May 1, 1928.

1,668,075

B. J. HELLWIG

SAFETY VALVE

Filed June 30, 1920

2 Sheets-Sheet 1

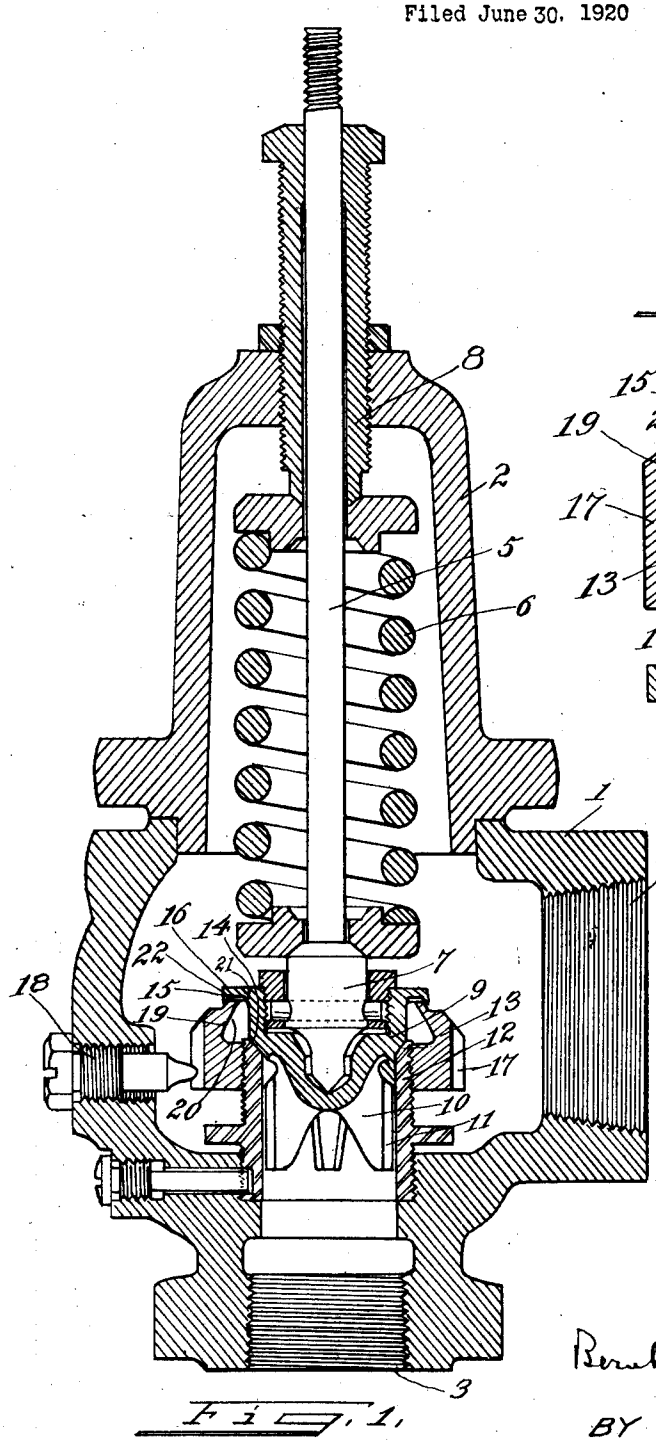


Fig. 1.

Fig. 2.

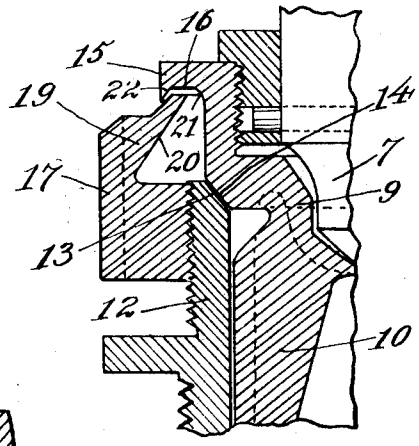
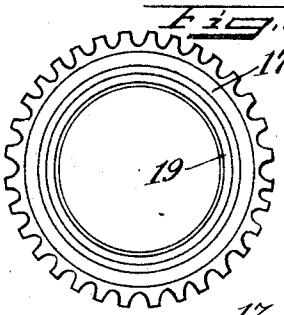


Fig. 3.



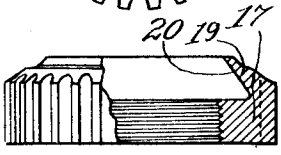


Fig. 4.

