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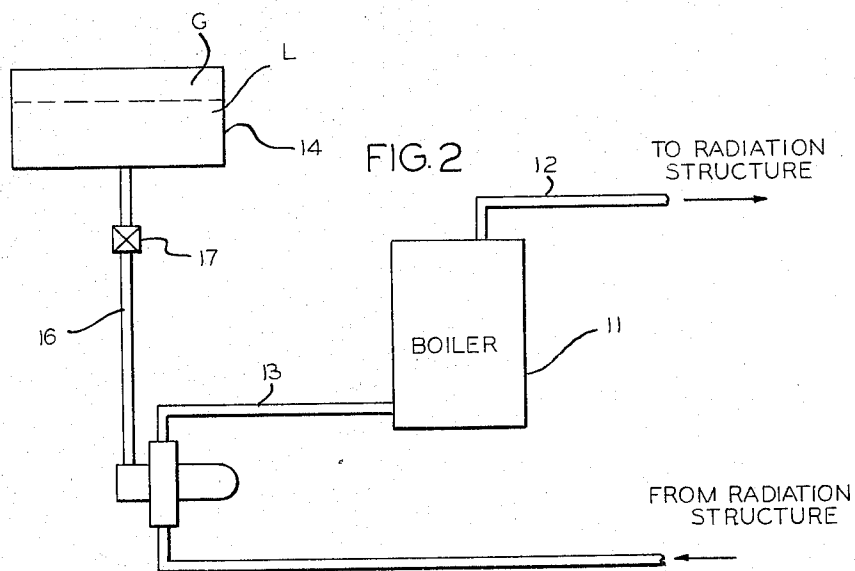
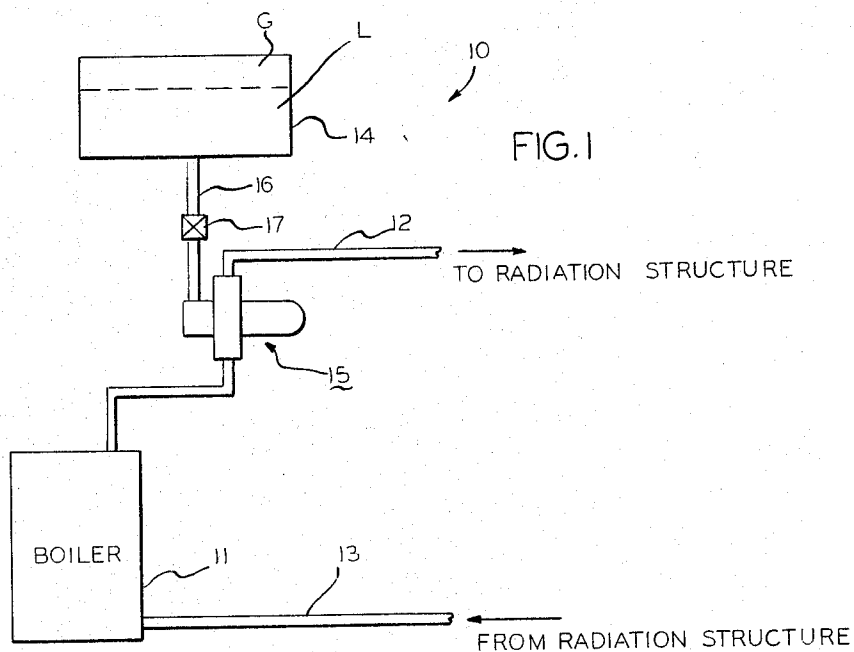
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GAS SEPARATION PUMP FOR LIQUID CIRCULATING SYSTEMS

