May 21, 1968 J. F. MELZER 3,384,101

SAFETY VALVE

Filed Jan. 27, 1965 2 Sheets-Sheet 1

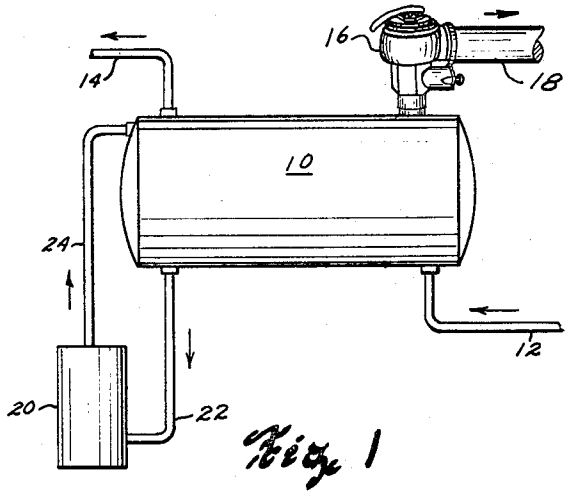


Fig. 1

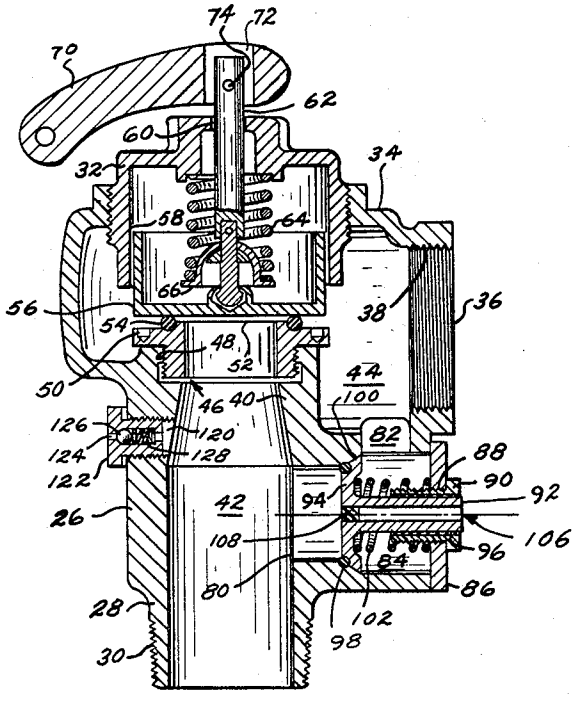


Fig. 3

INVENTOR.
JULIUS F. MELZER
BY J. Albert Hultquist
ATTORNEY

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SAFETY VALVE

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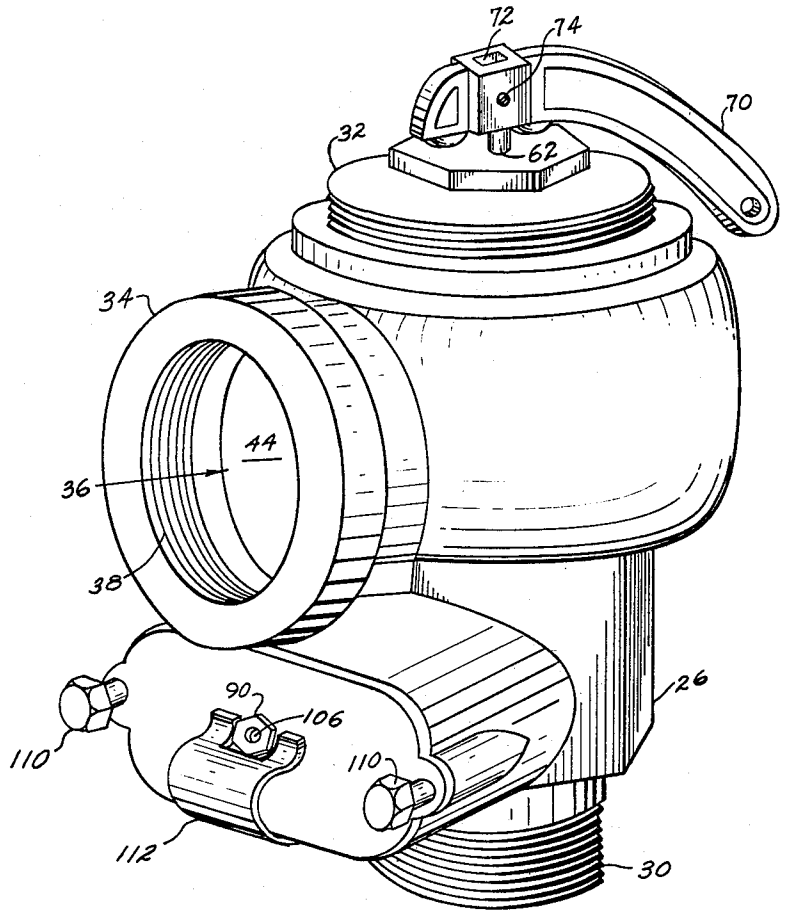


