No. 847,934. PATENTED MAR. 19, 1907.

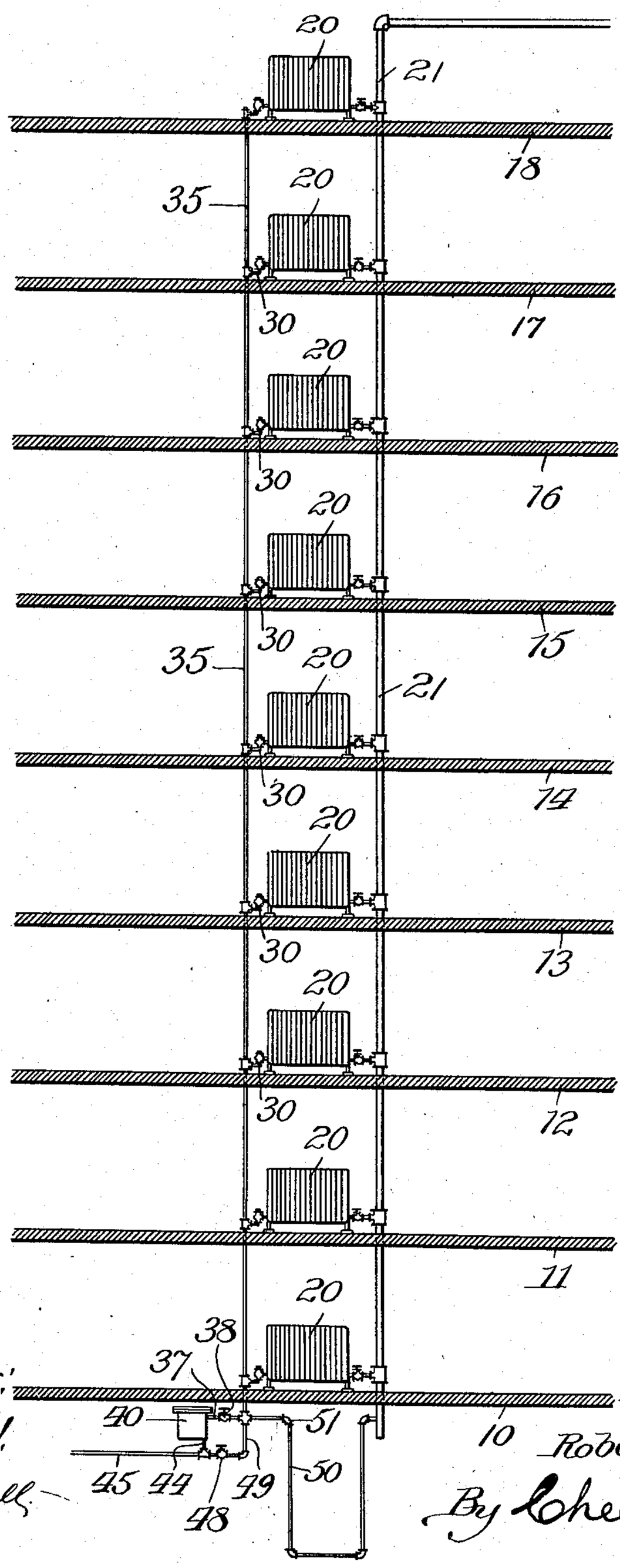
R. L. GIFFORD.

HEATING SYSTEM.

APPLICATION FILED OCT. 11, 1905.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

