April 27, 1965 J. J. BRAUN 3,180,577

APPARATUS FOR EXPELLING AIR FROM CLOSED HOT WATER SYSTEMS

Filed Jan. 5, 1963

FIG-1

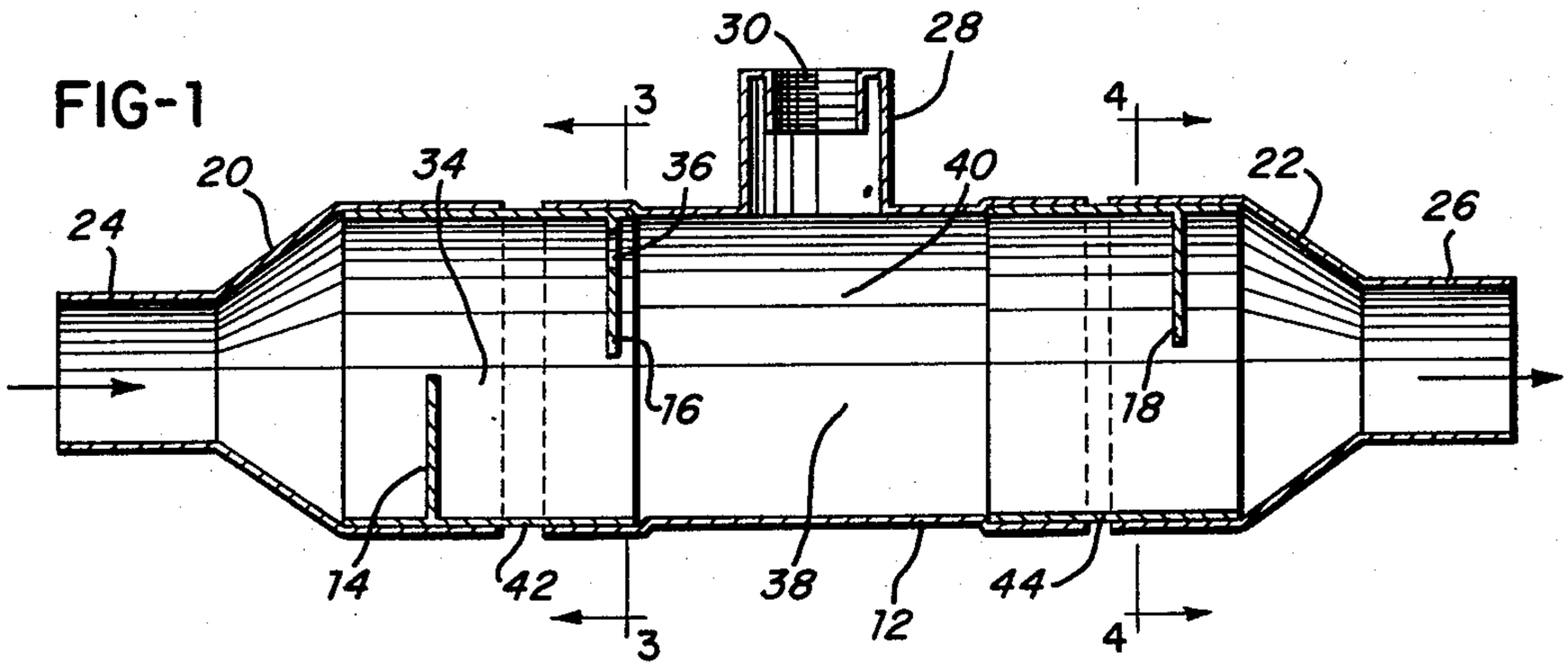


FIG-2

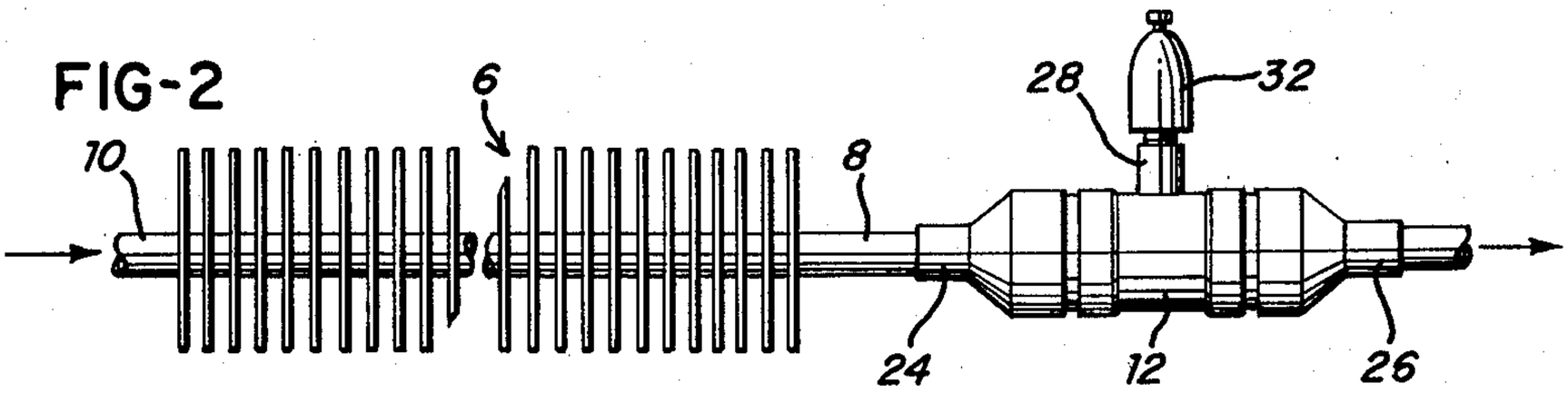


FIG-3

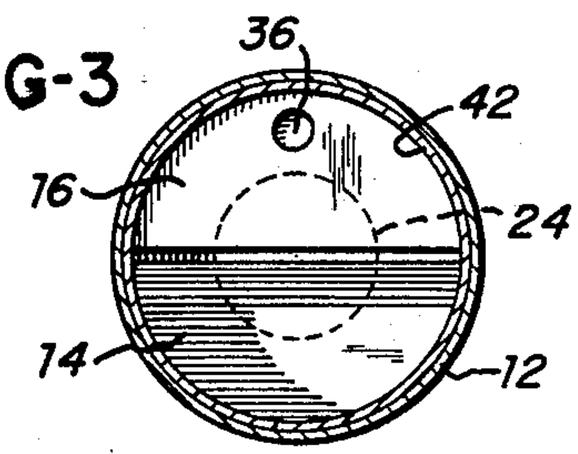
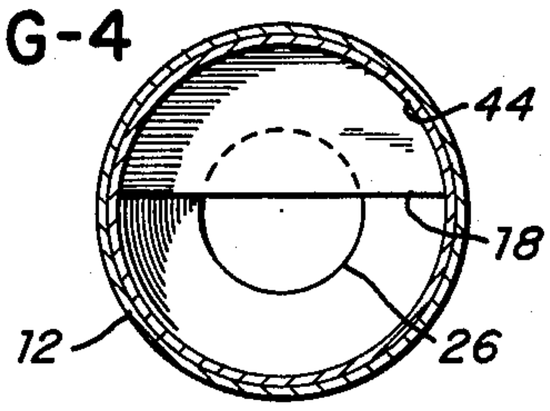


FIG-4



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United States Patent Office

3,180,577
Patented Apr. 27, 1965

3,180,577
APPARATUS FOR EXPELLING AIR FROM CLOSED HOT WATER SYSTEMS

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Filed July 5, 1963, Ser. No. 292,858
8 Claims. (Cl. 237—63)

The present invention relates to an apparatus for expelling air from closed hot water systems, such as space heating systems or the like.

In any closed system of heating by means of circulated hot water, the presence of air in the system produces undesirable effects the most annoying of which are noisy operation of the system and inability to maintain efficient and uniform heat radiation at all the heat exchange units or radiators of the system. While many allegedly curative devices, attachments, and system modifications have been proposed heretofore for eliminating the entrapped air problem, no satisfactory solution has yet proven effective.

It is an object of the present invention to provide novel means effective for eliminating from a circulating hot water heating system, the customary noise and erratic operation of the system due to entrapment of air in various portions thereof.

Another object is to achieve the foregoing objective with the use of a simple and inexpensive method and means to release entrapped air with the thoroughness and continuity necessary for efficient and quiet operation of the closed system.

Another object of the invention is to provide an improved air release unit which may easily and inexpensively be incorporated in existing as well as newly installed hot water heating systems, to achieve the greatest possible efficiency of operation of the system without the production of noise or vibration.

A further object of the invention is to provide effective, durable, and trouble-free means having no moving parts to be replaced or serviced, for eliminating air from a closed hot water heating system with sufficient effectiveness to preclude noise, vibration, and erratic operation of the system at all times.

The foregoing and other objects are attained by the means described herein and illustrated upon the accompanying drawing, in which:

FIG. 1 is a longitudinal vertical cross-section of the device of the present invention.

FIG. 2 is a side elevational view, on a reduced scale, showing a baseboard type of heat exchanger or radiator with the device of the invention applied in typical fashion.

FIG. 3 is a cross-section taken on line 3—3 of FIG. 1.

FIG. 4 is a cross-section taken on line 4—4 of FIG. 1.

