(No Model.)

2 Sheets—Sheet 1.

J. E. CRISP.

Safety Valve.

No. 235,748. Patented Dec. 21, 1880.

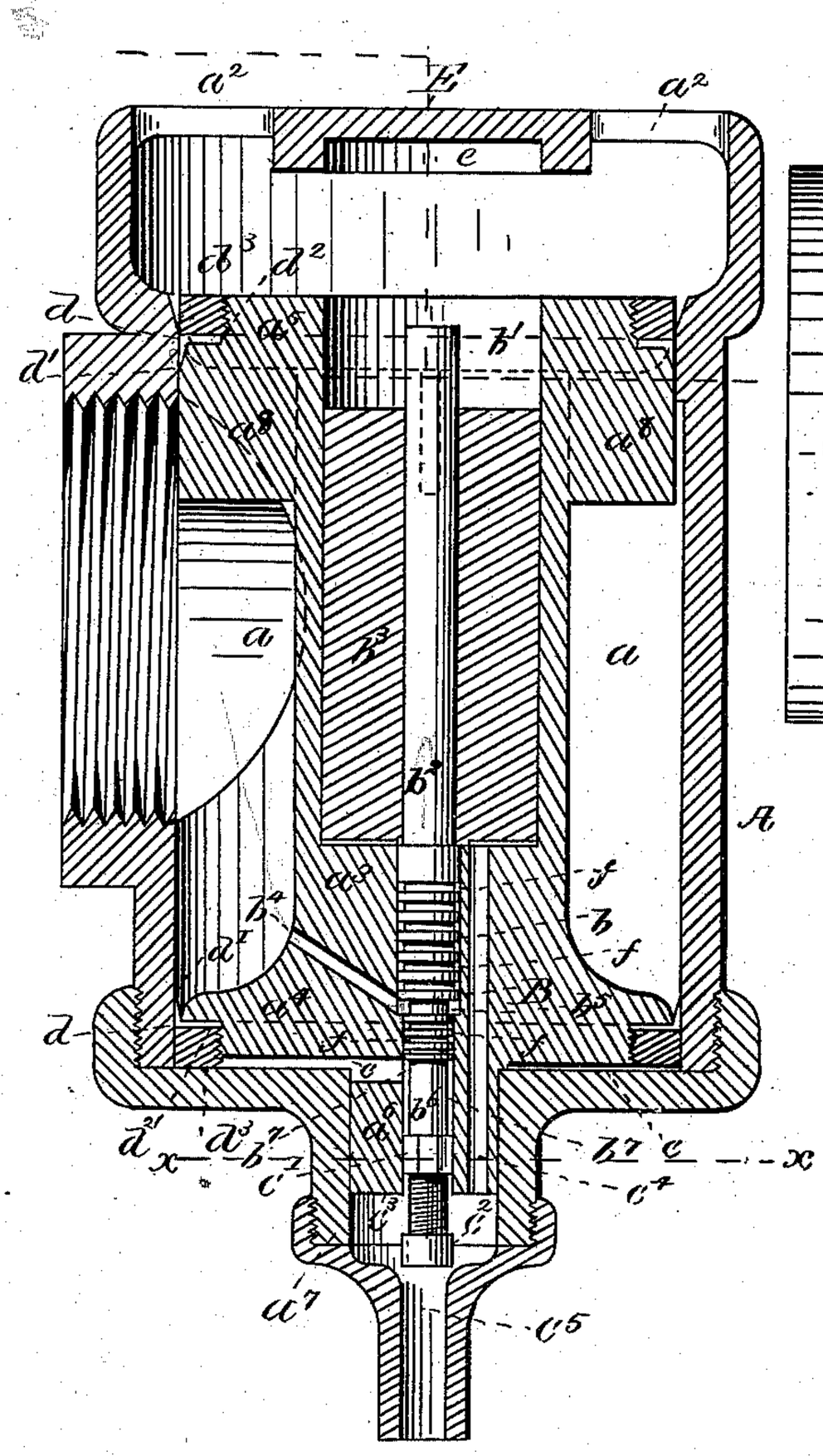

Fig. 1.

