No. 841,389. PATENTED JAN. 15, 1907.

F. C. GOFF.

STEAM HEATING SYSTEM.

APPLICATION FILED JULY 10, 1906.

2 SHEETS—SHEET 1.

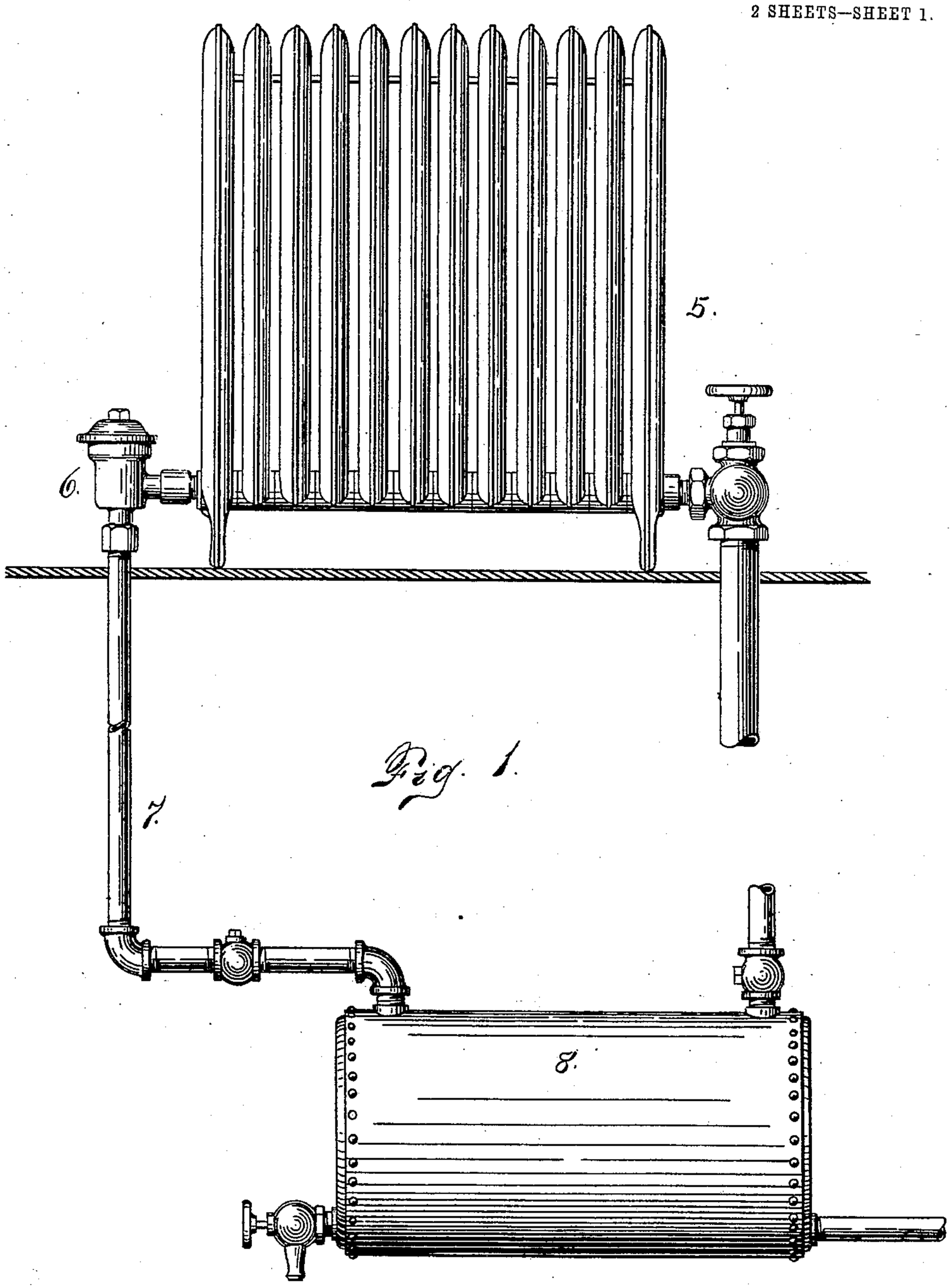

Fig. 1.

