

WILLIAM PAINTER.

Improvement in Feed-Water Regulators and Low-Water
Alarms for Steam-Boilers.

No. 127,917.

Patented June 11, 1872.

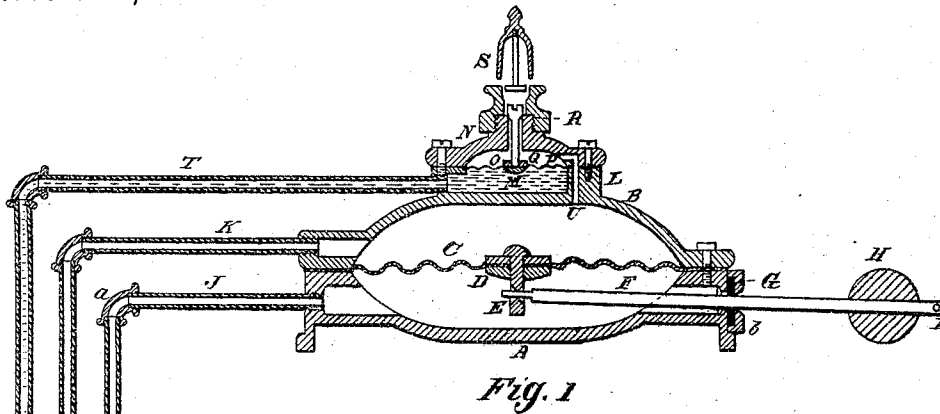


Fig. 1

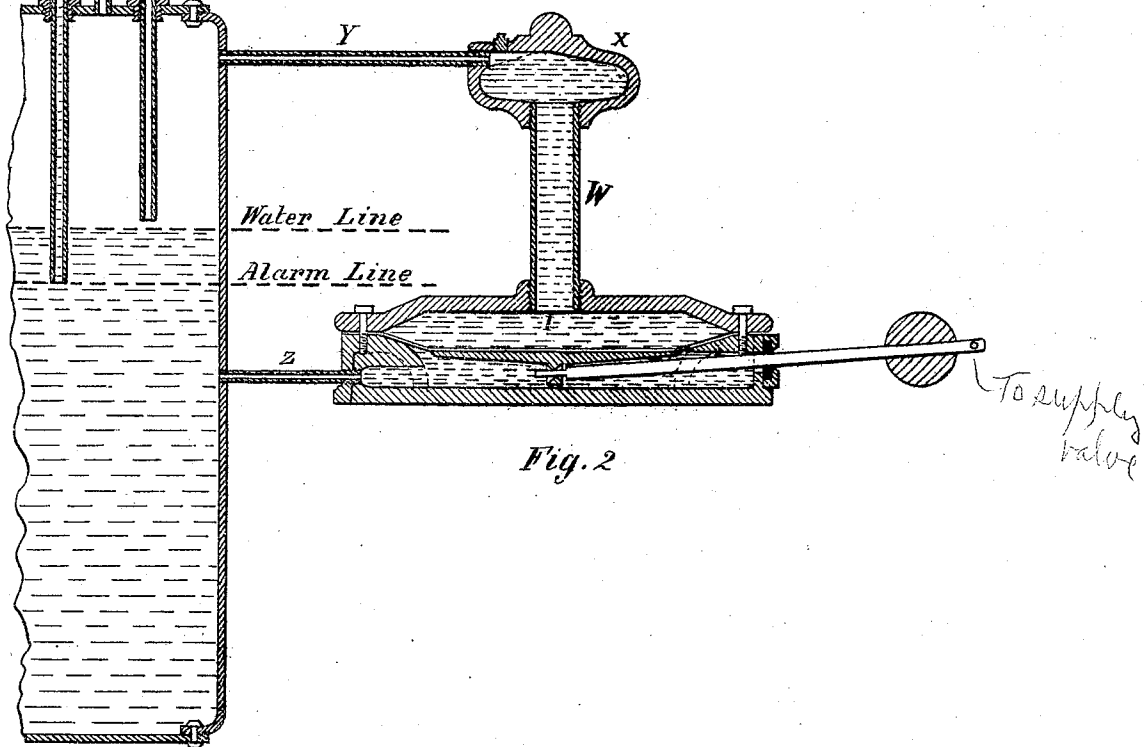


Fig. 2

Witnesses

Lewis R. Kizer
and Longbridge

Inventor

William Painter

UNITED STATES PATENT OFFICE.

WILLIAM PAINTER, OF BALTIMORE, MARYLAND, ASSIGNOR OF ONE-HALF
HIS RIGHT TO LEWIS R. KEIZER, OF SAME PLACE.

