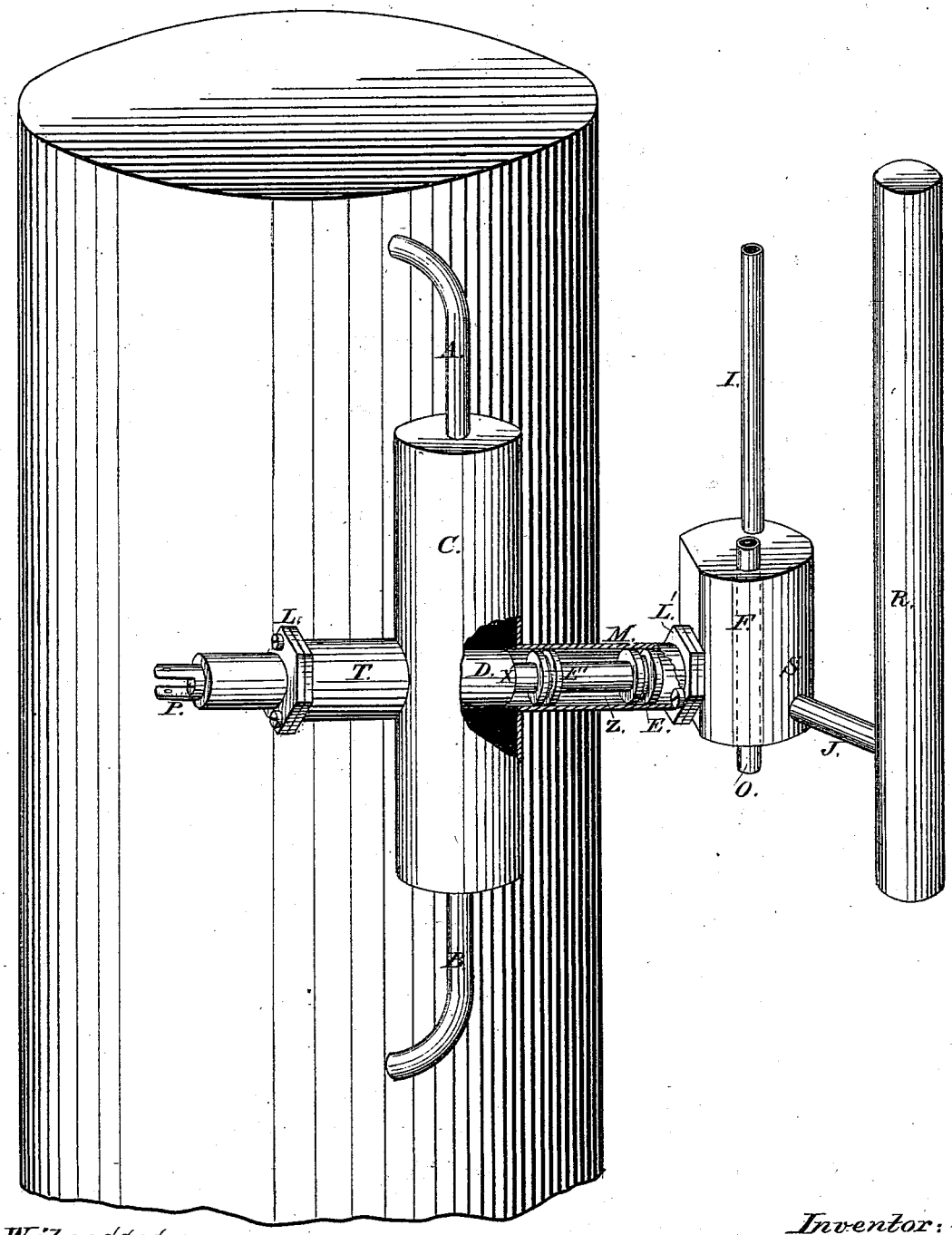
J. POOL.

Feed-Water Heaters and Regulators for Steam-Boilers

No. 211,781. Patented Jan. 28, 1879.



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IMPROVEMENT IN FEED-WATER HEATER AND REGULATOR FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. **211,781**, dated January 28, 1879; application filed November 14, 1878.

To all whom it may concern:

Be it known that I, JAMES POOL, of Friendsville, in the county of Wabash and State of Illinois, have invented certain new and useful Improvements in Feed-Water Heater and Regulator for Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which they appertain to make and use the same, reference being had to the accompanying drawing, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to that class of inventions known as "feed-water heaters and regulators for steam-boilers," by which water in the boiler is kept at a proper level without intervention of outside attention from the engineer, and whereby great economy of fuel is attained, and the heat of the exhaust-steam utilized.

It is well known that in the ordinary way of heating and feeding water to boilers, the water is heated in coils located in the furnace, uptake, or in vessels located in close contact with the fire or escaping gases, and also by exhaust-steam, such as in condensers or other vessels, and then forced into the boiler by pumps or injectors; and it is also well known that when the water gets to a certain temperature it cannot be forced in either by pumps or injectors, and that a vast amount of power is necessary to operate those pumps, all of which I avoid by my invention; and to this end the first feature of my invention consists in automatically maintaining a proper water-level in steam-boilers, by which the danger of explosion from low water is prevented, and also "priming" of the boiler obviated, thereby furnishing dry steam to the engine.

The second feature of my invention consists in feeding water to the boiler without the resistance due to the pressure of the steam therein, notwithstanding the temperature of the feed-water.

The third feature of the invention consists in the construction of the pump-plunger and piston attached thereto, whereby the resistance of the boiler-pressure to the plunger is balanced by equalizing the pressure on it the entire length of its stroke; and the fourth feature consists in the general arrangement of the heater, receiver, and their connecting parts, by which the water is heated, the sediment precipitated, and then supplied to the pump in a comparatively pure state, all of which will be hereinafter more fully described.

