No. 871,801. PATENTED NOV. 26, 1907.

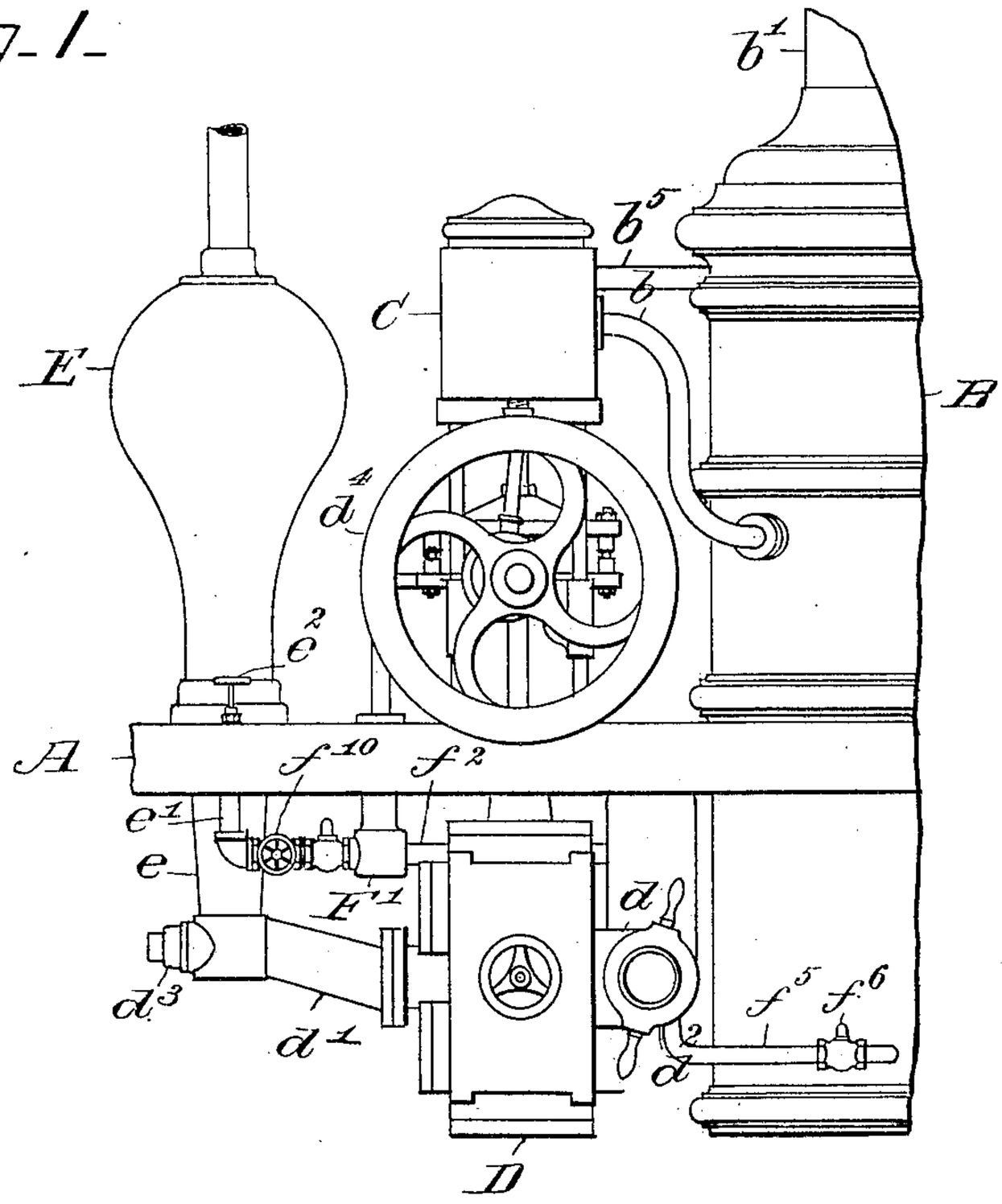
J. W. JANTZEN.

FEED WATER HEATER.

APPLICATION FILED APR. 14, 1906.