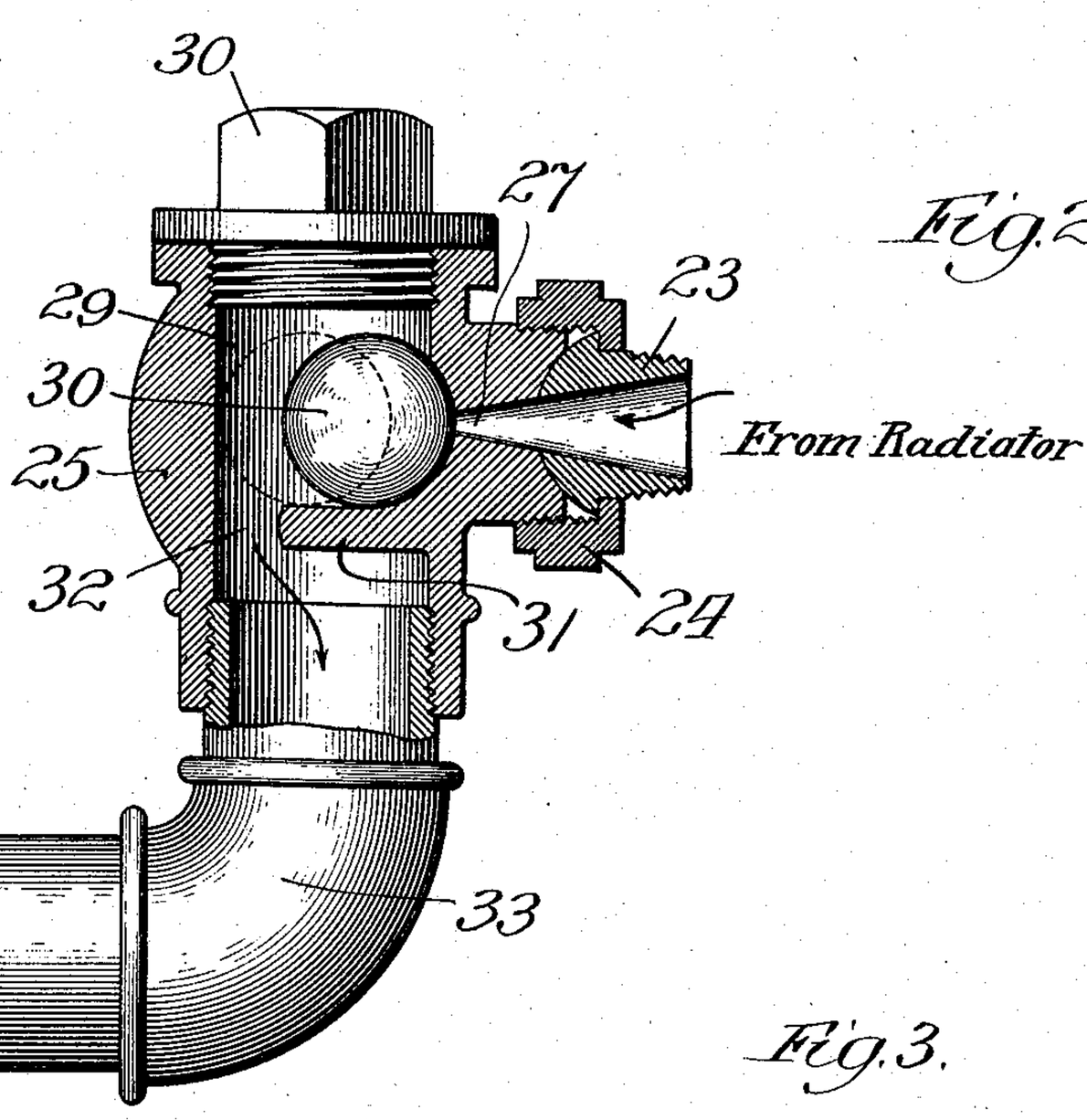

Fig. 2.

