No. 886,945. PATENTED MAY 5, 1908.

E. J. CLARKE.

SAFETY VALVE FOR STEAM BOILERS.

APPLICATION FILED JUNE 13, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

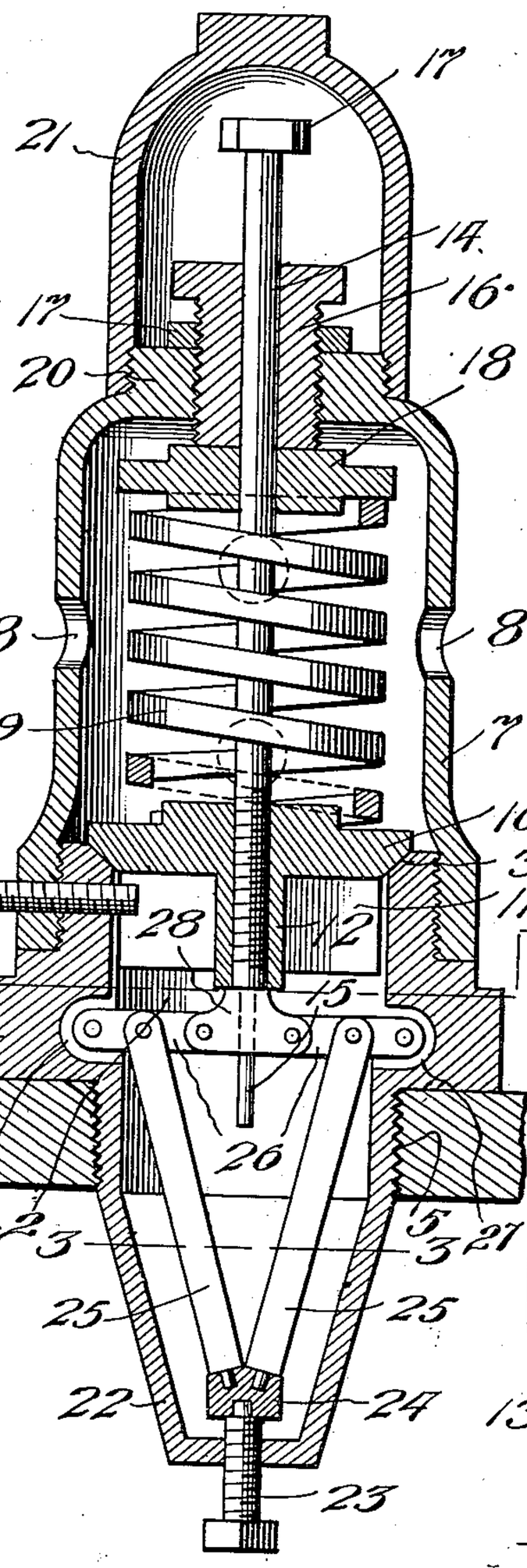


Fig. 2.

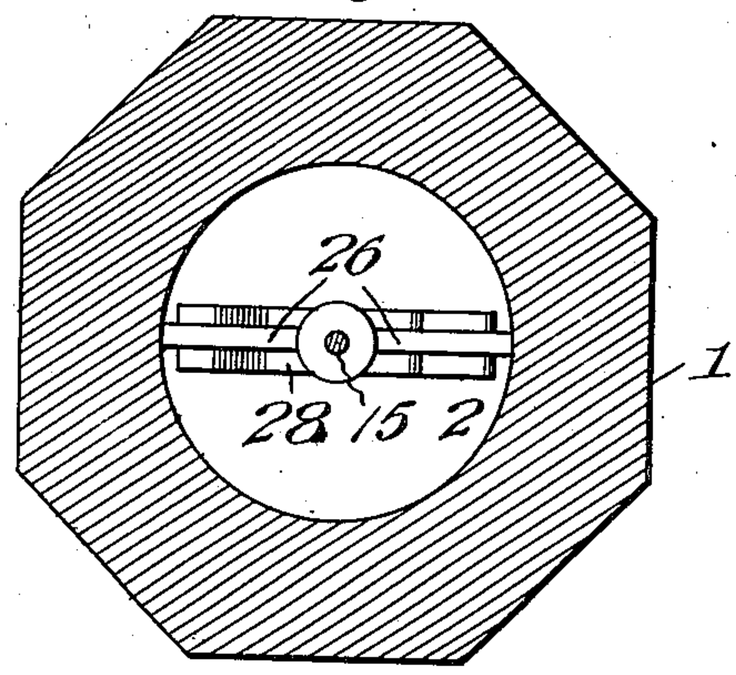


Fig. 3.

