

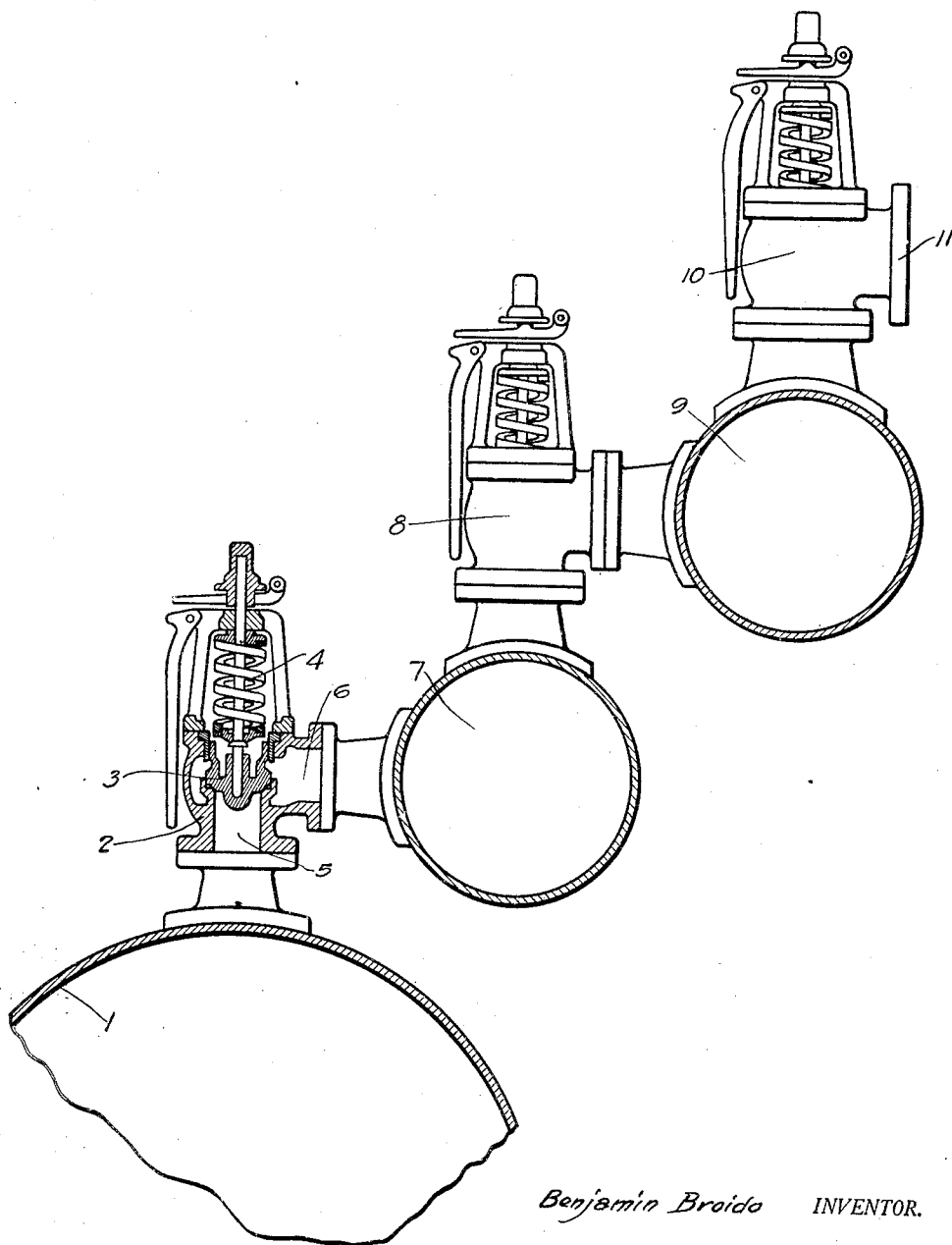
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SAFETY VALVE FOR HIGH PRESSURE BOILERS

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SAFETY VALVE FOR HIGH-PRESSURE BOILERS

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This invention relates to safety valves and particularly to safety valves which are intended to release excess pressure on so-called high pressure boilers, that is, boilers carrying pressures of 600 to 1500 lbs. or more per square inch.

To resist the tensile stresses involved in the use of such pressures, the boiler must have relatively very thick walls. This remains true even if, as is the natural tendency, the drums are made of as small diameters as admissible. This great wall thickness makes such drums expensive, both on account of the material used and of the difficulty of manufacture. In fact there are only few establishments that have facilities to manufacture such drums at all, as riveting them is out of the question and forging out of a solid billet must be resorted to. This small size of the steam and water drums involves a small cubical content of the steam space and results in rather wide pressure fluctuations with relatively slight variations in the load. In other words if the load drops off by even a small amount the pressure in the boiler rises much more quickly than if the steam space were larger, and on the other hand if the load momentarily increases even by a slight amount the withdrawal of the additional amount of steam from the boiler results in a rapid and disproportionately large pressure drop. The result of these conditions is that the safety valve is called into action more frequently than is the case with boilers of more moderate pressures.

