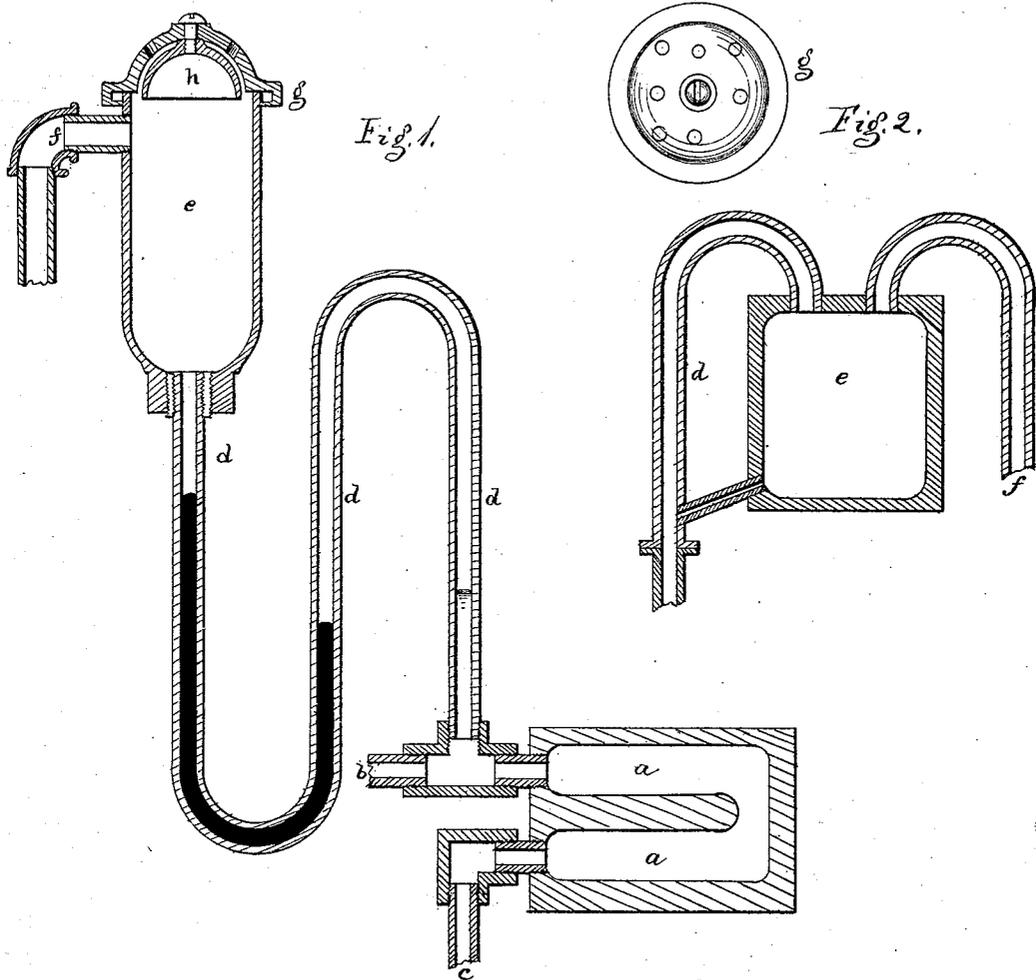


S. F. GATES.

Improvement in Steam Water-Elevators.

No. 127,592.

Patented June 4, 1872.



Witnesses,
M^r. W. Frothingham.
S. B. Bidder.

Inventor,
Stephen F. Gates,
By his Attys.
Crooby & Gould

UNITED STATES PATENT OFFICE.

STEPHEN F. GATES, OF CAMBRIDGE, ASSIGNOR TO CHARLES HOUGHTON,
OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN STEAM WATER-ELEVATORS.

Specification forming part of Letters Patent No. 127,592, dated June 4, 1872.

