No. 606,832. Patented July 5, 1898.

W. L. BONE.

LOW WATER ALARM AND SAFETY VALVE.

(Application filed Dec. 18, 1897.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

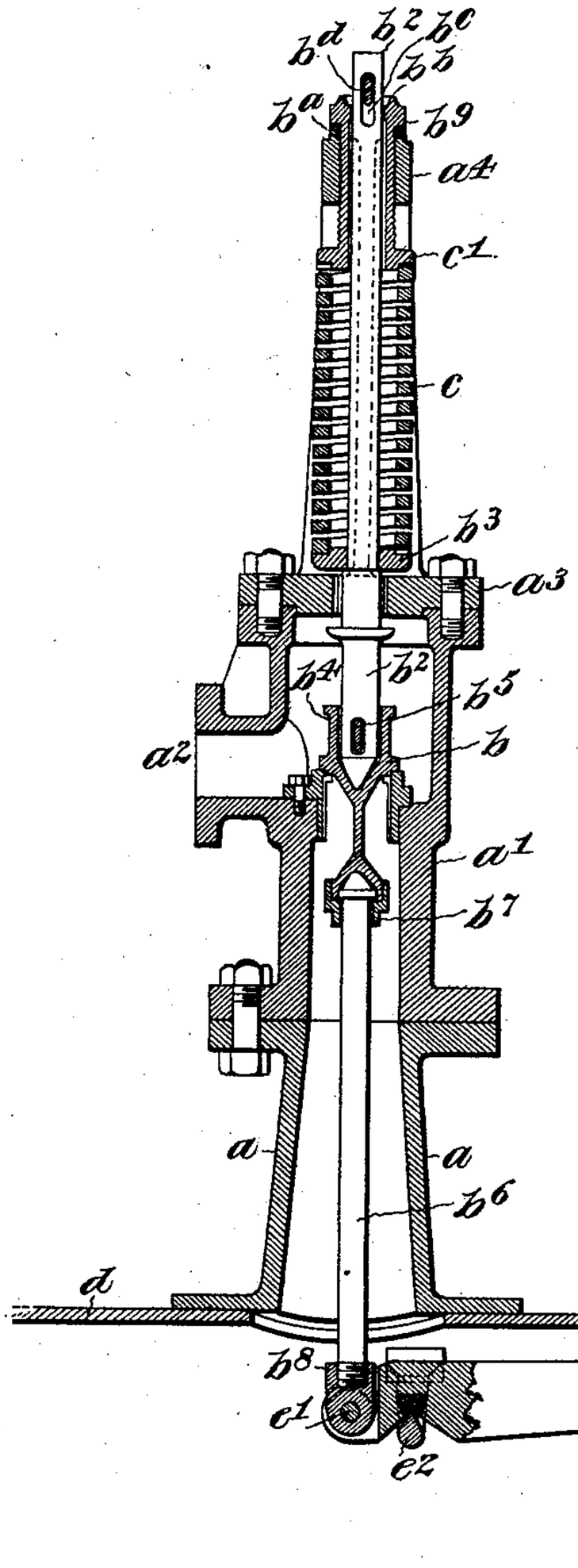
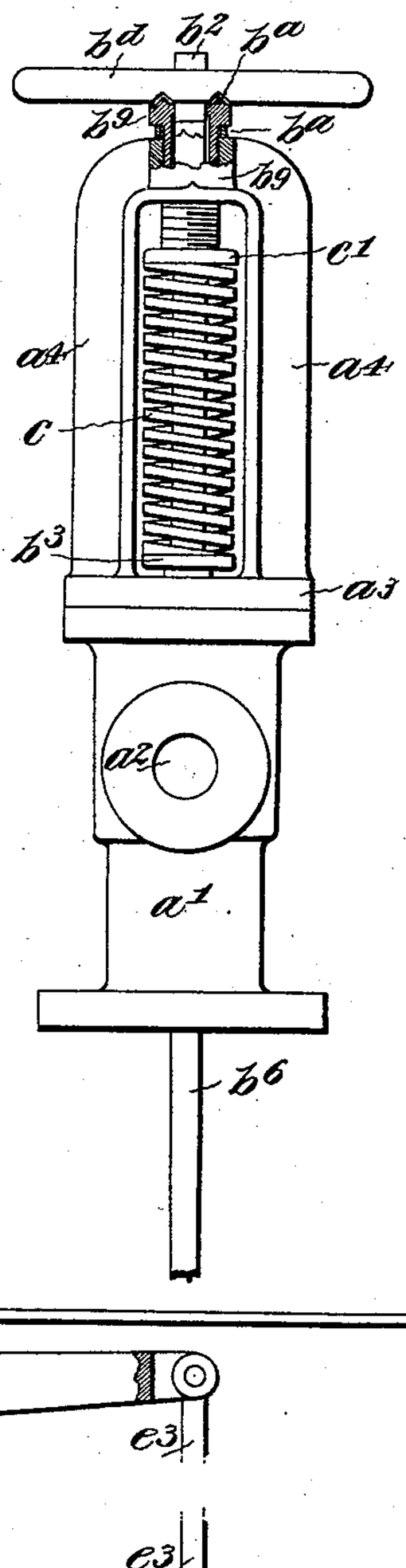
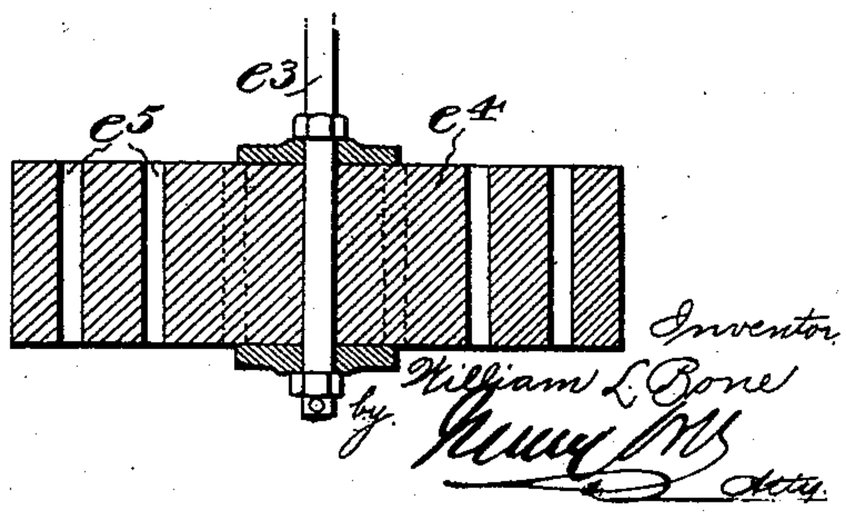


Fig. 2.