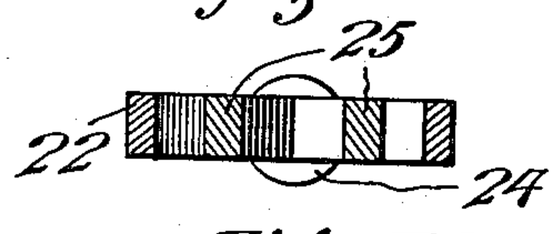
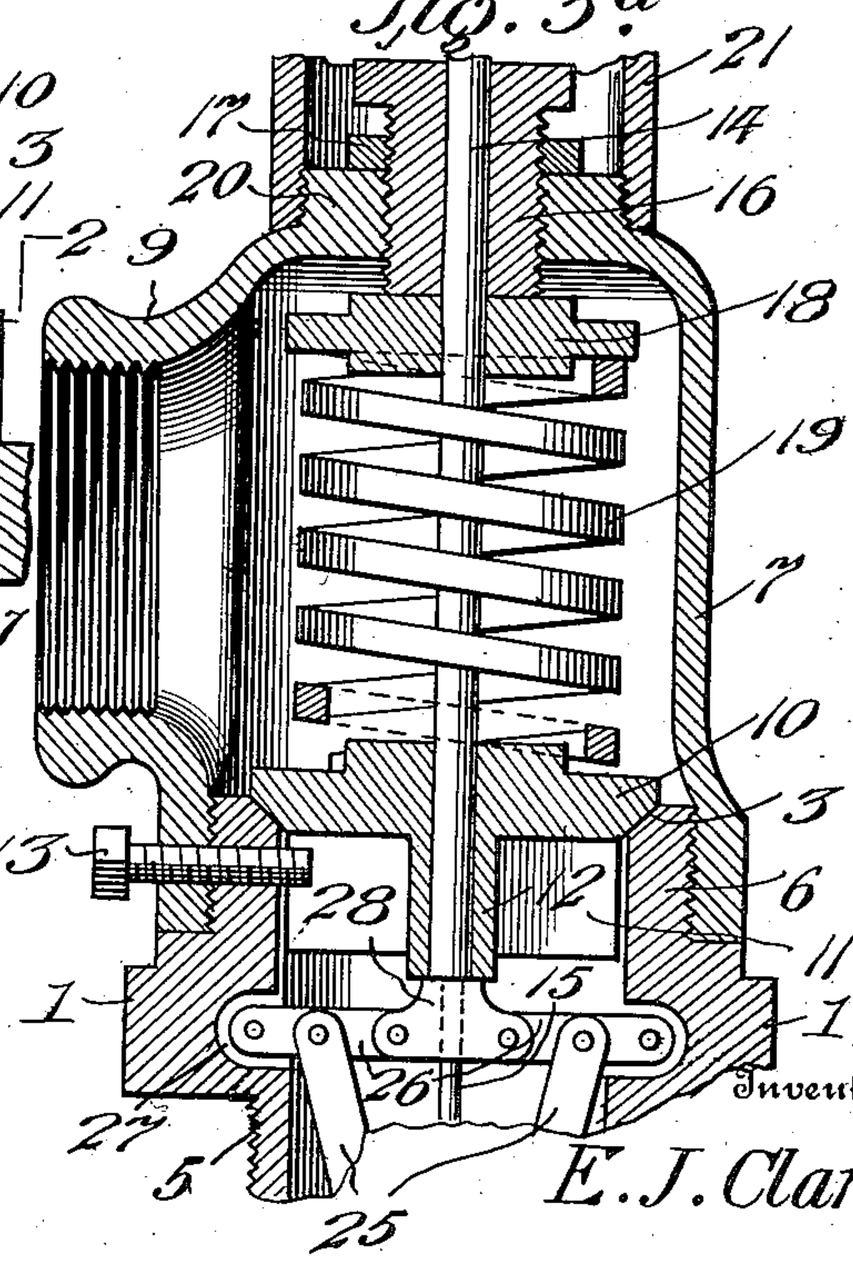


Fig. 3a.



