No. 874,112.

PATENTED DEC. 17, 1907.

C. C. PECK.

VACUUM HEATING APPARATUS.

APPLICATION FILED JULY 31, 1906.

2 SHEETS—SHEET 1.

FIG. 1.

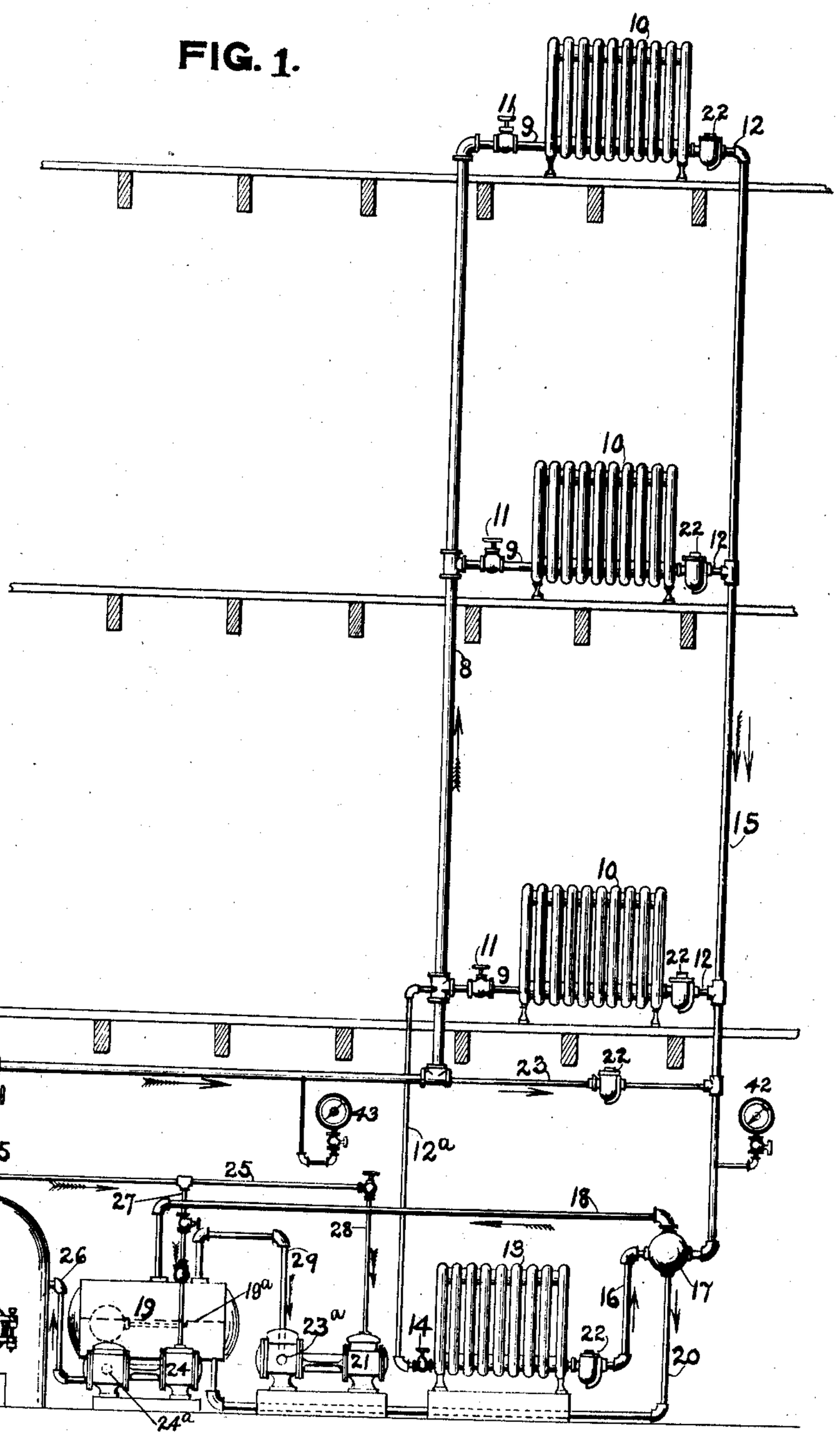
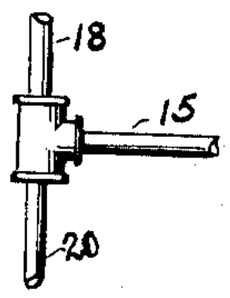


FIG. 4.



