July 19, 1960 G. E. HANSEN ET AL 2,945,505

STEAM TRAP

Filed July 24, 1957

Fig. 1.

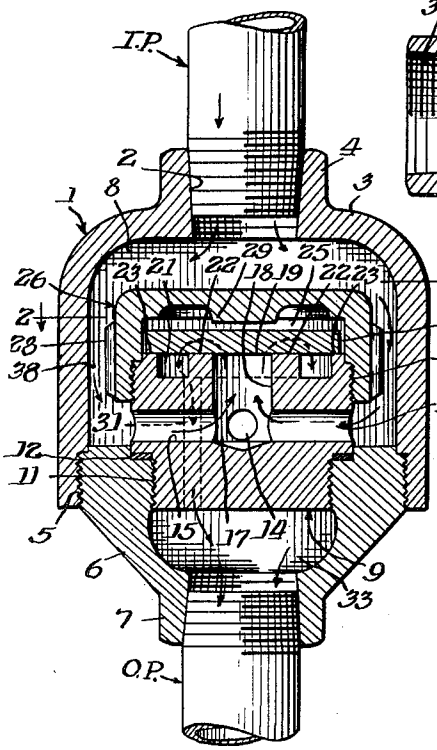


Fig. 3

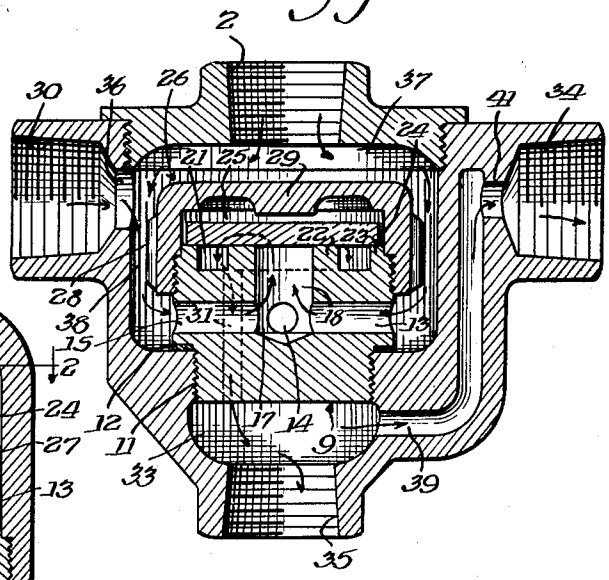


Fig. 2.

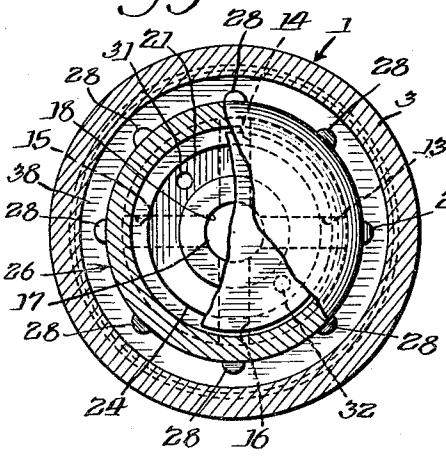
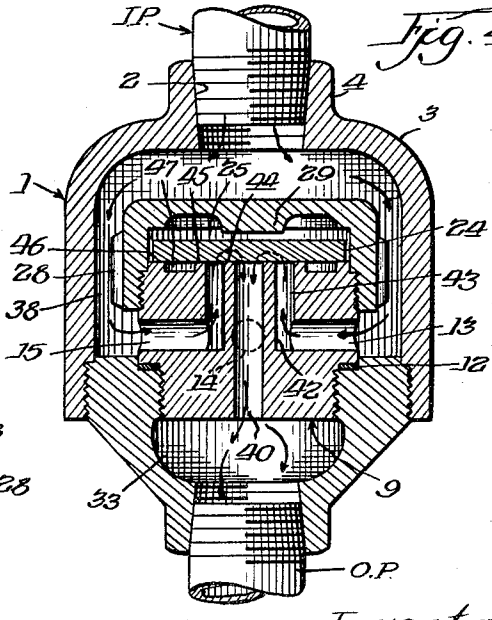


Fig. 4.



Inventors.
George E. Hansen, &
Frank J. Sanojca.

By Joseph O. Lange
Atty.

