

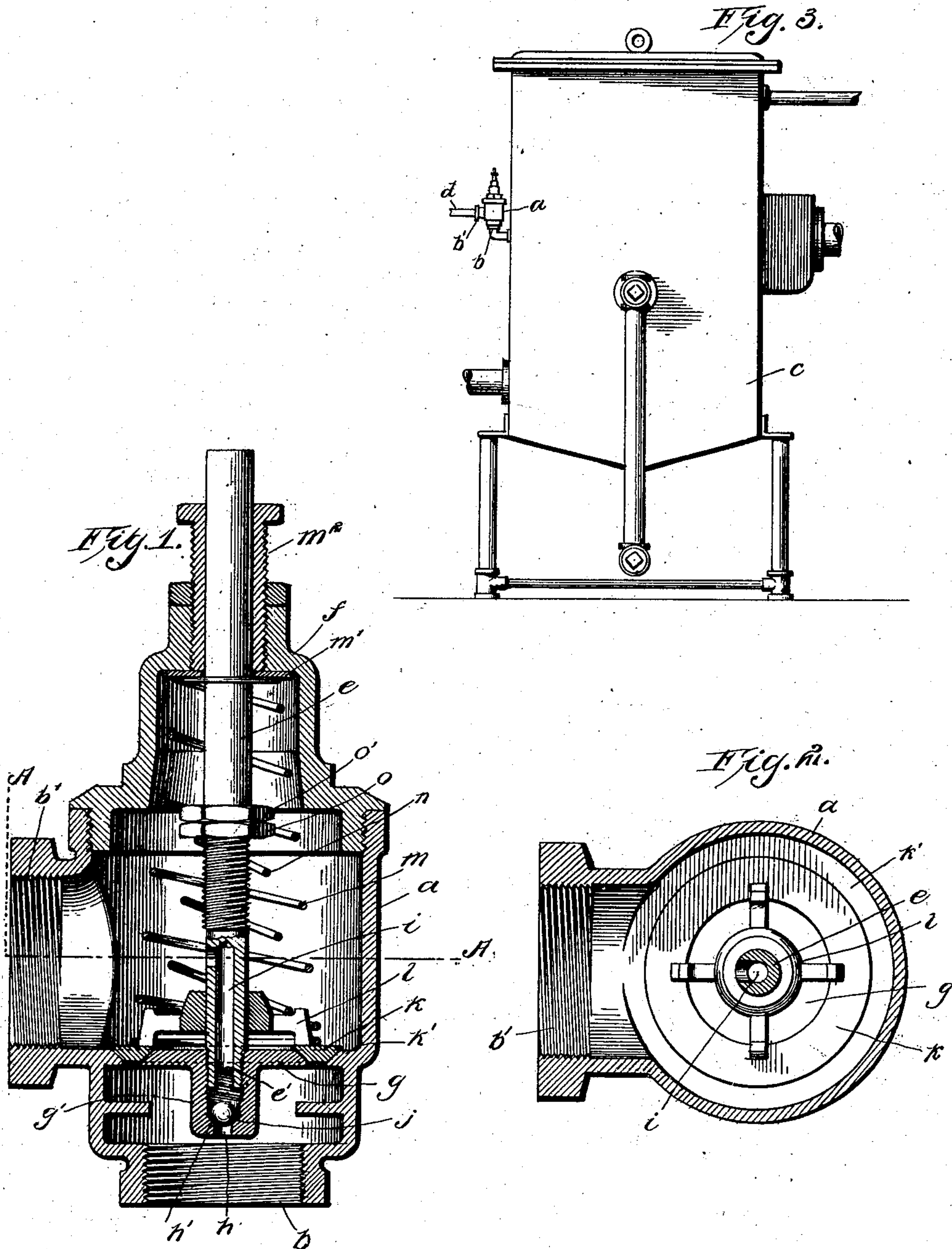
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Patented Feb. 18, 1902.

M. P. OSBOURN.  
AIR RELIEF VALVE.

(Application filed Sept. 11, 1901.)

