Sept. 1, 1931. J. MEINKEN ET AL 1,821,189

RELIEF VALVE

Filed June 3, 1927

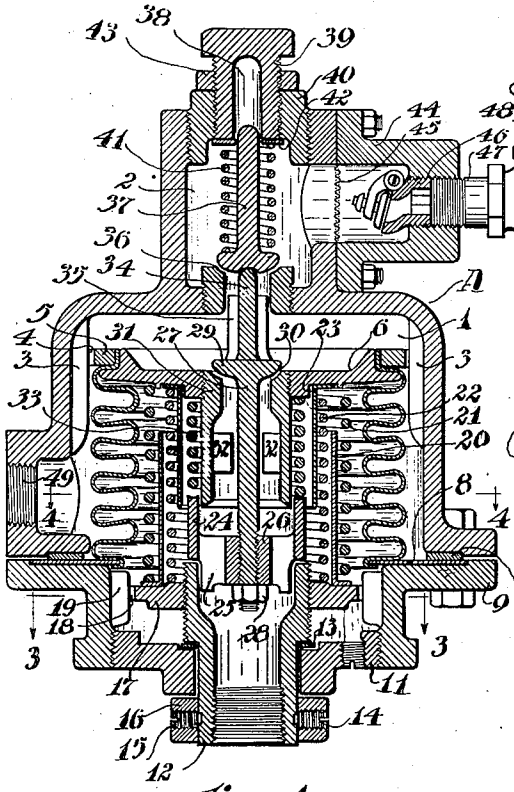

Fig. 1

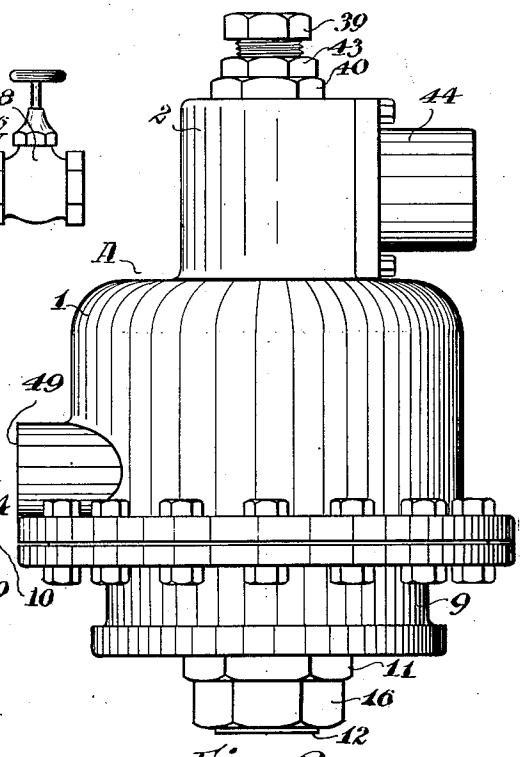

Fig. 2

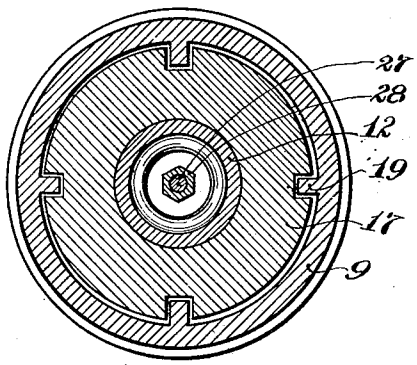

Fig. 3

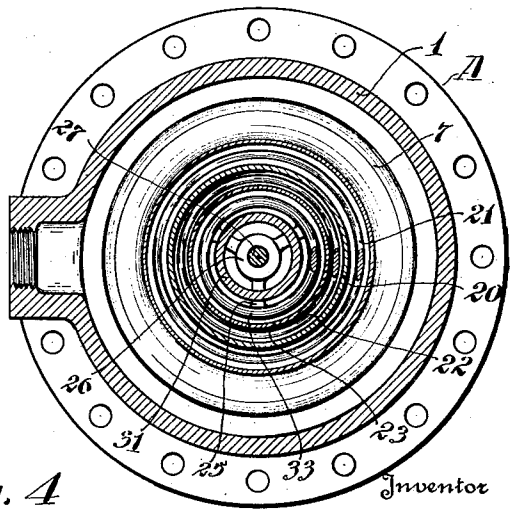

Fig. 4

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UNITED STATES PATENT OFFICE

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RELIEF VALVE

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The present invention relates to a safety and supply valve for hot water boilers.

An object of the present invention is to make a simple and safe supply and relief valve.

