No. 687,817. Patented Dec. 3, 1901.

C. C. CONNELL.

SAFETY AND VACUUM VALVE FOR EXPANSION PIPES.

(Application filed Mar. 19, 1901.)

(No Model.) 2 Sheets—Sheet 1.

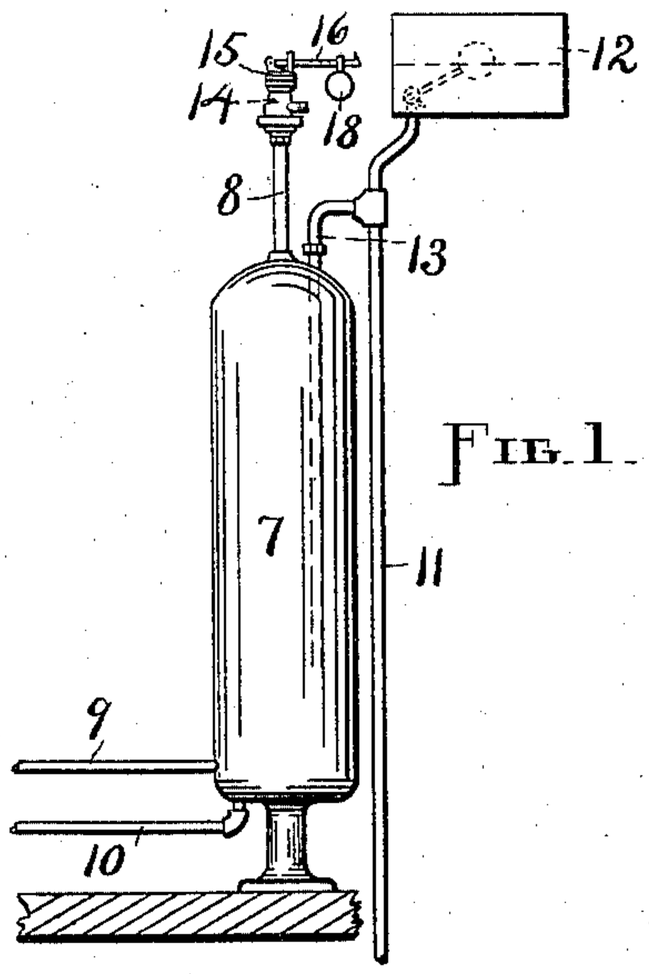

FIG. 1.

