J. S. BADIA.

Feed-Water Regulator.

No. 205,782. Patented July 9, 1878.

Fig. 1.

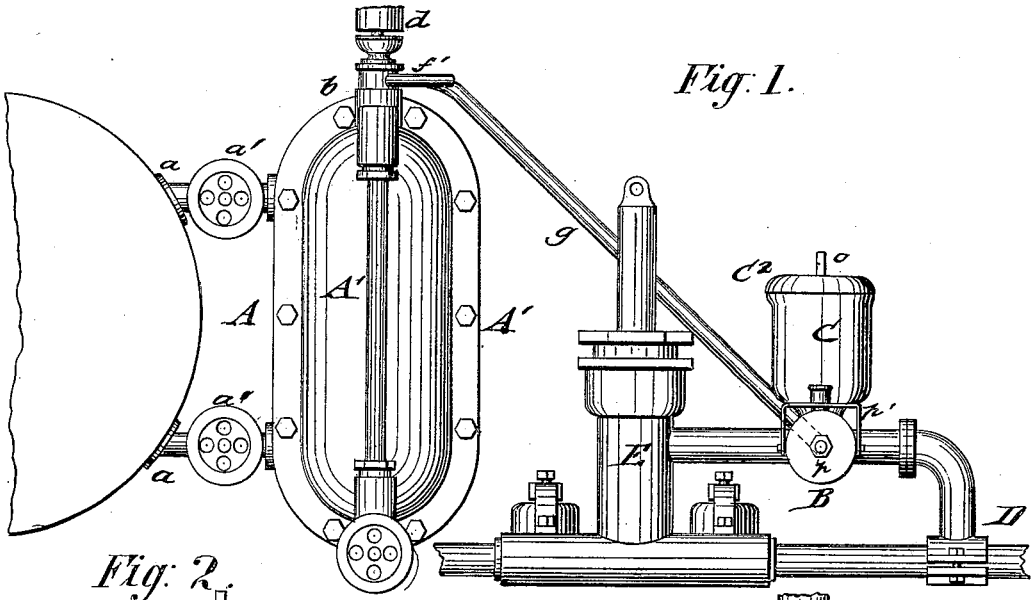


Fig. 2.

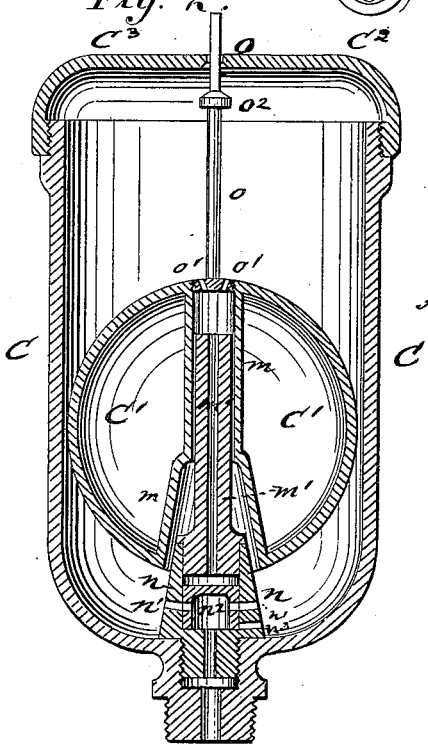


Fig. 5.

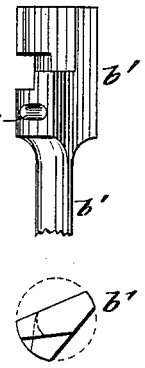


Fig. 3.

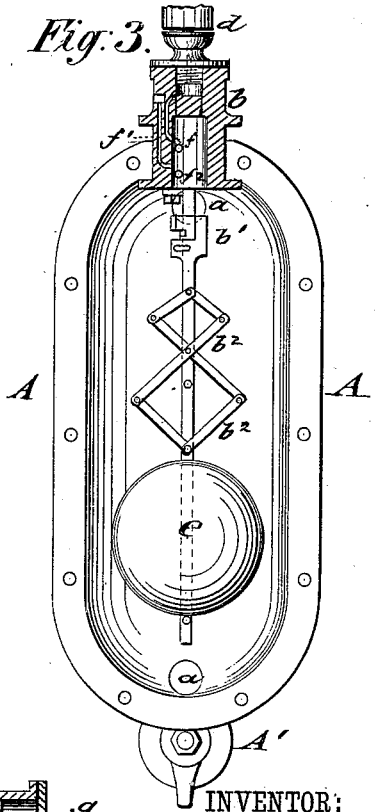
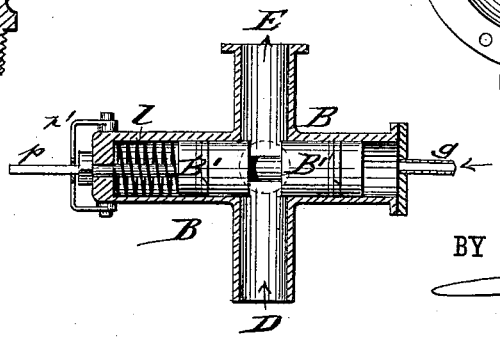


