

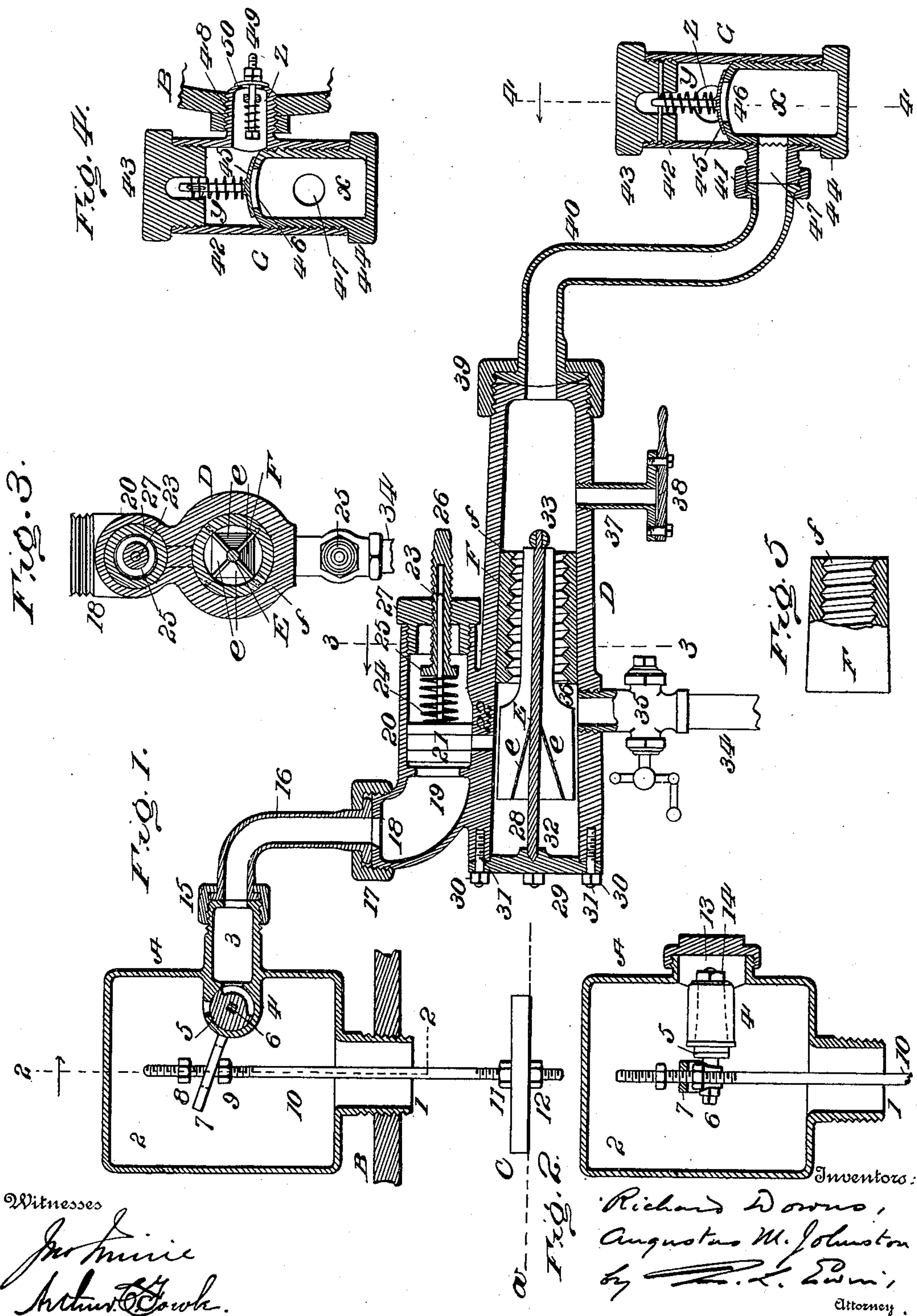
**No. 607,509.**

**Patented July 19, 1898.**

**R. DOWNS & A. M. JOHNSTON.**  
**AUTOMATIC STEAM BOILER FEEDER.**

(Application filed Dec. 14, 1897.)

(No Model.)





# UNITED STATES PATENT OFFICE.

RICHARD DOWNS AND AUGUSTUS M. JOHNSTON, OF LIMA, OHIO.

## AUTOMATIC STEAM-BOILER FEEDER.

SPECIFICATION forming part of Letters Patent No. 607,509, dated July 19, 1898.

Application filed December 14, 1897. Serial No. 661,843. (No model.)

