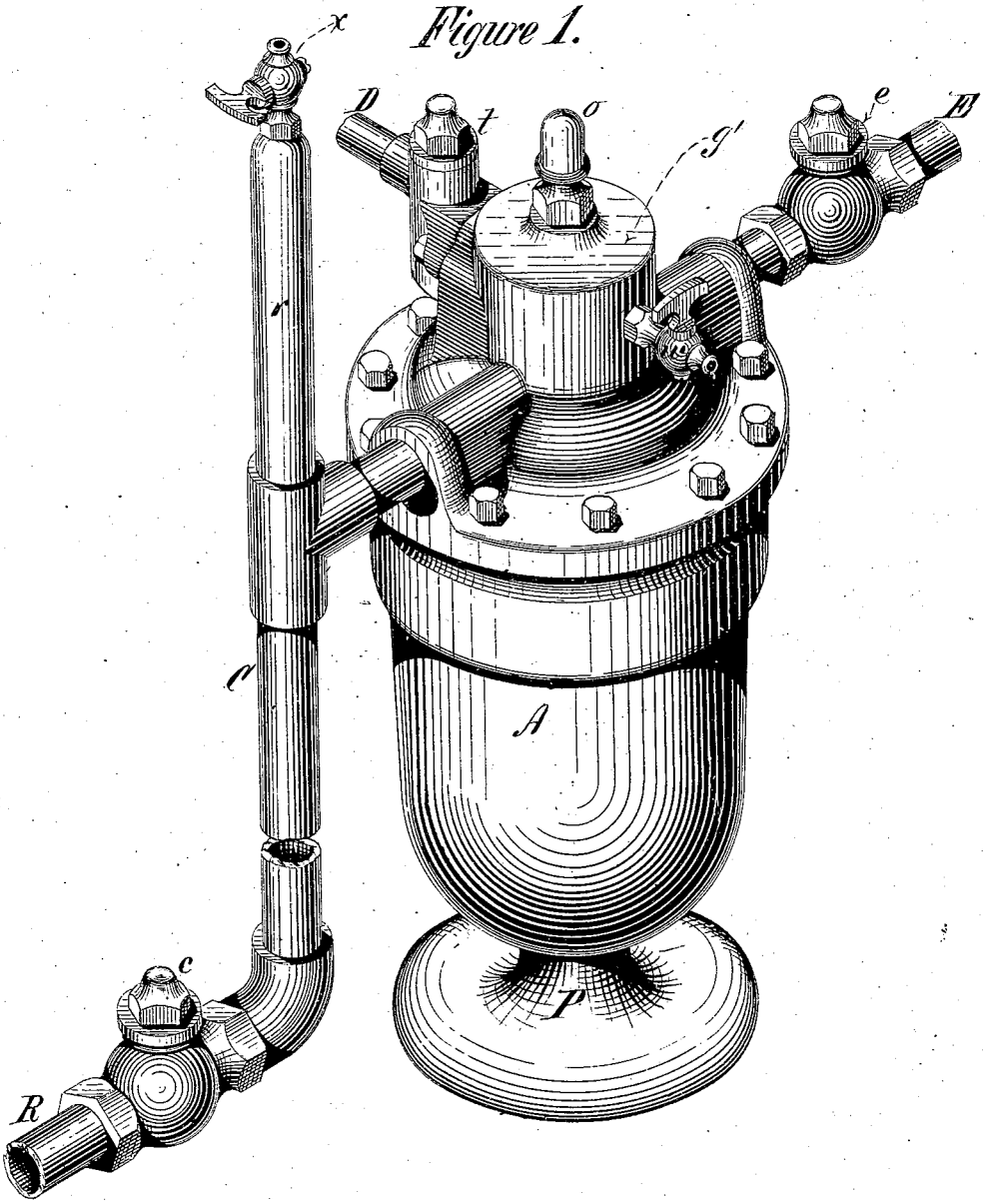
2 Sheets—Sheet 1.

J. H. BLESSING.

Steam-Trap.

No. 207,484. Patented Aug. 27, 1878.

Figure 1.



Witnesses:
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Inventor:
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By his attorney
E. N. Dickerson Jr.

