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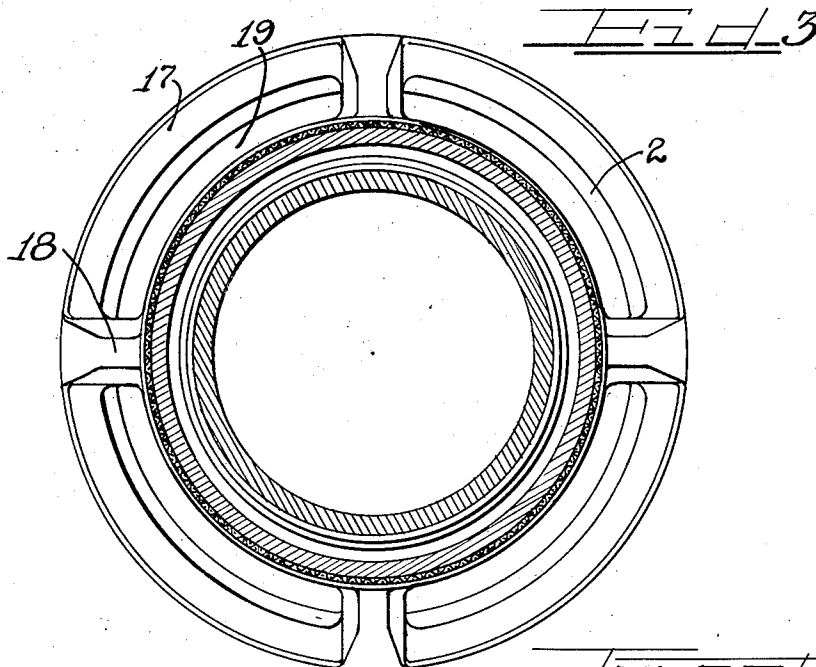
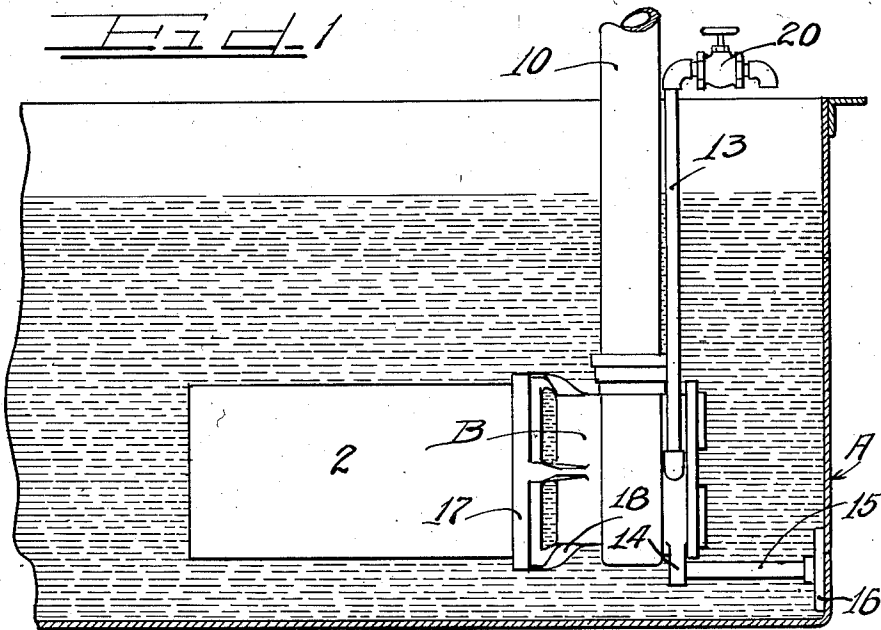
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2,055,211

