No. 688,283. Patented Dec. 10, 1901.

F. L. BICKEL.

STEAM TRAP.

(Application filed Apr. 17, 1901.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1

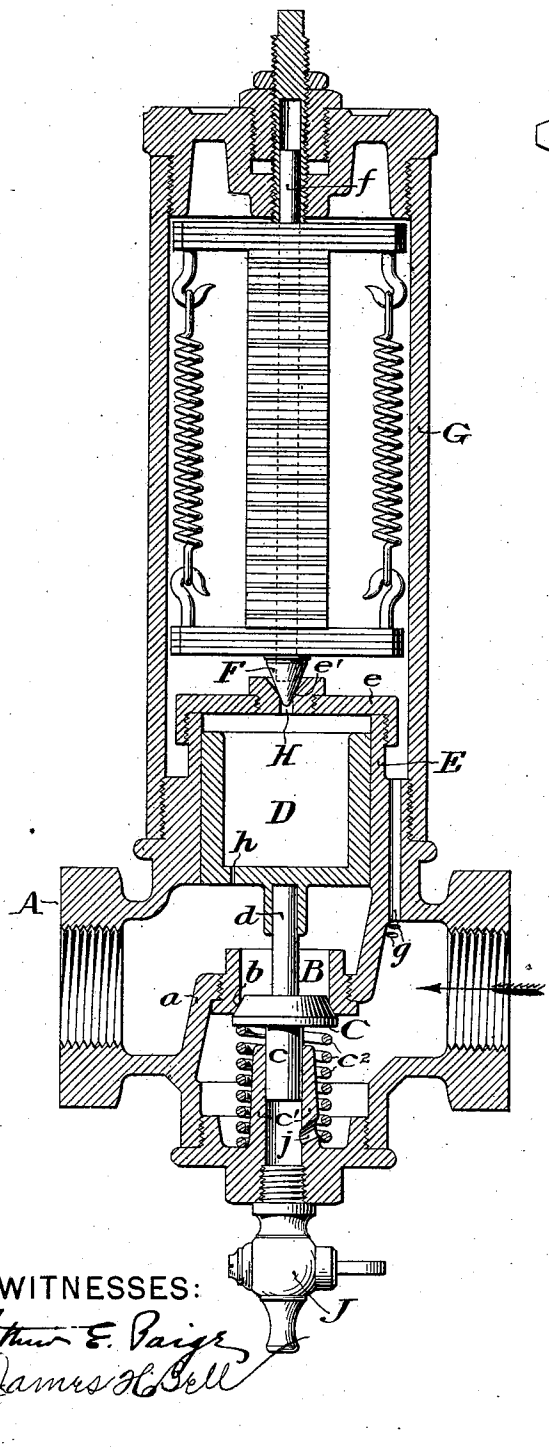
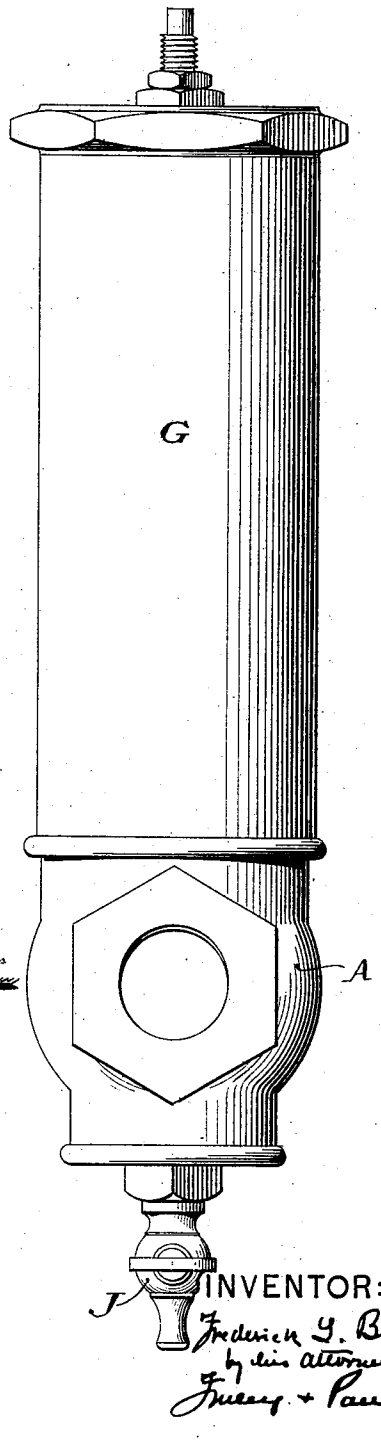