4 SHEETS—SHEET 1.

Fig. 1.




WITNESSES.

Kirkley Hyde.

Grace Crowley.

INVENTOR

James W. Jantzen,

By Albert M. Moore,

His ATTORNEY.

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4 SHEETS—SHEET 2.

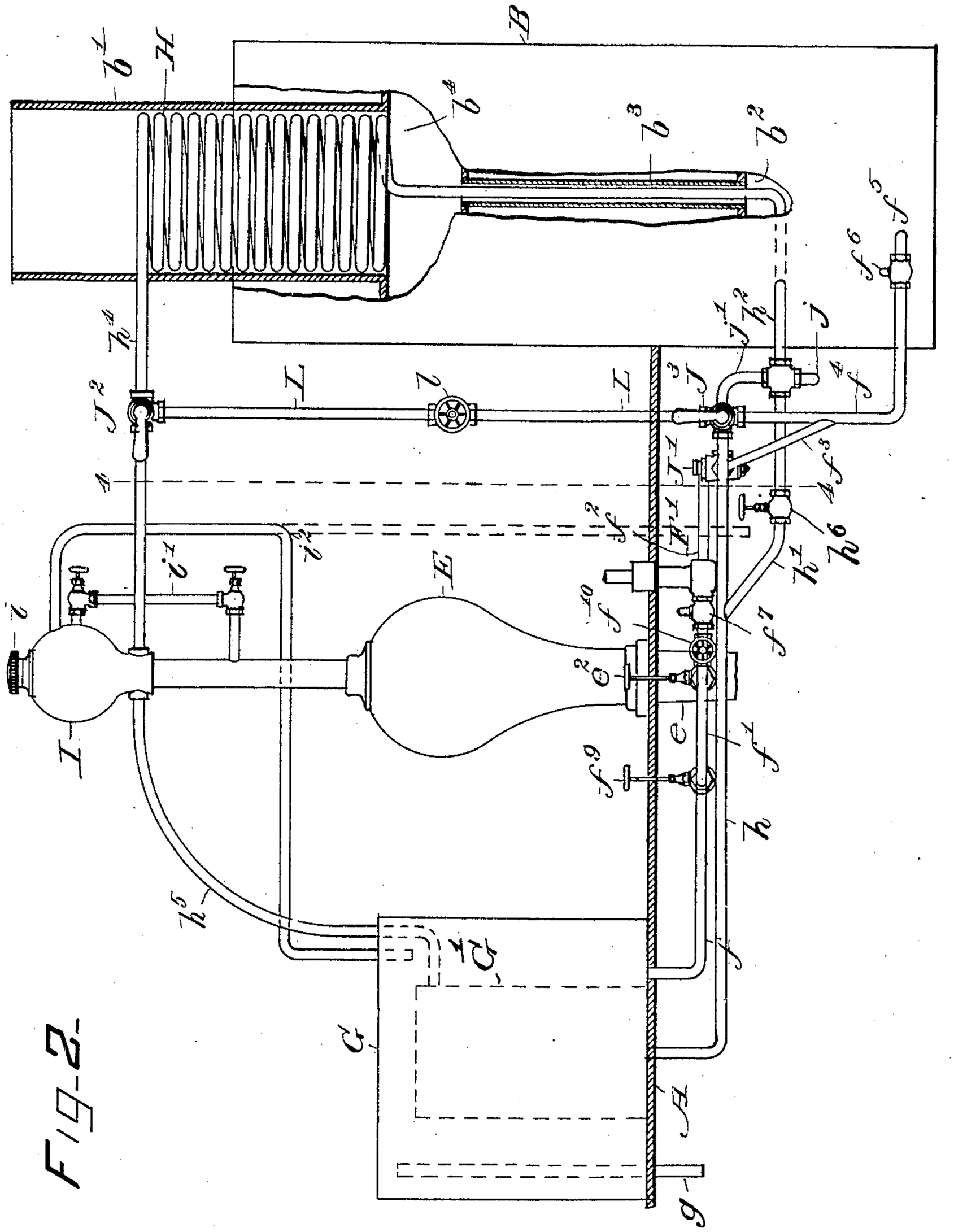


FIG. 2.

