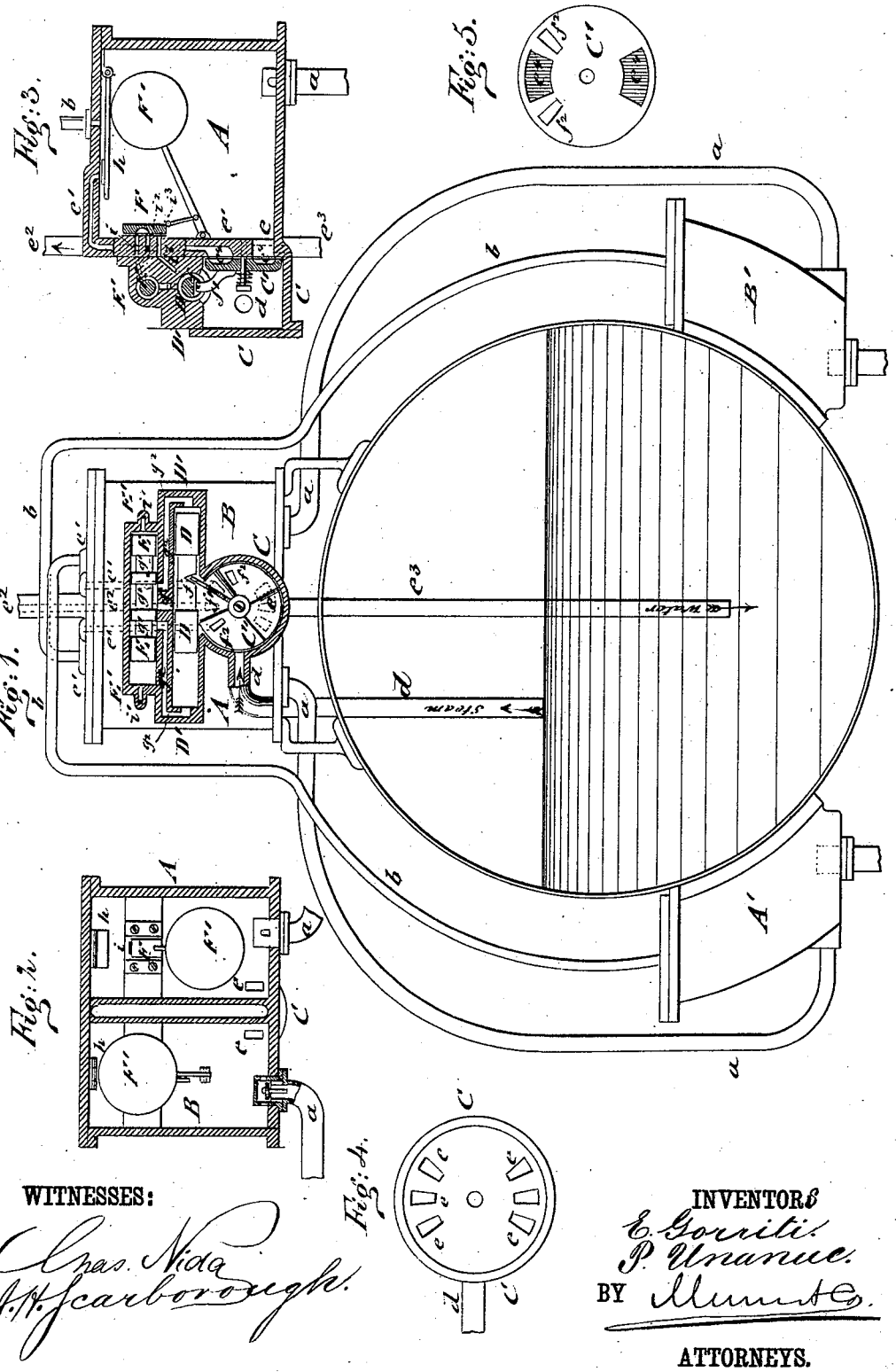
E. GORRITI & P. UNANUE.