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2 SHEETS—SHEET 2.

Fig. 4.

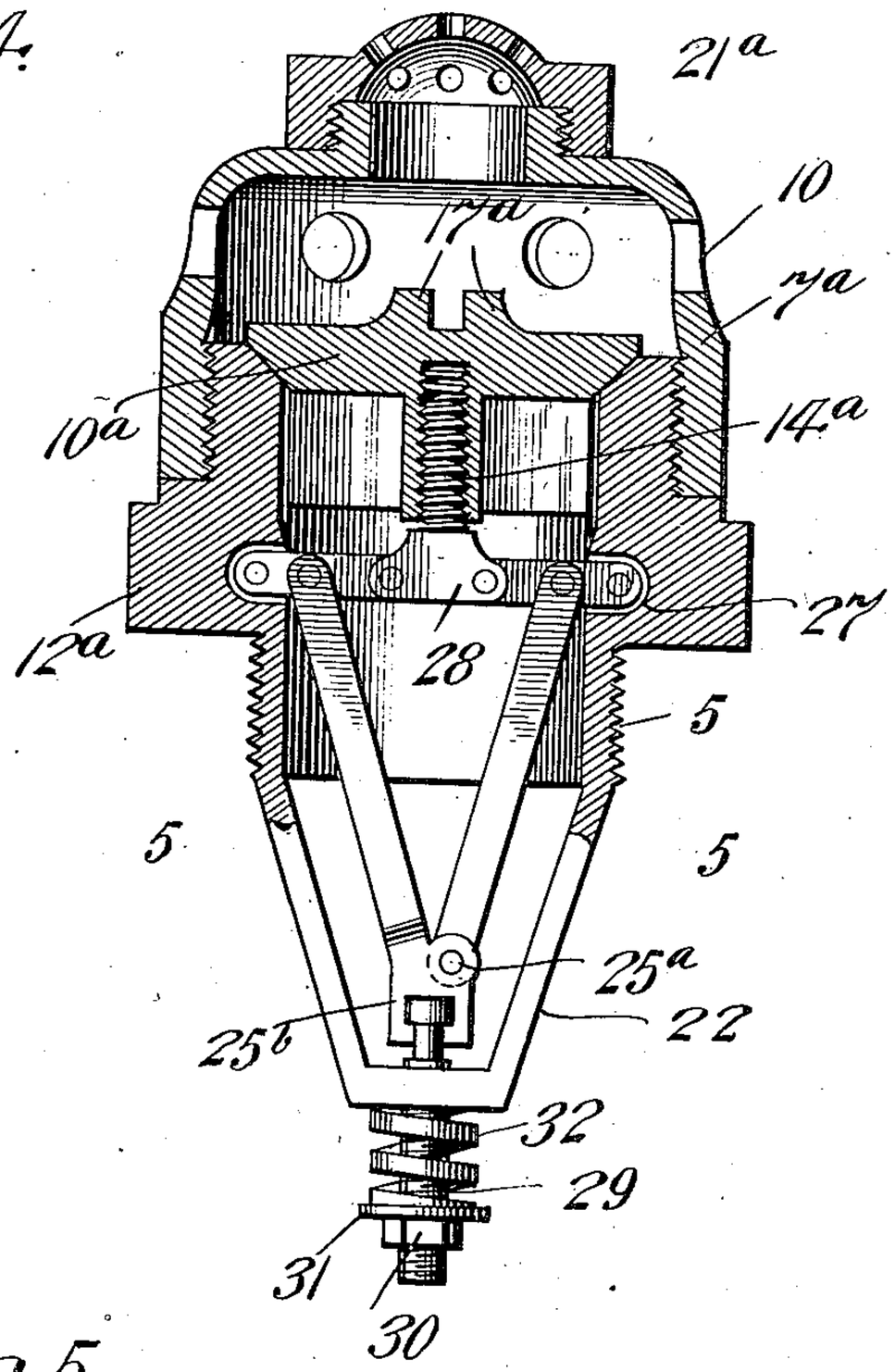
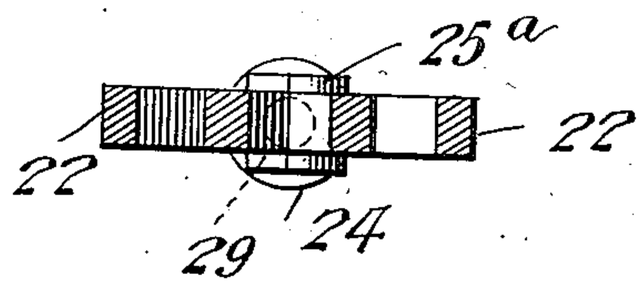


Fig. 5.



