(No Model.) 2 Sheets—Sheet 1.

W. R. FOX.

LOW WATER ALARM.

No. 435,742. Patented Sept. 2, 1890.

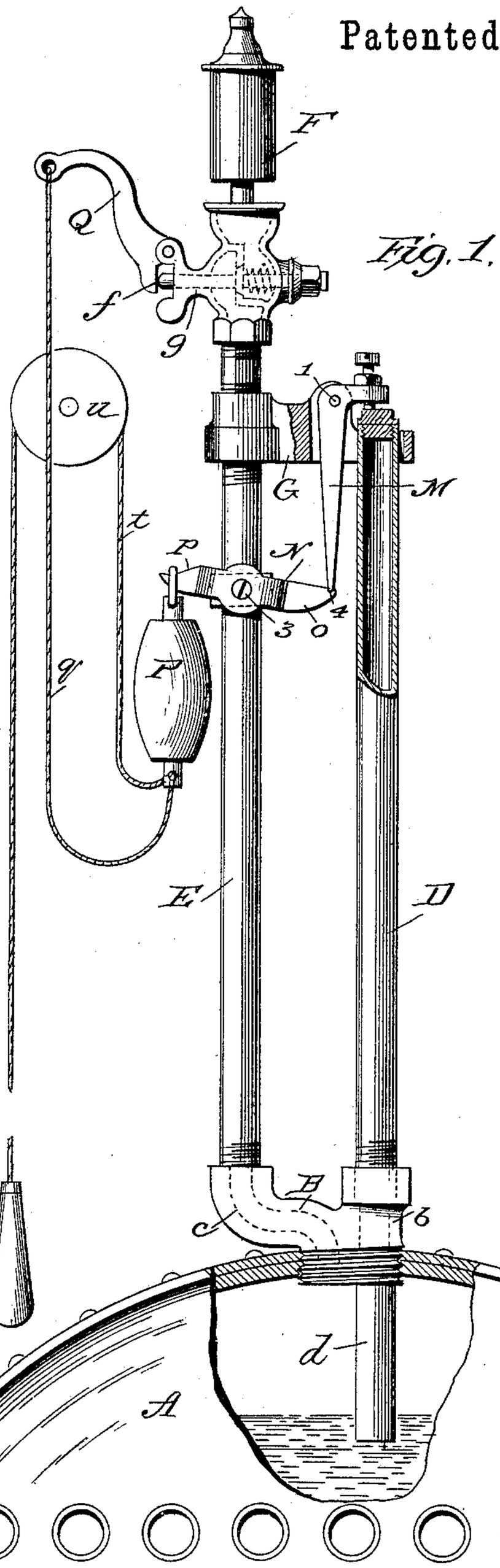