United States Patent Office 2,945,505 Patented July 19, 1960

2,945,505

STEAM TRAP

George E. Hansen, Elmwood Park, and Frank J. Sanoica, Chicago, Ill., assignors to Crane Co., Chicago, Ill., a corporation of Illinois

Filed July 24, 1957, Ser. No. 673,858

2 Claims. (Cl. 137—183)

This invention relates generally to steam traps and more particularly it is concerned with a type of trap construction in which the steam in the piping system is employed to keep the trapped valve closed.

In order to acquire a better appreciation of the merits of this invention, it should be understood that heretofore various forms of steam traps have been employed for the purpose, but apparently have failed either to recognize the necessity or to solve the problem for maintaining mass heat transfer value in the pipe line affected by means of a ready and efficient removal of the condensate in the pipeline.

It will be understood that in the instant device air and condensate are withdrawn from the steam line at a constricted passage or passages and in which when the steam is turned on, air is forced out through such passages and expands after passing through the region of such restriction. The expanding air creates a reduced pressure at the reduced passages and the reduced pressure serves to reduce the constriction of the passage and maintain it open sufficiently to permit the air to discharge rapidly. Cold condensate forced through the passage causes a reduced pressure beyond the constricted point in the passage so that the condensate may also discharge rapidly.

As the temperature of the discharge increases and approaches that of steam which forces it out, some condensate will flash into steam as it discharges through passage constrictions, the pressure created by this revaporization being substantially the saturation pressure corresponding to the temperature of the discharging condensate. The flashing of the condensate creates a vapor pressure in the passage greater than that which existed during flow of cold condensate and air, and this increased pressure acts through the control means (a valve closure) to increase the constriction of the passage. When the condensate is at substantially steam pressure, the vapor pressure created by its flashing is sufficient to substantially close the passage and thereby prevent any appreciable discharge of live steam therethrough.

An important object is to provide a trap construction in which a very high efficiency is maintained.

Another object is to provide for a construction in which while several parts may be used to provide the assembly only a single moving part is required.

Another object is to provide for a construction in which only one orifice size is used, thereby eliminating the necessity for the stocking of various sizes of trap seats usually employed for the purpose.

A further object is to provide for a construction which lends itself readily to the employment of two or more seat openings and thereby eliminates the serious objectionable condition occasioned by trap clogging.

Another object of this invention is to provide for a compact steam trap construction in which a novel arrangement of inner and outer chambers is used in the casing respectively surrounding and also positioned above the disc or closure member so that the trapping operation is thereby expedited. This is accomplished by allowing the incoming steam to condense on a wall surface or upon the walls outside of the chambers thus to maintain the steam in a vapor state or to cool the chamber and condense the steam to allow the closure member to be opened accordingly.

Another object is to provide for a trap construction in which the entire operating mechanism within the casing or housing can be conveniently removed as a unit either for inspection, replacement, or repair.

Other objects and advantages will become more readily apparent upon proceeding with the following description read in light of the accompanying drawings, in which:

Fig. 1 is a sectional assembly view of a steam trap with a preferred embodiment of our invention.

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1.

Figs. 3 and 4 show sectional assembly views of modified forms of steam traps embodying our invention.

Throughout the several views, similar numerals refer to similar parts.

Referring now to Fig. 1, as indicated by the arrow, an inlet pipe designated IP is attached to the upper end of the trap casing generally designated 1 by means of the usual connecting pipe threads 2, the housing 3 having the neck portion 4 to provide for such attachment. Obviously, other means of attachment may be employed, such as flanges, welding, soldering and the like. At its lower end limit, the housing 3 is connected by means of threads 5 in the fluid sealing relation to the base member 6. The latter member at its lower end portion as indicated is provided with a similar neck or extension 7 for threaded attachment to the outlet pipe generally designated OP. Within the valve chamber 8 of the housing 3, a cage member generally designated 9 is attached thereto as at 11 by means of the threads indicated. Preferably the said cage member is shouldered on the gasket 12 whereby to provide a fluid sealing connection with the base member 6. As indicated, the cage member 9 at its median portion is provided with a plurality of horizontally disposed radially extending ports as shown at 13, 14, 15, and 16, and which, as more clearly shown in the sectional view of Fig. 2, at their central or converging area or chamber designated 17 connect with the central port 18. The latter port at its upper limit 19 is defined by a plurality of annular surfaces in the same plane whereby outside of or around the said annular upper limit, an intermediate recess 21 is provided to form the spaced apart annular seat surface portions 22 and 23.

