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N. M. SMALL

1,952,780

HEAT EXCHANGER PROTECTING DEVICE

Filed Aug. 21, 1931

Fig. 1.

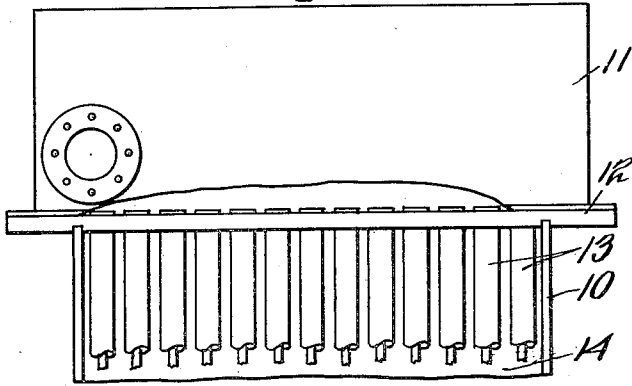


Fig. 2.

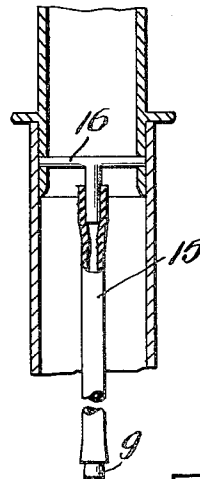


Fig. 3.

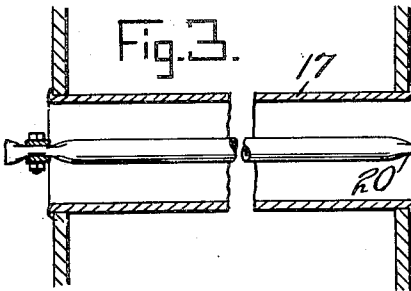


Fig. 4.

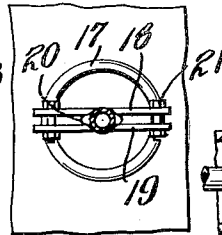


Fig. 5.

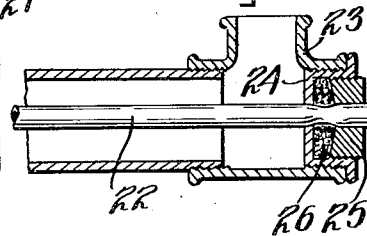
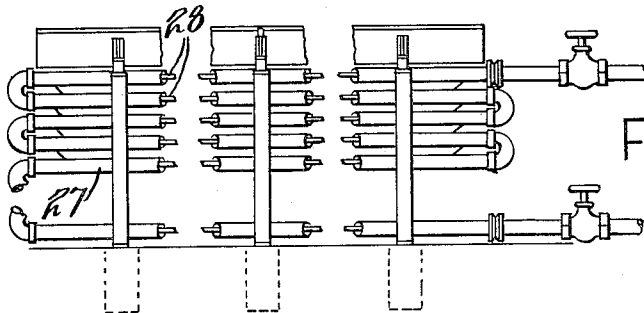
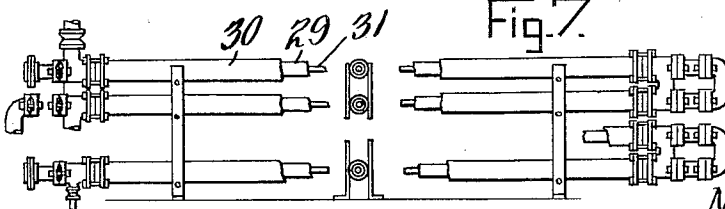


Fig. 6.

Fig. 7.



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HEAT EXCHANGER PROTECTING DEVICE

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Application August 21, 1931, Serial No. 558,567

4 Claims. (Cl. 62—1)

This invention relates to means for protecting pipes from bursting due to freezing of liquid within them and while it may be adapted for use in many different arts it is primarily designed with a view to its use in preventing tubes or pipes of heat exchangers from bursting due to accidental freezing of liquids within the pipes. The purposes of the invention are carried out by providing compressible tubes or rods within the pipe so that liquid within the pipe expanding during freezing will compress the tubes instead of bursting the pipes due to excessive pressure built up therein. The invention has been shown in its various forms as a rubber or similar flexible pipe or hose secured within the pipe in which liquid may freeze. Any kind of flexible tube or compressible tube or pipe or rod is deemed to be within the purview of my invention.

Referring to the accompanying drawing, which is made a part of my invention and on which similar reference characters indicate similar parts,

Figure 1 is a view in elevation of a portion of one type of heat exchanger to which the invention may be applied,

Figure 2, an enlarged vertical section of a tube of the heat exchanger showing my invention applied therein,

Figure 3, a sectional view of a longitudinal heat exchange tube with my invention applied thereto,

Figure 4, an end view looking from the right at Figure 3 showing means for holding the tubes in the pipes,

Figure 5, shows a horizontal pipe with the tube secured in one end, and

Figures 6 and 7 are views in elevation of heat exchanger systems having my invention incorporated therein.

