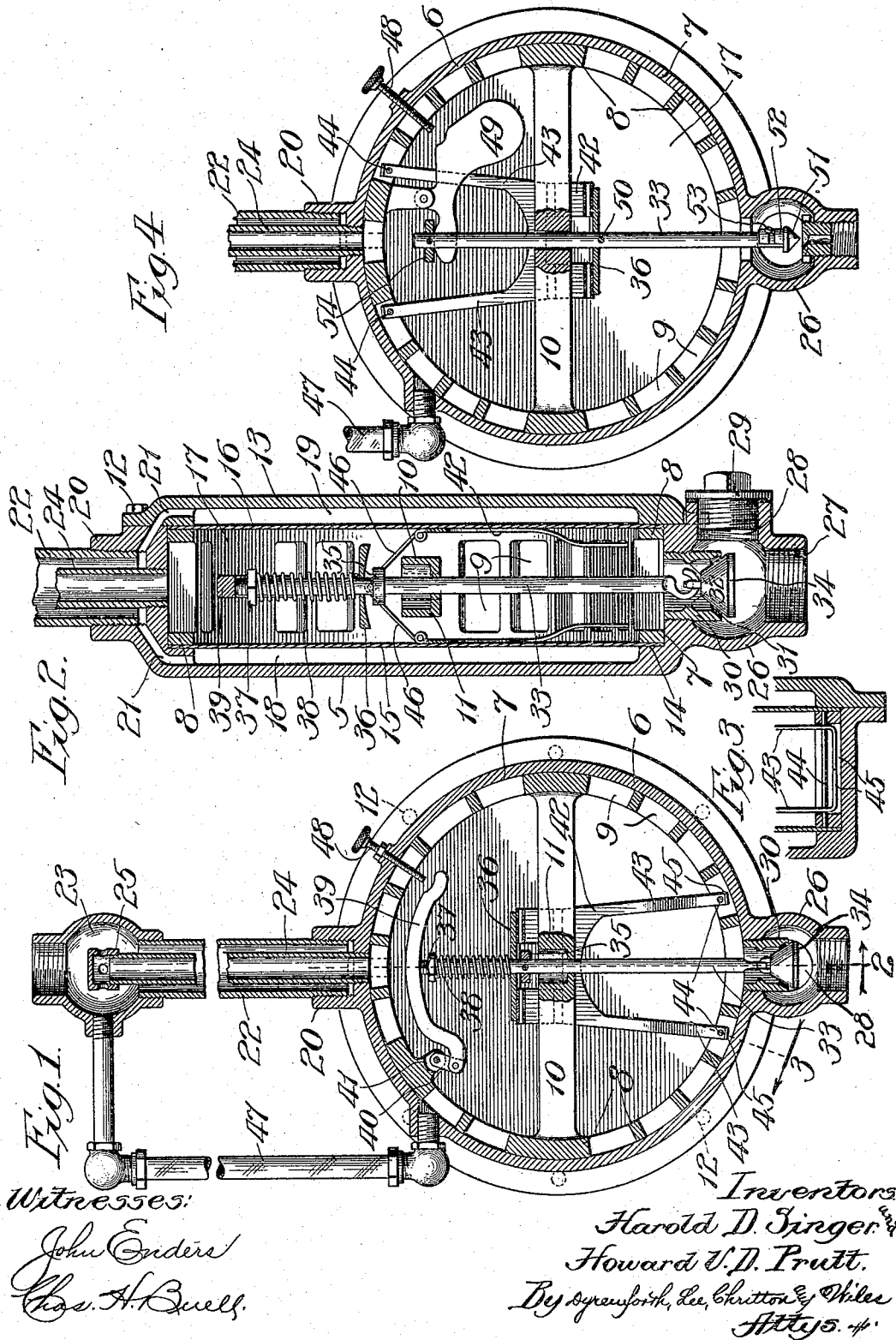


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STEAM TRAP.

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UNITED STATES PATENT OFFICE.

HAROLD D. SINGER AND HOWARD V. D. PRATT, OF KANKAKEE, ILLINOIS.