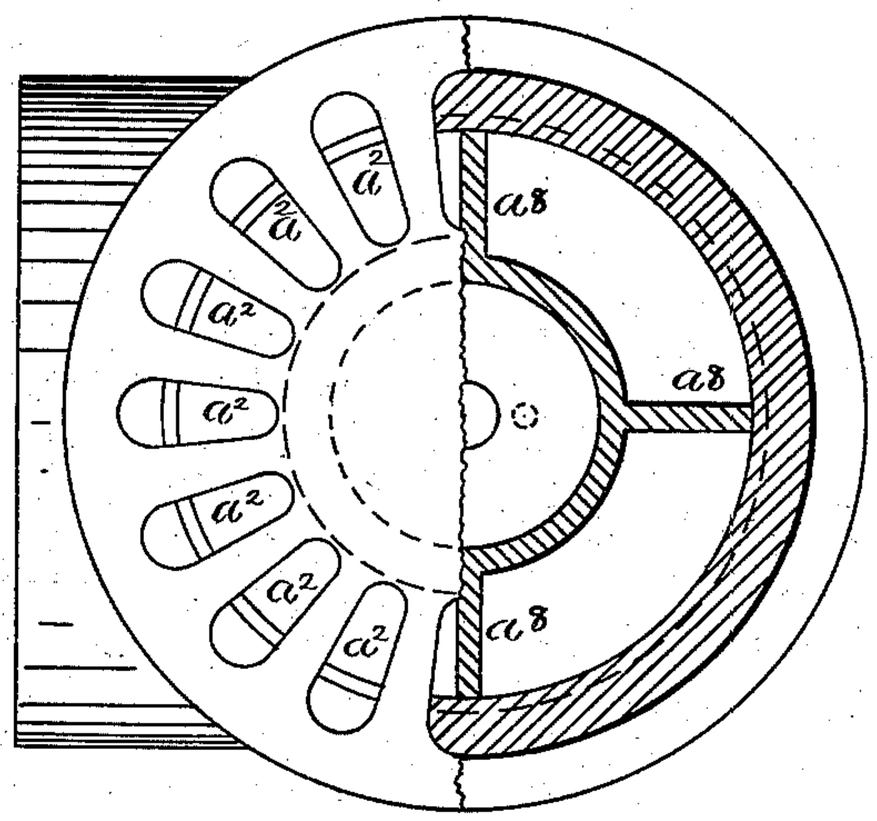

Fig. 2.

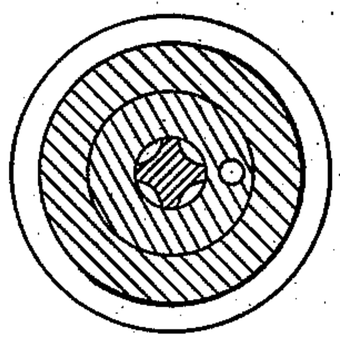

Fig. 3.

WITNESSES

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(No Model.) 2 Sheets—Sheet 2.

J. E. CRISP.

Safety Valve.

No. 235,748. Patented Dec. 21, 1880.