WATER HEATER

Filed May 13, 1935

2 Sheets-Sheet 1



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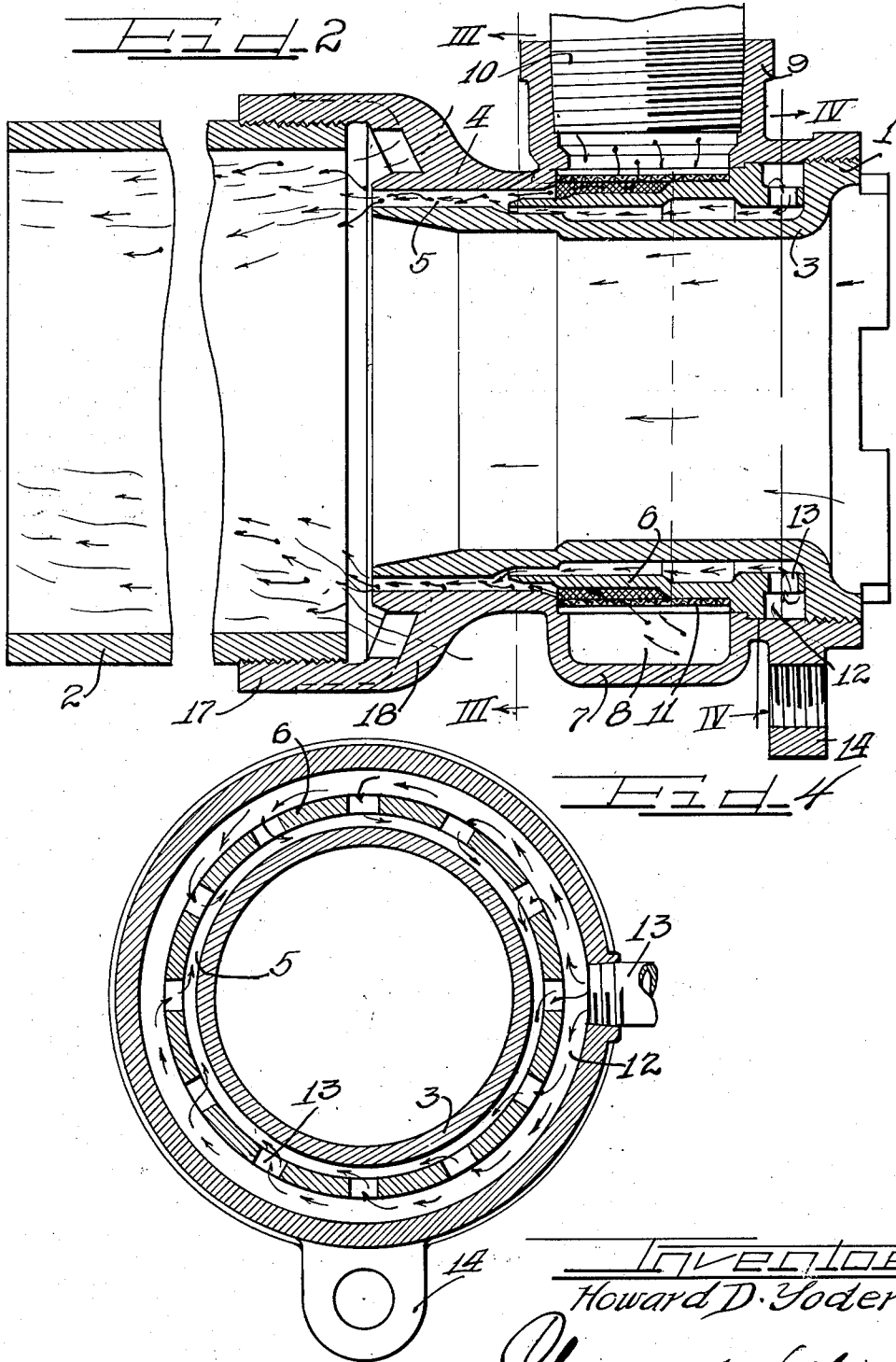
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WATER HEATER

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6 Claims. (Cl. 261—77)

The present invention relates to a water heater or steam condenser, and also to a method of condensing steam and heating water, of the type wherein steam is directed into the water, or fluid to be heated.

