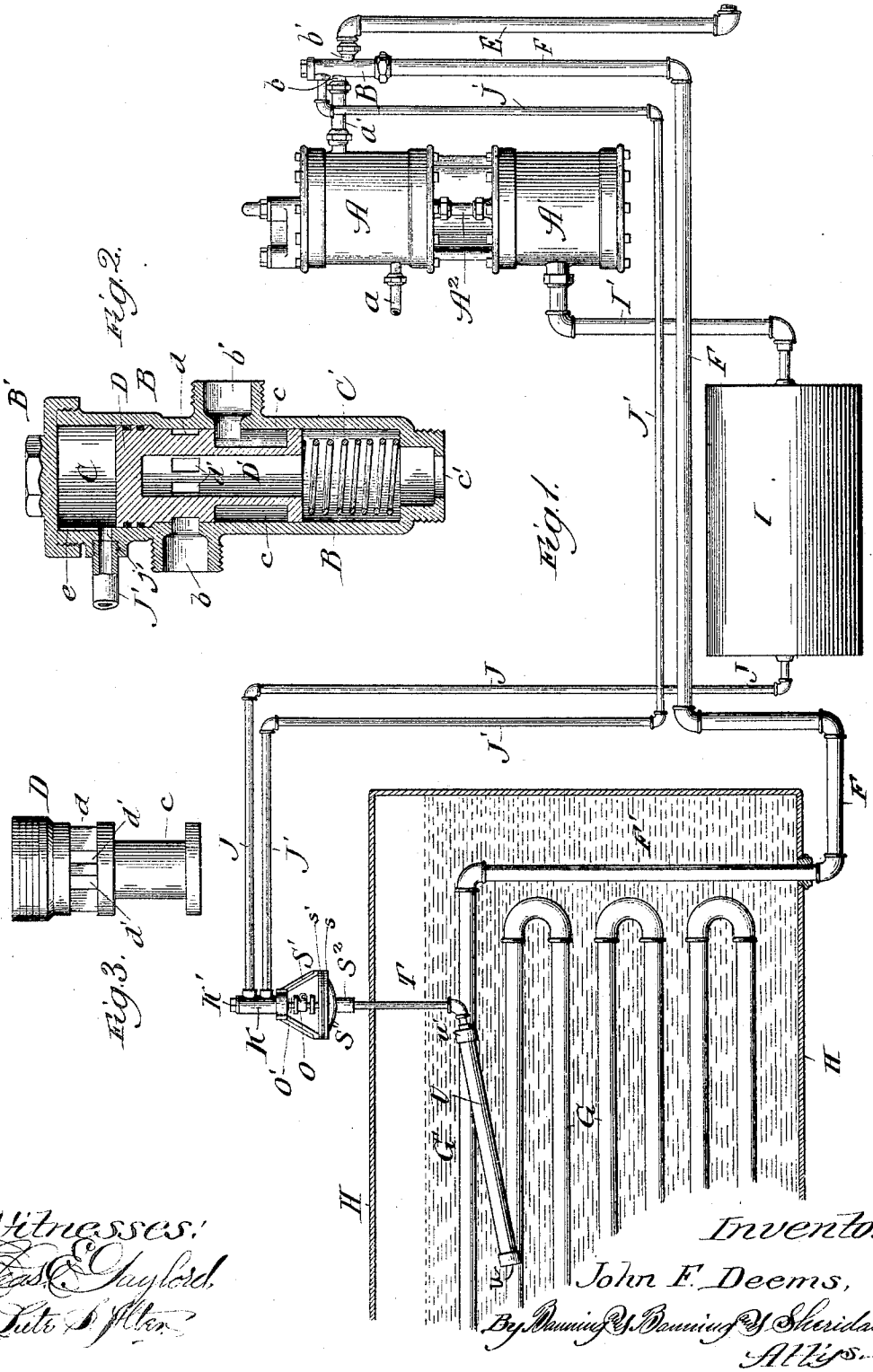
No. 642,088. Patented Jan. 30, 1900.

J. F. DEEMS.

WATER HEATER FOR LOCOMOTIVE TANKS.

(Application filed Sept. 18, 1899.)

(No Model.) 2 Sheets—Sheet 1.



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Fig. 5.

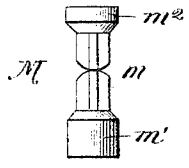


Fig. 4.