*To all whom it may concern:*

Be it known that we, RICHARD DOWNS, a citizen of England, and AUGUSTUS M. JOHNSTON, a citizen of the United States of America, both residing at Lima, Allen county, in the State of Ohio, have invented a new and useful Improvement in Automatic Steam-Boiler Feeders, of which the following is a specification.

10 This invention relates to "automatic" feed-water injectors for steam-boilers; and it consists in certain novel combinations of parts hereinafter set forth and claimed.

15 The leading objects of the invention are to render the apparatus automatic in a peculiar manner, to inject the water by a whirling or cyclonic action, adapting the apparatus to lift the water and overcome the boiler-pressure with great power, and to provide for inspecting the interior of the injector and its check-valve and for making necessary repairs in either with the boiler under steam-pressure without drawing the fire or blowing off steam.

25 A sheet of drawings accompanies this specification as part thereof.

30 Figure 1 of the drawings represents a vertical longitudinal section of an automatic steam-boiler feeder embodying all the several features of the present invention. Fig. 2 represents a vertical cross-section on the line 2 2, Fig. 1. Fig. 3 represents a vertical cross-section on the line 3 3, Fig. 1. Fig. 4 represents a vertical cross-section on the line 4 4, Fig. 1; and Fig. 5 represents a side view, partly in section, of a removable hollow screw within the injector.

Like letters and numbers refer to like parts in all the figures.

40 An attachment A, Figs. 1 and 2, screwed into the top of the boiler B by means of a vertical neck 1, is provided with a steam-chamber 2 in communication with the steam-space of the boiler through said neck and is constructed with a horizontal neck 3, in line with which the socket 4 of a spigot-valve 5 projects into said chamber 2. The bore of said socket is horizontal, and the valve 5 has an axial spindle 6, from which a slotted lever 50 7 projects above said neck 1 between a pair of nuts 8 and 9 on a vertical rod 10, the

lower end of this rod being provided with screw-nuts 11 and 12, between which a float C within the boiler is clamped. A hand-hole 13, Fig. 2, closed by a screw-cap, conveniently affords access to the screw-nut 14, by which the valve 5 is held within its socket.

To the extremity of the neck 3 a screw-coupling 15 connects a pipe 16, which is connected in like manner by a coupling 17 to an upwardly-projecting neck 18 on the hollow body of an injector D, Figs. 1 and 3, which forms the principal part of the apparatus. Said neck 18 communicates through a valve-seat or stop-flange 19 with the interior of the horizontal casing 20 of a piston-valve 21, which opens and closes the port 22, leading to the interior of the injector proper. An axial stem 23, with which said piston-valve is provided, is surrounded by a spiral spring 24, tending to hold the valve against said seat or stop 19, said spring being compressed more or less between the valve 21 and an abutment 25 at the inner end of a regulating-screw 26, which works in an internally-screw-threaded central bore in the head of a screw-cap 27, closing the rear end of said valve-casing. Said interior of the injector proper includes a vacuum or water-space 28, Fig. 1, at what is herein termed its "front end," and tapers from this end to its other end, which is its outlet end. A cap 29, preferably and conveniently fastened in place by nuts 30 on stud-bolts 31, affords access to the interior of the injector and renders the whirling devices E and F within the injector removable at said larger end, said whirling devices consisting of a rotary "fan" E, the horizontal spindle of which has bearings 32 and 33 at its respective ends, one of them being formed in the inner side of said cap 29, and a hollow screw F of rapid pitch and deep thread *f*, Fig. 5, said screw surrounding the rear portion of said fan, which is of smaller diameter as compared with its front portion. This front portion of the fan E is located beneath the steam-port 22, as shown in Fig. 1, and is provided with chute-forming inclines *e*, Figs. 1 and 3. A water-supply pipe 34 communicates with the interior of the injector through the casing of a water-regulating valve 35, which opens into a suction-space 36 at the rear end of said



screw F, where the diameter of the fan E is reduced.

Through a vertical neck 37 an overflow-valve 38 communicates with the interior of the injector near its outlet end and provides for relieving the injector of back pressure in starting it. To the extremity of said outlet end a screw-coupling 39 attaches a pipe 40, which is coupled in like manner at 41 to the casing of a check-valve G, Figs. 1 and 4, which completes the apparatus. Said check-valve G is composed of a vertical cylindrical barrel 42, Figs. 1 and 4, internally screw-threaded at both ends, top and bottom caps 43 and 44, screwed into said ends respectively, a spring-closed main valve 45, carried by the inner end of said top cap 43, a valve-seat 46, carried by the upper end of said bottom cap 44, horizontal necks 47, Fig. 1, and 48, Fig. 4, which coact, respectively, with said coupling 41 and with a drilled and tapped hole in the side of the boiler B, a supplemental spring-pressed valve 49, Fig. 4, and a seat 50 for the latter formed at the extremity of said neck 48, together with the springs of the respective valves and other like accessories.