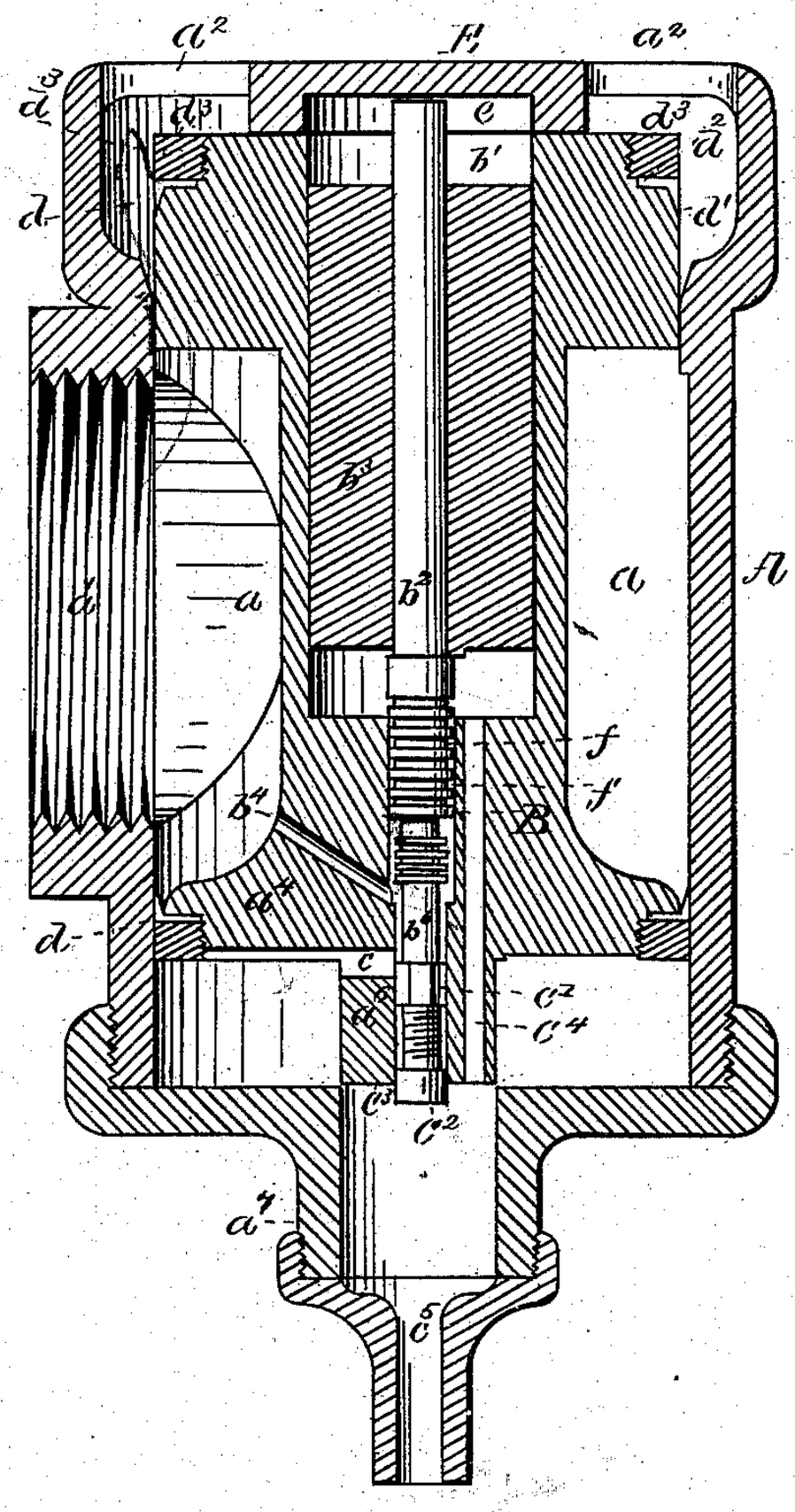

Fig. 4.

