(No Model.)

D. & F. D. ALMY.

FEED WATER REGULATOR FOR STEAM BOILERS.

No. 538,402. Patented Apr. 30, 1895.

Fig. 1.

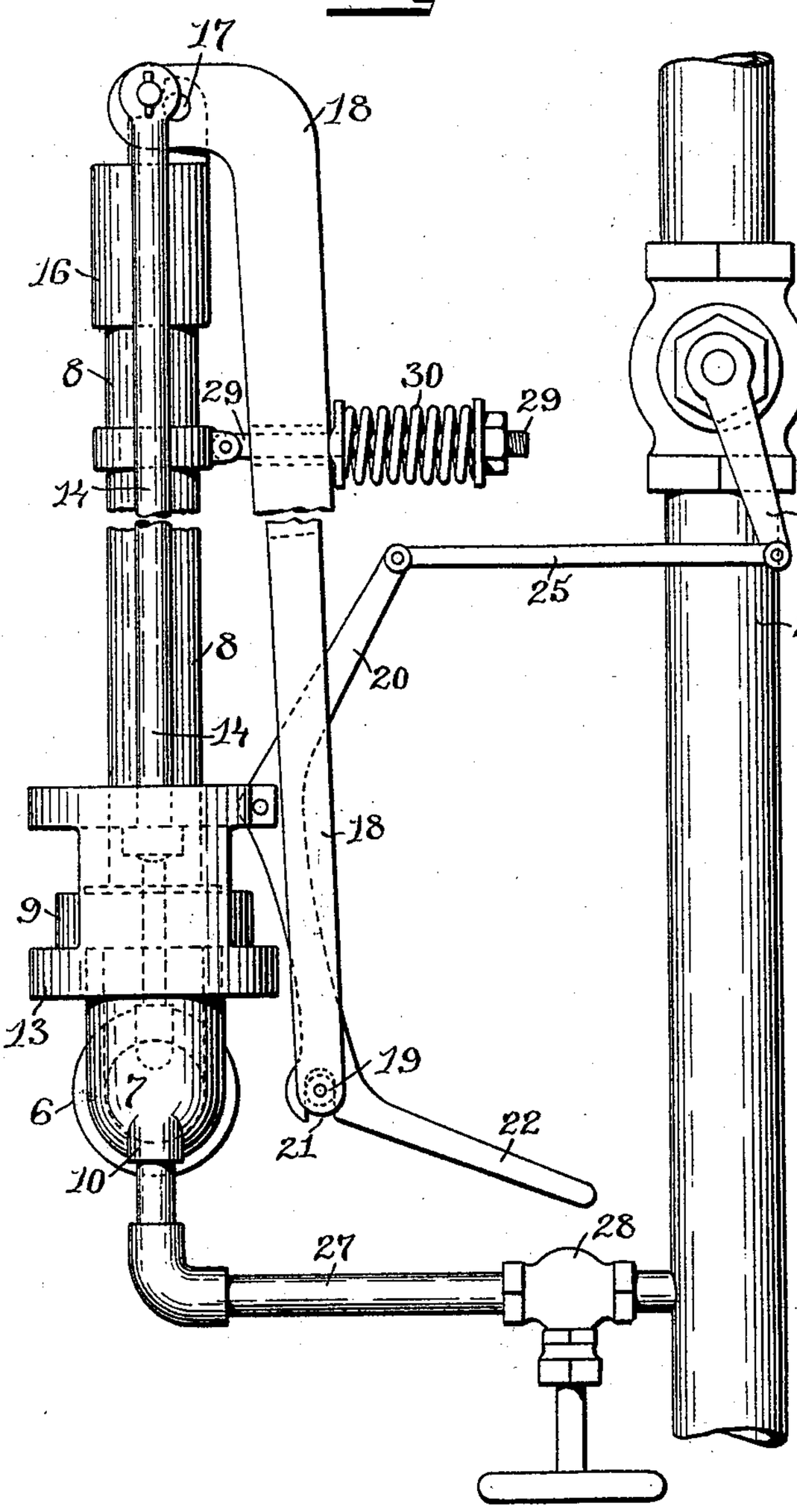


Fig. 2.