STEAM-TRAP.

No. 930,699.

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To all whom it may concern:

Be it known that we, HAROLD D. SINGER, a subject of the King of Great Britain, and HOWARD V. D. PRATT, a citizen of the United States, residing at Kankakee, in the county of Kankakee and State of Illinois, have invented a new and useful Improvement in Steam-Traps, of which the following is a specification.

Our invention relates to improvement in steam-traps of the general type wherein water of condensation forms two columns exerting pressure, respectively, against opposite sides of a valve-controlling diaphragm device, to actuate the device and permit water to escape when through the accumulation of water of condensation one column overbalances the other. Appliances of this type are useful in various connections, and are applied with great benefit to steam-heating systems in buildings.

Our object is to provide a differential steam-trap, of the class defined, of a generally improved, simple, compact and durable construction, rendering it peculiarly sensitive and positive in operation.

In carrying out our invention we employ a casing adapted to be readily interposed, for example, in the drainage pipe of a household steam-heating system and capable of being placed flatwise against or close to a wall to be out of the way. The casing contains two outer chambers separated from an inner chamber by a pair of cooperating flexible diaphragms. The outer chambers are in direct communication with the drainage-pipe above, while the inner chamber communicates with an overflow pipe of the drainage-pipe located preferably within the latter. At the base of the inner chamber is an outlet-valve having a stem under the influence of a weight which bears in the direction of opening said valve. Interposed between the cooperating diaphragms and the said valve-stem is lever mechanism, preferably of the toggle type, which under but slight movement of the diaphragms effects relatively great movement of the valve. In other words, preponderance of water pressure in the inner chamber against the diaphragms, producing but slight outward movement of the latter, effects quick and comparatively wide opening of the outlet-valve, while a preponderance of water pressure in the outer chamber against the diaphragms effects quick closing of said valve.

Referring to the accompanying drawing—Figure 1 is a partly broken vertical section of a steam-trap constructed with our improvements in one preferred form; Fig. 2, an enlarged broken section taken on line 2 in Fig. 1; Fig. 3, an enlarged fragmentary section taken on line 3 in Fig. 1; and Fig. 4, a view of the same character as Fig. 1 but showing a modified construction.

The main body portion of the trap is circular in form, having a disk-shaped back wall 5 and an annular rim-portion 6. The rim-portion presents an inner annular seating-face 7 fitted with a spacer-ring 8. The ring 8 is cast or otherwise formed with openings 9 through it as indicated, more especially to save weight, and has as an integral part thereof a horizontally extending cross-bar portion 10 much narrower in cross-section than the outer face of the ring. At its center the cross-bar is formed with a cup-portion 11, as indicated. Fastened by screws 12, or otherwise, against the open side of the body portion 5 is a disk or cap 13 forming the front wall of the casing. Clamped between the ring 8 and the annular shoulder 14 near the wall 5 is a disk-shaped flexible diaphragm 15; and a similar diaphragm 16 is clamped between the cap 13 and the ring 8. The diaphragms thus divide the interior of the casing into three vertical chambers, the inner chamber 17 being surrounded by the ring 8 and the outer chambers 18, 19 being water-tight.

At the top of the rim of the casing is an internally threaded boss 20 from which extend passages 21 to the chambers 18, 19; and threaded into said boss is the lower end of a pipe 22 upon the upper end of which is screwed a coupling forming a chamber 23. The device is secured by means of the said coupling to the lower end of the steam drainage-pipe (not shown) of, say, a household steam-heating system. Extending through the rim at the center of the boss 20 is a threaded opening from which rises an overflow tube 24 extending centrally within the pipe 22 and terminating at the chamber 23 where it is fitted with a perforated cap 25. The tube 24 thus communicates with the central chamber 17. At the under side of the rim of the casing is a boss 26 having a lower threaded opening 27, at which it may be jointed to an outlet pipe (not shown) and a threaded opening 28 fitted with a removable screw-plug 29. At the lower side of the

chamber 17 and communicating with the interior of the boss 26 is a threaded opening in which is fastened a short tube 30 flared at its lower end to form a valve-seat 31. On the inner wall of the tube 30 are lugs 32 for convenience in inserting or removing said tube when desired.