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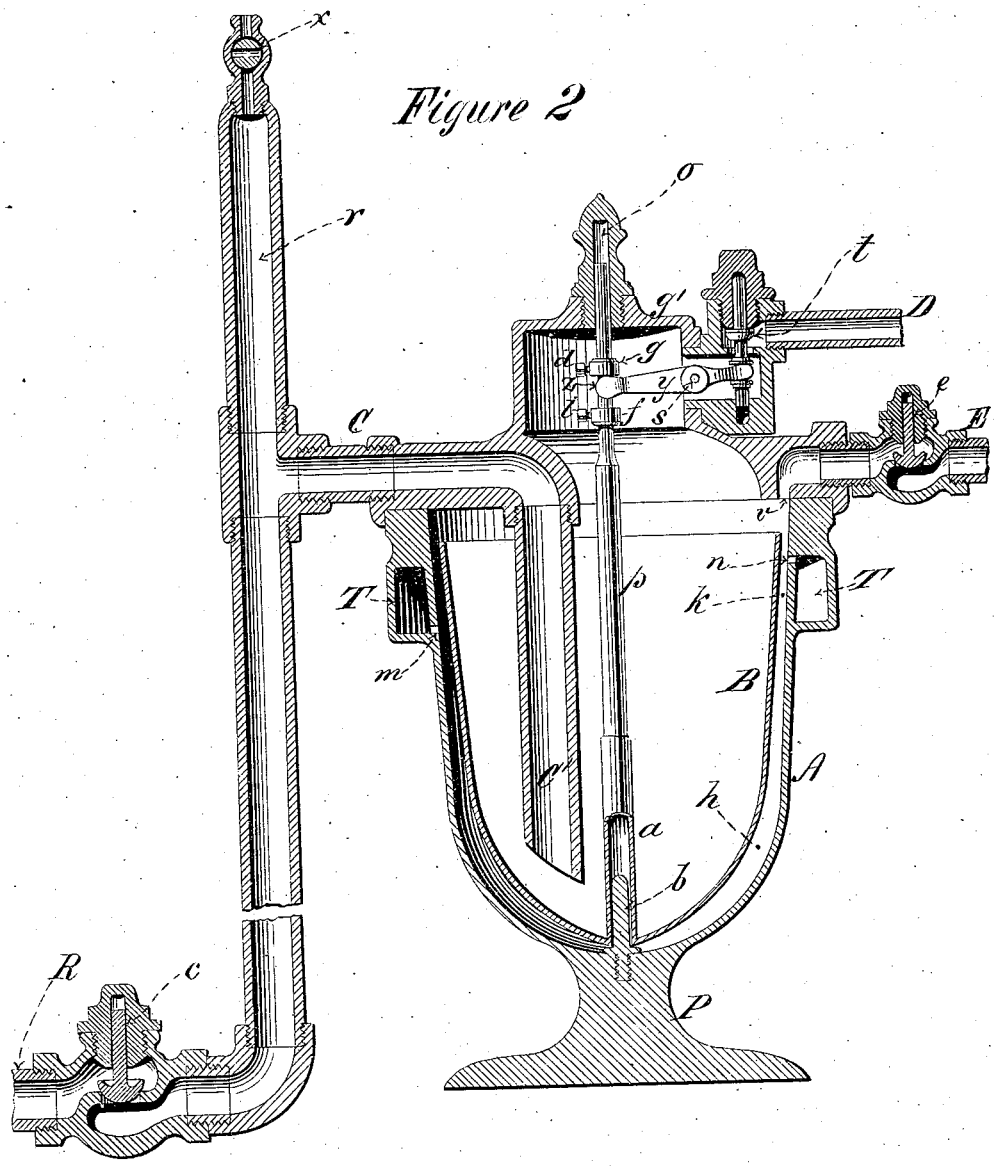
Figure 2



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UNITED STATES PATENT OFFICE

JAMES H. BLESSING, OF ALBANY, NEW YORK.

IMPROVEMENT IN STEAM-TRAPS.

Specification forming part of Letters Patent No. **207,484**, dated August 27, 1878; application filed November 6, 1877.

To all whom it may concern:

Be it known that I, JAMES H. BLESSING, of the city of Albany and State of New York, have invented a new and useful Improvement in Steam-Traps, of which the following is a full, true, and exact description, reference being had to the accompanying drawings.

The object of my invention is to return to a steam-boiler the water of condensation which is received from coils situated either above or below the level of the boiler; and my apparatus could also be used, though not very advantageously, to feed to the boiler such water as might be required to keep up the water-level in it. Many apparatuses have before now been made to accomplish this same result. In the present invention there is no sliding or vibrating part communicating with the exterior, nor is there any such contrivance within the vessel connecting steam-spaces of different pressures. My apparatus, moreover, is contained in a solid casing, and operates entirely within itself without necessitating any external moving parts. It is also very compact, which is an advantage where it is to be used in narrow spaces over a boiler.

Another advantage of this apparatus is that the parts, valves, and connections are all readily accessible by removing the cover of the apparatus.