Automatic Feed Water Regulator.

No. 196,797. Patented Nov. 6, 1877.



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IMPROVEMENT IN AUTOMATIC FEED-WATER REGULATORS.

Specification forming part of Letters Patent No. **196,797**, dated November 6, 1877; application filed September 29, 1877.

To all whom it may concern:

Be it known that we, ESTÉVAN GORRITI, of Navarre, and PEDRO UNANUE, of Guipozcoa, Spain, have invented a new and Improved Automatic Feed-Water Regulator, of which the following is a specification:

In the accompanying drawings, Figure 1 represents a vertical transverse section of a steam-boiler with our improved automatic feed-water regulator partly in section, to show the valves for governing the supply of steam to the water-chambers and of water to the boiler. Figs. 2 and 3 are vertical transverse and longitudinal sections of the water-supply chambers; and Figs. 4 and 5 are, respectively, a detail front view of the steam and water ports of the water-chambers and a detail rear view of the oscillating disk-valve of these ports.

Similar letters of reference indicate corresponding parts.

This invention is intended to provide for steam-boilers of all kinds an improved automatic feed-water regulator for supplying the required quantity of water to the boilers, whether the supply-tank is above or below the level of the water in the boilers, the regulator assuming in the latter case the functions of the pumps that feed the water to the boiler.

The invention consists, essentially, of water-chambers which are arranged on the top of the boiler, and in which, by steam-connection with the boiler, water-connection with the tank, and suitable slide-valves for inducting and exhausting the steam from the chambers, the chambers are alternately filled with water and emptied into the boiler.

Suitable floats and slide-valves at the inside of the water-chambers, together with steam conducting and exhausting channels, keep up the alternating operation of the water-chambers, which, when working with a tank below the level of the water in the boiler, are also connected, by steam and water pipes, with valved chests near the bottom of the boiler, so as to function as pumps, and keep up the supply of water to the upper water-chambers, and thereby to the boiler.

Referring to the drawing that illustrates our invention, A and B represent the water-supply chambers, which are supported on suitable brackets on the top of the boiler, and separated by an intermediate air-chamber, to prevent the condensation of the steam in one chamber while the other is filling with water.

The water-chambers A B are connected by valved water-pipes *a*, that open into the bottom of the chambers, either with a tank that is arranged above the level of the water in the boiler, receiving, in that case, the water by the direct pressure of the same, or connected to water-chests A′ B′, which are placed near the bottom of the boiler, below the level of the water, when the boiler is to be supplied from a tank below the level of the water in the boiler. In the latter case the water-chests A′ B′ are further connected, by steam-pipes *b*, with the water-chambers A B, the steam-pipes, however, connecting the top parts of the water-chambers with the tops of the chests at opposite sides of the boiler, as shown in Fig. 1, while the water-pipes enter through valved bottom openings of the chests, and form the communication of the water-chambers with the chests at the same side of the boiler.

The water-chambers A B are provided at the lower front part with a cylindrical casing, C, whose center line is made to coincide with the symmetrical axis of the chambers, and which is connected with the desired water-level in the boiler by a pipe, *d*, entering at the side or front of the casing.

The front wall of the steam-chambers A B is provided inside of the casing with six ports, *e*, of which three are arranged at the upper part and three at the lower part of the casing, as shown in Fig. 4, the upper ports *e* communicating with the steam supply and exhaust channels e^1 e^2, which extend upward in the walls of the chambers, while the lower parts pass entirely through the wall of the chambers, and form the water-supply ports from the chambers to the boiler.

The middle upper port *e* connects with central exhaust-channel e^2, while the side ports communicate with the side ducts e^1, that are extended over the top of the chambers to openings that connect with the interior of the chambers.

The middle lower port *e* communicates with a water-pipe, e^3, that extends down into the

boiler, while the side ports form connection, respectively, with the chambers A B.