Passing through a guide-opening in the cup-portion 11 of the bar 10 is a valve-stem 33 formed at its lower end into a hook from which is suspended a bell-valve 34 at the seat 31. Fastened to the stem above the bar 10 is a collar 35 and above the collar the stem passes loosely through an elongated plate 36 of rectangular form, and concave on its under side in the direction of its length. Confined between the said plate and a nut 37 at the top of the stem is a coiled spring 38.

39 is a weight, or lever, pivotally connected by means of a link 40 with a bearing-ear 41 on the spacer-ring. This swinging weight bears at its center upon the top of the stem 33.

42, 42 are opposite, flexible standard-ports of a toggle-lever device and are wide and flat at their upper parts, below which they are bifurcated to form the narrow spring legs 43. The legs extend downward into openings of the spacer-ring and are held in place by pins 44 passing through them and the walls of the ring. Beneath the pins 44 corresponding legs 43 are bent toward each other to form the abutting feet 45, which by abutting, hold the standards against approaching at their lower ends. The parts 42 bear against the inner faces of the diaphragms 15, 16, and hinged to the upper ends thereof are toggle-leaves 46 hinged together centrally between the diaphragms. The leaves 46 are cut away to allow for the passage of the stem 33 and collar 35 as indicated. The stem 33, weighted by the lever 39 as described, rests upon the spring 38, which in turn rests upon the plate 36, which in its turn rests upon the upper hinged joint of the toggle.

In practice, as water of condensation descends through the steam drainage-pipe mentioned it flows into the chamber 23 and thence through the pipe 22 and passages 21 into the chambers 18 and 19 to fill the same. The water pressure thus exerted against the diaphragms 15, 16 presses them in the direction of the chamber 17 and causes them to squeeze the toggle-mechanism, thereby extending the toggle-leaves and raising the weighted stem 33 and valve 34 to seat the latter. This closing of the valve will prevent any steam descending into the chamber 17 from escaping. As the water of condensation accumulates and the column thereof rises in the pipe 22 to the chamber 23, it overflows through the perforated cap 25 and pipe 24 into the chamber 17. The parts may be so constructed and arranged that when

the overflow water fills the chamber 17, or nearly fills it, or accumulates sufficiently to rise more or less in the pipe 24, the pressure of said water in the chamber 17 against the diaphragms, supplemented by the weight of the valve 34, stem 33 and lever 39, will overcome the pressure against the diaphragms from the chambers 18, 19 and press the diaphragms in the direction of the said outer chambers, permitting the toggle-leaves to descend and the valve 34 to open and cause part of the trapped water to escape. It will be readily understood that but slight movement of the diaphragms and standards 42 will cause comparatively great fall and rise of the upper ends of the toggle-leaves and consequently wide opening and quick closing of the valve.

Opening at its upper end into the chamber 23 and at its lower end into the chamber 17 is a water-gage 47, whereby the height of the overflowing water column in the tube 24 is shown. Extending through the casing in the position shown is an adjusting screw 48 which may be turned against the lever 39 to press it down and maintain the valve 34 open when, for example, it is desired to blow steam through the chamber 17 to clean it out.

In the modification shown in Fig. 4, the valve-seat is at the lower side of the hollow boss or chamber 26 and the valve on the stem 33 seats in the downward direction. To accommodate this construction the toggle-mechanism, though formed as in the preferred construction, is upside down and a weighted lever 49 constructed as shown operates to raise the stem 33 in the direction away from the valve-seat. In this construction the plate 36 rests upon a pin 50 passing through the stem, and the spring 38 of the preferred construction is dispensed with. The valve 51 shown is also in the present case a piece separate from the stem and is formed with a slotted extension 52 which fits against the side of the stem and is fastened in place by a screw 53 tapped into the stem. The short arm of the weighted lever 49 bears against a collar 54 pinned to the upper-end portion of the stem. In the operation of the modified construction, preponderance of water pressure in the inner chamber 17 tends to spread the diaphragms as in the preferred construction and permit the valve to be opened by the weight 49; while preponderance of water pressure in the outer chambers squeezes the toggle and presses the valve to its seat.