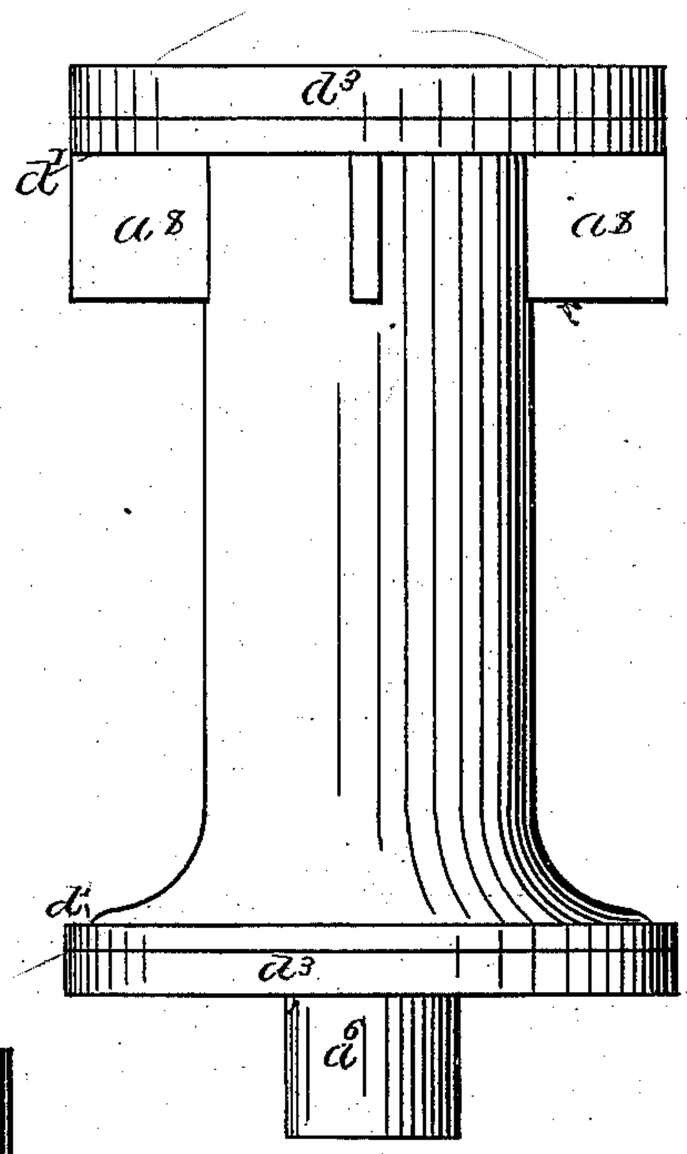

Fig. 5.

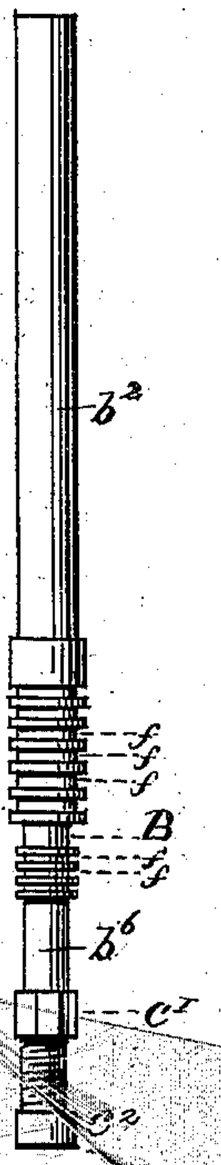

Fig. 6.

WITNESSES

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INVENTOR

J. E. Crisp

UNITED STATES PATENT OFFICE.

JOSEPH E. CRISP, OF BOSTON, MASSACHUSETTS.

SAFETY-VALVE.

SPECIFICATION forming part of Letters Patent No. 235,748, dated December 21, 1880.

Application filed August 30, 1880. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH E. CRISP, a citizen of the United States, resident at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Safety-Valves, of which the following is a full, clear and exact description, reference being had to the accompanying drawings, forming part of this specification, in explaining its nature, in which—

Figure 1 is a vertical section of the valve; Fig. 2, a plan, and Fig. 3 a cross-section on the line *x x* of Fig. 1. Fig. 4 is a vertical section of the valve, representing the position of the parts when the valve is open or blowing. Fig. 5 is an elevation of the main piston. Fig. 6 is an elevation of an auxiliary piston and its attachments, with the exception of the weight or load.

This invention relates to a safety-valve in which a weighted auxiliary piston or slide-valve controls the operation of the main piston or valve by being actuated by the excess of pressure in the valve-chamber to open a port and close an exhaust, whereby the pressure in the valve-chamber is allowed to enter a chamber below or at one end of the main piston and lift it, thereby opening a direct passage from the valve-chamber for the escape of the excess of pressure, and by the diminution of pressure in the valve-chamber to the required pressure, or a pressure slightly below the required pressure, to close the port and open the exhaust, whereby the pressure in the side chamber below or at one end of the piston is allowed to escape and the main piston is moved by the pressure in the valve-chamber to close the direct passage.

In the drawings, A represents the valve-casing; *a*, the valve-chamber; *a'*, the passage by which it is connected with the boiler or other pressure-generator; a^2, the direct escape port or passage from the valve-chamber; a^3, the main piston, which has two heads, a^4 a^5, of unequal area, the area of the head a^5 being somewhat less than that of the head a^4; a^6, a projection from the head a^4; a^7, a portion of the valve-casing surrounding the part a^6 of the main piston.

