

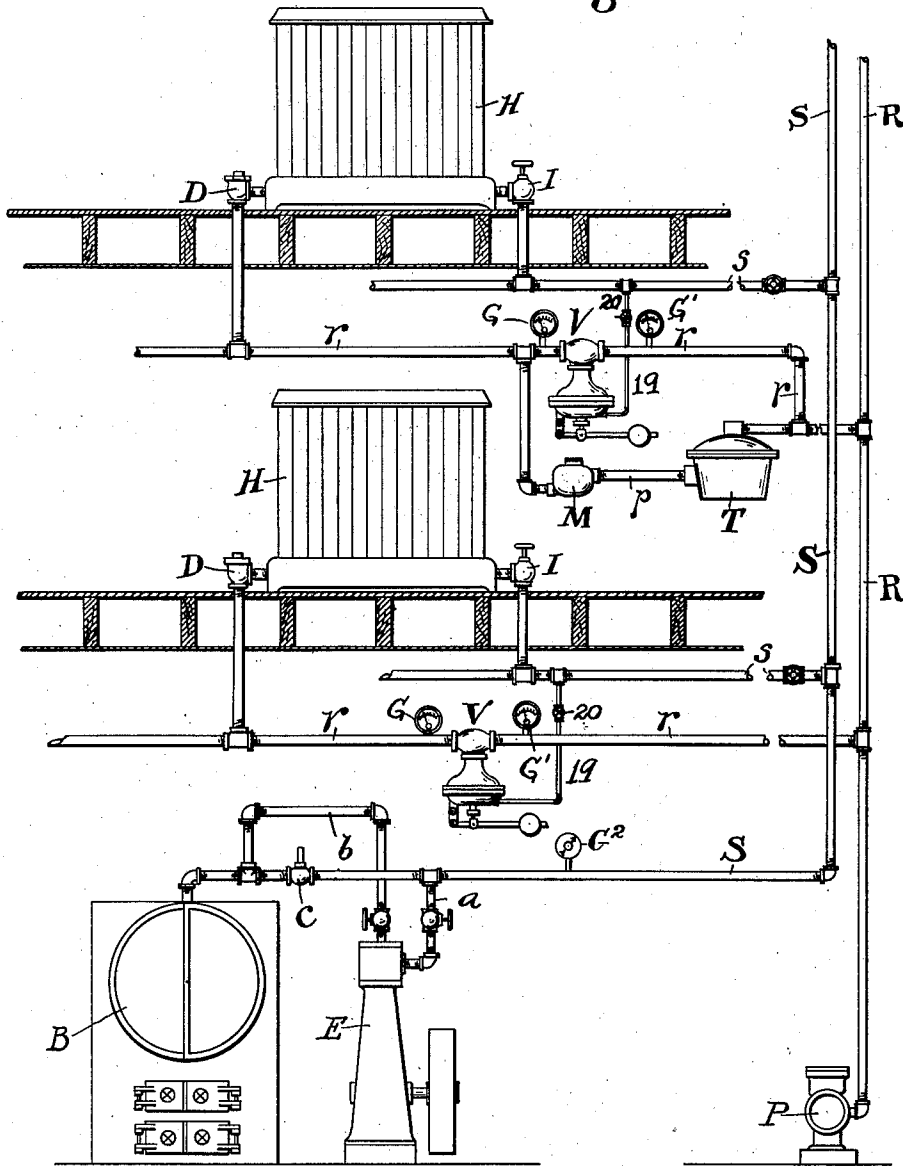
J. A. DONNELLY.
STEAM HEATING APPARATUS.
APPLICATION FILED JUNE 11, 1904.

1,047,622.

Patented Dec. 17, 1912.

2 SHEETS-SHEET 1.

Fig. 1.



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V 2 SHEETS—SHEET 2.

