J. M. DOUGHERTY & H. C. TABLER.

RELIEF VALVE.

APPLICATION FILED APR. 3, 1916.

1,210,913. Patented Jan. 2, 1917.

Fig. 1

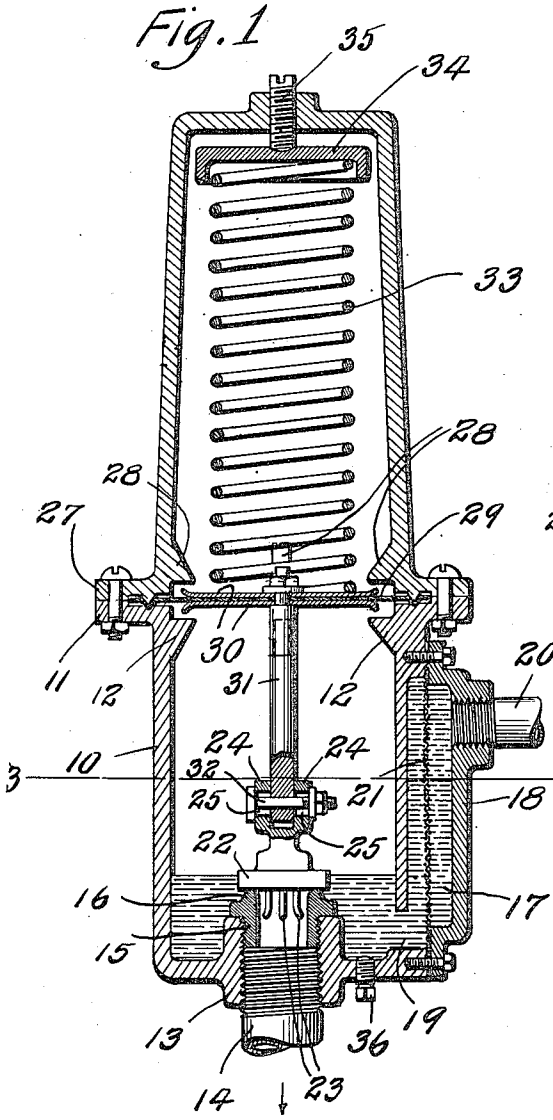


Fig. 2

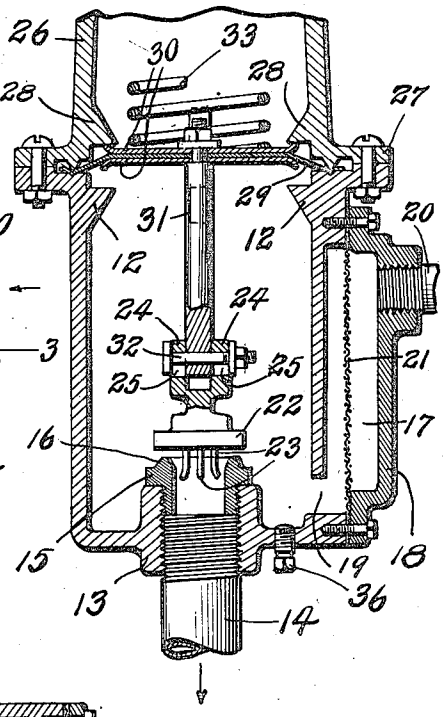
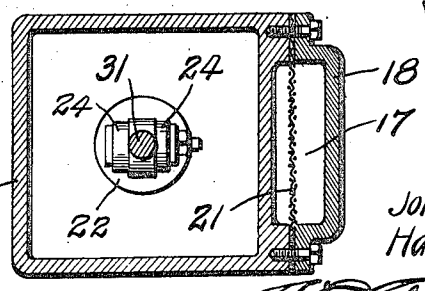


Fig. 3



Inventors
John M. Dougherty
Harry C. Tabler
By [illegible] Atty

UNITED STATES PATENT OFFICE.

JOHN M. DOUGHERTY AND HARRY C. TABLER, OF ST. LOUIS, MISSOURI.

RELIEF-VALVE.

1,210,913. Specification of Letters Patent. Patented Jan. 2, 1917.

Application filed April 3, 1916. Serial No. 88,717.

To all whom it may concern:

Be it known that we, JOHN M. DOUGHERTY and HARRY C. TABLER, citizens of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Relief-Valves, of which the following is a full, clear, and exact description, 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, forming part of this specification.

Our invention relates to new and useful improvements in relief valves of the type generally utilized in connection with hot water heating systems, the principal object of our invention being to provide a comparatively simple, inexpensive and efficient device which is positive in action and which will automatically open to permit the discharge of water and air from the system in the event that the pressure in said system rises to an abnormal degree or beyond a predetermined point.