A centrally-pivoted disk-valve, C′, is tightly pressed by a spiral spring of its pivot against the face of the front wall of the chambers inside of the casing, and turned axially from one side to the other by a slide-piston, D, that engages, by a notch, *f*, a fixed radial arm, f^1, to the disk-valve. The disk-valve C′ is, at the side facing the ports, provided with two channels or arches, e^1, near the upper and lower part of the disk, of sufficient length to communicate the center ports *e* with one of the side ports *e*, and establish thereby alternately the communication of the exhaust-port with one of the steam-ducts e^1 and of the water-pipe e^3 with one of the water-ports *e*.

The disk-valve C′ has also, in addition to the channels e^1 at each side of the upper channels, an opening, f^2, that registers with one of the upper side ports *e* whenever the channel e^4 connects the two remaining upper ports *e*.

The slide-piston D moves in a casing, D′, which communicates directly with the casing C, being placed horizontally on top of the latter.

The middle portion of the slide-piston D is annularly recessed or turned off, so as to admit the passage of the steam around the same to a central passage, *g*, above the same, that connects with the annular grooves g^1 of a second, but smaller, slide-piston, E, working in a shorter casing, E′, above the casing D′.

At both sides of the central passage *g* of casing D′ are side openings and ducts g^2, that open at both inside ends of the casing D′, so as to supply alternately steam from the casing C to the casing D′, to act on either end of the slide-piston D, and throw thereby the piston D from one side to the other, changing, also, the position of the disk-valve connected thereto by the radial connecting-arm *f*. The connection of the steam and water ports is thereby changed so as to admit the alternating discharge of the water-chambers.

To produce, however, the alternate filling and discharging of the water-chambers A B, an additional element is necessary, which is a vertically-guided slide-valve, F, at the inside of each chamber, which slide-valve is operated by link-connection with a float, F′, at the end of a lever, hinged to the inner front wall of the casing below the slide-valve F. The floats rise and fall with the water in the chambers and operate the slide-valves F′, the floats closing, when arriving at the uppermost position, by hinged guard-valves *h*, the openings of the top steam-ducts e^1, so as to prevent the entrance of the water into the same.

When the floats touch the bottom of the chambers the steam-ports *i* communicate with the steam-ducts i^1 of the upper slide-piston E, so as to throw the same, by the action of the steam in the chambers, to either side, according as the port *i* of one chamber or that of the other is opened. This action of the upper slide-piston connects the center passage and steam-duct of the lower piston D, so as to admit live steam to either end of the same, and change the position of the disk-valve C′, as before mentioned.

The face of each slide-valve F is scooped or arched, so as to place the upper port *i* in communication with an exhaust-duct, i^2, leading to the center exhaust-channel e^2 when the slide-valves are in raised position, but forming the connection of the exhaust-duct i^3 of the casing D′ with the exhaust-duct i^2 when the slide-valve F is at its lowermost position.

The interior slide-valve serves thus the twofold purpose of actuating the upper slide-piston for admitting the throwing of the disk-valve C′ and of exhausting the casings of both slide-pistons D′ E′.

The operation of the regulator is as follows: The water-chambers are intended to work alternately, being filled or emptied by the operations of the disk-valve and interior slide-valves. When the water in one chamber rises the interior slide-valve is raised by the float and the top guard-valve closed. The slide-valve of the adjoining water-chamber is at that moment at its lowermost position, so that the steam in the chamber can accomplish the change in the position of the disk-valve by throwing the slide-pistons to opposite sides.

The disk-valve is now in position to admit the supply of steam through one of the openings f^2, that registers with one of the steam-channels e^1, to the top of the full chamber, while establishing simultaneously the connection of the water-exit port with the water-pipe extending into the boiler.

The moment the steam enters at the top part of the chamber the steam-pressure in boiler and chamber is equalized, and thus the water in the chamber dropped by its own gravity into the boiler.

