J. W. Doughty,

Steam-Engine Water-Feeder.

No. 32,824. Patented July 16, 1861.

Fig 3.

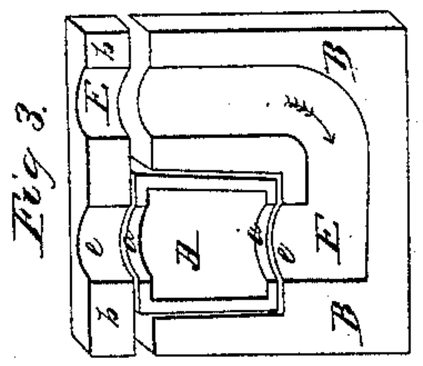


Fig 4

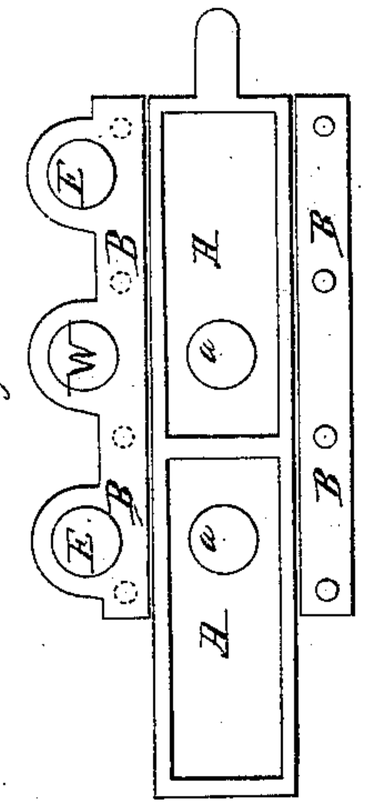


Fig 2.

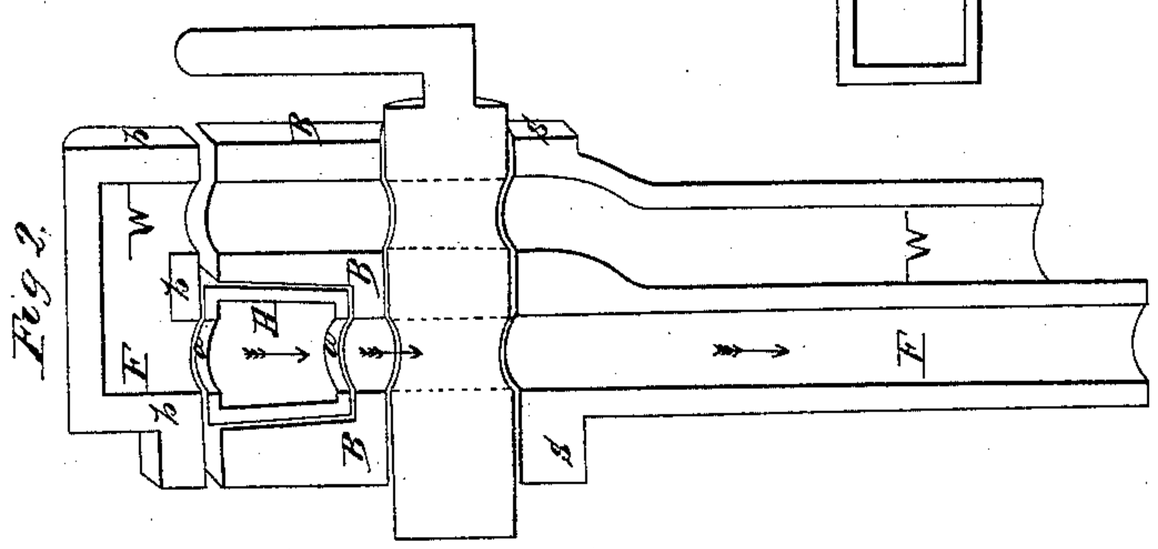
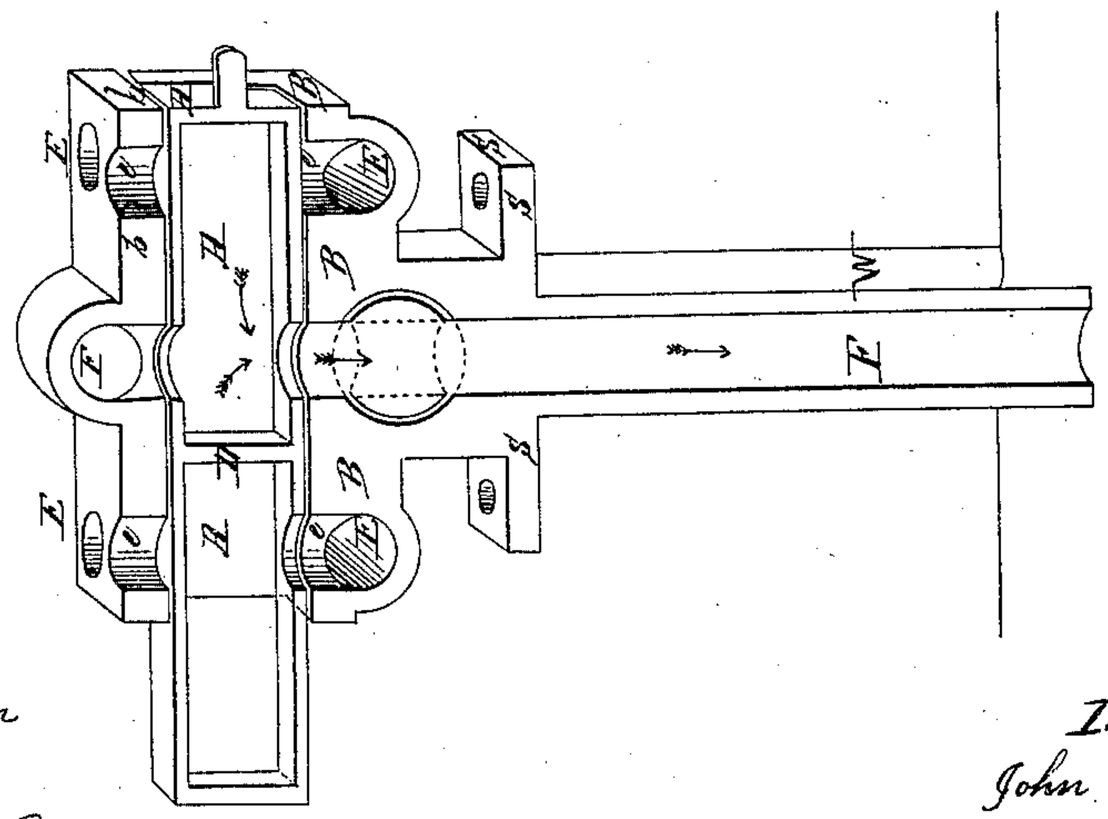