WITNESSES:

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VACUUM HEATING APPARATUS.

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2 SHEETS—SHEET 2.

FIG. 2.

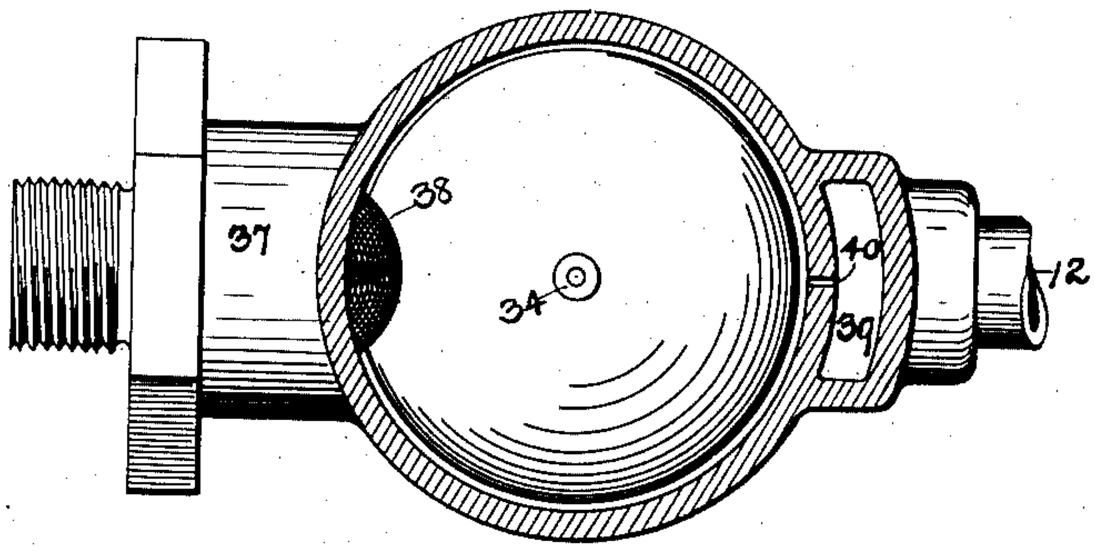
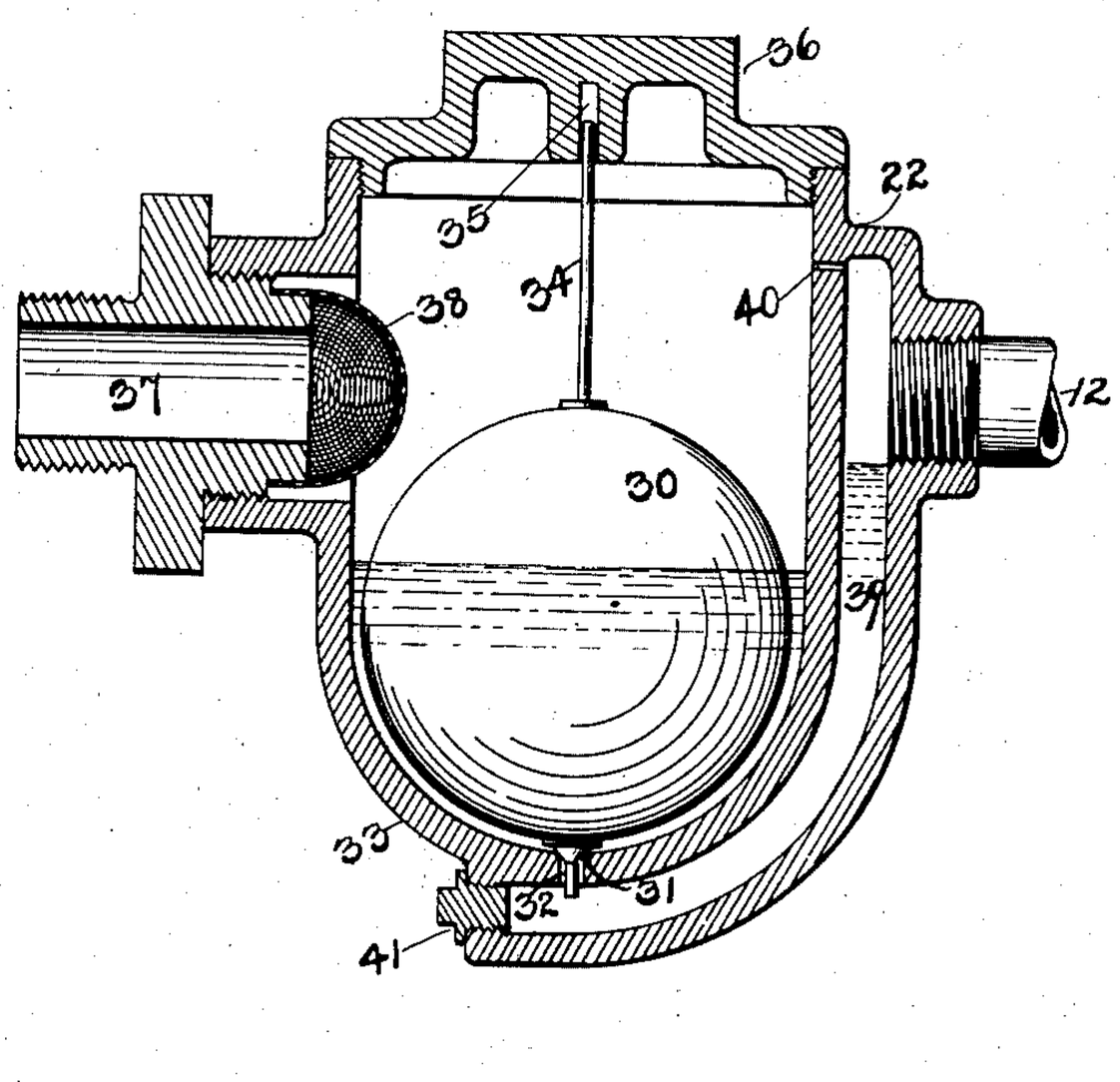