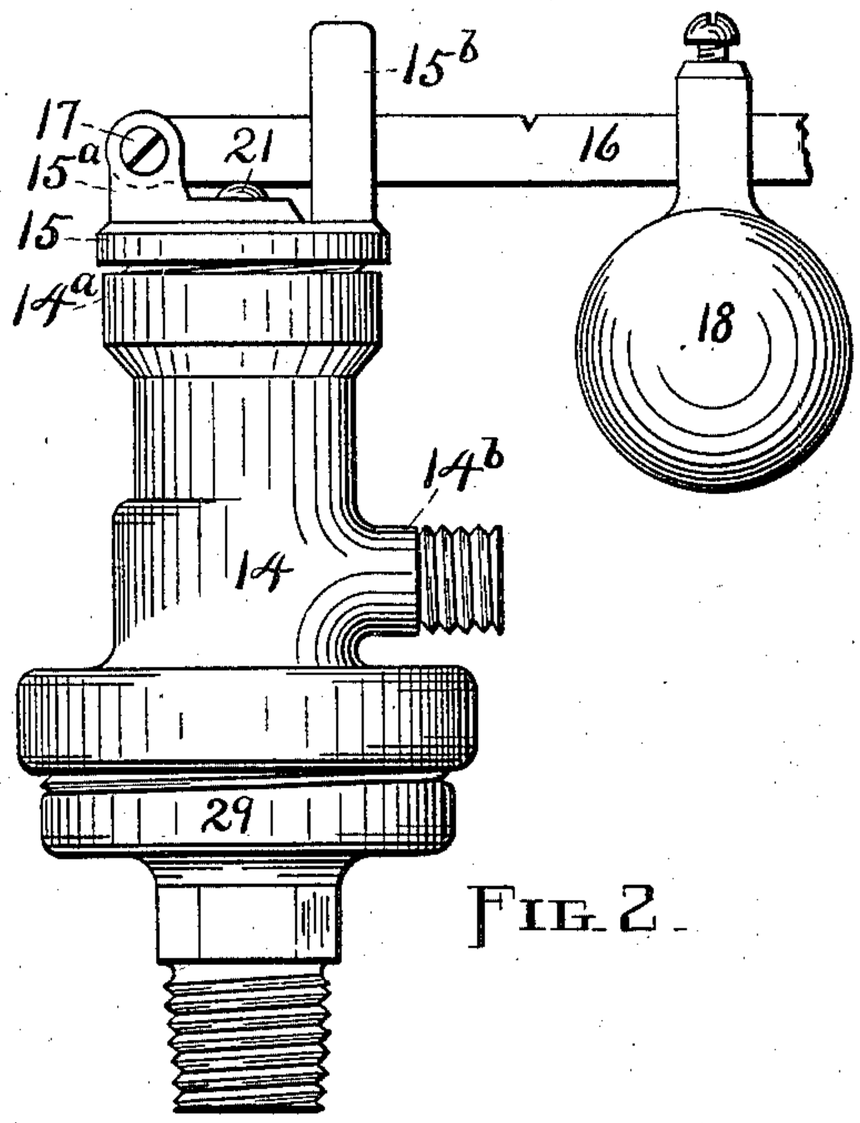

FIG. 2.

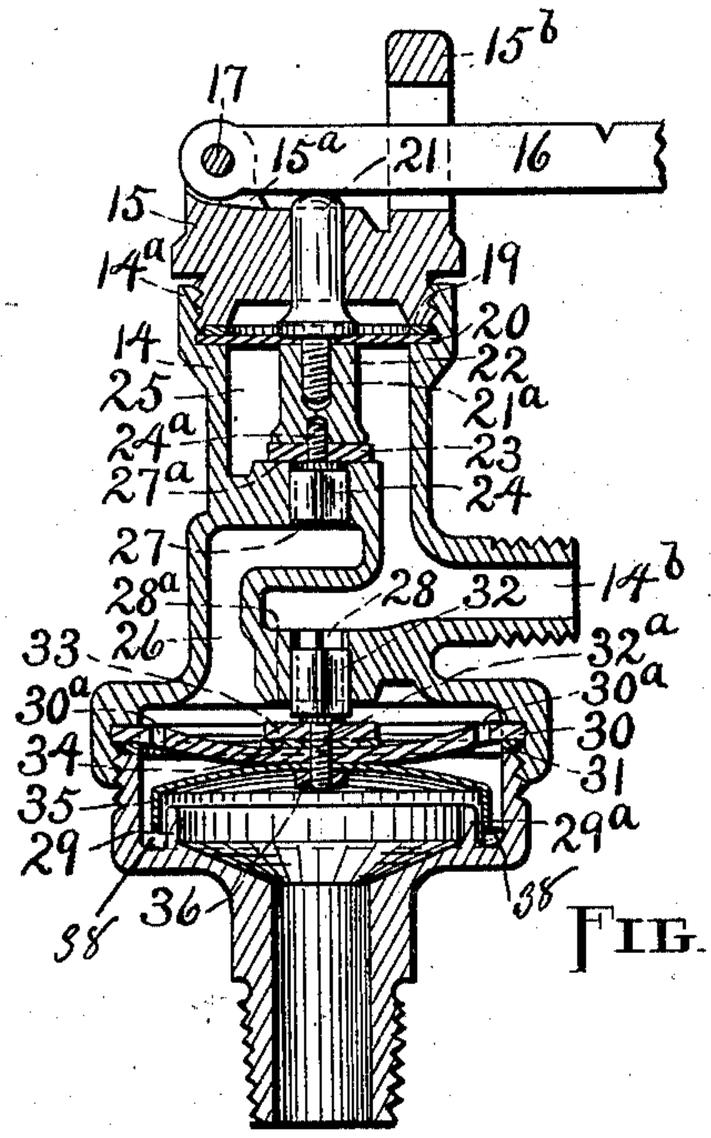

FIG. 3.