(No Model.)



Witnesses:

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# UNITED STATES PATENT OFFICE.

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## AIR-RELIEF VALVE.

SPECIFICATION forming part of Letters Patent No. 693,431, dated February 18, 1902.

Application filed September 11, 1901. Serial No. 75,002. (No model.)

*To all whom it may concern:-*

Be it known that I, MILLARD P. OSBOURN, of Camden, county of Camden, State of New Jersey, have invented an Improvement in Air-Relief Valves, of which the following is a specification.

My invention relates to air-relief valves; and it consists of the improvements which are fully set forth in the following specification and are shown in the accompanying drawings.

It is the object of my invention to provide an air-relief valve adapted to effect the constant discharge of air from the pipe or apparatus with which it is connected under changing conditions or varying pressures.

In feed-water heaters in which a partial vacuum or low pressure is maintained in the heater by drawing out the air released by the condensation of the steam much difficulty is experienced in effecting the constant discharge of the air from the heater under all conditions and also in preventing the formation of an excessively-low pressure or partial vacuum in the heater.

My invention relates to a triple-acting relief-valve adapted to effect the discharge of the air under normal conditions and without appreciable waste of uncondensed steam, but provided with means to effect a wider opening of the valve when the pressure in the heater increases beyond the normal low pressure desired or when the pressure in the heater falls below the normal.

In the drawings, Figure 1 is a vertical sectional view of an air-relief valve embodying my invention. Fig. 2 is a horizontal section of the same on the line A A of Fig. 1; and Fig. 3 is a side elevation of a feed-water heater, showing the application of my valve thereto.

The valve-body *a* is provided with two nipples *b b'*, adapted to be connected, respectively, with the heater *c* or device to be relieved of air and with a pipe *d*, leading to a pump or other exhausting apparatus.

*e* is a movable stem extending through the valve-body and preferably guided in the cap or bonnet *f*, through which it may project, as shown. This stem carries a valve-piece *g*, having an air passage-way *h* communicating with a passage-way *i* in the stem leading to

the outlet-nipple *b'*. The valve-piece *g* is provided with a check-valve *j*, controlling the air passage-way *h*. As shown, the valve-piece *g* is provided with a boss *g'*, which is perforated to form the air passage-way *h* and is enlarged on the interior to form a seat *h'* and space for the check or ball valve *j*.

The check or ball valve *j* is so arranged that when lifted from the seat *h'* by an excess of pressure on the inlet side leading to the heater *c* or other device it will open the air passage-way *h i* to the outlet *b'*. As shown, the valve-piece *g* is threaded on the end of the stem *e*, which is notched, as at *e'*, so that the ball *j* may be lifted into contact with the end of the stem *e* without sealing the air passage-way *i*.

Between the valve-piece *g* and the body *a* is a second valve-piece *k*, movable independently of the valve-piece *g*. As shown, this valve-piece *k* consists of a ring encircling the valve-piece *g* and closing the annular space between it and an annular flange *k'* within the body. This valve-piece *k* is further shown carried by a spider-frame *l*, guided and movable upon the stem *e*.

*m* is a spring bearing on the valve-piece *k* and acting to normally retain it closed. As shown, this spring bears at one end on the valve-piece *k* and at the other end against a washer *m'* within the bonnet *f*, controlled by an adjustable thimble *m<sup>2</sup>* in the bonnet. By adjusting the thimble *m<sup>2</sup>* the tension of the spring *m* may be adjusted.

*n* is a spring between the movable stem *e* and the valve-piece *k*. As shown, this spring bears at one end upon the spider-frame *l* and at the other end against an adjustable nut *o*, threaded on the stem *e*, by the adjustment of which the tension of the spring *n* may be regulated. The adjustable nut *o* may be locked in adjusted position by the usual lock-nut *o'*.

