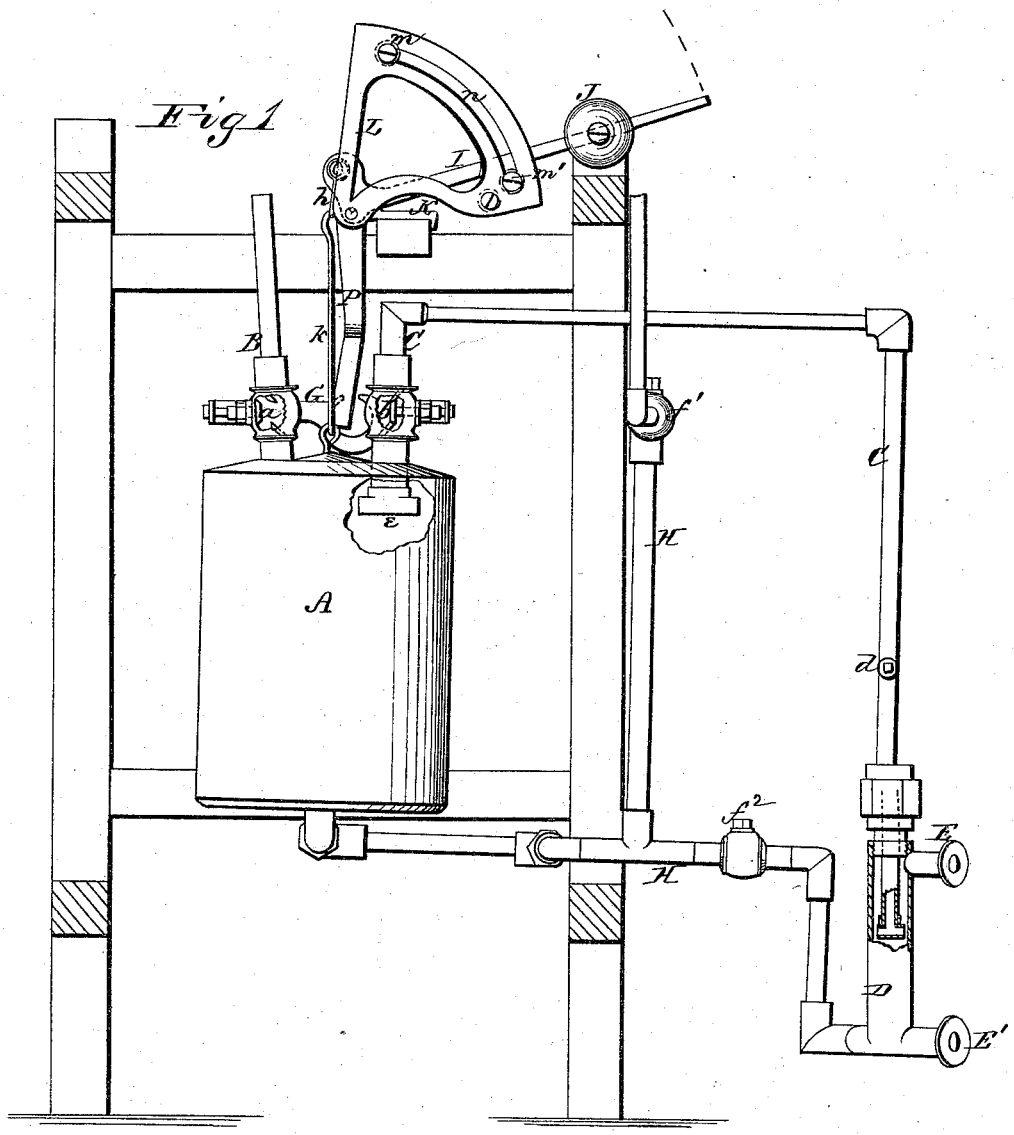
2 Sheets--Sheet 1.

T. G. GARDNER.

Boiler-Feeder and Regulator.

No. 163,177. Patented May 11, 1875.

Fig 1



WITNESSES

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2 Sheets--Sheet 2.

