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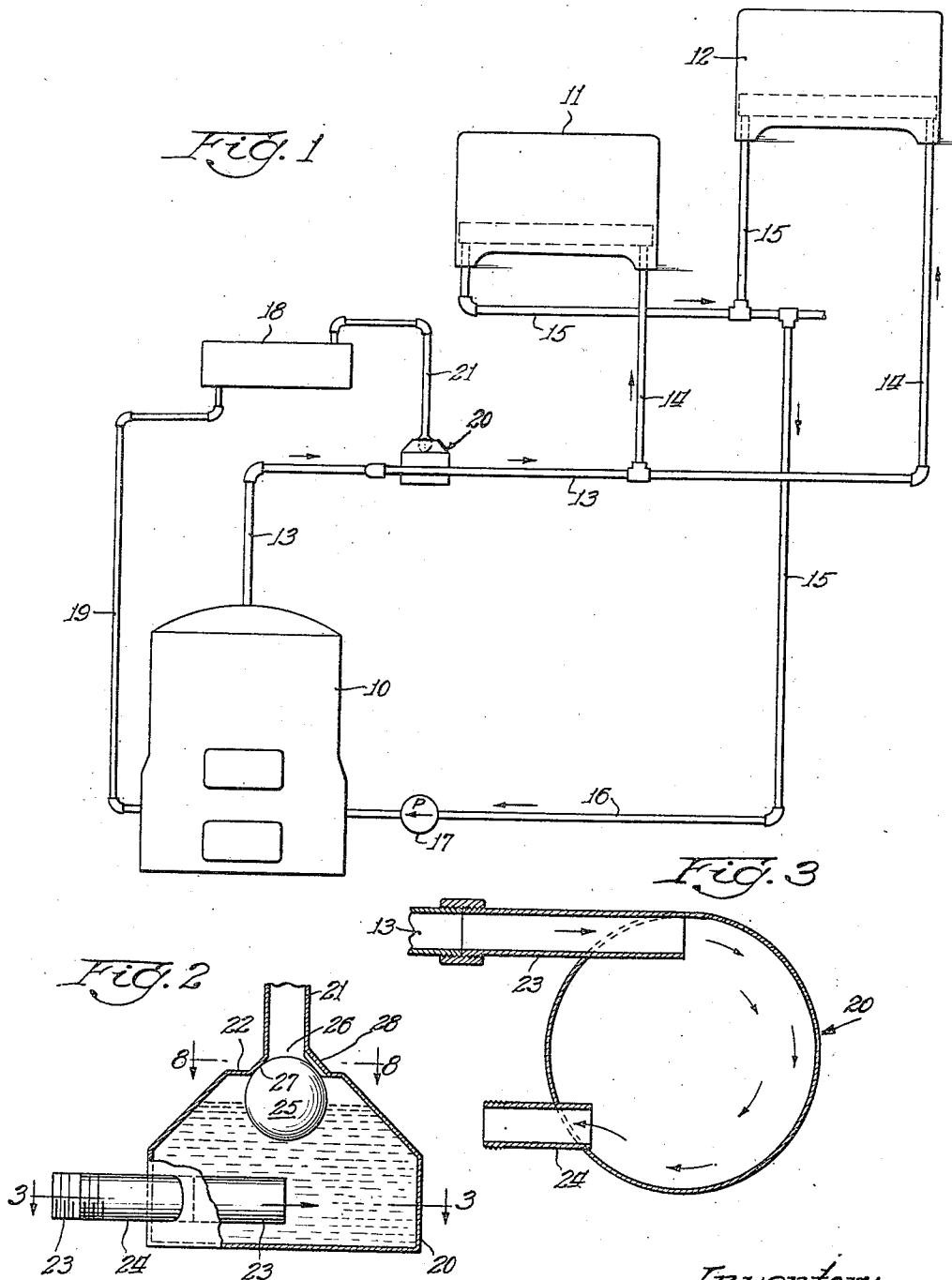
B. SPIETH