A further object of our invention is to provide a device wherein the normal pressure within the system is instrumental in maintaining the valve upon its seat and in closed position and further, to utilize the pressure and resiliency of a body of trapped air to actuate certain mechanical devices which in turn unseat the valve to permit the system to relieve itself of excess pressure.

Further objects of our invention are to provide a device having a spring-pressed diaphragm which forms one of the walls of the trapped air chamber; to mount the valve upon its stem or carrier so that it has independent movement relative to said stem, thus permitting it to be seated by the pressure within the system independently of the action of the spring-pressed diaphragm; to provide a strainer in the path of travel of the water toward the valve, thereby preventing sediment and the like from entering the valve chamber and accumulating upon the valve and its seat; to provide an economical device which does not require the use of mercury or the like, and further, to provide a relief valve or pressure-controller which does not require recharging or any attention after having been properly installed for use.

With the foregoing and other objects in view, our invention relates to certain novel features of construction and arrangement of parts, hereinafter more fully described, claimed and illustrated in the accompanying drawings, in which—

Figure 1 is a vertical sectional view taken through the center of a device of our improved construction and showing the valve in closed position upon its seat. Fig. 2 is a sectional view similar to Fig. 1 and showing the valve in unseated or open position. Fig. 3 is a horizontal section taken on the line 3—3 of Fig. 1.

In the drawings which illustrate the preferred construction of the valve, 10 designates a housing, the same being provided at its upper end with an integral outwardly projecting flange 11 and with a series of inwardly projecting lugs 12. These lugs, as shown, occupy positions a short distance below the top of the housing.

Formed integral with the bottom of the housing is a collar 13 into which is tapped a discharge pipe 14 and removably seated in the upper end of said collar is an annular valve member 15, the same being provided at its upper end with an annular upwardly projecting rib 16 which serves as a valve seat. Fixed to one of the walls of the housing 10 and spaced apart therefrom to form a vertically disposed chamber 17 is a cap plate 18 and the lower portion of this wall is cut away to form an opening 19 which establishes communication between the chamber 17 and the chamber within the housing 10. Tapped into the upper portion of plate 18 and discharging into the upper portion of chamber 17 is a pipe 20. Arranged within chamber 17 between the discharge end of pipe 20 and opening 19 is a strainer 21, preferably formed of wire netting of comparatively small mesh.

A disk valve 22, preferably of metal, is adapted to engage on the seat formed by the annular ring 16 and depending from the underside of said valve is a series of fingers 23 which serve as guides to correctly position said valve upon its seat. Formed integral with or fixed to the valve is a pair of upwardly projecting ears 24, in which are formed short vertically disposed slots 25.

A housing 26 closed at its upper end is provided with a flange 27 at its lower end, said flange resting upon and being fixed to flange 11 in any suitable manner. Formed integral with the lower portion of this hous-

ing and in a plane slightly above the lower edge thereof is a series of inwardly projecting lugs 28. Interposed between the flanges 11 and 27 is the edge of a metal diaphragm 29 and applied to the upper and lower faces thereof are metal disks 30, the edges of which are slightly curved with respect to the planes occupied by the bodies of said disks and said curved edges occupy positions between the diaphragm 29 and the lugs 12 and 28.

Fixed in any suitable manner to the center of the diaphragm 29 and the centers of the plates 30 is the upper end of a rod 31, the lower end of which is positioned between the ears 24 and seated in the lower end of said rod is a transversely disposed pin 32 which passes through the slots 25. Thus, the valve 22 is connected to the lower end of rod 31 so that it has a slight vertical movement independently of said rod, the length of such movement being governed by the length of the slots 24.

Positioned within housing 26 with its lower end bearing on the upper one of plates 30 is a compression spring 33. The upper end of this spring bears against the underside of a plate 34, said plate bearing against an adjusting screw 35, which latter is seated in the upper end of housing 26. This screw provides means for adjusting the tension of spring 33. A drain opening is formed in the bottom of the housing, said opening being normally closed by a screw plug 36.

Where our improved relief valve is utilized in connection with a hot water heating system, pipe 20 is connected to the main return pipe of said system, preferably at a point adjacent to the boiler and water from the system enters pipe 20, fills chamber 17, and passes from thence into the lower portion of the valve chamber within housing 10, thus trapping air in said last mentioned chamber. This trapped air is compressed to a certain degree by the normal pressure maintained within the system to which the valve is connected, and this air pressure is exerted downward on disk valve 22, thereby normally maintaining the same upon its seat 16 and closing the passageway into discharge pipe 14.

