(No Model.) 2 Sheets—Sheet 1.

J. H. BLESSING.

AUTOMATIC STEAM TRAP.

No. 578,310. Patented Mar. 9, 1897.

Fig. 1.

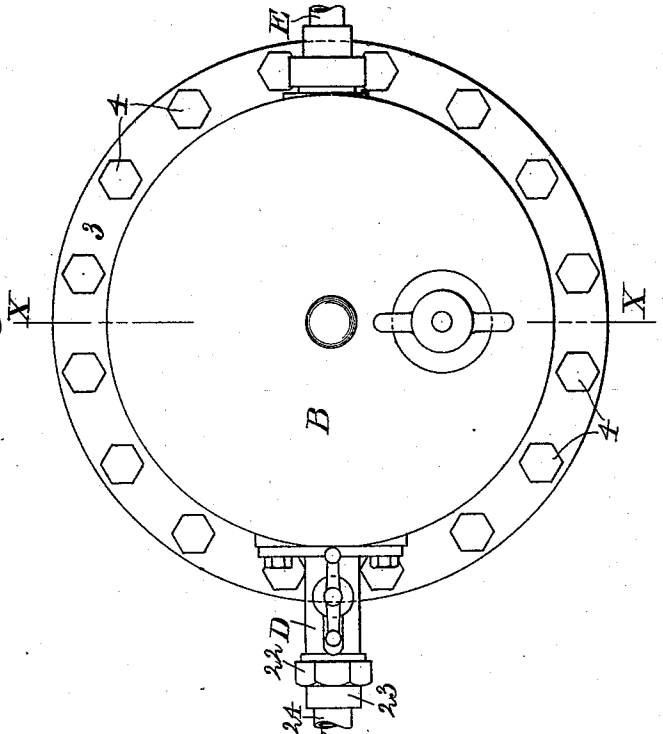
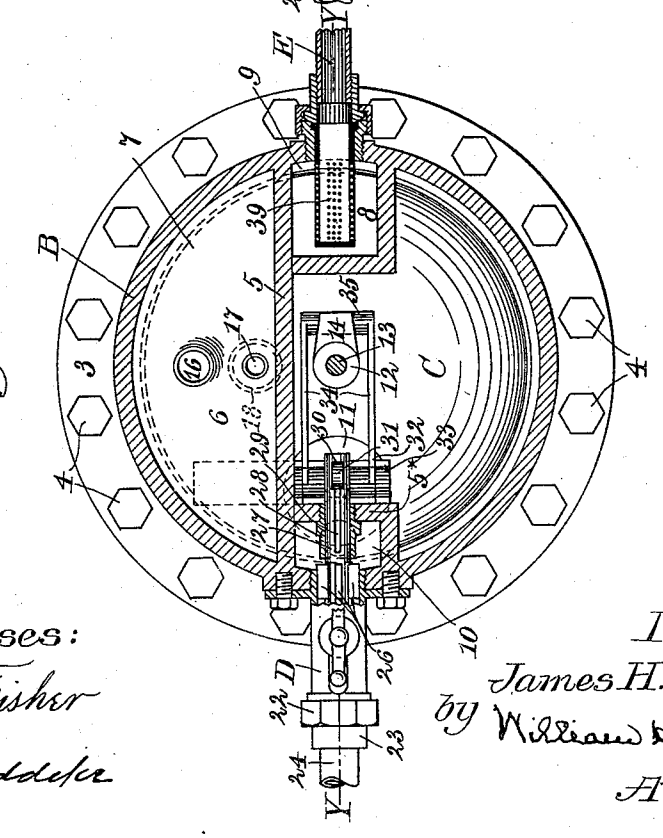


