protecting the thermal unit.

A steam trap in accordance with this invention comprises a casing or body 1 of conventional form, having an inlet opening 2 adapted to be connected to the apparatus to be drained, and an outlet opening 3 suitable for connection to a discharge or drain pipe. The top of the casing 1 is closed by a cover or cap 4 to which the thermal unit 5 is attached. The thermal unit 5 may be fabricated and charged with temperature-responsive fluid by any of several methods known to the manufacturers of such devices, and in its usual form consists of a convoluted bellows 5a and closing elements 6 at the top and 7 at the bottom, suitably fastened together to form a leakproof envelope or container, such as by soldering, brazing or welding. The top closing element 6 is provided with a threaded stud 8 for fastening the thermal unit to the cover 4, and the bottom closing element 7 has a centrally positioned threaded opening 9 for receiving the stem of a valve 10.

Directly beneath the valve 10 and in alignment with the coinciding axis of the valve 10 and the thermal unit 5 is a valve seat 11 threaded in an opening in the casing 1 leading to the outlet opening 3, and provided with a flange 12 of suitable size and shape to permit installation and removal of the valve seat with standard socket-type wrenches.

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Surrounding the thermal unit 5 is a cylindrical shield 13 which extends substantially the entire length of the thermal unit, and which is provided at the lower end portion with an inwardly curved flange 14 which is seated between the flange 12 of valve seat 11 and a raised boss 15 in the casing 1. The shield 13 is thus centered, fastened and maintained in correct position by the valve seat 11. The shield 13 extends upward into the cover 4 a sufficient distance to permit only a small circumferential opening 16 between the shield and cover, this opening being of sufficient area to allow the incoming steam easy access to the thermal unit 5, without directly impinging against the convoluted bellows of this unit, but small enough to exclude dirt, scale and foreign matter of sizes large enough to damage these convolutions.

In the lower end of the shield 13 are located one or more openings 17 for permitting the condensate which enters the casing 1 through inlet 2 to be discharged through the orifice 18 of valve seat 11, and thence to outlet 3. The openings 17 are preferably horizontal to avoid direct impingement of the condensate against the thermal unit, and placed low enough in the shield 13, with relation to the valve seat 11 and inlet 2, so substantially all of the condensate will flow to the outlet 3 by the force of gravity, from the trap, the apparatus it drains and the connecting piping, when the steam supply is shut off. By thus preventing the collection of pockets of water in said apparatus and piping, freezing and its consequent damage is avoided on applications subjected to low temperature.

The combined total area through the openings 17 is made to a predetermined lesser area than the orifice 18 through valve seat 11, thereby permitting condensate to be discharged through orifice 18 at a faster rate than it can enter the space 19 formed by the shield 13 around the thermal unit 5, thereby obviating collapse of the thermal unit from contact with a considerable volume of water traveling at high velocity, a condition commonly called water-hammer. The openings 17 are made small enough to exclude from the space 19 dirt, scale, pieces of pipe and gasket of sufficient size to damage the convolutions of the thermal unit 5, or which might lodge between the valve 10 and valve seat 11, causing the trap to become inoperative.

Where it is desirable to maintain a greater volume of condensate in the casing 1 for more intermittent trap operation and the danger of freezing is not a consideration the openings 17 may be omitted and the shield be formed with a solid wall as at 45 in Fig. 4 and where it is desirable to screen small particles of dirt, scale, etc. from the condensate the shield may be formed as in Fig. 5 where the wall 47 is provided with a plurality of small openings 48 extending upwardly in the wall 47 sufficiently to provide the desired area of opening and with the openings small enough to screen out all particles over a permissible size.