Normally the tension of the spring *n* will hold the stem *e* up, with the valve-piece *g* closed against the valve-piece *k*, which is in turn held closed upon the flange *k'* and valve-piece *g* by the spring *m*. The check *j* will be normally closed by gravity. If now there is any slight excess of pressure in the inlet *b*, it will open the check *j* and permit the air to be vented into the pipe *d* through the passage-



way *h i* without disturbing the valve-pieces *g* and *k*. This action will be sufficient under normal conditions to permit the escape of air accumulating at such a rate as would normally take place in a feed-water heater and to maintain the desired normal low pressure therein.

If for any reason the pressure in the heater should become excessive or above the desired normal, this pressure acting on the valve-pieces *g* and *k* will compress the spring *m* and lift the valve-pieces *g* and *k* until the pressure is relieved. If, however, for any reason there should be an excess of pressure in the outlet—*i. e.*, too low a pressure in the heater or inlet side—the excessive pressure acting on the valve-piece *g* will compress the spring *n* and open the valve-piece *g* until the normal pressure is restored. This opening of the valve-piece *g* under these conditions takes place because the spider *l*, against which the lower end of the spring *n* rests, is held against downward movement by its seat *k'*. The small passage-way *h i*, controlled by the valve *j*, is sufficient for the discharge of the air under normal conditions and will not permit the escape of appreciable volumes of uncondensed steam.

The passage-way *h i* constitutes the normal thoroughfare for the discharge of air under normal conditions, while the passage-way formed by the seat-flange *k'* constitutes a larger and normally closed thoroughfare, which is controlled by the double-acting valve devices *g k* to open the larger thoroughfare when the normal differential is destroyed by an excess or deficiency on either side.

While I have shown and described the valve device as applied to a feed-water heater, it is obvious that it may be used with any pipe or apparatus from which the air is to be constantly discharged or in which a uniform pressure is to be maintained.

The details of construction shown may be varied without departing from my invention.

What I claim as new, and desire to secure by Letters Patent, is as follows:

1. A triple-acting air-relief valve consisting of a valve-body having a thoroughfare for the passage of air under normal conditions, and a larger thoroughfare for the passage of air under abnormal conditions, an automatic valve-piece to control said normally acting thoroughfare by the differential pressure, and double-acting valve devices controlled by the differential pressure to control said larger thoroughfare and to open it to the passage of air when the normal differential is destroyed by an excess or deficiency of pressure on either side.

2. An air-relief valve consisting of a valve-body having a thoroughfare for the passage of air under normal conditions and a larger normally closed thoroughfare for the passage of air under abnormal conditions, an automatic valve-piece to control said normally acting thoroughfare by the differential pres-

sure therein, an automatic valve-piece to control said larger thoroughfare and open it upon an excess of pressure on the inlet side, and an automatic valve-piece also controlling said larger thoroughfare and partially opening it on a deficiency of pressure on the inlet side.

3. An air-relief valve consisting of a valve-body having a thoroughfare for the passage of air under normal conditions and a larger normally closed thoroughfare for the passage of air under abnormal conditions, an automatic valve-piece to control said normally acting thoroughfare by the differential pressure therein, an automatic valve-piece to control said larger thoroughfare and open it upon an excess of pressure on the inlet side, and an automatic valve-piece also controlling said larger thoroughfare and partially opening it on a deficiency of pressure on the inlet side, and means to independently adjust the tension of the automatic-valve devices controlling said larger thoroughfare.

4. An air-relief valve, consisting of a valve-body having a normally closed thoroughfare, double-acting automatic valve devices to control said thoroughfare and open it to the passage of air when the normal differential is destroyed by an excess or deficiency of pressure on either side, said valve devices being provided with a small thoroughfare for the passage of air under normal conditions, and an automatic valve-piece for controlling said small thoroughfare by the differential pressure therein.

5. An air-relief valve, consisting of a valve-body having a thoroughfare, two valve-pieces each partially closing said thoroughfare and controlled by the differential pressure therein to partially open said thoroughfare respectively when there is an excess or deficiency of pressure on the inlet side, said valve being further provided with a small thoroughfare for the passage of air under normal conditions, and an automatic valve-piece to control said small thoroughfare by the differential pressure therein.