Above the said latter seating surface portions, a plate-like closure member 24 of circular configuration is positioned closely within the chamber 25 to move reciprocably therewithin in response to fluid pressure as hereinafter described. Defining the limits of the said movement of the closure member 24, a cap generally designated 26 is threadedly attached as at 27 to the upper end of the cage member 9, and for purposes of attachment in positioning and tightening the cap 26 onto the cage 9 peripherally positioned lugs 28 are used. It will also be noted that the cap member at its central portion has a depending boss 29 for contacting the disc or closure member 24 when the latter under the influence of fluid pressure is lifted from the seats 22 and 23. As more clearly shown in Fig. 2, the annular groove or recess 21 is provided with the outlet ports 31 and 32 which, depending upon the volume of fluid being handled and the size of equipment being drained of condensate, may of course vary in size and number.

In considering the operation of the device hereinabove described in Figs. 1 and 2, it will be appreciated that when condensate from a separator (not shown, but usually superposed) reaches the trap that depends from the

pipe designated IP it passes into the chamber 8 and thence into the annular portion thereof 38 following the path of the diverging arrows to enter the radially extending ports 13, 14, 15, and 16 to move upwardly and into the centrally located seat port 18. The disc or closure member 24 is then caused to be lifted from its annular seat contacts 22 and 23 and line fluid pressure again following the path of the arrows indicated enters the groove 21 and passes into the oppositely disposed discharge ports 31 and 32, thus moving into the lower chamber 33 and thence outwardly into atmosphere or to a condensate return pipeline. It will of course be appreciated that when the incoming steam enters the chamber 8, it discharges the condensate and allows the steam to enter around the closure member 24 and onto the top of the said closure member. The chamber 25 immediately above the closure member houses the steam and the latter fluid forces the closure member acting as a piston due to its large diameter to move toward its seating surfaces in closing off the inlet opening 18 and the outlet openings 31 and 32 leading to the discharge chamber 33.

It will be understood that the foregoing structural arrangement provides a pressure tight chamber that contains steam thereby keeping the closure member or disc upon its seat 19. It will also be understood that when the incoming condensate fills up around the outer chamber 38, in accordance with the explanation hereinabove given, it cools off the steam and allows it to condense, thereby opening the valve upon which occurrence the same operating cycle is then repeated. Thus, when the line condensate reaches the trap 1 it raises the closure member or disc 24 allowing the condensate to be discharged through the orifices to atmosphere or return line. When the line steam reaches the trap following the condensate, it forces out the latter fluid thus causing the closure member acting as a piston due to its relatively large diameter to be maintained against the seat 19 thereby to close the valve and assume the position shown in Fig. 1. In the meantime, the chamber 25 within the cage 9 above the disc 24 which has been filled with steam keeps the valve closed until the steam condenses and the incoming condensate raises the disc or closure member. It will be understood that the steam chamber 25 in which the disc movement takes place is surrounded with an upper chamber 8 and an annular chamber 38 so that when condensate enters the valve it cools off the chamber 25 which cools off the steam and the latter fluid then condenses and the condensate is discharged by the disc 24 leaving its seat due to the incoming condensate. It will also be understood that when the hot steam enters the outer chamber 38 and the valve disc 24 is closed by the steam pressure the said outer chamber which is filled with steam will keep the inner chamber 25 in a relatively hot condition for a substantial period of time and thereby helps to prevent the steam in the chamber 25 from condensing. It will be understood that the valve 24 remains closed until the condensate reaches the outer chamber 38 and thereby cools off the inner chamber 25 in which the said closure member 24 is reciprocally actuated.

Accordingly, it will be appreciated that a new concept has been developed with respect to the operation of a steam trap of this type providing for extremely higher efficiencies than heretofore attained, while at the same time being able to provide such structure in a compact design.

In Fig. 3, a modified form of trap construction is illustrated in which the usual attachment of respective inlet pipes at 2 and 30 are provided with the outlet attachment means at 34 and 35 for connection to suitable receivers or else discharging to atmosphere. The trap operation is identical to that previously described in connection with Figs. 1 and 2 in that an inlet port at 36 permits the steam or condensate to enter the upper chamber 37 and then passing around the outer annular chamber 38 over

the cap generally designated 26 and then entering the cage member 9 similarly through the radially extending ports 13, 14, 15, and 16, the latter not being shown, to converge at central chamber 17 and then entering the central port 18, thereby to permit line steam pressure to lift the closure member 24 from its annular seats as at 22 and 23 in the same manner as described in connection with the earlier mentioned figures. Here, also, the annular groove 21 at its lower or base portion is provided with the vertically extending ports 31 and 32 (32 not being shown) and connected with the lower discharge chamber 33. It will be noted that the latter chamber at a side portion of periphery is provided with a discharge port 39 connected with the outlet port 41, the latter being in communication with the discharge connection 34. The condensate discharge here is thus directed into two areas, namely, the discharge pipe 34 and also the discharge pipe connecting at 35.