FIG. 3.



WITNESSES:

H. Gurnee.

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CASSIUS CARROLL PECK, OF ROCHESTER, NEW YORK.

VACUUM HEATING APPARATUS.

No. 874,112. Specification of Letters Patent. Patented Dec. 17, 1907.

Application filed July 31, 1906. Serial No. 328,630.

To all whom it may concern:

Be it known that I, CASSIUS CARROLL PECK, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Vacuum Heating Apparatus, of which the following is a specification.

My invention relates to the class of heating apparatus in which a vacuum of more or less extent is applied to the return end of a heating circuit for the purpose of removing air, to reduce the amount of initial vapor tension required for effecting circulation through the system, to insure even and complete circulation, and to withdraw water of condensation as well as air as fast as these accumulate.

It consists of two chief elements; first, a receiver having a water space and a steam space so connected to the return pipe, or pipes, of the heating system that water of condensation shall be conducted into the receiver below the water line, and air withdrawn from the heating circuit shall enter the air space of the receiver by a separate pipe, said air space being connected with a vacuum pump, and the water space connected with a separated water pump controlled by a float in the receiver; and, second, an air and water separating chamber located in the end portion of the return conduit, and connected with said receiver by separate air and water pipes.

In the drawings Figure 1 is an elevation of apparatus constituting a heating system embodying my improvements. Fig. 2 is a plan view, partly in section, of my vacuum valve which is of suitable construction for use with the means shown in Fig. 1 for maintaining a proper degree of vacuum in return pipes of a heating circuit, and for draining air and water from radiators. Fig. 3 is a central vertical section of the automatic valve shown in Fig. 2. Fig. 4 illustrates an alternative form of separator shown at 17, Fig. 1.

In the drawings arrows feathered on both sides indicate the flow of steam; those feathered on one side indicate the flow of air; and unfeathered arrows indicate the flow of water.