With reference to the accompanying drawing, FIG. 2 illustrates one of a group of radiators or heat transfer units **6**, usually connected in a closed hot water system which generally comprises a boiler and a system of feed and return pipes for hot water, substantially as disclosed in U.S. patent of B. Spieth, No. 2,434,596, issued January 13, 1948. Hot water usually is recirculated through the closed system by means of an electric motor driven pump under the control of one or more thermostatic demand devices in accordance with customary practice.

The radiator or heat transfer unit **6** may vary as to structure, depending upon taste or circumstances of installation, but for purpose of disclosure of the present invention it is herein exemplified as a baseboard unit in strip form. Hot water from the boiler enters the radiator unit at the left as indicated by the arrow, FIG. 2, and leaves the unit by way of a return pipe **8**. Pipe **10** may be considered the feed pipe for hot water. Intermediate the pipes **8** and **10**, the unit may be provided with concealed radiation fins or similar means to dissipate heat, according

to common practice and not necessary here to disclose in detail.

At **12** is indicated the air expelling or releasing device of the present invention, comprising in general an elongate hollow housing or body which may be cylindrical in form, and within which are disposed stationary baffle plates **14**, **16** and **18**. At its opposite ends, the housing is provided with an in-flow bonnet **20** and an out-flow bonnet **22**, which bonnets have cylindrical necks **24** and **26**, respectively, whereby fluid-tight connections may be made between sections of the return pipe **8** by means of solder joints or the equivalent thereof.

It will be noted that bonnets **20** and **22** are flared to a larger diameter than pipe sections **8**, so as to result in an enlargement of the size of housing **12**, the housing being thereby made larger in diameter and capacity than pipe **8**.

The housing **12** at a location intermediate the bonnets **20** and **22**, is provided with an upstanding hollow nipple **28** formed to provide an internally screw-threaded bore **30** in which may be inserted a common form of automatic air vent unit **32**. A popular form of automatic air vent unit is one known as the "Dole" unit, details of which are disclosed in the U.S. patent of Blackmore et al., No. 2,710,664, dated June 14, 1955. Such venting units include liquid absorptive elements which in a dry condition permit air to bleed from the pipe system to atmosphere; but as soon as the absorptive elements are subjected to moisture of water, they expand and act to close the vents against further bleeding.

One of the principal difficulties attending the use of automatic air vent units in a hot water heating system, has been the tendency for the absorptive elements thereof to act prematurely for closing the vents. That is, the absorptive elements heretofore were so exposed to a rising level of water and turbulence in the system, that they acted to close the vents long before much of the entrapped air had an opportunity to leave the system. The air remaining in the system after closing of the automatic vents, was the very air that induced pounding, vibration, and noise in the system. The device of the present invention is constructed to overcome this fault, by protecting the absorptive element of the automatic air vent unit aganist premature wetting, so that a major amount or nearly all of the entrapped air may leave the system before the vent unit closes.

The desired protection against premature wetting of the absorptive element of the automatic air vent unit, is afforded by the proper disposition and nature of the transverse baffle plates **14**, **16** and **18**. All of the plates are normally fixed relatively to housing **12**, and may be substantially at right angles to the housing axis. The first plate **14**, which is an initial interceptor of flow through the housing, projects upwardly from the housing bottom near the flared portion of bonnet **20** and acts as a dam over which liquid must flow in entering the primary chamber **34** between baffles **14** and **16**.

Flow of liquid over baffle plate **14** is impeded by the secondary baffle plate **16**, which is suspended from the top portion of housing **12** and serves to direct the flow downwardly and away from nipple **28**, while at the same time permitting a flow of superposed entrapped air through an upper baffle plate aperture **36**. Air passing through the aperture **36** enters freely into secondary chamber **38** of the housing, and will unrestrictedly rise into nipple **28** and leave the system through air vent unit **28** (FIG. 2). Secondary baffle plate **16**, while permitting air flow through its aperture **36**, has also intercepted any splash of water toward nipple **28** and the venting unit therein mounted, so as to preclude premature closing of the air vent unit.

The third or final baffle plate **18** is a solid plate sus-

pended in housing **12**, preferably near the out-flow bonnet **22**, and forms with plate **16** an air head compartment **40** in the upper portion of chamber **38**, wherein air may accumulate and be vented through nipple **30** and its venting unit **28** until such time as substantially all the air in compartment **40** escapes before wetting of unit **28** occurs. As will be understood the level of liquid in air head **40** will rise gradually as air therein is displaced, until finally the level of liquid reaches the absorptive element of vent unit **28** to close the unit against passage of both air and liquid. By the time closing occurs, practically all the entrapped air will have left the chamber **38–40**, thereby conditioning the system for quiet and efficient operation.