Fig. 2

INVENTOR.
JULIUS F. MELZER
BY J. Albert Waltquist
ATTORNEY

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SAFETY VALVE

Julius F. Melzer, 544 King St.,
Port Chester, N.Y. 10573

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ABSTRACT OF THE DISCLOSURE

A combined safety and relief valve to protect a boiler against excess pressure or temperature. The temperature relief valve is normally held closed by an alloy between the valve stem and a surrounding sleeve which melts at excess temperatures and allows the valve to open. When the pressure is relieved, a spring closes the valve to prevent excessive loss of boiler water but a small ancillary passage remains open to act as a tell-tale.

Should the main vent be plugged, a spring-pressed plate over a side aperture lifts to allow steam or hot water to escape into the boiler room as an alarm.

An object of the present invention is to minimize the possibility of undesirable excess temperatures or pressures being developed in hot water boilers.

Another object of the present invention is to minimize the dangers as aforesaid without, at the same time, unnecessarily wasting stored hot water.

Still another object of the present invention is the provision of a number of independent pressure-temperature relief devices for a hot water boiler so that if one should become frozen, plugged or otherwise inoperative, another will operate to protect the boiler.

Still a further object is the provision of means for giving positive visual indication of the operation of such other means so that steps may be taken to correct the malfunction.

Yet another object of the present invention is to provide positive relief of excess boiler temperatures or pressures even if the escape path to the exterior of the boiler room for the water and/or steam should become plugged, frozen or otherwise inoperative.

The foregoing objects and others which may appear from the following detailed description are attained in accordance with the principles of the present invention by providing a safety valve having a unitary body containing a first pressure relief valve having a poppet valve head held onto a cooperating valve seat by spring pressure and normally blocking a passage between the interior of the boiler and a vent or relief pipe.

Should the temperature and/or pressure within the boiler become excessive, for example, due to a failure of temperature responsive control means for the heater, the valve will open and allow the discharge of hot water and/or steam through the vent pipe to the exterior of the boiler room and/or to waste or sewer connections. Should this valve be inoperative due to crusting over by hard water deposits, corrosion, deliberate tampering or otherwise, a slight additional increase in temperature will allow an ancillary bypass path to open which will still release water or steam from the boiler to relieve. In this case, however, a small additional relief passage is opened which allows the escape of moderate amounts of water directly into the boiler room. This flow positively indicates that the ancillary relief has operated, and action must be taken to clear the difficulty with the main valve.

Since the aforesaid ancillary relief path is opened by the melting of a low melting point alloy connection, it is also necessary that a new relief structure also be installed. If either the main or ancillary relief operates and the relief or drain pipe is plugged due to corrosion, deposits or even icing conditions at the exterior of the building in which the boiler is situated, a relief path is provided from either the main valve or ancillary path allowing the escape of relief water and/or steam directly into the boiler room. While this form of relief may be inconvenient and even costly to take care of, it is still preferable to the disaster which could take place if relief were catastrophic.

Furthermore, I have provided as an integral part of the relief valve, means for relieving vacum conditions within the boiler during periods when the boiler may be operating under reduced heating conditions or shut down.

The present invention will be more fully understood by reference to the following detailed description of an embodiment thereof which is accompanied by a drawing in which:

FIGURE 1 illustrates diagrammatically one form of a hot water boiler with which the safety valve of my invention is adapted to be used, together with such valve and the various supply, discharge, and vent pipes or heating means associated therewith. FIGURE 2 illustrates in perspective view the exterior of the safety valve alone; and FIGURE 3 illustrates in vertical cross-section, the valve of FIGURE 2.

