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Aug. 25, 1959 L. W. HOYT 2,901,176

WATER COMPENSATOR FOR FORCED FLOW WATER SYSTEM INCLUDING AN EXPANSION TANK

Filed July 26, 1956

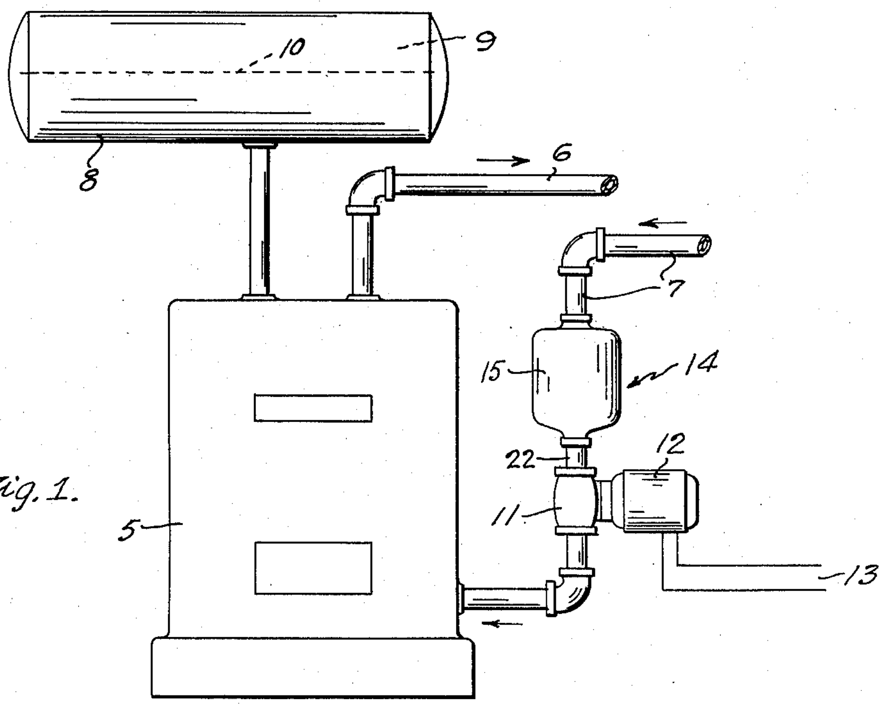

Fig. 1.

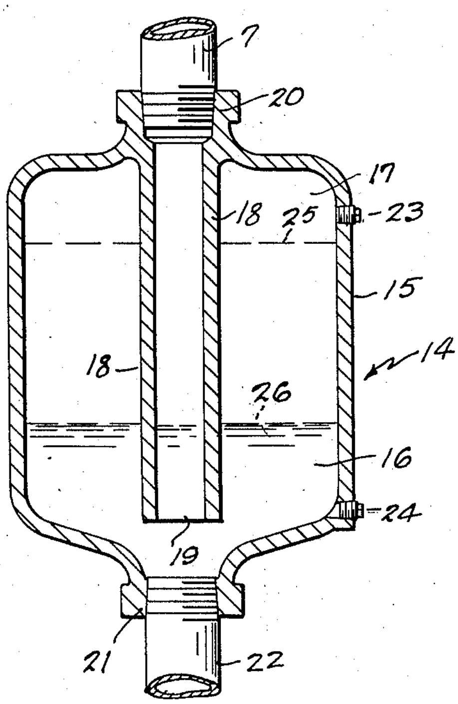

Fig. 2.

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United States Patent Office

2,901,176

Patented Aug. 25, 1959

2,901,176

WATER COMPENSATOR FOR FORCED FLOW WATER SYSTEM INCLUDING AN EXPANSION TANK

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Application July 26, 1956, Serial No. 600,231

7 Claims. (Cl. 237—66)

This invention relates to heating and cooling systems, in which water is circulated from the heat exchanger, either a boiler or cooler, through a heating or cooling system, and to which an expansion tank is connected, and has for an object to provide a compensator device in such a system which will discharge water to or absorb water from this system to compensate for the amount of water forced into the expansion tank by increase of pressure in the system when the circulating pump or booster is operating, and to reabsorb this amount of water when the circulating pump is not operating, and also to eliminate return of air to the system after it has been vented.