To all whom it may concern:

Be it known that I, STEPHEN F. GATES, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented an Improvement in Automatic Steam Water-Elevators; and I do hereby declare that the following, taken in connection with the drawing which accompanies and forms part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

In automatic steam water-elevators for raising water in dwelling-houses, of which those made under patent No. 111,542, issued to Charles Houghton, of Boston, February 7, 1871, are the only ones I have seen in practical use, there would seem to be no need of a safety-valve, the column of water to be raised being the only obstruction between the steam generated and the open air, which an excessive pressure of steam would drive entirely out of the outlet-pipe and find a free passage for itself. But it has been found in practical use that, by carelessness, the outlet-pipe for water in such water-elevators is sometimes left so exposed that in severe winter weather the water in it is frozen so as to entirely close the passage through it; or, by accident, some substance, like a bit of rag or paper, might come up in the water, and be forced into the outlet-pipe, and close it, and when so closed or nearly so, if steam is generated, some part of the apparatus which is the weakest must give way, and if all parts are strong a dangerous explosion might take place. The object of my invention is to render such an accident impossible.

In the drawing annexed, Figure 1, *a* represents the steam-generator of an automatic water-elevator, referred to, though it is not necessarily, and perhaps not preferably, in the precise form here shown. My improvement is equally useful with any form of steam-generator. *b* represents the steam-pipe, extending from the upper part of the steam-generator to the top of the cylinder of the water-elevator. *c* is what is termed the water-supply pipe, and conducts water from a reservoir prepared for the purpose, into the lower part of the steam-generator, intermittently supplying it and replenishing what has been converted into steam in the operation of the elevator. As these are all the parts of the elevator to which my im-

provement is attached, and necessary to show its connection with it, I will not describe it further. *d* is a bent-iron or other suitable metal tube, extending upward from the steam-generator or the steam-pipe of the automatic steam water-elevator, from five to eight feet, as the case may require, then turning downward about the same distance, then turning upward again a little higher than the first bend, there entering the cup or receptacle *e*. This tube may be one-quarter to one-half an inch inside diameter, and is to be filled with mercury about half way up from the lower bend of the tube. *e* is a cup or receptacle (of which Fig. 2 shows a modified form) placed at the outlet of the tube *d* to receive the mercury in it, when it may be forced out of the tube *d*, from which cup it will return to the tube *d* by its own gravity. *f* is a pipe for the escape of steam and water from the cup or receptacle *e*. *g* is a cap for the receptacle *e*, a top view of which is shown in Fig. 3. *h* is an inverted cup or deflector placed in the cap *g*, to prevent mercury from being blown out of the receptacle *e* by force of steam. The mercury in the tube *d* serves to close that tube against the passage of steam or water until the pressure in the steam-generator is great enough to force it out into the receptacle *e*. When steam is generated to operate the water-elevator, it will press the mercury down in the middle tube and up in the left-hand one until the column in the left-hand tube is enough longer than the column in the middle tube, so that the difference in length of the columns of mercury in the two legs of the tube *d* is more than equal in weight per square inch of end surface to the weight per square inch of the column of water to be raised. A column of mercury one foot high being equal to an equal column of water thirteen feet high, if the water is to be raised fifty feet by the elevator, a column of mercury five feet high will more than balance the column of water. But if the outlet-pipe for water becomes obstructed or entirely closed, then the pressure of steam will drive the column of mercury out of the tube *d* into the receptacle *e*, where it will remain until steam has escaped to relieve the undue pressure, when it will return to the tube *d* again.

In the operation of the water-elevator, when

the steam is condensed in the cylinder and a vacuum thereby produced in it, the pressure of the atmosphere through the receptacle *e* and tube *d* will force the mercury down in the outer or left-hand leg of the tube *d*, and consequently up in the middle tube *d* until the difference in the height of the columns of mercury is equal to the pressure of the atmosphere. Thus while the water-elevator is in operation the mercury in the bent tube *d* is constantly shifting from one leg of the tube to the other, preventing the escape of steam through the tube *d* until the pressure should be raised to several pounds above what is necessary and proper for the operation of the elevator, and acting as an air-cushion when the water flows in to fill the vacuum produced in the cylinder, relieving the concussion or blow which otherwise is felt every time the cylinder fills with

water, thus serving the two purposes of a safety-valve, more reliable and certain in its action than any other, and cheaper than any good safety-valve can be obtained, and as an air-cushion or chamber to relieve the blow when the ascending flow of water reaches the top of the cylinder, saving it from the injury which a constant succession of such blows must necessarily produce.

I claim—

The combination of the water-elevator herein described, with a siphon mercury-tube, *d*, and receptacle *e* having deflector *h*, all constructed and arranged substantially as and for the purpose set forth.

STEPHEN F. GATES.

Witnesses:

FRANCIS GOULD,
M. W. FROTHINGHAM.