Fig 1



Witnesses,
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UNITED STATES PATENT OFFICE.

JOHN W. DOUGHTY, OF NEW YORK, N. Y.

IMPROVED FEED-WATER APPARATUS FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. 32,824, dated July 16, 1861.

To all whom it may concern:

Be it known that I, JOHN W. DOUGHTY, of the city of New York, in the county of New York and State of New York, have invented a new and Improved Self-Regulating Feed-Water Apparatus for Steam-Boilers; and I do hereby declare that the following is a full and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, in which—

Figure 1 is a vertical section; Fig. 2, a vertical section made at right angles to Fig. 1, the intersections of the planes of Figs. 1 and 2 being in the axis of the feed-pipe F F; Fig. 3, a vertical section made at right angles to Fig. 1 through the pipes and orifices on the left of the feed-pipe F F, the corresponding parts in all the figures being referred to by the same letters. Fig. 4 is a horizontal section.

A A′ show hollow piston, which may be cylindrical or, as here represented, bounded by plane surfaces; D, solid partition dividing the interior of the piston into two trunks.

a a′ are orifices at the top and the bottom of each trunk for the ingress and egress of the water. The horizontal distance between the orifices *a a′* must be a little more than the diameter of the feed-pipe F F.

B *b* show piston-race, intersecting the upper part of the feed-pipe F F at right angles to its axis.

b represents cap to piston-race. The cap *b* is bolted to the lower part of the piston-race B. Its lower surface makes a steam-tight joint with the upper surface of the piston A A′, while the lower surface of the piston makes a steam-tight joint with the lower part of the piston-race B.

E E′, Fig. 3, show induction-pipe communicating with the supply tank or heater, passes down across the side of the piston-race, and, turning horizontally under the bottom, terminates in the orifice *e′*. This arrangement causes the water to enter the piston through the lower orifice, *a′*, while the air or steam passes upward through the orifice *a* into the tank or reservoir.

e e′ are orifices in the top and the bottom of the piston-race, made so as to be in a line with the orifices *a a′* of the piston, and placed as far from the feed-pipe F F as the orifices *a a′* are from each other.

