S. FUKUTOME.

WATER GAGE.

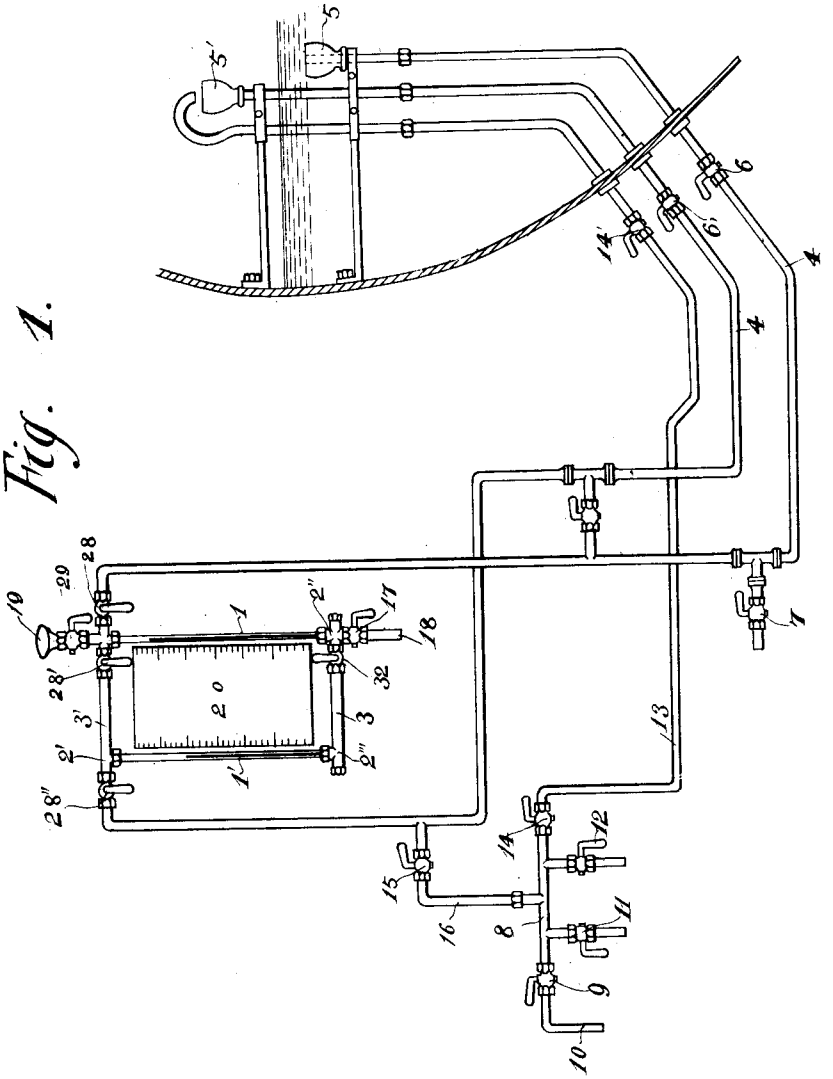
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1,066,807.

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3 SHEETS—SHEET 1.

Fig. 1.