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Fig 2

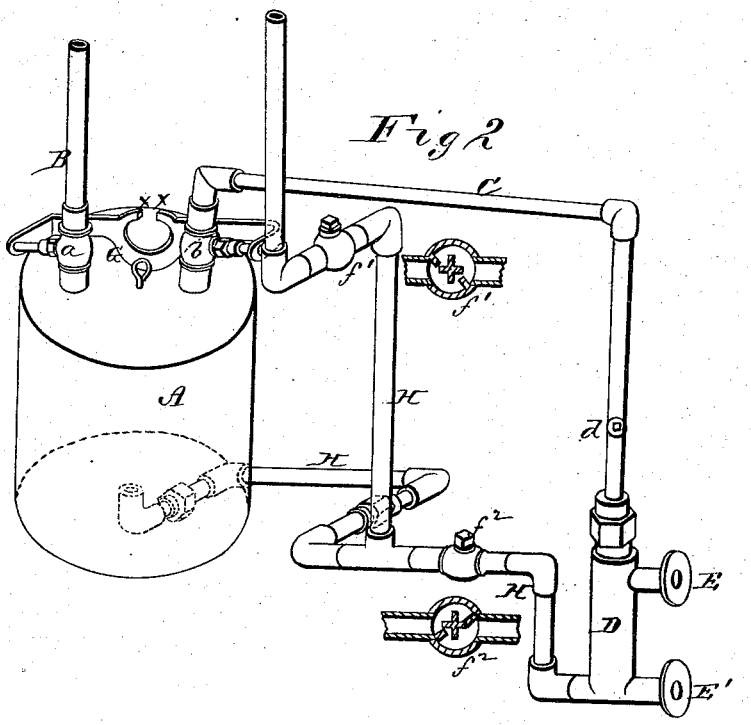
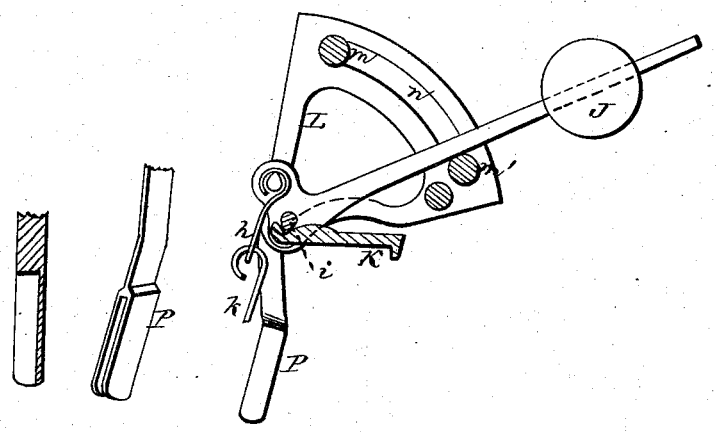


Fig 3



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UNITED STATES PATENT OFFICE.

THOMAS G. GARDNER, OF LINCOLN, ILLINOIS.

IMPROVEMENT IN BOILER FEEDERS AND REGULATORS.

Specification forming part of Letters Patent No. **163,177**, dated May 11, 1875; application filed January 13, 1875.

To all whom it may concern:

Be it known that I, THOMAS G. GARDNER, of Lincoln, in the county of Logan and in the State of Illinois, have invented certain new and useful Improvements in Boiler Feeder and Regulator; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings and to the letters of reference marked thereon, making a part of this specification.

The nature of my invention consists in the construction and arrangement of a boiler feeder and regulator for steam-boilers, as will be hereinafter more fully set forth.

In order to enable others skilled in the art to which my invention appertains to make and use the same, I will now proceed to describe its construction and operation, referring to the annexed drawings, in which—

Figure 1 is a side elevation of my invention. Fig. 2 is a perspective view of the same. Fig. 3 is a detached view of a part thereof.

A represents a hollow cylinder, made of metal, capable of sustaining the same pressure of steam that the boiler will. B is the exhaust-pipe, provided with globe-valve *a*, to discharge the steam from the cylinder A while it is filling with water. The stem of the valve *a* is smooth, and made steam-tight with suitable packing, to admit of its being opened and closed by means of devices hereinafter described. C is a steam-pipe, connecting the top of the cylinder A with the steam-space in a large pipe, D, on a level with the water-line in the boiler, said pipe D being attached to the boiler by means of connections E E′. In the steam-pipe C, near the cylinder A, is a common globe-valve, *b*, and the stems of the valves *a* and *b* are connected by means of an arm, G, in such a manner that one is closed and the other opened at the same time by the stroke from a weighted lever, hereinafter described. The pipe C is also to be provided with a stop-cock, *d*, to shut off the steam when desired, at some point near the boiler. The pipe C, after passing into the cylinder A, has a hollow T, *e*, screwed on its end in inverted position, so as to change the direction of the steam, and not allow it to strike the surface of the water in a jet from the pipe C when the valve *b* is first opened, as it would penetrate the water, and thus cause too much condensation of steam. The cylinder A is also provided with a water-pipe, H, passing into it at or near the bottom. This pipe H is forked, and the two prongs provided with common check-valves marked f^1 f^2, respectively. The upper prong of the water-pipe H is to connect with a water-tank, which must be higher than the cylinder A, and said cylinder must be higher than the water-line in the boiler. The lower prong of the water-pipe H connects with the lower elbow or connection E′ of the pipe D, said elbow connecting with the water-space of the boiler, while the upper elbow E connects with the steam-space thereof. I represents an elbow-lever, having one long and one short arm, which stand at about right angles with each other. This lever is at the angle provided with knife-edged pivots *i*, which pivot-edges stand at about the angle of forty-five degrees with the long arm of the lever, if extended. The long arm of the lever is provided with a ball, J, secured by a set-screw, and so arranged that when the long end of the lever is down it may be adjusted to balance the cylinder A and its contents when full of water. The short arm of the elbow-lever I is also provided with knife-edged pivots, upon which is hung a bail or stirrup, *h*, connected, by a rod, *k*, with the cylinder, thus suspending the cylinder from the lever. The knife-edge pivots *i* are placed in recesses on the upper surface of a forked plate, K, attached to the frame-work. To this plate are pivoted two segmental plates, L L, one on each side of the lever, which plates are connected by means of three screw-bolts. Two of these screw-bolts *m* and *m′* are adjustable in long slots *n* in the plates, and act as stops to the weighing-lever.