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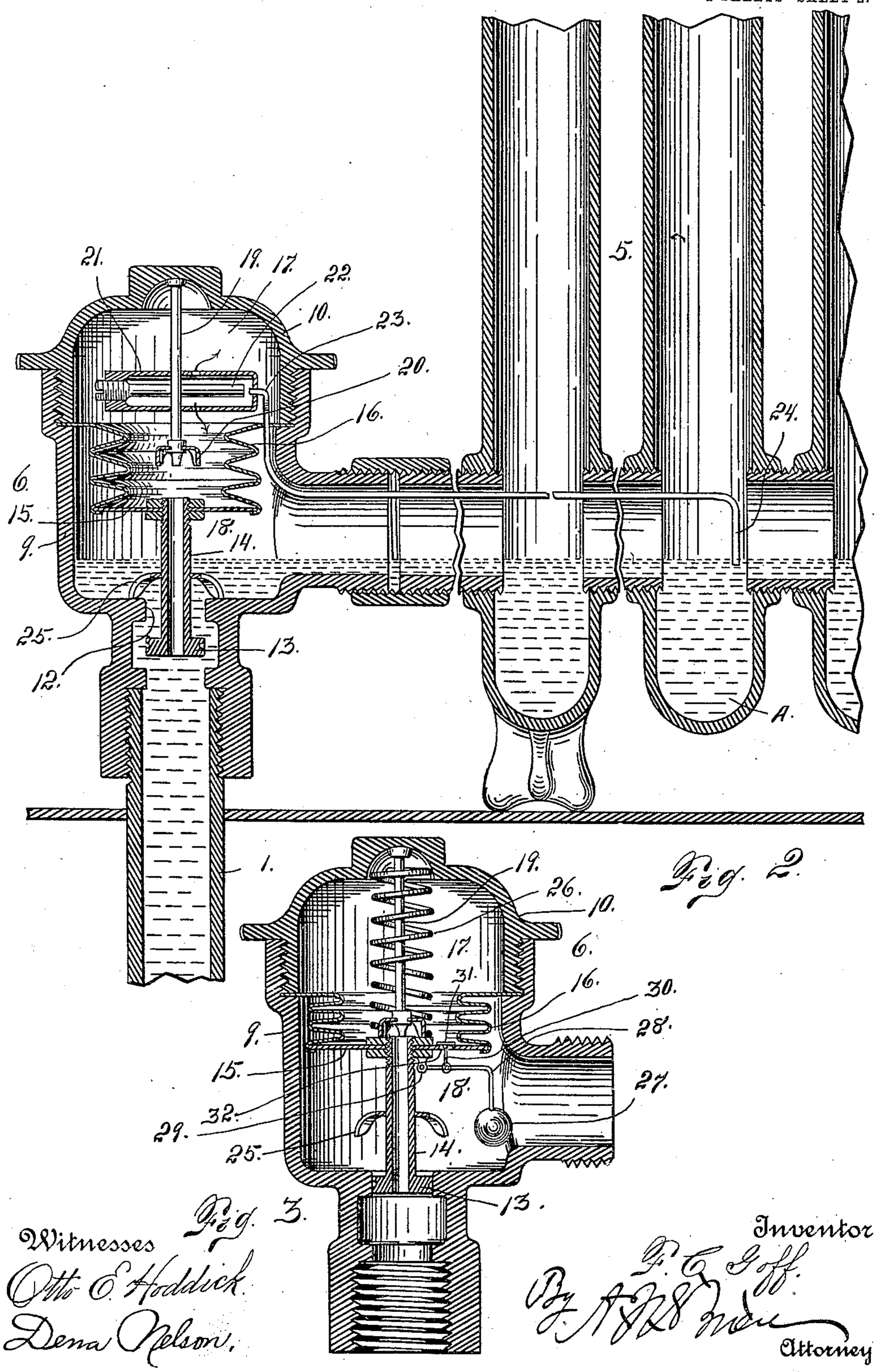

Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

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STEAM-HEATING SYSTEM.

No. 841,389. Specification of Letters Patent. Patented Jan. 15, 1907.

Application filed July 10, 1906. Serial No. 325,525.

To all whom it may concern:

Be it known that I, FRANK C. GOFF, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Steam-Heating Systems; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in steam-heating systems of the class in which a motor-valve is employed for ridding the system of the water of condensation.

One of the novel features of my improved construction is a special construction of motor for operating the valve-piece, the said motor including a bellows-like portion whereby the motor is more sensitive to the actuating-fluid pressure than is the case with motors of ordinary construction.