In my drawings similar letters of reference refer to similar parts in both the figures.

Figure 1 represents a general perspective elevation of my apparatus. Fig. 2 represents a cross-section of the same through the pipes C and E. In this drawing the position of the pipe D has been changed, so that it is parallel with the pipe E, thereby enabling the entire apparatus to be shown in one cross-section.

It is evident that the position of the pipe D is immaterial.

My apparatus consists, generally, in a vase-shaped vessel, A, supported on a pedestal, P. Three pipes communicate with the interior of this vessel—the supply-pipe E, the return-pipe R, and the steam-pipe D. The pipe E is connected with the water-supply, the pipe D with the steam-space of the boiler, the pipe R with the bottom of the boiler. The pipes E and R are provided with check-valves *e* and *c*, opening toward the boiler. Within the vessel A is the bucket B, having approximately the same shape as the vessel A. This bucket is supported on a rod, *p*, which terminates at its lower end in the pipe *a*, which slides upon the rod or guide-stem *b*. The upper end of the rod *p* slides in the tubular guide-channel *o*, situated at the top of the vessel, so that it will be seen that the bucket B can rise and fall vertically in the vessel A and its central axis is maintained constant with reference to the vessel A.

Surrounding the vessel A is the tank T, which communicates with the vessel A by two small openings, *m* and *n*, the object of which will be presently explained.

On the upper part of the rod *p* are the sliding rings or collars *g* and *f*, which can be adjusted on the rod *p* by means of the set-screws *d* and *l*. These collars act against the lever *y*, pivoted at the point *s*, by coming in contact with the arm *z* of the said lever *y*. The other end of this lever controls a valve, *t*, as will be readily seen, so that when the arm *z* is raised the steam-valve *t*, situated in the steam-pipe D, will be closed, while, when it is depressed and in the position shown in the figure, it will be open, and it is evident that this steam-valve *t* will be opened whenever the bucket B has descended to the bottom of the vessel A. The pipe C, which communicates with the bottom of the boiler, is provided with the descending pipe or siphon C′, which reaches nearly to the bottom of the bucket B. This return-pipe C is also provided with the upper tubular chamber *r* and valve *x*, for the purpose of receiving such air as may escape from the water during its passage through the apparatus.

The supply-pipe E, provided with the check-valve *e*, has an opening, *v*, so arranged that the water flowing through it will not enter the bucket B at first, but will pass outside of such bucket, and will fill the space *h* between the bucket B and the vessel A.

The operation of the apparatus can now be understood. Water is first caused to enter the vessel A by opening the air-valve *x*, previously described, and by shutting off the steam in the pipe D, which communicates with the steam-space of the boiler. The steam acting upon the water in the coils, since the pressure in the vessel A is relieved by the air-valve

x, will be forced to enter the vessel, and will fill the space between the vessel A and the bucket B, and thereby the bucket B will be floated. As it rises, the collar *f* will come in contact with the arms *z* of the lever *y*, and will thereby close the steam-valve *t*, when the valve which has been previously closed in the pipe D can be opened, and the pressure of steam upon the upper surface of the puppet-valve *t* will continue to hold said valve closed. Water continues to enter the vessel A through the passage *v*, floating the bucket B until its level is higher than the level of the upper surface of this bucket, when it will begin to overflow into the bucket. Meanwhile it has filled the tank T by means of the openings *m* and *n*. As the water continues to overflow into the bucket B, it is obvious that presently, the weight of the bucket B and of the water within it being greater than the weight of the water which it displaces, the bucket B and its load of water will sink. As soon as it sinks, the collar *g*, attached to the rod *p*, comes in contact with the arm *z* of the lever *y*, and opens the valve *t*, thereby putting the upper part of the boiler in communication with the upper part of the vessel A. This operation equalizes the pressure in the vessel A and the steam-space of the boiler. It will be observed that the arm *z* of the lever *y* is considerably longer than the other arm, which controls the valve. The weight of this arm, when once the puppet-valve *t* is lifted, is sufficient to keep this valve open, since there is but little current of steam passing through the pipe D, until the arm *z* of the lever *y*, which straddles the rod *p*, is struck by the ascending collar *f*. In this way the gradual reduction of pressure which would necessarily be caused by the gradual closing of the valve *t* is avoided, and the full boiler-pressure is maintained in the vessel A until the valve *t* is suddenly closed, as will be hereinafter explained. This evidently could not be accomplished if the valve *t* and rod *p* were permanently connected to each other, since the moment the bucket B began to rise the valve *t* would begin to close.

