

Safety-Valves for Steam-Boilers.

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R. Bonnett.
S. Caplinger.

Henry W. Shepard
By His Atty
H. Connets Jr.

UNITED STATES PATENT OFFICE

HENRY W. SHEPARD, OF MADISON, INDIANA, ASSIGNOR OF ONE-THIRD HIS
RIGHT TO GEORGE W. CABLE, OF ST. LOUIS, MISSOURI.

IMPROVEMENT IN SAFETY-VALVES FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. **145,534**, dated December 16, 1873; application filed
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To all whom it may concern:

Be it known that I, HENRY W. SHEPARD, of Madison, in the county of Jefferson and State of Indiana, have invented certain Improvements in Safety-Valves for Steam-Generators, of which the following is a specification:

The object of my invention is to provide an ordinary safety-valve with an auxiliary valve to assist the main valve in lifting the lever and weight just at the moment of action, thus insuring the full lift of the main valve and the consequent free escape of steam.

Before proceeding with a description of my invention, which is used in connection with a safety-valve of the ordinary kind, I will state that the principal objection to the common valve arises from the fact that it does not lift high enough under the blow-off pressure to permit the free escape of steam unless the valve is made extremely large, and then the pressure required to keep it down is so excessive that it is apt to stick and not blow off at all.

My invention is intended to obviate these difficulties by providing an auxiliary independent lift, acting under the lever, preferably at the outer end, at the same moment the main valve lifts, and lifting said lever until the said main valve has attained its full lift.

In the drawings, Figure 1 is a partial longitudinal vertical section of my invention. Fig. 2 is a plan and partial section of the same.

Let A represent the shell of the boiler; B, the chamber of an ordinary safety-valve; C, the fulcrum; D, the valve-stem; E, the lever; and F, the weight. These are common, and need no special description. A cylindrical plug with a chamber, G, is screwed into the boiler or steam-drum, and is surrounded by a metallic casing, H, which may be screwed on, as shown. This casing forms an annular chamber, *a*, around the chamber G, which is connected with the interior of the chamber G by means of the several holes *c c*. The upper portion of the casing H projects over the edge of the upper end of the chamber G, as indicated in Fig. 1, and is perforated with the several holes *b b*, which serve to connect the upper open end of the cylinder with the outer air. In the chamber G is fitted a piston, J, packed so as to be approximately steam-tight. The bore of the

chamber G is lessened sufficiently at the lower end to leave a ledge, *e e*, in which to form a beveled valve seat for the reception of the piston J. As the piston is ground to its seat this renders it steam-tight when seated. From the under side of the piston J, and inside the boiler, is suspended, by a rod, I, a weight, K. A pipe, *d*, connects the annular space *a* with a cylinder, L. This cylinder is provided with a piston, M, packed with spring-packing, as shown at *i i*. The cylinder L is secured to the boiler-shell A at some point under the valve-lever, and the rod N of the piston M is provided with a fork or saddle, *n*, in which said lever rests, as shown. A friction-roller, as at *j*, may be inserted for the lever to rest upon. The cap O of the cylinder L is merely intended as a guide for the piston-rod, and is perforated to admit air.

The operation is as follows: Let the weight F be adjusted on the lever to exert the required pressure on the valve, and then adjust the weight K, so that it will exert the same relative pressure on the piston-valve J. Now, when the pressure in the boiler reaches the required maximum, the main valve will begin to blow off sparingly, but it is a well-known fact among practical engineers that it requires a dangerous addition of pressure to cause it to rise high enough for the free exit of steam. When the pressure arrives at the maximum, and before it can rise perceptibly higher, the piston J rises, and being once lifted from its beveled seat *e e* the steam, acting on the newly-exposed area forming the seat, adds force to the lifting-pressure and carries the piston to the top of the chamber G. The spring P impinges against the plug or boiler as the piston rises, and thus prevents concussion. The spring also assists in starting the piston back to its seat when the steam-pressure falls. When the piston J rises to the top of the chamber G it rests entirely above the holes *c c*, and no obstacle is then interposed to prevent the passage of steam from the boiler through the holes *c c* along the pipe *d* to the cylinder L, and under the piston M, which it lifts, and with it the safety-valve lever, thus opening the main valve to any desired extent and permitting the free exit of steam. When the pressure in the boiler falls below that due to the weights K and F, the piston-

valve J drops back into its seat, thus cutting off the communication of the cylinder L with the boiler, but opening communication through the pipe *d*, holes *c c*, chamber G, and holes *b b*, for the escape of the steam employed in lifting the piston M to the outer air.

It will be seen that the safety-valve proper is constructed and is arranged so that it may operate entirely independent of my auxiliary device, so that if either should be out of order the other can still operate. The piston-valve J may be turned to fit truly, but not tightly, in the chamber G, as a slight leakage is not important, provided the valve-seat is steam-tight; but I prefer to pack the piston with spring packing in the usual way. Care, however, should be taken not to pack too tightly.

I desire to call particular attention to what I consider one of the most important features of my invention. When the piston-valve rises from its seat it is necessary that it should positively rise to the top of the chamber. To insure this I provide a seat for the piston J of suitable width to effect the purpose desired, and calculate the weight K to suit the contracted

area of the piston below the seat *c c*. Therefore, when the piston lifts from the seat, a new area equal to the area required for the valve-seat is exposed to pressure in addition to that calculated, which causes the piston to rise suddenly or pop up to the top of the chamber G. The device, consisting of the chamber G, piston J, weight K, and casing H, can be attached to the steam-drum of a battery of boilers, each bearing a safety-valve, and have several pipes leading to the different valves. The pipe *d* can be of any length.

I claim—

The device, consisting of the piston-valve J, chamber G, weight K, and casing H, the cylinder L, piston M, and pipe *d*, in combination with the lever, weight, valve, and chamber, which constitute the elements of the common safety-valve, when arranged to operate substantially as shown, and for the purposes specified.

HENRY W. SHEPARD.

Witnesses:

W. E. MCLELAND,
HENRY CONNELL, Jr.