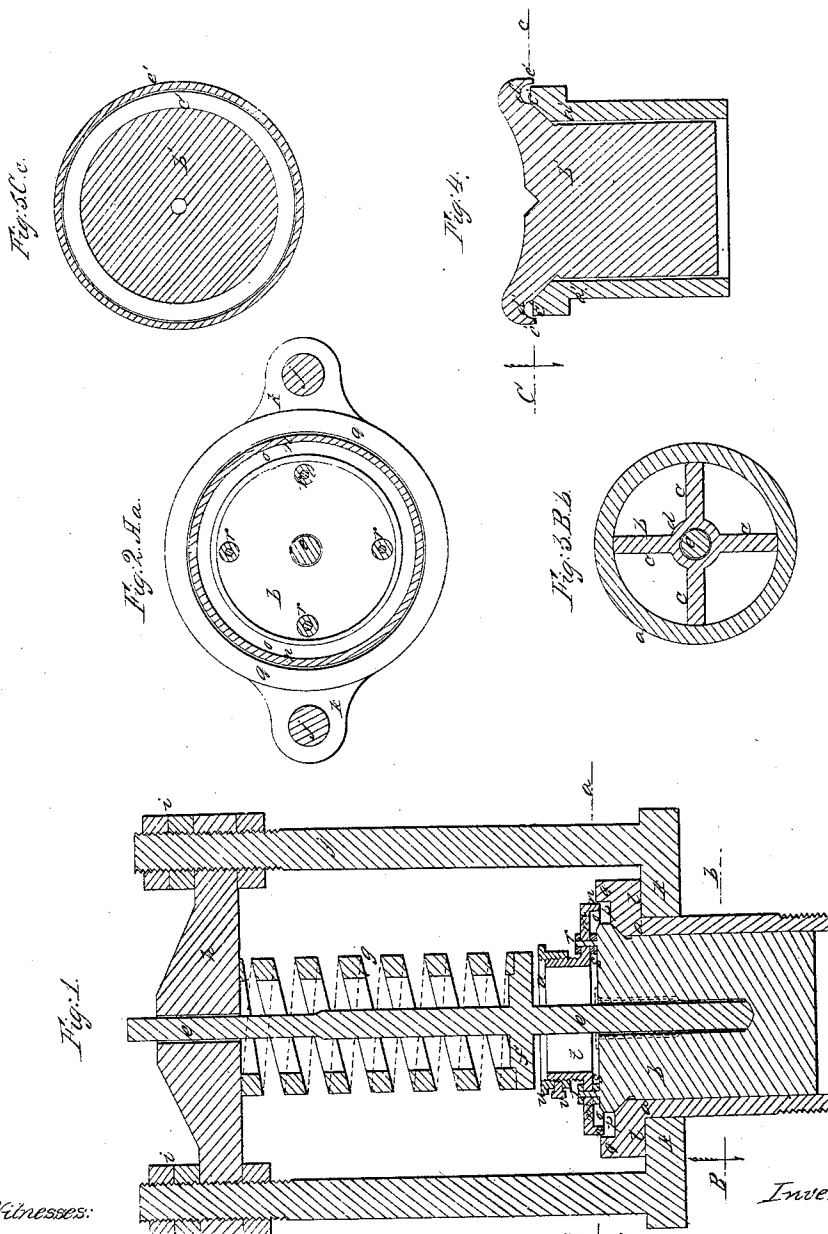


G. W. RICHARDSON.
STEAM SAFETY VALVE.

No. 85,963.

Patented Jan. 19, 1869.



Witnesses:

J. J. Tillinghast
W. H. Prior

Inventor:

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United States Patent Office.

GEORGE WILLIAM RICHARDSON, OF TROY, NEW YORK.

Letters Patent No. 85,963, dated January 19, 1869.

IMPROVEMENT IN STEAM SAFETY-VALVES.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, GEORGE WILLIAM RICHARDSON, of Troy, in the State of New York, have invented certain new and useful Improvements in Safety-Valves for Steam-Boilers or Generators; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a vertical section of the safety-valve and its connections, taken in the plane of the axis of the valve-stem;

Figure 2, a horizontal section, taken in the plane of the line A *a* of fig 1; and

Figure 3, another horizontal section, at the line B *b* of fig. 1.

Figure 4 is a vertical section, taken in the plane of the axis of the valve, representing a modification of my said invention, and

Figure 5, a horizontal section thereof, taken in the plane of the line C *c* of fig. 4.