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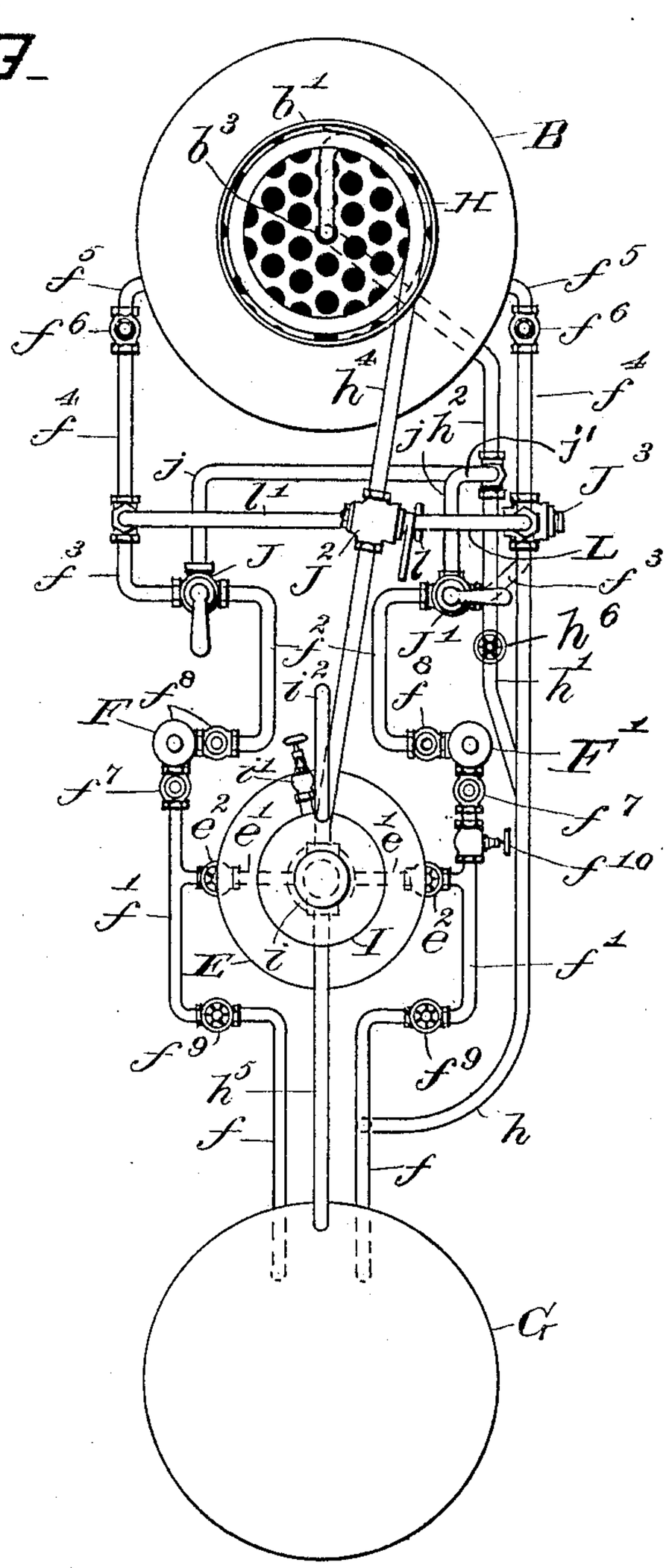
4 SHEETS—SHEET 3.

Fig. 3.

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4 SHEETS—SHEET 4.

Fig. 5.