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

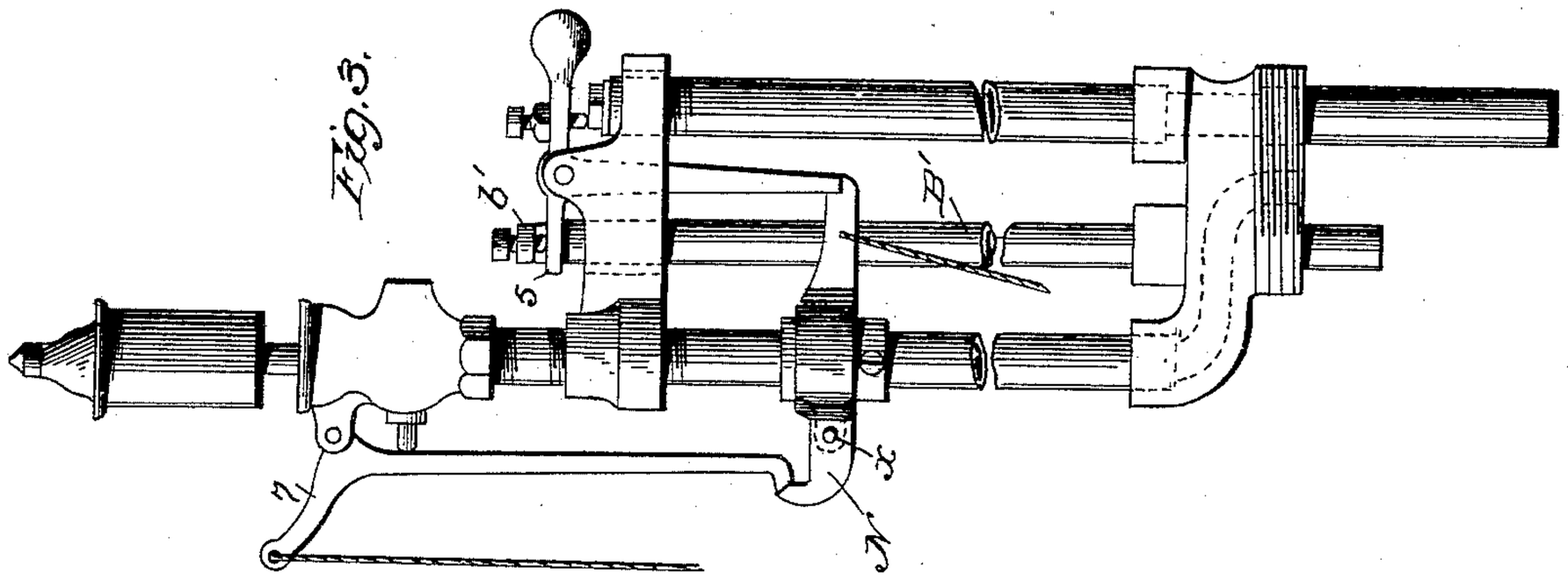
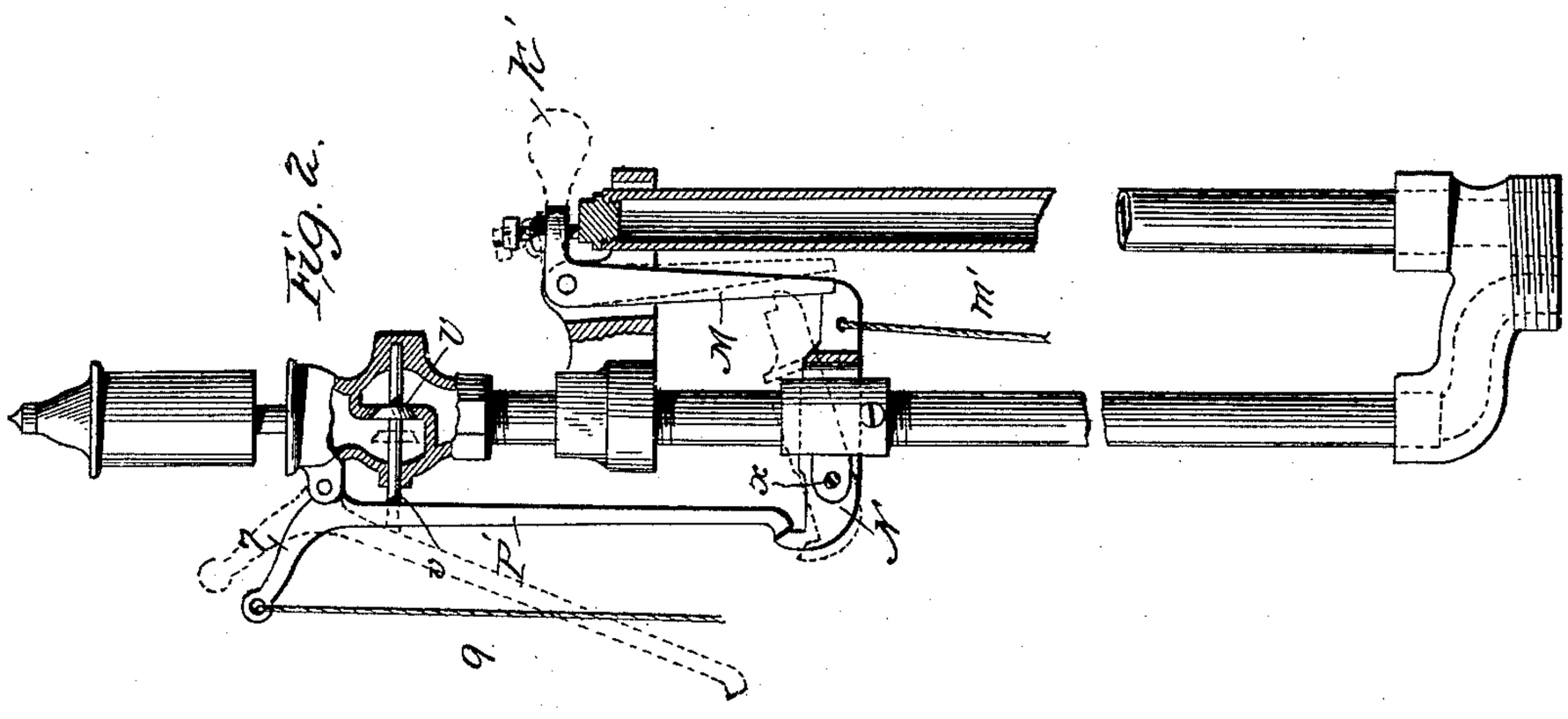


Fig. 2.