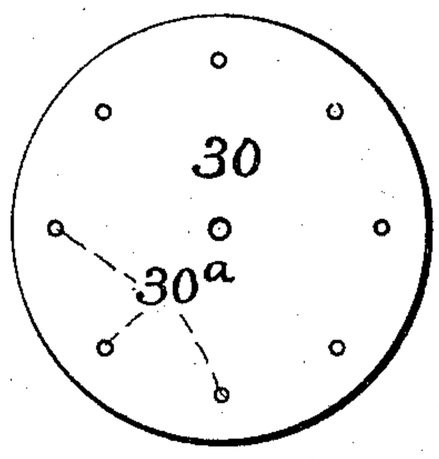

FIG. 4.

Witnesses
H. A. Leutter.
J. R. Sackett.

Inventor
Charles C. Connell
By Webster Zaft & Tilley
Attorneys

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C. C. CONNELL.

SAFETY AND VACUUM VALVE FOR EXPANSION PIPES.

(Application filed Mar. 19, 1901.)

(No Model.) 2 Sheets—Sheet 2.

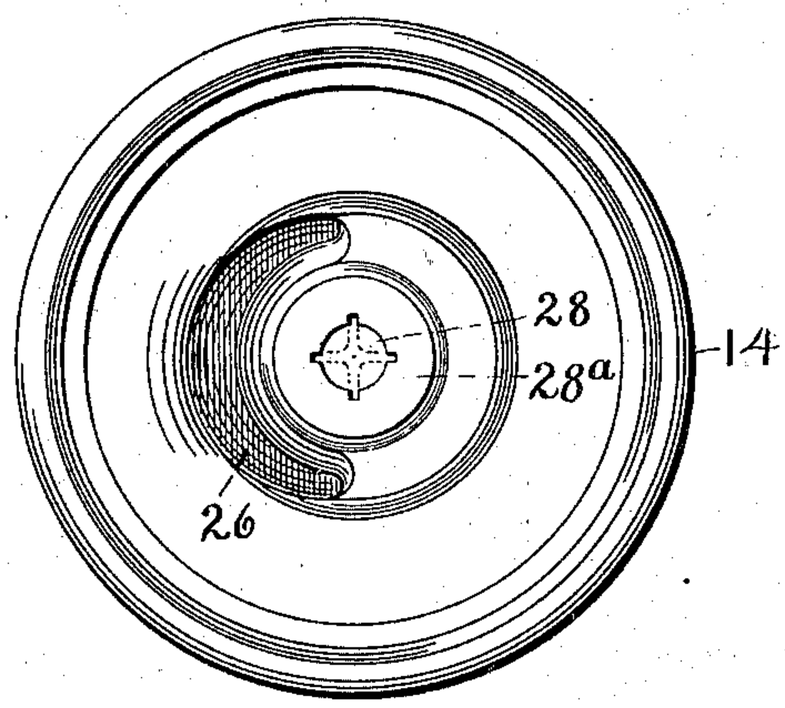

FIG. 5.

