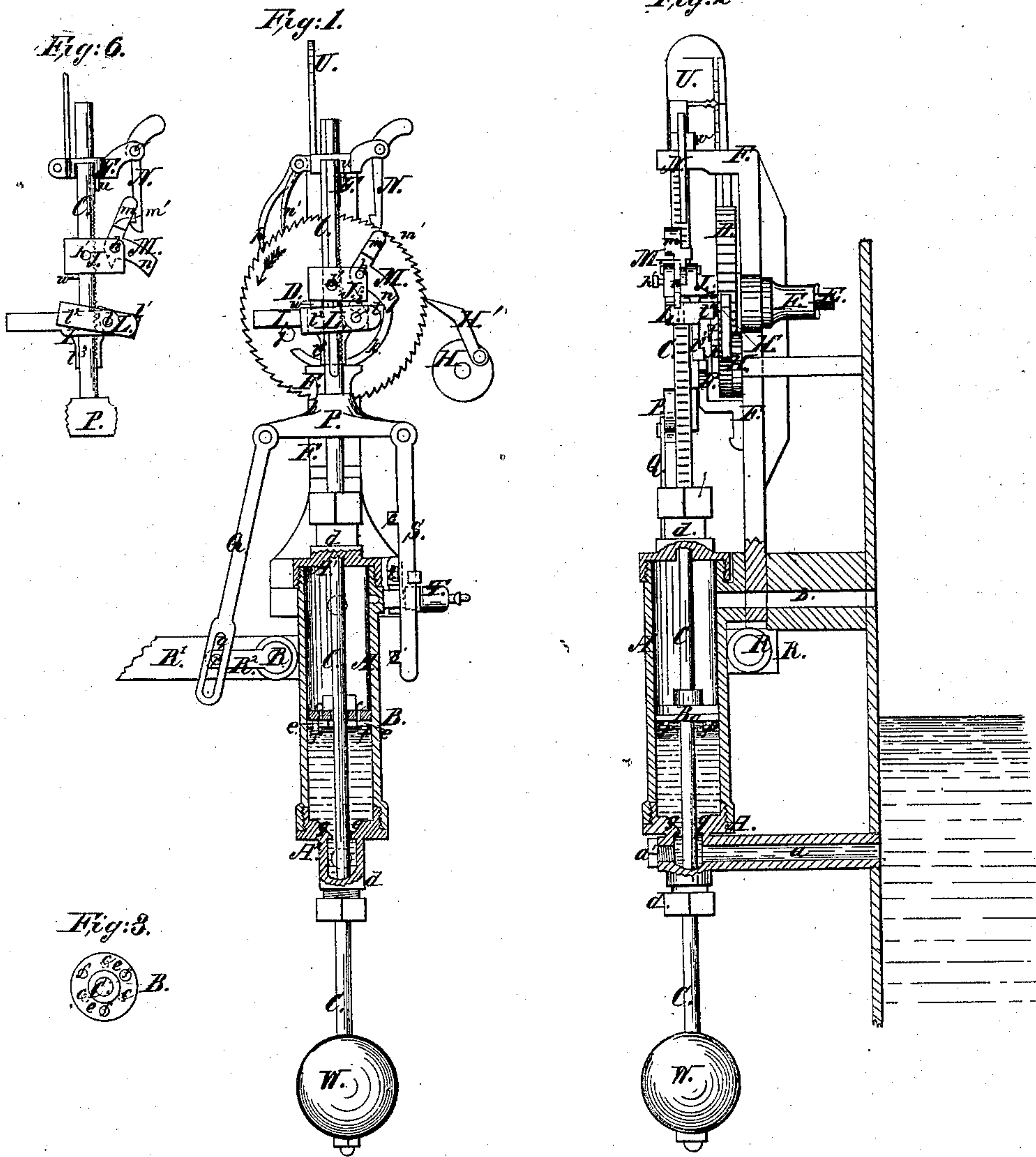


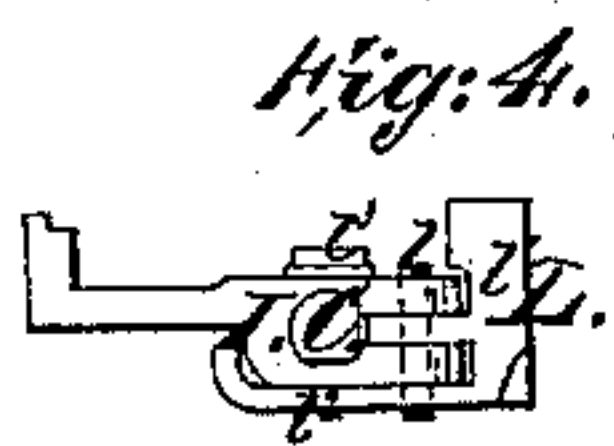
G. W. Rains,
Steam-Boiler Indicator.

N^o 32,532.

Patented June 11, 1861.



Witnesses:
J. W. Coombs
R. S. Spencer



Inventor:
G. W. Rains
Per Munn & Co
Attorneys

UNITED STATES PATENT OFFICE.

GEORGE W. RAINS, OF NEWBURG, NEW YORK.

IMPROVED SAFETY APPARATUS FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. 32,532, dated June 11, 1861.

To all whom it may concern:

Be it known that I, GEORGE W. RAINS, of Newburg, in the county of Orange and State of New York, have invented a new and Improved Safety Apparatus for Steam-Boilers; and I do 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, in which—

Figures 1 and 2 are elevations of the apparatus, taken at right angles to each other and both partly in section. Figs. 3, 4, and 5 are plans of portions of the apparatus. Fig. 6 is a front view of some portions of the apparatus, exhibiting them in a different condition from Fig. 1.

Similar letters of reference indicate corresponding parts in the several figures.

This invention consists in certain improvements in the apparatus which constitutes the subject-matter of Letters Patent issued to me April 24, 1860, and reissued July 24, 1860.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

A represents an upright cylinder, of brass or other metal, about ten inches in height, intended to be so arranged near the boiler that the middle of its length will be at or near the height of the proper water-level and connected at its lower end by a pipe, *a*, with the water-space of the boiler and near its upper end by a pipe or passage, *b*, with the steam-space thereof, so that it is always kept supplied with water from the boiler to the same level as the boiler itself.

B is a piston fitted loosely to the interior of the cylinder A, and attached to a rod, C, which works through a stuffing-box, *d d*, in the cover A' and bottom A² of the cylinder, the attachment being of such a character that, though the piston is compelled to move up and down with the rod, a limited lateral movement of the rod within it is permitted to prevent the possibility of its binding in the cylinder in case of the springing of the rod. This piston is intended to be lifted up from and dropped onto the surface of the water in the cylinder in the same manner as the piston of the apparatus which constitutes the subject-matter of my Letters Patent hereinbefore mentioned. The said piston has two or more