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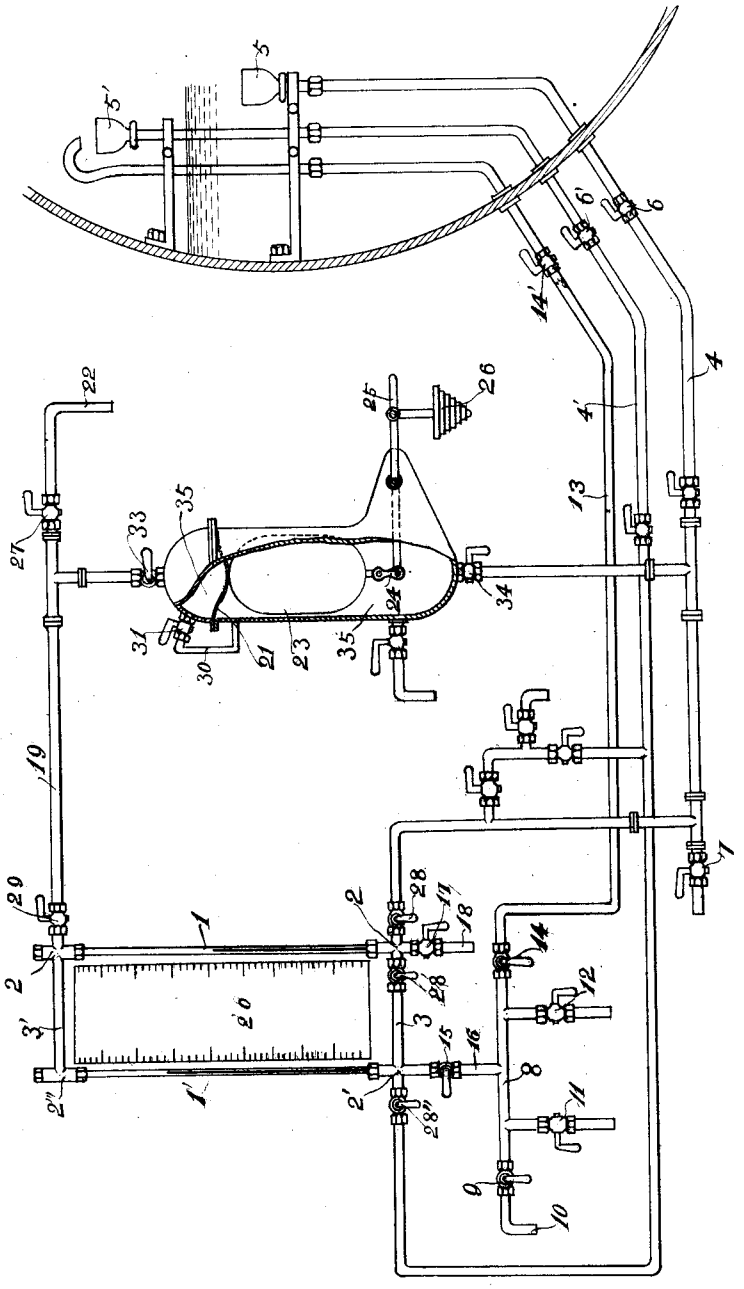
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

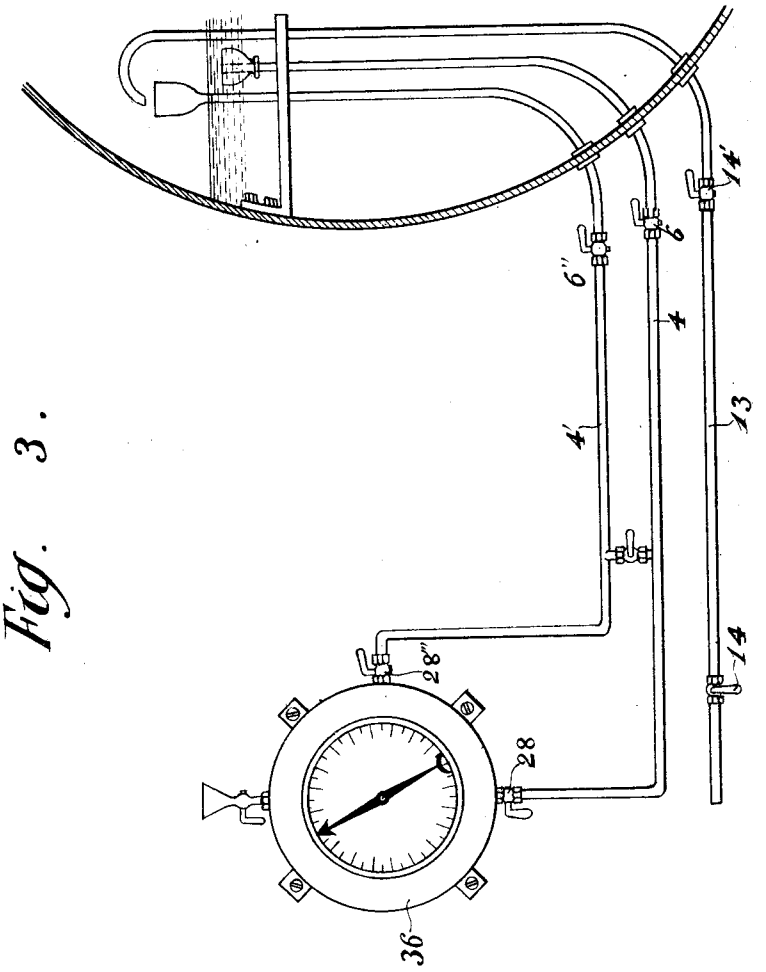


Fig. 3.