Attest
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UNITED STATES PATENT OFFICE.

WILLIAM R. FOX, OF GRAND RAPIDS, MICHIGAN.

LOW-WATER ALARM.

SPECIFICATION forming part of Letters Patent No. 435,742, dated September 2, 1890.

Application filed February 11, 1890. Serial No. 340,026. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM R. FOX, of Grand Rapids, in the county of Kent and State of Michigan, have invented a new and useful Improvement in Low-Water Alarms; and I do hereby declare that the following is a full, clear, and exact description of the same.

The invention which is the subject of the foregoing petition relates to automatic high and low water alarms of that class in which the alarm is caused by the expansion of a tube into which the steam is admitted by the fall of the water in the boiler below a certain line. Such a low-water alarm is shown in Letters Patent of the United States granted to Hardwick on the 24th day of December, A. D. 1889, and numbered 418,020. The alarm described in the said patent is operative as explained therein; but my said invention is designed to secure certain advantages not secured by the construction in the said patent and not to the best attainable extent. I retain the tube extending down into the boiler to the line of low water; but in the patent the expansion of the tube acts directly upon a bell-crank lever, which moves a sliding valve to open the passage for the steam to the whistle. In this construction a considerable amount of force is required, as the valve is under pressure of steam, which must be overcome by the pressure arising from the expansion of the tube. Further, in the patented alarm some trouble is experienced in securing the right adjustment between the lever which connects the expansible tube with the valve, so that when the water should fall below the end of the pipe and the steam be admitted therein the whistle should sound sufficiently to be heard, while avoiding so sensitive an adjustment that the whistle would not be sounded when from any cause other than the admission of steam the tube should become hotter than usual. In respect to this point, my invention, in which the valve is directly operated by an intermediate motor—such as a weight, and not directly—the expansible tube requires much less expansion and renders the alarm operative with a full opening of the whistle-valve at the lowest steam-pressure, the lowest ordinary pressure giving sufficient expansion to release the weight.

Another defect in the patented alarm I have sought to remedy—namely, that by reason of the slow cooling of the pipe the whistle would continue to sound from fifteen to forty-five minutes after the water in the boiler had been restored to its high level, and this could not be conveniently prevented.

Further, my invention is designed, by reason of a straight expansion-pipe and removable cap operated by the expansion, to allow the pipe to be readily cleaned, as that above referred to cannot be.

My said invention therefore consists, essentially, in combining with an expansible tube and a whistle-valve an intermediate motor—such as a weight—arranged to act on said valve or the force of the steam-pressure, and a lever operated by the said expansible tube, arranged to set the intermediate motor in operation.

My invention also includes the special details of construction which I have found best in carrying my invention into effect.

In the accompanying drawings, which illustrate my invention, Figure 1 represents the alarm with a weight as the intermediate motor held out of operation, the figure being in side elevation, but showing part of the boiler in section. Figs. 2 and 3 show modifications.

In the drawings, A represents a part of the boiler. In the top is screwed a casting B, which is formed with one straight stem *b* and a laterally-bent stem *c*. The straight stem is tubular and opens directly through the casting. The upper end receives the expansible tube D, and in the lower end is fixed the tube *d*, which forms a straight continuation of the expansible tube and extends to the low-water limit. The lateral stem *c* receives the tube E, which supports the whistle F and conducts steam thereto, the flow of steam being controlled by a valve held normally closed by a spring on the stem *f* of the valve. The expansible tube D is made preferably of copper, and may be conveniently used about twenty-four inches in length. The lower end communicates with the interior of the boiler on the line mentioned, and