Witnesses.
A. S. Ober.
W. Sommers.

Inventor.
William L. Bone
by Munn & Co.
Atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 606,832. Patented July 5, 1898.

W. L. BONE.

LOW WATER ALARM AND SAFETY VALVE.

(Application filed Dec. 18, 1897.)

(No Model.) 4 Sheets—Sheet 2.

Fig. 3.

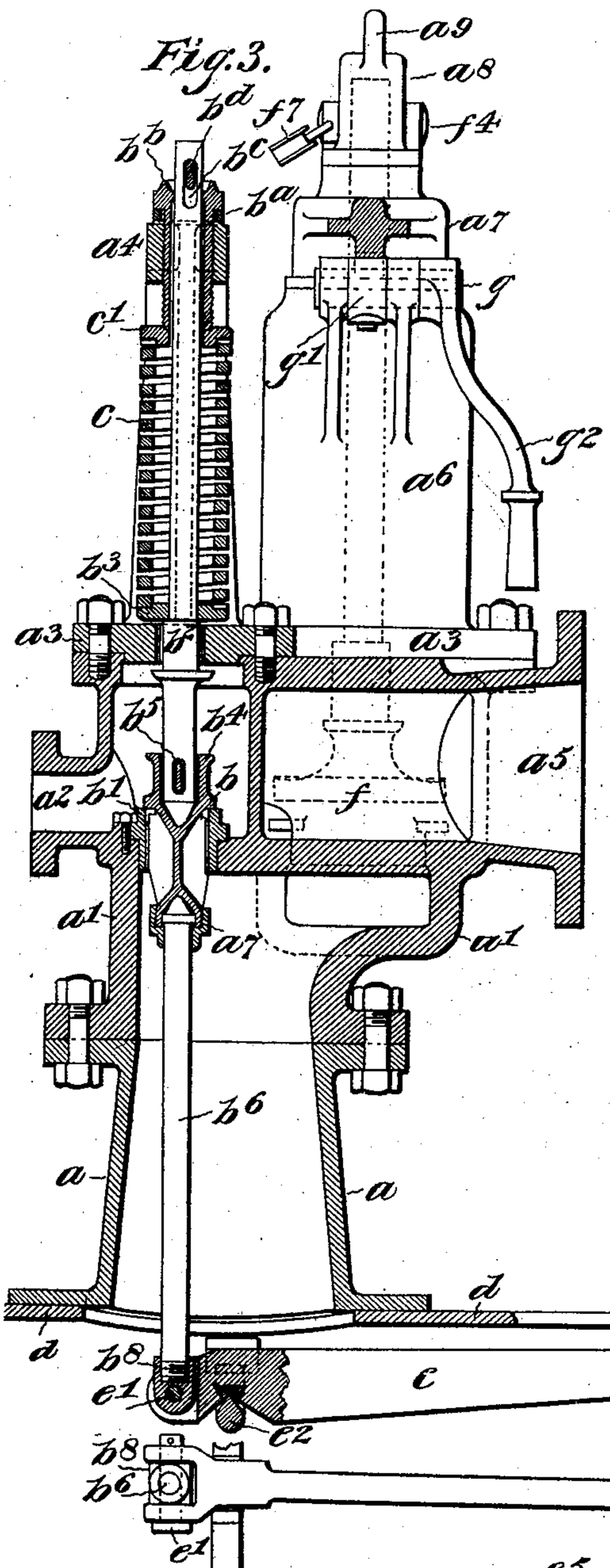
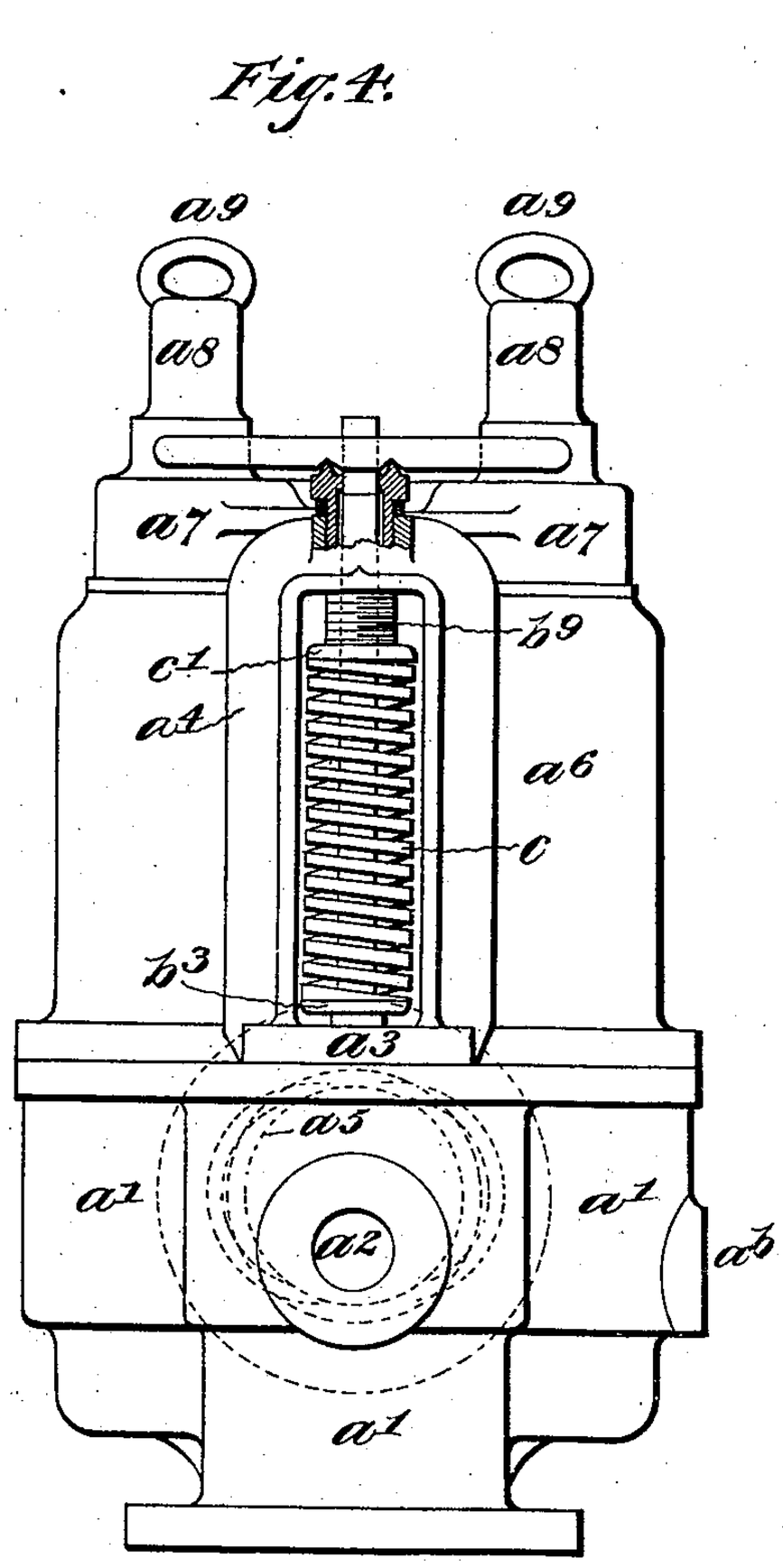
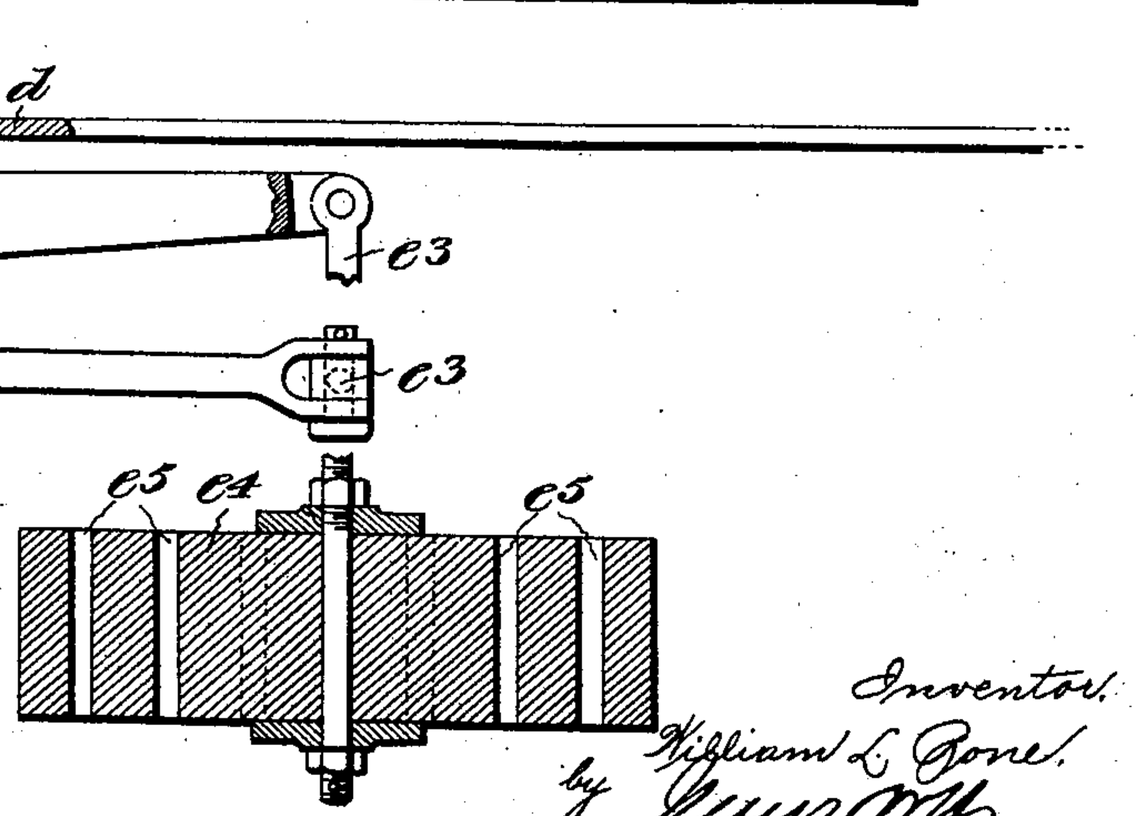