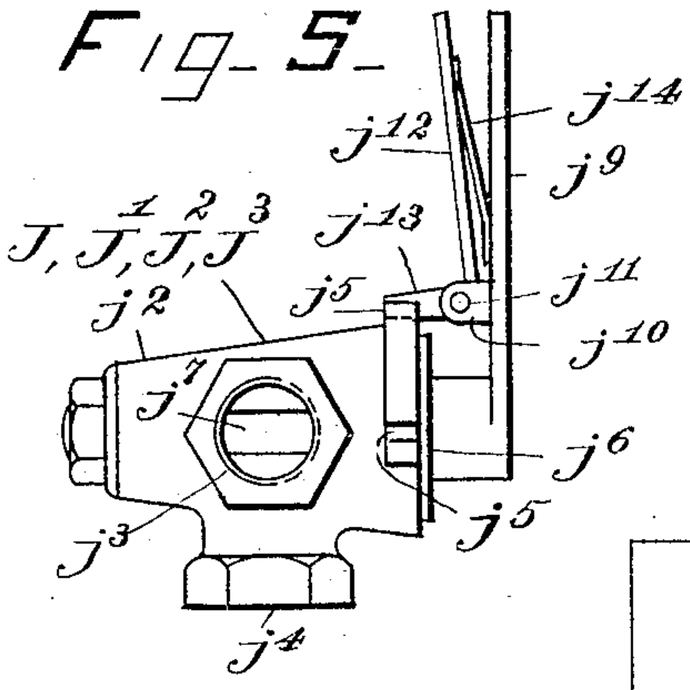



Fig. 4.

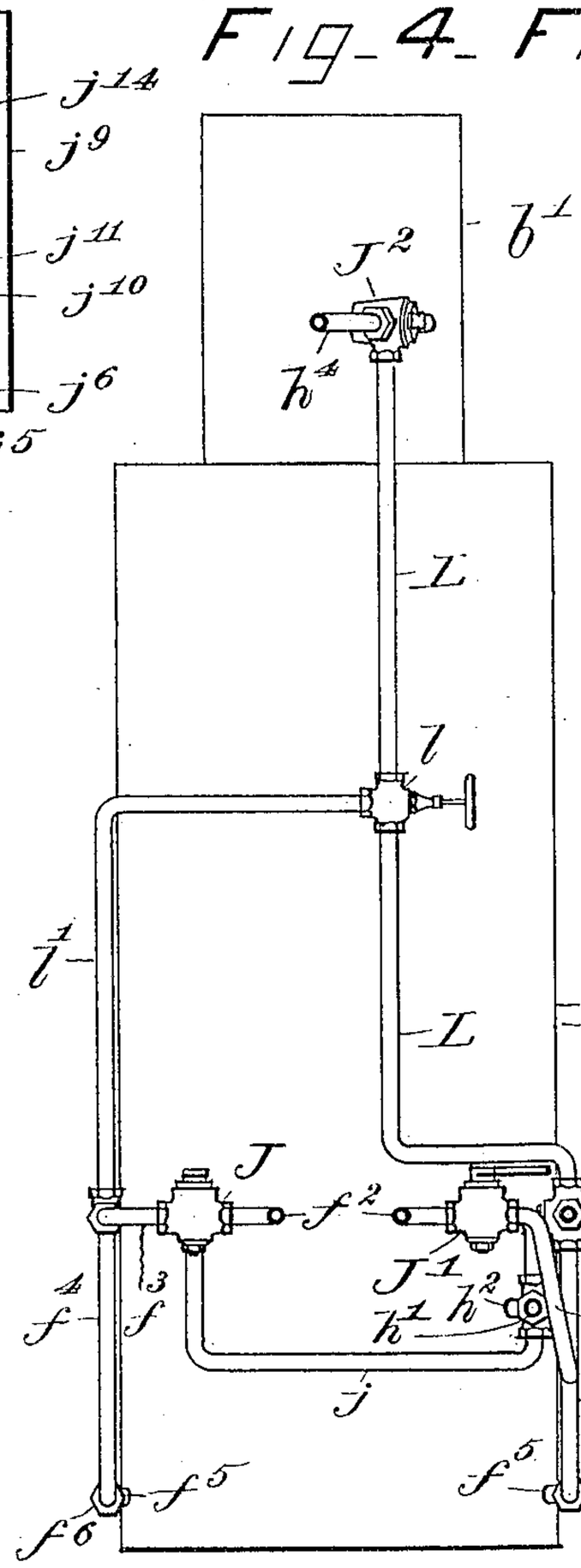



Fig. 6.