The heater of the present invention is designed for direct mixing of steam with the liquid to be heated, utilizing heat interchange, thereby resulting in the maintenance of the highest efficiency throughout the pressure and temperature range, and has been developed to provide a liquid heater operating quietly or noiselessly at all temperatures up to boiling, with steam pressures ranging from three pounds to 140 pounds approximately.

The heater or steam condenser of the present invention is submerged in the liquid to be heated and the steam is discharged into the liquid for circulating the liquid within the tank in which it is contained.

An object of the present invention is to provide a water heater or steam condenser which operates quietly at all temperatures up to boiling.

Another object of the present invention is to provide a novel apparatus for direct mixing of water and steam whereby the highest efficiency may be obtained, and whereby the operation of the apparatus will be noiseless.

A further object of the present invention is to provide a novel method of directly mixing steam with liquid to be heated to eliminate the noise of condensation action.

A still further object of the present invention is to provide a liquid heater or steam condenser wherein the steam is formed into a thin sheet prior to its discharge into the liquid to be heated.

Another and still further object of the present invention is to provide a water heater or steam condenser wherein steam is formed into a thin sheet prior to its discharge into the water and wherein free air is admitted to the steam prior to its discharge into the water for eliminating noise of condensation action.

The invention has for an additional object the provision of a novel method of condensing steam.

A yet further object of the present invention is to provide a novel method of heating water or other liquid.

The invention also contemplates, as an object, a water heater of the submerged type wherein direct mixing of the steam and water is effected, and heat interchange accelerated by formation

of the steam as a thin sheet prior to its discharge into the water.

Generally speaking, the apparatus of the present invention contemplates a tubular structure having an annulus opening at one end of the structure and through which structure water is passed by the force of the steam discharge from the annulus.

The invention also contemplates the supply of free air to the steam in the annulus prior to its discharge therefrom for the purpose of cushioning the noise of condensation action.

The invention also contemplates the provision of an apparatus whereby the steam may be discharged in the form of a thin sheet, which is cylindrical and which enters between two columns of water for accelerating condensation and heat interchange.

The above and further objects of the present invention will be apparent from the following description, accompanying drawings, and appended claims.

The accompanying drawings embody an apparatus constructed in accordance with the principles of the present invention, and illustrating one form of apparatus whereby the method of the present invention may be practiced, and the views thereof are as follows:

Figure 1 is a view in elevation of the illustrated form of the present apparatus, shown installed in a liquid tank, which tank is shown as a fragmental vertical section.

Figure 2 is a fragmental axial vertical section through the apparatus of the present invention.

Figure 3 is a vertical sectional view taken in the plane indicated by the broken line III—III of Figure 2, and

Figure 4 is a vertical sectional view taken substantially in the plane indicated by the line IV—IV of Figure 2.

The drawings will now be explained.

A tank A, of any known form, is supplied with a quantity of liquid, such as water, which is to be heated and supported within the tank A, so as to be submerged in the liquid therein, is the apparatus of the present invention designated generally as B in Fig. 1.

The apparatus, being submerged causes a direct mixing of steam with the liquid within the tank thereby resulting in the maintenance of the highest efficiency throughout the pressure and temperature ranges of the apparatus.

The heater B includes a section designated generally as 1 and a coaxially disposed pipe

or nipple 2 which is spaced from the section 1 for the purpose of allowing liquid entry into the pipe 2 between it and the section 1 as will be later explained.

5 The section 1 includes a throat 3, which is substantially cylindrical axially, and an enclosing casing 4 which is spaced, for its major part from the exterior of the portion forming the throat 3 to provide an annulus 5 in the section 10 1 which annulus opens at one end of the structure, the left end as shown in the drawings. The outer portion 4 is threaded to the throat 3 for assembly.

Positioned within the annulus 5 and spaced 15 from the outer surface of the throat 3 and the inner surface of the portion 4, is a substantially cylindrical partition member 6 which thus divides the annulus for a portion of its axial length into two chambers. The partition member 6 is 20 retained in position in the annulus by the assembly of the parts 3 and 4, as may be observed in Fig. 2.