FIGURE 1 shows a hot water boiler **10** having mounted therein inlet pipe **12** through which water to be heated is introduced into the boiler, outlet pipe **14** through which hot water is drawn for supply to various utilization means, and safety valve **16** which is connected to vent or waste pipe **18** through which excessively heated hot water or steam is conducted to the exterior of the room in which boiler **10** may be located. The water within boiler **10** may be heated by various means, one typical means being heater **20** which is connected to boiler **10** by circulating pipes **22** and **24**. It will be apparent that the water within boiler **10** may also be heated by electric heating elements inserted through the walls of boiler **10**, or boiler **10** may be arranged with interior chambers and passages for gas, oil or coal firing if desired. Normally boiler **10** will also be provided with heat insulating lagging (not shown) around its exterior.

Pipes **12** and **14** may alternatively be return and outflow pipes of a hot water room heating system if desired, without affecting the operation of principles of safety valve **16**. Valve **16**, as more fully shown in the sectional view of FIGURE 3, comprises a body **26** having an inlet neck section **28** provided with external screw threads **30** by means of which it may be installed in boiler **10**. Body **26** is provided, at the end opposite inlet neck section, with an internally threaded aperture into which is screwed valve cap **32**. The body is also provided with a side opening neck **34** having outlet aperture **36** having screw threads **38** on its interior into which outlet or vent pipe **18** (FIG. 1) may be received. Body **26** is provided with an interior wall **40** dividing the interior thereof, inlet chamber **42** and exit chamber **44**. Wall **40** has an aperture **46** coaxial with the aperture into which valve cap **32** is screwed, containing interior screw threads **48** into which valve seat holder **50** is screwed. Valve seat holder **50** is provided with an upper face **52**, having a step or annular recess adapted to receive valve seat **54**, preferably in the form of a toroidal "O ring" of a heat resistance resilient plastic material such as "Viton." Poppet valve disc **56**, in the form of a flat based cylinder cup is received within a cylindrical bore **58** within valve cap **32**. Valve cap **32** has a central bore **60** concentric with bore **58** through which passes valve stem **62** surrounded by valve spring **64**. Spring **64** bears against cup washer **66** coupled to valve stem **62** which is secured to valve disc **56** and also bears against the inner side of valve cap **32** thus urging valve disc **56** into engagement with

valve seat 54 until the pressure within boiler 10 exceeds the pressure for which the safety valve is set, whereupon valve disc 56 lifts and excess steam and hot water is discharged into vent pipe 18 (FIG. 1) until the excess pressure is relieved. Valve handle 70 has a slot 72 which surrounds stem 62 and is rockably pined thereto by through pin 74. By moving handle 70 either up or down until its lower surface bears against the top of valve cap 32, valve stem 62 may be levered upwardly, lifting poppet disc off seat 54 for testing to see that it is in operative condition.

It is apparent that should this testing be ignored, and corrosion or deposits fill in the space between bore 58 and valve disc 56, or if additional weights or ties should be placed over handle 70, the security of boiler 10 might be jeopardized. Therefore, I have provided an ancillary relief mechanism including side bore 80 opening into chamber 42 and connecting through passage 82, into outlet chamber 44. At the junction of side bore 80 and passage 82 is a chamber 84 normally covered with cover plate 86 which has a threaded aperture 88 into which is received a threaded sleeve 90 within which is soldered stem 92 of poppet valve 94 with a low melting point alloy 96. Low melting point alloy 96 is a eutectic alloy of metals designed to abruptly become liquid at a temperature only a little higher than the temperature equivalent to the pressure at which valve 56 is designed to lift off of valve seat 50.

Various combinations of tin, lead, bismuth, antimony or indium may be used to compound the alloy. For example, if it is indicated that valve 56 would lift at 10 pounds per square inch, an alloy of 55% bismuth and 45% lead will melt at 250° corresponding to a saturated steam pressure of 15 pounds per square inch. Other alloys can readily be obtained which will melt at temperatures from 180° and upwards.