With the foregoing and other objects in view, I have devised the construction illustrated in the accompanying drawing forming a part of this specification. It is, however, to be understood the invention is not limited to the specific details of construction and arrangement shown, but may embody various changes and modifications within the scope of the invention.

In this drawing:

Fig. 1 is a front view of a boiler of a hot water heating system with supply and return connections to the system, a circulator such as a circulating pump or booster, for circulating the water from the boiler through the system, and an expansion or compression tank connected to the system, with this improved compensator applied to this system, and

Fig. 2 is a vertical section through the compensator.

Although the device is shown and described specifically as applied to a hot water heating system, it is to be understood this same compensator may be employed in a cooling system, using cooled water instead of heated water.

The device will automatically supply to the heating or cooling system enough water to replace the water which is forced into the expansion or compression tank by increase of pressure in the system when the circulator pump or booster is operationing, to prevent any air lock and so forth in the circulating system. As soon as the pump or booster stops operating the increased pressure which has been applied to the air in the expansion tank forces the water back into the system, and this compensator receives it so that on the next operation of the circulator or booster pump this water is automatically re-supplied to the system by this unit to take the place of the water again forced into the expansion tank.

In the arrangement shown, there is indicated at **5** a heat exchanger, in this case the boiler or heater of a hot water heating system, with a supply pipe **6** to the radiators of the heating system (not shown), and a return pipe line **7** for returning the water from the radiators back to the boiler or heat exchanger **5**, and to the system is connected the usual expansion or compression tank **8** having in it the air space **9** above the changing water level **10** therein. In the return line **7** is any

suitable type of circulating pump or booster **11** operated by an electric motor **12** controlled by any suitable automatic thermostatic means (not shown) connected with this motor and operating it from any suitable electric current supply through the leads **13**.

Mounted in the return line, preferably closely adjacent the inlet or suction side of the motor **11**, is this compensator unit **14**. Its construction may vary, but its preferred and simplest construction comprises an upright hollow member **15** forming a container or reservoir for water in the lower part of this container, as indicated at **16**, and an air space **17** in the upper part of the container. In this container is a downwardly extending pipe **18** connected at its upper end to the top of the container and open at its lower end **19** adjacent the bottom of the container to thus communicate at its lower end with the water in the container, and this pipe is out of communication with the air space **17**, but has means **20** by means of which it may be connected to the return pipe line **7**. At its lower end the container has connecting means **21** by means of which a pipe **22** forming a continuation of the return line may be connected to the inlet or suction side of the circulating pump **11**. A vent plug **23** may be provided for the upper part of the container communicating with the air space, and a similar drain plug **24** may be provided for the lower part of the container.

This leaves a closed or sealed air space **17** above the water **16** in this booster compensator. When the pump is not running the pressure of the compressed air in the tank **8** forces water from this tank back into the system, which water flows back into this container **15** and its level rises to substantially the point **25** and compresses the air in the space **17** above this water. When the pump **11** starts operating and increases the pressure in the system on the outlet side of the pump or the supply side of the system, it forces water into the expansion tank **8**, further compressing the air in the space **9**, and the compressed air in the space **17** in the compensator forces a corresponding amount of water from this container through the lower connection **22** to the system to compensate for the water removed from the system by the flow into the expansion tank **8**. The water level in the compensator thus falls as indicated at the point **26**, but the capacity is such that this level does not fall below the lower end **19** of the depending pipe **18**. When the pump **11** stops operating the increased pressure which has been applied to the air in the expansion tank **8** forces water back into the system and into this compensator unit **15**, raising the level again to substantially the point **25** and again compressing the air in the space **17** preparatory to the next operation of the circulator pump.

Thus, this compensator automatically adds water to the system to make up for the amount of water forced into the expansion tank and thus removed from the circulating part of the system by operation of the circulator pump, and when this pump stops operating it automatically receives and stores the water returned to the systemp by the expansion tank, thus maintaining the system full of the proper amount of water and preventing air locks in the system.