In order to attain this object, there is provided, in accordance with one feature of the invention, a chamber having a compressible element mounted therein, said element being associated with supply and relief valves to maintain the pressure in the system with which the device is associated within certain predetermined limits.

These and other features of the invention will be more fully brought out in the following description and the accompanying drawings, wherein:

Figure 1 is a view in vertical transverse section through the center of a device made in accordance with the present invention.

Figure 2 is a view in side elevation of the mechanism shown in Figure 1.

Figure 3 is a sectional view on the line 3—3 of Figure 1; and

Figure 4 is a sectional view on the line 4—4 of Figure 1.

Referring to the drawings in detail, a housing A comprises an enlarged lower chamber 1 and a reduced upper chamber 2. Extending inwardly from the walls of the lower chamber are a plurality of guide fins 3 which ride in notches in the periphery of an annular member 5, which is associated with a plate 6 to grip the upper edge of a compressible bellows 7 of bronze, or other suitable material, in a well known manner, the lower edge of said bellows being secured to a plate 8. The plate 8 is held between the lower edge of the housing 1 and a bottom closure member 9, a gasket 10 being inserted between the housing 1 and the plate 8 to form a tight joint between these two members. Threadly inserted in the lower end of the bottom closure member 9 is a plug 11 having a central opening therein in which a support member 12 is mounted. The support member 12 rests upon a washer 13 which may be of bronze and has secured to the lower end thereof by means of set screws 14 and 15 a hexagonal member 16 by means of which the support member 12 may be rotated to raise or lower a spring supporting plate 17 which is threadly mounted on the support member 12 and has notches 18 in the periphery thereof which engage fins 19 extending inwardly from the side walls of the bottom closure member 11. These fins 19 hold the plate 17 against rotation so that by rotating the support member 12 by means of the hexagonal member 16 the plate 17 may be raised or lowered by the action of the threads upon the upper portion of the support member 12. Resting upon the upper surface of the plate 17 is a tubular member 20 having a flange extending outwardly from the lower edge thereof upon which rests a coil spring 21. Within the tubular member 20 is mounted a second coil spring 22, the upper end of which rests upon an outwardly turned flange at the upper end of a tubular member 23 which rests against the bottom surface of the upper plate 6. Normally resting upon the top edge of the support member 12 is a valve support member comprising a cylindrical rim 24 connected by means of fins 25 to a central portion 26 in which is threadedly inserted the stem of a valve 27 which is securely held in position thereon by means of a lock nut 28 resting against the lower edge of the central portion 26. The upper end of the valve comprises the valve proper 29 which co-operates with a seat 30 formed upon the upper end of a tubular member 31 which is threadedly mounted centrally of the top plate 6. Guide fins 32 extend inwardly from the walls of the tubular member 31 to prevent lateral displacement of the valve stem. A spring 33 surrounds the tubular member 31, the lower end of said spring resting upon the cylindrical portion 24 of the valve support member and the upper end thereof resting against the lower surface of the plate 6. The spring is held in compression between these members and acts to force the valve downwardly and the plate 6 upwardly to close the valve upon its seat.

Extending upwardly from the upper surface of the valve proper is a secondary valve operating pin 34 surrounded by a plurality of guide fins 35 to retain the secondary valve operating fin within the opening beneath a

valve seat 36 which is threadedly inserted in the bottom of the small upper chamber 2 of the housing. A secondary valve 37 is mounted to seat upon the valve seat 36, the stem of said valve being arranged to lie in a recess 38 provided therefor in a threaded member 39 which is inserted centrally of a secondary threaded member 40 which forms a closure for the top of the smaller chamber 2. This secondary threaded member 40 is provided to facilitate removing the valve seat 36 for inspection or replacement. A compression spring 41 has one end thereof resting upon the upper surface of the secondary valve 37 and the upper end of said spring resting against a washer 42 which in turn rests against the lower surface of the threaded valve guide member 39. A lock nut 43 is provided about the threaded valve guide member 39 to secure it in position. A check valve housing 44 is secured to the side of the small chamber 2 and is in open communication therewith, a screen 45 being inserted between the chamber 2 and the check valve housing to prevent the passage of solid matter into the valve. A check valve 46 of a conventional type is threadedly inserted in the interior of the check valve housing, while a nipple 47 connects the check valve to a source of water supply through a control valve 48.