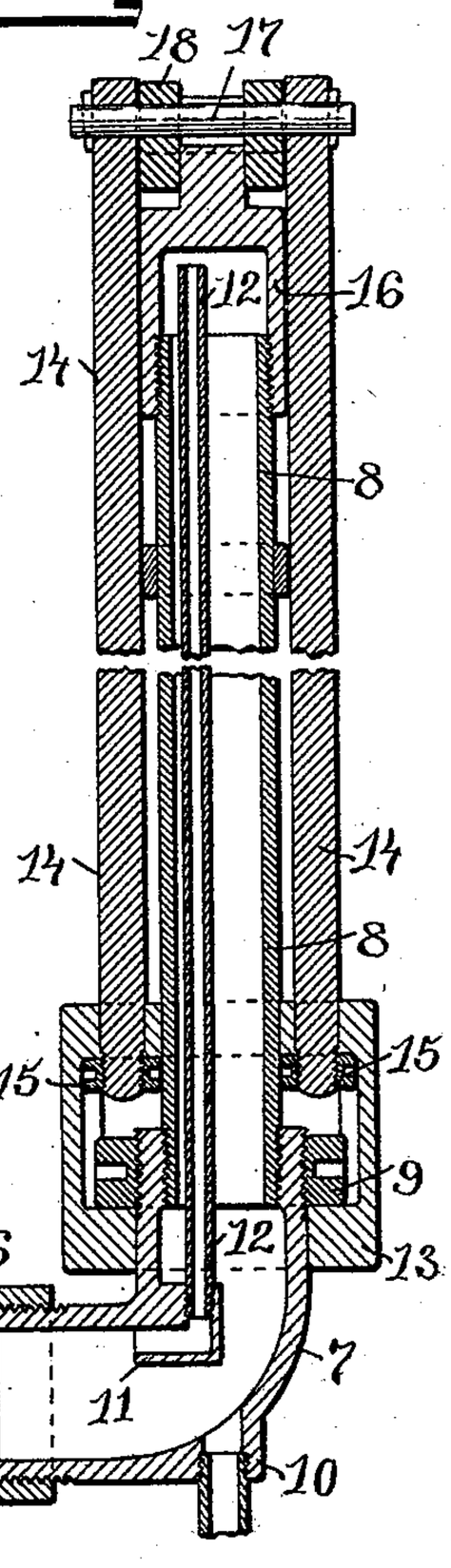
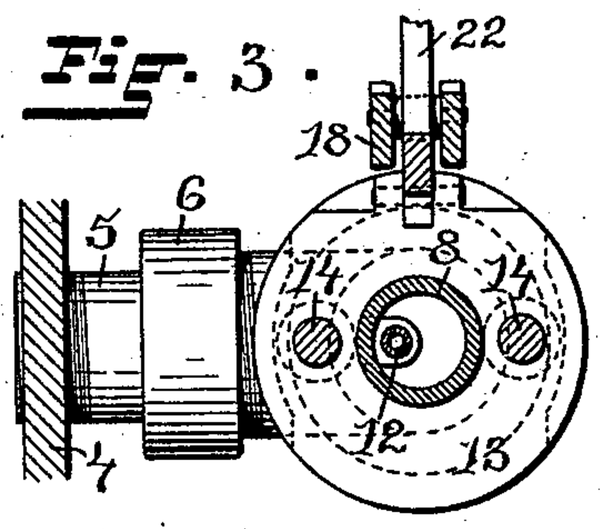


Fig. 3.



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UNITED STATES PATENT OFFICE.

DARWIN ALMY AND FRANK DELANO ALMY, OF PROVIDENCE, RHODE ISLAND.

FEED-WATER REGULATOR FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 538,402, dated April 30, 1895.

Application filed August 17, 1894. Serial No. 520,578. (No model.)

To all whom it may concern:

Be it known that we, DARWIN ALMY and FRANK DELANO ALMY, of the city of Providence, in the county of Providence and State of Rhode Island, have invented a certain new and useful Improvement in Feed-Water Regulators for Steam-Boilers; and we hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

This invention has reference to an improvement in devices for automatically regulating the supply of feed-water to steam generators.

It is essential to the practical and successful use of any steam generator that the water-level shall be maintained at, or nearly at, a constant level. In quick-steaming boilers, where a larger heating surface is used and the water is converted into steam rapidly while the quantity of water contained in the boiler is small in proportion to the heating surface, the maintenance of the water-level at the proper height is essential.