The receding of the water-level lowers the float and the slide-valve F, which, when arriving at their lowest point, admit the entrance of steam through the upper port of the slide-valve to the upper slide-piston, so as to shift the position of the same, and consequently that of the lower slide-piston and of the disk-valve.

The adjoining chamber, that has been filled in the meantime, is now in condition to throw its body of water into the boiler, while the lower water-port of the first chamber is closed by the disk-valve, but the steam-channel e^1 placed in communication with the central exhaust-channel e^2, so that the steam in the chamber may escape to the outside, and thereby the water rise again in the chamber.

The steam in the casing of the lower slide-piston D exhausts at the same time during which the slide-valve is in its lowest position, the same being then raised again by the float until, when arriving at the uppermost position, it admits the exhaust of casing E′ of the upper slide-piston E.

The alternate plate of the interior slide-valves and the alternate setting of the disk

valve by the action of the slide-pistons produce the alternate filling and discharging of the chambers in rapid succession, and thereby the reliable and effective feeding of the boiler with water.

When the water-chambers A B are supplied from the water-chests A′ B′ the steam passes, when the water is dropped from the chamber B into the boiler, through the connecting steam-pipe *b* into the water-chest A′, at the opposite side of the boiler, so as to force the water in the same into the chamber A, while the pressure of the steam closes the valve of the supply-pipe of the water-chest.

The exhaust of the steam from the first chamber, B, produces a vacuum in the connected water-chest A′, which lifts the valve of its supply-pipe and draws up water from the tank below.

When the water of the chamber A is dropped into the boiler the steam enters from the same to its communicating water-chest B′, and lifts the water therein into the chamber B, the chest B′ being refilled with water on the exhaust of the steam from the chamber A.

The water-chests work thus alternately but in connection with the water-chambers, and take the place of the feed-pump, being simpler and cheaper than pumps, and less liable to repairs.

The steam-supply pipe *d* is extended into the boiler to the level of the water in the same, and supplies the steam whenever the water falls below the fixed level, working then automatically the feed-water regulator, stopping the same as soon as the water reaches or rises above the fixed level.

In this manner an automatic working of the regulator and its water-chests is obtained that keeps the boiler continually supplied, and avoids the danger of a too small supply of water in the boiler.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The combination, with a steam-boiler, of two water-chambers that are connected, by a steam and water pipe, with the boiler, and alternately filled and discharged by a reciprocating disk-valve and interior alternating slide-valves operated by floats, substantially in the manner and for the purpose set forth.

2. The combination of the water-supply chambers A B, that are alternately filled and discharged by the action of a reciprocating disk-valve and interior slide-valves, with water-chests A′ B′ arranged near the bottom of the boiler, and connected by valved water-pipes with the bottom parts of the water-chambers, and by steam-pipes with the top parts of the opposite water-chambers A B, to operate as pumps for supplying the water to the chambers and boiler, substantially as specified.

3. The combination of water-chambers A B, having steam induction and eduction channels and water-exit ports, with a steam-casing and disk-valve, C′, and with slide-valves D D′ and E E′, of which the former is connected to the disk-valve, and operated by the direct action of the steam, while the latter is worked by the steam from the inside of the chambers, in conjunction with the interior slide-valves and ports, substantially as specified.

4. The water-chambers A B, having central front casing C, disk-valve C′, steam induction and eduction channels, and water-exit ports, in combination with the slide-valves D D′ and E E′, and with the alternately-working interior slide-valves F and their steam entrance and exhaust channels, for the purpose of alternately charging and discharging the water by the admission and exhaustion of the steam, substantially as and for the purpose described.

5. The combination of the front casing C, having steam and water ports, and of disk-valve C′, having radial arm *f*, with notched reciprocating slide-valve D D′, to change position of disk-valve from one side to the other alternately with motion of slide-piston D, substantially as described.

6. The combination of water-chambers A B, having interior supply and exhaust channels, and alternately-working guided slide-valves F, with the slide-pistons D E and casing D′ E′, to alternately change their position and exhaust the steam in the casings, substantially as specified.

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