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SAFETY-VALVE FOR STEAM-BOILERS.

No. 886,945. Specification of Letters Patent. Patented May 5, 1908.

Application filed June 13, 1906. Serial No. 321,485.

To all whom it may concern:

Be it known that I, EDWARD J. CLARKE, a citizen of the United States of America, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented new and useful Improvements in Safety-Valves for Steam-Boilers, of which the following is a specification.

This invention relates to improvements in safety valves for steam boilers, the main object of the invention being to provide a valve controlled by the temperature as it exists in the ordinary operation of steam boilers, and utilizing a thermostat or the expansion of metal as the operating medium, whereby the escape of steam or gases from the boiler is permitted when the temperature in generation reaches a determined degree or an inconsistent condition of temperature exists to obviate all liability of an explosion.

A further object of the invention is to provide a thermostatically-operated valve which, in one form of embodiment, may be used in conjunction with an ordinary safety valve or independently to effect the exhaust of steam and gases from the boiler when a dangerous temperature or pressure is reached, and which, in another form of embodiment, is adapted to be operated by both temperature and pressure, independently or conjointly, the construction being such as to permit adjustment of the operating medium to act at any degree of temperature within reasonable and safe limits.

Still another object of the invention is to provide a thermostatic safety valve which will operate to allow exhaust of steam from the boiler, so as to effect a positive relief, in the event of the ordinary safety valve or the valve member of the thermostatic valve sticking to its seat and failing to open under maximum steam pressure.

My invention operates on the principle that a certain temperature should exist, in accordance with established thermo-dynamics steam tables, with a determined steam pressure in the boiler, and such temperatures and such pressures should always be reasonably consistent, otherwise a condition, perhaps not indicated by the pressure gage, is liable to ensue and cause an explosion, notwithstanding the fact that the pressure gage through defect in action or other causes may show that the pressure of steam is much less than that which the boiler is designed to stand and below that under which the ordinary safety valve is set to open. If at any time during the operation of the boiler in the generation of steam the generating temperature should rise materially above that at which the intended maximum pressure is generated, the valve will operate to permit of the exhaust of the excess pressure to the atmosphere.

In the accompanying drawings,—Figure 1 is a vertical section of a combination safety valve embodying my invention, which valve is adapted to operate under both thermostatic action and steam pressure. Figs. 2 and 3 are horizontal sections thereof, taken respectively on the lines 2—2 and 3—3 of Fig. 1. Fig. 3ª is a sectional view showing a modification in the construction of the bonnet. Fig. 4 is a vertical section of a valve opened solely by thermostatic action. Fig. 5 is a horizontal section of the same, taken on line 5—5 of Fig. 4.

Referring to the drawing, the numeral 1 designates the valve body, which may be of any suitable form and construction, but as shown is of generally circular form and provided with an exhaust port or passage 2 and a valve seat 3 at the upper end of said passage. The body has an angular surface 4 below which is a threaded extension 5 adapted to be screwed into a suitable receiving opening in the top of the boiler shell A, as shown in Fig. 1, the angular surface 4 permitting of the application of a wrench or other suitable tool to enable the valve to be conveniently applied and removed.

The valve body terminates at its upper end in an externally threaded reduced portion 6, to which is connected the lower threaded end of a bonnet or casing 7, provided with a desired number of ports 8 for the direct passage of the escaping steam or gases to the atmosphere. If desired, however, these ports may be dispensed with and the bonnet provided in lieu thereof with a connection 9 as shown in Fig. 3ª for the attachment of an exhaust pipe to lead the escaping steam or gases to any desired point of discharge.