Poppet valve 94 has a head with an annular groove into which is mounted ring 98 bearing against conical valve seat 100 at the junction of bore 80 and chamber 84. Valve spring 102 surrounds stem 92 and bears against the inner side of plate 86 and the rear side of the valve head. The valve stem has a central through bore 106 plugged at its inner end with a low melting point alloy plug 108. Now should the temperature of water within boiler 10 increase excessively and valve disc 56 fail to lift for some reason, a slight further increase will cause alloy plug 108 to melt thus discharging moderate amounts of water and/or steam directly into the boiler room giving warning that something is amiss and that corrective measures should be taken. If this small relief is not sufficient to safeguard the boiler and the temperature continues to rise, it will disintegrate the bond 96 between the stem of valve 94 and sleeve 90 and the valve will be lifted off seat 100 against the pressure of spring 102 and relieve the boiler, through vent pipe 18. If the pressure then recedes to a safe value, spring 102 will force valve 94 against seat 100 before the alloy 96 sets thus preventing the total head of water in the system from being dumped through the vent pipe 18 but bore 106 remains open to indicate a failure and that the plug must be replaced. After the cause of the overheating is corrected and the boiler shut down, a new assembly of cover plate 86, sleeve 90, poppet valve 94 and spring 102 may be inserted. At the same time, of course, the reason for the failure of valve 56 to lift should be investigated and corrected. It is easy to open the valve by unscrewing cap 32 from the top of the valve body 26 thus giving access to all of the interior construction. If necessary, valve seat holder 50 may be unscrewed from aperture 48 by applying pins of a spanner wrench to appropriately spaced holes in the top thereof.

Cover plate 86 is held in place over chamber 84 by screws 110 (one of which is shown in FIGURE 2) and spring 112. Spring 112 is strong enough so that valve 94 is normally held in position in seat 100 against the pressure of boiler 10, but if vent pipe 18 (FIG. 1) is plugged

and the pressure and temperature within chamber 84 builds up sufficiently, alloy 96 will soften and the action of spring 102 and the pressure against cover plate 86 will cause it to be lifted against the pressure of spring 112 allowing the discharge of steam or water from chamber 84 directly into the boiler room. Thus a positive alarm as to the failure of vent or waste pipe 18 is given. While I have illustrated only a single ancillary relief valve 94, it is, of course, possible to use two or even more in a side by side relationship in chamber 84.

Valve body 26 is provided with a further side bore 120 into which is threaded check valve 122. Said valve has a central bore 124 into which is placed ball 126. The ball is pressed against a seat in the bore by spring 128. Should the pressure within the boiler decrease below atomspheric during shut down periods, ball 126 will be lifted off its seat to allow air to enter the boiler to prevent vacuum within the boiler causing strains or even collapse.

I claim:

1. A safety valve including a body casing having an inlet section adapted to be fitted to a boiler, an outlet section adapted to be coupled to a waste pipe, said body casing having a wall therewithin dividing said casing into inlet and outlet chambers, a valve seat in said wall, a poppet valve pressed against said seat by a compression spring adapted to hold said valve closed against pressures developed in said boiler up to a predetermined maximum, ancillary means for relieving said boiler pressures including a side chamber connected to said outlet chamber, a bore from said inlet chamber to said side chamber, a second valve seat at the junction of said side chamber, a cover plate over said side chamber, an opening in said cover in alignment with said bore, and carrying a valve stem guide sleeve, a second poppet valve seated in said second valve seat and having a stem passing through said guide sleeve and secured thereto by an alloy solder adapted to melt at temperatures slightly above the temperature of water at said predetermined pressure and a spring surrounding the stem of said second valve bearing against said plate and the head of said second valve to close said second valve when the pressure decreases below a predetermined level.

2. A safety valve including a body casing having an inlet section adapted to be fitted to a boiler, an outlet section adapted to be coupled to a waste pipe, said body casing having a wall therewithin dividing said casing into inlet and outlet chambers, a valve seat in said wall, a poppet valve pressed against said seat by a compression spring adapted to hold said valve closed against pressures developed in said boiler up to a predetermined maximum, ancillary means for relieving said boiler pressures including a side chamber connected to said outlet chamber, a bore from said inlet chamber to said side chamber, a second valve seat at the junction of said side chamber, a cover plate over said side chamber, an opening in said cover in alignment with said bore, and carrying a valve stem guide sleeve, a second poppet valve seated in said second valve seat and having a stem passing through said guide sleeve and secured thereto by an alloy solder adapted to melt at temperatures slightly above the temperature of water at said predetermined pressure and a spring surrounding the stem of said second valve, said second valve having a through bore plugged with an eutectic alloy which melts at said temperature bearing against said plate and the head of said second valve to close said second valve when the pressure decreases below a predetermined level.