Fig. 4.



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JOSEPH S. BADIA, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN FEED-WATER REGULATORS.

Specification forming part of Letters Patent No. **205,782**, dated July 9, 1878; application filed May 23, 1878.

To all whom it may concern:

Be it known that I, JOSEPH S. BADIA, of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a new and Improved Automatic Feed-Water Regulator, of which the following is a specification:

In the accompanying drawing, Figure 1 represents a side elevation of my improved feed-water regulator, shown as connected to the feed-pump and boiler. Fig. 2 is a detail vertical central section of the air-cup and float-valve for admitting the escape of the air from the feed-pump. Fig. 3 is side elevation of a semi-section of the water box and gage attached to the boiler, showing the automatic valve and alarm arrangement in section. Fig. 4 is a horizontal section of the cylinder and piston that regulate the passage of the water from the supply-pipe to the feed-pump; and Fig. 5 is a detail side view and top view of the regulating cut-off valve in the water-box.

Similar letters of reference indicate corresponding parts.

The object of this invention is to furnish for steam-boilers an improved automatic feed-water regulator that accomplishes, in reliable manner, three different objects at the same time—namely, to indicate the height of the water-level in the boiler, to give a whistle-alarm when the water-level is either too high or too low, and, finally, to act as an extractor of the air accumulating in the feed-pump.

The feed-water regulator keeps up a constant water-level in the boiler, secures the steady and reliable action of the steam-pump, and is so constructed that, if any part thereof should be out of order and refuse to work, the remaining parts may continue to operate without interruption, as neither impedes the working of the pump, which is independent of the other parts.

All the parts may be controlled from the outside, and any defect in the valves of the feed-pump or in the apparatus, or any leakage of water in the boiler, may be indicated by the alarm in due time, so as to prevent accidents.

The invention consists of a water-box and water-gage connected with the boiler, and provided with an interior float connected to an automatically-working valve, that either cuts off the steam or exhausts it, or sounds the alarm-whistle, or establishes the connection with the spring-acted piston that regulates the supply of water from the supply-pipe to the feed-pump and boiler.

The casing or cylinder of the piston is arranged with a cup and an automatically-acting air-escape valve and float-valve; and the piston is circumferentially grooved and spring-cushioned, to establish or interrupt connection of supply-pipe and feed-pump.

Referring to the drawing, A represents an upright water-box of cylindrical shape, that is rounded off at the top and bottom parts, and connected to the boiler by top and bottom pipes *a*, having stop-cocks *a'*, the pipes communicating respectively with the steam and water spaces in the boiler.

The water-box A is provided, in the customary manner, with a water-gage, A', that indicates the height of the water-level in the boiler.

At the top part of the water-box is arranged a cylindrical valve-casing, *b*, that is surmounted by a whistle-alarm, *d*, which is blown whenever the water in the boiler rises or falls beyond certain fixed limits.

In the valve-casing *b* is arranged a nicely-fitted valve, b^1, that is connected by its stem with a lazy-tong frame, b^2, which is again attached to a ball-shaped float, *e*, that rises or falls with the water-level in the water-box and boiler.

The valve b^1 is made of sector shape, and recessed at the middle part in such a manner as to form two faces, that close, respectively, a steam duct or channel, *f*, which leads to the space or chamber below the whistle-alarm, and an exhaust-channel, f^1, that communicates by a discharge-spout with the open air. The lower face of the valve b^1 also opens or closes a third port, f^2, that passes parallel with the ports $f f^1$ through the valve-casing, and is connected to a steam-conducting pipe, *g*, which extends down to one end of a horizontal casing or cylinder, B. The lower face of valve b^1 is also arranged with a groove, f^3, that connects the port f^2 and the pipe *g* with the exhaust-channel f^1 whenever the communication of the water-box with the pipe *g* and cylinder B is interrupted, so as to exhaust the steam in the pipe and cylinder into the outer air.