Fig. 3a.

Fig. 4.





Witnesses:
B. L. Ober.
W. Sommers

Inventor:
William L. Bone.
by Munn & Co.
Attys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 606,832. Patented July 5, 1898.

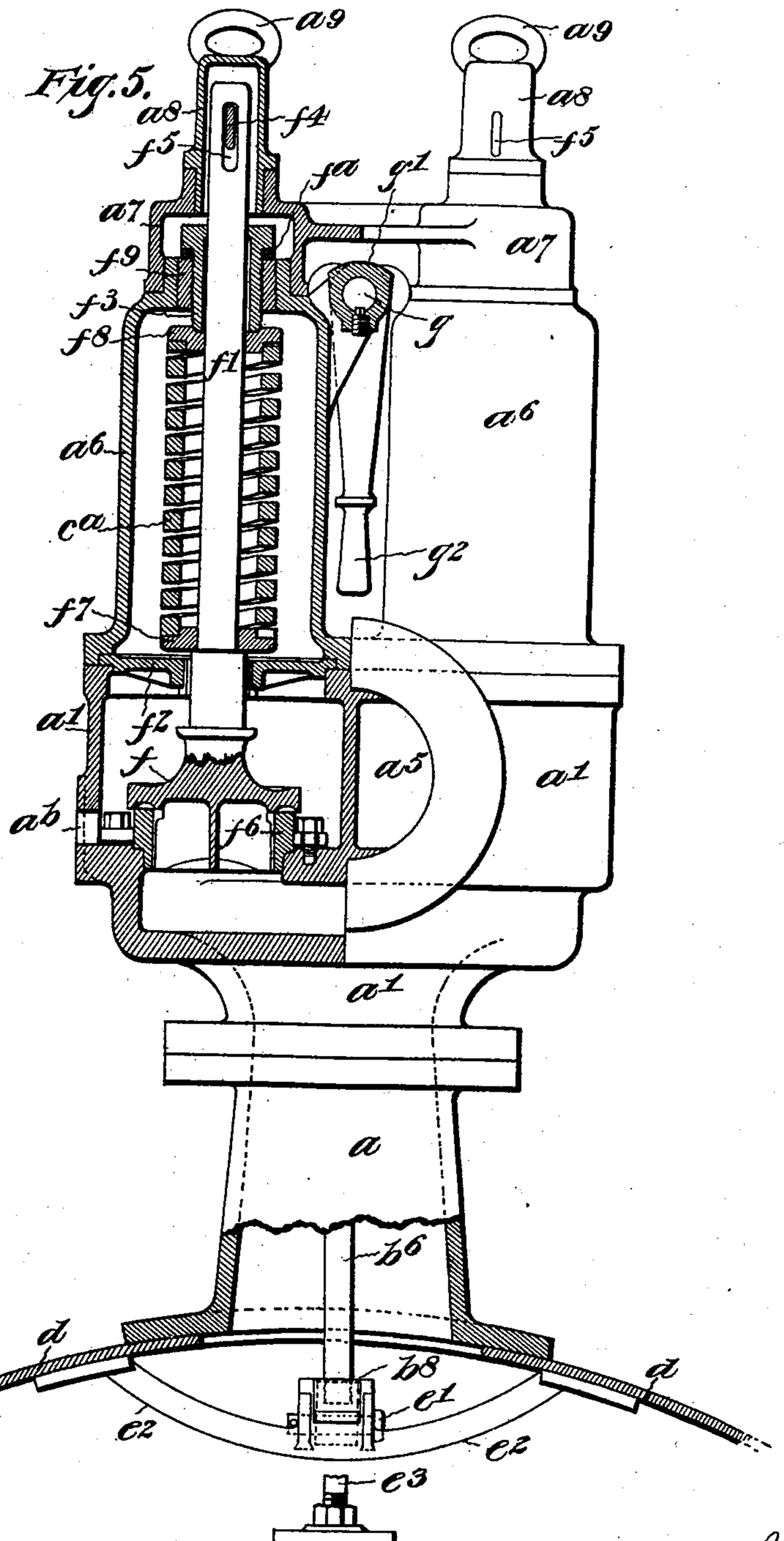
W. L. BONE.

LOW WATER ALARM AND SAFETY VALVE.

(Application filed Dec. 18, 1897.)

(No Model.) 4 Sheets—Sheet 3.

Fig. 5.



Witnesses:
B. S. Olen.
B. F. Sommers

Inventor:
William L. Bone.
by Munn & Co.
Atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 606,832. Patented July 5, 1898.

W. L. BONE.

LOW WATER ALARM AND SAFETY VALVE.

(Application filed Dec. 18, 1897.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 6.

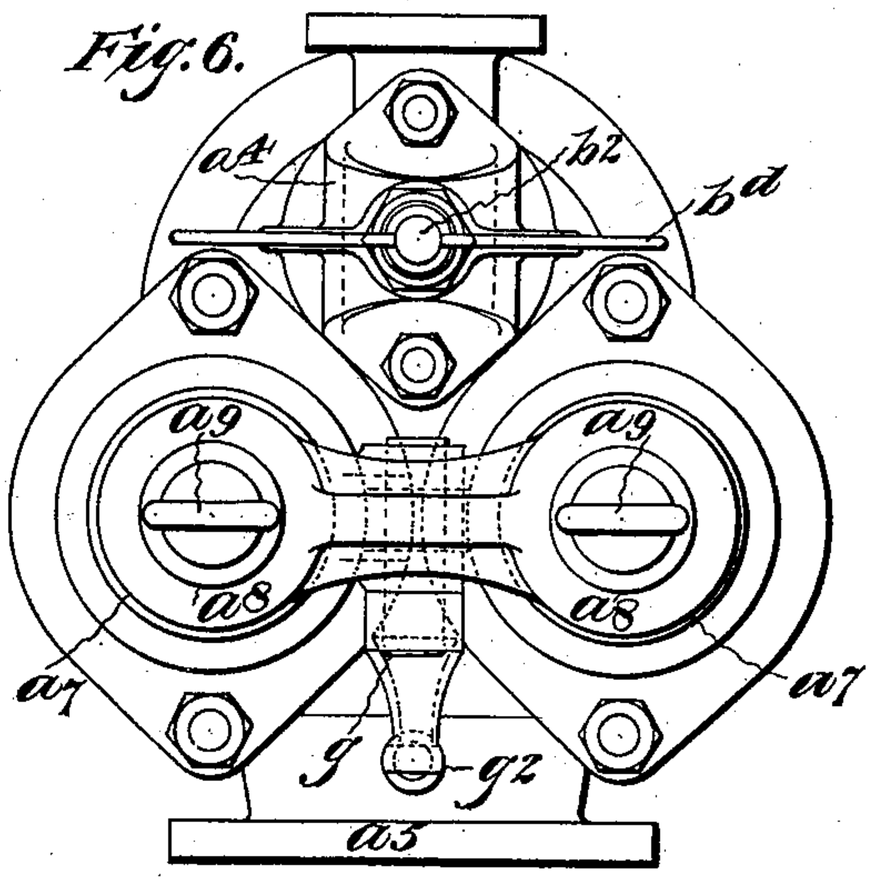


Fig. 8.