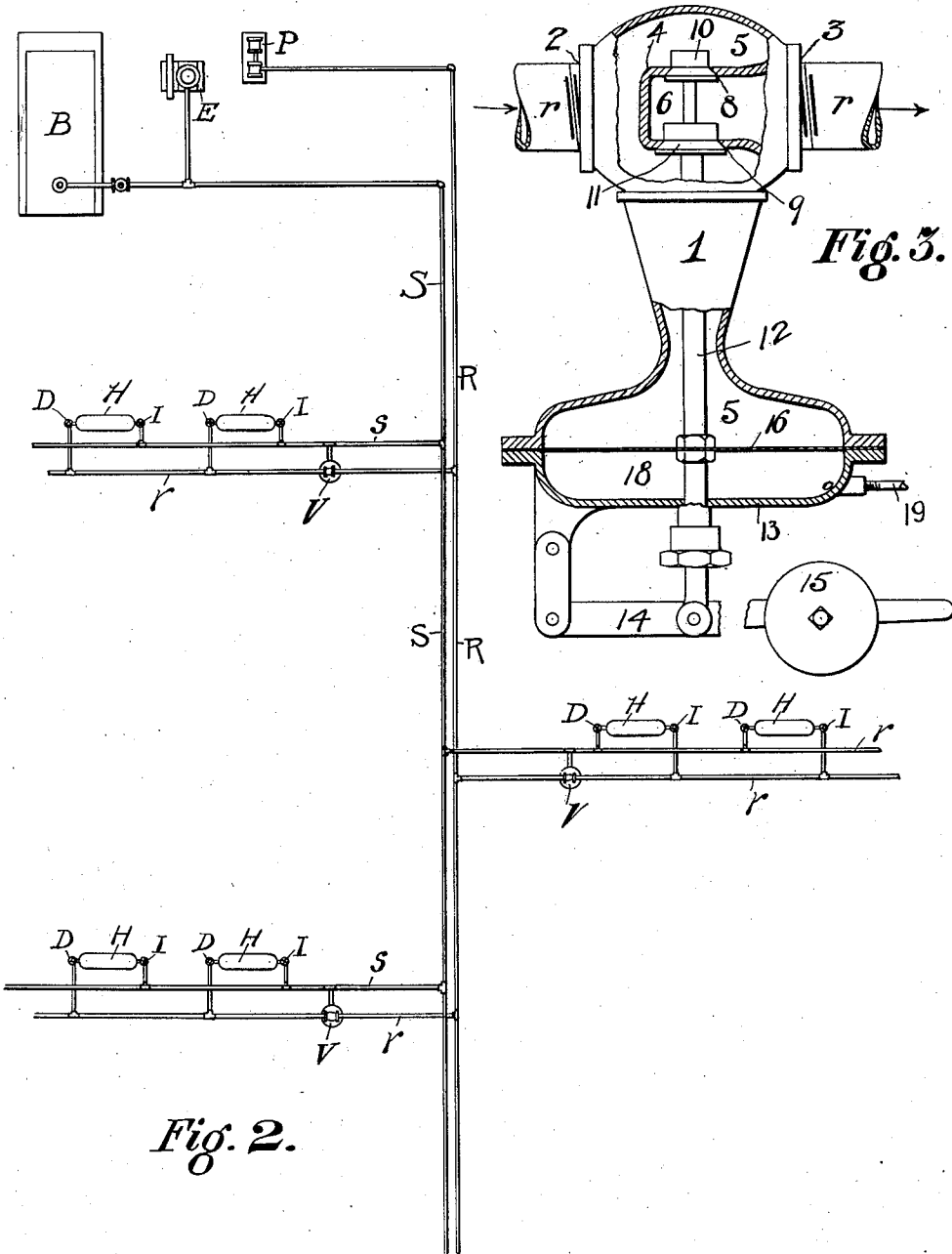


Fig. 2.

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STEAM-HEATING APPARATUS.

1,047,622.

Specification of Letters Patent.

Patented Dec. 17, 1912.

Application filed June 11, 1904. Serial No. 212,192.

To all whom it may concern:

Be it known that I, JAMES A. DONNELLY, a citizen of the United States of America, residing at New York city, in the county of Kings and State of New York, have invented certain new and useful Improvements in Steam-Heating Apparatus, of which the following is a specification.