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UNITED STATES PATENT OFFICE.

JOHN F. DEEMS, OF BURLINGTON, IOWA.

WATER-HEATER FOR LOCOMOTIVE-TANKS.

SPECIFICATION forming part of Letters Patent No. 642,088, dated January 30, 1900.

Application filed September 18, 1899. Serial No. 730,860. (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 Water-Heaters for Locomotive-Tanks, of which the following is a specification.

My invention relates to heating the water in a locomotive or engine tank or tender through the medium of exhaust-steam from the ordinary compressing-pump on the engine.

The principal object of the invention is to automatically regulate and control the steam-supply as required for heating purposes in the tank or tender; and the invention consists in the features, combinations, and details of construction hereinafter described and claimed.

In illustrating my invention only such parts of old devices as are necessary to a description of the invention are shown.

In the drawings, Figure 1 is a side elevation showing an air-compressing chamber, an air-reservoir, and a portion of a tank or tender of a locomotive or engine with my invention applied thereto; Fig. 2, a sectional elevation through the steam-controlling valve and its casing; Fig. 3, an elevation of the steam-controlling valve; Fig. 4, a sectional elevation of the regulating and controlling valve and its operating mechanism, and Fig. 5 an elevation of an air-valve for the regulator.

In the heating of the tender or tank water of a locomotive or engine from the exhaust-steam of the air-compressing pump as heretofore practiced a two-way valve or cock has been used for the connection between the exhaust from the steam-chest of the pump to the stack or to the heating-coil in the tank, such valve or cock being operated by the engineer. This construction while it utilized the waste steam of the pump required close and careful attention on the part of the engineer in order to properly operate the valve so as not to create overheating of the water, which might be dangerous and produce injurious effects, and for this reason the heating of the tank-water by the exhaust-steam of the air-compressing pump has not been entirely successful.

The object of my invention is to dispense with the necessity of care and attention from the engineer as to the regulation and control of the steam-supply and to have such supply automatically regulated so as to exhaust to the smoke-stack or to the heating-coil of the water-tank, accordingly as the temperature of the water requires.

In constructing and applying my invention I take an ordinary air-compressor pump having a steam-chest A and a compressing-cylinder A′, with a connecting-rod A^2 for the pistons of the chest and cylinder. The steam enters the chest through the supply-pipe *a* and is exhausted therefrom through the pipe *a′* with the operation of the pump. The exhaust-pipe for the steam is connected with a valve-casing B, having a chamber C, with which communicates an inlet-port *b* and an exhaust-port *b′*. The casing is closed at one end by a suitable cap or plug B′. A valve D is located in the chamber of the casing and has a central chamber or opening D′, which communicates through lateral ports or passages *d′* and an annular passage *d* with the supply-port *b* when the valve is in proper relation therefor, as hereinafter described. The valve also has an annular passage *c* around its exterior face, through which when the valve is in proper position communication is had between the inlet-port and the outlet-port of the chamber, and an outlet port or opening *c′* is provided for the chamber at the end of the casing for operation with the chamber D′. A spring C′ is located below the valve for the purpose of raising the valve when pressure is released from the opposite end thereof, and thereby bring the valve into position for communication between the inlet and outlet ports of the chamber, the wall of the chamber having a by-passage *e* for the escape of air in the upward movement of the valve after it passes the air-port *j′*. A pipe E is coupled to the nipple of the outlet-port *b′* and leads to the smoke-stack, as usual. A pipe F is attached by a coupling *f* to the nipple or casing around the opening *c′*, 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 or head pipe G′ of a heating-coil G, located in the water-tank H of the engine. The steam when the valve D is in the position shown in Fig. 2 passes through the exhaust-

pipe from the steam-chest into the annular passage d, and thence through the passages or ports d' into the chamber D' and out through the opening c' and through the pipes F and F' to the heating-coil for heating the water in the tank.