IMPROVEMENT IN FEED-WATER REGULATORS AND LOW-WATER ALARMS FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. 127,917, dated June 11, 1872.

Specification describing certain Improvements in Feed-Water Regulators and Low-Water Alarms, invented by WILLIAM PAINTER, of Baltimore, Maryland.

The first part of my invention relates to the use of a flexible diaphragm inclosed in a chamber, to which steam and water are admitted from the boiler by pipes so connected and arranged that the rising and falling of water in the boiler shall give motion to the diaphragm and through suitable means operate a valve to regulate the water-supply, control admission of steam to a feed-pump, or shift a belt to and from the same. The second part relates to the use of a secondary and smaller diaphragm inclosed in a chamber attached to the regulator, similarly operated, and connected with the boiler in such manner as to sound an alarm-whistle in case the water should fall to a dangerous point.

Figure 1 is a vertical transverse section, showing the several parts of the regulator and low-water alarm and their connection with the boiler and with each other. Fig. 2 shows the same view of a modification of the feed-water regulator alone.

In Fig. 1, A is the base-plate, forming the lower half of the chamber, and B the top, forming the upper half. Between the flanges of the respective parts, which are firmly bolted together, is the flexible diaphragm C, separating the chamber into two parts, which will be designated as the "upper" and "lower" chambers. This diaphragm is made either of thin brass or other metal, as in Fig. 1, or of rubber, as in Fig. 2. To the under side of diaphragm, at its center, is secured the plate D with projecting lug E. F is a rod or lever, one end of which engages with lug E. It passes through a cap or gland, b, bolted to base-plate, and inclosing a soft rubber gasket, G, surrounding the lever, which it is caused to hug tightly by the pressure of gland b, forming a steam-tight joint. The edge of opening in gland is beveled to form a knife-edge on which the lever vibrates. Its motion at that point being slight, the rubber readily conforms to it. At a point on the lever equidistant with lug E from the fulcrum is a counter-weight, H. I is a hole in lever for attach-

ing the rod connecting it with the regulating-valve, to which any motion of diaphragm will be thereby communicated. The lower chamber is connected with the boiler by a pipe, J, leading to the water-line; the upper by a pipe, K, leading to the steam-space. On the top-plate B is cast a ring or flange, L, inclosing the chamber M. Bolted to this flange is the concave-top N, inclosing the chamber O. Between these two parts is the secondary diaphragm P that operates the alarm-whistle. Attached to the center of this diaphragm is the valve Q opening upward and seated at R. S is the steam-whistle. The lower chamber M is connected to the boiler by a pipe, T, reaching to the low-water or alarm-line. The upper chamber O is connected with the upper chamber of regulator by the opening U. The regulator and alarm being properly attached to the boiler as described, let it be supposed the water stands at a level slightly below the mouth of pipe J, communicating with the lower chamber of the regulator. If steam be raised in the boiler the air in all the pipes and chambers will be compressed and steam will fill pipes J and K, while water will rise in pipe T, partially filling the lower chamber M of the alarm. As there is steam (or steam and air) in the upper and lower chambers of the regulator the pressure (which, let it be supposed, is fifty pounds per square inch) on both sides of diaphragm C will be equal; it is, therefore, balanced so far as steam pressure is concerned. But we have on lever F a counter-weight, H, of twenty pounds, which carries it downward until arrested by the tension of diaphragm C, which has sufficient motion to regulate the valve before the extreme, in either direction, is reached. The downward motion of lever referred to has the effect of opening the regulating-valve, admitting to the boiler a supply of water that, on rising, closes the mouth of pipe J; the steam therein condensing, water is forced up to supply its place, rising to a, and partially filling the lower chamber. It will now be observed that on the upper side of diaphragm C there is a pressure of fifty pounds per square inch, while on the lower side there is less, according to the height of column of water in pipe J. To more clearly