The device is intended to be adjusted at the factory for predetermined maximum and minimum boiler pressures and for use with predetermined water supply pressures. The valve 37 is retained on its seat by the pressure of the spring 41 and the pressure of the water from the source of water supply upon the upper surface of the valve 37. The plate 6 is urged upwardly by the coil springs 21 and 22, while the central coil spring 33 acts to force the plate 6 and the valve 27 in opposite directions to cause a closing of the valve 27. For the purpose of illustration, arbitrary forces may be assigned to the springs and the areas of the pressure controlled surfaces may also be arbitrarily assigned. The effective area of the plate 6 may be considered as ten square inches. Pressure exerted by the springs 21 and 22 is sufficient to exactly offset the pressure on this plate at twenty-four pounds per square inch, or a total of two hundred and forty pounds. The spring 33 may be considered to have a tension of forty pounds, while the spring 41, in combination with the water pressure on the valve 37 when seated, may be considered as having a total of forty pounds pressure. The water pressure from the source of supply through the check valve 46 and in the reduced upper chamber 2 may be anything over the minimum allowed pressure within the upper chamber 2, which minimum pressure may be considered as twenty pounds, at which pressure the valve 37 is intended to open, while the maximum pressure within the boiler above which pressure the relief valve 27 is intended to open, may be considered as twenty-eight pounds. With these values, the operation of the valve would be as follows:

At twenty-four pounds boiler pressure the upward pressure upon the plate 6 by the springs 21 and 22, which is two hundred and forty pounds, would be exactly counterbalanced by the downward pressure on the plate 6, the effective area of which is ten square inches at twenty-four pounds pressure per square inch. There would be no downward pressure of the rim 24 upon the valve support member 12 and the spring 33 acting upon the rim 24 would exert an upward pressure on the plate 6 of forty pounds to close the valve 27. There would be no upward pressure exerted upon the valve 37 which would be held closed by the combined pressure of the spring 41 and the water pressure within the chamber 2 on the upper surface of the valve 37, which combined pressure would be, as previously stated, forty pounds. Upon decreasing the pressure within the chamber 1 to twenty pounds, a reduction of four pounds per square inch, the total downward pressure on the plate 6 would be reduced forty pounds, thus making the upward pressure of the springs 21 and 22 forty pounds in excess of the downward pressure on the plate 6. At this point the upward pressure upon the valve 37 by means of the valve operating extension 34 would be exactly counter-balanced by the forty pounds downward pressure of the spring 41 and water pressure on the valve 37. Any decrease of the pressure within the chamber 1 below twenty pounds per square inch would overcome the forces holding the valve 37 upon its seat and raise the valve, whereupon water would be admitted to the housing 1 and thence to the boiler past the valve 37. Should the pressure in the water supply system through any cause fall below twenty pounds, upon opening of the valve 37 the check valve 46 would close and prevent the water from escaping from the boiler. While the valve is opened the water pressure on the under side of the valve would counter-balance the downward water pressure on the valve 37. The pressure of spring 41 alone would be somewhat less than forty pounds, so that the pressure in the boiler would necessarily have to be raised somewhat above the twenty-pound opening pressure before the valve 37 would again seat. The downward pressure of the valve 37 during the raising of this valve upon the valve operating extension 34 of the valve 27 would act to force the valve 27 more securely upon its seat, insuring a tight closing of the valve 27. When the pressure within the chamber 1 increases to a point where the downward pressure on the plate 6 will be less than the tension of the spring 41, the valve 37 will close. Upon increasing the boiler pressure,

as by heating, to a boiler pressure of twenty-four pounds, the forces upon the top of the plate 6 will again exactly balance the combined upward forces of the springs 21 and 22. The rim 24 will then be resting without pressure upon the upper rim of the valve supporting member 12. Upon increasing the pressure upon the plate 6 to twenty-eight pounds above the normal balancing pressure of twenty-four pounds, an additional forty pounds pressure will be exerted downwardly upon the plate 6 which will exactly neutralize the forty pounds upward pressure of the spring 33. Any increase in the boiler pressure above this point will overcome the resistance of the spring 33 and open the valve 27 to permit the escape of water from the chamber 1 to the drain through the valve support member 12. When the pressure is reduced by the escape of water from the boiler through the valve 27 to twenty-eight pounds or less, the forty pound pressure of the spring 33 will overcome the downwardly acting force of the plate 6 and again close the valve 27. To increase the tension of the spring 41 to cause the valve 37 to open at a lower boiler pressure, the member 39 may be screwed down to compress the spring 41. To cause the valve 37 to open at a higher boiler pressure the tension of the spring 41 may be decreased by unscrewing the member 39. To increase or decrease the pressure exerted by the springs 21 and 22 the valve support member 12 may be rotated by means of the hexagonal member 16 to raise or lower the spring supporting plate 17. By increasing the upward pressure upon the plate 6 the pressure required to open the valve 27 will be increased, while by decreasing the upward pressure upon this plate the pressure required to open the valve 27 will be decreased.