When the temperature of the water has been raised sufficiently, the supply of steam should be cut off, and this is automatically accomplished as follows: The air-reservoir I of the usual construction communicates with the air-compressing cylinder by the pipe I', and leading from the air-reservoir is a pipe J, which is coupled to a casing K and has communication with a chamber g in such casing. A second pipe J' communicates with a chamber g' in the casing K and leads to the casing B and has communication with the chamber C of the valve D by a port j', as shown in Fig. 2, and the by-passage e also communicates with the port of the pipe J'. A plug or second casing L is located in the chamber g, and this casing has a chamber i, which has communication with the chamber g through a port or passage h. A double valve M is located in the plug or casing L and has a wing-stem m sliding in an opening l therefor in the body of the plug. The valve or head m', which may be integral with the stem, seats against a face l', and the valve or head m^2 seats against a face l^2, so that with the shifting of the valve M as a whole communication is had or cut off between the chambers g and g'. The valve or head m^2 is attached to the stem by means of a threaded extension m^3 and a nut m^4, which construction is required in order to enter the valve from below through the passage l. As shown, a coil-spring j is located between the valve or head m^2 and the face of a recess in the plug K', which closes the end of the casing after the valves and their parts are in place; but this spring is only a necessity in making a full return of the valve M in case of breakage or disarrangement of the pressure-producing means for raising the valve.

The valve M is loosely mounted on a stem N, for which purpose the stem N has a reduced end n', which loosely enters a recess n^2 in the end of the valve or head m'. The stem N has a by-passage n, by means of which communication can be had from the chamber g' to the atmosphere. The stem N passes through a cap K^2, screw-threaded onto a nipple k^2 of the casing K, and its lower end is screw-threaded into a support O, having a lower portion o' split and provided with a screw o^2, by means of which the part o' can be made to operate as a clamp. A coil-spring O', located around the stem between the bottom of the casing K and the head O, is held in position on the head by entering a recess o. A screw-threaded stem P is entered into the support O, and this stem has a bearing-point p and is provided with an enlarged portion p', by means of which the stem can be turned so as to properly adjust its bearing-point in relation to the movement of the stem N for operating the valve M. The bearing-point p rests in a recess or countersink q of a disk or plate Q, attached to an annular diaphragm R by a screw r and washer r'. The edges of the annular diaphragm are entered between a flange s of a concave disk or plate S and a flange s', carried by arms S', and is held in place between the flanges to form a tight joint by screws s^2 or in any other suitable manner. The arms S' extend up and are attached to a depending rim or flange k of the casing K by screws k' or otherwise.

The disk or plate S has an extension S^2 at the center, in which is an opening or passage t leading to the chamber formed between the disk or plate and the diaphragm Q, so that pressure admitted to such chamber will bear against the diaphragm. A pipe T is screw-threaded into the extension or nipple S^2, so as to communicate with the passage t, and this pipe is attached to the cap or head u' of a cylinder or tube U, the opposite end of which is closed by a head or cap u. The tube or cylinder U is for the purpose of containing water or other fluid which will expand under heat, and this tube lies in the water of the tank or tender and may be adjacent to the heating-coil and be supported thereby or in any other suitable manner.

The operation is as follows: The exhaust-steam from the chest A when the steam-valve is in the position shown in Fig. 2, as already stated, passes to the water-tank and through the coil G heats the water. The temperature of the water is transmitted to the cylinder or tube U and raises the temperature of the water or liquid in such tube, and while the temperature remains below a point where injurious effects would occur the diaphragm remains down, and the parts operated therefrom are likewise down, so that the valve M has both of its heads m' and m^2 unseated, leaving the passage l between the chambers g and g' open for the pressure from the pipe J to pass through the chambers and the pipe J' to the valve C. 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 U and forces it into the chamber below the diaphragm R, raising such diaphragm with its stem N, thereby raising the valve M, seating the head or valve m', and closing the passage l against admission of air to the chamber g', allowing the pressure in the upper portion of the chamber C to pass out therefrom through the pipe J' into the chamber g', and thence through the by-passage n into the atmosphere. The release of the pressure in the upper portion of the chamber C allows the spring C' to act and raise the valve D, shutting off communication from the annular passage d and ports d' and opening communication between the annular passage c and the ports b and b' for the exhaust-steam from the chest A' to pass through the

ports and passage into the pipe E and thence to the smoke-stack or other point of discharge.