As hereinbefore stated, valve 22 is connected to rod 31 so as to have a slight vertical movement independently thereof, and thus the valve will maintain its closed position upon seat 16, regardless of the position of rod 31 and diaphragm 29 as long as the latter is subjected to normal pressure from the air within the valve chamber, and which latter, of course, is dependent upon the normal pressure in the system.

In the event of the development of excess or abnormal pressure within the system, such excess pressure will be transmitted through the water within chamber 17 and within the lower portion of the valve chamber, thus further compressing the air trapped within the valve chamber and this increased pressure acting against the underside of diaphragm 29 will cause the same to flex upwardly as illustrated in Fig. 2, and in so doing the resistance offered by compression spring 33 is overcome. As the diaphragm is thus moved upward, rod 31 will likewise be drawn upward, but during the first part of such upward movement the valve 22 will not be unseated by reason of the fact that the pin 32 carried by rod 31 is traveling through the upper portions of the slots 25. As diaphragm 30 and rod 31 continue to move upward under the increasing pressure, valve 22 will be drawn upward, thus entering the passageway through valve member 15 and permitting the excess pressure to discharge through pipe 14. When the excess pressure has been thus relieved, diaphragm 29 will move downward to its normal position and valve 22 will be reseated under the normal pressure of the air trapped within the valve chamber. The flexing movement of diaphragm 29 is limited in both directions by the lugs 12 and 28, the same serving as stops against which the curved edges of the plates 30 are adapted to engage.

The tension of spring 33 is regulated by adjusting the position of screw 35 and while there is little or no pressure within the air chamber beneath the diaphragm, said spring forces the diaphragm downward until the edge of the lower plate 30 rests on lugs 12. When so positioned, the valve 22 still has a certain amount of vertical movement independent of rod 31 and thus at no time does spring 33 act to force valve 22 to its seat, for, as heretofore, stated, said valve is seated and retained on its seat solely by the pressure of the trapped air. Under normal working conditions the pressure of the trapped air forces the diaphragm upward so that it occupies an intermediate position between the seats of lugs 12 and 28. (See Fig. 1.)

The screen 21 is of extremely fine mesh and serves as a strainer for all water entering the valve chamber, and consequently sediment and fine particles of dirt are prevented from entering the valve chamber and adhering to the valve and valve seat.

The surface area of the diaphragm is several times greater than that of the valve 22, thus precluding any possibility of the device failing to act in the event of the accumulation of increased pressure within the system and within the trapped air chamber.

A relief valve of our improved construction is comparatively simple, can be cheaply manufactured, is automatic in operation, requires no recharging or attention after having been properly installed, and while particularly designed for use in connection with

hot water heating systems, can be advantageously utilized with various forms of apparatus which require the automatic relieving of excess pressure.

It will be readily understood that minor changes in the size, form and construction of the various parts of our improved valve can be made and substituted for those herein shown and described, without departing from the spirit of our invention, the scope of which is set forth in the appended claims.

We claim:

1. The combination with a hot water heating system, of a chamber adapted to receive water from said system, which water traps and compresses air in the upper portion of said chamber, there being an opening in the lower portion of said chamber, a valve normally closing said opening and held in closed position by the normal pressure of air trapped within said chamber, a diaphragm forming one of the walls of the chamber, a rod carried by said diaphragm and having a connection with the valve, whereby the latter can move independently of said rod.

2. The combination with a hot water heating system, of a chamber adapted to receive water from said system, which water traps and compresses air in the upper portion of said chamber, there being an opening in the lower portion of said chamber, a valve normally closing said opening and held in closed position by the normal pressure of air trapped within said chamber, a diaphragm forming one of the walls of the chamber, a rod carried by said diaphragm and having a connection with the valve, whereby the latter can move independently of said rod, and yielding pressure means for resisting the outward movement of the diaphragm.

3. The combination with a hot water heating system, of a chamber adapted to receive water from said system, which water traps and compresses air in the upper portion of said chamber, there being an opening in the lower portion of said chamber, a valve normally closing said opening and held in closed position by the normal pressure of air trapped within said chamber, a diaphragm forming one of the walls of the chamber, a rod carried by said diaphragm and having a connection with the valve, whereby the latter can move independently of said rod, yielding pressure means for resisting the outward movement of the diaphragm, and means for regulating the tension of said yielding pressure means.

4. The combination with a hot water heating system, of a chamber adapted to receive water from said system, which water traps and compresses air within said chamber, a diaphragm forming one of the walls of the chamber, there being an outlet opening in the wall of the chamber opposite said diaphragm, a rod carried by said diaphragm, and a valve loosely connected to said rod, which valve is held in position upon its seat by the normal pressure of the trapped air within the housing.