This compensator device may be installed as an integral part of a forced hot or chilled water system. It will contain air and water under the system pressure, the proper amount of water leaving the unit when the pump is in operation to compensate for that removed from the system to the compression tank by this operation, and to automatically receive this water by return to this unit when the pump stops, this water thus to act as a make-up for the water stored in the expansion tank due to the pump action. This device thus forms an integral part of a forced circulation system and is normally installed at the suction or inlet side of the pump. It therefore delivers to the suction side of the pump, in addition to the normal return from the heating or cooling system, a certain amount of water to compensate for the amount forced into the expansion tank when the pump is in operation, and which amount of water will return to this device when the pump stops. The device does not add additional water to the system total, but stores a certain amount of water under air pressure to be delivered to the system when the pump starts and to permit its return when the pump stops, to thus equalize the amount of water forced into the expansion tank each time the pump operates, and permits its return to this unit when the pump stops. The device has no moving parts, and will thus operate indefinitely without wear or danger of getting out of order, the energy to operate it being supplied by the compressed air in the device, the starting of the pump, and the storing of water under air pressure in the expansion tank. It will be under the normal gravity head in the system when the pump is not operating, and will be subject to pump suction when the pump does operate. It will fill automatically when the system is filled with water.

As the system requires a complete filling of water in order for it to circulate, there cannot be any air in the system. If there is air in the system the circulation will not take place when the pump operates, and the units in certain parts of the system will remain dormant as the circulation has stopped. These systems are sealed to the atmosphere and are normally equipped with a relief valve and possibly an automatic filling valve connected to the city water. This can be to any water supply which has sufficient pressure to fill the heating or cooling system. The expansion tank is generally placed in a low portion of this system, and is used to balance the pressure developed by heat due to the expansion of water or change of pressure due to contraction of water on cooling. The system is filled and the air vented from all portions, either automatically or by hand, and after being filled to the highest point the automatic valve, if one is used, is set to keep this water at this altitude. The relief valve is set to relieve water if it expands over a predetermined amount. Thus the expansion tank with the air cushion absorbs certain expansion and contraction of the water. In a gravity system without a pump or circulator this system balances and maintains the desired pressure both in supply and return, but when a pump is inserted in the system the action is changed. The pressure exerted by the pump forces a certain amount of water into the expansion tank, and this places the system under a certain vacuum or reduced pressure. The effect is the same as if a small quantity of water was taken from the system. This causes a certain vacuum or reduced pressure which will be evident at the high point in the system. Naturally, when even a small amount of water is taken from a sealed vessel, the head pressure may remain due to the weight of water, but it is decreased and without letting air in, the water will remain in the system under vacuum or reduced pressure as it is sealed from the atmosphere. This unit will store water and air and will correct this unbalanced cycle automatically.

The pump in general practice is preferably placed in position to operate in the system before the water reaches the heat exchanger, such as the boiler or cooler. Thus the pressure developed by the pump is exerted through the heater or cooler and passes the fill valve, the automatic relief valve, and to the system supply line. The expansion tank is connected in this pressure rise. A small amount of water which is forced into the expansion tank will cause a certain vacuum or reduced pressure at the return from the radiators or cooling units. This may seem to be caused by the pump suction from the unit, but actually a great amount of this vacuum of reduced pressure is caused by loss of circulated water which remains in the expansion tank. As these systems must be completely filled and stay that way in order to function, it is obvious all air must be eliminated. This is done automatically or by hand with the pump not running. The function of this compensator unit is to overcome this cycle, and to deliver to the system the make-up water to replace the water discharged into the expansion tank and to permit return of this water to the unit when the pump stops and the pressure drops, allowing the water in the expansion tank to flow back to the system.

Thus this compensator unit is designed to keep the circulation system in a more perfect balance, to prevent air from entering the system, to eliminate necessity for frequent venting of the system, to provide more perfect circulation of liquid in the system, to relieve a certain load on the pump when it starts to circulate the liquid, and to keep the supply of water to the radiator or coil and the return from the radiator or coil in more perfect balance.

This unit is not used as the usual air chamber, to absorb vibrations or normal water movement, but to discharge and receive return water when the requirement is there, due to pump and expansion tank action. It may be installed in the return or as an attachment to the return. It may be made of any suitable material, such for example, as cast iron, steel, brass, and so forth, and its connections to the system may be of any suitable type, such as screwed, welded or flanged connections.

The size of the unit may vary depending on the system, but for the ordinary heating system a unit about eight inches in diameter and six and one-half inches high has been found satisfactory.