The main piston a^3 has a hole, *b*, and a chamber, *b'*, for the reception of the auxiliary piston B, the piston-rod b^2, and the weight b^3, which is carried by the piston-rod, and is secured thereon in any desirable way.

A passage, b^4, extends from the valve-chamber *a* through the main piston to the small annular chamber b^5 between the two heads of the auxiliary piston B. The part b^6 of the piston-rod, or "spindle," as I prefer to name it, is reduced in size to provide an annular channel, b^7, between it and the wall of the hole *b* below the lower head of the piston, and which, when the piston is lifted, as hereinafter explained, permits the steam to pass through the passage b^4 into the chamber *c* below the piston-head a^4, also connects the auxiliary piston B with the valve-disk c^2, which, with the seat c^3, controls the exhaust-passage *c'* extending from the chamber *c* downwardly through the projection a^6 of the main piston.

The auxiliary piston and its connection are fitted very loosely in the hole *b* and chamber *b'*, and they, together with the wall of the said hole and chamber, may be nickel-plated, if desired. This or similar provision should be made to reduce the amount of friction between the parts to a minimum, also to prevent the possibility of corrosion.

It will be observed, also, that the area of the upper head of the auxiliary piston is enough greater than that of the lower head to allow the ordinary pressure to lift the piston and piston-rod, but that the difference in area is not sufficient when the piston is loaded to allow the ordinary pressure to lift the piston and its load until the pressure in the chamber *c* exceeds the required pressure; also, that by proportioning the area of the two heads so that that of the upper head shall be a trifle the greater a very light load only is necessary to keep it seated at ordinary working pressure, while if the area be considerably larger a heavier load is needed; also, that the movement of the auxiliary piston B and its load by the excess of pressure in the valve-chamber not only opens the passage to the chamber *c*, but also closes the exhaust, and that the exhaust-passage remains closed during the upward movement of the main piston to open the valve for the escape of pressure as the auxiliary piston moves with it, and that while the

valve is blowing and after the pressure has been reduced sufficiently the auxiliary piston B falls and closes the passage b^4 and opens the exhaust, and that then the pressure on the lower piston-head causes the main and auxiliary pistons to move downwardly to their original position.

As the head a^4 of the main piston is greater in area than the head a^5, it follows that upon the opening of the exhaust and the closing of the passage between the chambers a and c the main piston will be returned to its original position by direct pressure from within the valve-chamber acting upon the head having the increased area with somewhat greater power than it acts upon the other head.

A drip-passage, c^4, extends from the bottom of the chamber b' downwardly through the projecting portion a^6 of the main piston to the passage c^5.

In order that the steam may pass freely into the chamber c, I groove the under side of the piston radially from the annular channel b^7. The amount of pressure required to lift the weight b^3 is varied by increasing or decreasing the weight or by varying the size of the chamber b^5 or the area of the heads of the auxiliary piston.

In lieu of a dead weight a spring or weighted lever may be employed. Any suitable packing may be used for packing the joints between the piston-heads and the valve-casing, and I represent in the drawings a metallic packing, d, consisting of the ring d', of sheet or other metal, shaped to fit the bore of the cylinder or valve-chamber, and having a flange, d^2, by which, with the aid of the nut d^3, it is fastened to the piston-head.

The interior of the ring is cup-shaped, and pressure upon it extends it against the wall of the cylinder. The piston-head a^5 has wings a^8, which give it a bearing against the valve-chamber or cylinder when the piston-head has been lifted to open the escape-port.

Generally the piston lifts until it contacts with the bunter e on the lower side of the top diaphragm or plate, E, of the valve-casing, and the casing is enlarged at its upper end above the piston-head in order to provide for the escape-passage a^2.

The weight b^3 should exactly balance the maximum pressure described, and any excess of that pressure will immediately lift the auxiliary piston-weight and spindle, thereby enabling the pressure to pass into the chamber below the main piston.

Any packing of a suitable nature may be used about the heads of the auxiliary piston B, and I have shown grooves or recesses f extending around the piston-rod and spindle for providing what is known as "air-packing." Of course the passage into the chamber c is not opened until the piston B has lifted the spindle sufficiently to bring the upper end of the port b^7 in line with the lower end of the passage b^4.