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

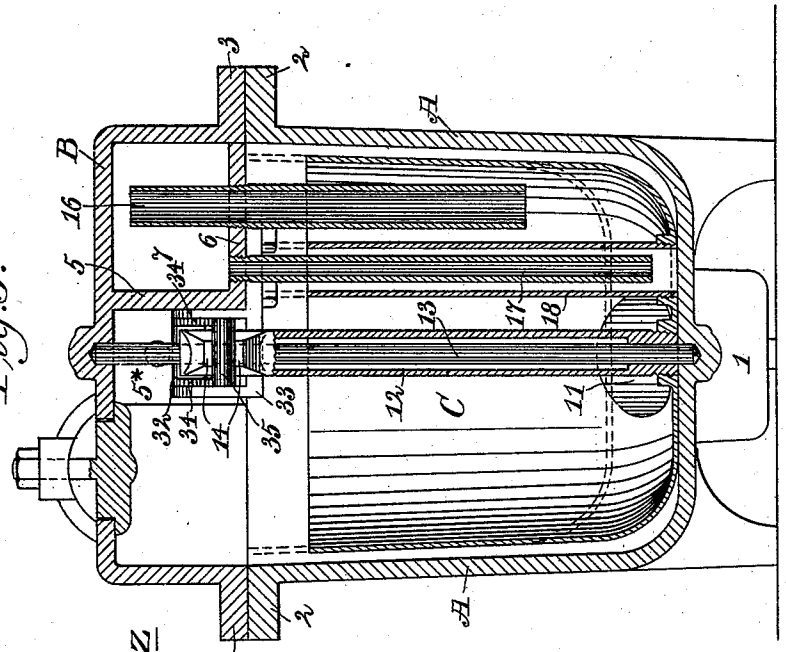


Fig. 5.

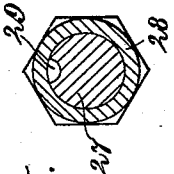
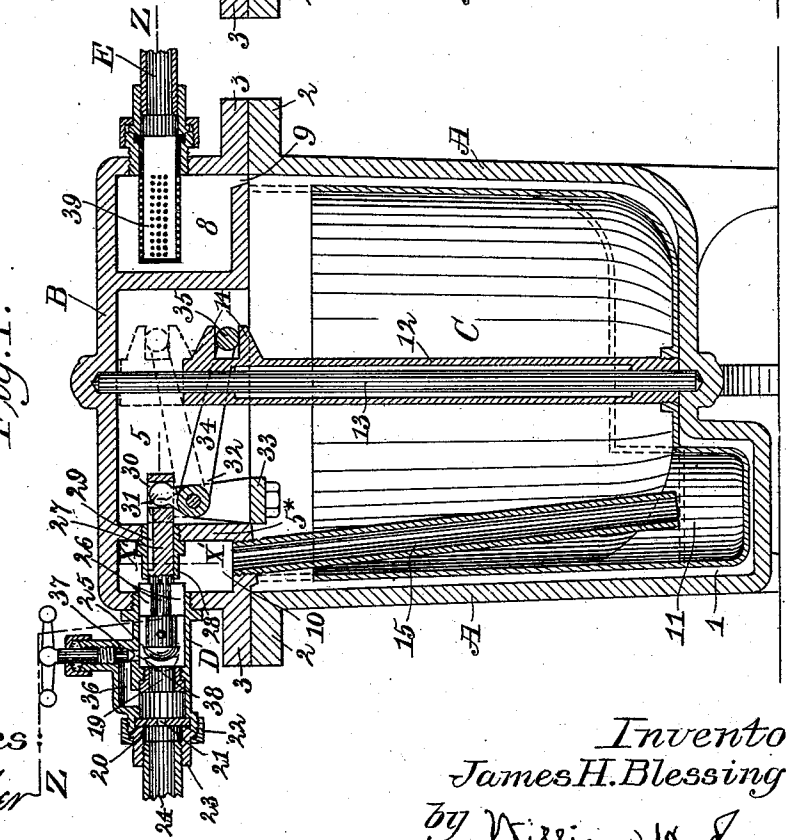


Fig. 4.



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UNITED STATES PATENT OFFICE.

JAMES H. BLESSING, OF ALBANY, NEW YORK.

AUTOMATIC STEAM-TRAP.

SPECIFICATION forming part of Letters Patent No. 578,310, dated March 9, 1897.

Application filed May 25, 1896. Serial No. 592,900. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. BLESSING, of Albany, in the county of Albany and State of New York, have invented new and useful Improvements in Automatic Steam-Traps, of which the following is a specification.

My invention relates to improvements in automatic steam-traps which are required to perform their functions while an exceeding pressure is maintained in the system of pipes to which a trap is connected; and the object of my improvements is to remedy certain defects in the operation of the class of steam-traps to which my invention appertains.

Heretofore considerable difficulty has been experienced to obtain a proper operation of the valve-operating mechanism of automatic steam-traps whose functions must be performed while an exceeding pressure is maintained in the system of steam-pipes from which the water of condensation must be removed by the steam-trap without reducing the pressure within said pipes. The difficulty referred to generally arises from an inability to properly operate a controlling-valve against an exceeding pressure within the steam-trap.

In the accompanying drawings, which are herein referred to and form part of this specification, Figure 1 is a plan view of a steam-trap in which my invention is embodied; Fig. 2, a horizontal section of the same at the irregular line Z Z on Fig. 4; Fig. 3, a vertical section at the line X X on Fig. 1; Fig. 4, a vertical transverse section at the line Y Y on Fig. 2, and Fig. 5 an enlarged detached transverse section of the valve-stem at the line X′ X′ on Fig. 4.

