No. 658,566. Patented Sept. 25, 1900.

J. F. DEEMS.

FEED WATER HEATER.

(Application filed Aug. 22, 1900.)

(No Model.) 2 Sheets—Sheet 1.

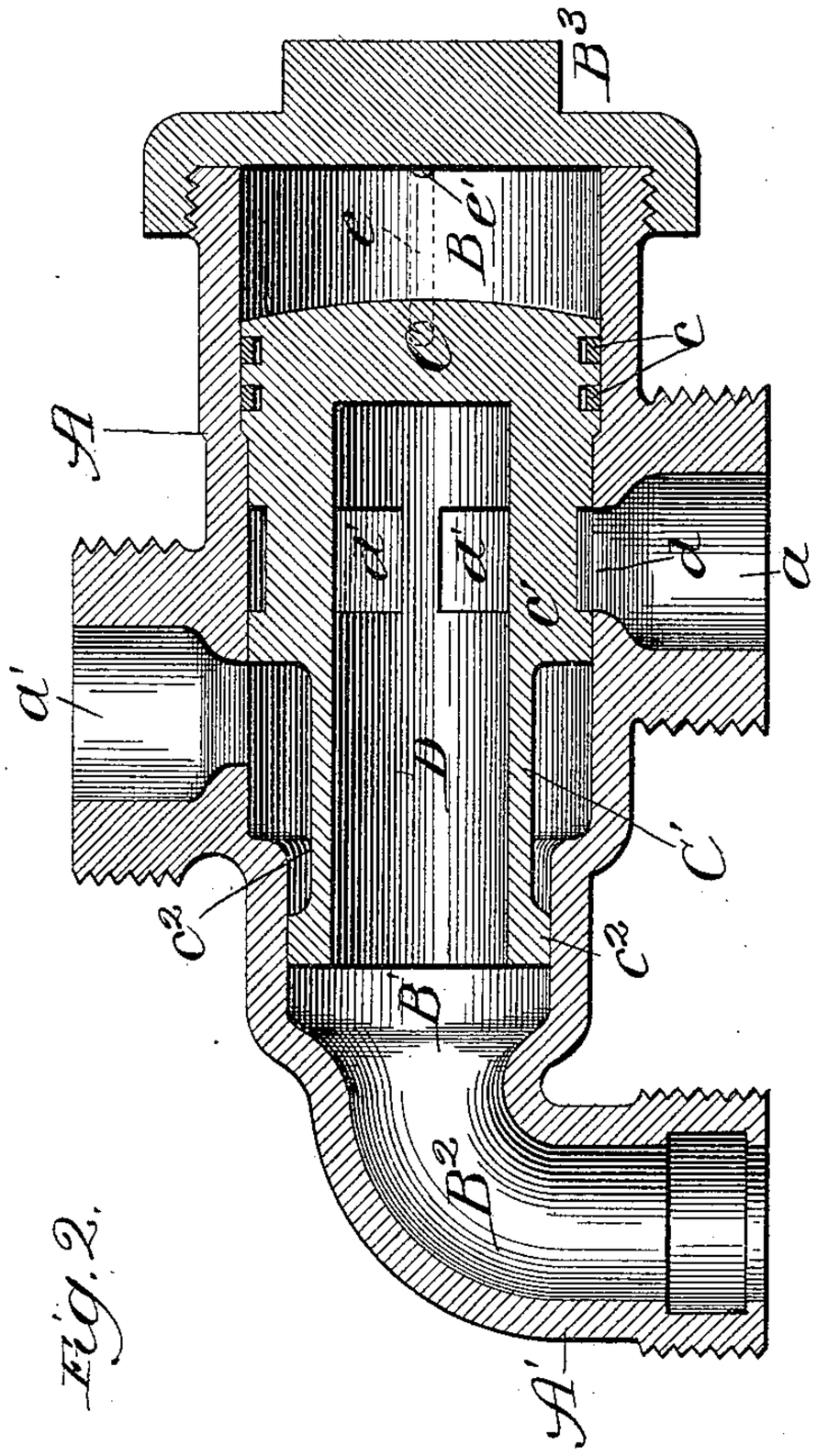

Fig. 2.