holes, *c c*, right through it, and is fitted on its under side with a ring-valve, *e*, to close the said holes. This valve, (shown in Figs. 1 and 2 and also in Fig. 3,) which is an inverted plan of the piston, is attached to the piston by three screws, *f f f*, which allow it to drop a short distance below the piston to permit steam to pass freely through the latter in its descent through the upper portion of the cylinder. The said valve on the piston, descending to the surface of the water, is arrested by the resistance of the water and thus caused to close the holes *c c c*; but when the descent of the piston is arrested the valve drops again onto the heads of the screws *f f f*. The piston-rod has attached to its lower part, below the cylinder, a weight, W, sufficient to overcome the friction of the stuffing-boxes *d d* and produce the descent of the piston and rod in the cylinder.

At the bottom of the cylinder there is a throat, *g*, of inverted conical form, which supersedes the valve used in my patented apparatus hereinbefore mentioned and renders the apparatus less liable to derangement. The opening of this throat is made sufficiently larger than the piston to permit a free water communication between the cylinder and the boiler, but yet to prevent too much of the water being driven back into the boiler by the falling of the piston, so that the latter may be arrested almost instantaneously on its arrival in contact with the water. By making the said throat of inverted conical form the collection of sediment around the piston-rod to close the water-passage is prevented, as a strong current of water is caused to pass between it and the piston-rod at each fall of the piston. The said throat is represented as formed in the solid metal of the cylinder-bottom; but it may be made of a separate piece with a flange to rest on a shoulder provided in the cylinder-bottom, where it will always remain. The pipe *a* connects with the cylinder below this throat, and provision is made for cleaning it out by a screw-plug, *a'*, (see Fig. 2,) on the opposite side of the cylinder-bottom.

