F. E. STANLEY.

WATER LEVEL INDICATOR AND AUTOMATIC FEED WATER AND FUEL CONTROLLING DEVICE FOR STEAM BOILERS.

APPLICATION FILED JULY 18, 1907.

1,168,229.

Patented Jan. 11, 1916.

2 SHEETS—SHEET 1.

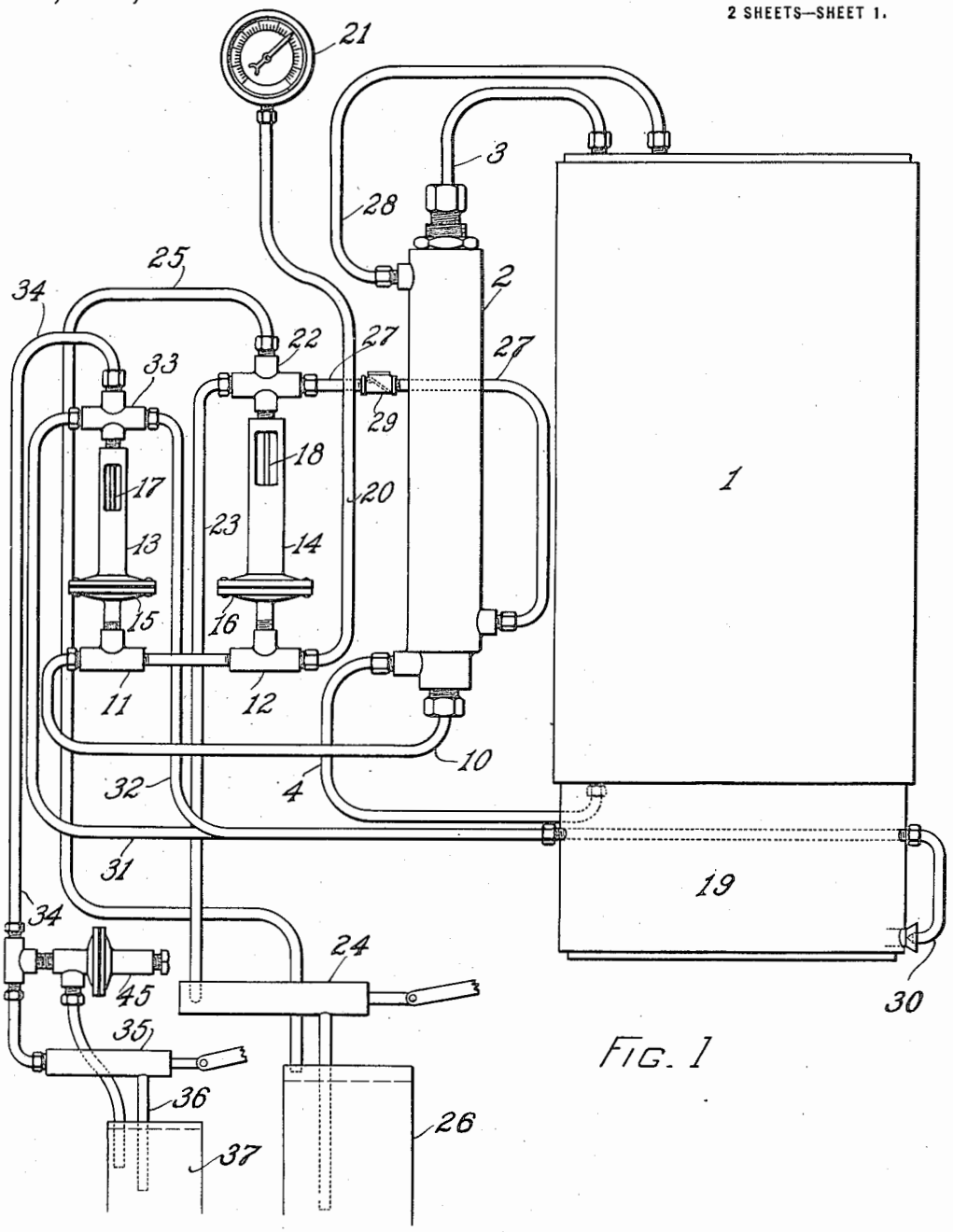

FIG. 1

WITNESSES

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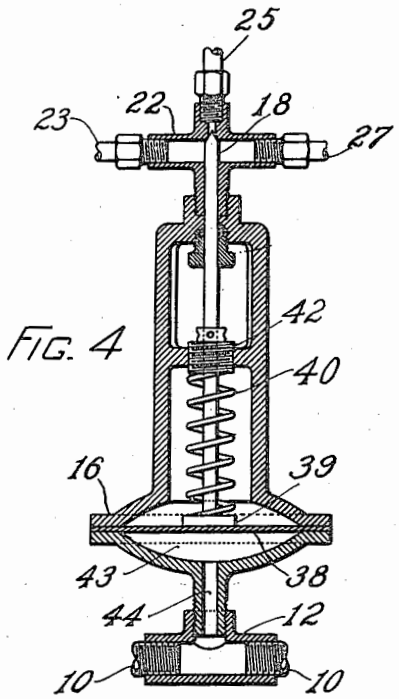

