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SAFETY VALVE

Filed Dec. 6, 1928

Fig 1

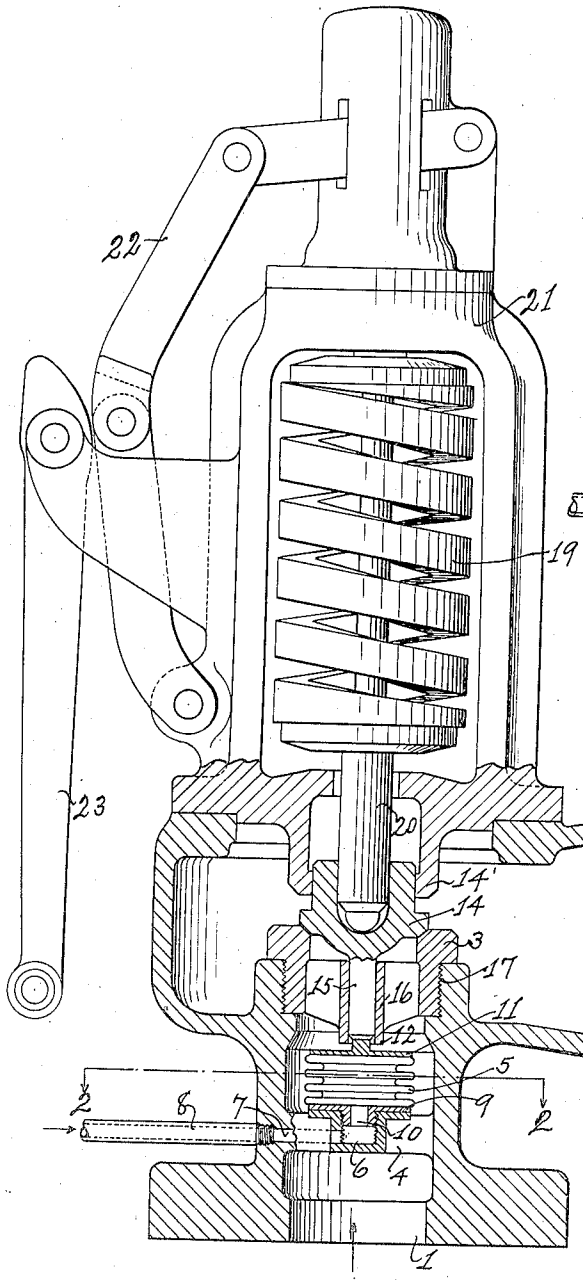
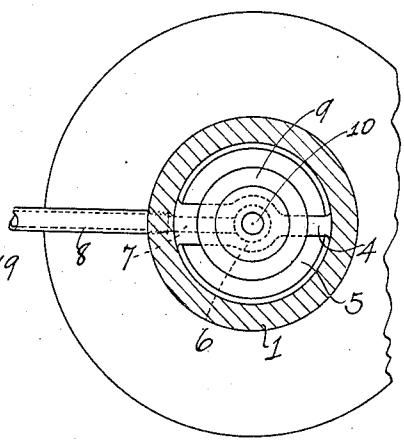


Fig 2



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SAFETY VALVE

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This invention relates to a safety valve for a steam boiler that is provided with a superheater for the steam. In such boilers there is a drop in pressure between the saturated steam in the boiler drum and the superheated steam passing out of the superheater due to the friction in the superheater. It is important that the superheater safety valve shall open before the saturated steam safety valve on the boiler drum which is first to blow. It is also important that the range of setting between the superheater safety valve and the saturated steam safety valve which is the first to blow shall not be too great as this results in a loss due to an undue lowering of the pressure leaving the superheater below that for which the boiler is built. By the present invention the saturated steam pressure is utilized in part for the opening of the superheater safety valve and the arrangement is such that the superheater safety valve will open when the steam in the steam and water drum reaches a predetermined pressure irrespective of what the pressure at the superheater outlet may be through the loss of pressure due to the friction of the steam in flowing through the superheater. By making the predetermined pressure, say, 10 lbs. per sq. in. below that at which the first saturated steam safety valve will blow, the desired result of having the superheater safety valve to be the first to blow will be accomplished.

The invention will be understood from the description in connection with the accompanying drawing in which Fig. 1 is a vertical section through an illustrative embodiment of the device and Fig. 2 is a section along the line 2—2 of Fig. 1. In the drawing, reference character 1 indicates an inlet for superheated steam into the lower end of the valve casing, this inlet being connected to the superheater steam space of the boiler. The outlet 2 for the waste steam leads to the atmosphere. A valve seat 3 is provided at the upper portion of the inlet 1 and a support 4 is provided in the inlet 1 for a bellows 5 made of resilient metal. The hollow central portion 6 of the support 4 is internally threaded, and an opening 7 leads through the wall of the casing into the hollow central portion 6. A steam pipe 8 leads from the steam space of the boiler drum or other portion of the boiler that contains saturated steam to the opening 7.

The lower disc 9 of the bellows is provided with a central hollow stud 10 that is threaded so that it can be screwed into the threaded hollow center 6. The upper disc 11 of the bellows is provided with a central projection 12.