D is a wheel from which the piston-rod and piston derive motion, as will be presently described. This wheel is secured to a short horizontal shaft, E, arranged in a suitable bearing in a standard, F, secured to the boiler or to

any other suitable support, and is intended to have a very slow rotary motion, which may be produced by its being furnished on its periphery with ratchet-teeth to be acted upon by a dog, H' , attached to a rocker, H , operated by the eccentric-rod of the engine. $p p$ are pawls engaging with the ratchet-teeth to prevent the wheel D from moving backward.

On the face of the wheel D there are two pins, i and j , and a projecting arc, k , the pin i , nearest the center, projecting farther forward than the pin j and arc.

$I L$ is a clamp consisting of a slide, I , fitted with a dog, L , and fitted to the piston-rod in such manner as to be capable of moving up and down thereon. This is acted upon by the shorter pin, j , to raise the said rod and the piston. Fig. 4 is a plan of the said clamp. The dog L works on a pin, l , and is constructed or furnished with a weighted arm, l' , which tends to keep it free of the rod, and with an arm, l'' , whose duty will be hereinafter explained. On the under side of the slide I there is a downward projection, l^3 , to rest on a fixed stop, F' , standing out in front of the standard F . This stop should have on its upper end a cushion of india-rubber faced with metal, to prevent the battering of the projection l^3 when the dog drops.

J is a weight fitted to slide on the piston-rod and furnished with a dog, M , working on a pin, h , to grip the said rod. Fig. 5 is a plan of this weight, whose duty it is to act upon the clamp $I L$ to cause it to arrest the piston-rod and piston in their descent. The dog M is so weighted at m that, though always free to move upward upon the piston-rod, it always tends to grip the rod, so as to be prevented from sliding down upon it when not acted upon by other means, and it is furnished with a tail, n , which hangs down below the weight. The pin j in the wheel and the arc k are made less prominent than the pin i , in order that they may pass the weight J in their revolution with the wheel.

The upper portion of the piston-rod C is made larger than the lower portion, and the larger portion is flattened on one side, and the weight J has its opening, which fits the said rod, of corresponding form to prevent its turning thereon, and that side of the upper and larger portion on which the dogs l and m are situated is toothed or roughened to give the dogs a good hold upon it.

The weight J is fitted with a screw, h' , whose end is adjusted to produce a certain degree of friction on the flat side of the piston-rod.

N is a catch attached by a pin, v , to the upper part of the standard F for the purpose of disengaging the dog m from the piston-rod during the descent of the latter, the said catch being so hung and weighted as to be moved aside by the said dog in the ascent of the piston-rod, but to drop under the dog before the piston-rod completes its upward movement.

u is a pin secured to the upper part of the stand F for the purpose of unlocking the dog m in case of the weight J ever being moved so high up the piston-rod as to be in danger of striking the upper part of the standard.

P is a cross-head secured to the piston-rod and having suspended from one arm a rod, Q , for controlling the feed-regulating cock R in the suction-pipe R' of the feed-pump, and from the other arm a rod, S , for opening the valve of a steam-whistle, T , which is attached to the upper part of the cylinder A . The connection of the rod Q with the feed-regulating cock R is by a slot, q , provided in the said rod to receive a wrist, r , on the lever R^2 of the cock, the length of the said slot being about equal to the distance of the upward movement given to the piston-rod by the pin j . The rod S has provided upon it two tappets, $s s'$, the distance between which is greater than the distance which the piston is generally raised by the pin j , the said tappets being for the purpose of acting upon a small lever, t , that is so applied in connection with the valve of the whistle T that it will open the said valve either by an upward or downward movement.