FIG. 4

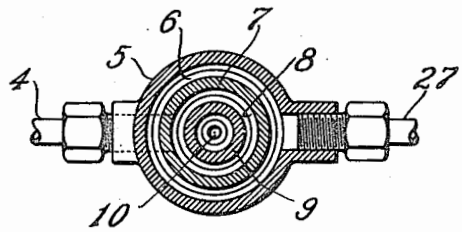

FIG. 3

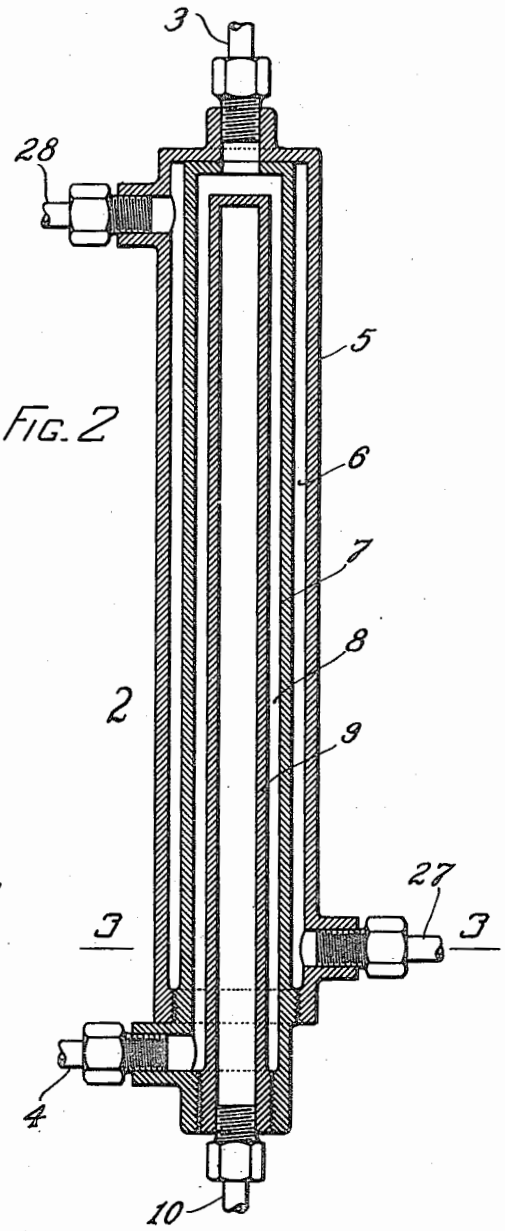

FIG. 2

WITNESSES

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UNITED STATES PATENT OFFICE.

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WATER-LEVEL INDICATOR AND AUTOMATIC FEED-WATER AND FUEL CONTROLLING DEVICE FOR STEAM-BOILERS.

1,168,229. Specification of Letters Patent. Patented Jan. 11, 1916.

Application filed July 18, 1907. Serial No. 384,377.

To all whom it may concern:

Be it known that I, FRANCIS E. STANLEY, a citizen of the United States, residing at Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Water-Level Indicators and Automatic Feed-Water and Fuel Controlling Devices for Steam-Boilers, of which the following is a specification, reference being had to the drawings accompanying same.

My invention relates to a device for indicating the height of water in a boiler, and for automatically controlling the supply of feed water to the boiler and the supply of fuel to the burner or furnace under a boiler.

The object of my invention is to provide a device that will indicate the height of the water in a boiler by a pressure gage or other device, and that may be connected to the feed water circulating pipes of the boiler in such way as to control the supply of feed water to the boiler and the supply of fuel to the burner by causing the feed water to flow into the boiler from a pump when the height of water is below a certain predetermined point, and to shut off the supply of fuel to the burner or furnace of a boiler when the water level reaches the lowest height consistent with safety to the boiler and those operating it.