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2 Sheets-Sheet 1



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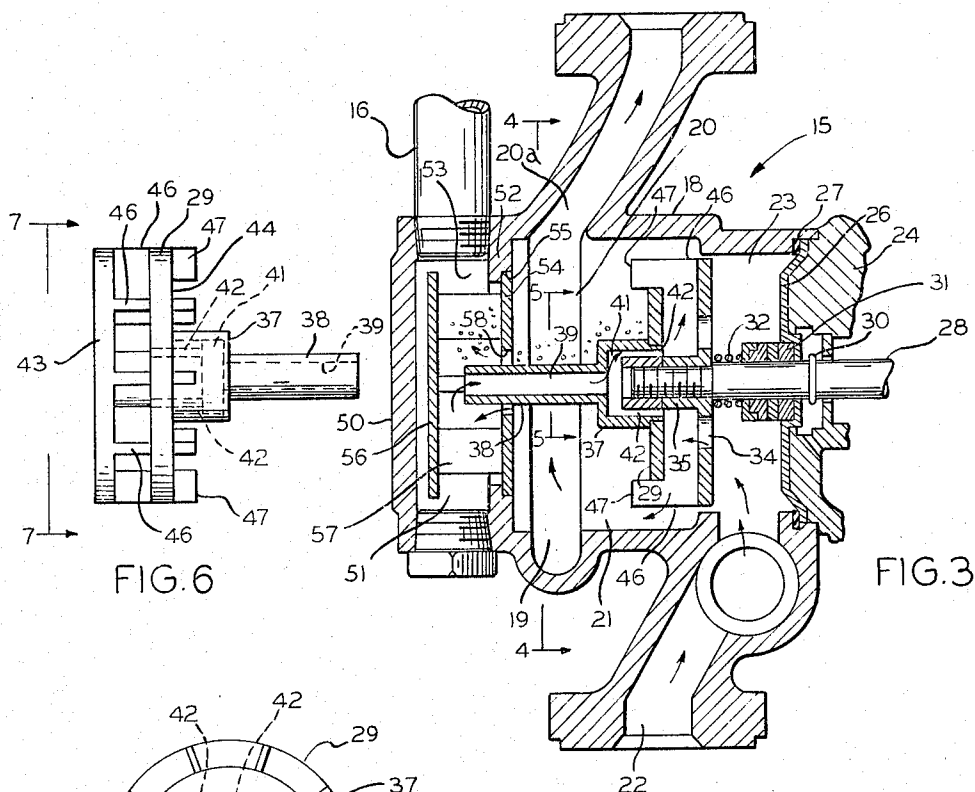


FIG. 6

FIG.3

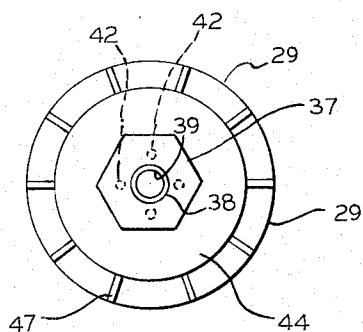


FIG.5

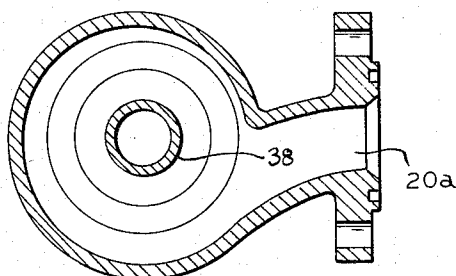


FIG. 4

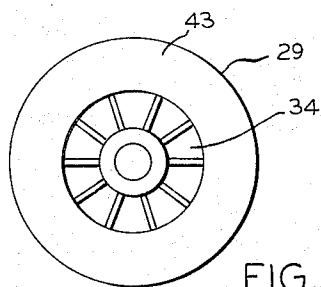


FIG. 7

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GAS SEPARATION PUMP FOR LIQUID CIRCULATING SYSTEMS

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3 Claims. (Cl. 55—203)

This invention relates generally to liquid circulating systems such as hot water heating and chilled water cooling systems of the forced circulating type, and has particular reference to improvements in system circulating pumps having the additional function of separating gases from the circulating liquid.

Heretofore, and particularly in closed pressurized hot water heating systems it has been necessary to provide structure for trapping gases released from the circulating water, these gases being trapped in a tank also providing a reservoir for the water as it expands and contracts. For example, in the systems of the prior art it has been necessary to provide suitable structure at the boiler or in other parts for separating out such released gases and directing them to the expansion tank where similar structure is provided to complete the separation of the gases from the water.

According to the present invention, it is unnecessary to provide structure as previously described, the separation being accomplished by a system circulating pump constructed in a unique fashion and connected into the system.

With the foregoing considerations in mind, it is a principal object of this invention to provide an improved liquid circulating system characterized by a circulating pump having structure therein for causing separation of entrained gases in the liquid, and for diverting the same to structure where the separation is completed.

Another object is to provide a pump for such system, such pump being characterized by structure for separating gases from the circulating liquid for causing the separated gases to be diverted into a separating chamber made as part of the system.

Still another object is to provide a circulating pump for a hot water heating or chilled water cooling system, said pump having structure for enabling entrained gases to be separated at the delivery side of the pump, and to be diverted into a chamber at the delivery side thereof prior to being further diverted to the conventional expansion tank of such system.

Other objects and important features of the invention will be apparent from a study of the following specification taken with the drawings, which together describe and illustrate a preferred embodiment of the invention, and what is now considered to be the best mode of practicing the principles thereof. Other embodiments may be suggested to those having the benefit of the teachings herein, and such other embodiments are intended to be reserved especially as they fall within the scope and spirit of the subjoined claims.

In the drawings:

FIG. 1 is a schematic view showing a hot water heating system having the improved gas separating pump according to the present invention embodied therein;

FIG. 2 is a view similar to FIG. 1, but showing an alternate way of connecting the gas separating pump into the system;

FIG. 3 is a vertical section taken through the gas separating pump of the systems of FIGS. 1 and 2;

FIG. 4 is a sectional view taken along the lines 4—4 of FIG. 3, looking in the direction of the arrows;

FIG. 5 is a front elevational view of the impeller em-

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ployed with the pump seen in FIG. 3, said view looking in the direction of the arrows 5—5 of FIG. 3;

FIG. 6 is a side elevational view of the impeller seen in FIG. 3; and

FIG. 7 is a back elevational view thereof looking in the direction of the arrows 7—7 of FIG. 6.

Referring now particularly to FIG. 1 of the drawings, the improvements in gas separating pumps for liquid circulating systems are best seen with respect to a liquid circulating system such as a hot water heating system referred to generally by the reference numeral 10, and including a boiler 11 having a supply main 12 connected to radiation structure, not shown, and a return main 13 from such radiation structure. In order to produce circulation in the supply and return mains 12 and 13, a pump indicated generally by the reference numeral 15 is connected in the supply main 12. One of the features of the present invention is the provision in the pump 15 of structure for separating gases, usually air, from the system liquid, such entrained gases being separated by the pump 15 and led from pump 15 to an expansion tank 14 by a line 16.

As seen in FIG. 1, the expansion tank 14 has a supply of water L therein, the quantity of which varies according to the expansion or contraction of the water in the system. A quantity of entrapped gas G is maintained under pressure above the level of the water L in the tank 14.

The line 16 may have a vent 17 therein, which is operative when all the liquid is returned from the tank 14 to the system, the valve 17 venting excess gas, and enabling the liquid to move to the tank 14 upon expansion thereof.

Referring now to FIG. 2 of the drawings, there is shown a system similar to that seen in FIG. 1, the difference being that the pump 15 is connected in the return line 13 to the boiler 11 instead of being connected to the supply main 12. Irrespective of the mode of connection of the pump 15, it is provided with structure whereby gas is separated from the circulated liquid to be directed to the tank 14, said tank having a quantity of gas G held under pressure above the level of the water L in the tank 14. Also, the line 16 connecting the pump 15 to the tank 14 is provided with valve means 17 for bleeding excess gas from the tank 14, so as to permit the tank 14 to store a quantity of the expanded water L.

Referring now to FIGS. 3 to 7 of the drawings, the pump 15 seen in FIG. 1 is of the centrifugal type and includes a pump body 18 which is formed integrally with a pump output chamber 19, see also FIG. 4, which pump output chamber 19 may be considered as being composed of a discharge chamber 20 and a dynamic separating chamber 21. Discharge chamber 20 is coextensive with a discharge passageway 20a which is formed in the pump body 18. The pump housing 18 has an entrance passageway 22 to a pump inlet chamber 23 which is closed by an end bell 24 secured to the pump body 18 in any convenient manner. A shaft seal supporting member 26 carries an annular gasket 27 at the periphery thereof to effect a seal between the pump body 18 and the end bell 24. A drive shaft 28 for a pump impeller 29 extends into the inlet chamber 23, and the seal supporting member 26 supports a pump seal 31 which has the proper biasing pressure maintained thereagainst by the bias of a spring 32 held between the entrance side of the impeller 29 and the seal 31, which is bottomed against the shaft seal supporting member 26. Shaft 28 carries a slinger collar 30 for water escaping past the seal 31.

Pump impeller 29 has a central hub 35 which is internally threaded to mate with threads on a threaded portion of the pump shaft 28. Hub 35 is integral with a portion 37 of hexagonal cross section for engagement with the usual wrench for assembly. Portion 37 has a hollow

tube-like extension 38 having a central bore 39 which is in communication with a counterbore 41 within hex portion 37. Small bores 42 connect the entrance eye 34 with the bore 39 for a purpose as will appear.

Referring now particularly to FIGS. 5 to 7 of the drawings, the impeller 29 has its entrance throat 34 formed in a back wall 43 thereof. The back wall 43 is spaced from a front wall 44 which is integral with the hex portion 37, and the back wall 43 and the front wall 44 are connected by pumping vanes 46 which extend radially from the central hub 35. As seen in FIG. 6, the front wall 44 of the impeller 29 has small pumping ribs 47 which extend radially inward from the peripheral portions of the front wall 44 to give an additional rotating or swirling effect to the pumped liquid.

Structure is provided for separating gas entrained in the pumped liquid, and directing the separated gases from the pump 15 and into the expansion tank 14 described with reference to FIGS. 1 and 2 of the drawings. The pump body 18 is accordingly formed with an integral housing 50 defining a fluid collecting and gas collecting static chamber 51 which is separated in part from the discharge chamber 20 and dynamic separating chamber 21 by a wall 52 having a circular opening 55 which is closed by a diffusing structure 53 consisting of spaced circular discs 54 and 56 joined by radial ribs 57. Disc 56 and ribs 57 extend within separation chamber, and disc 54 is press fitted into the circular opening 55.

Disc 54 also has a central opening 58 of larger diameter than the O.D. of extension 38, and the end of extension 38 extends into chamber 51 between the circular discs 54 and 56.

As the pump 15 operates, there is a pressure gradient which varies from a maximum at the peripheral portions of the dynamic separating chamber 21 in front of impeller 29 to a minimum at the center of rotation of the impeller 29 rotating within such chamber. The pumping action of the impeller thus compresses any entrained gases in the liquid stream, and such entrained gases will tend to move to the portions of the volute housing having the lower pressures therein.

In addition, there is a normal centripetal accelerating force acting upon the lighter gaseous elements forcing them toward the center of rotation of the rotating fluid in the dynamic separating chamber 21. Accordingly, the liquid pumped by the impeller 29 into the dynamic separation chamber 21 will at the same time pump the gases which are entrained in the liquid, and by reason of the fact that the entrained gases will tend to move to the center of rotation of the impeller 29, as compared to the movement of the liquid, and toward the portion of chamber 21 where the pressure is at a minimum, said gases will expand as the pressure thereon diminishes.

Accordingly, the mixture of water and entrained gases leaving the peripheral portions of the impeller 29 will move first to the dynamic separation chamber 21, where the separation of the gases from the liquid commences, the pumped gas detrained liquid leaving the pump housing by the passageway 20a. The gases, however, in their detraining process will move radially inward, and will move in the form of small bubbles along the outer surface of the extension 38, being expanded as the gases move radi-

ally inward. Those gases moving along the outer surface of extension 38 move into the gas collecting static chamber 51 by way of the opening 58 spaced around extension 38 and located in partition 54. The mixture of expanded gases and liquid collected in the gas collecting static chamber 51 can move therefrom by way of the line 16 which may be connected to the expansion tank 14.

The gas-free liquid in chamber 51 moves to a point of low pressure at the eye 34 of impeller 29, moving along the inside of extension 38 in bore 39, there being a pumping action induced therethrough by the pressure gradient between chamber 51 and the eye 34 of impeller 29.

It will be seen from the description foregoing, that there has been provided some new and useful improvements in gas separation pumps for liquid circulating systems. In the system disclosed, and the pump employed therewith, it is not necessary, for example, to have gas separating fittings at the boiler, such gas separation being achieved by the pump alone, and such gas separation being provided as an integral part of the pump.

Having thus described the invention in such full, clear, concise and exact terms as to enable one skilled in the art to make and use the same, and having set forth the best mode contemplated of carrying out the invention, the subject matter of the invention is particularly pointed out and distinctly claimed, it being understood that equivalents or modifications of, or substitutions for, parts of the above specifically described embodiment of the invention may be made without departing from the scope of the invention as set forth in what is claimed.

We claim:

1. In a pump operable to separate gases from a liquid circuit, a pump housing having a pump inlet, a dynamic separating chamber, a pump discharge chamber and a fluid collecting and gas collecting static chamber in said housing, a pump impeller rotating in said dynamic separating chamber, supply and discharge passages to said pump, a partition separating said pump discharge chamber from said fluid collecting and gas collecting chamber, and means defining a passageway between said fluid collecting and gas collecting chamber and said pump inlet comprising a hollow extension turning with said impeller and having an end thereof extending through said partition and into said fluid collecting and gas collecting static chamber, and means in said impeller connecting said hollow extension with the eye of said impeller through the same and at said pump inlet.

2. The invention as defined in claim 1 wherein said partition includes a diffuser extending within said fluid collecting and gas collecting chamber for gas entrained liquid moving into said chamber along said hollow extension.

3. The invention of claim 1 wherein said hollow extension is formed integrally with said impeller.

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R. BURKS, *Assistant Examiner*.