2,434,596

AIR ELIMINATOR

Filed April 15, 1944

2 Sheets-Sheet 1



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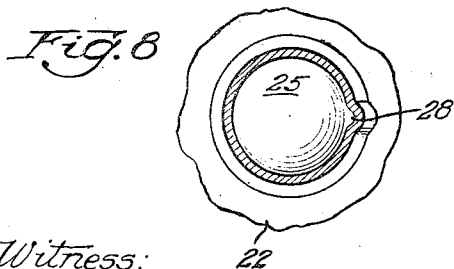
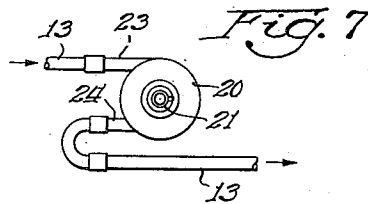
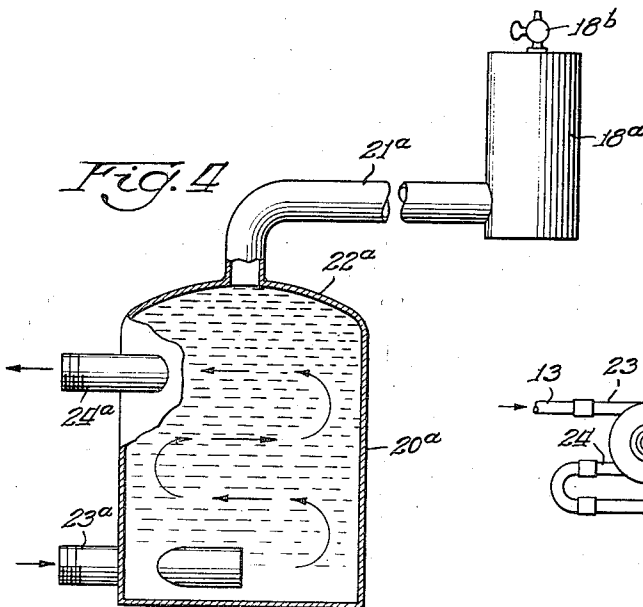
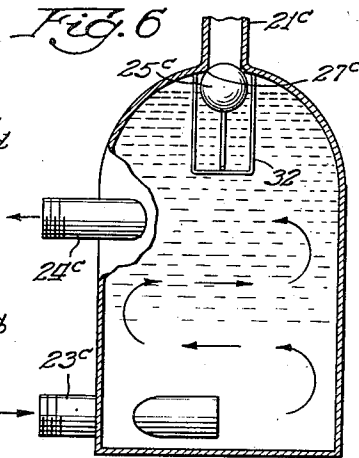
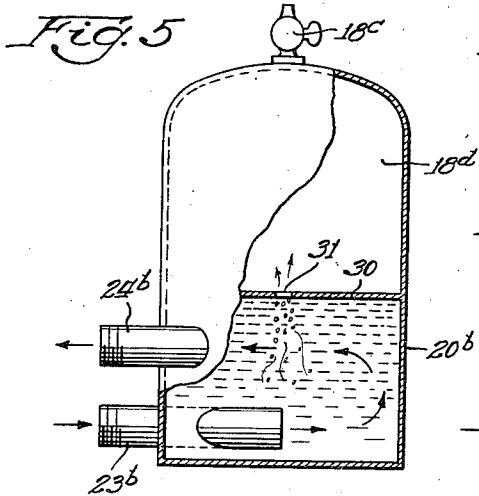
B. SPIETH

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AIR ELIMINATOR

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UNITED STATES PATENT OFFICE

2,434,596

AIR ELIMINATOR

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6 Claims. (Cl. 237-63)

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This invention relates to an apparatus for use in conjunction with heating and cooling systems, particularly hot water heating systems and cold water or brine cooling systems, for the purpose of eliminating air from the system. Air may enter the system entrained in the water, through a leaky pump packing, a leaky valve and other ways familiar to persons skilled in the art to which this invention pertains.