When the safety valve is called into action with such a high pressure boiler the wear and tear on the valve is very severe. The seat and disc of the valve are much more rapidly eroded and the spring deteriorates much more rapidly when the valve operates between a pressure of 1200 or 1500 lbs. and atmospheric pressure than is the case where a safety valve releases pressure from 200 lbs. to atmospheric pressure. Moreover, it is a matter of common observation that such a valve delivering steam from a pressure of 1200 or 1500 lbs. to atmospheric pressure does not work as smoothly as one working within narrower limits.

It is the purpose of the present invention to obviate these difficulties.

The invention is illustrated in the single figure of the drawing herewith which shows a portion of the steam drum of a high pressure boiler with my invention applied.

The steam drum of the high pressure boiler is shown at 1. The safety valve through which steam leaves the boiler in the first place is shown at 2. This safety valve is not in itself novel, but may be of any preferred form. In the form illustrated the valve proper 3 is held on its seat by the spring 4. Steam enters the valve at 5 and when the valve is opened by an excess pressure in the boiler leaves the valve through the opening 6.

Instead of allowing the steam to escape to atmosphere from the opening 6 I propose to lead it to a chamber 7 to which is attached a second safety valve 8, which may be similar in construction to the safety valve 2. This second safety valve is adjusted to operate when the pressure in chamber 7 rises to a point intermediate the boiler pressure and atmospheric. From this valve 8 the steam may be allowed to escape directly to atmosphere in some cases or, as in the case illustrated in the drawing, it is carried to an additional chamber 9 from which a third safety valve 10 relieves surplus steam to the atmosphere through opening 11. This third valve is adjusted to open when the pressure in chamber 9 is at some point intermediate the pressure prevailing in 7 and atmospheric pressure. These pressures in the boiler and in the two chambers 7 and 9 may for example be as follows: 1200 lbs. per square inch in the boiler, 600 lbs. in the chamber 7 and 300 in the chamber 9. The valve 2 will open when the boiler pressure exceeds 1200 lbs.; valve 8 will open when the pressure in 7 rises above 600 and valve 10 will open when the pressure in 9 exceeds 300. These pressures, it will be understood, are used only for illustrative purposes. In some cases it will be sufficient to use only two safety valves and in some cases it may prove advisable to use more than three. In any case the valves will be set to operate at successively diminishing pressures. The valves will increase successively in size

proportionately to the increased volume of the steam as it escapes through them.

The operation of this arrangement involves the fact that the flow of steam from a space or chamber of higher pressure to one of lower pressure is not materially affected by raising the pressure of the lower pressure chamber, provided this pressure is not raised beyond fifty-eight percent of that prevailing in the chamber of higher pressure. To apply this to the present case, the rate of flow from the boiler at 1200 lbs. through the safety valve 2 is not materially lowered by allowing it to exhaust into the space 7 where the pressure is 600 lbs. over what it would be if it exhausted directly into atmosphere. Similarly the flow from 7 through the safety valve 8 is not materially lowered by the arrangement shown and described from what it would be if this valve opened directly to atmosphere. The wear and tear on each of the valves, however, is very materially diminished and the valves each work much more smoothly than if they operated between the wider limits.

The advantage of the arrangement will at once be apparent. By it the frequency with which the safety valve has to be ground or repaired is lessened and in addition the operation of the boiler becomes safer and steadier. These advantages are more than sufficient to offset the cost of the extra valves and pressure chambers.

It will be obvious that the form of my invention which I illustrate and describe herein may be varied in some respects without sacrificing the inventive idea.

What I claim is:

1. In apparatus of the class described, the combination of a boiler drum; a series of steam chambers; a corresponding series of safety valves connecting the drum to the first chamber, the chambers in series to each other and the last chamber to the atmosphere, the several safety valves being so adjusted that the pressure in each of the steam spaces is about one half as high as in the preceding one.

2. A combination according to claim 1, the safety valves being so adjusted that the pressure in no steam space exceeds 58 per cent of that in the preceding space.

3. The method of releasing excess steam from a high-pressure boiler by permitting it to expand from boiler pressure to atmospheric pressure in a succession of stages each of which leaves the steam at a pressure substantially half that of the preceding stage.

4. The method of releasing excess steam from a high-pressure boiler in accordance with claim 3, the steam pressure at no stage exceeding 58 per cent of that of the preceding stage.

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