As will be seen from the foregoing, the opening of the steam-ports for the steam to pass to the smoke-stack or other exhaust and the closing of the ports against the steam passing to the heating-coil are had automatically with the increase of temperature of the water in the tank. 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 tube U, withdrawing its pressure from the diaphragm R and permitting the diaphragm to descend and the spring O′ to force back the stem N, releasing the valve M from its raised position for the air-pressure within the chamber *i* to act on the head or valve m^2 and unseat the valve m', and in such movement with the opening of the lower valve m' air-pressure will pass from chamber *g* through the port *h*, chamber *i*, and passages *l* into the chamber *g'*, and thence through the pipe J′ to the head of the valve D, forcing such valve down and again opening the ports for steam to pass to the heating-coil and shutting off the passage to the stack or exhaust.

The regulator operates the steam-valve automatically through the condition of the temperature of the water in the tank, and such operation turns the exhaust-steam either to the heating-coil or to the smoke-stack or other point of exhaust, as may be necessary, and the operation after the devices are once set and regulated is entirely automatic, requiring no care or attention from the engineer, fireman, or other operator.

The double valve on a single stem having wings (shown in Fig. 4) can be replaced by a double valve made up of two single valves, as shown in Fig. 5, the stems of the two valves contacting in the passage *l*, so that the movements of the stem N will operate the valve and the action of the spring *j* will seat and hold the upper valve when required. The upper head or valve when the fluid is expanding properly and the devices are in operative condition is not intended to close the passage *l*, as such closing will be done solely by the lower head or valve, and so far as the operation under correct conditions is concerned the upper head or valve could be omitted, as the lower head or valve would be all that was needed to perform the work; but in case of failure to expand the fluid either from leakage of the fluid or otherwise or from a breakage or disarrangement of the diaphragm or from some other cause there should be a failure in the proper expansion of the fluid, the upper head or valve then becomes operative and closes the communicating passage between the two chambers, relieving the pressure in the steam-valve chamber for the spring in such chamber to raise the valve and shut off steam to the coil and direct it to the stack or other exhaust. This operation is necessary, as otherwise the diaphragm-valve would be open and pressure would be on the steam-valve, so that such valve would be held open for the steam to pass to the tank and cause overheating of the water; but with the provision of the upper head or valve operative when the expansion of the fluid is a failure from any cause no overheating can possibly occur, as such valve becomes an emergency one, closing the air-passage between the two chambers for the steam-valve to be opened to the exhaust.

The diaphragm will move according to the degree of expansion of the fluid, and it can be made operative at any temperature desired so as to move the pressure-controlling valve by lengthening or shortening the connecting-stem between the diaphragm and valve—the longer the stem the lower the temperature required and the shorter the stem the greater the temperature required. The length of stem is adjusted by turning the screw-threaded stem P. The turning of such stem in the direction to raise the head O lengthens the stem N, and the turning of it in the direction to lower the head O shortens the stem; and it will thus be seen that through the screw-threaded stem P the proper length of operating-stem can be obtained.

I claim—

1. In a water-heater for locomotive-tanks, the combination of a valve-chamber communicating with the exhaust of the steam-chest of an air-compressing pump, exhaust-ports leading from such chamber, one for direct exhaust and the other for exhaust into a heating-coil in the water-tank, a valve controlling such ports and a regulator operated by the temperature of the water in the tank for automatically moving the valve and opening and closing the ports, substantially as described.

2. In a water-heater for locomotive-tanks, the combination of a valve-chamber communicating with the exhaust of the steam-chest of an air-compressing pump, exhaust-ports leading from such chamber, one for direct exhaust and the other for exhaust into a heating-coil in the water-tank, a valve controlling such ports, a tube or cylinder in the water-tank containing a fluid expansible under heat and a valve actuated by the expansion and contraction of the fluid from the temperature of the water in the tank for automatically moving the steam-valve and opening and closing the exhaust-ports, substantially as described.

3. In a water-heater for locomotive-tanks, the combination of a valve-chamber communicating with the exhaust of the steam-chest of an air-compressing pump, exhaust-ports leading from such chamber, one for direct exhaust and the other for exhaust into a heating-coil in the water-tank, a valve controlling such ports, a tube or cylinder in the water-tank containing a fluid expansible under heat, a diaphragm moved by the expansion and contraction of the fluid from the temperature of the water in the tank, and a valve actua-

ted by the movements of the diaphragm for automatically moving the steam-valve and opening and closing the exhaust-ports, substantially as described.