The ordinary constructions of motor, so far as I am aware, consist either of spring-held pistons slidable in the valve-casing or diaphragms secured at their edges and whose movement is principally due to their elasticity or stretching capacity. In either case as the pressure continues to act on the motor the power required to actuate it increases, since the tension of the spring behind the piston in the one case and the tension of the elastic body in the other case increases. In order to overcome this difficulty, to a large extent at least, the movable portion of my improved motor, or the part upon which I rely for actuating the valve, consists of a bellows-like structure having one or more folds, depending upon the degree of movement required. With this structure the pressure required to actuate it within the limits required for operating the valve is practically uniform or does not vary to any appreciable extent.

Another feature of my improved construction consists in locating an expansion-tube within the compartment adjacent the outer side of the motor, the said expansion device being adapted to close or cut off communication between the compartment on the outer side of the motor and the fluid pressure of the system, whereby the pressure, acting on the opposite side of the motor, serves to keep the valve closed except when there is sufficient accumulation of water in the system to seal the passage leading to the compartment on the outer side of the motor, in which event the expansion device is cooled and contracts sufficiently to open the said passage, whereby the pressure on opposite sides of the motor is equalized. In this event the motor through its own tension or through the assistance of a spring, as may be desired, acts to open the valve and allow the water of condensation to escape. The motor may be operated either through the instrumentality of the pressure within the system or an exhausting device connected with the return-pipe or both combined, as may be desired.

Having briefly outlined my improved construction I will proceed to describe the same in detail, reference being made to the accompanying drawings in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is an elevation showing my motor-valve connected with the system and also with an exhausting device. Fig. 2 is a fragmentary section of the system, shown on a larger scale, the valve mechanism being also sectionized. Fig. 3 is a sectional view of the valve, showing a slightly-modified form of construction.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a radiating device; 6, the valve; 7, the return-pipe; and 8, an exhausting device connected with the return-pipe.

The valve 6 is composed of a casing having a body part 9 and a screw-cap 10. This casing is suitably connected with the radiating device. The bottom of the valve-casing is provided with an opening 12, adapted to be closed by a valve 13, provided with a hollow stem 14, to whose extremity remote from the valve is connected a diaphragm 15, attached to the bellows portion 16 of the motor. The extremity of the motor remote from the valve-stem is held in place by the screw-cap 10.

The casing is divided by the motor into two compartments, (designated 17 and 18, respectively.) Located directly above the valve-stem is a rod 19, attached to the top of the screw-cap 10. The lower extremity of this rod is provided with a seat 20, adapted to engage the upper extremity of the valve-

stem and limit the upward or closing movement of the valve and prevent the latter from moving farther than is necessary for closing purposes.

Within the compartment 17 of the valve-casing is located a tubular device 21, in which is adjustably mounted an expansion-tube 22. Entering one extremity of the tubular device is one extremity of a small pipe 23, whose opposite extremity is located at any desired part of the system, as shown at 24. Both ends of this pipe are open when the system is not in use.

If we assume now that the system is not in use and that the valve 13 is open or in its normal position, the operation of the device will be as follows: When the steam is first turned into the system, it will enter the valve-casing on both sides of the motor. The expansion-tube 22 will shortly close the pipe 23, thus cutting off communication between the pressure of the system and the compartment 17 on the outside of the motor. The pressure then on the opposite side of the motor will serve to close the valve, since the diaphragm part 15 is of greater surface area than the valve itself. However, as the water of condensation (designated A in the drawings) accumulates in the system and seals the extremity 24 of the pipe 23 the expansion-tube 22 will soon cool sufficiently to cause it to contract and open the adjacent extremity of the pipe 23, allowing the water to enter the compartment 17, whereby the pressure is equalized in the compartments 17 and 18. The tension of the bellows feature of the motor will then act to open the valve to allow the water of condensation to escape. As soon as this water escapes the steam will again enter the chamber 17 through the pipe 24 and the temperature of the expansion-tube will be raised sufficiently to cause it to expand and close the pipe 24, in which event the pressure in the chamber 17 will be reduced below what it is in the compartment 18, and the pressure will act on the motor to close the valve, as heretofore explained.

The hollow valve-stem 14 is provided with a suitable stop 25, which limits the downward movement of the valve during its opening movement.