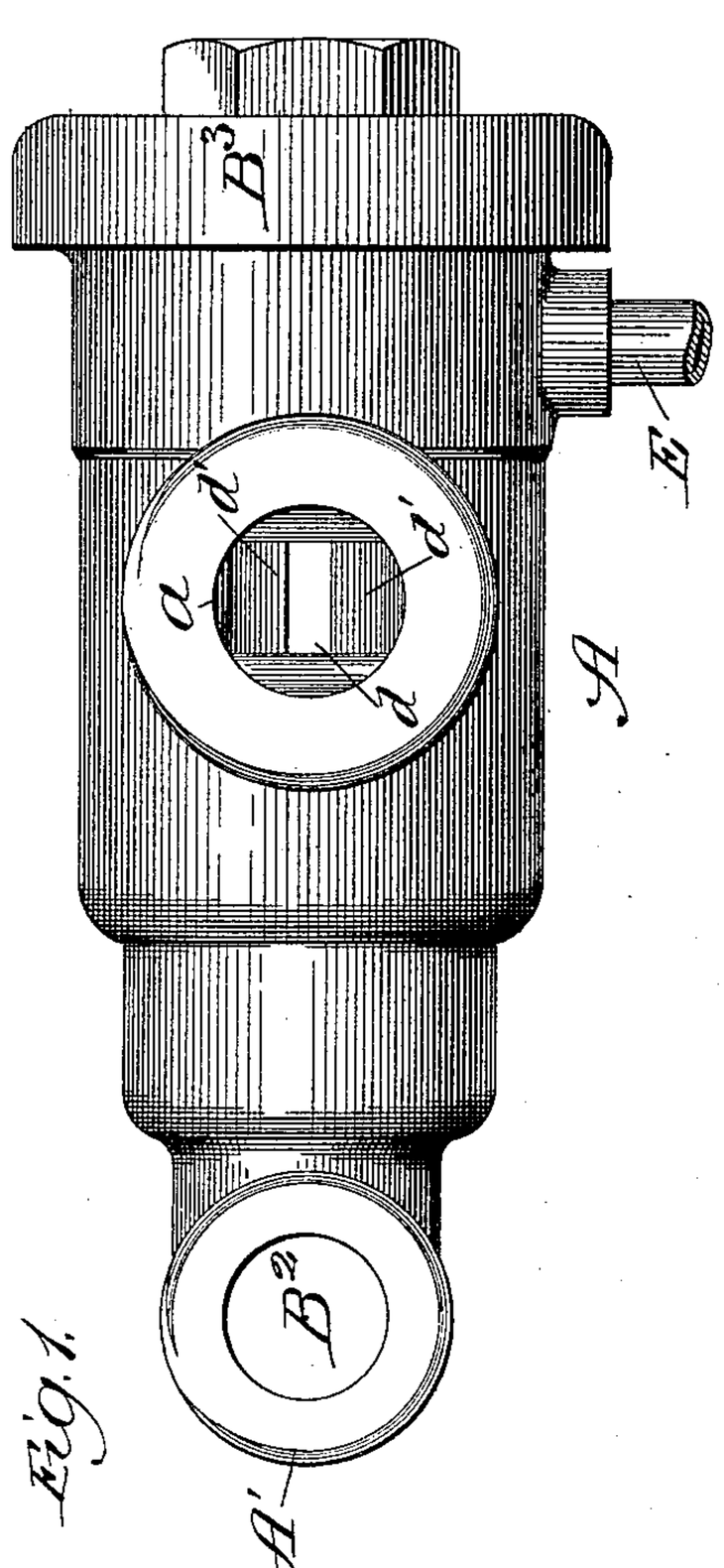

Fig. 1.

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Fig. 4.