A further object of my invention is to provide means containing a liquid, the receptacle for which does not communicate with the water space of the boiler wherein the expansion and contraction of the liquid, due to the rise and fall of water in the boiler, will indicate the height of water in the boiler and will open or close a by-pass valve to cause the feed water to flow to the boiler or cut it off from the same, and will open or close a fuel supply valve to the burner to allow the fuel free access to the burner or furnace when the water is at a safe level, and to cut off the supply of fuel to the burner or furnace when the water reaches the lowest point consistent with safety.

In the drawings accompanying this specification and forming a part thereof—Figure 1 is a diagrammatic view of a boiler taken in elevation and of my apparatus for indicating the height of water in the boiler and for automatically supplying or cutting off the feed water to the boiler and the supply of fuel to the burner or furnace, together with an illustration of feed water and fuel pump, and tanks for containing the feed water and fuel. Fig. 2 is a sectional elevation of my water level indicating device. Fig. 3 is a cross section of same taken on line 3—3, Fig. 2. Fig. 4 is a sectional elevation of the automatic by-pass valve used in both the feed water controlling device and the fuel controlling device.

In the drawings, 1 represents a diagrammatic elevation of a boiler; 2 is the water level indicating feed water and fuel controlling device, which also serves as a water column for the boiler by reason of it being connected with the top and bottom of the boiler, its top being connected by the pipe 3 and the bottom by the pipe 4.

The water level and feed water and fuel controlling device 2 comprises a column composed of three shells, the spaces between the shells having no communication with each other. The outer shell 5 forms the chamber 6 between its interior walls and the shell 7; the shell 7 in turn has the chamber 8 in which is located the tube 9. Said tube 9 is closed at its upper end and is secured in the lower end of the shell 7 by being screw threaded therein, or in any other suitable way. The pipe 10 is secured to the tube 9 and is provided with the T's 11 and 12 to which two automatic pressure controlled valves 13 and 14 are connected in such manner that any pressure in the pipe 10 will be communicated to the under side of steam-tight diaphragms of the usual construction contained in the portions 15 and 16, thus pressing upwardly the valves 17 and 18.

The by-pass valve 13 controls the supply of fuel to the burner 19, while the by-pass valve 14 controls the supply of feed water to the boiler 1. The pipe 10 has attached at its upper end a pressure gage 21, the pointer of which will indicate the pressure in the tube 9 and pipe 10 due to the expansion or contraction of liquid contained in said tube 9. The valve portion 22 of the automatic valve 14 is connected by a pipe 23 with a water pump 24 which may be of any suitable form, and either operated by power or by hand. The pipe 25 is a by-pass pipe through which the water is returned to the water tank 26 when the water in the boiler

is at a predetermined height. The pipe 27 is connected with the outer space 6 in the shell 5 in such manner that any water passing through said pipe 27 from the pump 24 will surround the shell 7 for most of its height and flow upwardly and out of said water space 6 through the pipe 28 to the top of the boiler 1. The pipe 27 has inserted in it near the valve 22 a check-valve 29 which serves to prevent the steam and water from flowing backwardly from the boiler 1.

In the illustration embodying my invention, it is applied to a boiler having a burner using liquid fuel or hydrocarbon gas generated from liquid fuel. In this embodiment 30 represents the nozzles through which the fuel is injected into the burner, and which are connected by pipes 31 and 32 to the valve 33, which valve in turn is connected by the pipe 34 to the fuel pump 35. The pump 35 may be operated by hand or power, as the case may be, and is connected by an in-take pipe 36 to the fuel containing tank 37. The pump 35 is of the usual type used in such cases.

The automatic valve 33 is controlled by a diaphragm located in the portion 15 and is so arranged that pressure in the pipe 10 will be communicated to the bottom of said diaphragm and through the valve portion 17 close the valve as illustrated in Fig. 4, so that fuel cannot get through the pipe 34 and into the pipes 31 and 32 when the pressure in said pipe 10 has reached a predetermined point due to a decrease in the height of the water in the boiler 1.

The portions 15 and 16 are alike in construction; *i. e.*, each contains a flexible diaphragm 38, a button 39 in which the valve stems 17 and 18 are secured, a spiral spring 40 surrounding the valve stems, its lower end being fitted upon the button 39 and its upper end upon the adjusting screw 42 and is arranged to adjust the tension upon the spring 40. The chamber 43 is formed in the portion 15 and is provided with the passage 44 which communicates with the pipe 10, so that a predetermined pressure in said pipe 10 is communicated to the under side of the diaphragm 38 to press it against the button 39 and thereby move the valve stems 17 and 18 longitudinally in their spaces in the valves 22 and 33 by overcoming the tension of the spring 40. When the pressure in the chamber 43 falls below the tension of the spring 40 said spring will move the valve stems 17 and 18 downwardly and open the valve.