As represented in the drawings, A designates the casing of my steam-trap. Said casing is made of cast metal in an approximately cylindrical form with a closed bottom in which a pocket 1 is formed near its side, eccentrically to the body of said casing. At the upper end of said casing an annular flange 2 is formed around its outer side.

B is a bonnet or cover which forms a closure for the upper end of the casing A. Said bonnet is recessed, as shown in Figs. 3 and 4, and it is made in corresponding form and size with said casing. The lower end of said bonnet is provided with an annular flange 3, which corresponds to the flange of the casing A, to which said bonnet is secured by joint-bolts 4, which pass through the flanges 2 and 3. A vertical partition 5, formed at one side of the center of the recessed side of said bonnet, joins to a horizontal partition 6 to form a chamber 7 for receiving the water from the system of steam-pipes to which the trap is attached. A chamber 8 is formed at one side of the recess in the bonnet B against the partition 5, and in the bottom of said chamber a segmental port 9 is formed to produce a constantly-open communication between the interior of the chamber 8 and an annular space between the wall of the casing A and a bucket that is arranged to rise and fall in said casing. Diametrically opposite to the chamber 8 in the recess of the bonnet B another chamber 10 is formed in said bonnet for a purpose that will be duly explained hereinafter.

C is a metallic bucket that is arranged to rise and fall within the casing A. Said bucket is made smaller in diameter than the interior of the casing, so as to leave an annular space between the bucket and casing, and a pocket 11 is formed in the bottom of the bucket and is arranged to loosely enter the pocket 1 in the bottom of the casing A, as shown by the full lines in Fig. 4. A sleeve 12, which is secured centrally in the bottom of the bucket C, is fitted to slide loosely on a guide-rod 13, whose lower end is held in the bottom of the casing A and whose upper end is retained by the bonnet B. Said guide-rod controls the line of movement of the bucket C and prevents the latter from being displaced from its required position. At the upper part of the sleeve 12 lugs 14 are formed with a space between them for a purpose that will be hereinafter explained. A pipe 15, secured to the bonnet B, leads from the bottom of the chamber 10 into the pocket 11, and said pipe is provided for the purpose of conveying the water of condensation from the bucket C into the chamber 10 as a preliminary to the discharge of said water from the trap.

A pendent pipe 16 extends downward from near the top of the chamber 7 into the bucket C, and it is provided for the purpose of allowing pressure to pass upward through said pipe from the interior of the casing A into the chamber 7 whenever the lower end of the pipe

16 is not closed by the water in the bucket C. Another pendent pipe 17 is secured in the horizontal partition 6 in such manner that the upper end of said pipe will be flush with the upper face of said partition. The pipe 17 leads downward into a standing pipe 18, which is secured in the bottom of the bucket C so as to stand erect in said bucket, and the bottom of the latter is provided with an opening which corresponds to the opening of the pipe 18. The lower end of the pipe 17 reaches nearly to the bottom of the casing A, but sufficient space should be left between the lower end of said pipe and the bottom of the casing to insure a free discharge of water from the pipe 17 into the casing A.

D is a valve-casing attached to the bonnet B and communicating with the chamber 10 of the latter. Said valve-casing is provided with a removable seat 19, which, should it become grooved or cut while in use, can be renewed without removing the valve-casing from the bonnet. The outer end of the valve-casing D is provided with a removable disk 20, having a discharge-orifice 21 of much smaller diameter than the bore of the valve-seat 19, the reduction in diameter of said orifice being made to retard the outflow of water therethrough. By making the disk 20 removable from the valve-casing provision is made for substituting disks having a different caliber of discharge-orifice, so as to obtain one that is best suited to the proper working of the trap under different pressures or conditions. The outer portion of the valve-casing D is provided with a screw-thread adapted to receive a coupling-nut 22, which takes against a coupling 23, whose inner end bears against the disk 20 and secures the latter in place. The coupling 23 is connected to a discharge-pipe 24, which carries off the water that passes through the trap. A valve 25 is arranged to automatically close the opening through the valve-seat 19. Said valve is provided with wings 26, which fit the bore of the valve-casing D, so as to guide the valve and allow a free passage for the flow of water through said valve-casing. The valve 25 has at its inner end a stem 27, which is fitted to slide loosely in a tubular sleeve 28, which is removably attached to the partition 5 of the bonnet B. Said valve-stem has a longitudinal groove 29, which, when the valve 25 is seated, as indicated by dotted lines in Fig. 4, will form a communication through which steam can pass from the casing A into the chamber 10, but when the valve 25 is carried away from the seat 19, as shown by full lines in Fig. 4, the outer end of the groove 29 will be moved into the bore of the sleeve 28, thereby closing the communication through said groove and preventing a flow of steam therethrough. Near the inner end of the valve-stem 27 a vertical mortise 30 is formed to receive an arm 31 of a bell-crank-lever 32, which is fulcrumed in a bracket 33, secured to the partition 6. Said bell-crank lever is provided with long arms 34, which are spaced apart to allow the sleeve 12 to pass between them. The outer ends of said arms are connected by a cylindrical pin 35, which engages between the lugs 14 of the sleeve 12. The arm 31 and pin 35 are fitted loosely to the parts with which they coact, which looseness allows a slight lost motion, so that a movement of the bucket C in either direction will not produce an instantaneous responsive movement of the bell-crank lever 32 and the valve 25, that is connected with said lever. A by-pass 36 is formed in the valve-casing D to permit of a discharge of air from the casing A preparatory to an automatic operation of the trap, and a valve 37 is provided for closing and opening a port 38, which forms a communication between the interior of said valve-casing and by-pass.