In Figure 1 of the drawing numeral 10 indicates a shell of a heat exchanger having a head chamber 11 and a tube plate 12 in which plate a number of tubes 13 are held. The space 14 about these tubes is filled with a refrigerant fluid, the tubes 13 themselves containing a liquid which may sometimes freeze in case the pumps which circulate it become stalled or in case the temperature of the refrigerant in the chamber 14 drops too low. To prevent this the flexible tubes or hose 15 are suspended from T's 16 mounted in the tubes 13. The hose 15 may have the lower ends closed by a plug 9. In a heat exchanger such as that shown in Figure 1 where the rubber tubes 15 depend vertically it is unnecessary to support the lower ends against the sides of the tube 13. They may therefore hang freely, the plugs 9 being

weighted sufficiently to keep them in substantially a vertical position. If the fluid which is passing through the tubes 13 freezes it will compress the flexible tube 15 instead of expanding and bursting the tubes 13.

As shown in Figures 3 and 4 the flexible tubes lie horizontally and are supported substantially axially and centrally of the tubes 17 by means of bars 18 and 19 which clamp the ends of the hose as shown at 20. The normal distance between the respective clamps is slightly less than the length of the tube, therefore the hose is stretched slightly in order to mount it in the tube with the clamps frictionally engaging the ends of the tube and the hose suspended substantially centrally of the tube. The ends of the bars 18 and 19 are held together by bolts or similar tensioning devices 21. In Figure 5 the hose 22 is shown mounted in a tube having a T connection 23. The hose extends out through the end of the T and is held in position by means of a bonnet 24 and a nut 25 which is secured within the bonnet may compress packing material 26 around the hose. The hose may be somewhat compressed as shown and is sealed to prevent the leakage of water about the end of the tube. Bursting of one of these tubes necessitates the replacing of them at considerable loss of time and consequent expense. Not only may the pipes freeze up due to a stop in the circulation but the operator may carelessly allow the refrigerant temperature to drop too low and thus freeze up the pipe so as to stop circulation and the stopping of the circulation in turn will cause all the pipes to freeze solid and burst.

In the form shown in Figure 6 the liquid to be cooled is carried in pipes 27 and cold brine or other refrigerant trickles down over these pipes. The resilient tubes 28 are positioned within pipes 27.

In Figure 7 the inner pipe 29 carries liquid to be cooled while the brine, ammonia or other suitable refrigerant is in the pipe 30 in contact with the outside of pipe 29. If the refrigerating fluid is below the freezing point of the liquid to be cooled and circulation of the liquid to be cooled should be suddenly stopped this liquid might freeze in the pipes 29. Tubes 31 are positioned within the pipes 29 which may collapse due to expansion of freezing fluid in the pipes 29 and thus prevent bursting of these pipes.

It will be seen therefore that my invention provides a safeguard against the bursting of any pipe through which a fluid which is likely to freeze solid may flow and as above stated while

it is shown and described primarily with a view to its use in a heat exchanger it nevertheless may be employed to protect any pipe carrying a liquid which is subject to freezing. Moreover while
5 the inner tubes may be made of rubber they do not necessarily need to be made in this manner, nor is it necessary that they be tubular. Any compressible rod, pipe or tube which will relieve the pressure due to expanding ice in the
10 tubes is deemed to come within the scope of my invention.

It will be obvious to those skilled in the art that various changes may be made in my device without departing from the spirit of the invention and therefore I do not limit myself to what is
15 shown in the drawing and described in the specification, but only as indicated by the appended claims.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a heat exchanger comprising heads connected by vertical open-ended tubes which tubes are adapted to have a refrigerant fluid circulated
25 about them, a compressible core resiliently mounted within the tube, clamps on the ends of said core adapted to impinge against the ends of the tube, the said core permitting expansion of the fluid within the tube to prevent bursting of
30 the tubes, substantially as set forth.

2. In a heat exchanger comprising pipes sur-

rounded by a shell, the pipes carrying a liquid to be cooled and the shell carrying a refrigerant for cooling the liquid and a compressible member having clamps on its ends positioned against
80 the ends of the pipes, said member absorbing expansion of the liquid to prevent bursting of the pipes due to freezing of the liquid, substantially as set forth.

3. In a device of the kind described a compressible member frictionally secured within a pipe
85 by means of attached clamps engaging the ends of said pipe through which a liquid is passing, which liquid may tend to freeze, the compressible member absorbing expansion of the liquid as it freezes to prevent bursting of the pipes, substantially as set forth. 90

4. A heat exchanger comprising a series of pipes, each of said pipes having a tube extending longitudinally thereof, said tubes being
95 adapted to carry a liquid to be cooled, the surrounding pipes being adapted to carry a refrigerating fluid, the said tubes having resilient tubes mounted therein, said resilient tubes being adapted to collapse under the expansion of liquid
100 freezing within the tubes thereby preventing bursting of the pipes, said resilient tubes having their ends fastened in the ends of said tubes to center the resilient tubes with respect to the tubes in which they are mounted, substantially as set forth. 105

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