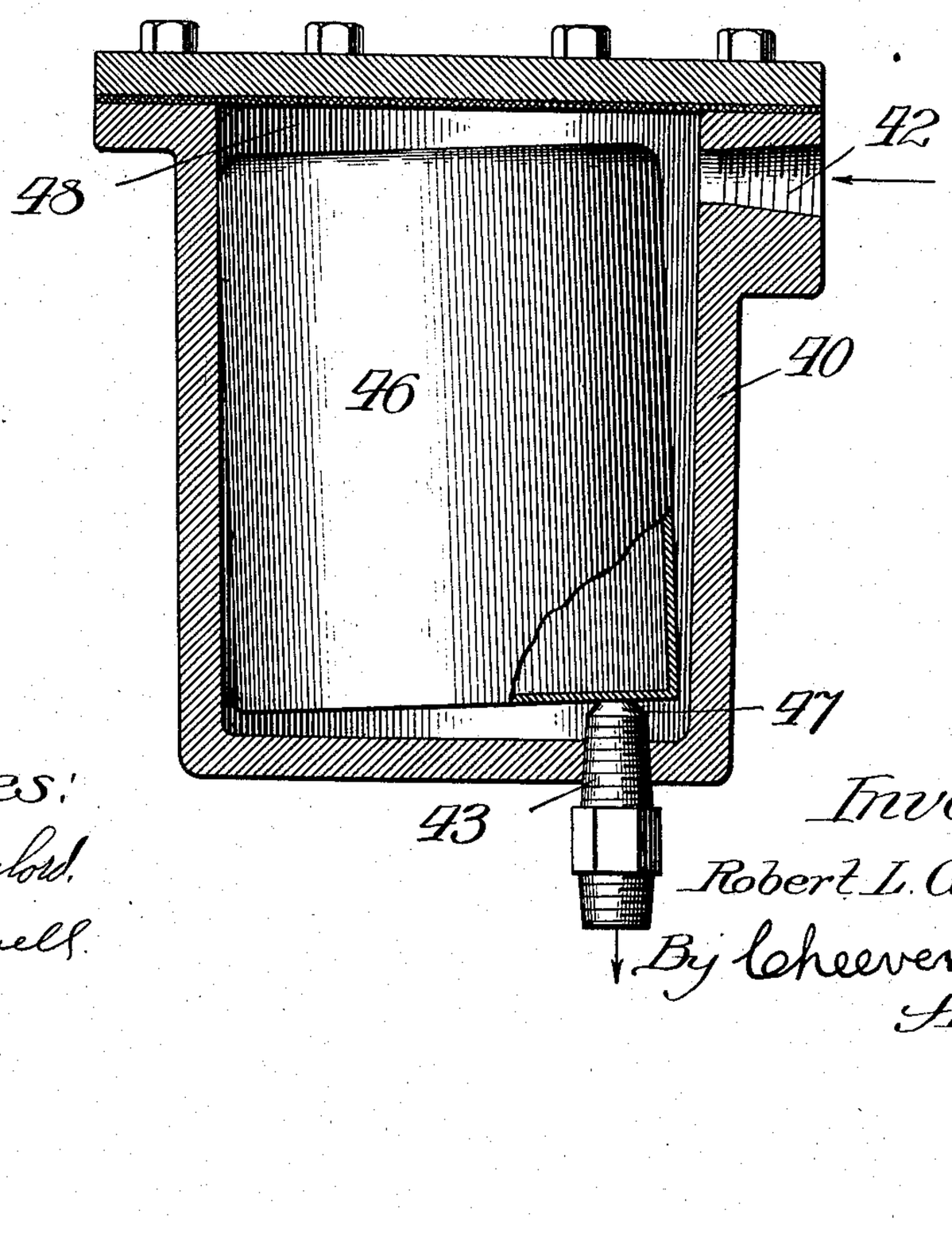

Fig. 3.

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UNITED STATES PATENT OFFICE.

ROBERT L. GIFFORD, OF CHICAGO, ILLINOIS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO ILLINOIS ENGINEERING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

HEATING SYSTEM.

No. 847,934. Specification of Letters Patent. Patented March 19, 1907.

Application filed October 11, 1905. Serial No. 282,315.

To all whom it may concern:

Be it known that I, ROBERT L. GIFFORD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Heating Systems, of which the following is a specification.

My invention relates to heating systems, and particularly to exhaust heating systems where exhaust-steam from an engine or other steam-actuated machine is used at as low pressure as will give proper circulation.

The object of my invention is to provide a steam-heating system of the general class described in which a thorough circulation through all of the radiators, coils, or other steam-heating units is insured, with a minimum of expense in installing the system and a minimum of expense in taking care of it and keeping it in operative condition.

In systems now in general use it is the practice to connect to the return end of each radiator or other steam-radiating unit a vacuum-valve and to connect the opposite end of each of these valves to a pipe in which a partial vacuum is maintained by vacuum-pumps or equivalent mechanism. These vacuum-valves are attached to the opposite ends of the radiators or other radiating units from where the steam is admitted to such radiators, with the result that the partial vacuum in the pipe to which the vacuum-valves are connected, usually called the "return-pipe," causes the air and water of condensation in the particular radiator to which a particular valve is attached to flow through that valve into the return-pipe and thence under the action of the exhaust-pump or equivalent mechanism to flow out of the system. Valves embodying mechanism capable of accomplishing all that is required of these valves are quite complicated, and they are easily put out of adjustment by the scale and grease present in a heating system. Where from one thousand to two thousand five hundred of such devices are installed in a single heating system, as is frequently the case in modern large office-buildings, it becomes almost impossible to keep such valves working in proper condition, and this can only be done by employing a force of inspectors who constantly clean out and adjust the various valves in the system.

My invention consists in the mechanism by which I do away with all of the vacuum-valves at the radiators and allow the water of condensation to flow directly through a restricted opening in the radiators into the return-pipe and thence to the lower portion thereof, thereby as it flows converting the return-pipe into a Sprengel air-pump tube with its vacuum extending to all of the radiators attached to the return-pipe, with the result that the water of condensation flowing through this return-pipe performs all of the heretofore-described functions desired in such system.