The float or ball *e* at the interior of the wa-

ter-box rises or falls with the water in the boiler, and moves, by the lazy-tongs frame, the valve b^1, which opens or shuts the different ports of the valve-casing, so as either to establish the communication with the pipe g and with the cylinder B, or to sound the alarm when the water in the boiler rises or falls beyond a certain level, or to exhaust the steam from pipe and cylinder.

The upper valve-face passes either above or below the alarm-port, and admits the steam in either case to pass to the alarm, so as to sound the same.

The port f^2, that communicates with the horizontal cylinder, is opened or closed by the lower valve-face, which moves up and down, following the level of the water in the water-box, the steam entering into port f^2 when the valve-face passes below the port, but, on the contrary, shutting the port when the water rises, and bringing, finally, the groove f^3 of the valve-face in communication with the exhaust-port f^1.

The horizontal cylinder or casing B is made with tubular side portions B^2, which are coupled, respectively, to the suction-pipe D and feed-pump F, as indicated in Fig. 1. The piston B^1 is guided in the cylinder B, and provided with a central annular recess or groove, h, with packing at both sides thereof, the annular groove or space serving either to shut off or establish the connection of the supply-pipe with the feed-pump, according to the position of the groove in the cylinder.

When the water in the boiler rises above its regular level the regulating-valve in the water-box slides below the port connecting with the cylinder B, and supplies thereby steam to the same, the steam pushing back the combined double piston and valve and compressing a spiral spring, l, that is placed between the piston and the opposite end of the cylinder. The recessed portion is thereby brought in line with the supply-pipe and pump-connection, so that the water that enters the pump, instead of being pumped into the boiler, returns into the suction-pipe.

When the steam-port is closed by the falling of the water-level in the water-box and boiler, the waste-steam in the communicating pipe g and cylinder B is exhausted into the air; and, as the pressure on the piston is thereby relieved, the spiral spring l forces the combined piston and valve back to the former place, so as to interrupt the communication between the supply-pipe and the feed-pump, and pump thereby the water directly into the boiler through the pipe connecting the feed-tube with the boiler.

For the purpose of admitting the escape of the air that frequently accumulates in the pump, either from bad packing or from other causes, a cup, C, is placed on the central part of the cylinder B, which cup is clearly shown in enlarged scale in Fig. 2.

At the interior of the cup C is arranged a ball-shaped float, C^1, which slides, by a central tube, m, with conical lower part, on a central guide-rod, m', that is screwed into a conically-tapering sleeve, n, screwed firmly into the base of the cup C. To the upper part of the float C^1 is attached a rod, o, that is screwed into the top of the float, and provided at its base with two small holes, o^1, through which the air passes freely into the center tube of the float when the same moves up and down on the center guide-tube of the cup. Near the upper end of the float-rod o is arranged a fixed valve, o^2, which, when the float ascends, comes in contact with a central valve-seat, o^3, of the cover C^2 of the cup, the upper part of the float-rod o being made square, and extended through a center hole of the cover above the same, the rod o forming thereby an additional guide for the float D.

The cover C^2 is screwed tightly on the cup, so as to be readily detached for cleaning and repairing the interior parts of the same. The conical base-piece or sleeve n corresponds in taper to the taper of the lower part of the center tube of the float, and is arranged with radial perforations n^1 and a central perforation, that communicates with the central channel in the stem of the cup and with the cylinder B. Between the bottom of the fixed sleeve n and the lower end of the center guide-tube m of the float is formed a small chamber, in which an inverted cup-valve, n^2, with radial perforations, slides, which perforations communicate with the perforations of the conical sleeve, so that the vertical play of the valve n^2 either establishes or interrupts communication with the interior of the cup C.

At the lower part of the conical sleeve n is a small hole, n^3, as shown in Fig. 2, that also communicates with the interior of the cup.

When the plunger of the pump is on the downstroke, the air or water forces the small cup-valve up, and opens thereby the small hole, through which the air, and if there is no air some water, enters the cup.