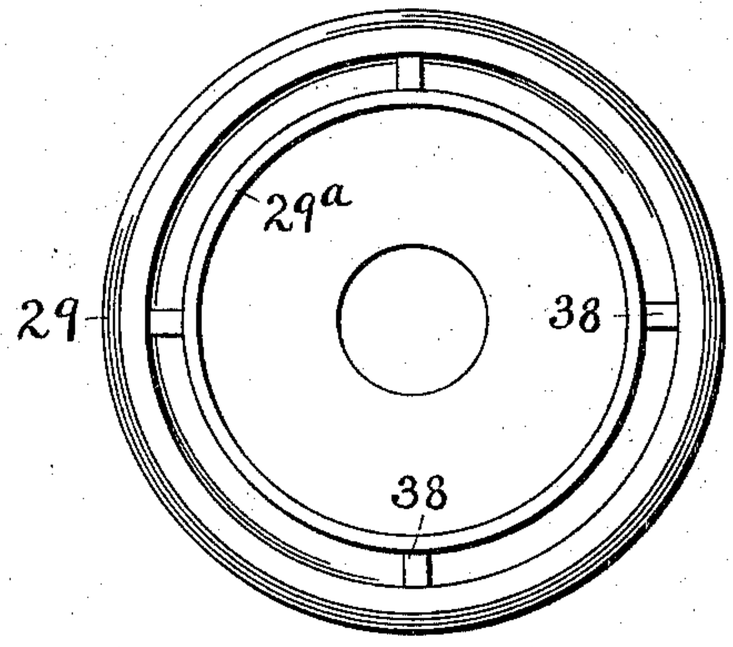

FIG. 6.

Witnesses
H. Heutter.
D. D. Taft Jr.

Inventor
Charles C. Connell
By Webster, Taft & Tilley
Attorneys

UNITED STATES PATENT OFFICE.

CHARLES C. CONNELL, OF HAYDENVILLE, MASSACHUSETTS, ASSIGNOR TO HAYDENVILLE COMPANY, OF HAYDENVILLE, MASSACHUSETTS, A CORPORATION.

SAFETY AND VACUUM VALVE FOR EXPANSION-PIPES.

SPECIFICATION forming part of Letters Patent No. 687,817, dated December 3, 1901.

Application filed March 19, 1901. Serial No. 51,884. (No model.)

To all whom it may concern:

Be it known that I, CHARLES C. CONNELL, a citizen of the United States, residing at Haydenville, in the county of Hampshire and State of Massachusetts, have invented a new and useful Safety and Vacuum Valve for Expansion-Pipes, of which the following is a specification.

My invention relates to a device for preventing the exploding or collapse of house-heating and range hot-water boilers particularly; and it consists, essentially, of a perforated flexible diaphragm having a valve attached thereto and an auxiliary valve in a bi-compartment-shell, provision also being made for a water seal in this construction; and the objects of my improvement are, first, to provide against the loss of hot water and against undue pressure in the boiler and possible explosion resulting from steam generated suddenly or quickly from any cause; second, to relieve any vacuum that may occur, and thus prevent collapse of said boiler, as when the water from the main supply is suddenly withdrawn, and, third, to vent the boiler in the absence of pressure therein, thereby insuring free delivery of water being drawn from the same, as well as affording an opportunity for all air, whether hot or cold, to escape, and obviating the liability of said air being held back or forced into any crook, **S** connection, or delivery-pipe to interfere with the proper working of the apparatus or system. My device is useful, too, in connection with the cold-water supply for a house, as it removes the danger of pipes bursting and prevents serious "water-hammer." I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a hot-water boiler equipped with my automatic safety and vacuum valve; Fig. 2, an enlarged side view of said valve; Fig. 3, a vertical section through the latter; Fig. 4, a top view of the rubber diaphragm; Fig. 5, an enlarged interior view of the shell looking into the same from below, and Fig. 6 an enlarged interior view of the base-piece looking into the same from above.

Similar figures refer to similar parts throughout the several views.

My invention is shown mounted on a hot-water boiler 7 at the top of the expansion-pipe 8 in Fig. 1, said boiler having the circulating-pipes 9 and 10 extending therefrom. The boiler 7 receives its supply of water from either the street-main 11 or the tank 12, into which said main opens, through the pipe 13. The high-pressure and vacuum safety device is preferably attached to the expansion-pipe at the top of the boiler, but may of course be attached to a cold-water-supply expansion-pipe. The valve-shell 14 has the threaded top 14^a, into which the fulcrum-hub 15 is screwed. The hub 15 is equipped with the ordinary ears 15^a, to which the safety-valve lever 16 is pivoted at 17, and with the guide 15^b for said lever. The lever 17 is notched as usual and provided with the weight or ball 18.