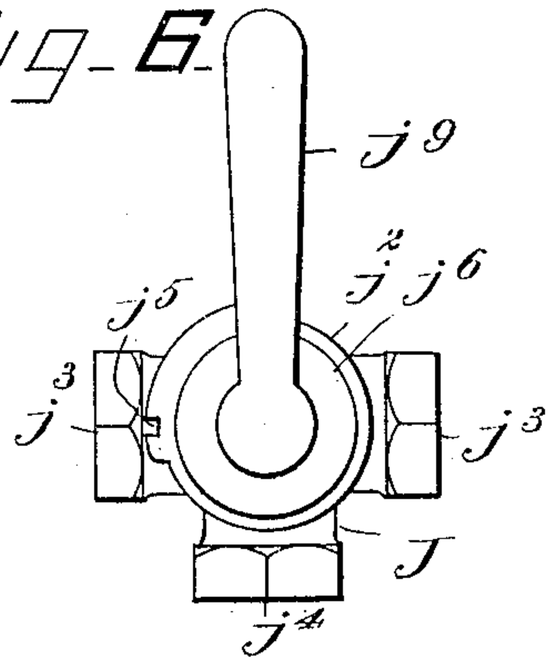
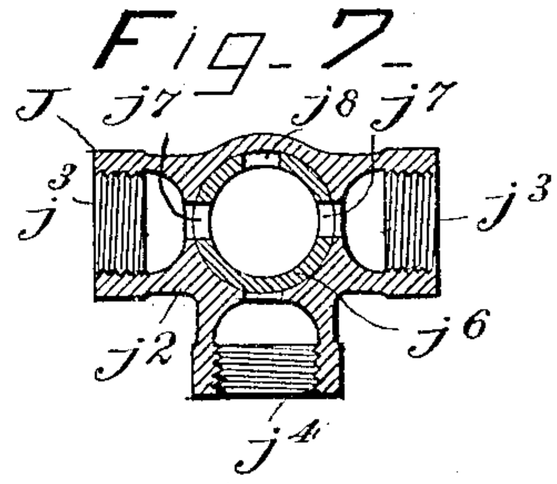



Fig. 7.




WITNESSES.

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# UNITED STATES PATENT OFFICE.

JAMES W. JANTZEN, OF LOWELL, MASSACHUSETTS.

## FEED-WATER HEATER.

No. 871,801. Specification of Letters Patent. Patented Nov. 26, 1907.

Application filed April 14, 1906. Serial No. 311,646.

*To all whom it may concern:*

Be it known that I, JAMES W. JANTZEN, a citizen of the United States, residing at Lowell, in the county of Middlesex and Commonwealth of Massachusetts, have invented a certain new and useful Improvement in Feed-Water Heaters, of which the following is a specification.

This invention relates to feed-water heaters, particularly for steam-boilers, having a forced draft caused by the heated waste gases of combustion and by exhaust steam, as boilers of steam fire-engines.

The invention is shown and described as applied to a steam fire-engine of ordinary construction and provided with the usual water-tank, boiler, air-chamber and main pumps and feed-pumps.

The objects of this invention are to secure a constant circulation of feed-water by the gravity system between the tank and the coil or like heating device and thus to avoid the danger of the water freezing in the tank and feed-pipes; to equalize the expansion and contraction of the boiler by introducing the feed-water from a single feed-pump to the boiler at a plurality of places at considerable intervals from each other; to enable the feed-water at will to be forced directly from the coil or like heating device to the tank or to the boiler and thus to enable one feed-pump to be run constantly; to maintain the feed-water supply at a constant head notwithstanding the varying pressure of the main pumps, to enable one feed-pump to force water from the tank through the heating device back to the tank while the other feed-pump introduces water directly from the main pumps to the boiler.