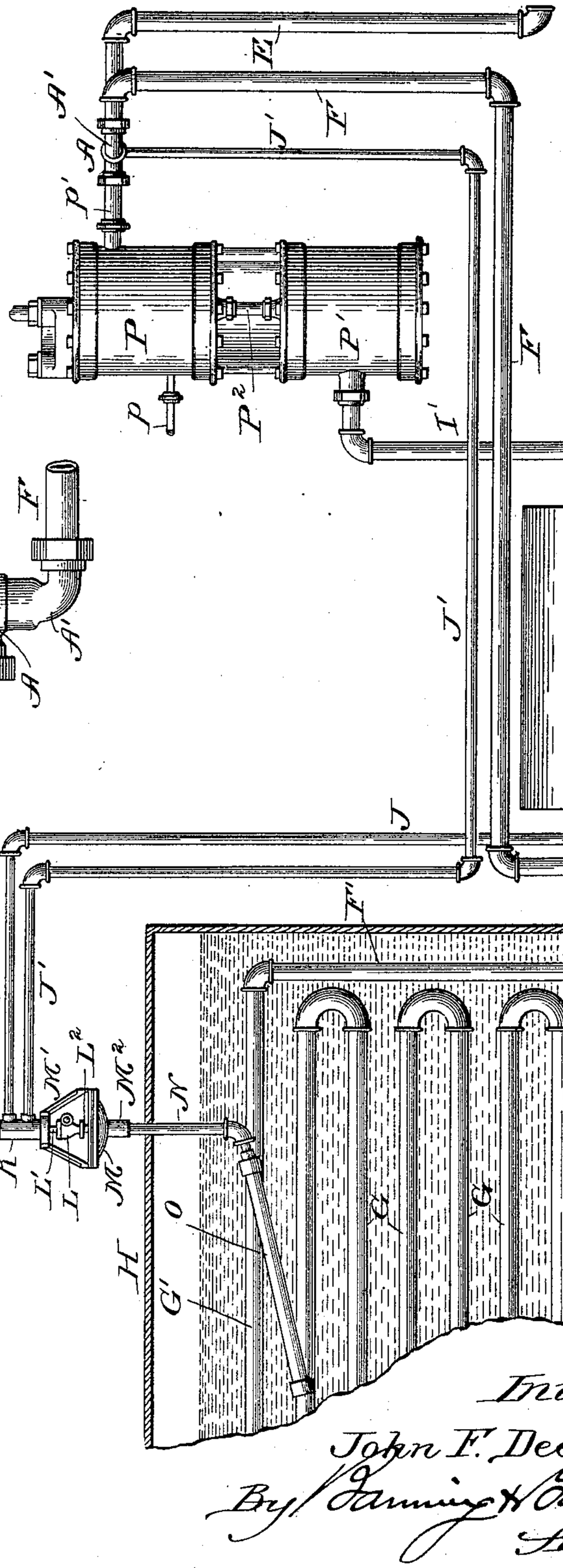

Fig. 3.

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UNITED STATES PATENT OFFICE.

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FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 658,566, dated September 25, 1900.

Application filed June 18, 1900. Serial No. 20,692. (No model.)

To all whom it may concern:

Be it known that I, JOHN F. DEEMS, a citizen of the United States, residing at Burlington, in the county of Des Moines and State of Iowa, have invented a certain new and useful Improvement in Feed-Water Heaters for Locomotive-Tanks, of which the following is a specification.

My invention relates to water-heaters for locomotive-tanks, for which Letters Patent of the United States No. 642,088, dated January 30, 1899, were granted to me; and the invention pertains specifically to the valve controlling the exhaust-steam from the air-compressing pump by which the exhaust is transmitted to the smoke-stack or to the water-tank, as fully and at large described in my said patent.

The object of the invention is to render the steam-controlling valve automatic in its operation through the steam and air pressure and dispense with the use of springs or other means to move the valve in either direction and at the same time render the valve more sensitive and positive in its movements; and the invention consists in the features of construction and combination of parts hereinafter described, and pointed out in the claims as new.

In the drawings the valve controlling the exhaust-steam is all that it is deemed necessary to illustrate, as the parts with which it is designed to have such valve coöperate will be of the construction shown in my said former patent.

In the drawings, Figure 1 is a plan view, and Fig. 2 a central longitudinal section, of the valve; Fig. 3, a side elevation showing an air-compressor pump, an air-reservoir, and a portion of a tank or tender of a locomotive or engine with my invention applied thereto; and Fig. 4, a plan view of the steam-controlling valve.

