F. MILLWARD.

Improvement in High and Low Water Indicators for Steam-Boilers.

No. 115,501. Patented May 30, 1871.

Fig. 1.

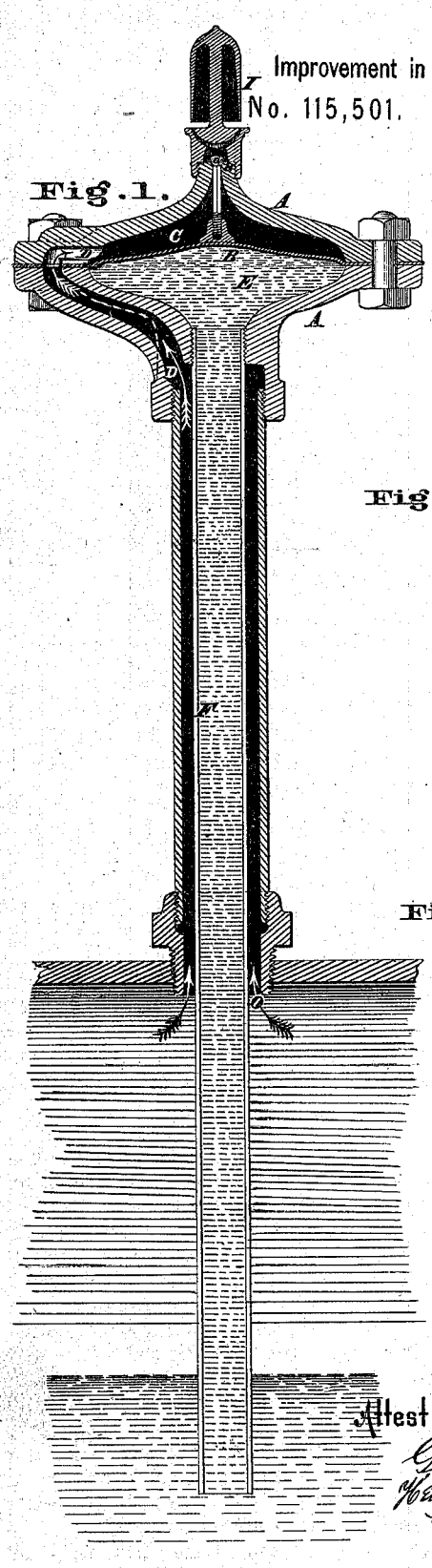


Fig. 2.

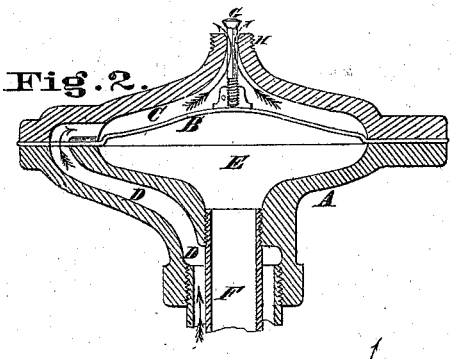


Fig. 3.

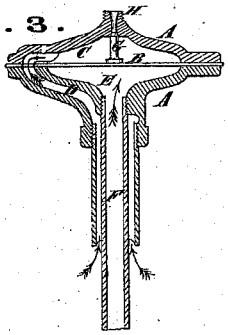


Fig. 4.

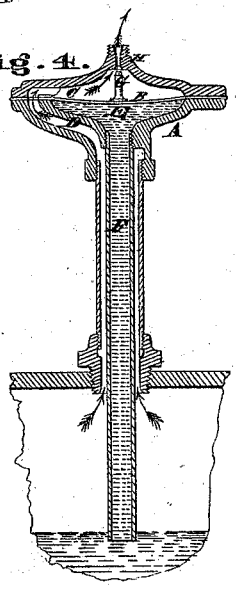


Fig. 5.