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2 Sheets-Sheet 2

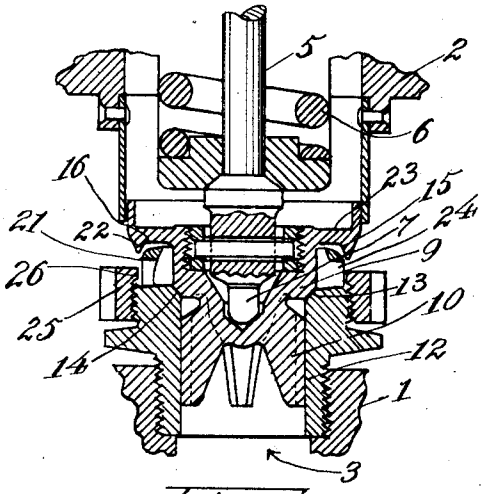


Fig. 5.

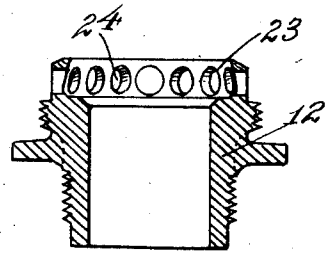


Fig. 8.

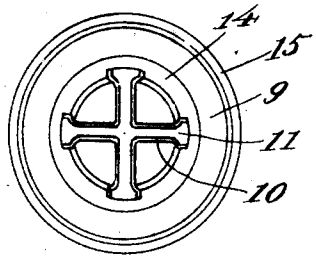


Fig. 9.

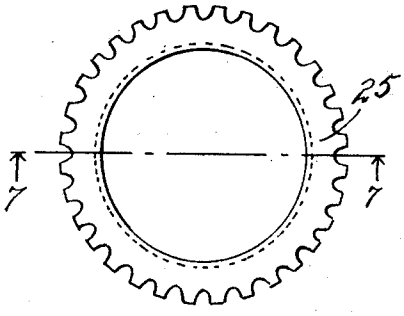


Fig. 6.

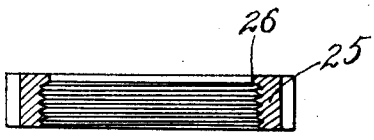


Fig. 7.

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Patented May 1, 1928. 1,668,075

UNITED STATES PATENT OFFICE.

BERNHARD J. HELLWIG, OF CINCINNATI, OHIO, ASSIGNOR TO THE LUNKENHEIMER COMPANY, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

SAFETY VALVE.

Application filed June 30, 1920. Serial No. 393,025.

My invention relates to safety valves of the type termed commercially "pop valves" which are employed for the most part in steam boilers for the release of steam therefrom upon excessive pressure.

With boilers of large capacity where great quantities of steam must escape to prevent dangerous over pressures, it has been the practice to use one large or a number of smaller safety valves of moderate relieving capacity and close regulation. Attempts have been made to reduce the size or number of such valves by providing a construction through which much greater quantities of steam are discharged during the relieving operation, but all such attempts have been only partly successful in that while discharge capacities were greatly increased, the closeness of the regulation was widened in proportion with consequent serious and unnecessary loss of steam during the blowing period.

Hence, the problem involved in a modern pop safety valve is to provide for a sufficiently rapid release of excessive pressure and at the same time for a release which will sharply close at a point below the pressure at which the valve is set, with as little drop below that point as possible, with the valve operating smoothly and positively.

These objects and other advantages to be noted I accomplish by that certain construction and arrangement of parts to be hereinafter more specifically pointed out and claimed.

In the drawings,

Figure 1 is a longitudinal section through my new valve in one form thereof.

Figure 2 is a detail section of the valve seat, and huddling chamber of the form of valve shown in Figure 1, on a larger scale.

Figure 3 is a plan view of the blow-down regulating ring.

Figure 4 is a partially sectioned side elevation of the same.

Figure 5 is a longitudinal section through another form of valve made according to my invention.

Figure 6 is a plan view of the regulating ring.

Figure 7 is a section of the said ring on the line 7, 7, of Figure 6.

Figure 8 is a longitudinal section through the seat ring.

Figure 9 is a bottom plan view of the valve disk.

It should be noted of my invention that the essential basis thereof is to provide a huddling chamber for the valve which due to its special characteristics brings about the rise and fall of the valve, there being no essential difference between my valves and those of the prior art except with relation to this huddling chamber and the parts which surround it. In one of the instances the huddling chamber is formed between the valve disk and the seat ring, the seat ring having an adjusting ring in connection therewith. In the other instance the seat ring has mounted thereon an adjusting ring which itself forms a portion of the huddling chamber.

I will briefly refer to the normal safety or "pop valve" parts which I employ. There is the body 1, the top 2, mounted thereon, the inlet port 3 and the discharge port 4 being in the body. There is the stem 5 under control of the spring 6, which spring presses downwardly on the spring holder 7 at the end of the stem.

The adjusting screw 8 threaded into the top of the valve adjusts the pressure on the spring and thus the point at which the valve will pop off. I prefer that the spring be a long one, which will, in my opinion, add to the value of a valve made according to my invention.