The object of this invention is to construct an automatic feed-water regulator so that the variation of the water-level will be confined to very narrow limits.

The invention consists in the peculiar and novel construction of the regulator, as will be more fully set forth hereinafter, and in the novel construction by which a constant but adjustable feed-water supply is admitted to the boiler through the regulator.

Figure 1 is a side view of the feed-water regulator. Owing to its length the central portion is cut out and the ends are brought closer together than they are in the practical device. Fig. 2 is a vertical transverse section of the same, and Fig. 3 is a horizontal sectional view.

Similar numbers of reference indicate corresponding parts in all the figures.

In the drawings, 4 indicates the shell of the steam generator or a part connected with the same near the normal water level, 5 a nipple, and 6 a coupling.

7 is an elbow-shaped fitting provided with a screw-thread by which it is secured to the nipple 5 by the coupling 6. The other end of the fitting 7 is screw-threaded internally for the reception of the tube 8 and externally for the collar 9. The fitting is provided with the inlet 10 and has the internal partition 11 forming a passage-way to the small tube 12.

The coupling piece 13 consists of an upper and lower disk connected by two webs. The lower disk has a hole through which the fitting 7 extends and the coupling piece is firmly secured to the fitting by the collar 9. The upper disk has a hole through which the tube 8 passes and two holes into which the rods 14 fit and are secured by the nuts 15 at their lower ends.

The tube 8 is made of brass or other metal having a greater capacity to expand and contract under changes in temperature, and the rods 14 are made of iron, steel, or other material having less capacity to expand or contract under changes of temperature than the tube 8, the difference in the expansion or contraction of the two parts, namely, the tube 8 and the rods 14, being utilized to operate the regulating device.

The upper end of the tube 8 is provided with the cap 16 from the end of which extends the bracket 17 on which the lever 18 is pivoted. The pivoted end of this lever 18 is bifurcated and the rods 14 are pivotally connected with the two bifurcated ends of the lever 18 close to the pivotal connection of the lever 18 with the bracket 17. The lower end of the lever 18 is provided with a pin, or preferably with a small roller journaled on a pin, and connects with the bell-crank 20 pivotally secured to the coupling piece 13. This bell-crank lever 20 at its lower end is provided with a recess 21 into which the pin, or roller, 19 on the lever 18 enters and is also provided with the arm 22 on which the pin or roller 19 rides when, by excessive expansion of the tube 8, the pin or roller leaves the recess 21. The upper end of the bell-crank lever 20 is connected with the arm 23 of the valve 24 by the connecting-rod 25.

The valve 24 is shown in Fig. 1 as placed into the feed-water pipe 26, but this valve may be placed into the steam-pipe which supplies steam to the steam-pump and instead of regulating the flow of the feed-water directly, as shown, regulate the speed of the steam-pump

and thereby the feed-water supplied to the boiler.

The feed-water supply-pipe 26 is connected by the piping 27 with the feed-water regulator through the inlet 10, so that a part of the feed-water is constantly supplied through the regulator to the steam-generator. The quantity of this constant supply is regulated by means of the valve 28.

To secure the prompt operation of the regulator it is essential that the bearings of the lever 18 on the pivots shall be always under tension when the tube 8 expands as well as when the same is contracting. To attain this end we secure one end of the rod 29 to the tube 8, provide the other end with a screw-thread and place the coiled-spring 30 between two disks, so as to bear on the lever 18 by spring pressure, and regulate the tension of the spring 30 by a nut placed on the threaded end of the rod 29. We do not wish to confine ourselves to this specific arrangement and location of the spring, or the use of a spring, as a weight may be placed on an arm extending at or practically at right angles from the lever 18 and will secure practically the same result when the regulator is placed vertically.

To enable others skilled in the art to clearly understand our invention, we will now describe its operation.