A valve disc 14 is provided for the valve seat 3 and the stem 15 of the valve disc extends through a guide 16. A guide or stop 14′ is provided above the valve disc 14 to guide the same and limit the extent of its travel. This guide may be made integral with the seat 3. The lower end of the valve stem 15 rests upon the central stud 12. The seat 3 may be screwed into place as indicated by the screw threads 17.

The valve disc 14 may be pressed against its seat by means of a spring 19 that presses a plunger 20 against the valve disc, the spring being held by means of a yoke 21. A toggle mechanism 22 of the well known type may be attached to the plunger 20 and an operating lever 23 is provided to enable the toggle mechanism to be operated manually to withdraw the plunger 20 from the valve disc.

The operation is as follows: The spring 19 is set so that the valve disc 14 may be lifted by the steam pressure when it exceeds a predetermined amount, and superheated steam is permitted to escape through the outlet 2 when the valve is opened. Superheated steam enters through the inlet 1 and contacts with the lower side of the valve disc 14 surrounding the stem 15, and also with the outside of the bellows 5 tending to collapse the bellows. Saturated steam that is at a higher pressure than the superheated steam because of the friction as the steam passes through the superheater, enters the bellows 5 through the pipe 8, opening 7, hollow central portion 6, and hollow stud 10. The differential in pressure between the saturated steam inside of the bellows and the superheated steam outside of the same causes the stud 12 on the disc 11 to be pressed against the stem 15 of the valve disc 14, so that this

disc is lifted by the superheated steam that presses against this disc, together with the differential pressure caused by the bellows 5. The amount of this differential pressure depends upon the effective area of the bellows 5. The effective area of the bellows 5 is preferably made about the same as the effective area of the valve disc 14.

When the effective area of the bellows is made the same as the effective area of the valve disc 14, the force tending to open the valve will be the force exerted by the superheated steam on the valve disc supplemented by the force exerted by the pressure differential on the bellows and the total of these forces will be equivalent to the pressure of the saturated steam on an area corresponding to the area of the valve disc in as much as the force exerted by the superheated steam on the valve disc will be wholly off-set by the force exerted by the superheated steam tending to collapse the bellows. Therefore, the valve can be set to open on the presence of a certain saturated steam pressure and its opening will be entirely independent of variations in the superheated steam pressure. By varying the effective area of the bellows, as, for example, changing the size of the bellows in use, the amount of this supplemental force can be varied and the valve arranged to open at steam pressures other than the pressure of the saturated steam.

I claim:

1. In a safety valve for a steam boiler that produces saturated steam and superheated steam, a spring pressed valve disc having a stem, means to cause superheated steam to press against the face of said valve disc and means located on the superheated steam side of said valve disc for causing differential pressure between the saturated and superheated steam to press against said valve stem.

2. In a safety valve for a steam boiler that produces saturated steam and superheated steam, a spring pressed valve disc having a stem, means to cause superheated steam to press against the face of said valve disc and means located on the superheated steam side of said valve disc for causing differential pressure between the saturated and superheated steam to press against said valve stem, said differential pressure being obtained from an area approximately equal to the area of said valve disc.

3. In a safety valve for a steam boiler that produces saturated steam and superheated steam, a spring pressed valve disc having a stem, means to cause superheated steam to press against the face of said valve disc, means located on the superheated steam side of said valve disc for causing differential pressure between the saturated and superheated steam to press against said valve stem, and means to limit the extent of travel of said valve disc.

4. In a safety valve to be operated by saturated steam at one pressure and superheated steam at a lower pressure, a normally seated spring pressed valve disc, a bellows located on the superheated steam side of said disc, and means for leading superheated steam to one side of said valve disc and to the outside of said bellows and saturated steam to the inside of said bellows.

5. In a safety valve to be operated by saturated steam at one pressure and superheated steam at a lower pressure, a valve body, a valve disc normally seated in said body, a compression spring tending to maintain said valve seated and located externally of said body, a bellows located on the superheated steam side of said disc and opposing the action of said spring, means for leading superheated steam to one side of said valve disc and to the outside of said bellows and saturated steam to the inside of said bellows.

6. In a safety valve to be operated by saturated steam at one pressure and superheated steam at a lower pressure, a spring pressed valve disc, a bellows located on the superheated steam side of said disc, means for leading superheated steam to one side of said valve disc and to the outside of said bellows and saturated steam to the inside of said bellows, and a stop arranged to limit the extent of travel of said bellows.

7. In a safety valve to be operated by saturated steam at one pressure and superheated steam at a lower pressure, a spring pressed valve disc, a bellows located on the superheated steam side of said disc, means for leading superheated steam to one side of said valve disc and to the outside of said bellows and saturated steam to the inside of said bellows, the effective area of said bellows being approximately equal to the area of the superheated steam side of said valve disc.

8. In a safety valve for a steam boiler that produces saturated steam and superheated steam, a spring pressed valve disc having a stem, means to cause superheated steam to press against the face of said valve disc, means located on the superheated steam side of said valve disc for causing differential pressure between the saturated and superheated steam to press against said valve stem, and manually operated means to open said valve.

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