Should the bellows 7 be punctured, or through any other cause should water be permitted to enter the interior of the bellows by any means except through the normal operation of the release valve 27, it will not endanger the boiler, as would be the case if the valve were rendered entirely inoperative by such failure, since, upon such failure, the escape of water or steam from the boiler would reduce the boiler pressure and the springs 21 and 22 would drive the plate 6 upward, opening the secondary valve 37 and permitting cold water to enter the boiler. The excess water or steam would pass through the bellows and into the drain through the member 12. This would leave the secondary valve 37 open, which would insure a supply of water to the boiler, even though most of the water so admitted would flow through the break in the bellows and thence to the drain.

By elevating the point of discharge of the drain pipe, as by connecting a pipe, not shown, to the member 12 and elevating the discharge end of said pipe by extending it upwardly to a higher point as to a flush tank on a higher floor of the building in which the device is installed, the pressure created by the column of water in said pipe would increase the pressure within the bellows and against the lower surface of the plate 6 which would permit the use of lighter springs 21 and 22 than would be required with the discharge connected at a point lower than that at which the device is installed. Another advantage attained by so connecting the overflow pipe to discharge at a higher elevation lies in the fact that in case of emergency where steam is formed in the boiler the column of water would be lightened by the presence of steam bubbles, thus reducing the internal pressure on the bellows and permitting a wider opening of the relief valve until the steam had been discharged.

We claim:

1. A combined pressure regulating and relief valve, comprising a two compartment chamber, a valve mounted between said compartments, a spring mounted to normally close said valve, a diaphragm mounted in said second compartment and having a valve opening in alinement with said first valve, a valve mounted in said valve opening, a projection from said second valve toward said first valve to open said first valve on a predetermined movement of said diaphragm, an adjustable valve stop mounted to limit the movement of said second valve, spring means mounted between said second valve and said diaphragm, an adjustable spring supporting member threadedly mounted on a rotatable member mounted in said chamber, spring means mounted on said adjustable spring supporting member and engaging said diaphragm to exert pressure thereon.

2. A combined pressure regulating and relief valve, comprising a two compartment chamber having a valve opening therebetween, a valve mounted in said valve opening, a spring mounted to normally close said valve, a rigid plate positioned in one of said chambers, said plate having a bellows skirt hermetically sealed to the periphery of said plate and to the walls of said compartment, a drain opening in said compartment centrally of said bellows, a tubular support member mounted for free rotation within said opening, a spring support threadedly mounted on said support member, spring means carried by said spring support to engage said plate, a valve mounted within said valve opening in said plate and having a downwardly projecting stem and an upwardly projecting extension toward said first valve, a stop member threadedly connected to the downwardly extending valve stem to be adjustable thereon, said stop member being positioned to be engaged by said support member at a predetermined point, and a spring positioned between the upper

surface of said stop member and said plate.

3. In a combined pressure regulating and relief valve, a chamber, a compressible bellows mounted therein to extend upwardly into the interior thereof, a rigid top plate secured to said bellows and having a valve opening and seat centrally thereof, a valve mounted in said valve opening and having the stem of said valve extending downwardly into the interior of said bellows, an adjustable stop member secured to the lower end of said valve stem, a rotatable member secured in said chamber and positioned to engage said stop member at a predetermined point in its downward movement, a spring support member threadedly connected to said rotatable member for adjustment thereon, a spring positioned between the top of said valve stop member and the lower face of the rigid top plate, and spring means supported on said adjustable spring support and engaging the inner surface of said rigid top plate to exert an upward pressure thereon.

4. A combined pressure regulating and relief valve, having a chamber with an inlet opening and an outlet opening therein, a valve mounted in said inlet opening, resilient means normally holding said inlet valve to close said inlet opening, a relief valve mounted in alinement with said inlet valve and having a projection thereon adapted to engage said inlet valve on an upward movement of said relief valve, a lateral projection to the lower end of said relief valve, a freely rotatable sleeve mounted in the lower end of said compartment and having an opening therein through which fluid from said relief valve may be discharged, a spring support member threadedly mounted exteriorly of said sleeve, adapted to be moved longitudinally of said chamber by a rotation of said sleeve, resilient means mounted between said diaphragm and said support member and held in compression between said support member and said diaphragm, and independent spring means operating between said laterally projecting member and the lower end of said valve stem and said diaphragm and held in compression between said laterally extending member and said diaphragm.

In testimony whereof we affix our signatures.

JOHN MEINKEN.
EMIL E. JOHNSON.