6. An air-relief valve, consisting of a valve-body having a thoroughfare, two valve-pieces each partially closing said thoroughfare and controlled by the differential pressure therein to partially open said thoroughfare respectively when there is an excess or deficiency of pressure on the inlet side, said valve being further provided with a small thoroughfare for the passage of air under normal conditions, and an automatic valve-piece to control said small thoroughfare by the differential pressure therein, and means to independently control the tension of said valve-pieces which control said normally closed thoroughfare.

7. An air-relief valve consisting of a valve-body having a thoroughfare, a valve-piece partially closing said thoroughfare and controlled by the differential pressure therein to open when there is an excess of pressure on the inlet side, a second valve-piece normally closing the remaining portion of said thor-



oughfare and controlled by the differential pressure therein to open when there is a deficiency of pressure on the inlet side and provided with a small normally acting thoroughfare for the passage of air when said valve-pieces are closed, and an automatic valve-piece to control said small thoroughfare by the differential pressure therein.

8. An air-relief valve consisting of a valve-body having a thoroughfare, the valve-piece *k* opening toward the discharge side and partially closing said thoroughfare, the valve-piece *g* closing the remaining portion of said thoroughfare and opening toward the inlet side, said piece *g* being provided with a small thoroughfare for the normal escape of air, and an automatic valve to control said small thoroughfare by the differential pressure therein.

9. An air-relief valve consisting of a valve-body having a thoroughfare, the valve-piece *k* opening toward the discharge side and partially closing said thoroughfare, a spring *m* normally retaining said piece *k* closed, the valve-piece *g* closing the remaining portion of said thoroughfare and opening toward the inlet side, said piece *g* being provided with a small thoroughfare for the normal escape of air, the spring *n* normally retaining said piece *g* closed, and an automatic valve to control said small thoroughfare by the differential pressure therein.

10. An air-relief valve consisting of a valve-body having a thoroughfare, the valve-piece *k* opening toward the discharge side and partially closing said thoroughfare, the valve-piece *g* closing the remaining portion of said thoroughfare and opening toward the inlet side, said piece *g* being provided with a small thoroughfare for the normal escape of air, the movable stem *e* carried by said piece *g*, the spring *n* between the stem *e* and the valve-piece *k*, and an automatic valve to control said small thoroughfare by the differential pressure therein.

11. An air-relief valve consisting of a valve-body having a thoroughfare, a movable stem

within said valve-body, a valve-piece carried by said stem and partially closing said thoroughfare, a second valve-piece closing the remainder of said thoroughfare, a spring between said stem and the second valve-piece, said valve being provided with a small normally open thoroughfare for the passage of air when said valve-pieces are closed, and an automatic valve-piece to control said small thoroughfare by the differential pressure therein.

12. An air-relief valve consisting of a valve-body having a thoroughfare, a movable stem within said valve-body, a valve-piece carried by said stem and partially closing said thoroughfare, a second valve-piece closing the remainder of said thoroughfare, a spring between said stem and the second valve-piece, said valve being provided with a small normally open thoroughfare for the passage of air when said valve-pieces are closed, and an automatic valve-piece to control said small thoroughfare by the differential pressure therein, a spring *m* bearing at one end upon the second-mentioned valve-piece, and an adjustable thimble *m*<sup>2</sup> carried by the valve-body and bearing on the other end of said spring.

13. An air-relief valve consisting of a valve-body having a thoroughfare, an annular valve-piece *k* fitting within and partially closing said thoroughfare, a spring *m* bearing on said valve-piece *k*, a valve-piece *g* fitting within the annular piece *k*, the movable stem *e* carrying said piece *k* and the stem *e*, said valve-piece being provided with a small thoroughfare for the passage of air when said pieces *g* and *k* are closed and an automatic valve-piece *j* to control said small thoroughfare by the differential therein.

In testimony of which invention I have hereunto set my hand.

MILLARD P. OSBOURN.

Witnesses:

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F. JOS. MILLER.