The valves in both instances have disks 9 having guiding wings or webs 10, same being widened at the face as at 11 to provide ample guide surface within the seat ring 12. In each instance also the seat ring is threaded into the body and is formed with a seat 13 for the valve disk.

The disks in both cases are formed with seat bearings 14 and at the upper end there-

of have a lip 15 that depends around the edge of the disks to form a recessed chamber 16. The spring holders 7 on the ends of the stems find a freely rocking seat within the concavity at the top of the valve disks.

Taking now the exemplary embodiment of my invention shown in Figures 1 to 4, it will be noted that the seat ring is externally threaded to receive a special shaped regulating ring 17, this regulating ring being adjustable due to its threaded mounting and adapted to be held in adjusted position by the regulating ring screw 18, threaded into the valve body.

The upper portion of the regulating ring is formed with an annular, upwardly and inwardly extending sleeve 19, the inner wall 20 of which has a conical upward slant to the axis of the valve disk and its seat. The angle which the said inner wall forms with relation to the angle of the valve seat should be according to my experience nearer 90 degrees to the path of the escaping steam than 45 degrees.

No exact angle is prescribed, however, except that the slope of the wall 20 should be directed towards the inner curve or slope 21 of the lip recess; and the height of the sleeve 19 forming this angle should be such as to substantially close with or approach closely to the outer slope 22 of the lip recess 16 to produce a reaction effect.

In fact the forms of the invention with which I have had greatest success have been ones in which the huddling chamber has been in substantially the form of a right angle triangle in cross section with the wall 20 forming the hypotenuse.

I have now found by extensive experiments that the formation of a huddling chamber above the valve seat, by means of a sleeve with conical interior, and a recessed disk lip above it, that the resulting inwardly and upwardly impelling steam flow with its consequent reaction produces much more efficient action than any other known construction. By this I mean that when "popping" the disk is lifted from its seat to a height far exceeding ordinary practice, that it operates smoothly due to the centralizing effect of the steam flow and closes down gradually with a final closure which, while sharp, is no more injurious than the seating of less efficient valves. Perhaps the greatest gain accomplished by my peculiar construction is that pop valves so made can be regulated to perform their function of relieving excess pressure with less wastage of steam than has heretofore been thought possible in valves of high relieving capacity.

The amount of the blow-down or steam relief is regulatable within limits by adjusting the ring 17 up or down according to conditions.

In the modification shown in Figures 5–9, the valve disk is the same, but the seat ring is formed with an upwardly and inwardly extending sleeve 23, which is formed at an angle, as to its inner wall, as in the case of the regulating ring of the first described form, and thus forms the outer wall of the huddling chamber of the valve.

This sleeve has an annular series of holes 24 therein which are controlled by means of a regulating ring 25, threaded onto the seat ring and adapted in its various positions to close off portions of the holes against escape of steam. The preferred form of regulating ring 25 has an inwardly extending lip 26 which wipes the outer surface of the seat ring sleeve.

As is apparent the difference between the two forms is in the method of adjusting the amount of escape of steam from the huddling chamber, this being controlled in the first form by the amount of escape around the top of the huddling chamber, and in the second form by the amount of escape through the side walls of the huddling chamber, the action of the valve being about the same in either case.

I desire to include within the scope of my claims that follow the full range of equivalent structures familiar to those skilled in the valve making art.

Vertical outer walls for huddling chambers are in use at the present time, and in some instances these walls are formed with small pockets at the base, to form a sort of underlying motive force of compressed steam under the valve. The outer huddling chamber wall in my invention forms a directing wall for the escaping steam, deflecting it inwardly and upwardly against the reactive disk lip.

This together with the possibilities of adjustment permits of a nice balance which suits my valve for all purposes in steam boiler equipment, particularly a wide opening and an accurate, easy closing without excessive blow-down.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a safety valve, the combination with a valve seating member, a resiliently held valve disk, and an adjusting ring, said adjusting ring having inwardly and upwardly sloping walls intercepting the path of steam across the seat, and the valve disk having an outwardly and downwardly turned edge overhanging the adjusting ring on its outer edge.

2. In a safety valve, the combination with a valve seating member, a resiliently held valve disk, and an adjusting ring, said adjusting ring having inwardly and upwardly sloping walls intercepting the path of steam across the seat, and the valve disk having an

outwardly and downwardly turned edge overhanging the adjusting ring on its outer edge and means for adjusting the amount of escape from the chamber formed by said disk and said adjusting ring.

3. In a safety valve, the combination with a valve seating member, a resilient valve disk, and an adjusting ring, said adjusting ring having inwardly and upwardly sloping walls intercepting the path of steam across the seat, and the valve disk having an outwardly and downwardly turned edge overhanging the adjusting ring on its outer edge, and means for adjustably positioning the adjusting ring to determine the normal opening between its upper edge and the said disk.

BERNHARD J. HELLWIG.