The valve is to be set or placed horizontally and is to be located adjacent to the air-compressing pump, so as to receive exhaust-steam therefrom for the exhaust to pass either to the smoke-stack or to the water-tank, as may be necessary or required, to heat the tank-water or to exhaust to the smoke-stack.

The valve is constructed with a casing A, having on one side an inlet a and on the other side an outlet a', it being understood that the inlet or induction port a and the outlet or eduction port a' can be located on opposite sides of the casing, as shown, or be arranged in such other relation one to the other as to provide an induction and eduction for the exhaust-steam from the air-compressing pump into and out from the controlling-valve. As shown, each port a and a' is surrounded by an annular wall on the casing, having a screw-thread on its exterior for the attachment of a connecting-pipe between the induction-port a and the air-compressing pump and for the attachment of an exhaust-pipe to the eduction-port leading to the exhaust-chamber for the smoke-stack. The casing A, as shown, has a neck or bend A′ at one end with a screw-thread on its exterior for the attachment of a pipe leading to the water-tank of the engine.

The casing A has an interior chamber B and B′, having different diameters, and a passage B^2 is continued from the smaller section B′ of the interior chamber through the neck A′, forming a passage for the exhaust-steam to the water-tank. The casing is provided with a cap or cover B^3 at one end for closing the chamber in the interior of the casing. A piston-valve is located in the chamber of the casing, and this valve is of different diameters, having one portion C to fit the portion B of the chamber and a portion C′ of a smaller diameter to fit the portion B′ of the chamber. The portion C has in its periphery packing-rings c to make a tight joint and has a face b' to fit a seat b on the wall of the chamber, the two faces being ground or otherwise formed so as to make a ground or tight joint between the valve and the casing. The end C′ of the valve is cut away circumferentially, so as to leave a chamber C^2. This chamber at one end terminates in a shoulder or face of a flange or collar c' and at the other end terminates in a curved face of a flange or collar c^2 on the end of the valve having the smallest diameter.

The valve has a central interior chamber D, and the body of the valve on the exterior has a peripheral channel d, which communicates with the chamber D by openings or ports on d', so that when the channel D is in communication with the induction-port exhaust-

steam will pass into the channel and through the ports or openings d' into the chamber D and out through the passage B^2 to the water-tank of the engine. The exhaust-steam, when the chamber or passage C^2 is in communication with the induction-port a, passes around in such chamber and out at the eduction-port a' to the smoke-stack, so that the exhaust-steam will pass either to the water-tank or to the smoke-stack, according to the position of the valve, and, as shown in the drawings, the valve is in position to exhaust from the air-compressing pump into the chamber D and through the passage B^2 to the water-tank. The exhaust-steam from the valve enters a pipe E, coupled to the nipple of the outlet-port a', which pipe leads to the smoke-stack, as usual. The exhaust-steam for the tank or tender enters a pipe F, attached by a coupling to the neck or casing end A, and this pipe may be made up of sections, so that it can be located properly in position, and is coupled to a pipe F' within the water-tank, which pipe is coupled to the first pipe or header G' of a heating-coil G, located in the water-tank H of the engine.