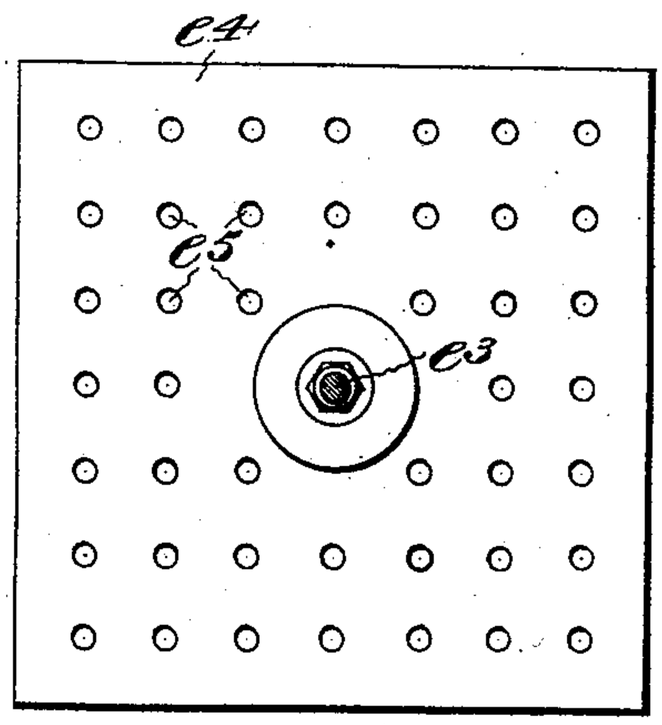


Fig. 7.

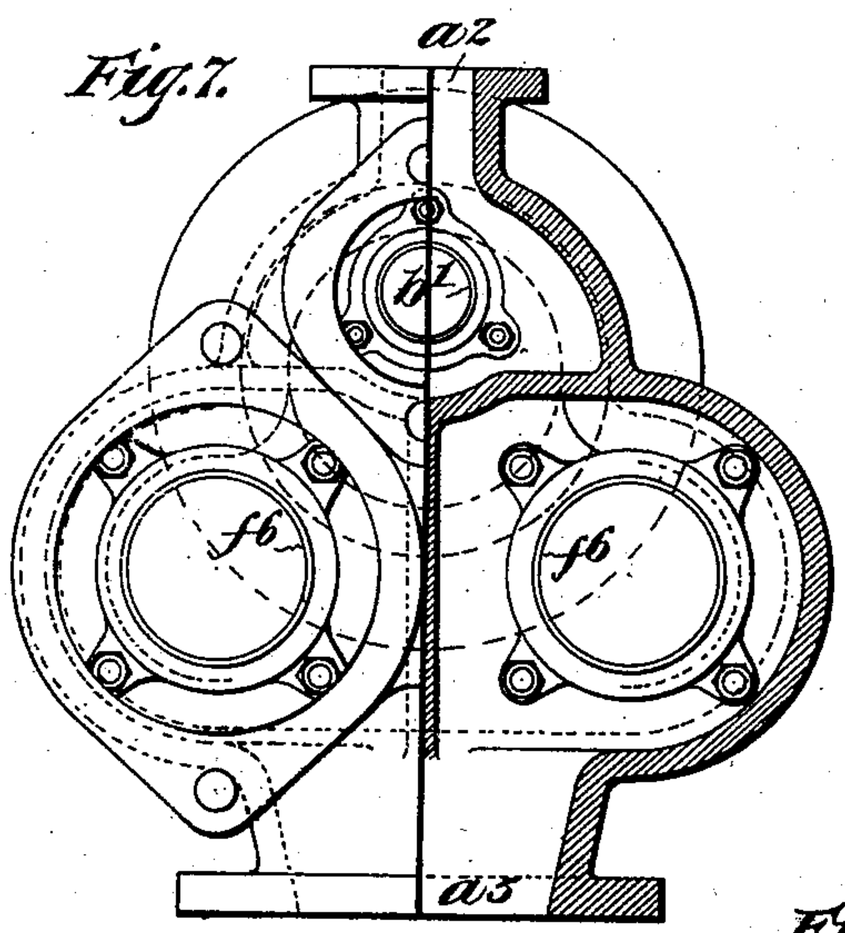


Fig. 9.