FIG. 2



WITNESSES:

Victor E. Paige

James H. Bell

INVENTOR:

Frederick L. Bickel

by his attorneys

Fulleng & Paul

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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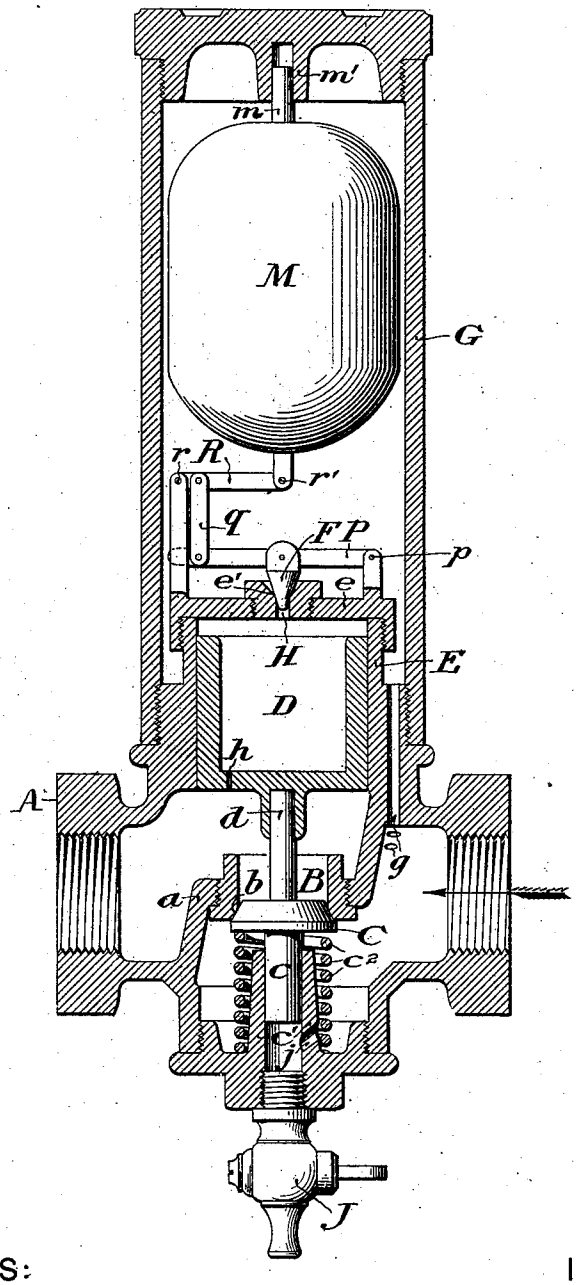
F. L. BICKEL.

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(No Model.) 2 Sheets—Sheet 2.

FIG. 3.



WITNESSES:

Arthur E. Paige

James H. Bell

INVENTOR:

Frederick L. Bickel

by his attorneys

Fulley & Paul

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FREDERICK L. BICKEL, OF PHILADELPHIA, PENNSYLVANIA.

STEAM-TRAP.

SPECIFICATION forming part of Letters Patent No. 688,283, dated December 10, 1901.

Application filed April 17, 1901. Serial No. 56,180. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK L. BICKEL, a citizen of the United States, residing at No. 1348 Palmer street, in the city and county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Traps, whereof the following is a specification, reference being had to the accompanying drawings.

My invention relates to a steam-trap of which the main valve is opened against the pressure which it confines by the operation of a secondary valve, which in turn is controlled by the presence or absence of water on the pressure side of the main valve.

In the accompanying drawings, Figure 1 is a vertical central section through a steam-trap embodying my invention. Fig. 2 is a side elevation of the same. Fig. 3 is a section similar to Fig. 1 through a modified form of steam-trap embodying my invention.