F F show feed-pipe through which the water passes from the piston A A′ into the boiler. This pipe extends from the upper part of the boiler downward below the water-line.

W W, Fig. 2, show water-line pipe. This pipe is of the same size as the feed-pipe F F. It is placed by the side of the feed-pipe, and, having its lower end on the water-line, passes upward across the side of the piston-race, and, turning horizontally, terminates in the feed-pipe F F above the piston A A′. This position of the water-line pipe introduces the pressure of the steam into the feed-pipe above the piston, and thereby establishes an equilibrium, so that no more force is required to operate the piston when the pressure is one hundred pounds than there is when the pressure is nothing. Again, the lower end being on the water-line, whenever the water boils away so as to fall below that line, the pressure above the piston balancing the pressure below it will allow the water to descend from the piston through the feed-pipe into the boiler. This becomes evident from an examination of Fig. 2, where it is seen that the feed-pipe and water-line pipe, in combination with the orifices *a a′* of the piston, make a perfect siphon.

Let us suppose the shoulder *s*, Fig. 1, bolted to the top of the boiler, and the cap *b* of the piston-race either projecting into the heater or the orifices *e*, and E connected with the heater by a large pipe, the cock which passes through the feed and water-line pipes being open. It is plain that a reciprocating motion of the piston A A′ would at each stroke introduce into the feed-pipe F F a quantity of water equal to the capacity of one of its trunks and take from the boiler an equal volume of air or steam, the water continuing to rise in the boiler until it covers the end of the water-line pipe W W, when no more water will enter the boiler because the air or steam cannot escape; but the pipes F F and W W would fill and render it impossible for any more water to leave the trunk of the piston A A′, and however long-continued or rapid the motion of the piston no more water could enter the boiler while the end of the water-line pipe is covered

with water; but in practice the water is escaping in the form of steam at the rate of several gallons a minute, and consequently the water in the boiler would in a few seconds fall below the end of the water-line pipe, when the pipes would empty their contents into the boiler and then be refilled as before. The same process would of course continue to be repeated for any length of time, the quantity of water in the boiler never varying more than a gallon or two.

From the above it will be seen that my improvement accomplishes three very desirable results. First, it dispenses with the use of all valves; second, it conducts the water into the boiler without acting against the pressure of the steam, and, third, it makes the feed-water apparatus perfectly self-regulating. The advantages which the above results secure are as follows: Dispensing with the use of valves increases the certainty of the action of the feed-water and diminishes the liability to get out of order. Conducting the water into the boiler without having to overcome the pressure of the steam effects a saving of power and is less wearing to the machinery. Further, it is evident that every boiler will generate steam more rapidly and therefore more economically when it contains its requisite (to be ascertained) quantity of water. By adopting the above device this quantity could be maintained with an accuracy and reliability beyond that which the most skillful and attentive could reach without it. Again, when we consider that more than nine-tenths of boiler explosions are caused by an irregular and insufficient supply of water, it becomes evident that any device which, being self-regulating, shall furnish a uniform supply of water will not only very much lessen the liability to accident where steam is now used, but render the use of steam as safe as it would be economic in many cases where fear of accident has hitherto discouraged its use.

What I claim as my improvement in the feed-water apparatus for steam-boilers, and desire to secure by Letters Patent, is the following parts of the apparatus, constructed, arranged, and operating substantially as described:

1. The hollow piston A A′, having in the top and the bottom the orifices *a a′*, as described.

2. The piston-race B *b*, in which the piston A A′ by its reciprocating motion brings the orifices *a a′* alternately in a line with the orifices *e e′* and the axis of the feed-pipe F F, as described.

3. The induction-pipe E E′, by which the water is made to enter the piston through the lower orifice, *e′*, of the piston-race, as described.

4. The water-line pipe W W, which, having its lower end on the water-line of the boiler and the other end terminating in the feed-pipe F F above the piston A A′, establishes an equilibrium of the pressure about the piston and at the same time makes the feed-water apparatus self-regulating by allowing the piston to discharge its contents into the feed-pipe whenever the water gets below the water-line, as described.

JOHN W. DOUGHTY.

In presence of—
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