E is a water-inlet pipe, which forms a communication between a system of steam-heating pipes (not shown in the drawings) and the trap. Said inlet-pipe leads into the chamber 8, and, preferably, the inner end of said pipe is provided with a strainer 39, which will prevent any organic matter from passing into the trap.

It should be understood that this trap is not intended for returning the water of condensation to a generator in which the steam has been produced, and for that reason it should be likewise understood that the discharge-pipe 24 is arranged to deliver the water from the trap either directly to the atmosphere or into a drain or sewer which will convey said water to any place selected for the purpose.

By effecting a retardation of the outflow of water from the trap by providing a small discharge-orifice 21 the water will be discharged from the trap with sufficient rapidity for all practical purposes, but the danger of emptying the trap with such rapidity as to exhaust the water therefrom, so as to allow a current of steam to escape without producing a beneficial effect, is avoided.

My improved steam-trap operates in the following manner: The water-inlet pipe E is connected to a system of steam-heating pipes and the discharge-pipe 24 arranged to deliver the water of condensation at any preferred point, but before the trap will begin to operate automatically the by-pass 36 must be opened to allow the air in the trap to escape therefrom. As soon as the latter is accomplished the by-pass should be closed. The water from the system of heating-pipes will then flow into the chamber 8, escaping therefrom through the port 9. Said water will fall into the annular space between the casing A and the outer side of the bucket C, and the latter will rise as soon as the flotation of the water overcomes the weight of the bucket. The continued inflow of water between the casing A and the exterior of the bucket C will cause the bucket C to rise to a position indicated by dotted lines in Figs. 3 and 4, whereby the valve 25 will be moved to close the opening through the valve-seat 19. The continued inflow will cause the

water to rise until it pours into the bucket C over the upper edge of the latter. When a sufficient weight of water has been accumulated in the bucket to overcome the flotation of the water acting on the outer surface of said bucket, the latter will sink in the water contained in the casing A; but before this sinking is accomplished the water from the bucket C will be forced by a superincumbent pressure to pass through the pipe 16 and fill the chamber 7. The sinking of the bucket C causes the valve 25 to be retracted from the seat 19, and the pressure on the surface of the water in the bucket C forces the water to pass upward, through the pipe 15, into the chamber 10, and thence, through the orifice 21, into the discharge-pipe 24, by which it is conveyed to the place of its final discharge.

When the bucket C has reached the lowest point of its movement and the water is discharged therefrom sufficiently to uncover the lower end of the pipe 16, the pressure in the casing A will pass upward through said pipe and expel the water from the chamber 7, from which chamber the water will suddenly fall, through the pipe 17, into the lower part of the casing A. The sudden influx of the water into the casing A will cause the bucket C to rise rapidly to its higher position, and thereby the trap will be restored to a proper condition for a repetition of the operation above described.

When preferred, the valve 25 may be removably attached to the valve-stem 27, which attachment is effected by a pin which passes transversely into an annular flange on the back of the valve and through the valve-stem 27, so that said valve can be attached to or detached from the valve-stem after the valve-casing D has been removed from the bonnet B. By constructing the valve 25 and valve-stem 27 as last described the valve 25 will be renewable whenever occasion may require.

The disk 20 being removable from the valve-casing D, and the place assigned to said disk being located exteriorly to the body of the trap and where it will be accessible at all times, enables me to make a number of the traps at a time and finish them without regard to the pressure that may be required to be maintained in a system of pipes to which a trap may be applied by omitting the disk 20 therefrom, and the latter can be inserted in its place after the pressure of steam has been determined. This enables me to keep a stock of traps made and ready for completion in a few minutes, which would be impossible to accomplish if the disk 20 or other means for adapting the apparatus to operate under different degrees of pressure were located within the body of the trap or in any other inaccessible place.