Referring to Fig. 1, the boiler 1 supplies steam through valved pipe 2 to run engine 3, exhaust steam from which may be used to supply the heating system through valved pipe 4, or said system may be supplied direct from the boiler through valved pipe 5, which may or may not have a pressure reducing valve. Pipe 6, having back pressure valve 7, discharges exhaust steam which is not required for the heating system. Pipe 8 is the main steam supply for the heating system, and the branch pipes 9 supply radiators 10, controlled by valves 11. Pipe 12[a] supplies radiator 13 through valve 14. The return pipes 15 and 16 connect the aforesaid radiators with air and water separating chamber 17, air going thence through pipe 18 to the air space in top of receiver 19, and water flowing through pipe 20 to the bottom of said receiver. In each of the branch return pipes 12, connecting radiators 10 with return pipe 15, is one of my vacuum valves 22, shown on an enlarged scale in Figs. 2 and 3, and in return pipe 18 from the lowest placed radiator is another of these valves; also in pipe 23, which serves to drain supply pipe 8 into return pipe 16, is one of the same kind of valves. Receiver pump 24, having the valved steam supply pipe 27, is controlled automatically by a float in the receiver controlling the live steam supply by opening and closing valve 27[a] as required by the water level in the receiver.

In proportion as the water level rises steam is admitted to drive the pump, the duty of which is to take water from the receiver through the pipe connection on opposite side of the pump from that shown, the position being indicated at 24[a], and deliver the water into boiler 1 through pipe 26. The normal water level in receiver 19 is indicated by a broken line 19[a]. Vacuum pump 21, driven by steam supplied through valved pipe 28, withdraws air from space above water level in the receiver through connecting pipe 29 and discharges it to atmosphere through pipe connection 23[a], which is usually fitted with a pipe for conveying moist air and vapor out of doors. The amount of vacuum desired for the heating system is thus produced and maintained in the space above the water line in the receiver, and so in separator 17 and throughout the return pipes of the heating circuit.

The apparatus is intended to be represented as located on four different floors of a building, the three upper floors being indicated in section.

Referring now to the automatic water and air relief valve 22, shown in detail in Figs. 2 and 3, the float 30 has a valve and stem 31 which seats on the edge of water passage

opening 32 in case 33, having also a guide rod 34 which enters recess 35 in the case cover 36 to control movement of float and valve. At the left hand side of float case 33 is a fitting 37 provided on its inner end with a strainer 38 for intercepting dirt and scale, the opposite end being intended to connect with the return end of a radiator, or coil, either directly or with a union, or it may connect with the drain pipe of a supply main, as 23, Fig. 1. On the opposite side of the float case is an inclosed passage 39 for conducting water of condensation escaping through valve passage 32 into return pipe 12, or 16, or 23. At the upper end of this passage is a very small hole 40 connecting the upper portion of the float chamber with passage 39. The plug 41 provides for cleaning out any solid matter which may collect in passage 39.

Vacuum gage 42 on return pipe 15 gives means for constant indication of the degree of vacuum in returns of the heating circuit; and pressure gage 43 shows any degree of pressure which may exist in supply pipe 8.

Operation is as follows: In starting up the heating system, live steam is first turned on to vacuum pump 21 through valved pipe 28 so as to start the pump and remove air as fully as possible from all the pipes and radiators of the heating system. When this has been done, and the desired degree of vacuum, usually five inches to ten inches, is indicated on gage 42, steam is let into the heating circuit through pipe 8 either from boiler 1 through valved pipe 5, or from engine 3 through valved pipe 4. The partial vacuum which exists in radiators 10 and 13 allows steam to rush into them through pipes 9 and 14 with little resistance. As the steam condenses in radiators, water of condensation which accumulates therefrom flows out by gravity through branch return pipes 12 and 16, and condensation in pipe 8 is discharged through pipe 23 and valve 22 into return pipe 15, valve 31 on float 30 being raised by the water so as to admit of its passage through opening 32 in float-case 33, thus admitting the water to channel 39, where it flows into the aforesaid pipes 12 and 16. Partial vacuum in the return pipes causes unbalanced pressure in the float chamber above water therein which pressure forces the water out of said chamber and through the branch pipes into the main return and into air and water separating chamber 17. From this separator all air is drawn through pipe 18 into receiver 19 in consequence of vacuum created by pump 24, driven by steam supplied through valved pipe 28, the water of condensation sinking by gravity through pipe 20 into the bottom of receiver 19. This receiver with its pump 24 may be of any ordinary pattern of pump and receiver. The pump will usually deliver water of condensation into a boiler, but may make any other preferred disposition of it.