The elimination of air from hot water heating systems or cold water or brine cooling systems is necessary, since the air tends to collect and trap in the heat transfer elements of the system. When this occurs in a hot water heating system, the hot water or heating fluid is displaced by a corresponding volume and the effectiveness of the heating element is reduced in proportion. The problem of air elimination from cooling systems is well recognized.

Although the influence of trapped air in hot water systems is well known, no completely satisfactory method for eliminating air from the system has been developed prior to the present time. The most common expedient has been to provide an air pocket or chamber in each heating element and then to vent the air pocket or chamber at regular intervals by means of a small manually operated air-cock.

In accordance with the present invention, I provide an air separator which may be interposed in the piping arrangement of the system, whereby to automatically remove the air from the system before the air can be conducted to the individual heating elements by the risers.

With these and other objects and advantages in view, this invention consists in the several novel features of construction, arrangement and combination of parts hereinafter fully set forth and claimed.

The invention is clearly illustrated in the drawings accompanying this specification, in which:

Fig. 1 is a diagrammatic view in side elevation of a hot water system equipped with an air eliminator embodying one form of the present invention;

Fig. 2 is a view partly in side elevation and partly in central vertical section of the air eliminator illustrated in Fig. 1;

Fig. 3 is a horizontal section taken on the line 3-3 of Fig. 2;

Fig. 4 is a view partly in side elevation and partly in central vertical section of a slightly modified form of air separator connected to an air chamber which is illustrated in side elevation;

Fig. 5 is a view partly in side elevation and

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partly in central vertical section of another modified form of air separator;

Fig. 6 is a similar view of another modified form of air separator;

Fig. 7 is a plan of the air separator seen in Fig. 1 and adjacent portions of the hot water mains; and

Fig. 8 is a detail enlarged horizontal section taken on the line 8-8 of Fig. 2.

Referring to said drawings, and first to Figs. 1 to 3 inclusive and Figs. 7 and 8, which illustrate the invention in connection with a hot water heating system, the reference character 10 designates a conventional hot water boiler, and 11, 12 designate several heating elements such as radiators, convectors, unit heaters and the like, connected to the boiler by a hot water supply pipe or mains 13 and risers 14; and also connected with the boiler by return pipes 15 and the usual return mains 16. Where desirable, a water circulating pump 17 is interposed in the return mains to speed up the circulation of the water. In closed installations a compression tank 18 is employed which is connected to the boiler by piping 19. The construction and operation of the parts above described is common and well known and requires no further description so far as this specification is concerned.

The air separator, illustrated at 20, is preferably interposed in the hot water supply pipe so that only one air separator need be used for each system or for each zone; and also, if desired, the air can be returned from the air separator through to the compression tank. All or any portion of the air entrained fluid may be passed through the air eliminator.

In the form of the invention illustrated in Figs. 1 to 3 inclusive, the air separator comprises a hollow cylindrical body or receptacle formed with a dome shaped top 22 and having an inlet pipe 23 connected to the hot water mains 13 in any desirable manner, and entering the hollow of the body to one side of the center line thereof, as in a tangential direction, preferably adjacent the cylindrical wall thereof, whereby liquid entering the body through the inlet pipe is thrown into a whirl within the body as it follows along the cylindrical wall. Leading from the hollow body is an outlet pipe 24, which may or may not be located off center from the center line of the body, and said outlet pipe is also connected with the hot water mains 13. The limiting positions of the entrance of the outlet pipe to the body may be anywhere from a radial line to a line tangential to the cylindrical wall of the body and

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it may be located in the same horizontal plane as the inlet pipe, or in a plane above or below it. The ends of the body may be flat, concave or convex, or any combination thereof.

An air connection is made to one end of the body, preferably the upper end thereof, for the escape of air from the air separator. The air connection may be in the form of a pipe or conduit 21 connected at one of its ends to the top wall of the dome and connected at its other end to an air chamber into which the collected air is discharged. In Fig. 1 the air pipe 21 is shown as connected to and discharging air into the compression tank 18.