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UNITED STATES PATENT OFFICE.

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WATER-GAGE.

1,066,807. Specification of Letters Patent. Patented July 8, 1913.

Application filed October 2, 1911. Serial No. 652,402.

To all whom it may concern:

Be it known that I, SHIZUHARU FUKUTOME, engineer, a subject of the Emperor of Japan, residing at No. 704 Shimoijiki-Mura, Kagoshima-Ken, Empire of Japan, have invented certain new and useful Improvements in Water-Gages, of which the following is a specification.

My invention relates to improvements in water level indicating apparatus for steam boilers, and more particularly to apparatus adapted to indicate the level of the boiler water not only in the boiler room, but also at any other desired point where such apparatus is installed.

Another object of the invention is to provide a device of this character, that can easily be installed, and in which one of the two gage pipes which are both constantly filled with water has its cup end located above the highest level of the boiler water, while the other pipe has its cup end located below the lowest level of the boiler water, so that the difference in pressure, due to the corresponding difference in the height of the water columns in said two pipes will be indicated and represent the actual level of the water in the boiler.

Finally, a still further object of the invention is to provide an improved water level indicating apparatus which can be very conveniently used on board of steamers so as to expedite the supervision of the boiler and to prevent casualties having their causes in disturbances of the boiler water.

With the above and other objects in view my invention has particular relation to certain novel features of arrangement and operation, an example of which is described in this specification and illustrated in the accompanying drawings, wherein:

Figure 1 is a diagrammatical view of my apparatus, showing a fragment of a boiler and the general arrangement of the device in which mercury is used as an operating agent. Fig. 2 is a view similar to Fig. 1 in which air is used as an operating agent, parts being broken away so as to show the interior of the air feeding device. Fig. 3 is a view similar to Fig. 1 in which a pressure gage is used as an operating agent in lieu of air or mercury.

Similar characters of reference refer to the same parts throughout the drawings.

The present invention comprises two conducting pipes, which I term maximum and minimum pipes, respectively, the former having its cup end located higher than the highest level of the boiler water, while the latter has its cup end located below the lowest level of the boiler water.

In the accompanying drawing the numerals 1, 1′ represent two vertical gage tubes arranged parallel to each other at the sides of a scale board 20. The ends of both of said tubes are provided with suitable sockets 2, 2′, 2″, 2‴. On both sides of the socket 2 suitable valves 28, 28′ are arranged while in front of the socket 2′ one valve 28″ is provided as shown in the drawing. If the apparatus is operated through the agency of mercury, the socket 2″ is preferably fitted with a valve 32. 3 and 3′ represent two suitable tubes adapted to communicate with and fitted into said sockets at their respective ends as shown in the drawing.

4 and 4′ are two conducting pipes which are termed minimum and maximum pipes, respectively, The maximum pipe 4′ is provided at its upper extremity with a cup 5′ shown in Fig. 2. The position of said cup is such that the level of the boiler water will never rise above the upper edge of the cup even when the boiler is fed to its full capacity where the water reaches its highest level. The minimum pipe 4 is also provided at its upper extremity with a cup 5 in such a position that the level of the boiler water will never sink below the upper edge of said cup, even if the boiler water is evaporated to such an extent that it reaches its lowest level.

The maximum and minimum pipes 4′, 4 are secured to the boiler plate in any suitable manner, and their opposite free ends are connected to suitable gage tubes 1, 1′, interposed between the valves as shown in the drawing. Two valves 6 and 6′ are arranged within a short distance from the boiler plate on the outside of the same in each of the pipes 4 and 4′. Suitably spaced from said valve 6 and the lower part of the minimum pipe is provided a drain cock 7. A water inlet pipe 13 extends into the interior of the boiler and has its discharge opening arranged above the cup 5′, its rear end being connected to the socket 8 communicating with a drain pipe 10 and a valve 9 is interposed between said socket and the drain pipe. In the neighborhood of the valve 9 is provided a valve 11 which is

adapted to communicate with a hand operated pump.