understand this, let it be supposed this column (or in other words the distance from diaphragm C to the water-line) is two feet. The pressure of steam required to sustain this column is one pound per square inch. If, then, we have fifty pounds' pressure in the chamber above the diaphragm, there will be but forty-nine pounds per square inch in that below, leaving a preponderance of one pound per square inch on the upper side, acting in opposition to the counter-weight H. If, now, the diaphragm be of such a size as to receive, at the rate of one pound per square inch, an aggregate force of forty pounds on its upper side in excess of that on the lower, the diaphragm will be depressed, raising the counter-weight and lever and closing the valve, shutting off the water-supply. When, from evaporation, the water-level falls below the mouth of pipe J, the water in it descends by its own gravity, steam rising to take its place—the original pressure of fifty pounds per square inch—the lower chamber is restored, whereby the diaphragm is again balanced and the counter-weight and lever descend, opening the supply-valve. As soon as the water-level again rises, closing the mouth of pipe J, condensation takes place, water rises in it, reducing the pressure on the under side of diaphragm, which, in consequence, descends, raising the counter-weight and lever, and again opening the supply-valve. The action is thus continued, a very slight rising and falling of the water-level being required to fill and empty pipe J, acting upon the diaphragm and controlling the supply-valve, as described. On reference to the diaphragm P of the low-water alarm it will be noticed that it is subject to the same conditions as that of the regulator. In the chamber O, above the diaphragm which communicates with the upper chamber of regulator through the opening U, the pressure is fifty pounds per square inch, while in the chamber M, under the diaphragm, there is but forty-nine pounds, owing to the boiler pressure being required to sustain the column of water in pipe T. There is, therefore, sufficient downward pressure on the diaphragm P, to which valve Q is attached, to hold it on its seat, in opposition to the steam pressure tending to open it. So long as the water-level in boiler is above the mouth of pipe T the whistle-valve is held closed; but should the line fall below it the water in pipe T falls by its own gravity, steam rising to fill its place; the pressure in chambers O and M becomes equal, the diaphragm is balanced, and, there being no force to retain valve Q on its seat it is raised by the steam, which escapes and sounds the alarm-whistle. As the water-level rises, covering the mouth of pipe T, condensation takes place and water rises in it, reducing the pressure in chamber M, diaphragm P is depressed, and the whistle-valve closed.

To actuate the diaphragms as described it is not necessary that the water should more than

fill the perpendicular pipes leading to the regulator and alarm. The horizontal pipes and chambers may contain air, steam, or water, neither having any effect on the diaphragms.

The modification of regulator shown in Fig. 2 embraces the essential features of that already described, the principal difference being in the means of operating the diaphragm and connecting the regulator with the boiler.

The upper and lower chambers, diaphragm, lever, and counter-weight are the same as in Fig. 1, except that in this case the diaphragm is of rubber.

From the chamber V rises the pipe W having a chamber X at top, connected with the steam-space of boiler by a pipe, Y. Z is a pipe leading from the lower chamber to the boiler at a point below the water-line. The machine being placed in such a position that its center is on a level with the water-line in boiler, and being properly attached, the chamber V, pipe W, and chamber X are filled with water to the mouth of pipe Y. When steam and water are turned on from the boiler, water will fill the chamber below the diaphragm and steam the space in chamber X, above the mouth of pipe Y. If it is assumed the height of column of water in pipe W is two feet, it will exert a pressure of one pound per square inch on the diaphragm, which is of such size that it will receive an aggregate of forty pounds. Below the diaphragm there is a pressure, due to the height of water in boiler above it, (one foot) of one-half pound per square inch, making twenty pounds. In addition to this the counter-weight on lever exerts an upward force of twenty pounds, making an aggregate of forty pounds. There being, then, the same pressure on both sides, the diaphragm stands balanced. If, now, the water in boiler rise, an increased pressure is brought to bear on the under side of diaphragm, which is raised, and the lever and counter-weight descend, closing the valve and cutting off the water supply. When the water in boiler falls the pressure below diaphragm is reduced, the column of water in pipe W preponderates, the diaphragm is depressed, and the valve opened.

The object of chamber X is to prevent any considerable change in the height of column, due to the rising and falling of the diaphragm.

I do not limit myself to any precise form of the feed-water regulator or alarm, or the method of connecting them with the boiler, as they may be varied without departing from the essential features of the machine; but

Having fully described my invention, what I claim is—

1. In combination with the above the supplemental vessel containing chambers O and M, separated by the flexible diaphragm P, chamber O taking steam through port U from upper chamber of vessel B, and chamber M provided with the water-pipe T extending to the alarm or lowest safe water-line, to form a

combined feed-water regulator and alarm, as set forth.

2. The knife-edge gland, and rubber gasket G, in combination with the vessel B, diaphragm C, and lever F, to form a water-tight and non-frictional port and bearing for said lever, as set forth.

3. In combination, the chamber V, with pipe

W, and chamber X, and the steam-pipe Y, as shown in Fig. 2, to interpose a body of water between said diaphragm and the steam from the boiler, as and for the purpose set forth.

WILLIAM PAINTER.

Witnesses:

LEWIS R. KEIZER,

WILLIAM LOUGHRIDGE.