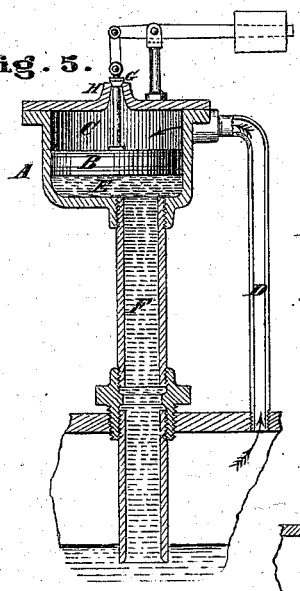
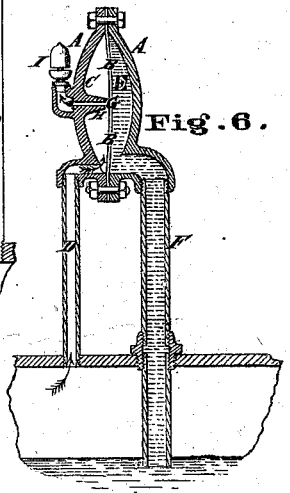


Fig. 6.



Attest.

G. F. Gray Jr.

Wm. J. Williams

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Frank Millward

UNITED STATES PATENT OFFICE.

FRANK MILLWARD, OF CINCINNATI, OHIO.

IMPROVEMENT IN HIGH-AND-LOW-WATER INDICATORS FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. 115,501, dated May 30, 1871.

I, FRANK MILLWARD, of Cincinnati, in the county of Hamilton and State of Ohio, have invented a certain new and useful High-or-Low-Water Indicator for Steam-Boilers, of which the following is a specification:

Nature and Objects of the Invention.

All low-water indicators for steam-boilers hitherto used have proved unreliable for continued service. Indicators whose alarm-vent is governed by a float either inside or outside of the boiler fail, owing to the water from the boiler incrustating the valve and seat, or the float becoming too heavy by a coating of lime or mud, or the moving parts becoming clogged by incrustation or corrosion. Indicators which operate by the gravity of water, of which there are many styles, necessitate the use of joints, which, upon slight corrosion or incrustation, stick and prevent an alarm. Indicators which operate by a slight expansion and contraction of metals require a delicate easily-displaced adjustment, which has been proved wholly unreliable even for a short period of time, the parts of the instrument, moreover, being liable to be so clogged with dirt from the boiler in the operation of giving an alarm that a repetition of it at the next occurrence of low water is impossible. Indicators which depend for an alarm upon the fusing of a soft-metal plug have failed in numerous instances, owing to the collection of foreign substances over the face of the plug, and owing to the fusible character of the plug changing with use.

My invention, which embodies a new principle for low-and-high-water indicators, is designed to obviate all difficulties heretofore experienced in the reliable indication of low and high water in steam-boilers, and provides an indicator which operates with certainty and precision under all conditions of boiler pressure, is free from incrustation, and has no rubbing or moving parts liable to stick.

My invention consists of a case or shell composed of two chambers divided by an elastic diaphragm or equivalent, communicating with the water-line and steam-space of the boiler separately, both compartments of the case being under pressure, and one provided with an alarm-valve vent, whose valve is operated in one direction by the preponderance of pressure upon one side of the diaphragm due to the support of a hydrostatic column upon the other side, and in the opposite direction by the retraction of the elastic diaphragm or other retractile force, upon the restoration of equal pressure, after the loss of the hydrostatic column occasioned by the fall of water in the boiler below the end of the pipe communicating with one compartment of the indicator.

Description of the Accompanying Drawing.

Figure 1 is a vertical section of my indicator attached to a boiler for indicating low water, the moving parts of the instrument being in position occupied when the water in the boiler is sufficiently high. Fig. 2 is a view of the same instrument when the moving parts have changed position to give an alarm, owing to the absence of sufficient water in the boiler. Fig. 3 is a vertical section of my indicator with the parts arranged for indicating high water, as seen when the water is below high-water mark. Fig. 4 is a view of the instrument shown in Fig. 3 in the act of giving an alarm occasioned by the presence of too much water in the boiler. Figs. 5 and 6 are modifications in the construction of the instrument.

General Description.

A is a metallic case divided into two compartments by a diaphragm, B, the chamber or compartment C being designed for the occupancy of steam exclusively, and communicating with the steam-space in the boiler by passage D. The chamber or compartment E is designed for the occupancy alternately of water and steam, it being connected to the boiler by pipe F, which ends at the low-water mark in Figs. 1 and 2, and at high-water mark in Figs. 3 and 4. The diaphragm B is constructed to move easily with a slight preponderance of pressure upon one side, and has a valve, G, attached to, forming a part of, or resting by weight upon it, which seats steam-tight against the valve-seat H.

The seat, valve, and diaphragm may be plated with nickel or other material to prevent corrosion.