The valve 12 of a branch of socket 8 is adapted to make communication with the main feed pump or other suitable water supplying apparatus. 14 and 14′ are two other valves located in the inlet pipe 13. The valve 14′ is arranged at the same distance from the boiler plate as the other two valves 6 and 6′ of the maximum and minimum pipes 4′ and 4. The maximum pipe which terminates in the gage tube 1′ is also adapted to communicate with a water supply pipe 16 in which is located the valve 15 as shown in the drawing. At the lower end of the gage tube is provided a drain pipe 18 with a valve 17 while at its upper end, if the apparatus is operated through the agency of mercury, there is arranged a suitable cup 19 which is controlled by the valve 29. In case the apparatus is to be operated through the agency of the atmospheric air a suitable supplementary air inlet pipe 19′ is used as shown in Fig. 2 which is also controlled by the valve 29.

As the air is likely to escape from the water in course of time, it is necessary to provide a means to compensate for the loss of air. For this purpose I provide a special air feeder as shown in Fig. 2 of the drawing, which comprises an air chamber 35 and a water chamber 35′ separated by a suitable diaphragm 21. The air chamber 35 is controlled by the valve 33 which is connected to the air supplying pipe 22 communicating with the air chamber of either feed or air pump. The communication between the air and water chambers 35, 35′ is effected by means of a connecting pipe 30 in which a valve 31 is arranged. Said water chamber 35′ is adapted to communicate with the minimum pipe 4 by means of the valve 34 secured to the bottom of the feeder. Inside the feeder is placed a suitable float 23, the lower end portion of which is secured to one end of a horizontal lever 25 by means of a connecting link 24, the rear end of said lever 25 being adapted to receive weights 26.

It will be observed that by suitably adjusting the weights 26 the float 23 will be raised or lowered and will cause the diaphragm 21 to rise, if more weights are added, by which motion it will compel the air confined in the air chamber to pass into the air feeding pipe 19′ and into the gage tube.

When operating the apparatus by the agency of mercury, all valves, except 28′ and 32 are closed, so as to leave the two gage tubes 1 and 1′ in communication with each other. Then a suitable quantity of mercury is introduced through the cup 19 into the gage tubes until it reaches a suitable height. The two valves 15 and 11 are then opened and by means of a hand pump the supply of water is forced into the inlet pipe 16 until it leaves the cup 19. After the valves 28, 32, 29 are closed more water is admitted through the valves 28″ and 6′ which have been opened for this purpose into the maximum pipe 4′ until it is entirely filled. Then valves 28 and 6 are opened. It will be observed that in this way the mercury in both gage tubes 1 and 1′ which now are both in communication with the boiler water will come to a state of rest, or will be balanced in both tubes at a certain height. Care must be taken to keep the maximum pipe 4′ constantly filled with water. If not properly filled, a fresh supply of water should be furnished at once by opening the valves 14 and 14′ of the inlet pipe 13.

In order to ascertain whether the gages operate properly or not the valves 28′ and 32 must be opened. The column of water in the maximum pipe 4′ will then be found to descend too low to balance the level of the boiler water and consequently the columns of mercury in both gages will be balanced. Then the said valves 28′ and 32 are closed again and the maximum pipe 4′ is filled with water. The mercury columns in each of the gages if the device is properly working must show the same readings as before. Should they fail to do so, the fault must reside either in the maximum or minimum pipe. The condition of the water in the maximum pipe will be readily ascertained by working the valves as follows: First, by closing the valves 28′ and 28 and by opening the valves 28″. 15 and 9 and then again opening valve 28. The condition of the water in the minimum pipe will be ascertained by closing the valve 28″ and opening the valve 28 so as to discharge the water from the valve 7.