A tight joint is formed between the shell 14 and the fulcrum-hub 15 by means of the metallic washer 19 and the diaphragm 20, of rubber or other flexible material, the latter being held firmly between the spindle 21 and the valve-stem 22, which screws onto the threaded spindle-shank 21^a, passing through said diaphragm into said stem. The washer 19 and the diaphragm 20 are held tightly between adjacent surfaces of the shell 14 and the hub 15. The spindle 21 rises through an opening in the hub 15 to receive the lever 16. The valve 23, preferably of rubber, is attached to the base of the stem 22 by the winged guide 24, which has the threaded shank 24^a to pass through said valve and screw into said base.

The shell 14 is divided into the two compartments or chambers 25 and 26 by walls in which are the vertical openings 27 and 28, one above the other, said openings being surrounded by the valve-seats 27^a and 28^a, respectively. The projection 14^b extends from one side of the shell 14 for a vent or waste pipe connection and opens into the chamber 25. The chambered base-piece 29 is screwed into the threaded lower end of the shell 14, tight against the outer edges of the flexible

diaphragm 30 and the metallic washer 31. On the interior of the base-piece 29 is the vertical ridge 29ª, forming a channel with the surrounding wall for a water seal. The lower end of the base-piece 29 is threaded to screw into the expansion-pipe 8. The winged guide 32 has the threaded shank 32ª extending through openings in the valve 33, the metallic washer 34, the diaphragm 30, and the metallic dome 35, and the nut 36 is screwed onto the bottom of said shank to bind these parts tightly together. The winged guides 24 and 32 operate in the openings 27 and 28, respectively, which latter are grooved to receive the registering projections or wings of said guides and retain their attached valves constantly in proper position relative to the seats 27ª and 28ª. The grooves in the wall about the opening 28 for the reception of the wings of the guide 32 are best shown in Fig. 5, in which the guide itself is also indicated by dotted lines. The wall about the opening 27 is grooved in a similar manner.

The valve 33 is preferably of rubber and adapted to bear against the seat 28ª. The diaphragm 30 is also preferably of rubber, and should be of greater diameter than the peripheral bearing for the same in order to allow for considerable movement on the part of said diaphragm. Said diaphragm is provided with a series of holes 30ª, somewhat remote from the edge thereof. The dome 35 is shaped like a shallow cup inverted, with its edges in the water-seal channel. The object of the water seal is to condense the steam that arises, and thereby prevent deleterious action on the rubber parts in the interior of the device.

It will now be readily understood that any undue pressure that may accumulate for any reason, such as an increase caused by the sudden lowering of the water in the boiler, and consequent rapid formation of steam, or the lessened demand for water at night must elevate the dome 35, with the diaphragm 30, and force the valve 33 against its seat 32. In the same manner the loss of hot water forced out of the expansion-pipe into the base-piece 29 by the inflow of cold water is prevented; otherwise the water would escape through the diaphragm-holes 30ª, the chamber 26, the opening 28, the chamber 25, and the passage in the projection 14ᵇ. After the valve 33 is closed the pressure accumulates in the chamber 26, entering through the holes 30ª until of sufficient force to raise the auxiliary valve 23 from its seat and escape through the opening 27, the chamber 25, and the passage in the projection 14ᵇ, thus obviating any tendency toward an explosion. On the other hand, the withdrawal of pressure in the chamber of the base-piece 29 allows the diaphragm 30 to drop and carry the valve 33 away from its seat, so that air can enter by way of the passage in the projection 14ᵇ, the chamber 25, the opening 28, the chamber 26, and the holes 30ª to prevent the formation of a vacuum and remove the liability of collapse. Lugs 38 prevent the lower edge of the cup-shaped piece 35 from entirely closing the opening. Four (more or less) of these lugs are arranged on the bottom of the channel formed by the wall of the base-piece 29 and the ridge 29ª, as will be clearly seen upon reference to Fig. 6. The holes in the diaphragm 30 are large enough for the passage of air, but not so large as to admit a sufficient quantity of water to pass through to interfere with the elevation of said diaphragm and the proper closing of the valve 33. The winged guides 24 and 32 do not fill the openings in which they operate sufficiently to interfere with the adequate passage of the elements through said openings.