No part of the valve or stem need touch

the sides of the aperture for the steam-vent, so that closely-rubbing surfaces liable to stick upon slight corrosion can be avoided entirely.

To permit of the passage of steam to give the alarm, (see Fig. 2.) the stem of the valve may be much smaller than the hole in the seat, or squared, as shown, or grooved. It should in all cases fit loosely.

The chamber C has no communication with the water-space in the boiler; consequently incrustation of the valve and seat, which is of such frequent occurrence in some of the best indicators used heretofore, is impossible in my instrument.

Friction being entirely avoided and incrustation of valve and seat rendered impossible, full confidence can be placed in this instrument for prompt indications in long-continued service.

The valve is as certain of action as a nickel-seated safety-valve, and the diaphragm as reliable as that of a steam-gage.

Operation.

When the instrument, in the form used to indicate low water, as shown in Figs. 1 and 2, is attached to the boiler, the steam has a direct and uninterrupted communication with chamber C through passage D. The chamber E (when the water is high enough to cover the end of the tube) is filled with water, and when in this condition the pressure upon the lower side of the diaphragm B is less than that upon the upper side, owing to the presence of the hydrostatic column in pipe F, the downward pressure of which reduces to an extent in direct proportion to its height the upward pressure caused by the steam in the boiler. If the vertical distance from the water-line to the diaphragm is but a little over two feet, a preponderance of one pound per square inch will exist on the valve side of the diaphragm, which, when the diaphragm is five inches in diameter inside, will give (after allowing a deduction for the unbalanced boiler pressure upon the valve) over eighteen pounds to force and keep the valve to its seat. In order to produce a greater difference than this it will be only necessary to increase the height of the hydrostatic column. When the water in the boiler has been reduced to a point below pipe F, the water in chamber E is discharged and steam takes its place. The diaphragm is then in equilibrium, except for an area of boiler pressure upon the lower side equal to the area of the valve-seat, and it then, by retraction to its normal position, and with the assistance of the slight unbalanced boiler pressure upon the lower side, assumes the position shown in Fig. 2, opens the valve G, and gives the alarm.

A whistle, I, may be attached to the case A, as shown. The diaphragm itself may form the valve, as shown in Fig. 6.

The form of instrument shown in Figs. 3 and 4 is constructed to indicate high water, and it differs from that shown in Figs. 1 and 3 in this only—the valve seats on the inside of the case, and is shut when the diaphragm is exposed to a boiler pressure of steam upon both sides. It is forcibly opened by a deflection of the diaphragm when there is an unbalanced pressure due to the presence in tube F of a hydrostatic column.

It is obvious that the details of construction of this instrument may be varied without departing from the principles of construction and operation of the same; as, for example, a piston sliding in a cylinder may be used as the dividing-diaphragm, operated in one direction by a spring or weight, and in the other by the preponderance of pressure opposed to the hydrostatic-column side of the piston, as shown in Fig. 5. The steam may also be conducted to the valve-chamber C in many ways. The instrument may also be attached in place of one of the boiler gage-cocks, and also combine within itself a gage-cock similar to the old combination of gage-cocks and other indicators.

The diaphragm B may be corrugated concentrically and radially to induce freedom of action, and should be placed so as to discharge any condensed water on its face back again into the boiler.

In cases where the boiler to which the indicator is to be attached superheats its steam, it is necessary in most instances that the pipe F should not be surrounded by a steam-jacket, such, for instance, as is shown in Fig. 1. The attachment of pipe F should then be made to the side of the boiler, and may be in place of one of the gage-cocks, the steam being conducted to the chamber C by a small separate pipe from the top of the boiler.

In order that air may be expelled from chamber E, when necessary or desirable, to insure the speedy closing of the valve when the boiler is being first fired up, a cock may be inserted near the top of chamber E.

Claim.

A high or-low-water indicator for steam-boilers having two chambers, C E, communicating with the water-line and steam-space of the boiler separately, and a diaphragm alarm-valve, B G, dividing the chambers, operated in one direction by a preponderance of pressure in one compartment created by the support of a hydrostatic column in the other, and in the opposite direction by any suitable retractile force, substantially in the manner and for the purpose set forth.

In testimony of which invention I hereunto set my hand.

FRANK MILLWARD.

Witnesses:
ELITHA F. LAYMAN,
HENRY MILLWARD.