It will be observed that when the columns of mercury are balanced in both tubes, that is when they are brought to a state of rest, the difference between their heights can be read off from a scale board and by translating it into the corresponding height of water, the actual depth of the boiler water will be ascertained as the difference in the mercury columns is proportional to the height of the water between the top of the maximum pipe 4′ and the actual level of the boiler water.

In case the apparatus is to be operated through the agency of air, the valves 15, 28 and 28′, 33, 31, 34, 29, and 11 or 12 are first opened. Then by working either hand pump or main feed water pump, the supply of water is allowed to flow into the system until it stands at a suitable height in the water chamber as well as in the gage tube. Hereafter the valves 15, 28, 29, 31 and 34 are closed and the valve 27 opened. A supply of air is then admitted into the air chamber

35. Hereafter the weights 26 are adjusted by removing part of them and the float 26 will sink until the air chamber is completely filled with air. The valve 33 is then closed and the valves 29 and 17 are opened while more air is supplied to expel the water out of the gage tubes until its level is so low that it is about two or three inches from the bottom of the tubes whereafter the valves 17, 29 and 27 are closed. Hereafter by opening the valves 28 and 6 through the medium of the minimum pipe 4 the communication between gage and boiler water will be established. As soon as the water stands still and is counter-balanced in the gage by the boiler water, it will stand at a proportionate height to the level of the boiler water. Then the valve 28′ is closed and the valves 15, 28″ and 6′ are opened so that the water is admitted into the system until it overflows in the cup 5′ and by closing the valve 15 the water in the gage tube 1′ will come to rest in balance with the water in the maximum pipe 4′. The maximum pipe 4′ should be constantly kept filled with water, and any loss in the quantity of such water will readily be compensated by opening the valves 14 and 14′ whereby a fresh supply of water will be obtained from the pump and injected through the cup 5′. The air is likely to escape from the water and if any reduction in the volume of the air in the tubes is noticed, the valve 29 must be opened. Then the float is moved upwardly by adjusting additional weights on the lever 25 until the diaphragm 21 expels the air out of the chamber 35 into the tubes leading therefrom. Thus when the equilibrium is established, it will be seen that the required height of the boiler water is equal to the difference between the height of the water in the maximum pipe and of the water in the boiler and the difference in the water levels in the two gage tubes which is read off from the scale board. Finally the pressure gage 36 (Fig. 3) used in the present apparatus may be of any suitable form without interfering with the principle of the invention according to which the point of the gage will slide over the face of the instrument under the influence of the maximum and minimum water columns which are communicated to the pressure gage. As is well understood the gages used for this purpose must be strictly water-tight.

I claim:

1. In a water level indicating apparatus used in conjunction with steam boilers, in combination with two indicating tubes, a pipe connecting one of said indicating tubes with a boiler, a cup upon the free end of said pipe within said boiler extending above the maximum level of the boiler water, a second pipe connecting said indicating tubes with the boiler, a cup upon the free end of said tube within said boiler extending below the minimum level of the boiler water, means for making and interrupting the connection between the boiler and said indicating tubes, a water inlet pipe having one of its ends connected to the main feed pipe and its other end extending into the boiler over the cup above the maximum water level for constantly supplying water to said pipe, means for controlling the water supply to said indicating tubes and to said boiler, and means for indicating the height of the water column in the boiler by the variations in pressure.

2. In a water level indicating apparatus used in conjunction with steam boilers, in combination with two indicating tubes, a pipe connecting one of said indicating tubes with a boiler, a cup upon the free end of said pipe within said boiler extending above the maximum level of the water, a second pipe connecting the other of said indicating tubes with the boiler, a cup upon the free end of said tube within said boiler extending below the minimum level of the boiler water, valves in the pipe conduits for making and interrupting the connection between the boiler and said indicating tubes, means for regulating the air supply to said indicating tubes, a water inlet pipe having one of its ends connected to a hand pump and its other end extending into the boiler over the cup above the maximum water level for constantly supplying water to said pipe, drain pipes in connection with the minimum conductive pipe, one of said indicating tubes, and the water supply pipe, and means within said indicating tubes for indicating the height of the water column contained in the boiler by the variations in pressure.

Dated this seventh day of September 1911.

SHIZUHARU FUKUTOME.

Witnesses:

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