My invention relates to certain novel and useful improvements in circulating systems, and has particular application to a heating system.

In the present application, by way of illustration, I show and describe my invention employed in connection with a steam radiator system to which it has been found by experience to be very adaptable.

In carrying out my invention it is my purpose to provide a system embodying the desired features of economy of operation and regularity of action.

The invention consists in the improvements set forth in and falling within the scope of the appended claims.

In the accompanying drawings wherein one form of my invention is delineated, Figure 1 represents a diagrammatic view of a steam heating apparatus embodying my invention; Fig. 2 is a similar view showing the system as extending throughout a number of detached buildings; Fig. 3 is an elevation partly in section, illustrating the construction of the controlling valve, used in the present instance.

Similar letters and numerals of reference designate corresponding parts throughout the several views of the drawings.

Referring now to the accompanying drawings in detail, and particularly to Fig. 1 thereof, wherein I have shown my invention applied to the vacuum system, the letter B designates a steam generator, the steam main *b* of which is connected with an engine E of a usual type. The exhaust from the engine is connected by a pipe *a* with the steam supply pipe or feeder S supplying the branch pipes *s*. A suitable reducing valve *c* is inserted into the steam main through which live steam may be caused to enter the steam pipe when desired.

P is a vacuum pump or other exhausting apparatus which is in the present instance shown as attached to the main return R to which the several branch returns *r* from the several series of radiators or radiating devices H are connected.

D are restricting means, such as the ordinary automatic branch valves, and are placed at the outlet ends of the radiators H, which latter are, as shown, in independent communication with the common return, there, of course, being one of such restricting valves for each radiator.

In the system herein shown, instead of following the usual custom and connecting the main returns, herein indicated by R, directly with the outlet ends of the radiators H through the branch returns *r* for the purpose of permitting the outflow of fluids from the radiator, I provide a novel form of construction described in detail hereafter. One of the essentials of this construction is a controlling means, in the present instance, a valve V. In the drawings I show this valve established or positioned in the branch return *r*; said valve having an inlet and outlet to which the pipes forming the return are coupled. While the controlling element or valve may be of any desired and suitable construction, I have found that for many purposes a valve of the nature shown in the drawings is satisfactory. This valve is of the type commonly known as a diaphragm valve and comprises the valve casing 1 having the inlet 2 and the outlet 3. At the top of the casing is formed a U-shaped partition which cuts off a portion of the chamber 5 forming a chamber 6 communicating with the outlet 3, while the chamber 5 communicates with the inlet 2. In the partition 4 are formed two thoroughfares 8 and 9 arranged in vertical line, and controlled respectively by the valve pieces 10 and 11 mounted upon a common valve rod 12. The lower end of the valve rod 12 passes through a cap 13 closing the bottom of the casing and is connected with a lever 14 having thereon an adjustable weight 15. To the valve rod 12 is attached a diaphragm 16 which is secured to the casing by the cap 13, and the chamber 18 so formed is connected with the branch steam supply pipe *s* by means of a small branch pipe 19 controlled by a suitable valve 20. This chamber forms the high pressure chamber of the valve. The chamber 5 will fill with water of condensation which passes off to the pump or other point of discharge through the return.

Having described the mechanical construction of the valve I will now detail the means by which it is operated and certain functions it is designed to perform. It is