My said invention relates to improvements in the invention described in Letters Patent granted to me, and bearing date the 25th day of September, 1866, which said patented invention relates to a means for providing a more free escape for the steam than could be obtained by safety-valves as constructed prior thereto, and to insure the keeping of the valve open until the pressure of the steam in the boiler or generator falls below the pressure which was required to open it, the said means, so patented, consisting in forming the valve with a surface outside of the ground joint for the escaping steam to act against; the said surface being surrounded by a projecting or overlapping lip, rim, or flanch, leaving a narrow space for the escape of the steam when the valve is opened, but which, although of greater diameter than the valve-seat, by reason of the said lap, presents a less area of opening for the escape of steam than is produced at the valve-seat, so that the steam which escapes through the area between the valve, shall exert pressure against the said surrounding surface, and thereby not only open the valve completely, but hold it up until the pressure of the steam in the boiler falls below the pressure by which the valve was opened; and one part of my present invention relates to a means for regulating or adjusting the area of the aperture for the escape of the steam after acting on the said surface outside of the valve-seat, so that the valve may be set to close at any desired pressure below the pressure which will open it; and this part of my invention consists in making the aperture or apertures for the escape of the steam, after it has acted on the said surface outside of the valve-seat, adjustable; and

My said invention also relates to means for preventing the guides and stem of a valve controlled by a spring from binding, and thereby impeding the move-

ments of the valve; and this part of my said invention consists in making the pintle or stem, which receives the tension of the spring, bear on the valve, so far below the plane of the valve-seat as that the force of the spring shall always be communicated to the valve in the direction of its axis.

I will first describe the preferred mode of application of my said invention, as represented in Figures 1, 2, and 3, of the accompanying drawings.

In the said figures, *a* represents the valve-seat, which is to be attached to a steam-boiler or generator in the usual or any other suitable manner, and which is formed, in the usual manner, with a bevelled seat for the valve *b*, fitted thereto by what is well known as a ground joint.

The valve is formed with wings, *c*, in the usual manner, properly fitted to the cylindrical bore of the valve-seat, to act as guides. It is cast, or otherwise formed, with an enlargement, *d*, at the junction of the wings, and extending down about one-third of the way from the lower end of the wings, so that a central hole may be drilled therein, to receive a rod or stem, *e*, the lower end of which is suitably formed, to rest as a pivot on the centre of the bottom of the said hole, so that no portion of the rod, which is of less diameter than the said hole, shall touch to make friction.

A short distance above the valve, the said rod *e* is formed with a flat and circular disk-like projection, *f*, on which bears the lower end of a helical spring *g*, that surrounds the rod without touching.

And this spring is held down, to make the required pressure on the valve, by a cross-head, *h*, held in place by nuts *i*, tapped on the upper ends of two rods, *j*, from a plate, *k*, below a flanch, *l*, of the valve-seat. The upper end of the valve-rod or stem *e* plays in a central hole in the cross-head *h*, without touching.

By reason of the spring *g* bearing on the disk of the rod *e*, the lower end of which bears centrally on the valve, at a considerable distance below the bevelled seat, it results that the valve, when moving up and down, cannot deviate from a true line, and that neither of the wings can be made to chafe or bind in the bore of the valve-seat; and it follows, also, that the valve-rod, when once placed centrally in the hole in which it plays in the cross-head *h*, will move up and down without touching.

It is well known that safety-valves, as heretofore made, frequently fail to open when the steam goes beyond the pressure to which it is loaded, because of undue friction and binding of the parts, and this is effectually prevented by the arrangement hereinabove described.

When used on locomotive-boilers of coal-burning engines, or other places where ashes, smoke, dust, &c., accumulate, to prevent such impurities from getting into the hole in the valve, in which the valve-rod or stem rests, the said rod may be provided with a washer

or a sleeve, having a flanch at the upper end resting on the upper surface of the valve, as represented by *rcd* lines in fig. 1.

It is desirable that so soon as the pressure of the steam in the boiler or generator reaches the pressure at which it should be relieved, the safety-valve should open wide for the free escape of steam, and that the valve should remain open until the pressure in the boiler is reduced below the pressure by which the valve was opened, and that it should be so organized that the engineer may be able to adjust it so that it will close at any desired number of pounds' pressure below the pressure at which it was opened. To accomplish these results was the main object of my said invention.