A disk valve 10 engages the seat 3 and controls the port 2 and is provided with depending spaced guide wings 11 and a central boss 12, the wings being adapted to engage the walls of the port to guide the valve in its movements. A securing screw 13 extends through the interconnecting threaded portions of the body and bonnet and into the space between adjoining wings of the valve, thus holding the bonnet and valve from any tendency to rotative movement.

A stem 14 extends vertically through the bonnet and passes at its lower end through the valve body and boss 12, the said lower end of the stem being formed with a reduced extension 15 projecting below the valve. The lower end of the stem and the receiving opening or passage therefor in the valve and boss have a threaded engagement to permit the valve to be adjusted to regulate its seating action. The upper end of the stem extends through a guide plug 16 threaded for adjustment in a threaded opening in the top of the bonnet, and is provided with a head 17, whereby it may be adjusted to regulate the movement of the valve. The plug 16 is adapted to be held in adjusted position by a lock nut 17 and bears at its lower end upon a pressure head 18. Surrounding the stem between this head and the valve 10 is a coiled pressure spring 19 which holds the valve seated under a determined pressure, which pressure may be regulated as desired by adjusting the plug 16. The plug receiving opening in the top of the bonnet extends through a boss or enlargement 20 which is externally threaded for the reception of the lower threaded end of a dome cap 21, which incloses and shields the projecting portions of the plug and valve stem.

From the threaded extension 5 depends a yoke or open frame 22 which projects down into the steam space A′ and terminates above the highest normal water level. The base of said yoke or frame is formed with a threaded opening receiving an adjusting and supporting screw 23. The upper end of this screw is journaled in and supports a head 24 carrying metallic expansion bars or strips 25. These strips are suitably connected at their lower ends to the head and are divergently arranged and pivotally connected at their upper ends to oppositely arranged levers 26. The said levers 26 extend horizontally across the port 2 when the valve is closed and are seated and pivoted at their outer ends in recesses 27 formed in the valve body and pivotally attached at their inner ends to a head 28 arranged to slide upon the portion 15 of the stem and abutting against the lower end of the valve boss 12. It will be observed that the upper ends of the expansion bars are pivoted to the intermediate portions of the levers 26, which latter are raised and lowered as the bars expand and contract and thereby through the connections described impart pressure to force the valve open against the resistance of the spring and to permit it to close under the action of said spring. The bars, levers and their supports form a thermostat for controlling the action of the valve independent of steam pressure, and it will be observed that the head 28 by being slidably mounted on the portion 15 permits the valve to freely open under steam pressure in the usual way.

It will, of course, be understood that the valve may be constructed in any suitable manner for application to the boiler, and that the parts may be modified in various ways as may be deemed preferable, so long as the principle of operation is preserved. It will also be understood that I may employ any preferred form of expansion means for operating the valve, and that the valve may be employed independent of or in connection with a pressure safety valve of known types in use.

The valve is adjusted after the device is applied to the boiler to regulate the pressure of the spring 19 to allow the valve member 10 to open under the pressure of the steam when the latter rises to the desired maximum degree, the position of the device being such that the yoke 22 projects down into the top or steam space of the boiler, so that the bars 25 will be affected by the temperature within said space.

When the steam pressure rises above the safety limit, the valve 10 will be caused to open thereby to allow of the exhaust of the extra pressure, so that the device will subserve the function of the ordinary safety pressure valve. When the temperature in the steam space of the boiler exceeds the degree which should exist when the steam pressure reaches the safety limit, the expansion bars 25 lengthen and transfer motion to the levers 26, which, in turn, raise the valve 10 against the resistance of the spring 19, thus permitting the excess steam to exhaust. By this means, if the valve should stick so that it will not open under steam pressure when the safety limit of pressure is passed, it will be forcibly opened by the combined forces of the thermostatic pressure and steam pressure, and by adapting the valve to operate in this manner and to perform the function of an ordinary pressure safety valve double security is afforded in the way of preventing an explosion. The action of the thermostat may be regulated to accord with the degree of pressure of the spring 19 by the adjusting screw 23, and by means of said screw and the adjustable connection between the valve and stem 14 the parts may be adjusted while the valve is in action to adapt the valve to operate with any desired degree of sensitiveness.

Hence, it will be seen that if through sticking or any other cause the valve should not be opened by steam pressure, it will be opened by the thermostat to exhaust the excess pressure before an explosion occurs.