the upper end is closed by the movable plug. This upper end is held loosely in the end of an arm G, fixed upon the steam-tube E, so that the copper pipe in expanding may move freely in the arm. The said arm has a vertical slot, in which is pivoted at 1 a bell-crank lever M, the upper short arm of which carries an adjusting-screw and extends over the upper end of the expansible tube, the screw bearing on said end. The lower arm of said lever is longer and projects into range with a lever N, pivoted on the steam-pipe E. The lever is formed on a ring encircling the pipe E and has pivoting trunnions 3. The inner extension *o* of this lever has a notch 4, fitted to receive the edge of the lower end of the bell-crank lever, and when the levers are in contact the outer end *p* of the lever N is held up and sustains a weight. This weight is connected to the lever Q by a cord or chain *q*, the said lever being pivoted on the bracket above the valve-stem. The lever Q has a stud which bears on the end of said stem, and when the lever is pressed down, as by the weight P, it presses on the stem and operates the valve, giving full passage of the steam to the whistle. The weight is hung upon the end *p* of the lever N, and in this position is held by the bell-crank lever, as aforesaid. When the water falls in the boiler, thereby the steam is admitted to the pipe, expanding it and raising the upper arm of the bell-crank lever. A very slight movement and force are required for this, and thereby the lower arm of the lever is removed from the lever N, permitting the weight to drop from the other end *p*, with the result stated above. The parts are so arranged that the inner end of the lever N falls by gravity after the release of the weight, and the long arm of the bell-crank lever swings down by gravity over said inner end, and to restore the parts to normal position it is only necessary to hang the weight again on the arm *p*. As the valve is operated solely by the intermediate motor, the expansible tube has no work to perform, excepting that it releases the motor, which requires but very slight movement. The relation of the bell-crank lever to the tube D may therefore be easily adjusted and with perfect accuracy to secure release only when the tube is filled with the steam, and the weight or other intermediate motor may be made of any required power sufficient to move the valve under any circumstances.

To restore the valve and stop the whistle, it is necessary only to take the force of weight or other intermediate motor off from the lever which operates the stem of the valve, or to push the valve to its seat and secure it. This may be done by means of a cord *t*, attached to the weight and passing over a pulley *u* down to convenient position within reach of the attendant. The weight may at any time be restored to its place as soon as the tube D is cooled. The expansible tube is liable to become clogged by scum formed from the surface of the water in the boiler, and thus the alarm rendered inoperative. To remedy this in my improved construction, it is necessary only to remove the bell-crank lever by taking out the removable gib on which it is pivoted and remove the plug from the top of the tube. Then a swab may be inserted, and as the tube D is straight this swab may be pushed through to the lower end of the tube.

While I have shown the weight as the simplest and a perfectly effective form of intermediate motor, it will be readily understood that a spring may be substituted therefor, and this spring may operate to open the valve, while the valve is held normally closed by the intermediate lever, or the pressure of the steam may be utilized as an intermediate motor.

In Fig. 2 I have shown a form in which the steam acts as the intermediate motor. The valve at V is a puppet-valve, and is seated on the perforated diaphragm and opens by steam-pressure. Its stem *v* bears on the lever P′, which is held with the valve sealed by means of the upturned end of the lever N, and when the lever N is released, as above described, the valve opens by the force of the steam acting as the intermediate motor, with the effect explained.

To cause the bell-crank lever to engage with the inner end of the lever N, it may have a weight K′, and to secure the movement of the lever N, I add a cord, by which it may be pulled down to engage with the other lever. I add also in this modification an arm 7 to the lever P′ with a cord 9, by means of which the valve may be closed before the expansible tube has cooled sufficiently to reset the alarm.

The position of the parts when properly set is shown in full lines, the dotted lines representing the position when the device is operated.

In Fig. 3 I have shown a modification, in which I have added to the device heretofore described a high-water alarm. An expansible tube B′ extends loosely through the bracket and down into the boiler to the high-water line. It has an arm *b′* extending over an opposite arm 5 of the bell-crank lever provided with an adjusting-screw, which bears on the arm. When the high-water rises in the tube B′, it cools and contracts it, drawing down the opposite extension 5, releasing also the valve-operating mechanism.

The lever is pivoted at *x* to an ear on a sleeve which is held on the pipe by means of a screw. The lever M has a bend, by means of which it fits around the sleeve loosely enough to allow it to turn on its pivot and drop when the lever M is forced out by the expansion, as aforesaid, and when the lever drops it ceases to act as a stop, as before explained.

I claim as my invention—

1. In combination with an expansible tube extending into the boiler and with a pipe

having a whistle and whistle-valve, a lever operated by the expansion of the tube, and an intermediate motor arranged to be set in action by the lever to operate the whistle-valve, substantially as described.

2. A high-water alarm consisting of the tube of expansible material extending through the boiler to the high-water line and held therein with its upper end loosely held in the bracket, a lever arranged to be drawn down by the said tube, and an intermediate motor normally in engagement with said lever and being also arranged to operate the whistle-valve, substantially as described.

3. In combination with the whistle and valve, an expansible tube D, a high-water tube B′, a pivoted lever arranged to be operated by the expansion of the tube D and the contraction of the tube B′, and a motor arranged to be set in action by the lever to operate the whistle, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM R. FOX.

Witnesses:
THEO. H. MCCALLA,
E. HOWARD BURKE.