An important function of the baffle plate arrangement is to ensure a relatively quiescent or non-turbulent character of liquid flow beneath nipple **28** and the automatic air vent unit supported thereon, so that any chance splash of liquid onto the vent unit absorptive element is effectively prevented. This action precludes any premature closing of the vent unit and resultant entrapment of air which otherwise would have vented to atmosphere.

The housing **12** may be formed of metal or other suitable material, and its baffle plates **14**, **16** and **18** may reach centerward to approximately the major axis of the housing.

In the embodiment illustrated, the housing is shown formed in telescopic sections which may be extended to increase the capacity of the housing chambers if desired. It may sometimes be found advantageous to adjust the capacity of housing **12** proportionately to the size of the radiator it serves, or to locations in the system which are expected to accumulate air in excessive amounts. It will be understood, of course, that the device may be manufactured in various sizes initially, instead of providing for the telescopic adjustment for capacity.

If the telescopic form of device is desired, it is necessary only to mount slidable sleeves **42** and **44** upon the opposite end portions of the middle body element, and then slidably apply the bonnets **20** and **22** to such sleeves at the desired locations. Once the capacity of the device has been thereby established, solder may be applied at the sleeve joints to preclude leakage of liquid and air from the housing interior.

In charging a newly installed hot water heating system with water, or in filling any system which for any reason has been emptied of water, it is considered advantageous to follow the customary procedure of manually venting the system first to release the large quantity of air entrapped incident to filling. Thereafter, the means of the invention may be depended upon to maintain the system in efficient and noiseless operating condition.

It is to be understood that various modifications and changes may be made in the structural details of the device, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. In a circulating hot water heating system comprising feed and return pipes and a radiator arranged in closed system relationship, a hollow elongate housing having at opposite ends thereof a water in-flow port and an out-flow port connected in one of said pipes to convey water and air with which the system is charged, a pair of baffle plates depending within the housing and in downstream spaced relation to provide therebetween an air chamber beneath which water may flow, one of said baffle plates having an elevated aperture therein providing for passage of air into the chamber from the region of the in-flow port, means intermediate the in-flow port and the apertured baffle plate to direct flow of water from the in-flow port in a direction away from the aperture aforesaid, and an automatic air venting unit in communication with the air chamber above the baffle plate aperture, said venting unit including a water absorptive element responsive to wetting for precluding venting of air and water from the chamber when a rising level of water within the chamber reaches the absorptive element.

2. The combination as set forth in claim 1, wherein the elongate housing is of greater cross-sectional area than the pipe in which it is interposed.

3. Apparatus for expelling air from closed hot water heating systems, comprising a hollow elongate housing having at opposite ends thereof a water in-flow port and an out-flow port, a pair of baffle plates depending within the housing and normal to the longitudinal axis of the housing and spaced apart longitudinally of the housing to provide an upper air chamber beneath which water may flow through said ports, one of said baffle plates having formed therein an elevated aperture placing the upper portion of the air chamber in fluid communication with the water in-flow port, and an automatic air venting unit above and in communication with the air chamber, said venting unit including a water absorptive element responsive to wetting for precluding venting of fluid from the chamber when water within the chamber reaches the absorptive element.

4. Apparatus as set forth in claim 3, wherein the housing includes a third baffle plate upstanding within the housing between the in-flow port and the apertured baffle plate and lying normal to the longitudinal axis of the housing to impede flow of water into the housing and deflect such flow away from the aperture of the apertured baffle plate.

5. Apparatus for insertion in a pipeline of a closed hot water heating system, comprising a hollow elongate housing embodying a middle section and end bonnet sections, each bonnet section having a reduced neck extension, said neck extensions of said bonnet sections forming inflow and outflow ports and said middle section and said neck extensions being axially aligned, spaced depending partitioning elements in the housing providing an upper air chamber intermediate said ports and below which chamber water may flow from the inflow port to the outflow port, said partitioning elements dividing approximately the upper half of the housing, an upstanding partitioning element dividing substantially the lower half of the housing between the inflow port and an adjacent one of the depending elements, said adjacent one of the depending elements having an aperture therethrough, and means connected with the air chamber at the top of the housing to vent the chamber to atmosphere, said vent means being responsive to wetting for sealing the chamber against venting to atmosphere when exposed to wetting.

6. Apparatus as defined by claim 5, wherein said bonnet sections are connected with said middle section for longitudinal adjustment relative to the middle section whereby to change the volume of the housing.

7. Apparatus as defined by claim 5, wherein said bonnet sections are connected with the middle section by interposed sleeves slidably connected with the bonnets whereby to change the volume of the housing.

8. The invention as defined by claim 7 wherein each of said sleeves carries one of said spaced depending partitioning elements.

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