My experience has taught me that in steam-traps that are used in connection with systems of pipes in which an exceeding pressure of steam must be maintained and in which the discharge-opening is as large as or larger than the caliber of the bore of the valve-seat the water will be discharged from the trap with such rapidity that the bucket cannot rise with sufficient promptitude to close the valve that governs the discharge of water, and as a consequence a current of steam will flow from the discharge-pipe, thereby defeating the purpose for which a steam-trap is employed, which is the discharge of the water of condensation without a wastage of steam from the system of pipes. My experience has likewise taught me that in order to obtain the most efficient operation of a steam-trap when an exceeding pressure of steam has to be maintained the discharge-aperture must be proportioned to the pressure of steam, and under a pressure of two hundred pounds to the square inch the best results have been obtained with a discharge-orifice of one-eighth of an inch in diameter. For one hundred and seventy-five pounds pressure to the square inch the discharge-orifice should be three-sixteenths of an inch in diameter, and so on in a like proportion. For every decrease in the pressure of steam a corresponding increase in the diameter of the discharge-orifice will be required in the ratio stated.

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

1. An automatic steam-trap, comprising a closed vessel, a floatable bucket contained in said vessel, a valve and its operating mechanism controlled by said bucket, and a removable bonnet which forms a closure for said vessel and is provided with three separate chambers that are formed in said bonnet; one of said chambers being connected with an inlet water-pipe and having an outlet-port arranged to deliver water directly into said closed vessel, a second chamber adapted to temporarily contain a volume of water and having an inlet water-pipe—which forms a communication between the upper part of said chamber and the interior of the bucket—and an outlet water-pipe—which forms a communication between the bottom of said chamber and the lower part of the closed vessel—so as to deliver from said chamber directly beneath said bucket, and a third chamber having a pipe arranged for conducting water from the bucket into said chamber, and a discharge-pipe leading from the third chamber, as herein specified.

2. In an automatic steam-trap, the combination of a closed vessel, an open-top bucket arranged to rise and fall in said vessel, a valve operated by said bucket and adapted to close the opening of a valve-seat, and a removable disk or annulus arranged exteriorly to the body of the trap and provided with a discharge-orifice having a smaller opening than the bore of the valve-seat; whereby a retardation of the discharge of water will be effected, as herein specified.

3. In an automatic steam-trap, the combination of a closed vessel provided with a re-

movable bonnet which forms a closure for said vessel; said bonnet containing three separate chambers which are formed therein—one of said chambers having a supply-pipe leading thereinto and an outlet-port formed in its bottom to communicate with the interior of said vessel, the next chamber being adapted to temporarily contain a volume of water, and the third chamber having a pipe that conducts the water from the closed vessel into said chamber and a discharge-pipe that leads from said chamber, an open-top bucket arranged to rise and fall in said vessel, and a discharge-valve operated by said bucket and arranged to govern the outflow of water from the trap, as herein specified.

4. In a steam-trap, the combination of a bonnet, B, provided with a chamber, 10, a valve-stem, 27, fitted to move through a wall of said chamber and having a longitudinal groove, 29, adapted to form a communication between the recess in said bonnet and the chamber 10; said valve-stem having a retractive movement whereby communication through said groove will be closed, as herein specified.

5. In a steam-trap, the combination of a valve-casing, D, provided with a valve-seat, 19, a removable disk, 20, held in said valve-casing independently of said valve-seat, and provided with a discharge-orifice, 21, whose area is smaller than that of said valve-seat; said disk being exchangeable for one having a discharge-orifice of different caliber, whereby the steam-trap will be rendered operative under a different pressure, as and for the purpose specified.

6. In a steam-trap, the combination, with a closed vessel, A, a bonnet, B, which forms a closure for said vessel, a bucket, C, arranged to rise and fall in said vessel, a chamber, 10, formed in the bonnet B, and provided with a pipe, 15, leading into the bucket C, a valve-casing, D, attached to the bonnet B and provided with a valve-seat, 19, and with an annulus or disk, 20, that has a discharge-orifice, 21, of smaller caliber than the bore of said valve-seat, of a valve, 25, operated by the bucket C and having—in its stem—a longitudinal groove, 29, arranged to intermittently form a communication between the recess of the bonnet B and the chamber 10; the pipe 15 being adapted to convey the water from the bucket C into the chamber 10, as and for the purpose specified.

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