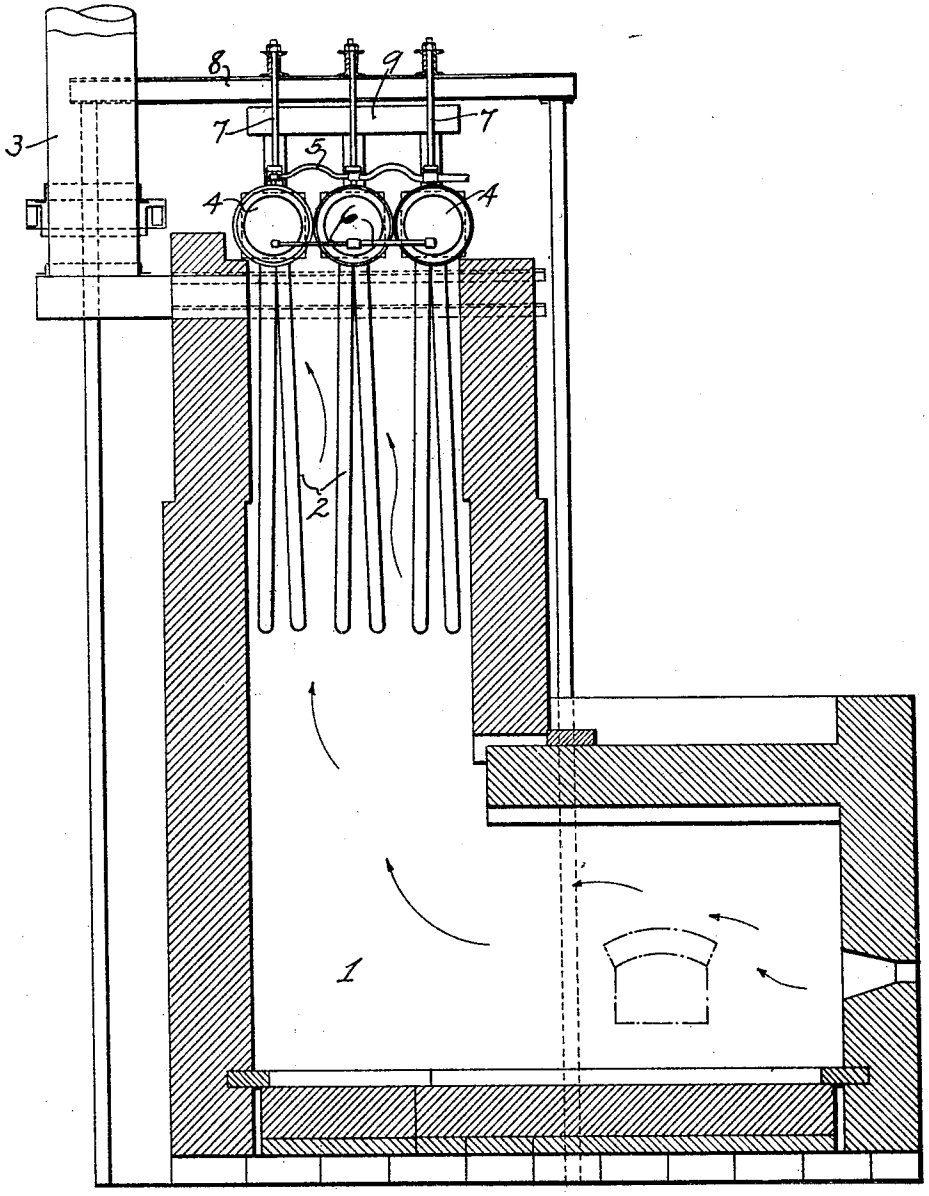
May 23, 1933. J. PRENTICE 1,911,037

MERCURY BOILER WITH TUBES

Filed March 25, 1929 2 Sheets-Sheet 1

Fig. 1.