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

1. In combination with a chambered shell having a valve-opening, a flexible diaphragm having holes between its center and circumference and connected with a valve, interposed between the chamber in said shell and an expansion-pipe connection.

2. In combination with a chambered shell having a valve-opening, a chambered base-piece, and a flexible diaphragm having holes between its center and circumference, connected with a valve and interposed between the chambers in said shell and base-piece.

3. In combination, a bicompartment-shell having two valve-openings, a perforated flexible diaphragm interposed between one of the compartments in said shell and an expansion-pipe connection, a valve connected with said diaphragm and adapted to close one of said valve-openings, and an auxiliary valve adapted to close the other of said valve-openings.

4. In combination with a range or water system for buildings supplied from a street-main or tank, a shell mounted on an expansion-pipe, and a flexible diaphragm secured by its edges in said shell, said diaphragm having holes between its center and circumference and provided with a central valve adapted to close a valve-opening when under pressure.

5. In combination with a range or water system for buildings supplied from a street-main or tank, a shell mounted on an expansion-pipe, a perforated flexible diaphragm secured by its edges in said shell, said diaphragm provided with a central valve adapted to close a valve-opening when under pressure, and an auxiliary safety-valve normally closing a second valve-opening.

6. In combination with a chambered shell having a valve-opening, a chambered base-piece provided with a water-seal channel, a perforated flexible diaphragm connected with a valve and interposed between the chambers in said shell and base-piece, and a dome attached below said diaphragm and movable therewith, a portion of said dome extending into said water-seal channel, substantially as set forth.

7. In combination with a range or water system for buildings supplied from a street-

main or tank, a shell mounted on an expansion-pipe and provided with a water-seal channel, a perforated flexible diaphragm secured by its edges in said shell and provided with a valve and a dome depending into said water-seal channel, said valve adapted to close a valve-opening when under pressure, substantially as set forth.

8. In combination, a bicompartment-shell having two valve-openings, a chambered base-piece provided with a water-seal channel, a perforated flexible diaphragm interposed between one of the compartments in said shell and the base-piece chamber, a valve connected with said diaphragm and adapted to close one of said valve-openings, a dome attached below said diaphragm and movable therewith, a portion of said dome extending into said water-seal channel, and an auxiliary valve adapted to close the other of said valve-openings, substantially as set forth.

9. In combination with a range or water system for buildings supplied from a street-main or tank, a shell mounted on an expansion-pipe and provided with a water-seal channel, a perforated flexible diaphragm secured by its edges in said shell and provided with a valve and a dome depending into said water-seal channel, said valve adapted to close a valve-opening when under pressure, and an auxiliary safety-valve normally closing a second valve-opening, substantially as set forth.

10. The combination, of a bicompartment-shell having a vent or waste pipe opening leading from one of the shell-compartments, a chambered base-piece, two valve-openings between the shell-compartments, valves for said openings, a weighted lever to normally control one of said valves and a perforated flexible diaphragm to normally control the other, substantially as set forth.

11. In combination with a chambered shell having a fulcrum-hub mounted thereon, and a weighted lever pivoted to said hub, a flexible diaphragm held by adjacent surfaces of said shell and hub, and valve-stem members attached to said diaphragm, said lever bearing on the valve-stem, substantially as set forth.

12. In combination, a chambered shell having a valve-opening, a fulcrum-hub mounted on said shell, a flexible diaphragm held by adjacent surfaces of said shell and hub, a valve, and valve-stem members attached to said diaphragm and normally under control of a weighted lever, substantially as set forth.

13. In combination with a chambered shell having a valve-opening with grooved walls, a valve provided with a winged guide adapted to register with the valve-opening grooves and reciprocate therein, substantially as described.

14. In combination with a valve mechanism, a flexible diaphragm held firmly by its edges and slack in the center, capable of intermediate movement, and a valve connected therewith, said diaphragm having holes through the same between its center and circumference, substantially as shown.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES C. CONNELL.

Witnesses:

WILLIAM G. LOOMIS,

CARL B. MARTIN.