The form of construction shown in Fig. 3 is substantially the same as that shown in Fig. 2, except that a spring 26 is employed to aid the bellows portion of the motor in imparting the opening movement to the valve, while a float 27 is employed for opening communication between the compartments 17 and 18 of the valve-casing. This float is provided with a lever-like arm 28, fulcrumed at 29. To this lever device is attached a stem 30, which passes through the bottom 15 of the motor and has a valve 31 attached to its upper extremity. The opening through which the stem 30 passes is somewhat larger than the stem in order to open communication between the compartments 17 and 18 when the float 27 is raised by the accumulation of water of condensation in the system. The operation of this device is substantially the same as that shown in the other forms of construction.

Assuming that steam is turned into the system, it will act on the diaphragm 15 of the motor to close the valve, and the latter will remain in this position until the water of condensation accumulates sufficiently to raise the float 27, in which event the small port 32 will be opened, allowing the pressure to equalize in the two compartments 17 and 18. The tension of the bellows portion of the motor acting in conjunction to the spring 26 will then act to open the valve.

In case an exhauster is used with my improved valve construction, if we assume that the exhauster is set in operation at the time the steam is turned into the system, the air will be exhausted from the system through the return or the discharge pipe. As soon as the steam enters the compartment 17 of the valve-casing it acts on the expansion-tube 22 to close the latter. The exhauster then acts to produce a vacuum within the chamber 17 to a sufficient extent to cause the bellows portion of the motor to move upwardly and close the valve 13. This condition will continue until the water of condensation is accumulated sufficiently to cool the expansion-tube 20 to cause the latter to open. In this event the influence of the exhauster will be the same in both compartments 17 and 18 of the valve-casing, with the result that the valve will be opened through the recoil of the bellows portion of the valve either alone or aided by an auxiliary spring 26, as shown in Fig. 3.

Having thus described my invention, what I claim is—

1. A motor-valve provided with a valve-piece, and a motor having a bellows-shaped portion for actuating the valve-piece, the motor being actuated by the differential pressures of the system acting directly on the opposite sides thereof.

2. A motor-valve provided with a casing, a motor-diaphragm separating the casing into two compartments, said diaphragm having a bellows-shaped portion, a valve-piece connected in operative relation with the said bellows portion, and means located in the compartment on the outer side of the motor and controlled by the conditions within the system for regulating the pressure on the outer side of the motor, whereby the valve is controlled by the differential pressure of the system acting directly on the opposite sides of the motor.

3. A motor-valve consisting of a casing, a diaphragm secured to the casing and separating the latter into two compartments, the

said diaphragm being provided with a bellows portion connected with the valve-piece, and a temperature-controlled device located in the casing-compartment on the outer side of the motor, and a pipe leading from the system to the said device, the end of the pipe adjacent the said device being automatically opened and closed by the conditions within the system, and the motor being directly acted on by the pressures within the system.

4. In a heating system, the combination of a radiating device, a discharge-pipe, a valve interposed between the outlet of the radiating device and the discharge-pipe, a pressure-motor for operating said valve, said motor having its opposite sides directly acted upon by the pressures within the system, a passage connecting the fluid-pressure compartment on the outside only of the motor with a portion of the pressure system beyond or outside of the inlet side of the valve device, and means for controlling the pressure on the outer side of said motor, said means being adapted to be controlled by the fluid passing through said passage.

5. A motor-valve comprising a casing, a valve-piece, and a motor having a bellows-shaped portion for actuating the valve-piece, the motor being directly actuated by the pressure within the system.

6. A motor-valve comprising a casing having an outlet-port, a valve-piece for controlling said port, and a motor having a bellows portion directly connected with the stem of the valve-piece for actuating the latter, the motor being located within the casing and directly acted on by the pressure within the system.

7. In a heating system, the combination of a radiating device, a discharge-pipe, a valve interposed between the outlet of the radiating device and the discharge-pipe, a pressure-motor for operating said valve, said motor having its opposite sides acted upon by the pressures within the system, and having a bellows portion directly connected with the valve-piece, and an exhauster connected with the discharge-pipe, the motor being directly acted on by the pressure within the system.

8. In a heating system, the combination of a radiating device, a discharge-pipe, a valve interposed between the outlet of the radiating device and the discharge-pipe, a pressure-motor for operating said valve, said motor having its opposite sides directly acted upon by the pressures within the system, a passage connecting the fluid-pressure compartment on the outside only of the motor with a portion of the pressure system beyond or outside of the inlet side of the valve device, and means for controlling the pressure on the outer side of said motor, said means being adapted to be controlled by the fluid passing through said passage, and an exhauster connected with the discharge-pipe.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK C. GOFF.

Witnesses:

A. F. O'BRIEN,

DENA NELSON.