In another steam trap modification embodying our invention, as shown more clearly in Fig. 4, the inlet pipe IP is connected as at 2 to the trap generally designated 1 by means of the upper casing portion 3. Here the boss 4 allows for the inlet fluid to move within the chamber 8, thence into the annular outer chamber 38 downwardly and into the radially extending ports 13, 14, 15, and 16 (16 not being shown). In this modified form, instead of said ports converging at the center chamber 17 as shown and described in connection with Figs. 1 and 3, the central portion of the cage member 9 is provided with an upwardly extending hollow cylindrical seat portion designated 42. The latter portion has spaced therearound an annular chamber as indicated at 43 for the passage of the steam or condensate as the case may be, the upper limit thereof being defined by the plurality of annular seating surfaces at 44, 45, and 46 in the same plane, the annular groove 47 providing for the lands for the seats previously designated. Thus, in the operation of this modified form of the device, steam will move upwardly within the annular inlet passage 43 thereby to lift the closure member 24 from its seat to abut against the cage depending projecting boss 29. The fluid will then follow inwardly below the closure member in the direction indicated by the arrows downwardly into the trap discharge passage 40, into the chamber 33, and thence into the discharge or outlet pipe designated OP. It will be apparent that the operation of the trap is identical to that described in connection with the previous figures, gaining the benefit of a structure in which steam in the inner chamber is prevented from escaping and wherein the valve 24 remains closed until the condensate reaches a predetermined pressure within the inner chamber 25 at which the valve disc 24 will open.

It will be apparent that the new steam trap is of a compact construction made up of a small number of parts, only one of which is movable. The device may be readily assembled. The device will operate without adjustment at any fluid pressure consistent with the strength of the parts, and will discharge both air and condensate at any temperature below that of steam.

It will of course be apparent that while only a few preferred embodiments have been illustrated, the invention is capable of being used in a wide variety of structures. Therefore, the invention should be measured by the scope of the appended claims.

We claim:

1. In a steam trap, a casing therefor having inlet and outlet means, the said casing including an upper housing portion and a lower base portion connected thereto to form a central chamber therebetween, a cage member within said central chamber having a portion sealingly connected to said outlet means to prevent direct communication between said central chamber and said outlet means, a central port in said cage member and a pair of concentric upwardly facing annularly projecting seats therearound having seating surfaces in a common plane

defining the upper limits of the cage member, said seats defining an annular fluid passage therebetween, a cap member attached to said cage member and overlying said annularly projecting seats to provide an inner chamber therebetween, a plate-like closure member snugly fitted within and reciprocally movable within said cap member to predeterminately abuttingly engage said seating surfaces, said cage member having an inner projecting stop for limiting the movement of the said closure member in the central chamber in a direction away from the said seat, the said cap and cage members substantially filling the casing central chamber except for having an annular chamber formed around the side of the cage and cap members and a space across the top of the cap member adjoining the casing inlet, the cage member having substantially vertical passage means directly connecting the annular fluid passage with the casing outlet means, transversely extending passage means in the cage member communicating at one end thereof with the casing inlet through the said annular chamber formed around the side of the cage and cap members and the space extending

across the top of the cap member adjoining the casing inlet, the said transversely extending passage means communicating at the other end thereof with the central port of the cage member, the said cap member encircling the periphery of the plate-like closure member to guide the latter member in its reciprocal movement.

2. The subject matter of claim 1, the said substantially vertical passage means extending uninterruptedly for substantially the overall length of the cage member from said inner chamber defined by the annularly projecting seats of the cage member to the casing outlet means continuously in a plane substantially parallel to the central axis of the said casing outlet means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,216,622	Miller	Oct. 1, 1940
2,634,744	Wells	Apr. 14, 1953

FOREIGN PATENTS

1,116,221	France	Jan. 30, 1956

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,945,505 July 19, 1960

George E. Hansen et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, line 8, "cage" should read -- cap --.

Signed and sealed this 7th day of April 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents