Jan. 22, 1963 E. B. TIDD 3,074,646

AIR SEPARATOR FITTING FOR HYDRONIC SYSTEM

Filed Nov. 21, 1960

Fig.2

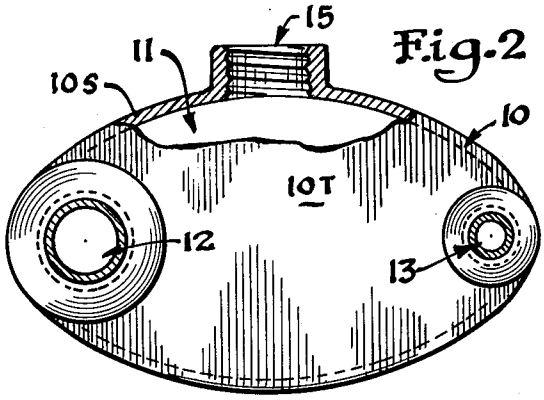


Fig.3

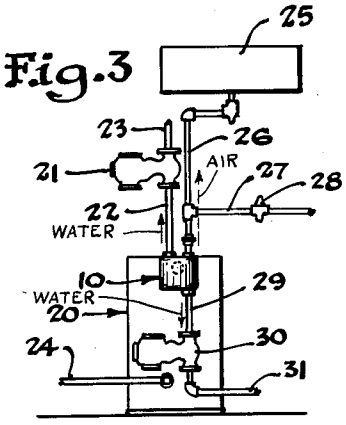


Fig.1

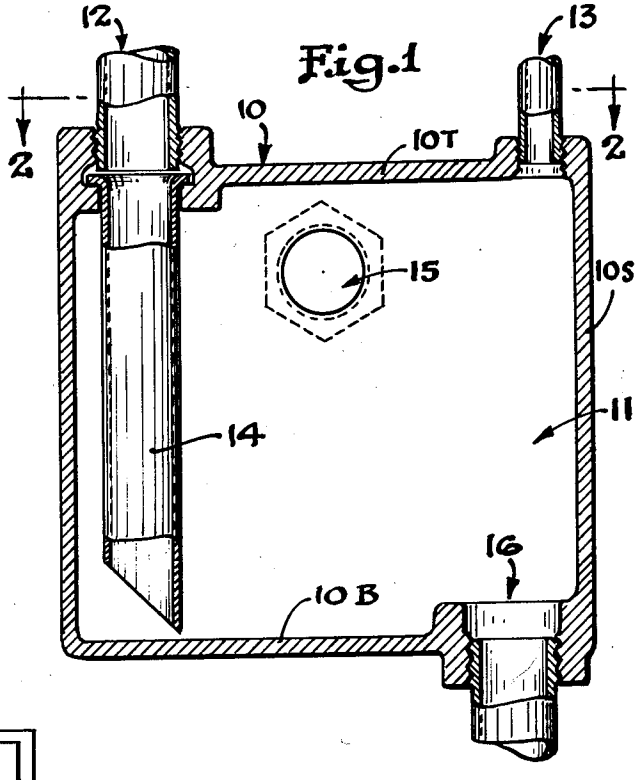
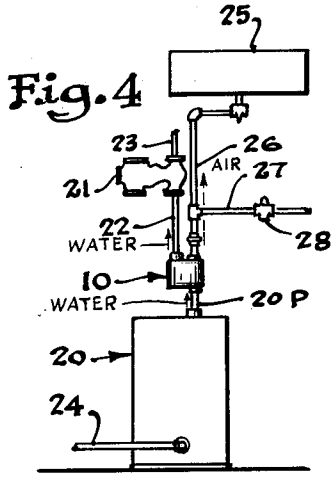


Fig.4



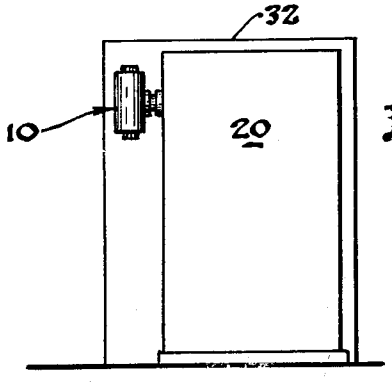


Fig.5

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AIR SEPARATOR FITTING FOR HYDRONIC SYSTEM

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This invention relates to a novel tank type fitting for use in separating entrained air from a fluid flowing in a hydronic heating or cooling system and more particularly it is concerned with a tank type fitting for universal installation in all types of heat exchangers and boilers. For this purpose it has inlet and outlet openings arranged to accommodate connection to either side outlet or top outlet arrangements.

It is well known that as a flowing stream of water is heated air bubbles become entrained in the stream and are carried with it through the piping and radiation gear of a hydronic system. These entrained air bubbles cause gurgling noises throughout the system and in many instances become lodged in part of the radiation gear so as to interfere with or actually prevent the desired circulation through the system. Various facilities are known for separating these entrained air bubbles from the main stream of the fluid circuit and collecting and depositing the air bubbles in a compression tank that is provided for the system. Prior to the present invention the facilities for side outlet and top outlet boiler arrangements have been distinctively different due to the varying fluid connection and air separation problems that are involved. Moreover, the present day facilities have been unduly expensive in many instances and have required special piping and other auxiliary fittings to facilitate their incorporation into a system and in other instances have been difficult to locate.

The provision of a tank type air separator fitting of compact low-cost construction and of substantially universal application to both side outlet and top outlet types of boilers is the principal object of this invention.

Another object of the invention is the provision of a fitting of the above type that may also be connected for either upfeed or downfeed radiation circuits or both in the case of multiple zone systems.

Other objects and advantages of this invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same:

FIG. 1 is a vertical sectional view through the novel fitting of this invention;

FIG. 2 is a top plan view of the fitting with parts broken away and sectioned to facilitate disclosure;

FIG. 3 is a fragmentary diagrammatic illustration of a hot water heating system having a side outlet type boiler that is shown equipped with the air separator fitting of this invention;

FIG. 4 is a fragmentary diagrammatic illustration of a hot water heating system having a top outlet type boiler that is shown equipped with the identical air separator fitting; and

FIG. 5 is a diagrammatic side elevational view illustrating the application of the fitting with a packaged type boiler installation.

Referring now to the drawings, a preferred form of air separator fitting as is illustrated in FIGS. 1 and 2, for purposes of disclosure, comprises a vertically elongated

hollow tank **10** having generally elliptically shaped surrounding side wall structures **10S** and correspondingly shaped top and bottom walls **10T** and **10B**, respectively, enclosing and defining an air separation chamber **11** of substantially greater flow capacity than the piping of the liquid flow circuit in which it is used.

A water outlet or port opening **12** and an air outlet opening **13** are provided in the top wall adjacent its opposite extremities with a dip tube **14** being fitted permanently within the liquid outlet and projecting to a point adjacent the bottom wall of the fitting. The dip tube thus provides a separate chamber located within the confines of the main separator chamber **11**, and the lower end of the dip tube is open and is cut on a bias to more efficiently receive the air free liquid pooling in the bottom of the chamber for discharge through the top outlet.

An opening or port **15** is provided adjacent the top and approximately centrally of one of the major side wall sections to provide an inlet port for convenient connection to a side outlet type boiler arrangement. As fluid enters the port **15** from a side inlet pipe connection, it jets across the separation chamber at high velocity to strike the opposite major side wall section and deflect for directing the fluid stream toward the bottom of the tank at a greatly reduced velocity. This reduction in velocity of the entering liquid permits the entrained air to separate from the moving stream, whereupon the air rises to the top of the tank for delivery through the air outlet port **13**. The air-free fluid collecting in the bottom of the tank is continuously drawn up the dip tube to exit through the liquid outlet port **12**.

The pertinent elements of a forced hot water heating system, as shown in FIG. 3, include a side outlet type boiler **20**, the fitting **10** of this invention mounted alongside the boiler and connected through a conduit, not shown, which leads into its side inlet port **15** to deliver a stream of water entrained with air bubbles, and a booster pump **21** having its suction side connected to the top outlet port **12** by a conduit **22** and having its discharge side connected through supply piping **23** leading to the radiation gear, with the piping **24** constituting a return line from the radiation gear and feeding into the bottom of the boiler. A conventional compression tank **25** is connected through a line of piping **26** to the air outlet port **13** for receiving and storing the air that is separated out by the fitting **10**. A cold water supply line **27** is shown tapped into the piping **26** and includes a control valve **28** for initially filling the system.

An opening or port **16** is provided through the bottom wall **10B** of the tank at an extremity thereof adjacent to the end of the top wall at which the air outlet port **13** is located and this port is bidirectional in that in some applications of the fitting air-free liquid emerges from the tank through this port and in other applications liquid entrained with air enters the tank for separation of the air in the tank.

When the fitting is used on a side outlet boiler arrangement such as is shown in FIG. 3, it may be required that the air-free liquid be withdrawn from the port **16** of the bottom wall rather than through the dip tube. An arrangement of this type is also shown in FIG. 3 wherein, for the moment, it may be assumed that the outlet port **12** of the dip tube is plugged up. A separate radiation system is shown having piping **29** connected to extend from the bottom port **16** of the fitting **10** to the suction side of a booster pump **30**, the discharge side of which

is connected to piping 31 that feeds radiation gear, not shown, with the return line 24 being assumed to be connected to the other side of this system.

FIG. 3 may also be viewed as an illustration of a multiple zone radiation system having one radiation circuit that includes the booster pump 21 being supplied with air free liquid from the dip tube 14 and outlet port 12 and having a separate radiation circuit that includes the booster pump 30 being supplied with air-free liquid through the bottom outlet port 16. An added advantage of the fitting of this invention is that it is conveniently adaptable to the connection arrangements for such a multiple zone system and moreover it maintains its efficiency even in such a multiple zone system. For such an application the air separating action in the tank 10 is substantially identical, since in both instances the air-free liquid is drawn out from a point closely adjacent the bottom of the tank. Alternatively, in a multiple zone radiation system liquid may be drawn simultaneously through both the dip tube 14 and the bottom port 16.

The other function of the bottom port 16 of the fitting 10 relates to the use of the fitting with top outlet type boiler arrangements such, for example, as is shown in FIG. 4 in which case the port 15 of the side wall is plugged up. The liquid entrained with air issues from the boiler 20 and enters through the bottom port 16 and air free liquid is drawn off through the dip tube. As the air entrained liquid enters at the bottom of the fitting and flows into the enlarged air separation chamber 11, its velocity of flow is reduced sufficiently to permit air bubbles to separate out from the liquid, whereupon the air bubbles again rise to the top of the separation chamber for delivery to the compression tank 25. This action is, in general, similar to that described previously, and a radiation system is shown in FIG. 4 wherein the fitting 10 is mounted directly above the boiler 20 that is illustrated as being of the top outlet type, with piping 20P connecting the liquid being discharged from the boiler into the bottom port of the fitting. Air-free liquid is drawn off through the piping 22 by a booster pump 21 which circulates the air-free liquid throughout the system. The compression tank 25 is connected through the piping 26 to the air outlet port 13 and a water supply line 27 having a valve 28 is again shown tapped into the piping 26.

The elliptical shape of the fitting not only contributes to increased efficiency of air separation but it provides space saving features of particular importance in the packaged type boiler installations that are becoming so popular. In FIG. 5 a side outlet type boiler 20 is shown connected to the fitting 10 and a metal jacket 32 encases these parts as well as a number of related components. Since the fitting is elliptical it may be mounted alongside the boiler with a minimum of lateral projection and therefore the enclosing jacket may be of correspondingly smaller size.

It should be understood that the description of the preferred form of the invention is for the purpose of complying with Section 112, Title 35 of the United States Code, and that the appended claims should be construed as broadly as the prior art will permit.

I claim:

1. A multiple purpose air separator for direct interposition in a forced circulation hydronic system of the type including a boiler of either the side outlet or top outlet type and also including a booster pump and piping connecting the boiler, the separator and the booster pump in series, and a compression tank connected for trapping air separated from liquid in said system, said separator comprising a tank having openings therein providing a vertically elongated chamber of substantially greater flow capacity than said openings in said tank, said tank having surrounding side wall structure provided with an inlet opening horizontally therethrough for supplying liquid entrained with air horizontally into said chamber to impinge upon an opposing portion of said side wall structure

and effect a velocity reduction of said liquid as it enters said tank to allow for separation of entrained air and a pooling of air free liquid within the lower end of said chamber, said tank having a top wall having a liquid outlet opening and an air outlet opening at opposite extremities thereof and having a dip tube in said liquid outlet opening and projecting to adjacent the lower end of said chamber for drawing air free liquid pooling within the lower end of said chamber, and said tank having a bottom wall having an opening to said chamber and optionally connectable either as a liquid outlet that communicates only with air free liquid pooling within the lower end of said chamber or as a liquid inlet opening into said chamber for supplying liquid entrained with air therein to effect a velocity reduction of said liquid as it enters said tank and thereby allow for separation of entrained air and a pooling of air free liquid within the lower end of said chamber for exit through said dip tube.

2. A multiple purpose air separator for direct interposition in a forced circulation hydronic system of the type including a boiler of either the side outlet or top outlet type and also including a booster pump and piping connecting the boiler, the separator and the booster pump in series, and a compression tank connected for trapping air separated from liquid in said system, said separator comprising a tank having openings therein providing a vertically elongated chamber of substantially greater flow capacity than said openings in said tank, said chamber having a generally elliptical horizontal cross-sectional configuration, said tank having surrounding side wall structure provided centrally within one major wall section thereof with an inlet opening horizontally therethrough for supplying liquid entrained with air horizontally into said chamber to impinge upon an opposing major wall section of said side wall structure and effect a velocity reduction of said liquid as it enters said tank to allow for separation of entrained air and a pooling of air free liquid within the lower end of said chamber, said tank having a top wall having a liquid outlet opening and an air outlet opening at opposite extremities thereof and having a dip tube in said liquid outlet opening and projecting to adjacent the lower end of said chamber for drawing air free liquid pooling within the lower end of said chamber, and said tank having a bottom wall having an opening to said chamber at the extremity thereof that underlies said air outlet opening and optionally connectable either as a liquid outlet that communicates only with air free liquid pooling within the lower end of said chamber or as a liquid inlet opening into said chamber for supplying liquid entrained with air thereinto to effect a velocity reduction of said liquid as it enters said tank and thereby allow for separation of entrained air and a pooling of air free liquid within the lower end of said chamber for exit through said dip tube.

3. In a forced circulation hydronic system, the combination including a boiler of either of the side outlet or top outlet type, a multiple purpose air separator, a booster pump, piping connecting the boiler, the separator and the booster pump in series, and a compression tank connected for trapping air separated from liquid in said system, said separator comprising a tank having openings therein providing a vertically elongated chamber of substantially greater flow capacity than said openings in said tank, said tank having surrounding side wall structure provided with an inlet opening horizontally therethrough for supplying liquid entrained with air horizontally into said chamber to impinge upon an opposing portion of said side wall structure and effect a velocity reduction of said liquid as it enters said tank to allow for separation of entrained air and a pooling of air free liquid within the lower end of said chamber, said tank havng a top wall having a liquid outlet opening and an air outlet opening at opposite extremities thereof and having a dip tube in said liquid outlet opening and projecting to adjacent the lower end of said chamber for drawing air free liquid

pooling within the lower end of said chamber, and said tank having a bottom wall having an opening to said chamber and optionally connectable either as a liquid outlet that communicates only with air free liquid pooling within the lower end of said chamber or as a liquid inlet opening into said chamber for supplying liquid entrained with air thereinto to effect a velocity reduction of said liquid as it enters said tank and thereby allow for separation of entrained air and a pooling of air free liquid within the lower end of said chamber for exit through said dip tube.

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