5. The combination with a hot water heating system, of a chamber adapted to receive water from said system, which water traps and compresses air within said chamber, a diaphragm forming one of the walls of the chamber, there being an outlet opening in the wall of the chamber opposite said diaphragm, a rod carried by said diaphragm, and a valve loosely connected to said rod, which valve is held in position upon its seat by the normal pressure of the trapped air within the housing and unseated by the outward movement of the diaphragm and the rod carried thereby.

6. The combination with a hot water heating system, of a chamber adapted to receive water from said system, which water traps and compresses air within said chamber, there being an auxiliary chamber through which the water passes before entering the first mentioned chamber, a strainer within said auxiliary chamber, there being an outlet at the lower end of the first mentioned chamber, a diaphragm forming one of the walls of said chamber, a rod carried by said diaphragm, and a valve having a loose connection with said rod, which valve normally closes said outlet opening.

7. The combination with a hot water heating system, of a chamber adapted to receive water from said system, which water traps and compresses air within said chamber, said chamber being provided with an outlet opening, a diaphragm associated with the chamber so as to be actuated by the air pressure therein, a valve connected to said diaphragm and independently movable for a limited distance with respect thereto, which valve normally closes the outlet opening in the chamber, and means for limiting the movement of the diaphragm in both directions.

8. The combination with a hot water heating system, of a chamber adapted to receive water from said system, which water traps and compresses air within said chamber, said chamber being provided with an outlet opening, a diaphragm associated with the chamber so as to be actuated by the air pressure therein, a valve connected to said diaphragm and independently movable for a limited distance with respect thereto, which valve normally closes the outlet opening in the chamber, means for limiting the movement of the diaphragm in both directions, and means for yieldingly resisting the outward movement of said diaphragm.

9. The combination with a hot water heating system, of a chamber adapted to receive water from said system, which water traps and compresses air within said chamber,

said chamber being provided with an outlet opening, a diaphragm associated with the chamber so as to be actuated by the air pressure therein, a valve connected to said diaphragm and independently movable for a limited distance with respect thereto, which valve normally closes the outlet opening in the chamber, means for limiting the movement of the diaphragm in both directions, means for yieldingly resisting the outward movement of said diaphragm, and means for straining the water prior to its entry into the chamber.

10. The combination with a hot water heating system, of a chamber in which air is trapped and compressed by water from said system, said chamber being provided with an outlet opening, a diaphragm associated with the chamber and acted upon by the pressure of the air trapped therein, a rod carried by said diaphragm and a valve directly connected to said rod and adapted to move freely in both directions for a limited distance thereon, which valve normally closes the outlet opening of the chamber.

11. In a device of the class described, a chamber in which air is trapped and compressed, said chamber being provided with an outlet opening, a diaphragm associated with the chamber and acted upon by the pressure of the air trapped therein, yielding pressure means arranged to resist the movement imparted to the diaphragm by the air pressure, a rod connected to said diaphragm, a valve having a pin and slot connection with the lower end of said rod, whereby said valve may move freely in both directions for a limited distance upon said rod, which valve normally closes the outlet opening of the chamber under the influence of the pressure of the air trapped in said chamber, and means against which the diaphragm is adapted to engage, whereby the valve is relieved of the influence of the yielding pressure means.

12. In a pressure controller, a chamber adapted to receive water which traps and compresses air within said chamber, said chamber being provided with an outlet opening, a diaphragm associated with the chamber so as to be actuated by the air pressure therein, a rod connected to said diaphragm, a valve having a pin and slot connection with said rod and independently movable for a limited distance with respect thereto, which valve normally closes the outlet opening in the chamber under the influence of the air trapped in the chamber, means for yieldingly resisting the outward movement of the diaphragm, and means for limiting the inward movement of said diaphragm, whereby the valve is relieved of the influence of the yielding resistance means.

13. In a relief valve of the class described, a chamber in which air is trapped and compressed, said chamber having an outlet opening, a diaphragm associated with the chamber and acted upon by the pressure of the air trapped therein, a member carried by said diaphragm, and a valve connected to said member so as to move independently for a limited distance with respect to said member, which valve normally closes the outlet opening from the chamber and is held upon its seat by the pressure of the air trapped within the chamber.

In testimony whereof we hereunto affix our signatures in the presence of two witnesses, this 31st day of March, 1916.

JOHN M. DOUGHERTY.
HARRY C. TABLER.

Witnesses:
M. P. SMITH,
M. A. HANDEL.