operated as follows: Assuming fluid to be flowing through the main S at a relatively high pressure, such fluid passing through the branch 19 into the chamber 18 below the diaphragm normally tends to close the valve and were no counterforce employed the valve would be held closed. But when the circulation of the fluid brings it back through the return *r* to the valve V, it flows into the chamber 5 and exerts a pressure upon the upper side of the diaphragm 16. But as this pressure from the return is relatively lower than the pressure flowing from the supply into the chamber 18, it is necessary to employ an additional force to operate and open or unseat the valve. In the drawings I have shown this additional force, a weight as at 15, but it is to be understood that any equivalent or convenient means of supplementing the initial valve opening force may be adopted. Thus it will be seen that the pressure from the return plus the action of the weight serves to balance the pressure from the high pressure or supply main sufficiently to unseat the valve and establish the same in position to maintain a constant difference in pressure between the branch supply and return pipes of the individual radiators or other branch systems. In connection with this and analogous systems a controlling agent such, for instance, as this valve, installed substantially as above recited, is capable of performing a number of important functions, among which it might be mentioned that it controls the flow of fluid from a plurality or series of heating agents, such as radiators, which communicate with a common return pipe or main, in which common return the controller is situated. For instance, each radiator being in independent communication with the return branch, there flows from such radiator to the branch a fluid matter which may comprise steam, water or air, or a mixture of all or any of these. And the air and water flowing from all the radiators may be controlled and removed by this common controlling element. For example, fluids flowing through the automatic restriction valves at the outlet of the radiators passes into the common return branch and thence into the controlling valve. Pressure being thus raised in the return branch the fluids escape through the now open controlling valve to the main return or other suitable point of discharge. Thus fluids flowing from a series or plurality of radiators through the automatic restricting valve thereof are automatically controlled by a common controlling element. Furthermore, I have found that in consequence of the wide variation of pressure in different parts of main pipes, according to the distance of such parts from the source of supply and exhaust, a uniform and outward flow through the separate radiators or

branch systems is difficult of attainment without some expedient to preserve a proper difference of pressure between the inlet and outlet and individual radiators or control systems, regardless of changes of pressure in the main supply and return. Therefore, I employ as an expedient the described valve, or similar element, in the return of the branch systems or radiators, said valve so controlled by the difference of pressure existing between the inlet and outlet of the radiators or control systems as to react on said difference of pressure and to keep it constant.

It will be readily understood that as the pressure in the chamber 5 varies, which pressure corresponds to the pressure in the radiator return *r*, the change of pressure on the diaphragm 16 will either increase or decrease the openings at the valves 10 and 11, thus permitting more or less escape of fluid from said return branch. When the pressure falls in the return, that is, in the chamber 15, the decreased area of opening at the thoroughfares 8 and 9 serves to check the passage of fluid between the radiator H and the differential valve V, so that the pressure at this point is increased and thus maintains constant the predetermined difference of pressure between the branch supply and the part of the branch return included between the radiator and the differential valve. When the pressure in the radiator return, that is, in the chamber 5, rises, the pressure on the upper side of the diaphragm 16 forces the same downwardly and increases the openings at the thoroughfares 8 and 9. This causes an increased flow in the return, and the fluid is rapidly discharged, thus tending to diminish the pressure in the return and so maintaining difference of pressure. The degree of difference of pressure to be maintained is determined by the position of the weight 15 on the lever 14 and may be varied as conditions require.

In the upper part of Fig. 1, I have shown the branch return *r* provided with a by-pass *p* containing a meter M and a steam trap T.

In Fig. 2 I have shown the system extended through several detached buildings, S, being steam supply, R, R, the main returns, H the radiating devices, *s*, *r* the branch supply and return pipes respectively, V the controlling valves; B the boiler, E the engine, P, a vacuum pump.

It is of course to be understood that I do not wish to restrict myself to any particular arrangement of the system or the construction of its parts or to the source of steam supply, or whether it be a high or a low pressure, as it is evident that changes can be made without departing from the spirit of my invention. When the pressure of the source of steam supply is substantially constant, it will be understood that the valve 20

in the pipe connection between the steam pipe *s* and the valve *V* may be closed to cut off the lower pressure chamber of said valve *V* from the steam pipe *s*, under which conditions the difference of pressure will be kept constant. It will be understood that the valve 20 is open when it is desired to employ the valve *V* in maintaining the difference of pressure constant when the pressure of steam in the pipe *s* is not constant. In practice, I place in the branch supply pipe *s* the gage *G*² and in the branch returns the gage *G* and *G*'.

Having thus described my invention, what I claim is:—

1. In a heating system, the combination of a supply pipe, a return pipe, a plurality of heat-distributing systems each in independent communication with said supply and return pipes, and means to control the circulation through said heat-distributing systems controlled by the relative pressures in the inlets and outlets thereof.