The drawing represents a vertical boiler with my improvement attached thereto. The apparatus is shown partly in section and partly an elevation in perspective.

Pipe A connects with the steam space of the boiler and the upper end of the receiver C, and B with the water-space of the boiler and the bottom of the receiver.

The receiver C is also provided with two projections, nearly about midway its length. One of said projections forms the working-cylinder M for the piston-heads E′ E. The other projection forms stuffing-box T. Each of said projections is provided with flanges, for the purpose of attachment to the heater at one end, L′, and for a gland, L, on the other. Thus it will be seen the receiver C is cruciform in shape, but may be deviated from as occasion may require. These projections T and M may be cast with the receiver in one piece, or they may be attached by any well-known means or devices; but they must in all cases be in line with each other, particularly when they are cast in one piece with the receiver, so they can be properly bored out true for the reception of the plunger at one end and the piston at the other.

It will be readily seen that the receiver is much larger in diameter than the plunger, and therefore the plunger readily passes through it.

After the cylinder M and stuffing-box T are properly bored out the plunger D is inserted, first properly packing the piston-heads E′ E, then packing the stuffing-box T by gland L, when that portion of the apparatus is ready for use.

I will now describe my improved piston-plunger. At or near about the middle of the plunger I form a recess, X. One end of this recess is formed a collar, on which the steam presses. The other end of the recess forms one side of a piston-head, E′. On the other side of piston-head E′ I form another recess, much longer than the first; and at the end

of the second recess, Z, I form another or second piston-head, E, which also forms the end of the plunger. Recess Z performs the function of a bucket. On the outer end of the plunger is formed a double ear-piece, P; or the plunger may be provided with any other device for attachment to motive power.

At the end of cylinder M, I attach my heater F by flanges, couplings, or any well-known method, as seen at L. This coupling, however, must always be sufficiently large to allow the piston-head E to pass into the heater F as far as S. Piston-head E′ then fits snugly at the end of cylinder M. An exhaust pipe or pipes, O, runs up through heater F; or the heater may have cast within it exhaust-passages, providing for a larger heating-surface for imparting the heat of the exhaust-steam to the water within it on its passage out. At the other side of the heater, or in any convenient place, I attach a pipe, J, to a vessel or reservoir, R. This vessel or reservoir will be located sufficiently high to keep the heater F always supplied with water.

The heater F is also provided at its top with a pipe, I, for the purpose of relieving it of any uncondensed steam or vapor that would tend to prevent the water from freely flowing from vessel R into it. This pipe I also serves as an overflow-pipe, should the water rise too high in heater F.

Operation: Water being in the boiler and steam generated, the water will rise as high in the apparatus as in the boiler through pipe B. Steam will enter from the steam-space of the boiler to the apparatus through pipe A, so that the steam-pressure in receiver C is just the same as in the boiler. The water is now below the proper level. The plunger is then put in operation, and with it the piston-heads E′ E, the steam-pressure being equal on each side of recess X, thus balancing the plunger. The piston-heads are now traveling in the direction of the arrow. When piston-head E reaches S piston-head E′ is at the end of cylinder M, heater F is filled with water, and fills up the recess Z, formed between the two piston-heads. The plunger then takes its return stroke, drawing the piston-heads with it, and also all the water in recess Z, and continues this stroke until piston-head E takes the position of E′. The water then falls from recess Z, by its own gravity, into the receiver, and, of course, into the boiler, and so on continuously until the water rises to its proper level in the boiler, which level is the level of cylinder M.

It will be obvious that when this level is reached, and the pump still working, it will only pump the same water back and forth until the water in the boiler requires replenishing.

The water is heated by means of the exhaust-steam passing through heater F, and also by steam and hot water conveyed into the heater by the piston-heads on their return into the heater.

It will be seen that the water in the boiler cannot either rise so as to prime, or fall so low as to endanger explosion, but is kept at nearly a permanent level, such as may be decided upon at the setting of the machine.

Of course this apparatus is just as applicable to horizontal boilers as to vertical, and may be applied at the ends as well as at the sides, and will pump or feed hot as well as cold water, and by the balancing arrangement the pressure on the plunger is fully equalized. Thus it is easily operated, requiring but little power, the resistance being that of friction only.

Having now fully described my invention, its construction and operation, I desire to have it distinctly understood that I do not confine myself to the precise details hereinbefore shown and described, as many modifications may be made without departing from the spirit of my invention.

I therefore claim—

1. In a feed-water apparatus, the pump-plunger D, provided with recess X and piston-head E′, by which the plunger is balanced, in combination with piston-head E and cylinder M, substantially as described.

2. The combination of the receiver C, balanced plunger D, and cylinder M, constructed and operating substantially as shown, and for the purpose set forth.

3. The combination, in a feed-water heater and feed apparatus, of the receiver C, balanced pump-plunger D, cylinder M, and heater F, arranged to operate in the manner set forth and described.

4. In a feed-water apparatus, the combination of receiver C, balanced pump-plunger D, cylinder M, heater F, and reservoir R, arranged to heat and automatically feed the water to the boiler, as herein set forth and described.

5. A feed-water apparatus consisting of the receiver C, connections A B, balance-plunger D, cylinder M, and heater F, said heater being provided with an exhaust-steam pipe, O, all operating as set forth, and for the purpose specified.

6. In a feed-water heater and feeder, the cylinder M, piston D, heater F, connected and arranged to receive the piston-head E, exhaust-pipe O, escape-pipe I, and reservoir-connections J, all combined and arranged to operate as set forth.

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