The wheel D rotates very slowly—say about three times every minute—in the direction of the arrow shown upon it in Fig. 1, and the action it produces during each revolution is as follows: Let it be first supposed that the apparatus is in the condition represented in Fig. 1, the piston resting on the water in the cylinder, the slide I of the clamp $I L$ resting on the stop F' , the dog L of the said clamp being held in contact with the piston-rod by its arm l' resting against the interior of the arc k , and the weight J resting on the clamp $I L$. The rotation of the wheel D brings the pin i under the weight J and moves the said weight up the piston-rod, and afterward brings the pin j into action on the under side of the arm l' of the dog L of the clamp $I L$ and causes the said clamp to lift the piston-rod and raise the piston B from the water in the cylinder A . The weight J remains clamped to the piston-rod by its dog M after the pin j in its revolution has passed out of contact with it, and hence is caused to rise with the piston-rod as the latter continues its ascent, passing the hook of the catch N . When the pin j passes out of contact with the arm l' of the clamp $I L$, the said arm drops and removes the tooth of the dog L from the piston-rod, and the clamp $I L$, the weight J , and the piston-rod and piston all drop together. The clamp $I L$, being perfectly free, falls quickly upon the support F' ; but the piston-rod, being subject to the friction of the packing in the stuffing-boxes, has its descent a little retarded, and hence a short interval of time elapses before the weight J is unlocked by the catch m' on its arm m falling upon the hook of the catch N , as represented in Fig. 6, which shows the rod, clamp, and weight all falling together. The weight J is now left entirely free, and

continues its descent until, on the arrest of the piston by striking the water, the said weight falls upon the clamp I L, and a spring protuberance, *w*, on its under side, by striking the arm *l*² of the dog L causes the latter to bite the piston-rod and prevent its further descent. In this operation the dog I L is always raised to the same height and the piston always raised the same distance; but the distance of the fall of the piston varies, as it is arrested very exactly at the surface of the water in the cylinder whatever the height of that surface may happen to be at the moment of its fall. The arms Q and S rise and fall with the piston, and so long as the water in the cylinder does not change its level the cock R and whistle T are not acted upon, the slot *q* being as long as and the distance between the tappets longer than the distance which the piston is lifted. Should the level of the water become lower, the piston has to fall lower to reach its surface, and the rods Q and S, moving lower also, the upper end of the slot will move the lever R² downward and thus give a larger opening for the water to the force-pump and cause an increased feed. Should the level of the water in the cylinder rise, the reverse action takes place and the feed is diminished. In case of the water from any cause getting dangerously low or objectionably high in spite of the action of the lever Q on the lever of the supply-cock, or in case of those parts of the apparatus getting out of order, the piston, continuing to fall lower or rise higher, brings the tappet *s* or *s'* into action on the lever *t*, and so causes an alarm to be given by the whistle. This action will also generally take place in case of any of the working parts of the instrument getting out of order, for as the good condition of all the moving parts is essential to the proper action of the apparatus should any one part fail the pis-

ton will not be arrested at the surface of the water, but will continue to rise above or sink below the same until the alarm shall have been sounded.

On the upper part of the standard F there is placed a fixed scale, U, upon which the true level of the water at each fall of the piston may be indicated by a pointer or index rigidly attached to the upper part of the piston-rod.

The arc *k* may be placed in such a position on the wheel D as to bear against a projection on the arm *l*² of the dog I in such a manner as to serve the purpose of the pin *j*, which in that case would be dispensed with.

The weight J may be arranged with projecting guides touching the wheel D, and in that case the piston-rod will not require to be flattened on its front side.

The screw in the weight J, with the dog M attached to said weight, may be separately used or combined, as represented in the drawings.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The inverted conical throat *g*, arranged relatively to the water pipe or passage *a*, and in combination with a piston-rod passing through the bottom of the cylinder, substantially as and for the purpose herein specified.

2. Furnishing the piston B with one or more valves, *e*, applied to operate substantially as herein described, for the purpose set forth.

3. The independent weight J, applied to the piston-rod C, to operate in combination with the dog I L, substantially as and for the purpose herein specified.

GEO. W. RAINS.

Witnesses:

JAMES B. BEVERIDGE,
WILLIAM SILLIMAN.