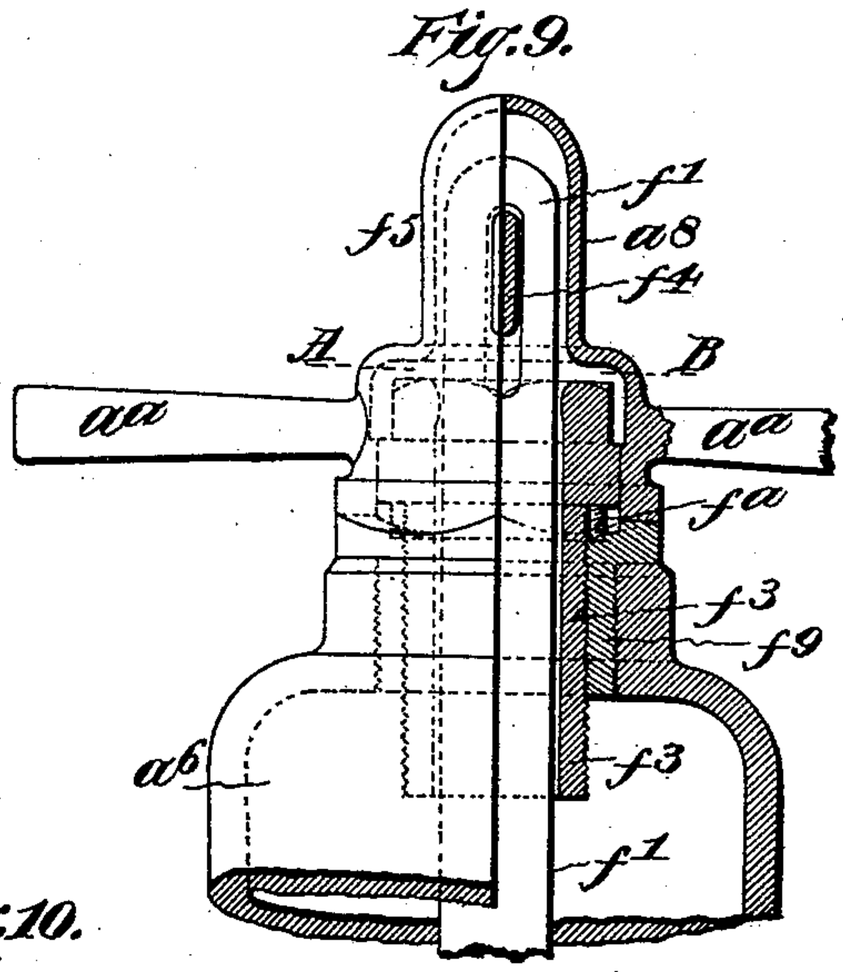
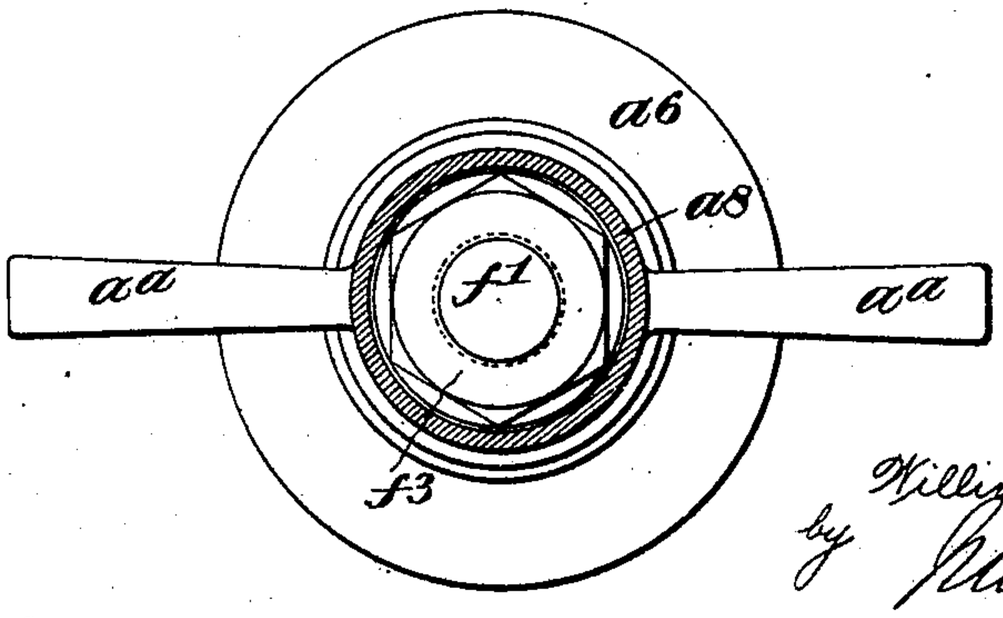


Fig. 10.



Witnesses.
B. L. Baker.
A. H. Sommers

Inventor.
William L. Bone
by Munn & Co
Atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM LOCKHART BONE, OF MANCHESTER, ENGLAND.

LOW-WATER-ALARM AND SAFETY VALVE.

SPECIFICATION forming part of Letters Patent No. 606,832, dated July 5, 1898.

Application filed December 18, 1897. Serial No. 662,443. (No model.) Patented in England August 29, 1895, No. 16,225.

To all whom it may concern:

Be it known that I, WILLIAM LOCKHART BONE, a subject of the Queen of Great Britain and Ireland, residing at Manchester, in the county of Lancaster, England, have invented certain new and useful Improvements in Low-Water-Alarm and Safety Valves for Steam-Generators, (for which Letters Patent have been obtained in Great Britain and Ireland under date of August 29, 1895, No. 16,225;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My invention will be illustrated by reference to the accompanying drawings, of which—

Figure 1 is a sectional elevation of my improved low-water-alarm valve mechanism, and Fig. 2 is an outside elevation of the same above the casting forming a junction with the boiler and at a right angle to the plane of Fig. 1. Fig. 3 is a sectional elevation of my improved low-water-alarm valve mechanism, illustrating its combination with my improved twin safety-valves against excess of pressure. Fig. 3^a is a plan view of the lever through which the float operates. Fig. 4 is an outside elevation at a right angle to the plane of Fig. 3, above the junction-casting with the boiler, looking toward the low-water-alarm valve. Fig. 5 is a sectional elevation in the plane of Fig. 4 and at a right angle to the plane of Fig. 3, but showing the opposite side of the apparatus to that shown by Fig. 4, the section being taken through one of the twin steam safety-valves and through a part of the upper shell of the boiler to which the junction-casting is attached. Fig. 6 is a top plan view. Fig. 7 is a top plan view, half the view being seen when the upper casing for the valve-springs and other parts are removed, the other half of the view being a section in a line just above the valve-seatings. Fig. 8 is a detached plan view of the float for the low-water alarm, this float being also shown in elevation as parts of Figs. 3 and 5. Fig. 9 is a sectional elevation of a modified arrangement for lifting a single safety-valve when single valves are used in place of twin safety-valves; and Fig. 10 is a plan section of the same on the line A B, Fig. 9.

First. My invention relates to valves which are opened to allow the escape of steam from boilers or generators when the water or fluid in such gets below the level fixed upon and will thus give an alarm or indicate the fact by the escaping steam. Such valves have hitherto been loaded by direct weights or by levers and weights hanging in the boiler, and when in action as low-water valves are operated upon by a float suspended by a link on one end of a beam-lever, the other end of the lever having a weight to partly counterbalance the weight of the float when submerged, the float, counterweight, and lever being inside the boiler. This part of my invention (illustrated by Figs. 1 and 2) consists in an improved combination and arrangement of low-water-alarm valve which is actuated by a float and lever inside the boiler, but without counterweight thereon, all counterweight and weight that may be required to load the valve being obtained by a spring or weights on the exterior of the boiler. There is a junction-casting a with the top of the boiler d, to which a junction-casting a' is secured by flanges and bolts to receive the seating b' (fitted and secured by screws to the casting a') for the cone or other suitable form of valve b, which opens outward, and this casting a' has a branch a^2 for steam, which escapes past the valve, and has a cover a^3 secured to its upper side by bolts and flanges, which cover also forms a stand a^4, of loop form, which guides the spindle b^2, ascending from the upper side of the valve b. The upper end of this stand a^4 also forms the abutment, as hereinafter explained, for a helical spring c on the spindle b^2, the lower end of which spring comes against a washer b^3, acting against a shoulder on the spindle. Thus arranged the spring c operates to hold the valve b down close upon its seating b'. The lower end of the spindle b^2 enters a socket b^4 in the boss from the upper side of the valve b, in which socket the spindle is secured by a cotter b^5, or the spindle may be in one solid piece with the valve. A spindle b^6 is also secured to the valve b on the lower side of its seating by a screw-coupling cap b^7, that acts against a shoulder on the spindle b^6, so as to