A is a pipe-section fitted with a diagonal diaphragm *a*, within which is fitted a valve-seat *b* with a valve-aperture B. Upon the pressure side of this valve-seat rests the valve C, controlling the valve-aperture B. This valve has a spindle or stem projecting in both directions. The stem C on the pressure side is supported and centered within a collar *c'*, formed in the pipe-section and surrounded by a coiled spring c^2, the pressure of which tends to seat the valve. The stem *d* on the opposite side of the valve is attached to a piston D, playing within a fixed cylinder E, the diameter of which is greater than that of the valve-aperture B. The head *e* of this cylinder has mounted within it a valve-seat *e'*, the aperture H of which is controlled by a secondary valve F. An aperture *h* much smaller than aperture H pierces the head of the piston D; but if the fit of the piston within the cylinder is moderately loose aperture *h* may be omitted. At the bottom of the pressure side of the valve a small aperture *j* may conveniently be formed leading to a small petcock or drip J.

A dome or chamber G, mounted upon the pipe-section A, and the interior of which is in free communication with the pressure side of the valve by means of the apertures *g*, contains the means for controlling the secondary valve F. These means, as shown in Fig. 1, consist of a series of thermostatic bimetallic plates or couples mounted upon the spindle *f* of the secondary valve, which by their expansion under the temperature of steam heat or higher close the secondary valve and by their contraction at the temperature of water open it. The construction of these thermostatic couples, as also the means at the top of the dome for accurately adjusting their action, have already been described in the specification forming part of Letters Patent of the United States No. 668,766, issued to me under date of February 26, 1901, and consequently description thereof need not be here repeated.

In Fig. 3 the arrangement of the valve and the secondary valve is the same except that in the place of the thermostatic couples for controlling the secondary valve I have substituted a hollow float M, mounted upon a vertical stem *m*, which is received and centered within a collar *m'*, formed on the inner side of the top of the dome G. This float may be connected with valve F directly; but I prefer to employ a system of multiplying-levers, as shown in the drawings, where it will be observed that valve F is attached pivotally to the center of lever P, which is fulcrumed on the fixed pivot *p* at one end and controlled by the link *q*, pivoted to it at the other end. The other end of the link *q* is pivoted to lever R near to its fulcrum on the fixed pivot *r*. The free end of the lever R is pivoted at *r'* to the bottom of the float M. The proportions of the levers, as shown, multiply the motion of the float some six or eight times before communicating it to the valve-seat F.

Although I prefer to operate the main valve by a piston sliding within the cylinder, it may be similarly operated by a flexible diaphragm fixed within the cylinder.

The operation of my steam-trap is as follows: If nothing but steam at 212° Fahrenheit or superheated to any extent thereabove is present upon the pressure side of the valve, its pressure, combined with that of the spring c^2, closes the valve. The steam also passes through aperture *g* and fills the interior of dome G. If this dome contains the thermostatic devices shown in Fig. 1, the heat of the

steam expands the bimetallic couples therein, so as to seat the secondary valve F. If it be of the construction shown in Fig. 3, this valve is seated by the pressure of the steam as well as by its own weight. If, however, water is present on the pressure side of the valve, it will pass through aperture *g* into the dome G, and as the steam therein condenses will gradually rise therein. The effect of the water will be to contract the thermostatic series of Fig. 1 by reason of its lower temperature or to raise the float of Fig. 2, thereby opening the secondary valve F, allowing the water to enter the interior of the cylinder and to communicate its pressure therein. As piston D has a greater area than valve C the excess of hydrostatic pressure immediately forces valve C from its seat, allowing the water to escape through aperture B. When the water has all escaped, the steam which follows will again fill the dome G and effect the closure of valve F. This removes the pressure from the interior of the cylinder, (which escapes through aperture *h*,) and the valve C is reseated.

Having thus described my invention, I claim—

In a steam-trap, the combination of a main valve opening toward the pressure side; a fixed cylinder of larger aperture than the valve fitted with a yielding partition (piston or diaphragm,) responding to pressure within the cylinder; a connection whereby the advance of this yielding partition, occasioned by pressure within the cylinder, is opposed to the closure of the valve; a chamber in free communication with the pressure side of the valve; an aperture between this chamber and the interior of the cylinder; a secondary valve controlling this latter aperture; and means within said chamber for controlling the secondary valve, whereby when it is filled with water said secondary valve is open, and when it is filled with steam it is closed, substantially as described.

FREDERICK L. BICKEL.

Witnesses:
JAMES H. BELL,
C. BRADFORD FRALEY.