The automatic by-pass valve 45, of the usual construction, is connected to the pipe 34, and from thence a pipe leads to the fuel tank. This serves to by-pass the liquid fuel from the pump 35 back into the tank 37 when the automatic valve 33 is closed.

The operation of the indicating device and its various parts is as follows:—The space 8 of the indicating device 2, as before stated, forms a water column, the top and bottom of which is connected with the top and bottom of the boiler by the pipes 3 and respectively so that water will stand in the space 8 at the same height that it is in the boiler 1, and surround the tube 9, thus bringing into contact with said tube 9 the water in the boiler, as well as the live steam above the water in the boiler, thus subjecting said tube 9 to the heat of the water in the boiler as high as the water level, and above that point to the heating effect of the live steam. The tube 9 is designed to be completely filled to its top with a liquid medium and connected by the pipe 10 to piping leading through the two automatic valves 13 and 14, and thence by the pipe 20 to the gage 21.

It will be understood that the pipe 3 is above the level of the water in the boiler and in communication with the top of the space 8, and the pipe 4 is below the level of the boiler in communication with the space 8 so that the water in space 8 cannot circulate and is therefore practically stagnant, and that the pipe 4 is exposed to the air and will radiate the heat of the water contained therein, and that the space 8 surrounded by the wall 7 has its wall 7 in contact with the constantly circulating body of cold feed water so that water contained in the space 8 will have its heat radiated through the wall 7 and carried away by the water circulating through the space 6. Hence, owing to the radiation of heat in the water contained in the pipe 4, and space 8, and said water being practically stagnant it will be cooler than the live steam which is admitted to the top of space 8 and which is at a temperature at all times of at least the boiling point, for the reason that if the temperature in said steam should radiate it becomes condensed and mingles with the water and its place is taken by additional live steam from the boiler. Thus, the portion of the tube 9 which is exposed to the live steam must be more highly heated than the portion which lies within the water, and as the level of the water rises and falls in the space 8, more or less of the tube 9 is exposed to the heat of the steam, as the case may be, thus expanding and contracting the water in the tube 9 as the water falls and rises in the space 8.

By the form and arrangement of the various parts of my water indicator, that portion of the liquid contained in the tube 9 which is above the water level in the boiler will be heated by the live steam, and expanded, thus creating pressure in said tube 9, which will be communicated to the diaphragms in the valves 13 and 14, and to the pressure gage 21, indicating upon said pressure gage or other device, by the increase or decrease of the pressure thereon what portion of the tube 9 is exposed to the heat of the live

steam, and thus the height of the water in the boiler.

When the level of water in the boiler reaches a point where it is above the upper end of the space 8 it will completely inclose the tube 9 and condense and contract the water in the tube, thereby causing the pressure on the gage 21 to decrease and the valves 17 and 18 to open, letting more fuel to the burner, and causing the water pumped by the water-pump 24 to by-pass out through the pipe 25, and thence to the water tank 26. The condensation of the liquid in the tube 9 is assisted by the cooling effect of the feed water which enters when cold at the lower end of the chamber 6, passes upward around the shell 7, and out through the pipe 28 to the boiler. As the water level in the boiler 1 falls below the top of the space 8 the steam will heat the tube 9, causing pressure therein and continuing to heat more of the tube as the water level in the boiler falls, increasing the pressure in the pipe 10, and upon the diaphragms 13 and 14 to a point where the valve stems 17 and 18 will close the water by-pass, cutting off the supply of fuel to the burner.

It is understood that the automatic water valve 13 has its diaphragm set at a point where the fuel will be cut off only when the water level in the boiler reaches a point where it is no longer safe to generate steam.

I have illustrated the best embodiment of my invention now known to me, and have described its construction and operation; but desire to have it understood that the apparatus shown is only illustrative, and that the form and arrangement of the different parts may be changed in practising my invention, without departing from it.

What I claim is—

In a fuel supply controlling device for steam boilers, a water column; pipe lines connecting the upper and lower ends of the water column with the top and bottom of the boiler respectively; a water space contiguous to and outside the water column through which the feed water is pumped; a thermostatic tube closed at one end and inclosed in said water column; a pipe line connecting said tube with a diaphragm-controlled by-pass fuel valve; said fuel valve; a continuously operated fuel pump; pipe lines connecting said fuel by-pass valve with the fuel pump and a burner; said burner; all arranged so that the fuel supply will be cut off through the action of a low water condition in the boiler.

In testimony whereof, I have hereunto set my hand, in the presence of two subscribing witnesses, this the 6th day of July, A. D. 1907.

FRANCIS E. STANLEY.

Witnesses:
E. E. WALKER,
F. J. MAURER.