To the upper surface of the valve I secure a cap-plate or annulus, *m*, formed with a downward-projecting flanch, *n*, at its outer periphery, leaving an annular space, *o*, all around, between the outer periphery of the valve and the inner periphery of the flanch *n* of the said cap. And the upper surface of the valve-seat *a* is extended all-around, a little beyond the outer periphery of the flanch *n* of the cap, leaving an annular surface, *p*, surrounded by an upward-projecting rim, *q*, the plane of the upper edge of which, when the valve is closed, extends a short distance above the plane of the lower edge of the flanch *n* of the cap.

The said cap-plate, *m*, is connected with the top of the valve by studs *r r*, or cast with it, in such manner as to leave an open space, *s*, between the two for the passage of steam to the central aperture *t* in the cap, through which steam can escape when the valve is lifted from its seat. This central aperture is surrounded by a projecting cylindrical flanch, threaded on the outside, to which is fitted a threaded ring, *u*, that can be turned up or down, to any desired elevation, and there secured by a set-screw, *v*.

The disk-like projection *f*, on the valve-rod or stem *e*, extends over the said central aperture *t*, in the cap-plate *m*, and at such an elevation that the upper edge of the adjustable ring can be set in contact with it, or let down so far below it as to leave sufficient space for the free escape of steam.

From the foregoing, it will be seen that when the pressure of steam in the boiler or generator becomes sufficient to lift the valve from its seat, it acts against the surface of the annular space *o*, between the bevel of the valve-seat and the downward-projecting flanch *n* of the cap, to assist in lifting and holding up the valve, particularly when the valve is borne down by the tension of a spring which presents an increasing resistance as the valve is lifted.

If the projecting rim *q* were in the same plane with the lower edge of the flanch *n*, the diameter of these parts being greater than that of the valve-seat, on the lifting of the valve and cap, the area of the opening between the flanch *n* of the cap and the projecting rim *q* would be greater than the area of the opening between the valve and its seat, just in proportion as the diameter of the one is greater than the other, and the steam escaping from the valve would pass unchecked between the flanch *n* and rim *q*, and would not exert any force against the surface of the annular space *o*;

but as the rim *q* extends above the lower edge of the flanch *n* of the cap-plate, it follows that the aperture between the valve and its seat, by the lifting of the valve, is always greater than the aperture between the flanch *n* and the rim *q*, and hence, the escaping steam, by its elastic force, will act against the surface of the annular space *o*, to assist in lifting and holding up the valve, until the pressure in the boiler or generator falls below the pressure by which the valve was first opened.

The difference between the pressure against which the valve will close and the pressure by which it will be opened, will depend upon the distance between the outer periphery of the flanch *n* of the cap-plate and the inner periphery of the projecting rim *q*.

To render this adjustable, the area of the aperture for the escape of steam beyond the valve-seat must be adjustable. This is effected by the raising or lowering of the ring *u*. If it be set to its lowest position, the steam escaping from the valve will be free to escape between the top of the valve and the cap, through the central aperture, and thence between the upper edge of the ring *u* and the disk *f*, without materially aiding to lift or hold up the valve; but by setting the ring *u* nearer to the under surface of the disk *f*, and thereby reducing the space for the escape of steam, it will be caused to act by its elastic force against the annular space *o* of the cap-plate, and thus assist in lifting the valve and holding it up.

I have described and represented this as the simplest mode of adjusting the area of the aperture for the escape of the steam after it passes the valve-seat, but it will be obvious that the same result may be attained by equivalent means, such, for instance, as making the rim *q* in adjustable segments, so that its diameter can be increased or diminished, but this would be more complicated than the mode first and fully described.

And it will also be obvious that the devices for holding up the valve may be inverted, as represented in figs. 4 and 5 of the accompanying drawings, in which *a'* is the valve-seat, and *b'*, the valve, with its bevelled ground joint, the valve-seat *a'* having a flat annular surface, *c'*, beyond the bevel, and the valve an annular surface, *d'*, with a downward-projecting flanch, *e'*, the lower edge of which, when the valve is closed, extends a little below the plane of the surface, *c'*, of the valve-seat, and a narrow annular space being left for the escape of steam between the inner periphery of the said flanch, and the outer periphery of the valve-seat *a'*, as set forth in my patent of September 25, 1866.

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

The combination of the surface beyond the seat of a safety-valve, with the means herein described for regulating or adjusting the area of the passage for the escape of steam, substantially as and for the purpose described.

GEORGE WM. RICHARDSON.

Witnesses:

I. I. TILLINGHAST,
W. H. POOR.