2. In a heating system, the combination of a supply pipe, a return pipe, a plurality of heat-distributing systems each in independent communication with said supply and return pipes, and means for establishing and maintaining a predetermined difference in pressure between the inlet and outlet of any of said heat-distributing systems.

3. In a heating system, the combination of a supply pipe, a return pipe, a plurality of heat-distributing systems each in independent communication with said supply and return pipes, a valve in the return from any heat distributing system to the return pipe, and means for controlling said valve by the differential pressures in the inlet and outlet to said heat-distributing system.

4. In a steam heating system, the combination with the main supply pipe and the main return, of a series of radiating sections or systems, branch supply and return pipes connecting said radiating sections or systems with the supply and return mains, a controlling valve in the branch return pipe of each of said radiating sections or systems, and a pressure motor device controlling said valve and controlled by the differential pressures in the branch supply pipes and in the branch returns between said valve and the radiating section or system.

5. In a heating system, the combination of a supply pipe, a return pipe, a plurality of heat-distributing systems each in independent communication with said supply and return pipes and each containing one or more radiating devices, means at the outlets of said radiating devices to restrict the flow, and means to control the circulation through said heat-distributing systems controlled by the relative pressure in the inlets and outlets thereof.

6. In a heating system, the combination

of a supply pipe, a return pipe, a plurality of heat-distributing systems each in independent communication with said supply and return pipes and each containing one or more radiating devices, automatic valves at the outlets of said radiating devices, and means to control the circulation through said heat-distributing systems controlled by the relative pressures in the inlets and outlets thereof.

7. In a heating system, the combination of a supply pipe, a return pipe, a plurality of heat-distributing systems each in independent communication with said supply and return pipes and each containing one or more radiating devices, means at the outlets of said radiating devices to restrict the flow, and means for establishing and maintaining a predetermined difference in pressure between the inlet and outlet of any of said heat-distributing systems.

8. In a heating system, the combination of a supply pipe, a return pipe, a plurality of heat-distributing systems each in independent communication with said supply and return pipes and each containing one or more radiating devices, automatic valves at the outlets of said radiating devices, and means for establishing and maintaining a predetermined difference in pressure between the inlet and outlet of any of said heat-distributing systems.

9. In a heating system, the combination of a supply pipe, a return pipe, a plurality of heat-distributing systems each in independent communication with said supply and return pipes and each containing one or more radiating devices, means at the outlets of said radiating devices to restrict the flow, a valve in the return from any heat-distributing system to the return pipe, and means for controlling said valve by the differential pressures in the inlet and outlet to said heat-distributing system.

10. In a heating system, the combination of a supply pipe, a return pipe, a plurality of heat-distributing systems each in independent communication with said supply and return pipes and each containing one or more radiating devices, automatic valves at the outlets of said radiating devices, a valve in the return from any heat-distributing system to the return pipe, and means for controlling said valve by the differential pressures in the inlet and outlet to said heat-distributing system.

11. In a steam heating system, the combination with the main supply pipe, and the main return, of a series of radiating sections or systems comprising one or more radiating devices, means at the outlets of said radiating devices to restrict the flow, branch supply and return pipes connecting said radiating sections or systems with the supply and return mains, a controlling valve

in the branch return pipe of each of said radiating sections or systems, and a pressure motor device controlling said valve and controlled by the differential pressures in the branch supply pipes and in the branch returns between said valve and the radiating section or system.

12. In a steam heating system, the combination with the main supply pipe, and the main return, of a series of radiating sections or systems comprising one or more radiating devices, automatic valves at the outlets of said radiating devices, branch supply and return pipes connecting said radiating sections or systems with the sup-

ply and return mains, a controlling valve in the branch return pipe of each of said radiating sections or systems, and a pressure motor device controlling said valve, and controlled by the differential pressures in the branch supply pipe and in the branch return between the said valve and the radiating sections or systems.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JAMES A. DONNELLY.

Witnesses:

A. FABER DU FAUR, Jr.,
RAENA H. YUDIZKY.