In order to prevent any considerable amount of water from being discharged through the air pipe 21, a float or ball valve 25 may be provided for partially closing the port 26 between the interior of the body and the air pipe 21. A valve seat 27 is formed around the port 26, against which the water may imperfectly seat the valve when the level of the water reaches a maximum high level in the body, thereby preventing any considerable amount of water escaping through the air pipe. In order to permit air to leak past the valve and escape through the air pipe, an air by-pass 28 is provided (see Fig. 8) which may comprise one or more grooves in the valve seat, which by-pass small quantities of air when the valve is seated.

In the event that a large slug of air enters the air separator body, the water will be displaced by the air which rises to the upper end of the dome and the valve will then drop, thereby opening the relatively large port to the air pipe for a quick clearance of the air. As the large volume of air escapes, the level of the water rises again and seats the valve, whereby it functions as an imperfectly seated valve, permitting quantities of air to leak past the valve. Ordinarily, the leak will be sufficient for the satisfactory performance of the apparatus.

At the same time, the valve acts as a restriction in the circuit 13, 20, 21, 18, 19 to prevent continuous circulation of relatively large volumes of water from the air separator 20 through the compression tank, where it would displace air-laden water and force this air-laden water through the piping 19 back to the boiler, where the entrained air would again have to be removed from the circulating water to prevent trouble by trapping in the heating units.

In operation, when water is circulated through the system, it enters the air separator in a tangential direction from the hot water mains, and the cylindrical wall of the separator body causes it to whirl around in the hollow body, permitting the entrained air to separate from the water and rise and escape through the air pipe 21. The whirling water discharges through the outlet pipe 24 and flows on through the hot water mains, the risers, and heating units and then returns through the return pipes and return mains to the boiler.

In the modified form of the invention illustrated in Fig. 4, the air separator 20a is generally cylindrical in form, having a dome shaped top 22a from which an air pipe 21a leads to an air tank 18a, from which air may be permitted to escape by opening a pet-cock 18b. However, the air pipe may lead to the compression tank, as in Fig. 1.

In this form of air separator, the water inlet pipe 23a enters the cylindrical wall of the separator body adjacent its bottom, and the outlet pipe 24a leads from the upper portion of the body.

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Preferably the inlet pipe enters the body in a generally tangential direction, whereby the cylindrical wall will cause the water to swirl and rise to the outlet pipe, permitting the freed air to rise and escape through the air pipe.

In the modified form illustrated in Fig. 5, an apertured plate 30 extends horizontally across the interior of the separator body 20b and joins with the side wall thereof. This plate separates the whirling portion of the water from an air chamber 18c thereabove. Air is forced to the center of the whirling water and escapes through the aperture 31 into the upper chamber and displaces water therein. As the air chamber becomes filled, it may be relieved of the air by the pet-cock 18c.

The water inlet pipe 23b and outlet pipe 24b may enter and leave the separator body in the same manner as has been described in connection with the other forms of the air separators.

The form of the invention illustrated in Fig. 6 is practically the same as that shown in Fig. 4, except that a float valve 26c is used which imperfectly seats on a valve seat 27c formed around the port between the interior of the separator body and the air pipe 21c. A wire cage 32 is shown around the valve and acts to prevent it from dropping too low, in case the water level drops below the outlet pipe; in which case it might be forced against the inlet end of the outlet pipe, thereby obstructing the outlet. The inlet pipe 23c and outlet pipe 24c may be located in the positions suggested with reference to Figs. 2 and 4.

From the above it is apparent that I have provided an air eliminator for hot water heating systems, which is simple, inexpensive, and can be installed in systems now in operation. Furthermore, that the entrained air is separated from the hot water before it reaches the heating elements and is discharged from the system.

While I have shown and described the invention as applied to a hot water system, it is to be understood that it is equally applicable to a cold water or brine cooling system.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of my invention; hence, I do not wish to be understood as limiting myself to the exact form, construction, arrangement and combination of parts herein shown and described, or uses mentioned.