My invention also consists in details for making this system operative which will be hereafter described and claimed as the specification proceeds.

In the drawings, Figure 1 is a sectional view through the floors of the building having mechanism of my invention applied thereto, showing such mechanism in full side elevation. Fig. 2 is a vertical sectional detail view of the return check-valve connected between each radiator and the return-pipe. Fig. 3 is a sectional detail view of an automatic vacuum-trap installed at the bottom of the return-pipe.

The details of this device are shown, described, and claimed in United States Patents Nos. 691,796 and 787,094.

Referring now to the drawings, numerals 10 to 18, inclusive, indicate successive floors of the building in which my system of heating is installed. On each floor I place one or more radiators 20, having their supply end connected to a steam-supply pipe 21 in the usual manner. I prefer to install these radiators so that so far as possible corresponding radiators on each floor will be directly over each other, as shown. In other words, in Fig. 1 I have simply shown one tier of radiators so connected. In a large building there are many such tiers of radiators. Into the opposite end of each radiator 20 from that at which the steam-supply pipe 21 is connected I secure a tailpiece 23 of ordinary construction and connect to it by a union 24 a valve 25, such as is shown in Fig. 2. This valve 25 has a restricted orifice 27 entering the radiator through the tailpiece 23, the orifice being proportioned to the size of the radiator to which the particular valve

containing this orifice is attached. This orifice 27 enters the main chamber 29 of the valve, in which is placed a ball 30, preferably of vulcanized rubber, to render the action of the valve noiseless. This ball 30 rests upon a ledge 31 and is adapted to roll back and forward across the chamber 29 of the valve to close the orifice 27 when the ball is in the full-line position of Fig. 2 and to leave it open when the ball is in the dotted-line position of Fig. 2. The chamber 29 of the valve has a downwardly-extending opening 32, not closed by the ball 30, entering the pipe 33. The opposite end of each pipe 33 is directly connected to a vertical return-pipe 35, extending from top to bottom of the building, and preferably in as near a vertical line as possible, though it may be inclined or offset somewhat, either in whole or in part, without departing from my invention.

Attached to the bottom of each return-pipe 35, by means of a pipe 37, preferably controlled by a hand-valve 38 or other suitable means, is an automatic vacuum-trap 40, such as is shown in Fig. 3. This trap consists of the exterior casing, as shown, having an entrance-orifice 42, connected with the pipe 37, and an exit-orifice pipe 43, connected with the pipe 44. Within the casing of this trap 40 is a float 46, adapted to normally rest upon the upper end 47 of the orifice-pipe 43 in an inclined manner to control the entrance to said pipe 43, as will more fully appear from an inspection of the patents heretofore mentioned. The result of this construction is that when there is no liquid in the trap 40 the entrance 47 of the orifice-pipe 43 will be partially open, so that air, gas, or liquid may flow from the interior 48 of the trap 40 through the entrance 47 of the orifice 43 into the pipe 44, and that as water comes into the interior 48 of the trap 40 it causes the float 46 to lift up clear of the entrance 47 of the orifice-pipe 43, and thereby allow the water and entrained air to freely flow through the orifice 42 and the interior 48 out of the orifice-pipe 43. When now the supply of water diminishes to a point below the line at which a sufficient quantity is present to lift the float, the float settles upon the opening 47, and thereby checks the flow of water through the device, and thereby constitutes a water seal against the flow of steam through the device in the direction described, and indicated by the arrows, should such steam be present in the return-pipe 35 until such time as more water of condensation comes down through the return-pipe and again lifts the float.

To the pipe 45 I attach, beyond the figure, an exhaust-pump. (Not shown.) The pipes 45 from all of the return-pipes 35 of the building or plant are connected to one common exhaust-pump or equivalent mechanism. In the drawing I have shown a pipe connection 49, having in it a hand-valve 48, connecting the return-pipe 35 to the pipe 45. This is simply a by-pass which can be used in an emergency to allow the contents of the return-pipe to pass directly into the pipe 45 without going through the trap 40. I have also shown the main steam-supply pipe 21, connected to the return-pipe 35 by a pipe 50. This is to allow any condensation occurring in the steam-supply pipe to settle into this U-shaped pipe 50, which when full of water up to the elbows 51 or thereabout forms a water seal through which low-pressure steam cannot escape while the water passes over into the trap 40.