It is likewise plain, as soon as the bucket B begins to sink, owing to the fact that its weight, with the weight of the load of water which it contains, is greater than the weight of the volume of water which it displaces, that the surrounding water will begin to enter the bucket B and cause it to fall suddenly, and that there will be an overflow into this bucket B of so much water as is contained in the vessel A between the level of the upper edge of the bucket where it originally stood and the level which the upper edge of the bucket reaches when it is in its lowest position—that shown in Fig. 2. This fact, therefore, causes an increase in the water contained in the bucket B. This overflow likewise gives a very positive descent to the bucket B, and gives it the necessary force to open the steam-valve *t* wide, since it begins to descend before the collar *g* strikes the arm *z* of the lever *y*, and it has therefore acquired a certain momentum and impetus, which opens the steam-valve suddenly and surely, while, if it were not for this last motion, it might happen that the weight of the bucket and its load of water, being only slightly greater than the floating-power of the surrounding water, would be unable to start the steam-valve, and the bucket would be hung up and the apparatus come to rest.

Steam now enters through the pipe D and presses upon the surface of the water in the bucket B, which bucket is then in the position shown in Fig. 2. It is obvious that the air-cock *x* should now be closed. The pressure of the steam upon the surface of the water in the bucket B will force the water through the siphon C′, pipe C, check-valve *c*, and pipe *r* R back into the boiler, since the vessel A is situated above the water-level of the boiler, and the pipes C′, C, and R form a siphon. It is obvious that the opening of the steam-valve *t* will have closed the check-valve *e* in the supply-pipe E, and that no more water will enter from said supply-pipe. The water in the bucket B will be gradually forced out through the pipes C′, C, and R until the weight of the bucket B and its contained water is less than the floating-power of the water contained in the space *h*, when it is obvious that the bucket B will rise.

Since the pressure admitted by the equalizing steam-pipe D upon the surface of the water contained in the bucket B is no greater than the pressure in the return-pipe R, and since the water in the bucket B in its passage to the boiler has to rise through the siphon C C′, it is evident that some means must be employed to fill this siphon C C′ at the time of starting the machine. This is done by opening the air-valve *x*. It is evident that when once the machine has begun to operate the siphon C C′ will be permanently filled with water; and that when the valve *t* is opened, since the whole apparatus is situated above the water-level of the boiler, the pressure of steam and the weight of the water in such vessel, acting through the siphon C, will cause the water to flow back through tube R into the boiler. As it rises it is obvious that the level of the water between the bucket B and the vessel A would fall very rapidly; but it is necessary, in order that the bucket B rise high enough to close the valve *t*, that the level of the water between the bucket B and the vessel A be approximately maintained.

It is also necessary that the steam-valve *t* be kept open until the bucket B has been pretty thoroughly emptied and the water which it contains has been driven into the boiler by the return-pipe R.

It is plain that, if the tank T were not attached to the vessel A, as the bucket B rose the water contained in the space *k* between the bucket B and the vessel A would fall rapidly. The water within the bucket B would continue to pass into the boiler by means of the pipe R until a point would be reached when the steam-valve *t* would be partially closed

and the pressure in the vessel A would be insufficient to force the water in the bucket B back into the boiler, owing to the fact of its passage through the narrow opening caused by the partial closing of the valve *t*. The pressure in the vessel A would prevent any further entry of the water by the return-pipe E, and therefore the entire apparatus would come to a standstill.

It is necessary to the proper operation of this apparatus that two results be obtained: In the first place, that sufficient time elapse before the vessel B begins to float to allow of the return of the water held within it to the boiler by means of the return-pipe R; but after the vessel B has been emptied it is necessary that it be raised far enough and with force enough to firmly close the valve *t*, in order that condensation may ensue in the vessel A and allow water to enter again by means of the supply-pipe E. This result is accomplished by means of the tank T, which communicates with the interior of the vessel A by two small holes, *m* and *n*, the aperture *m* being situated in the upper portion of the tank T, the aperture *n* at its lower portion. These holes are so small that it requires a considerable time to allow the escape of the water contained within the tank T into the vessel A through the aperture *m*. Therefore, after the bucket B begins to rise, the level of the water in the space *k* between the bucket B and the vessel A will fall rapidly, thereby preventing the further elevation of the bucket B. This prevents the steam-valve *t* from closing, since this valve is kept open, as previously described, by the weight of the arm *z*. As soon as the water-level in the space *k* has fallen below the aperture *n* the water in the tank T will begin to slowly enter the space between the bucket B and the vessel A, thereby filling the space which has been emptied by the descent of the water between the bucket B and the vessel A due to the rising of the bucket B, which we have just described, the bucket B being continually made lighter, owing to the fact of the water within it being forced back to the boiler through the pipe R. It is evident that a point will finally be reached when the water which is returned to the space *k* from the tank T will cause the bucket B to once more ascend with a positive motion, and thereby close the valve *t*, which valve will be firmly closed, owing to the difference in pressure between the steam contained in the pipe D and the steam in the vessel A, which will immediately begin to condense; water will again enter through the pipe E and check-valve *e;* the bucket B will again fall, but will not open the steam-valve *t* until the collar *g* has come in contact with the arm *z*, whereby a certain amount of lost motion is allowed, and time is given to fill, or partially fill, the bucket B.