Having thus set forth the nature of my invention, I claim:

1. In a water circulating heating or cooling system comprising a heat exchanger, supply and return pipe lines connected to the exchanger for circulation of water through the system, a circulating pump in the return line to the exchanger including suction and discharge connections to the line, an expansion tank connected to the system on the discharge side of the pump, and a compensator in the line on the suction side of the pump comprising a hollow member enclosing an air chamber, a depending tube in said chamber connected at its upper end to the return line and open at its lower end adjacent the bottom of the chamber forming a conduit for flow of water from said line to the lower part of the chamber, said tube otherwise closed against communication with the chamber so that there is a closed air space above said open lower end of the tube, and a pipe connection from the lower part of said chamber to the suction side of the pump.

2. In a water circulating heating or cooling system including a heat exchanger, supply and return pipe lines connected to the exchanger for circulation of water through the system, a circulating pump in the return line including inlet and discharge connections to the line, an expansion tank connected to the system on the discharge side of the pump, a compensator unit in the return line on the inlet side of the pump comprising a hollow member enclosing an air chamber, a depending conduit in the chamber connected at its upper end to the return line and communicating with the air chamber only at the lower part thereof, and a pipe connection from the lower part of the chamber to the suction side of the pump.

3. In a water circulating heating or cooling system including a heat exchanger, supply and return pipe lines connected to the exchanger for circulation of water through the system, a circulating pump in the system circulating water from the exchanger to the system through the supply line and back to the exchanger through the return line, an expansion tank connected to the system on the discharge side of the pump, a compensator unit in the return line on the suction side of the pump comprising a hollow container enclosing a water supply and an air

chamber above the water, a return pipe connection from the return line to said container below the water level therein and disconnected from the air chamber, and a supply connection from the lower part of the container below the water level therein to the suction side of the pump for return to the exchanger.

4. In a water circulating heating or cooling system including a heat exchanger, supply and return pipe lines connected to the exchanger for circulation of water through the system, a circulating pump in the system circulating water from the exchanger to the system through the supply line and back to the exchanger through the return line, an expansion tank connected to the system on the discharge side of the pump, a compensator unit in the return line on the suction side of the pump comprising a hollow member forming a chamber enclosing a water supply and a closed air space in contact therewith, said return line leading to said chamber below the water level therein and disconnected from the air space, and the return line also leading from the lower part of said chamber below the water level to the suction side of the circulating pump.

5. In a water circulating heating or cooling system including a heat exchanger, supply and return pipe lines connected to the exchanger for circulation of water through the system, a circulating pump in the return line including inlet and discharge connections to the line, an expansion tank connected to the system on the discharge side of the pump, a compensator unit in the return line on the inlet side of the pump comprising a hollow member enclosing a water chamber and a closed air chamber, an inlet connection from the return line to the water chamber disconnected from the air chamber, and an outlet connection from the water chamber to the inlet side of the pump.

6. In a water circulating heating or cooling system including a heat exchanger, supply and return pipe lines connected to the exchanger for circulation of water through the system, a circulating pump, an expansion

tank connected to the system on the discharge side of the pump, a compensator comprising a water supply chamber and a closed air compression chamber associated therewith adapted to permit water to flow into the supply chamber on increase of water pressure and to force it from said chamber on decrease of said pressure, a return pipe connection from said return line to the water supply chamber out of communication with the air chamber, and a discharge pipe connection from the water supply chamber to the inlet side of the pump.

7. In a water circulating heating or cooling system including a heat exchanger, supply and return pipe lines connected to the exchanger for circulating of water through the system, a water circulating pump connected in the system, an expansion tank connected to the system on the discharge side of the pump, a compensator connected to the system comprising a container and reservoir for water and an air space in which the air is compressed by the water pressure in the container, and a connection from the water container to the system on the suction side of the pump whereby water is forced from the container to the system by the compressed air to replace the water forced into the expansion tank while the circulating pump is operating, and said latter connection also forms a return for water from the system to the container under pressure from the expansion tank when the circulating pump is not operating.

References Cited in the file of this patent

UNITED STATES PATENTS

361,649	Rider	Apr. 19, 1887
571,243	Reed	Nov. 10, 1896
2,469,616	Tidd	May 10, 1949
2,650,031	Hitch et al.	Aug. 25, 1953

FOREIGN PATENTS

415,350	Great Britain	Aug. 23, 1934
57,924	Sweden	Apr. 10, 1923