In case of radiator 13 it will be noted that it sits too low to drain by gravity into separator 17. Supposing the valve 14 in branch supply pipe 12ª to be open, condensation and drainage will occur the same as in the other radiators, for as fast as water collects so as to raise float 30 in valve 22 the unbalanced pressure acting on surface of water in the float chamber will force the water out and up pipe 16 into separator 17, where it will mingle with water coming from other radiators and flow through pipe 20 into the receiver.

In order that air may separate freely and quietly from water, the separator must have sufficient liberating surface, and must be located above the level of water in receiver 19, and also drain pipes from the heating circuit, as 15 and 16, should enter on the side and in a horizontal direction, the water discharge pipe being connected to the bottom and the air pipe to the top, all as shown. For a small system a large pipe tee, as shown in Fig. 4, will answer for a separator.

If one of the valves 11 of radiators 10 be suddenly closed, condensation of steam may occur so rapidly as to cause a greater degree of vacuum in the radiator than in the return pipe 15, in which case water might be drawn back into the radiator from the return pipe except for the small hole 40, which is located above the water level, and which allows air from the return pipe to be drawn into the radiator to replace steam as it condenses. This hole also provides for constant withdrawal of air from the radiator to insure keeping the latter filled with steam when supply valve 11 is open. By slightly opening said valve, the radiator may be partially heated, as is often desired to suit weather conditions.

It will be seen that unless water of condensation collects in a radiator so as to raise float 30 in drain valve 22, said float will sink so as to allow valve 31 to seat and shut off communication between the radiator and the return pipe, except for the small hole 40 which does not allow of passage of sufficient steam to affect the vacuum to the extent of materially reducing vacuum in the return pipe. Under this condition, taken in connection with separator 17 and the manner of placing and connecting it with receiver 19, and the pump 24 for disposing of the water of condensation, the vacuum pump 21 has only the duty of withdrawing air from the heating system, and therefore can do this more efficiently and economically than where, as is usually the case, a single pump is employed to handle both air and water which flow in a mixed state to the pump.

The vacuum system is especially adapted for utilizing exhaust steam in heating. When the supply of this is insufficient, the deficiency is

usually made up with live steam delivered through a pressure reducing valve. In either case there is no occasion with my system for using steam above atmospheric pressure in the heating system, hence there is no back pressure on engines where the exhaust from same is used for heating, neither collection and retention of water in radiators or connecting pipes to cause water hammer and create liability of damage by freezing.

It is obvious that one drainage valve may serve for more than one radiator, as illustrated by pipe 23 having valve 22 which drains the supply pipe 8 of three radiators 10.

I do not confine myself to the exact apparatus and details shown and described as illustrating suitable means for carrying out my system of heating, as equivalent mechanical appliances may be substituted without departing from what I claim as my invention.

1. In a vacuum heating system and in combination, a source of steam supply; a supply conduit; a return conduit; a radiator; means establishing communication between said radiator and conduits; an air and water drainage valve for said radiator controlling differential pressure between the radiator and the return conduit; a closed air and water receiver at the return end of the system; separate air and water pipes communicating respectively with the air and water spaces of said receiver and with the return conduit; an air pump; a water pump; means establishing communication between said air and water pumps and the air and water spaces, respectively, of the receiver; and means for actuating said pumps.

2. In a vacuum heating system and in combination, a source of steam supply; a supply conduit; a return conduit provided with a separating chamber for air and water; a radiator; means establishing communication between said radiator and conduits; an air and water drainage valve for said radiator controlling differential pressure between the radiator and the return conduit; a closed air and water receiver at the return end of the system; separate air and water pipes communicating respectively with the air and water spaces of said receiver, and with said separating chamber; an air pump; a water pump; means establishing communication between said air and water pumps and the air and water spaces, respectively, of the receiver; and means for actuating said pumps.

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