What I claim as new and desire to secure by Letters Patent is:

1. In an air eliminator for hot water systems, an air separator having a cylindrical wall and a dome rising therefrom, an inlet pipe arranged tangentially to the cylindrical wall of the separator, an outlet pipe, the inlet port of which is offset from the center of the receptacle, said inlet and outlet pipes being interposed in the piping of a hot water system, an air discharge pipe leading from the dome of the receptacle, and a float valve for partially closing the port to the air discharge pipe, but adapted to uncover said port whenever the water lowers in the receptacle below a level at which it holds the float valve closed, whereby trapped air may escape freely, there being a restricted passage between the valve and port of the air discharge pipe, whereby air may continuously leak out past the valve.

2. An air eliminator for hot water systems comprising an air separator having a cylindrical wall and a dome rising therefrom, an inlet pipe ar-

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ranged tangentially to the cylindrical wall of the receptacle, an outlet pipe, the inlet port of which is offset from the center of the receptacle, said inlet and outlet pipe being interposed in the piping of a hot water system, an air discharge pipe leading from the dome of the receptacle, a float valve for partially closing the port to the air discharge pipe but adapted to uncover said port whenever the water lowers in the receptacle below a level at which it holds the float valve closed, whereby trapped air may escape freely, there being a restricted passage between the valve and port of the air discharge pipe, whereby air may continuously leak out past the valve, and a pump in the system for circulating the water through the receptacle.

3. In an air eliminator for hot water systems, an air separator having a cylindrical wall and a dome rising therefrom, an inlet pipe arranged tangentially to the cylindrical wall of the receptacle, an outlet pipe leading from the receptacle on a line offset with respect to the center of the receptacle, said inlet and outlet pipes being interposed in the piping of a hot water system, the dome of said receptacle having an air discharge port, an air discharge pipe leading from said air discharge port, and a float valve adapted to seat upon said port, said valve being responsive to the rise and fall of the level of the water in the receptacle.

4. An air eliminator for hot water systems comprising an air separator having a cylindrical wall and a dome rising therefrom, an inlet pipe arranged tangentially to the cylindrical wall of the receptacle, an outlet pipe leading from the receptacle on a line offset with respect to the center of the receptacle, said inlet and outlet pipes being interposed in the piping of a hot water system, the dome of said receptacle having an air discharge port, an air discharge pipe leading from said air discharge port, a compression tank into which the air discharge pipe discharges air, said air discharge port having an imperfect valve seat, and a float valve adapted to seat upon said valve seat, said valve being responsive to the rise and fall of the level of the water in the receptacle.

5. An air eliminator for hot water systems comprising an air separator having a cylindrical wall and a dome rising therefrom, an inlet pipe arranged tangentially to the cylindrical wall of the receptacle, an outlet pipe leading from the receptacle on a line offset with respect to the

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center of the receptacle, said inlet and outlet pipes being interposed in the piping of a hot water system, the dome of said receptacle having an air discharge port, an air discharge pipe leading from said air discharge port, a compression tank into which the air discharge pipe discharges air, said air discharge port having an imperfect valve seat, a float valve adapted to seat upon said valve seat, said valve being responsive to the rise and fall of the level of the liquid in the receptacle, and a pump in the system for circulating water through the air separator.

6. An air eliminator for hot water systems comprising an air separator having a cylindrical wall and a dome rising therefrom, an inlet pipe arranged tangentially to the cylindrical wall of the receptacle, an outlet pipe leading from the receptacle on a line offset with respect to the center of the receptacle, said outlet pipe communicating with the receptacle at a higher level than the level of the inlet pipe, said inlet and the outlet pipes being interposed in the piping of a hot water system, the dome of said receptacle having an air discharge port, an air discharge pipe leading from said air discharge port, a compression tank into which the air discharge pipe discharges air, said air discharge port having an imperfect valve seat, a float valve adapted to seat upon said valve seat, said valve being responsive to the rise and fall of the level of the water in the receptacle, and a pump in the system for circulating water through the air separator.

BENJAMIN SPIETH.

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