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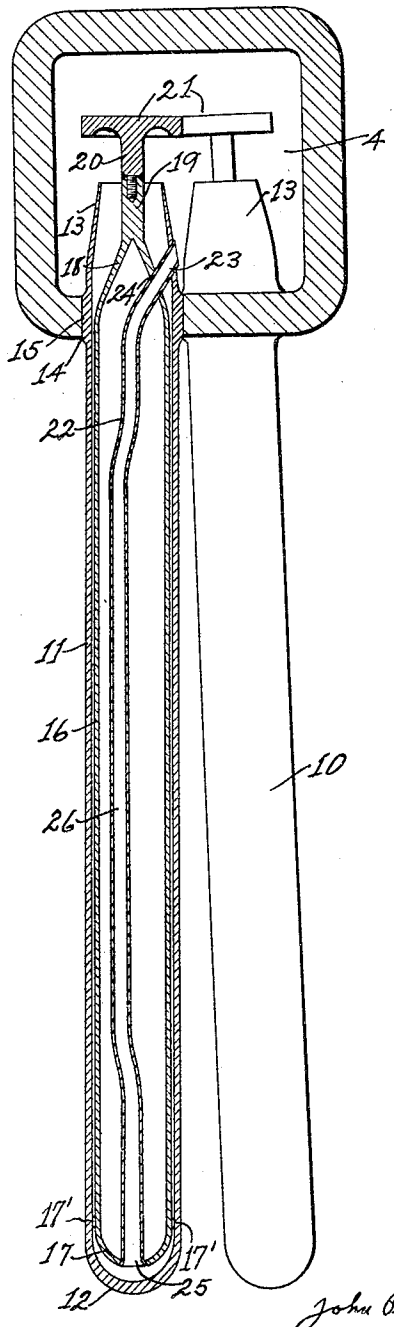
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Fig. 2.



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UNITED STATES PATENT OFFICE

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MERCURY BOILER WITH TUBES

Application filed March 25, 1929. Serial No. 349,655.

This invention relates to a mercury boiler comprising headers and tubes, each tube being composed of several elements which can be connected to and removed from the headers as a unit.

The invention will be understood from the description in connection with the accompanying drawings in which Fig. 1 is a vertical section through a furnace, showing the boiler in place; and Fig. 2 is a vertical section through an illustrative embodiment of one of the headers and tubes.

In the drawings reference character 1 indicates a furnace in the upper part of which the tubes are suspended so as to be heated by the products of combustion flowing to the stack (not shown).

The headers 4 of the mercury boiler, the ends of which are shown in Fig. 1 of circular cross section, are installed side by side and are cross-connected by a pipe 5 connected to the vapor spaces and a pipe 6 connected to the liquid spaces of the headers. The headers may be supported by rods 7 attached to the upper sides of the headers and suspended from supports 8. Pipes may lead from the vapor spaces of the headers 4 to a header 9 or other place where mercury vapors are utilized.

In Fig. 2 one of the headers 4 of square cross section is shown with generating tubes 10 extending downwardly therefrom. Each generating element or tube 10 comprises an outer tube 11 having a closed hemispherically shaped lower end 12. The upper end of the tube 11 is open and of frusto conical shape, as shown at 13. The tube 11 is upset or its wall is thickened a short distance from its upper end, as indicated at 14 and the thickened portion is threaded so that the tube can be screwed into a threaded opening 15 in the lower wall of the header 4 with the upper end of the tube projecting some distance into the header.

An inner or displacement tube 16 is located in side of the tube 11 and spaced therefrom so as to provide an annular space between the outside of the tube 16 and the inside of the tube 11. The lower end of the tube 16 is also made hemispherical as shown at 17, and teats or lugs or spacers 17′ may be provided to maintain the inner and outer tubes in proper spaced relationship. The upper end of the tube 16 is closed and terminates in a solid extension 19 that may be provided with a threaded hole in its end into which the threaded end of the stem 20 of an umbrella type of separator 21 may be screwed.

A liquid feed tube 22 extends through the side walls of the portions of the tubes 11 and 16 that are inside of the header 4, as indicated at 23 and 24, and tight joints are provided where the tube 22 extends through the walls of both tubes 11 and 16. The lower end of the tube 22 extends through the hemispherically shaped lower end 17 of the tube 16 and a tight joint is provided as shown at 25. An intermediate portion 26 of the liquid feed tube 22 is offset or bent to permit relative expansion and contraction between the tube 22 and tubes 16 and 11 without overstressing or causing leakage at the tight joints 23, 24 and 25. The joining of tube 22 to tubes 11 and 16 at 23 and 24 holds tube 16 in place inside tube 11 and resists any flotation tendency of the mercury to push tube 16 upward.