An air-reservoir I communicates with the compressing-cylinder of the pump by a pipe I', and leading from the compressed-air reservoir is a pipe J, coupled to a casing K, in which is located a controlling-valve. A second pipe J' communicates with the valve-chamber in the casing K and leads to the steam-controlling valve and is connected with the supply port or passage in the casing for admitting compressed air back of the piston-valve and releasing compressed air therefrom. The valve in the casing K is connected with a support L, and between the support and the valve is a coil-spring L' for retracting or opening the valve, and the support is carried by a stem L^2 from a movable diaphragm located in a saucer or dish shaped receiver M, connected by arms M' with the shell or casing K and having at its center a tubular stem M^2, into which is screw-threaded a pipe N, passing into the water-tank and connected with a tube or cylinder O, containing water or other liquid or fluid which will expand under heat. The parts just described constitute a thermostat or regulator actuated from the heat of the water in the tank to operate the compressed-air-controlling valve in the casing K and admit air into the casing to pass through the pipe J' into the steam-controlling valve. The steam-controlling valve is connected with an ordinary compressor-pump having a steam-chest P, a compressor-cylinder P', and a connecting-rod P^2 for the pistons of the chest and cylinder. The steam for operating the pump is admitted to the steam-chest by a pipe p and is exhausted therefrom through a pipe p' into the chamber of the shell or casing A to pass therefrom either to a direct exhaust or to the heater in the tank or tender, according to the position of the controlling-valve in the shell or casing. The water in the tank or tender is heated from the exhaust-steam transmitted thereto from the steam-chest P of the compression-pump. The temperature of the water acts on the cylinder or tube U and raises the temperature of the water or liquid in such cylinder or tube, and with the temperature below a point which might cause injurious effects the valve in the shell or casing K is open for the pressure from the pipe J to pass into the pipe J' and to the valve-casing A back of the piston-valve C in the chamber B, holding the valve in the position shown in Fig. 2 for the exhaust-steam to pass to the tank or tender. An increase of temperature of the water in the tank to a point that might be dangerous or that would cause injurious effects expands the water or liquid in the cylinder or tube O and operates the valve in the shell or casing K, shutting off the admission of compressed air through the pipe J and permitting air in the chamber B to escape, releasing the air-pressure on the piston-valve C in the chamber back thereof. As will be seen from the foregoing, the opening of the ports for steam to pass to the smoke-stack or other exhaust and the closing of the ports against the steam passing to the heating-coil in the tank or tender are had automatically with the increase of temperature of the water in the tank or tender. A reverse operation takes place when the temperature of the tank-water falls or is reduced, such reduction of temperature causing a corresponding reduction of temperature of the water or liquid in the cylinder or tube O, permitting the valve to open for compressed air to pass through the pipe J and the valve into the pipe J' to enter the valve-chamber B and by its pressure force the piston-valve to open the ports for steam to pass to the tank or tender and shut off the passage of steam to the stack or exhaust.

The compressed air from the thermostat or regulator is supplied to the valve by a pipe J', entering into the casing A and communicating by a passage e and port e' with the end B of the chamber of the casing between the cap or cover B^3 and the end C of the valve, so that the pressure of the compressed air will act on the end of the valve and force the valve into the position shown in Fig. 2 for the exhaust-steam to pass into the chamber D of the valve. This operation takes place when the water in the tender has become reduced enough in temperature to operate the thermostat or regulator and open the thermostat-valve for the air to enter the end of the chamber B. When the temperature of the tank-water has been raised sufficiently to operate the thermostat and close the compressed-air valve, shutting off the compressed air from entering the end B of the chamber, the exhaust-steam entering the chamber D will act on the wall or face at the closed end of the chamber and also act on the outer end wall or face of the flange or collar c^2 of the end C' of the valve, and this pressure will be sufficient to force the valve toward the cap

or cover B^3, and when the flange or collar c' has passed the line of the induction-port a the exhaust-steam in addition will act on the face of the collar or flange c', so that the pressure of the steam on the end face of the end wall of the chamber and on the end face of the flange or collar c^2 and on the end face of the flange or collar c' will force the valve to the cap or cover B^3, in which position the induction-port is in full communication with the chamber or passage C′ and the eduction-port a' for the exhaust-steam from the air-compressing pump to pass to the smoke-stack. The valve will remain in its open position for exhausting to the smoke-stack until the temperature of the tank-water has become again reduced sufficiently for the thermostat to open the compressed-air valve and admit air under pressure through the passage e and port e' into the end B of the chamber and against the end C of the valve, forcing the valve again into position shown in Fig. 2 for the exhaust of the air-compressing pump to pass to the water-tank. These operations will continue and will occur as the temperature of the water rises and falls, and the operation of the valve will be automatic and controlled wholly by the temperature of the water in the engine-tank, thus dispensing with the use of springs for moving the valve and operating the valve by the pressure of the steam and compressed air.