From the preceding description it will be seen that the bucket B can both rise and fall to a certain extent without affecting the steam-valve *t*, which valve remains in the position in which it has last been placed by the bucket until acted upon by the other collar surrounding the stem P. In other words, the valve *t* remains open after it has been opened until it is struck by a collar, *f*, and it remains shut after it has been shut until it is opened by the collar *g*, which arrangement produces the effect which has previously been accomplished by tumbling-bobs and similar arrangements—namely, of keeping the valve wide open or tight shut until its position is suddenly and surely changed, which is a necessity with this class of apparatus.

The purpose of the lost motion between the collar *g* and the collar *f* and of the tank T is, to a certain extent, the same; for the tank T is so constructed, as has been previously described, that it slows the upward movement of the bucket B and allows a certain time for the water to be forced out by the siphon, as there is a certain amount of lost motion between the valve-moving collars.

Attempts have previously been made to restrain the upward movement of buckets similar to B by means of detents; but the accomplishing of this same result by means of the laws governing the flow of the water and of the action of steam upon it I consider a great improvement over the method of doing it by merely mechanical contrivances.

During the operation of the machine the air-cock *w* should be left slightly open, to allow of the escape of any air which may accumulate in the upper part of the vessel A.

It is plain that the apparatus connecting the rising and falling bucket B and the steam-valve *t* is contained in the same space, in which respect this valve differs from most of those which have gone before.

It is a matter of the utmost importance that there be no stuffing-box required in an apparatus of this kind, for the reason that a stem or rod passing through a stuffing-box is very likely to stick and prevent the operation of the machine. Those stems sometimes connect the steam-space with the atmosphere, and sometimes two steam-spaces at different pressures. Both arrangements are objectionable.

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

1. An automatic steam-trap for the purpose of returning water to the boiler, having an open-top float, into which water enters and whence it is delivered to the boiler, thereby causing said open-top float to rise and fall, when the said open-top float is connected to an equalizing steam-valve by a connecting apparatus which does not connect a steam-space and the atmosphere, nor two steam-spaces of different pressures, and when the opening and closing of the steam-valves is not effected gradually, but suddenly and surely, by reason of the fact that there is a certain amount of lost motion between the movement of the open-top float and its action on the valve.

2. An automatic steam-trap consisting of a

containing-vessel and a rising and falling open-top float, when the water which enters said trap first fills the space between the open-top float and the containing-vessel, and when the equalizing steam-valve is not immediately actuated by the movement of the open-top float, but the open-top float is connected to said steam-valve by means of apparatus allowing a certain amount of lost motion, substantially as described.

3. An automatic steam-trap which consists of an inclosing-vessel, A, and a rising and falling open-top float, B, when the inclosing-vessel is provided with a tank communicating with its upper portion, substantially as described.

4. An automatic steam-trap having a vessel, A, provided with a tank, T, connecting with its upper portion, which tank communicates with the vessel by means of two or more small openings, thereby delaying the escape of the water in the tank into the inclosed vessel, substantially as described.

5. An automatic steam-trap for returning water to the boiler, provided with a rising and falling vessel, and with apparatus, substantially as described, independent of the mere inflow of water from the supply, whereby the water-level between the rising and falling vessel and the containing-casing is maintained and raised after the vessel begins to ascend.

6. The combination of the vessel A, open-top float B, and rod *p*, provided with collars *g* and *f*, operating the steam-valve *t*, when the collars *g* and *f* are separated for the purpose of allowing a certain amount of lost motion before opening or closing the valve, substantially as described.

7. In an automatic steam-trap for returning water to the boiler, the combination of a shell, A, with a siphon, C and C′, provided with the air-cock *x*, for the purpose of filling said siphon, substantially as described.

8. An automatic steam-trap provided with the tank T, connecting with the upper part of said trap by means of apertures *m n*, and operating the steam-valve by means of apparatus substantially as described, whereby a certain amount of lost motion is allowed between the rising and falling open-top float and the equalizing steam-valve, substantially as described.

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