In the accompanying drawings, on four sheets, Figure 1 is a left side elevation of the operative parts of a steam fire-engine; Fig. 2, a left side elevation of the tank, air-chamber and boiler of an engine provided with my improvement, a part of the boiler and smoke-chamber being broken away to show the boiler tubes and the coil or heater; Fig. 3, a plan of the parts shown in Fig. 2; Fig. 4, a vertical section on the line 4—4 in Fig. 2; Fig. 5, a side elevation of a three way-cock; Fig. 6, a front elevation of the same; Fig. 7, a section of the same.

The deck or horizontal frame A which supports the working parts of the machine; the boiler B, having its steam-space connected by a pipe $b^5$ to the engine proper C; the main pumps D (only one of the two commonly used being shown in Fig. 1); the pump inlet $d$ and pump outlet $d^1$ provided with couplings $d^2$, $d^3$ for the attachment of suction-hose and delivery-hose; the fly-wheels $d^4$, only one being shown; the air-chamber E, and its induction-pipe $e$; the feed-pumps F, $F^1$; the chimney or stack $b^1$, into which the exhaust steam from the engine C is conducted by the pipe $b$ to force the draft, and the supply-tank G, provided with an overflow $g$, commonly arranged under the driver's seat, are or may be all of any usual construction and operation, except as hereinafter described. The feed-pumps F, $F^1$ are operated when the main-pumps are operated, to supply water to the boiler B, water being taken from the tank G through the feed-pipe $f$, $f^1$ and forced by the feed-pump through the feed-pipe $f^2$, $f^3$, $f^4$, $f^5$ into the lower part or water-leg of said boiler at each side of the boiler (Figs. 1, 2, and 3); or water may be taken through the branch-pipe $e^1$ which connects the induction-pipe and a section $f^1$ of the pipe $f$, $f^1$ leading from the supply-tank to a feed-pump, the pipes which connect the tank and the boiler being in duplicate on opposite sides of the machine, as represented in Fig. 3, and each feed-pipe being provided with a valve $f^9$ between the tank and the corresponding branch-pipe $e^1$ and a valve $e^2$ being arranged in each pipe $e^1$, substantially in the usual manner, and said feed-pipes being provided with check-valves $f^6$ where said pipes enter the boiler and with other check-valves $f^7$, $f^8$ on each side of each feed-pump. It will be seen that whether a feed-pump takes water from the tank G or from the induction-pipe $e$ will depend on which of the valves $f^9$, $e^2$ is open and which is closed.

All the above-described parts are in common use. To the foregoing, I have added the parts hereinafter described.

I arrange a valve $f^{10}$ in the feed-pipe at one side of the machine between the corresponding feed-pump and the branch-pipe $e^1$ so that when the valves $f^9$ and $e^2$ are both open and the engine is in operation water from the induction-pipe $e$ will quickly fill the tank G, said feed-pump meanwhile running inoperatively.

In the best form of my invention, shown in Fig. 2, I have represented an inner tank $G^1$ as arranged to save space in the tank. I will first, however, for convenience describe

the invention as shown in Fig. 3 where this inner tank is omitted, as well as the overflow pipe $g$.

I connect to the tank G, or to the feed-pipe between said tank G and the valve $f^9$, a pipe $h$, $h^1$, $h^2$ which leads into the fire-box $b^2$, through one of the boiler-tubes or flues $b^3$ of the boiler to a coil H, or convenient arrangement of pipe to form a heater, disposed in the smoke-chamber $b^4$ and uptake of said boiler and preferably extending into the chimney or stack $b^1$, in such a manner as to obstruct the draft as little as possible. A pipe $h^4$ from the top of the heater H runs forward through the side of the stack $b^1$ into an auxiliary or overflow tank I, which may be conveniently supported on the air-chamber E, as represented in Fig. 2, and is connected by a pipe $h^5$ to the supply-tank G. The tank I is provided with a removable cap $i$, through which both of the tanks G, I and the heater may be filled if desired, and with a glass water gage $i^1$ of ordinary construction which enters said tank I above and below the pipe $h^4$, to enable the height of the water, which should be above the top of the heater to prevent burning the latter, to be known. The auxiliary tank I is also provided with an overflow pipe $i^2$ which when the tank $G^1$ is omitted may discharge upon the ground, said pipe $i^2$ being indicated by dotted lines as continued down through the deck A.