When attached to a steam-generator and connected with the feed-water supply-pipe, the feed-water regulator, when the various parts are in the position shown in Fig. 1, has shut off the main water-supply by closing the valve 24. A small quantity of feed-water is, however, flowing through the valve 28 and the pipes 27 into the elbow-shaped fitting and through the same into the steam generator. The water line is slightly above the nipple 5 and the interior of the nipple, the fitting 7 and the tube 8 are filled with water. In the preferred form and particularly for use on marine boilers, we place the tube 8 in the vertical position, as it will not in this position be affected by the rolling or pitching of the vessel and also because by its peculiar construction the water is more quickly discharged from the tube when in the vertical position. Considering, therefore, the feed-water regulator secured, as shown in the drawings, with the tube 8 extending vertically above the nipple 5 and that the evaporation of the water in the steam generator has lowered the water-level a little below the inlet, the steam will pass into the space above the partition 11, enter the tube 12 and pass through this tube to the upper end of the tube 8, thereby equalizing the pressure on the water in the tube 8. The gravity of the column of water in the tube 8 will facilitate its discharge from the tube. The steam which now fills the tube causes the same to expand. The pivot in the bracket 17 exerts considerable force on the lever 18 and causes the same to swing on the pivot-shaft secured to the upper ends of the rods 14. The long arm or arms of the lever 18, acting against the spring 30, carry the lower end, provided with the pin or roller 19, outward and with it the lower end of the bell-crank lever 20, the upper end of which opens the valve 24 and the main supply of feed-water to the steam-boiler. Under normal conditions the water-level in the steam-boiler soon rises above the inlet in the nipple 5 and, in feed-water regulators of the class to which this present invention appertains, the steam has to condense before the water from the steam-generator could enter the tube 8. This action was slow and the difference in the temperature between the water of the steam-boiler and the steam not sufficiently great to insure the prompt contraction of the tube 8. By supplying a comparatively small portion of the feed-water directly to the regulator, this colder water enters the tube 8 and it facilitates the condensation of the steam, the contraction of the tube and the prompt operation of the regulator. This part of our invention is applicable to all feed-water regulators in which a tube, pipe, or vessel, is alternately filled with steam and water and secures the prompt and more reliable action of the same.

In working a steam-generator and particularly a marine boiler to its full capacity under the most economic conditions, it is desirable that the supply of the feed-water be continuous and practically uniform in quantity. To secure this end we have provided the bell-crank 20 with the arm 22 on which the roller 19 rides without materially affecting the valve 24 or changing the water-supply until the water-level in the steam-generator rises above the inlet to the feed-water regulator, when by the contraction of the tube 8 the roller or pin on the lower end of the lever 18 again enters the recess 21 and by acting against one of the two sides of the recess operates the valve 24.

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

1. The combination with a boiler feed-water regulator adapted to control the main feed-water supply, of an auxiliary supply-pipe adapted to feed a smaller constant supply of feed-water through the regulator into the boiler, as described.

2. The combination, in a feed-water regulator, with the fitting 7, the tube 8 and rods 14, of the lever 18 pivoted to the rods 14 and connected with the tube 8, the free end of the lever connected with mechanism, substantially as described, to operate the feed-valve, and a connecting pipe, between the main feed-supply and the fitting 7, adapted to constantly supply feed-water to the boiler through the regulator, as described.

3. The combination, in a feed-water regulator, with the expansible tube 8 and connections with the boiler, the rods 14, and lever 18 provided with the pin or roller 19 at its free end, of the bell-crank lever 20 connected at one end with the regulating valve, the other

end provided with the recess 21 and the arm 22, as and for the purpose described.

4. The combination, in a feed-water regulator, with the fitting 7 adapted to be connected with a steam-generator, the tube 8, the rods 14, the lever 18 provided with the pin or roller at the free end, the bell-crank lever 20 connected at one end with the regulating-valve the other end provided with the recess 21 and the arm 22, of the partition 11 and tube 12 adapted to facilitate the discharge of water from the tube 8 and the operation of the feed-water regulator, as described.

5. The combination, in a feed-water regulator, with the fitting 7, the tube 8, the rods 14, the lever 18, and the bell-crank lever 20 connected at one end with the regulating valve the other end provided with the recess 21 and arm 22, of the partition 11, the tube 12, and the pipe 27, having the valve 28, adapted to feed a portion of the feed-water through and facilitate the operation of the regulator, as described.

In witness whereof we have hereunto set our hands.

DARWIN ALMY.
FRANK DELANO ALMY.

Witnesses:
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