I do not confine myself to the location of the slide-valve or auxiliary piston in relation to the main piston described; but it may be located outside the valve-chamber a, and be adapted to operate the main piston substantially as herein described, in which case the passage b^4, instead of passing through the main piston, would pass from the valve-chamber into a chamber corresponding to the chamber b^5, located outside the casing A, and containing the auxiliary piston and devices for operating the exhaust, and upon the upward movement of the auxiliary piston a passage would be opened into the chamber c in the main valve.

The operation of the valve is as follows: The piston-rod b^2 is loaded by a weight which determines the amount of pressure in the valve-chamber required to lift the auxiliary piston B, and the excess of pressure in the chamber b^5 over the balancing-point causes the auxiliary piston and weight to lift sufficiently to connect the passage b^4 with the port b^7 and to close the exhaust-passage, thereby allowing the pressure in the valve-chamber a to pass into the chamber c below the piston-head a^4 and to force the main piston upwardly sufficiently to allow the escape of pressure directly from the main chamber of the valve around the upper head, a^5, through the direct passage or port a^3. Upon the reduction of the pressure in the chamber b^5 the auxiliary piston automatically returns, closing the passage b^4 and opening the exhaust c', whereby the steam in the chamber c is allowed to escape and the piston is returned to its original position by the pressure within the main valve-chamber, as hereinbefore indicated.

The area of the inlet a should be somewhat smaller than that of the escape-passage a^2, in order that the pressure in the valve-chamber when the valve is blowing may be lower than in the boiler.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States—

1. In a safety-valve, an auxiliary double-headed piston, the auxiliary valve-chamber b^5, and the passage b^4, connecting the main valve-chamber with the auxiliary valve-chamber, in combination with the double-headed main piston a^3, the said valve-chamber a, and the passage a', connecting the valve-chamber a between the heads of the main piston with the boiler, all adapted to operate substantially as described.

2. In a safety-valve, the combination of the valve-chamber a, a double-headed piston, one head of which is of greater area than the other, and the passage a', connecting the valve-chamber between the two heads of the pistons directly with the boiler, substantially as and for the purposes described.

3. In a safety-valve, the combination of the chamber a, the piston a^3, having the piston-heads a^4 a^5, the passage a', connecting the chamber between the piston-heads directly with the boiler, the auxiliary weighted piston

B, the passage b^4, the port b^7, the chamber c, exhaust c', and its valves, substantially as and for the purposes described.

4. In a steam safety-valve, a weighted auxiliary piston adapted, upon the excess of pressure in the valve-chamber, to open the port connecting the valve-chamber a with a chamber below the main piston, and to close the exhaust-passage to the chamber below the head, and upon the reduction of the pressure to close the port and open the exhaust, substantially as and for the purposes described.

5. In a safety-valve, the combination of a weighted auxiliary piston for opening the port connecting the valve-chamber with the chamber below the main piston, and for closing the exhaust-passage, and upon the reduction of the pressure to close the port and open the exhaust, with the chambers a and c and the main piston a^3, all arranged in relation to each other to operate substantially as described.

6. In a safety-valve, a valve-chamber having the steam-induction way a' and the steam-eduction way a^2, arranged in relation to the piston a^3 as described, and the piston a^3, having two heads of unequal area, controlled as to its operation in opening and closing the eduction-way a^2 by an auxiliary double-headed piston operating a slide-valve and exhaust and the pressure within the valve-chamber a between the two piston-heads, whereby an excess of pressure in the valve-chamber is employed in lifting the piston, and the direct pressure in the valve-chamber after the reduction of pressure therein is employed in closing the valve, substantially as and for the purposes described.

7. The combination, in a safety-valve, of a valve-chamber, a, having the inlet a' and outlet a^2, with a double-headed piston, arranged in relation to the inlet as described, and provided with the passage b^4, the chamber c below the lower head of the piston, and an auxiliary piston controlling a slide-valve in a passage between the two chambers a and c, substantially as and for the purposes described.

J. E. CRISP.

Witnesses:
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A. J. OETTINGER.