When the connections above described between the heater H and the tank G are open and unobstructed and there is a fire under the boiler, there will be a constant circulation of water from the lower part of said tank to and through the heater back through the overflow tank I to said tank G, owing to the greater temperature and consequent less weight of the water in the heater,—that is, by the gravity system. This circulation above described will not only prevent freezing of the water in the tank G and feed-pipes, but will enable hot water to be supplied to the boiler at a great saving of time and fuel by the feed-pump from said tank.

I arrange in the sections $f^3$ of the feed-pipes between the feed-pumps and the boiler three-way cocks J, $J^1$ and connect them by pipes $j$, $j^1$ to a section as $h^2$ of the pipe which leads from the supply-tank G to the lower end of the coil H, so that by setting either cock J, $J^1$ in the position indicated at J in Fig. 3 to connect the corresponding feed-pipe with the coil, water will be forced by the feed-pump at that side of the machine directly from said supply-tank to said coil. One three-way cock, as J, may be so set as to force water from the tank G to the coil while the other three-way cock $J^1$ allows water from said tank G to pass directly to the boiler, and these cocks will normally be so set, as indicated in Fig. 3, where water from the feed-pump F goes through pipe-section $f^2$, three-way cock J, pipes $j$, $h^2$ to coil, while the water from the other feed-pump $F^1$, the valve $f^{10}$ being open, may be taken from the air-chamber, or from tank G at will by opening one and closing the other of the valves $f^9$, $e^2$. I also arrange a three-way cock $J^2$ in the pipe $h^4$ which leads from the coil to the auxiliary tank I and connect the third way of the same with the pipe L which connects at $l$ with the pipe $l^1$ which is connected by a Y with the feed-pipe $f^3$, $f^4$ which leads to the water-leg of the boiler, as above described. (Figs. 3 and 4.) The pipe L then continues downward and connects through the three-way cock $J^3$ to the feed-pipe section $f^4$ which leads to the water-leg of the boiler, as above described, at the outer side of the machine. Said cock $J^3$ also connects the pipe L to the pipe $h$.

When the cock $J^2$ is turned to admit water to the pipe L and the cock $J^3$ is set to connect the pipe L to the feed-pipe section $f^4$, as shown in Fig. 2, which in this respect is like Fig. 3, water will pass from the heater to the boiler without going to the supply-tank G as long as water is being forced from said tank into said heater, and in a similar manner through the pipes L, $l^1$, and $f^4$ at the other side of the boiler if the valve $h^6$ in the pipe $h^1$ and the cock $J^3$ are closed. When water is not needed for the boiler, the cock $J^3$ may be so turned that its handle is parallel with the pipe $h$ and the water will be returned from the heater to the tank G, and when said cock $J^3$ is in the last-named position, the water will not flow through the pipes $l^1$, $f^4$, because the boiler pressure is greater than the pressure in said tank.

The valve $l$ where the pipe $l^1$ runs from the pipe L serves merely to cut off said pipe $l^1$ from said pipe L, but does not close the latter.

When the cocks $J^2$, $J^3$ are set to admit the water to the pipe L, the valve $h^6$ in the pipe should be closed to prevent the water from returning through said last named pipe to the tank G and to enable the water to be forced into the boiler. Said valve $h^6$ should be open when the heater is restored to the normal condition to permit the gravity circulation between the tank G and the heater. When the valve $h^6$ is slightly open, the water may be forced both to the heater and to the tank G, and the cock $J^3$ may be moved to either position.

In Figs. 5, 6, and 7, I have shown a form of three-way cock which represents a suitable construction for either of the cocks J, $J^1$, $J^2$, $J^3$ above mentioned—in which a shell $j^2$, circular in cross-section, is provided with three openings $j^3$, $j^3$, $j^4$ and with a tapering rotary plug $j^6$ which has a corresponding number of openings. The two openings $j^3$, $j^3$ are diametrically opposite each other and the third opening $j^4$ is at 90° from them. The openings $j^7$, $j^7$ of the plug are opposite each other

and the opening $j^8$ is half way between them. A suitable handle or lever $j^9$ is secured to the plug $j^6$ and is used to turn the same. A latch-lever $j^{12}$ is pivoted at $j^{11}$ between ears $j^{10}$ on the handle $j^9$, and has a projecting dog $j^{13}$ which is forced by a spring $j^{14}$ into engagement with either of the two notches $j^5$ and holds the valve in either of its positions.