To aid in preventing collapse of the thermal unit 5 from the effects of water-hammer a wall or partition 20 is integrally formed with the casing 1 between the interior of this casing and the inlet 2. An opening 21 through this partition of a predetermined lesser area than the orifice 18 through the valve seat 11 permits condensate to be discharged through orifice 18 at a faster rate than it can enter the interior of casing 1 through the opening 21. The opening 21 is preferably placed low enough in partition 20, with relation to the inlet 2 and valve seat 11, so all of the condensate can flow to the outlet 3 by the force of gravity, from the apparatus drained and the connecting piping, when the steam supply is shut off. By thus preventing the collection of pockets of water in said apparatus and piping, freezing and its consequent damage is avoided on those applications subjected to low temperature.

Where the casing 1 is not provided with an integral wall, as the wall 20 of Fig. 1, there may be provided in the inlet 2 an inlet reducing connection as the removable fitting 22 shown in Figs. 2 and 3. The fitting 22 has a threaded end portion 23 adapted to be engaged in the trap inlet 2 and its opposite end of suitable shape for engagement with a wrench and formed with a threaded opening 24 for connection to the apparatus to be drained. The opening 25 through the end 23 preferably will have a lesser area than the orifice 18 through the valve seat 11, thus permitting condensate to be discharged through the orifice 18 at a faster rate than it can enter the interior of casing 1 through the opening 25.

The top closing element 6 of thermal unit 5 is provided with an inwardly extending hollow cylindrical tube 26 integral therewith, and the bottom closing element 7 is provided with an inwardly extending integral cylindrical stem 27. These parts are machined so stem 27 is a close sliding fit inside the hollow tube 26. A shoulder 28 is included on stem 27 against which the end of hollow tube 26 abuts when the thermal unit 5 is contracted, thus limiting the contraction of the thermal unit to a predetermined minimum dimension. The top and bottom closing elements 6 and 7 are manufactured and the thermal unit 5 is assembled so that threaded stud 8, hollow tube 26, threaded opening 9 and cylindrical stem 27 are in alignment axially at all points between the extreme extended and contracted positions of the thermal unit. This construction prevents flexural distortion of the thermal unit convolutions and insures proper seating of the valve 10 in valve seat 11 when thermal unit 5 is extended during operation. Openings 29 in the hollow tube 26 and openings 30 in cylindrical stem 27 are

provided to permit unobstructed flow of the temperature-responsive liquid to the interior of thermal unit 5 during the charging operation, and free circulation of this liquid and its vapor as the thermal unit extends and contracts when the trap is in operation.

For fastening and unfastening the thermal unit 5 and valve 10 to and from each other and the trap cover 4 without requiring the application of strap, band or pipe wrenches, the top closing element 6 and the bottom closing element 7 are provided with flat shoulders or steps 42 formed dimensionally parallel to fit standard flat wrenches.

While the invention has been shown and described in connection with a thermal unit of a particular construction it is to be understood the invention is equally applicable to thermal units of other types and constructions where protection of the unit is desirable.

What is claimed is:

1. In a thermostatic steam trap, a casing having inlet and discharge openings, a thermal unit mounted in said casing, a valve operated by said thermal unit and controlling said discharge opening, guide means within said thermal unit rigid with said casing, guide means cooperating with said rigid guide means and moving with the thermal unit to guide said valve, a seat for said valve mounted in said discharge opening, and shielding means for said thermal unit comprising a metallic cup-shaped member surrounding said thermal unit and having its base portion secured to said casing by said valve seat, the side wall of said cup-shaped member being imperforate around said thermal unit and having drainage holes in the zone adjacent said valve seat.

2. In a thermostatic steam trap, a casing having inlet and discharge openings, a thermal unit mounted in said casing, a valve operated by said thermal unit and controlling said discharge opening, guide means within said thermal unit rigid with said casing, guide means cooperating with said rigid guide means and moving with the thermal unit to guide said valve, a seat for said valve mounted in said discharge opening, shielding means for said thermal unit immovably secured to said casing by said valve seat and restricting the flow of fluid to said discharge opening, said shielding means having a side wall formed and positioned to prevent impingement against said thermal unit of dirt particles.

HAROLD L. JOHNSON.

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