The construction of the valve is one which in effect makes it an unbalanced valve, enabling the excess of pressure of either the steam or the air to move the valve to operative position for the required exhausts, and this unbalanced condition is secured by the excess of pressure-surface had through the end wall of the chamber D, the end face of the flange or collar c^2, and the end face of the flange or collar c', which gives an excess of pressure in opening the valve for exhaust to the smoke-stack. The placing of the valve in a horizontal position and reducing the walls of the chamber and the body of the valve, so as to give the valve an unbalanced character, place the control of the valve wholly under the pressure of the steam and the compressed air and make the valve more positive in its movements than where a spring or other means is necessary to return the valve in one direction or to hold the valve against dropping or moving independently of the pressure. The valve is moved in either direction by direct force and against a resistance making it very sensitive and positive in operation, as in one direction it is moved against the resistance of the air-pressure and in the opposite direction is moved against the resistance of the steam, rendering it necessary for pressure to overcome pressure, by which a more perfect and uniform action of the valve is obtained. The exhaust from the air-compressing chamber is of an intermittent character, and for this reason a spring, while it will perform the required work, is open to the objection that when used in connection with a vertically-standing valve the valve might fall back between each exhaust, thereby changing the direction of the exhaust, which would interfere to some extent with the full operation for heating the tank-water and exhausting to the smoke-stack. This objection is entirely overcome by placing the controlling-valve horizontally and operating such valve through the pressure of the steam and air. The valve can also be used for the purpose of controlling or directing a part of the main exhaust through the exhaust-pipe in the front end or smoke-stack of the engine, as well as for controlling or directing the exhaust from the air-compressing pump, and will be equally as operative for controlling a portion of the main exhaust as in controlling the exhaust from the air-compressing pump.

I claim—

1. In a water-heater for locomotive-tanks, the combination of a horizontal valve-casing having therein a steam-induction port communicating with the exhaust of an air-compressing pump, a steam-eduction port and a steam-eduction passage for direct exhaust and for exhaust into a heater located in the water-tank, respectively, a chamber in the casing communicating with the ports and passage, a piston-valve traversing the chamber longitudinally and having an interior chamber, a peripheral channel communicating with the interior chamber and with the steam-induction port and a peripheral passage communicating with the steam induction and eduction ports, a fluid-pressure regulator operated by the temperature of the water in the tank, and a fluid-pressure port at one end of the casing-chamber, for moving the valve by the differential pressure thereon of steam and fluid to change the direction of the eduction or discharge of steam through the valve, substantially as described.

2. In a water-heater for locomotive-tanks, the combination of a horizontal valve-casing having therein a steam-induction port communicating with the exhaust of the air-compressing pump, a steam-eduction port, and a steam-eduction passage for direct exhaust and for exhaust into a heater located in the water-tank, respectively, a chamber in the casing having ends of different diameter, a piston-valve traversing the casing-chamber longitudinally and having ends of different diameters to fit the ends of the casing-chamber, and having an interior chamber, a peripheral channel communicating with the interior chamber and with the steam-induction port and a peripheral passage communicating with the steam induction and eduction ports, a fluid-pressure regulator operated by the temperature of the water in the tank, and a fluid-pressure port at one end of the casing-chamber, for moving the valve by the differential pressure on the ends of steam and fluid to change the direction of the eduction or discharge of steam, substantially as described.

3. In a water-heater for locomotive-tanks, the combination of a horizontal valve-casing, having therein a steam-induction port communicating with the exhaust of the air-compressing chamber, a steam-eduction port and a steam-eduction passage, for direct exhaust and for exhaust into a heater located in the water-tank, respectively, a chamber in the casing having ends of different diameters, a piston-valve traversing the casing-chamber longitudinally and having ends of different diameters to fit the ends of the casing-chamber, a seat on the wall of the chamber and a face on the valve fitting the seat, an interior chamber in the valve, a peripheral channel on the valve, lateral openings from the peripheral channel to the valve-chamber furnishing communication between the induction-port for steam and the valve-chamber, a peripheral passage on the valve furnishing communication between the steam induction and eduction ports, a fluid-pressure regulator operated by the temperature of the water in the tank, and a fluid-pressure port at one end of the casing-chamber admitting fluid-pressure to the chamber, for the valve to be moved by the differential pressure of steam and fluid to change the direction of the eduction or discharge of steam, substantially as described.

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