Formed as a part of the portion or part 4 is a circumferential enlargement 7 forming a 25 steam header 8. As a part of the header, a threaded neck 9 is provided to receive in threaded engagement one end of a steam supply pipe 10. The construction is such that steam entering the section 1 through the supply pipe 10 30 passes circumferentially around the section within the header 8 and enters the annulus 5 for discharge. In order to strain foreign matter out of the incoming steam, a screen 11 is interposed between the header 8 and the annulus 5, as 35 may be observed in Fig. 2.

The construction of the parts is such that a circumferential header 12 is formed between the portions 3 and 4 of the section 1 and constitutes an air header. An air supply pipe 13 40 communicates with the header 12 through a suitably disposed opening in the outer portion 4 of the section 1, as may be observed in Figs. 1 and 4. The partition member 6 is, within the air header 12, provided with a plurality of equally spaced openings 13 through which air from the 45 header 12 may enter the annulus 5 and therein become mixed with the steam, prior to discharge from the section 1. Figure 4 indicates by arrows the manner of air flow through the section 1 50 from the air supply pipe 13 to the section. The section 1 is provided, in the present instance, with an attaching lug 14 by which it may be suitably supported within the tank A, as by means of a rod 15 secured to a base member 16 within 55 the tank and entered in the lug 14, for supporting the heater in the manner illustrated in Fig. 1.

The pipe or nipple 2 is coaxially arranged with respect to the throat 3 and is supported by the section 1 by means of a flange 17 in threaded engagement with the adjacent end of the pipe 2, and connected to the section 1 by circumferentially spaced integral ribs 18 in such manner 60 as to provide elongated openings 19 for liquid entry into the pipe 2 adjacent the section 1 of the apparatus, as may be observed in Figs. 1 and 3.

The air supply pipe 13 is provided with a suitable valve structure 20 for regulation of the amount of air supplied to the heater apparatus. 70 If desired, the steam supply 10 may be provided with a suitable steam regulating valve for like purpose.

In the operation of the water heater of the present invention, steam is discharged into the 75 pipe or nipple 2 in cylindrical form of thin

radial dimension. Prior to the discharge of the steam from the annulus 5, free air is admitted into the annulus and mixed with the steam so that the combined air and steam issuing from the annulus cushions the noise of the condensation action. 5

The issuance of the steam and air from the annulus 5 causes circulation of liquid through the throat 3 and the pipe 2, axially of the heater in a direction from right to left as viewed in 10 Figs. 1 and 2. The circulation of the liquid in the manner stated results in rapid condensation of the steam with a resultant rapid heating of the liquid within the tank A.

As the steam in cylindrical form issues from 15 the annulus 5, it surrounds and contains a column of water substantially that of the diameter of the throat 3 and is surrounded by another column of water which is drawn into the pipe or nipple 2 through the openings 19 by the movement 20 of the steam, between the steam and the interior of the pipe or nipple 2.

The provision of the multiple water stages just described provides a large quantity of water 25 which is in direct contact with the steam which feature is important as water at high temperatures becomes less effective in its condensing action. The formation of the steam as a thin sheet, with the induced air, and ample water, produces a superior heater which is unusually 30 quiet in operation.

The maximum degree of quietness is obtained by the utilization of free air admitted to the steam substantially adjacent the discharge of the steam nozzle or annulus. The valve 20, in the 35 air line, may be adjusted for controlling the volume of air supplied to the steam to secure maximum quietness.

As the temperature of the liquid within the tank A approaches the boiling point, the turbulence may be limited by throttling the steam supply. 40

The heater of the present invention has been devised for operation with steam pressures ranging from three pounds to 140 pounds pressure at the heater nozzle. 45

The parts of the heater may be constructed of such materials as not to be affected by the nature of the liquid utilized in the tank A. The parts are made preferably of bronze. 50

It will be observed that the principle used in the present invention is the direct mixing of steam with the liquid to be heated and that the steam entering the section 1 passes through the strainer, is evenly distributed in the annulus 5 55 and is discharged therefrom as a thin sheet in the form of a cylinder. The steam expands in the annulus and flows into the nipple or pipe 2 causing movement of the liquid through the heater, condensing the steam and forcing circulation of the volume of liquid to be heated. The admission of free air to the strained steam prior to its discharge into the nipple or pipe 2 cushions the noise of the condensation action, making the apparatus practically noiseless. 60 65

The method of the present invention contemplates the formation of the steam to be condensed into a thin sheet, mixing air with it prior to its discharge into the liquid for eliminating the noise of condensation, and utilizing the moving jet of steam for moving a column of liquid to effect condensation of the steam and heating of the liquid.