3. A safety valve including a body casing having an inlet section adapted to be fitted to a boiler, an outlet section adapted to be coupled to a waste pipe, said body casing having a wall therewithin dividing said casing into inlet and outlet chambers, a valve seat in said wall, a poppet valve pressed against said seat by a compression spring adapted to hold said valve closed against pressures developed in said boiler up to a predetermined maximum,

ancillary means for relieving said boiler pressures including a side chamber connected to said outlet chamber, a bore from said inlet chamber to said side chamber, a second valve seat at the junction of said side chamber, a cover plate over said side chamber, said cover plate being spring-pressed into position over said side chamber, an opening in said cover in alignment with said bore, and carrying a valve stem guide sleeve, a second poppet valve seated in said second valve seat and having a stem passing through said guide sleeve and secured thereto by an alloy solder adapted to melt at temperatures slightly above the temperature of water at said predetermined pressure and a spring surrounding the stem of said second valve, said alloy solder being responsive to excess temperatures in either said inlet chamber or in said side chamber whereby limited amounts of water are released into the space around said boiler upon actuation of said second valve or excess pressures in said waste pipe.

4. A safety valve including a body casing having an inlet section adapted to be fitted to a boiler, an outlet section adapted to be coupled to a waste pipe, said body casing having a wall therewithin dividing said casing into inlet and outlet chamber, relief valve means in said wall responsive to pressures beyond a predetermined maximum for relieving excess pressures in said boiler, ancillary means for relieving said boiler pressures including a side chamber connected to said outlet chamber, a bore from said inlet chamber to said side chamber, a valve seat at the junction of said side chamber, a cover plate over said side chamber, an opening in said cover in alignment with said bore, and carrying a valve stem guide sleeve, a poppet valve seated in said valve seat and having a stem passing through said guide sleeve and secured thereto by an alloy solder adapted to melt at temperatures slightly above the temperature of water at said predetermined pressure and a spring surrounding the stem of said valve.

5. A safety valve including a body casing having an inlet section adapted to be fitted to a boiler, an outlet section adapted to be coupled to a waste pipe, said body casing having a wall therewithin dividing said casing into inlet and outlet chambers, relief valve means in said wall responsive to pressures beyond a predetermined maximum for relieving excess pressures in said boiler, ancillary means for relieving said boiler pressures including a side chamber connected to said outlet chamber, a bore from

said inlet chamber to said side chamber, a valve seat at the junction of said side chamber, a cover plate over said side chamber, an opening in said cover in alignment with said bore, and carrying a valve stem guide sleeve, a poppet valve seated in said valve seat and having a stem passing through said guide sleeve and secured thereto by an alloy solder adapted to melt at temperatures slightly above the temperature of water at said predetermined pressure and a spring surrounding the stem of said valve, said valve having a through bore plugged with an eutectic alloy which melts at said temperature.

6. A safety valve including a body casing having an inlet section adapted to be fitted to a boiler, an outlet section adapted to be coupled to a waste pipe, said body casing having a wall therewithin dividing said casing into inlet and outlet chambers, relief valve means in said wall responsive to pressures beyond a predetermined maximum for relieving excess pressures in said boiler, ancillary means for relieving said boiler pressures including a side chamber connected to said outlet chamber, a bore from said inlet chamber to said side chamber, a valve seat at the junction of said side chamber, a cover plate over said side chamber, an opening in said cover in alignment with said bore, and carrying a valve stem guide sleeve, a poppet valve seated in said valve seat and having a stem passing through said guide sleeve and secured thereto by an alloy solder adapted to melt at temperatures slightly above the temperature of water at said predetermined pressure and a spring surrounding the stem of said valve, said valve having a through bore plugged with an eutectic alloy which melts at said temperature, said cover plate being spring pressed into position over said chamber.

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WILLIAM F. O'DEA, *Primary Examiner.*

D. R. MATTHEWS, *Assistant Examiner.*