4. In a water-heater for locomotive-tanks, the combination of a valve-chamber communicating with the exhaust of the steam-chest of an air-compressing pump, exhaust-ports leading from such chamber, one for direct exhaust and the other for exhaust into a heating-coil in the water-tank, a valve controlling such ports, a tube or cylinder in the water-tank containing a fluid expansible under heat, a diaphragm moved by the expansion and contraction of the fluid from the temperature of the water in the tank, an adjustable stem carried by the diaphragm and a valve actuated by the movements of the diaphragm and stem for automatically moving the steam-valve and opening and closing the exhaust-ports, substantially as described.

5. In a water-heater for locomotive-tanks, the combination of a valve-chamber communicating with the exhaust of the steam-chest of an air-compressing pump, exhaust-ports leading from such chamber, one for direct exhaust and the other for exhaust into a heating-coil in the water-tank, a valve controlling such ports, a tube or cylinder in the water-tank containing a fluid expansible under heat, a diaphragm moved by the expansion and contraction of the fluid from the temperature of the water in the tank, a return-spring for the diaphragm, an adjustable stem carried by the diaphragm, and a valve actuated by the movements of the diaphragm and stem for automatically moving the steam-valve and opening and closing the exhaust-ports, substantially as described.

6. In a water-heater for locomotive-tanks, the combination of a valve-chamber communicating with the exhaust of the steam-chest of an air-compressing pump, exhaust-ports leading from such chamber, one for direct exhaust and the other for exhaust into a heating-coil in the water-tank, a valve controlling such ports, a tube or cylinder in the water-tank containing a fluid expansible under heat, a diaphragm moved by the expansion and contraction of the fluid from the temperature of the water, a valve actuated by the movements of the diaphragm and two fluid-pressure chambers having a passage between them controlled by the diaphragm-valve for automatically moving the steam-valve and opening and closing the exhaust-ports, substantially as described.

7. In a water-heater for locomotive-tanks, the combination of a valve-chamber communicating with the exhaust of the steam-chest of an air-compressing pump, exhaust-ports leading from such chamber, one for direct exhaust, and the other for exhaust into a heating-coil in the water-tank, a valve controlling such ports, a tube or cylinder in the water-tank containing fluid expansible under heat, a diaphragm moved by the expansion and contraction of the fluid from the temperature of the water, a valve actuated by the movements of the diaphragm, a fluid-pressure chamber having communication with a compressed-air reservoir, a fluid-pressure chamber having communication with the chamber of the steam-valve, and a passage between the two fluid-pressure chambers controlled by the diaphragm-valve for automatically moving the steam-valve and opening and closing the ports, substantially as described.

8. In a water-heater for locomotive-tanks, the combination of an air-compressing pump, a valve controlling the direction of the exhaust from the steam-chest of the pump, a heating-coil in the water-tank, a compressed-air reservoir, a fluid-pressure chamber communicating with the compressed-air reservoir, a fluid-pressure chamber communicating with the chamber of the exhaust-controlling valve, a passage between the two chambers and a valve for such passage actuated by the differential pressure from the temperature of the tank-water for automatically moving the steam-exhaust-controlling valve, substantially as described.

9. In a water-heater for locomotive-tanks, the combination of an air-compressing pump, a valve controlling the direction of exhaust from the steam-chest of the pump, a heating-coil in the water-tank, a compressed-air reservoir, a fluid-pressure chamber, a pipe leading from the compressed-air reservoir to such chamber, a second fluid-pressure chamber, a pipe leading from such chamber to the valve-chamber of the steam-exhaust, a passage between the two fluid-pressure chambers, a valve controlling such passage, and a diaphragm for actuating the valve moved by differential pressure from the temperature of the water in the tank, for automatically moving the exhaust-controlling valve, substantially as described.

10. In a water-heater for locomotive-tanks, the combination of an air-compressing pump, a valve controlling the direction of exhaust from the steam-chest of such pump, a heating-coil in the water-tank, a compressed-air reservoir, a fluid-pressure chamber, a pipe leading from the compressed-air reservoir to such chamber, a second fluid-pressure chamber, a pipe leading from such chamber to the steam-exhaust-valve chamber, a passage between the two fluid-pressure chambers, a valve controlling such passage, a diaphragm for actuating the valve, and a tube or cylinder containing fluid expansible under heat and contracting and expanding from the temperature of the water in the tank, to move the diaphragm and automatically move the steam-exhaust-controlling valve, substantially as described.

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