The adjustment is as follows: The upper stop *m* is unscrewed, when the long end of the lever I is raised till the weight will just overbalance the empty cylinder A, when the stop *m* is tightened against the lever at that point. The lower stop *m′* should be fastened at such a point that when the lever rested against it the cylinder filled with water will just overbalance the weighted lever.

It will be observed that the relative lengths

of the two arms of the lever I are changed as the weighted end moves back and forth between the upper and lower stops, the short arm increasing and the long arm decreasing as the weight goes up, and vice versa as the weight goes down, thus giving an accelerated velocity in its motion both ways, and giving sufficient force to operate the valves both ways.

From one of the plates L an arm, P, extends downward, the lower end of said arm being grooved on one side, and enters a slot or opening formed in the bar G, that connects the two valves *a b*, so that said arm will operate against points *x x* on the bar G, to move the same.

The operation of the feeder is as follows: Suppose the weighted end of the lever I is down against the lower stop *m'*, as shown in Fig. 1, the steam-valve *b* is closed, and the exhaust-valve *a* opened. The valve f^2 in the pipe H is closed by the pressure of steam from the boiler. There is now no pressure in the cylinder A, and the weight of water from the tank above presses against the under side of the check-valve f^1, raising it, and the water runs down through the pipe H into the cylinder A, and as soon as the cylinder is filled with water it overbalances the weight on the lever I, and causes the lever to strike the upper stop *m* with a force sufficient to cause the arm P to move the arm G to open the steam-valve *b* and close the exhaust-valve *a* at the same stroke. Now the steam rushes into the cylinder A, causing back pressure against the valve f^1, closing it. As soon as the cylinder has equal pressure with the boiler, the weight of the water in the cylinder pushes the valve f^2 open, and the water passes into the boiler; at the same time the steam is passing through the steam-pipe C into the cylinder to take the place of the water. When the cylinder has emptied all of its water into the boiler, it becomes light enough for the ball J to overbalance it, when the lever I falls back against the lower stop with a force that opens the exhaust-valve *a* and closes the steam-valve *b*, and the pressure from the boiler closes the check-valve f^2 in the pipe H.

The cylinder thus continues to operate and feed the boiler so long as the water in the boiler is below the lower end of the steam-pipe C, which is adjusted to the desired water-line, and it gradually ceases to operate as the water approaches the desired level in the boiler, and again increases as the water falls below that level.

The lower end of the pipe C should terminate in an inverted T, as shown in Fig. 1, or be provided with a double elbow with the mouth thereof at the water-line; or, if desirable, the pipe may be attached or connected to the pipe D by a series of stop-cocks at different heights, by which the water-line may be made to coincide with any one of the cocks that may be desired, by which means the water-line may be raised or lowered by simply opening the cock above or below.

The object of using the pipe D—instead of connecting the pipes C and H direct to the boiler—is to avoid the foam that rises on the surface of the water in the boiler being carried into the cylinder A by the steam passing through the pipe C. By letting the feed-water pass through the lower elbow E′ it is always supplied with clean water.

Suitable stop-cocks should be applied in the various pipes to be used when desired to take out and repair any of the other valves when out of order.

The pipe H, when comparatively short, should be provided with joints suitably packed to permit the cylinder to rise and fall freely; but it is preferable, where the situation will permit, to have the pipes long enough to spring up and down about two inches, and thus conform to the motion of the cylinder without packed joints.

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

1. The pipe D, provided with elbows or connections E E′, for attachment to a steam-boiler, and connected by pipes C and H with the rising and falling cylinder A, substantially as and for the purposes herein set forth.

2. The steam-pipe C, passing from the intermittently-reciprocating cylinder A to the pipe D, and provided with a globe-valve, *b*, and with an inverted T at each end, substantially as and for the purposes herein set forth.

3. The combination of the cylinder A, pipe D, connections E E′, pipe C, having valve *b*, and inverted T at each end, and the forked pipe H, having valves $f^1 f^2$, all substantially as set forth.

4. The combination, with the intermittently-reciprocating water-cylinder A, of the exhaust-pipe with valve *a*, and the steam-pipe C with valve *b*, the two valves being connected by a bar, G, and operated by means of a weighted lever in such a manner as to open one valve and close the other simultaneously at each stroke of the lever, substantially as and for the purposes herein set forth.

5. The combination, with the intermittently-reciprocating water-cylinder A, of the oscillating elbow-lever I, with adjustable weight J, and knife-edge pivots *i*, bearing-plate K, slotted plates L L, with adjustable stops *m' m*, and arm P, and the bar G connecting the valves *a b*, all substantially as and for the purposes herein set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 12th day of December, 1874.

THOMAS G. GARDNER.

Witnesses:

H. L. PIERCE,

J. W. SPELLMAN.