The operation of the apparatus is as follows: When the water-level *w*, Fig. 1, falls below a given height, the float C, falling therewith and pulling on the rod 10, brings the nut 8 on said rod into contact with the lever 7 of the steam-valve 5, and as it continues to descend gradually turns said valve and admits steam from the chamber 2 through the neck 3 and pipe 16 into the neck 18 of the injector D, where it presses through the opening of the seat 19 against the piston-valve 21, forcing it back and opening the port 22, the resistance of the spring 24 as regulated by the screw 26 determining the steam-pressure at which said piston-valve 21 will open. Entering the main chamber of the injector through said port 22 the steam acts on the large end of the fan E within said chamber and rotates the fan, and reacting against the inclines *e* between the blades of the fan the steam flows longitudinally through the chutes formed by said blades and inclines and is acted on by the internal screw-thread *f* of the hollow screw F, the two serving to set up a whirling or cyclonic action of the steam, which creates a partial vacuum at 28, Fig. 1, elevating the water through the pipe 34 and regulating-valve 35 into the suction-space 36 and vacuum-chamber 28 of the injector and forcibly propelling the same from thence through the pipe 40 and neck 47 into the chamber *x*, Figs. 1 and 4, of the lower cap 44 of the check-valve G. From thence the mingled water and steam presses through the opening of the valve-seat 46 against the bottom of the main valve 48 of the check-valve G, elevates this valve, and fills the chamber *y* between the end caps 43 and 44 and the chamber *z* within the neck 48. There acting upon the supplemental valve 49 it overcomes the pressure of its spring, plus the boiler-pressure, and forces

its way into the boiler. When the water-level rises sufficiently, the elevated float C, acting through said rod 10, its nut 9, and said lever 7, turns the valve 5, so as to gradually stop the admission of steam to the injector, and when the admission of steam is so reduced to the given extent the spring 24 forces the piston-valve 21 against its seat, closing the port 22 and arresting the action of the injector.

To relieve the injector from back pressure until the whirling devices E and F have given the steam sufficient momentum, the overflow-valve 38 is left open until the flow of water is established.

When it is desired to inspect the interior of the injector, the steam-valves 5 and 21 both being normally closed, together with the valves 45 and 49 of the check-valve, the cap 27 may be unscrewed and the piston-valve 21 and its appurtenances withdrawn, or the injector-cap 29 may be released by unscrewing the nuts 30 and removed from the front end of the injector-body, and the fan E and also, if desired, the screw F may be withdrawn, said screw being removable, as illustrated by Fig. 5, and held in place within the injector-body by a corresponding external taper. In like manner the interior of the check-valve G may be inspected and the main valve 45 re-ground, if necessary, or otherwise repaired without blowing off the water or steam or drawing the fire, by removing the end caps 43 and 44, either or both, the supplemental valve 49 preventing the escape of water or steam.

The apparatus as a whole, as above described, is designed for stationary steam-boilers. To adapt it for locomotive-boilers, it is only necessary to omit the attachment A and to connect the pipe 16 by a suitable coupling with the top of the boiler, an ordinary globe-valve being preferably interposed to provide for making repairs within the valve-cylinder 20. Other like modifications will suggest themselves to those skilled in the art.

Having thus described said improvement, we claim as our invention and desire to patent under this specification—

1. The combination with a steam-boiler and connecting-pipes of an automatically-opened steam-valve, an injector having an internal whirling device operated by the admission of steam, a water-supply pipe in communication with said injector, and a check-valve opening into the boiler.

2. A boiler-feeding injector having an internal hollow screw and a rotary fan within the same for giving the steam and water a whirling or cyclonic movement.

3. A boiler-feeding injector having a tapering hollow body and an internal hollow screw, correspondingly tapered externally, and removable through the larger end of said body.

4. In combination with a boiler-feeding injector, a check-valve in communication therewith having a removable seat for its main



valve, and a supplemental valve within the boiler preventing the escape of water or steam therethrough when said seat is removed.

5 5. A check-valve having screw-caps at top and bottom, provided respectively with a main valve and its seat, and having a boiler connection provided with a supplemental valve to prevent the escape of water or steam when either of said caps is removed.

10 6. A normally-closed boiler-feeding injector having a horizontal hollow body provided in-

ternally with a whirling device, and having a removable cap giving access to its interior.

7. A boiler-feeding injector having a horizontal body containing a whirling device and 15 provided with an overflow, substantially as hereinbefore specified.

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