(No Model.)

C. B. BOSWORTH.

FEED WATER REGULATOR.

No. 558,598. Patented Apr. 21, 1896.

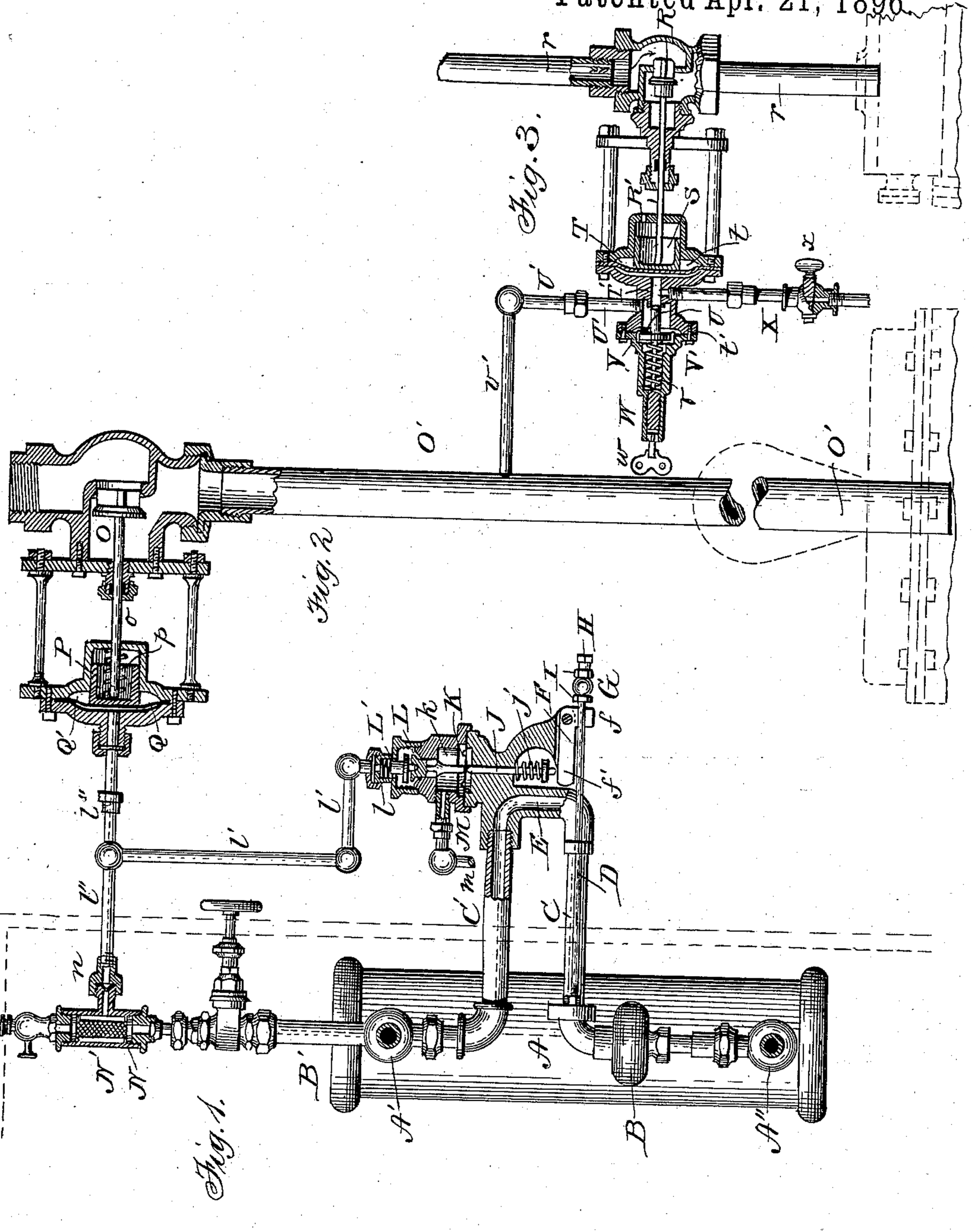

Fig. 3.

Fig. 2

Fig. 1.

Witnesses
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CHARLES B. BOSWORTH, OF EVERETT, MASSACHUSETTS, ASSIGNOR TO THE CROSBY STEAM GAGE AND VALVE COMPANY, OF BOSTON, MASSACHUSETTS.

FEED-WATER REGULATOR.

SPECIFICATION forming part of Letters Patent No. 558,598, dated April 21, 1896.

Application filed August 1, 1895. Serial No. 557,841. (No model.)

To all whom it may concern:

Be it known that I, CHARLES BARTLETT BOSWORTH, a citizen of the United States, residing at Everett, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Feed-Water Regulators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in feed-water regulators, which will be hereinafter more particularly described and pointed out.

In the accompanying drawings, forming part of this specification, Figure 1 represents an elevation of a thermostat attached to an ordinary water-column of a steam-boiler, partly in section. Fig. 2 is a transverse vertical section of a water-valve located in the feed-water pipe. Fig. 3 is a transverse vertical section of a pump-governor located in the pipe which supplies steam to the pump.