When the plunger is on the upstroke, a vacuum is formed inside of the cup, which causes the valve to descend, so as to close the hole n^3, but to establish communication with the radial holes of the sleeve, so that the water which had before entered through the cup through the small hole n^3 is drawn out and used again for the pump, a greater quantity being drawn out than has entered before, on account of the several holes that serve to drain off the water in the cup, while there is only one small hole that feeds or fills the cup. As the greater quantity of water drawn off from the cup into the pump would necessarily cause the entrance of air, the ball-float prevents this, as it decends with the water, and closes the holes of the conical sleeve n until the cup receives again sufficient water through the small hole n^3 by the succeeding stroke of the pump. The float accomplishes thereby two objects: first, it prevents the water from overflowing the cup by closing the valve in the cover; and, secondly, it prevents the water

from being entirely exhausted from the cup, keeping thereby the water at about a medium level, and preventing also the outer air from entering the cylinder from the cup. As the horizontal cylinder B is placed in connection with the upper part of the pump-barrel, any air that accumulates in the latter is quickly forced into the cup, and passes from there into the atmosphere. When the pump stops, for some reason or other, the water fills the pump or cup; but as the float is raised thereby, and forces the fixed valve of its top guide-rod against the seat of the cover C^2, there is no overflow possible, as the top exit-hole is closed by the fixed valve. A stop-cock may be placed in the neck of the cup, to disconnect it from the cylinder B, if there is any part out of order. The pipes that connect the cylinder with the pump and suction-pipe may also be provided with stop-cocks, so as to shut out the cylinder at will. The different pipes may be connected either by flanges, union or other coupling, as desired. The pipe *g*, that conveys the steam from the water-box to the cylinder, may be suspended or laid in the ground, because that pipe fills with water soon after the apparatus commences to work from the condensed steam.

The guide-rod *p* of the piston B^1 extends through the opposite head of the cylinder B, and is provided with a screw-thread and nut, by which the piston may be held at any point, so as to admit of operating the combined piston-valve by hand, whether steam is circulating in the communicating-pipe or not. In case there should be interruption in its automatic working, a pivot, bridle, or bail, *p'*, applied to the closed end of the cylinder B, may be swung down so as to bind over the nut, and hold thereby the piston in position. The bridle *p'* is only used when the apparatus is out of order. When the apparatus is working automatically the bridle *p'* must be turned up above the end of the cylinder, as shown in Fig. 1, and the nut unscrewed until it clears the head of the cylinder, so that the piston works then freely both ways. By observing the projecting ends of the piston-rod and of the cup-rod it may be readily seen whether the piston and cup work properly or not. When the cup-rod moves up and down in accordance with the pump-plunger, but in opposite direction thereto, the cup operates in proper manner.

The apparatus may be readily tested by letting a sufficient quantity of water out of the water-box until a low-water level is reached, and thereby the whistle-alarm sounded, and by filling the box to such an extent that the whistle-alarm is again sounded. At the same time the small rod on the piston must be seen to move in the end of the cylinder.

When the apparatus is working in regular manner the combined piston and valve is thrown, by the admission of steam, to the pipe connecting water-box and cylinder, owing to the lowering of the valve therein, and thereby the water allowed to pass from the feed-pump to the suction-pipe again, so that the feed-pump operates and forces the water back until the proper level is established in the boiler. The steam-port in the water-box is then closed and the steam in the connecting-pipe exhausted. A too high or too low level sounds the alarm-whistle, in addition to the automatic working of the regulator, so as to indicate by the signal given thereby any irregularities in the apparatus.

The cup that provides for the escape of air from the feed-pump keeps up its operations in connection with the cylinder, as described.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of a boiler and feed-pump with a water-box, connected to boiler and having a water-gage, interior float-regulated valve, and with a casing or cylinder having spring-acted and annularly-grooved piston, and being connected to water-box and feed-pump, substantially as and for the purpose set forth.

2. The combination, in a feed-water regulator, of the cylinder or casing B, being connected by steam-pipe with the valve of water-box, and by side portions to feed-pump and suction-pipe, with a sliding and spring-acted piston, B^1, having central annular groove and guide-rod, adjusting-nut, and pivoted bail or bridle, substantially as specified.

3. The combination, in a feed-water regulator, with the feed-pump and cylinder, of a cup for the exit of air accumulating in the feed-pump, the cup having an interior float and valves for regulating the water-level and preventing overflow, substantially as set forth.

4. The combination, in a feed-water regulator, of the air-escape cup C, having cover with center hole, with a perforated bottom sleeve, having interior perforated cup-valve, and with a guided float-valve, having air-exit holes and top stem with fixed valves, substantially as set forth.

JOSEPH SANJURJO BADIA.

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JOHN C. SMITH.