In the embodiment of the invention disclosed in Figs. 4 and 5, I have shown a valve normally held closed by the thermostat and adapted to be opened by the expansion of the thermostat when the temperature in the boiler rises to a dangerous degree to allow of the escape of the steam and thereby obviate any liability of an explosion. This valve may be used upon a boiler equipped with an ordinary steam safety valve and will operate entirely independently thereof to insure safety from dangerous conditions arising from an overgeneration of the steam if such safety valve should not work. As shown, the construction of this valve is generally the same as that shown in Fig. 1, the valve body, yoke, disk valve and thermostat being of the same general form and type except that the spring mechanism for holding the valve seated against steam pressure is dispensed with and the bonnet or casing 7^a correspondingly shortened, the opening in the top of the casing being closed by a perforated cap 21^a. The disk valve 10^a in this form of the invention is provided with a depending screw-threaded socket 12^a to receive a screw stem 14^a projecting upwardly from the head 28, whereby the valve is fixed to the head and normally held by the levers 26 and thermostatic bars closed against the exhaust of steam pressure. The valve is provided with lugs 17^a by which it may be adjusted on the stem 14^a to regulate its seating action under the operation of the thermostat. The metallic expansion bars or strips 25 also differ slightly in construction from those shown in Fig. 1, in that one of the bars is made longer than the other and pivoted thereto, as indicated at 25^a, and provided at its lower end with a head 25^b recessed to form a journal for the upper headed end of a screw stem 29 fitted to turn and slide freely in an opening in the base of the yoke 22. Below the yoke the stem carries a nut 30 and a washer 31, and surrounding the stem between the washer and yoke is a coiled spring 32. By this construction the lower ends of the expansion bars are secured to the yoke in such manner as to permit a yielding action of the connection to prevent distortion or injury to the parts from any tendency to excessive contraction of the bars. This form of connection may be employed, if desired, upon the valve construction shown in Fig. 1. The operation of this form of valve will be readily understood from the foregoing description.

Having thus described the invention, what is claimed as new is:—

1. A safety valve for steam boilers, comprising a casing, an escape valve arranged therein, and a valve-opening thermostat supported by the casing, said thermostat being adjustable with relation to the valve.

2. A safety valve for steam boilers comprising a casing, an escape valve arranged therein, a valve-opening thermostat supported by the casing, and an operating connection between the thermostat and valve, said connection comprising pivotally mounted levers.

3. A safety valve for steam boilers comprising a casing, an escape valve arranged therein, a thermostat supported upon the bottom of the casing independent of the valve, and an operative connection between the thermostat and valve, whereby the expansive action of the thermostat will open the valve.

4. A safety valve for steam boilers comprising a casing, levers pivotally mounted therein, a head pivotally connected with the levers, a valve arranged in the casing and adapted to be operated by the head, and a thermostat supported by the casing and operatively connected with the levers.

5. A safety valve for steam boilers comprising a casing, a thermostat supported thereby, a valve-operating device controlled by the thermostat, and an escape valve in the casing adapted to be opened by said device, said valve being adjustable with relation to the thermostat.

6. A safety valve for steam boilers comprising a casing having an escape passage and a depending portion, a perforated bonnet carried by the casing, an escape valve controlling the passage and adapted to open upwardly into the bonnet, and a thermostat supported by the depending portion of the casing and operatively connected with the valve, said valve and thermostat being relatively adjustable.

7. A safety valve for steam boilers, comprising a casing, a thermostat carried thereby, means for regulating the action of the thermostat, a valve operating means operable by the thermostat, and an escape valve adjustably connected with said means, and adapted to be opened thereby upon the expansion of the thermostat.

8. A safety valve for steam boilers comprising a casing, an escape valve arranged therein, a head for operating the valve, levers pivotally connected with the casing and head, and a thermostat comprising divergent bars supported at their lower ends by the casing and pivotally connected at their upper ends with the levers.

9. A safety valve for steam boilers comprising a casing having an outlet passage and a depending yoke, an escape valve controlling the outlet passage, valve-operating mechanism pivotally mounted within the

outlet passage, and a thermostat supported by the yoke and connected with the valve-operating mechanism.

10. A safety valve for steam boilers comprising a casing, a thermostat supported thereby, adjusting means for regulating the action of the thermostat, and an escape valve adapted to be opened by the thermostat and adjustable with relation thereto.