The inner or displacement tube 16 is preferably made by taking a piece of tubing, swedging it closed at the bottom to a hemispherical shape, swedging the top down to a conical shape with the cylindrical extension 19 which can be forged or welded into a solid piece, thus hermetically sealing the ends of the tube 16. A hole is drilled in the bottom portion 17 of the tube 16 and in the side of the conical top portion to receive the liquid supply tube 22. The top end of the extension 19 is provided with an internally threaded hole. The liquid supply tube 22 of appropriate length, with a bend or expansion loop intermediate its ends with its top bent to extend through the hole in the conical portion of the tube 16, is inserted through the bottom hole 25 until its bent over end projects through the hole 24. The tube 22 is then welded in place in the holes 24 and 25 to make tight joints.

The outer tube 11 is made from a piece of tubing by closing the lower end, as indicated at 12, upsetting the portion 14 and providing

it with threads. A hole 23 is provided through the tube 11 beyond the upset portion 14 to receive the end of the supply tube 22. The assembled inner tube 16 and supply tube 22 are passed into the outer tube 11 through the open end until the extending end of the tube 22 is in line with the hole 23. The portion of the tube 11 beyond the upset portion 14 is then contracted to form the top conical portion, whereupon the end of the supply tube 22 is made to protrude through the hole 23. The joint between the extended end of the tube 22 and the tube 11 is then welded tight. The umbrella separator 21 is then screwed into place in the extension 19.

The assembly of tubes and umbrella separator can be screwed into place in the header from which it may be removed as a unit. When in place, the extending portion 13 prevents the mercury which collects in the bottom of the header 4 from entering the space between the tubes 11 and 16. The mercury enters the vaporizing tube through the liquid feed tube 22 and passes to the lower end of the space between the tubes 11 and 16 and the vapors generated rise in this annular space. The rising mixture of vapor and mercury impinging against the curved surfaces of the separator 21 causes the liquid mercury to become separated from the vapor and to collect in the bottom of the header 4, while the vapor collects in the upper portion and passes out through a pipe or pipes connected to the vapor space. In this way the feeding of mercury to the vapor generating tubes does not interfere with the escape of mercury vapor from these tubes, and at the same time a thin layer or sheet of mercury is in contact with highly heated vapor generating surfaces. The top extensions 13, of the tubes 11 projecting through the liquid mercury in the bottom of the header act as displacers to reduce the volume of mercury in the system, and it is understood that other displacer members may be inserted between tubes in the header space and between header walls and tubes.

I claim:

1. A vapor generating element for a boiler, comprising an inner and an outer tube, and a feed tube for the space between said tubes, one end of said feed tube being connected to one end of said inner tube and the other end extending through the sides of said inner and outer tubes and secured thereto.

2. A vapor generating element for a boiler, comprising an inner and an outer tube, a feed tube for the space between said tubes and connected to them, one end of said outer tube being open and the corresponding end of said inner tube being closed, and a separator attached to the closed end of said inner tube.

3. A vapor generating element for a boiler, comprising an inner and an outer tube, said inner tube being sealed at both ends and spaced from the outer tube, and a feed tube extending through both tubes at approximately adjacent points and through said inner tube at another point communicating with the space between the inner and outer tubes.

4. A vapor generating element for a boiler, comprising inner and outer tubes closed at adjacent ends, and a feed tube entering through the wall of both tubes and extending longitudinally of the inner tube through the lower portion thereof to provide for admitting liquid between the tubes, the outlet of said feed tube being sealed with respect to said inner tube.

5. In a vapor generator, a header forming a liquid and vapor chamber, and vapor generating elements entered into the lower portion thereof, each comprising outer and inner spaced tubes, the inner tubes providing a closed chamber, a feed tube extending through the upper and lower ends of said chamber and intermediately formed to allow for expansion and contraction, said feed tube having an extension projecting through the side wall of the outer tube and into the liquid space of said header.

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