It will be seen by the foregoing description that water may be forced from the supply-tank by both feed-pumps directly to the boiler or to the heater or by either one of the feed-pumps from the supply-tank directly to the boiler and by the other feed pump to the heater; that the water may be made to pass from the heater back to the supply-tank or directly from the heater to the boiler; that the water supplied to the feed-pumps is maintained at a constant head and pressure by means of the overflow pipe from the auxiliary tank.

In Fig. 2, I have shown in dotted lines an inner tank $G^1$ arranged within the supply-tank G and connected at the top to the pipe $h^5$ from the supply-tank and at the bottom to the pipe $h$, so that this inner tank $G^1$ is in the hot-water system above described and serves all the above described purposes of the tank G shown in Fig. 3 and above described, while said outer tank is connected to the feed-pipe and to the overflow pipe $i^2$ as previously described. I have shown in Fig. 2 an overflow-pipe $g$ for the outer tank G which limits the height of water in said outer tank and will prevent any undue pressure of water in said tank G.

The use of the inner tank and outer tank G allows the boiler to be filled from said outer tank when the apparatus is not connected to any external water supply without interfering with the hot water system.

I claim as my invention:—

1. The combination of a boiler having a fire-box or furnace and having a chimney or smoke-stack, a heater located within said chimney or stack, a water-tank on a lower level than said heater, direct and return water-connections between said tank and heater, to maintain a constant circulation of water from said tank to said heater and back to said tank, a feed-pipe connecting said tank and said boiler, means of forcing water from said tank to said boiler, and an overflow connected with said direct connection and discharging above said heater.

2. The combination of a boiler having a fire-box or furnace and having a chimney or smoke-stack, a heater located within said chimney or stack, a water-tank on a lower level than said heater, direct and return water-connections between said tank and heater to maintain a constant circulation of water from said tank to said heater and back to said tank, a feed-pipe connecting said tank to said boiler, a connection between said return-pipe and said boiler, suitable valves and a feed-pump, whereby water may be forced from said tank directly to said boiler or from said tank through said heater to said boiler.

3. The combination in a steam-fire engine of a boiler having a fire-box or furnace and having a chimney or smoke-stack, a heater located within said chimney or stack, a supply tank, a main pump, a water-connection or pipe between said main pump and said tank, a feed-pump, pipes connecting said feed-pump to said tank, heater and boiler and an overflow to maintain a constant head or pressure of water in said supply-tank.

4. In a steam fire-engine, the combination of a boiler, having a fire box and chimney, a gravity system of heating water consisting of a tank, a heater arranged in said chimney, single direct and duplicate return water-connections between said tank and heater, two main-pumps, two feed-pumps, pipes connecting said feed-pumps with said main pumps and with said return connections, pipes to connect each feed-pump separately with said boiler, pipes connecting said return connections with each other, and valves arranged in said pipes and connections, to enable either or both of said feed-pumps to throw water from said tank to said heater or from said main-pumps to said boiler at two different places.

5. The combination in a steam-fire engine of a boiler having a fire-box or furnace and having a chimney or smoke-stack, a heater located within said chimney or stack, a supply-tank, a main-pump, a water-connection or pipe between said main pump and said tank, a feed-pump, pipes connecting said feed-pump to said tank and boiler, an outer tank surrounding said first tank and receiving the discharge of said overflow, another overflow for said outer tank to limit the pressure of water therein, and a pipe connecting said outer tank to said feed-pump.

In witness whereof, I have affixed my signature, in presence of two witnesses.

JAMES W. JANTZEN.

Witnesses:

ALBERT M. MOORE,

GRACE CROWLEY.