convey the thrust due to weight of float transmitted through the float-lever, but is so arranged by the above-described coupling b^7 that the valve can be rotated upon its seating without turning the spindle b^6. The lower end of the inner spindle b^6 screws into a socket in a joint part b^8, and the joint part is secured in the forked end of a lever e by a joint-pin e', the under side of the lever being prepared with an inverted-V notch to rest upon a knife-edge on a bar e^2, passing across the opening in the boiler-shell d, leading to the valve, this cross-bar being secured to the inside of the shell of the boiler, or this supporting-bar e^2 or a corresponding part may be from the casting a, forming a junction with the boiler for the valve. To the end of the lever e, inside the boiler, a rod e^3 is jointed, to the lower end of which rod the float e^4 is secured by a washer above and below it and screw-nuts on the rod e^3, as shown. The upper end of the standard a^4 for the spindle from the upper side of the valve is formed by a screw-bush b^9, that screws through the boss at the upper part of the standard, and the lower end of the screw acts against a washer c' upon the spindle b^2 to give more or less compression to the spring c and thus the load upon the valve b. When the load on the valve is adjusted, the shoulder on the screw b^9 comes against a ring b^a, which prevents greater compression being given. The upper edge of the screw b^9 is formed with an annular ridge b^b round the spindle, across which there is a slot b^c for a bar b^d to pass through, the under side of which bar is just clear of the said annular ridge on the screw in the standard when the valve is closed. By lifting or depressing one end of the bar b^d, or lifting one end and depressing the other end, or lifting both ends of the bar the spindle b^2, and thus the valve b, will be slightly lifted, as the said annular ridge b^b forms a fulcrum whichever way the bar moves up or down, and by this bar the valve may also be rotated on its seat when required. By this means it may be at all times ascertained whether or not the valve is in working order. The float e^4 is by preference made of some suitable material of tile-like character, of light specific gravity, and is formed with a series of small holes e^5 through it to allow steam-bubbles to rise up through them, so that such bubbles will be less liable to disturb and cause movement in the float, as is the case with ordinary floats, where such movements cause the low-water-alarm valve to discharge puffs of steam at such times when the water in the boiler is not in fact below the normal working level. The valve b is weighted down by the spring c with such pressure as will keep it closed at the highest working pressure of the steam and with an additional weight equal to sustain the weight of the float when it is fully immersed in the water. The float is of such weight when not sustained by the water in the boiler as to be sufficient, acting through the lever e, to lift the alarm-valve b even when there is no pressure of steam in the boiler, and with such pressure the float will readily lift and open the valve when the water has descended below the float.

Secondly. My invention consists in combining a low-water-alarm valve arranged as described, with either a single valve or twin safety-valves. This modification of my invention is illustrated with twin safety-valves by Figs. 3, 3ª, 4, 5, 6, 7, and 8. In this case the branch a from the boiler-shell d is prepared to receive a casting a' both for the low-water alarm and the safety valve or valves, (twin valves being shown,) which casting has two separate outlets for steam escaping past the valves, one, a^2, for the low-water-alarm valve b, (which will also act as a safety-valve,) and one, a^5, for steam from the single or twin safety-valves. On the casting a' there is a lid a^3, secured by flanges and bolts, which carries the standard a^4 for the low-water-alarm valve and a casing a^6 for the single or twin safety-valves, a double casing being shown. The safety-valves f (see Fig. 5) are formed somewhat similar to the low-water-alarm valve b and are secured on the lower end of a spindle f', passing through a disk-plate f^2, resting on a ledge in the casting a' and secured therein when the casing a^6 is bolted to the casting a'. The valve when shut rests upon a seating f^6, secured in the casting a' by bolts. The upper ends of the spindles each pass through a guiding-bush f^3, screwing into a bush f^9, of brass by preference, in the upper part of the casting a^6, and then passes into holes in the interior of a loose cap or casting a^7 (double in this case) and then into a socket a^8 within a hole in the said cap a^7, which socket has a loop a^9 at its upper end. The spindle f' and socket a^8 are connected by a cotter f^4, passing through a slot f^5 across the socket and spindle; but the cotter allows the spindle f' to lift slightly. This cotter may have a hole across it at one end for the bow of a hang-lock f^7 (see Fig. 3) to prevent the valve apparatus from being taken to pieces and tampered with. Under the said double cap a^7 there is a horizontal shaft g, having bearings in projections from the exterior of the casting a^6, and on the shaft g, between its bearings, there is a cam-piece g' (see Figs. 3 and 5) secured, which comes under a part extending between and connecting the two caps a^7 of a twin safety-valve. When the cap or caps are down at their lowest point, they are resting on the casting a^6, so that by oscillating the shaft by a lever-handle g^2 on its end either way the cap or caps a^7 are lifted, and with them the sockets a^8, and with the sockets the spindles f' of the valve by means of the cotters f^4, and thus the valves f. When there is a single valve, the shaft g may be placed on one side of the casing a^6 and may have two arms to come under projections on each side of the cap a^7. By inserting a bar in the loop a^9 at the upper

end of the socket a^8 for each valve the valve can be turned round on its seating. Upon each spindle f' for the valves f there is a disk or washer f^7, which rests against a shoulder on the spindle f' at the lower part, and there is a corresponding washer f^8, which can slide on the spindle f' at the upper part, against which the end of the screw-bush f^3 comes, which puts pressure upon the spring c^a, which thus loads the valve against the pressure of the steam acting to open it. When the screw-bush f^3 is adjusted to give the pressure required, the shoulder under its head comes against a ring f^a. a^b, Figs. 4 and 5, is an outlet from the casting a' for condensed steam.