Assuming now that the entire system shown in Fig. 1 is dry, I start the exhaust-pump, heretofore described, which produces a vacuum in each pipe 45. This vacuum extends through the trap 40 into the return-pipe 35, thence through orifices 27 into each radiator, thereby producing a partial vacuum in each radiator. I now turn on steam to the supply-pipes 21, which under the action of the vacuum in each radiator flows into such radiators. As soon as this occurs the cold air on the outside of the radiators causes the steam in them to begin to condense, which causes water of condensation to form and flow, under the action of the vacuum heretofore described, produced by the vacuum-pump, from the valves 25, thence through said valves and pipes 33 into the return-pipe 35. As soon as water thus begins to flow from the radiators attached to a particular return-pipe the small quantities of water flowing from each of the radiators come together at some point or points in the pipe, thereby creating a more or less solid column, piston, or plug of substantially vertically-falling water, which as it falls acts as a Sprengel air-pump and creates a vacuum above it in the return-pipe. This vacuum serves in each radiator the function heretofore performed by the vacuum produced by the vacuum-pump, causing more steam to be drawn into each radiator and more water of condensation to be drawn through the orifice 27 and into the return-pipe, which new water of condensation joins the falling water in the return-pipe, or a new section of it, and thereby repeats the operation described. The system thereby becomes automatic, and the operation of the mechanically-moved vacuum-pump may be wholly discontinued as long as the system remains in continuous operation. When the device is operating in this way without the aid of a mechanically-manipulated air-pump, (not shown,) the outlet-pipe from the trap is in open communication with the atmosphere, and owing to the external air-pressure thus admitted to the trap water will accumulate in the lower portion of the pipe 35. The height of the effective water column thus formed in said

pipe in accordance with well-known principles, will be a measure of the degree of vacuum produced in the system. In order to prevent such column of water entering the lowest radiator or radiators of the system, thereby impairing the working of the system, I in actual practice make the distance between the outlet 30 of the lowest radiator and the outlet through the trap a distance greater than this effective water column. Owing to the fact that the Sprengel pump here described cannot maintain a perfect vacuum in the system, because of the constant admission of steam and water from the radiators of the system to the return-pipe 35, this effective water column is not of a sufficient height to cause any inconvenience in construction.

As the column, piston, or plug of falling water heretofore described reaches the bottom of the return-pipe 35, in which it is formed, it enters the trap 40 and automatically passes through it into the pipe 45 and thence out of the system, the trap 40 operating in the manner described to regulate the flow of water through it and maintain enough water in the return-pipe to which it is attached below the lowest radiator in order to maintain a water seal, so that the return-pipe will continue to act as a Sprengel air-pump in the manner described. As long as the bottom of the return-pipe is thus kept sealed and the system remains in operation—that is, steam continues to be supplied in the supply-pipe—the return-pipe will continue to act as a Sprengel air-pump in the manner described, whereas were the trap 40 or equivalent mechanism omitted the water would run out of the return-pipe, thereby destroying the vacuum in the tube and making a continuous use of an exhaust-pump a necessity.

In practice I prefer to run the exhaust-pump continuously, but only for the purpose of creating a vacuum in the pipe 44 up to the trap, so as to insure immediate and proper flow of water from the return-pipe through the trap 40, as described. This permits the use of a relatively small pump compared to the pumps necessary in other systems heretofore described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A heating system comprising one or more radiators or units of radiation, means for supplying steam to said radiator or radiators, a return-pipe, having its upper portion connected to said radiator or radiators through restricted, normally open orifices, and its lower end extending below said radiator or the lowest of said radiators, of such interior diameter that the water of condensation, from the radiator or radiators, falling therein forms one or more pistons of a pump, and mechanism adapted to maintain a water seal in the lower portion of said return-pipe for the purposes set forth.

2. A heating system comprising one or more radiators or units of radiation, means for supplying steam to said radiator or radiators, a return-pipe, having its upper part connected to said radiator or radiators through restricted, normally open orifices, and its lower end extending below said radiator or the lowest of said radiators, of such interior diameter that the water of condensation, from the radiator or radiators, falling therein forms one or more pistons of a pump, mechanism adapted to maintain a water seal in the lower portion of said return-pipe and an automatic check-valve between each radiator and the return-pipe adapted to prevent the passage of the contents of said return-pipe into the radiator for the purposes set forth.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

ROBERT L. GIFFORD.

Witnesses:
CAROLYN RAFTERY,
DWIGHT B. CHEEVER.