11. A safety valve for steam boilers comprising a casing, a thermostat carried thereby, an escape valve adapted to be opened by the thermostat, means for regulating the action of the thermostat, and means for regulating the action of the valve.

12. A safety valve for steam boilers including a casing, an escape valve therein, and thermostatic means for opening the valve, said valve and thermostatic means being relatively adjustable.

13. A safety valve for steam boilers comprising a casing, an escape valve therein, a thermostat supported by the casing and operative to open the valve, and means for permitting the valve to open independent of the thermostat.

14. A safety valve for steam boilers comprising a casing, a thermostat supported thereby, a valve adapted to be opened by the thermostat, a movable connection between the valve and thermostat, permitting the valve to open independently under steam pressure, and means for setting the valve to open under different pressures.

15. A safety valve for steam boilers comprising a casing, a thermostat supported thereby, a valve adapted to be opened by the thermostat, and an operative connection between the thermostat and valve, whereby the valve is adapted to open independently of the thermostat under steam pressure.

16. A safety valve for steam boilers comprising a casing, a thermostat supported thereby, a valve operative to be opened by the thermostat or to open independently thereof under steam pressure, pressure means for resisting the opening movement of the valve, and means for regulating the pressure means.

17. A safety valve for steam boilers comprising a casing, a thermostat supported thereby, an escape valve slidably connected with the thermostat for operation thereby or movement independently thereof under steam pressure, pressure-controlling means acting on the valve, and adjusting means connected with the casing for regulating the action of the thermostat.

18. A safety valve for steam boilers comprising a casing, an escape valve therein, a thermostat supported by the casing and including a head and levers operatively connected therewith, said head being slidably connected with the valve, and adjusting means for regulating the action of the thermostat.

19. A safety valve for steam boilers comprising a casing, a thermostat supported thereby, an escape valve adapted to be operated by the thermostat and having a sliding connection therewith for independent movement under steam pressure, adjusting means for the valve, adjusting means for the thermostat, a spring for normally holding the valve from movement, and means for varying the resistance of the spring.

20. A safety valve for steam boilers comprising a casing having an outlet passage and a depending yoke, levers pivotally mounted within the outlet passage, a head pivotally connected with the levers, a thermostat comprising bars pivotally connected at their upper ends with the levers and supported at their lower ends by the yoke, an escape valve having a depending portion engaging the head, a stem adjustably connected with the valve and having a portion slidably connected with the head, means for operating the stem to regulate the seating action of the valve, a spring for resisting the opening movement of the valve, and means for varying the pressure of the spring.

21. In combination with a boiler, a valve casing in always open communication with the boiler, said casing having an outlet passage, a valve controlling the outlet passage, a thermostat supported within the steam space of the boiler wholly above the water level, means operated by the expansion of the thermostat to open the valve, and means rendering the valve and thermostat relatively adjustable.

22. In combination with a boiler, a valve casing having an outlet passage communicating with the steam space of the boiler, a valve controlling said passage, a thermostat supported within the steam space of the boiler and wholly above the water line thereof, said thermostat being independent of the valve, and means operated by the expansion of the thermostat for opening the valve.

23. In combination with a boiler, a valve casing having an outlet passage in always open communication with the steam space of the boiler, a valve controlling said passage, a thermostat independent of the valve and supported within the steam space of the boiler, means operated by the expansion of the thermostat to open the valve, and means whereby the valve is adapted to open independently under steam pressure.

24. In combination with a boiler, a valve casing having an outlet passage in direct communication with the steam space of the boiler, an escape valve controlling said passage, operating levers supported by the casing and connected with the valve, and a thermostat supported within the steam space

of the boiler and comprising expansion bars connected with said levers, whereby upon the expansion of said bars the valve will be opened.

25. In combination with a boiler, a valve casing having an outlet passage in always direct communication with the steam space of the boiler, a valve controlling said passage, a thermostat supported by the casing and subjected always to the influence of the temperature conditions within the steam space, means operated by the expansion of the thermostat to transmit open movement to the valve, and means rendering the valve and thermostat independently and relatively adjustable.

In testimony whereof, I affix my signature in presence of two witnesses.

EDWARD J. CLARKE.

Witnesses:

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GEO. W. BUCKNAM.