Figs. 9 and 10 illustrate another mode of lifting the cap a^8, Figs. 3, 4, 5, and 6, when single safety-valves are used. a^3 is the upper part of the casing in a bush f^9, and at its upper end a bush f^3 is screwed, which guides the upper end of the spindle f'. The cap a^8 is formed with two handles a^a, by which it can be rotated, and its hollow incloses the head of the screw-bush f^9, and its lower edge, which comes in contact with the face of the bush f^9, is corrugated to fit corresponding corrugations on the head of the external bush f^9. f^a is the ring to prevent the screw-bush f^3 from being screwed in farther when the pressure of the spring upon the valves has been adjusted. f^4 is the cotter passing through a slot in the sides of the cap a^8 and also through a slot f^5 through the spindle f', which slot f^5 is lengthened downward to allow the valve-spindle and valve to lift by the pressure of the steam acting upon it. When the cap a^8 is rotated by the handles a^a, it rises by reason of the corrugations above referred to and thus lifts the spindle f' by means of the cotter f^4. When the cap a^8 is turned and left in its normal position where the corrugations correspond one over the other, the valve is at liberty to rest close against its seating. By rotating the cap a^8 the valve f is both rotated and lifted and its working condition is thus easily tested at any time.

In the drawings hereinbefore described, springs c for weighting the low-pressure valves in each modification are shown and preferred; but weights may be used in place of the springs c, acting directly on the spindle and resting on a washer corresponding to that b^3, Figs. 1, 3, and 4.

It will be observed that the safety-valves in each modification are arranged so that they cannot be weighted from the exterior of the casings and can only be acted upon to open or rotate them for testing purposes. The low-water indicator-valves may be arranged in like manner to the pressure-valves by making the stand a^4 in an inclosing casing and with a cap to inclose the top of the spindle, the cap having a slot in its sides for the bar b^d.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The combination with a steam-boiler, of a casing provided with a passage leading from the steam-space of the boiler to the atmosphere, a valve interposed in said passage and controlling the flow of steam therethrough to the atmosphere, said valve provided with a stem projecting outwardly from the said casing, a bearing for said stem above the casing, a coiled spring on the projecting portion of said stem acting as a load for the valve, and adjusting devices on said projecting portion of the stem adapted to coöperate with its bearing in the adjustment of the tension of the spring, for the purpose set forth.

2. The combination with a steam-boiler, of a casing provided with a passage leading from the steam-space of the boiler to the atmosphere, a valve interposed in said passage and controlling the escape of steam therethrough to the atmosphere, said valve provided with a stem projecting outwardly from the casing, a bearing for said stem above said casing, a coiled spring on the projecting portion of the stem, acting as a load for the valve, appliances coöperating with said bearing for adjusting the tension of the spring, and means for displacing the valve on its seat, likewise carried by said valve-stem, for the purpose set forth.

3. The combination with a steam-boiler, of a casing provided with a passage leading from the steam-space of the boiler to the atmosphere, a float-controlled valve interposed in said passage and controlling the flow of steam therethrough to the atmosphere, said valve provided with a stem projecting outwardly from said casing, a bearing for said stem above the casing, a coiled spring on the projecting portion of said stem acting as a load for the valve, and adjusting devices on said projecting portion of the stem adapted to coöperate with its bearing in the adjustment of the tension of the spring, for the purposes set forth.

4. The combination with a steam-boiler, of a casing provided with a passage leading from the steam-space of the boiler to the atmosphere, a float-controlled valve interposed in said passage and controlling the escape of steam therethrough to the atmosphere, said valve provided with a stem projecting outwardly from the casing, a bearing for said stem above said casing, a coiled spring on the projecting portion of the stem, acting as a load for the valve, appliances coöperating with said bearing for adjusting the tension of the spring, and means for displacing the valve on its seat, likewise carried by said valve-stem, for the purpose set forth.

5. The combination with a steam-boiler, of a valve-casing provided with a passage leading from the steam-space of the boiler to the atmosphere, a valve controlling the flow of steam through said passage, and provided with a stem whose upper portion is exposed, a lever at the end of said exposed portion, and a bearing on which said lever is adapted to rock, for the purpose set forth.

6. The combination with a steam-boiler, of a valve-casing provided with a passage leading from the steam-space of the boiler to the atmosphere, a valve controlling the flow of steam through said passage and provided with a valve-stem whose upper portion is exposed, a coiled spring thereon, abutments for the ends of said spring, a tension-adjusting sleeve through which the valve-stem passes freely, said sleeve adjustable in a suitable bearing and adapted to operate on one of the spring-abutments, a lever at the upper exposed end of the valve-stem, and a rocking bearing for and on which said lever is adapted to rock, substantially as and for the purpose set forth.

7. A float for low-water indicator-valves for steam-boilers provided with perforations or passages parallel with its minor axis, for the purpose set forth.

8. The combination with a steam-boiler, of a casing provided with a main passage leading to the steam-space of the boiler, and with a plurality of branch passages leading from said main passage to the atmosphere, a float-controlled valve interposed in one of said branch passages, a pressure-controlled valve in the other branch passages, and means for simultaneously displacing the pressure-controlled valves on their seats, for the purpose set forth.

9. The combination with a steam-boiler, of a casing provided with a main passage leading to the steam-space of the boiler and with three branch passages leading from said main passage to the atmosphere, a float-controlled valve in one of said passages, a pressure-controlled valve in the other two passages, means for displacing the valves on their seats independently of one another, and means for displacing the pressure-controlled valves simultaneously, for the purpose set forth.

10. The combination with a steam-boiler, of a casing provided with a main passage leading to the steam-space of the boiler and with three branch passages leading from said main passage to the atmosphere, a float-controlled valve in one of said branch passages, a pressure-controlled valve in each of the other branch passages, said valves provided with stems carrying the load for these valves, casings inclosing the stems of the pressure-controlled valves, a cap loosely fitted to said casings, cotters passing through elongated slots in said casings, and in the valve-stems, and means adapted to lock the cotters against unauthorized removal, for the purposes set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

WILLIAM LOCKHART BONE.

Witnesses:

PETER J. LIVSEY,

WILLIAM FAULKNER.