With two diaphragms coöperating against a valve opening and closing lever-device, such as a toggle, the diaphragms need move but slightly, as before explained, to open the valve wide and produce quick closing of the latter. In the event that one of the outer chambers becomes clogged in a manner to

prevent proper movement of one of the diaphragms, the other diaphragm may still act to open and close the valve. The construction of the weighted lever 39 permits it, by swinging upon the link 40, to rise and fall vertically without danger of binding against the top of the stem. All the moving parts are constructed to work easily and the construction renders them particularly strong and durable. The valve is easily accessible through the plugged opening 28 for the purpose of cleaning it or its seat when desired, and all the moving parts may be readily removed and replaced on the removal of the cap 13. The device may be interposed between lengths of a steam drainage pipe, connected with the top of the chamber 23 and the opening 27, and the steam-drainage pipe is the only support required.

As the device is flat-sided and shallow, it may be placed against or close to a wall and thus out of the way.

While we prefer to construct our improvements throughout as shown and described, they may be variously modified in the matter of details of construction without departing from the spirit of our invention as defined by the claims.

What we claim as new and desire to secure by Letters Patent, is—

1. In a steam-trap, the combination of a casing with means for connecting it to a steam-pipe, cooperating diaphragms separating the interior of the casing into an inner and two outer chambers, the said outer chambers being in direct communication with the steam-pipe, a steam-pipe overflow tube communicating with the inner chamber, an outlet valve for the inner chamber, and valve-operating lever-mechanism in the inner chamber actuated by the movement of said diaphragms.

2. In a steam-trap, the combination of a casing with means for connecting it to a steam-pipe, cooperating diaphragms separating the interior of the casing into an inner and two outer chambers, the said outer chambers being in direct communication with the steam-pipe, a steam-pipe overflow tube communicating with the inner chamber, an outlet valve for the inner chamber, and valve-operating toggle-lever mechanism in the inner chamber actuated by the movement of said diaphragms.

3. In a steam-trap, the combination of a casing with means for connecting it to a

steam-pipe, cooperating diaphragms separating the interior of the casing into an inner and two outer chambers, the said outer chambers being in direct communication with the steam-pipe, a steam-pipe overflow tube communicating with the inner chamber, an outlet valve for the inner chamber, a weighted stem for the valve tending normally to hold said valve open, and valve-closing lever-mechanism in the inner chamber actuated by movement of said diaphragms under preponderance of water pressure in the outer chambers.

4. In a steam-trap, the combination of a casing with means for connecting it to a steam-pipe, cooperating diaphragms separating the interior of the casing into an inner and two outer chambers, the said outer chambers being in direct communication with the steam-pipe, a steam-pipe overflow-tube communicating with the inner chamber, an outlet valve for the inner chamber, a weighted stem for the valve tending normally to hold said valve open, and valve-closing toggle-lever mechanism bearing against said diaphragms, in the inner chamber, and engaging said stem and actuated by movement of said diaphragms, under preponderance of water pressure in the outer chambers, to close said valve.

5. In a steam-trap, the combination of a casing with means for connecting it to a steam-pipe, cooperating diaphragms separating the interior of the casing into an inner and two outer chambers, the said outer chambers being in direct communication with the steam-pipe, a steam-pipe overflow-tube communicating with the inner chamber, an outlet valve, for the inner chamber, having a stem, a swinging weight in the inner chamber bearing against the stem and tending normally to hold said valve open, means extending through the shell and adjustable against the weight to hold the valve open, and valve-closing lever-mechanism, bearing against said diaphragms, in said inner chamber, and engaging said stem, and actuated, by movement of said diaphragms under preponderance of water pressure in the outer chambers, to close said valve.

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In presence of:

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