A is the water-column of a steam-boiler, its upper arm A′ connected to the steam-space and the lower arm A″ to the water-space. The water-gage and gage-cocks are removed for simplifying the view. In the lower arm A″ there is a water-chamber B, which by radiation cools the water, which alternately with the steam flows into its horizontal part C. The upper arm C′ is always filled with steam and communicates with the lower arm C by the passage E. A pipe B′ is connected with the upper arm A′, in which is a valve N, surmounted by a cylindrical strainer N′.

F is a bell-crank lever, which is controlled by two steel rods D, one being on each side of the lower arm C, and which are connected together by a yoke G. In this yoke is an adjusting-bolt H, controlled by a check-nut I, which acts upon the short arm *f* of the lever F. Resting on the top of the long arm *f′* of lever F is a spindle J, held to it by a spiral spring *j* encircling it. The upper part of spindle J is in contact with the under side of a diaphragm K. Resting on the top of K is the guide of a valve L, held to its seat by the spindle L′, surrounded by a spiral spring *l*. A chamber *k* communicates with the open air at M or by a pipe *m* to the ash-pit of the boiler. Above the valve L a pipe *l′ l″* leads directly to the strainer N′, and by a pipe *l‴* also to the water-valve O. (Shown in Fig. 2.) The opening at the strainer is considerably reduced, being a small hole through the partition at *n*.

O is the feed-water valve located in the feed-water pipe O′, which runs from the pump to the boiler. The stem *o* of the valve O extends to the cylindrical piston P, and is surrounded by a spiral spring *p*, which serves to hold the valve O open in normal condition. Above the cylindrical piston P is a rubber diaphragm Q, which divides the elliptical chamber Q′. From the top of this chamber Q′, and above the diaphragm Q, is the pipe *l‴*, before mentioned, coming from the pipe *l′*, connected with the thermostat in Fig. 1.

R is a valve located within the steam-pipe *r*, which supplies the steam for the feed-water pump, and it controls the flow of steam thereto. The valve R, as shown, is normally open. Attached to the valve R is the stem R′, which extends to the cylindrical piston S, which is of greater area than the valve R. On the outer side of the piston S is a diaphragm T, which divides the elliptical chamber *t*. A passage T′ communicates thence to the lower part of the smaller chamber *t′*. A valve U, connected to a diaphragm V, divides the passage T′.

Beyond the diaphragm V is a spindle V′, encircled by a spiral spring *v*, which is controlled by a screw-bolt W by an ordinary key *w*. Entering the chamber *t′* beyond the valve U is a pipe U′, which communicates with the feed-water pipe O′. From the passage T′ between the valves S and U is a pipe X, which may run to the supply-pipe of the pump or to waste. In this pipe X there is a small cock or valve *x*, having a small hole in it to regulate the pressure therein. In the drawings it is shown as longitudinal with the pipe. By turning the cock it will close the pipe.

Operation: The valves L of the thermostat, O of the water-valve, and R of the pump-governor are all represented as being open in the drawings. Such position of these valves

is caused as follows: The water in the boiler having fallen in or below the lower arm C of the thermostat steam has replaced the water. The heat of the steam expands the arm C against the stationary rods D, producing a pressure thereby upon the short arm *f* of the lever F by means of the bolt H, so that the long arm of F being lifted will also lift the spindle J, which will lift the valve L and open a way from the top of the water-valve to the air at M, through which the steam in the pipes *l' l'' l'''* escapes, and the valve O thereby being free from said pressure is forced open by means of the spring *p*, as shown in Fig. 2, or by the pressure in the feed-water pipe O', and the said feed-water pipe is thereby free to discharge the water into the boiler. When the water rises in the boiler and fills or partially fills the lower arm C, it cools and contracts it, and thereby the pressure on the short arm *f* of lever F being released the spindle J falls by force of spring *j* and permits the valve L to close by the action of the steam flowing from the strainer N' through the pipes *l'' l'*. Then the steam also flows through pipe *l'''* directly to the elliptical chamber, and thence acting on the cylindrical piston P closes the valve O and prevents the inflow of water to the boiler. Simultaneously with this action the pump, being in action, increases the pressure within the feed-water pipe a few pounds above the pressure of the steam in the boiler, which, passing through the branch pipe U' to the pump-governor, lifts the valve U by means of the diaphragm V, and flowing downward into the passage T' exerts itself upon the cylindrical piston S, closes the steam-valve R, and thus stops the pump. When the water in the boiler falls so as to flow out of the lower arm C of the thermostat, the action of the incoming steam, as above described, causes the valve L, as also the water-valve O, again to open, and thereby a reduction of the pressure in the feed-water pipe O', the valve U of the pump-governor closes, thus allowing the water which forced the cylindrical piston S to escape outwardly through the pipe X leading to the air, and the steam in pipe *r*, acting upon the valve R, is allowed to pass to the pump and sets it in motion. This alternating action continues so long as the boiler is in use.

I claim—

The combination of the feed-water valve, O, the feed-water pipe, O', having a branch pipe, U', the valve, U, connected to a diaphragm, V, the spindle, V', controlled by the spring, *v*, and regulated by the screw-bolt, W, the passage, T', the cylindrical piston, S, having a diaphragm, T, valve-stem, R', and valve, R, located within the steam-pipe, *r*, of a water-pump and an outlet-pipe, X, all substantially as and for the purpose described.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES B. BOSWORTH.

Witnesses:
J. H. MILLETT,
A. L. BOWKER.