The fact that a column of liquid is within the throat 3 tends to cool the steam as it enters the 75

annulus 5 from the header 3. This precooling of the steam aids in rapid condensation and heat interchange as the steam enters the pipe or nipple 2.

5 The invention has been described herein more or less precisely as to details yet it is to be understood that the invention is not to be limited thereby, as changes may be made in the arrangement and proportion of parts, and equivalents
10 may be substituted, without departing from the spirit and scope of the invention.

The invention is claimed as follows:

1. A two-stage water heater and circulator for immersion in a body of liquid, said heater comprising a casing having means defining an elongated casing open at both ends and having means defining an inlet for cold water at one end, an outlet neck for the discharge of a mixture of steam and liquid at the other end, side ports in
15 the outlet neck for the admission of liquid to unite with the mixture of liquid and steam and to be discharged through the outlet, and conduit means in the casing defining a chamber for the admission of and the guided flow of steam to aspirate liquid through said inlet and through
20 said side ports for discharge through said outlet neck and to heat the moving liquid.

2. A two-stage heater and circulator for immersion in a body of liquid, said heater comprising an elongated casing having an inlet at one end and an outlet at the other end, and defining a longitudinally extending conduit for a main stream of liquid between the inlet and outlet ends of said casing and being provided with
30 side ports near its outlet end for the admission of an auxiliary stream of liquid to merge with and be discharged with the main stream, means in said casing defining a chamber for the guided flow of steam to unite with the main stream of liquid and aspirate liquid through the inlet of
40 said casing, said auxiliary stream of liquid being heated in said casing as it unites with the main stream of the mixture of steam and liquid.

3. A water heater and circulator for immersion in a body of water, said heater comprising a casing having an inlet at one end and an outlet at the other end, and defining a conduit for a stream of water passing from the inlet to the outlet end of said casing, said casing having an inner
50 member defining a throat and being positioned to

define a first chamber with the wall of said casing for the guided discharge of steam into the stream of water flowing through said casing, and a member interposed between said throat member and a wall of said casing to define a second
5 chamber opening into said first chamber for the admission of air into the steam before it leaves said first chamber, a steam inlet connection to said first chamber, and an air inlet connection to said second chamber.
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4. A water heater and circulator for immersion in a body of water, said heater comprising a casing having means defining a first elongated conduit for the flow of water therethrough, means defining a second conduit for the guided flow
15 of air and opening into said first conduit, an air inlet connection for said second conduit, means defining a third conduit for the guided flow of steam and opening into said second conduit so that a mixture of air and steam enters said first conduit, and a steam inlet connection for said
20 third conduit.

5. A two-stage water heater and circulator for immersion in a body of water, said heater comprising an elongated casing open at both ends and defining a conduit for a main stream of water passing therethrough from the inlet end to the outlet end of said casing, means defining a steam injector near the inlet end of said casing for the passage of steam into the main stream
25 to heat and move the main stream, said casing being provided with side inlet ports near the outlet end thereof for the admission of a side stream of water to unite with and be discharged with the mixture of steam and water in the main
30 stream.
35

6. A water heater and circulator comprising a casing defining a conduit for the passage of a stream of water therethrough, means in said casing to heat the stream of water, said means comprising a nozzle having means defining a single outlet passage opening into the conduit, and having means defining a first inlet passage provided with a connection for air and having means defining a second inlet passage provided with a connection for steam, said first and said second inlet passages being formed merging into each other within the nozzle, to discharge into the single outlet passage within the nozzle.
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