J. E. VANNATTER.

WATER LEVEL RECORDING AND INDICATING DEVICE FOR STEAM BOILERS.

APPLICATION FILED APR. 16, 1910.

996,170. Patented June 27, 1911.

3 SHEETS—SHEET 1.

Fig. 1

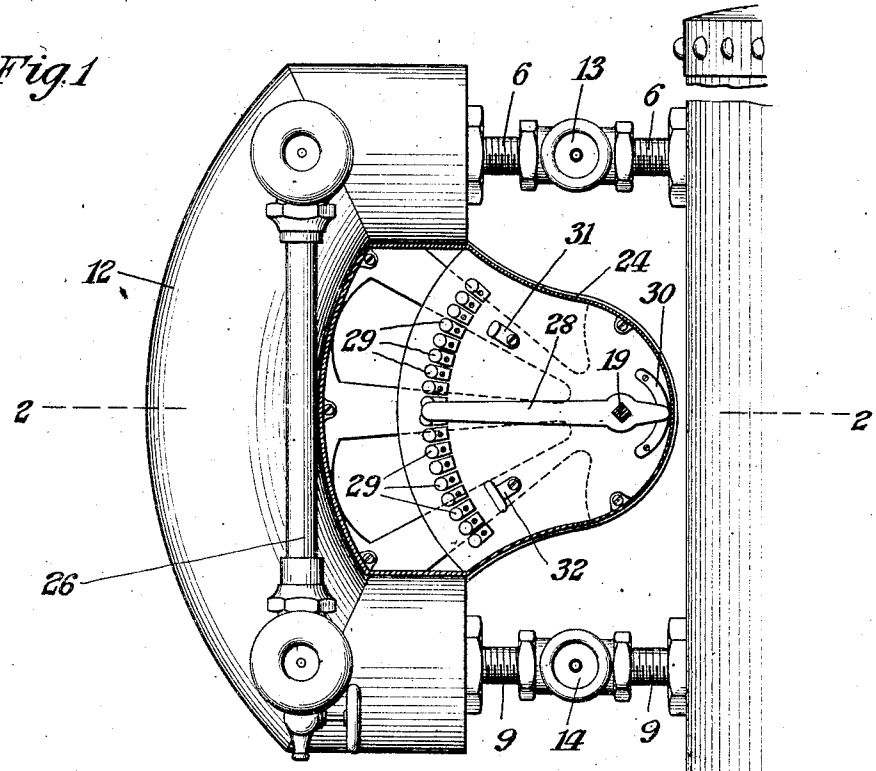
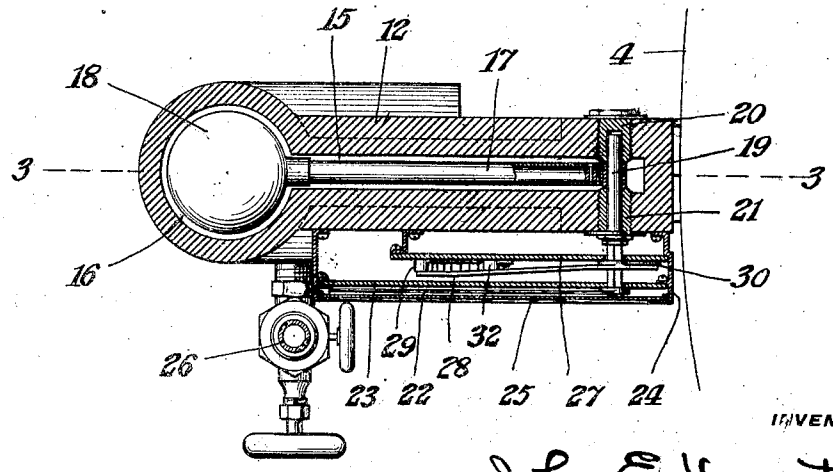


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

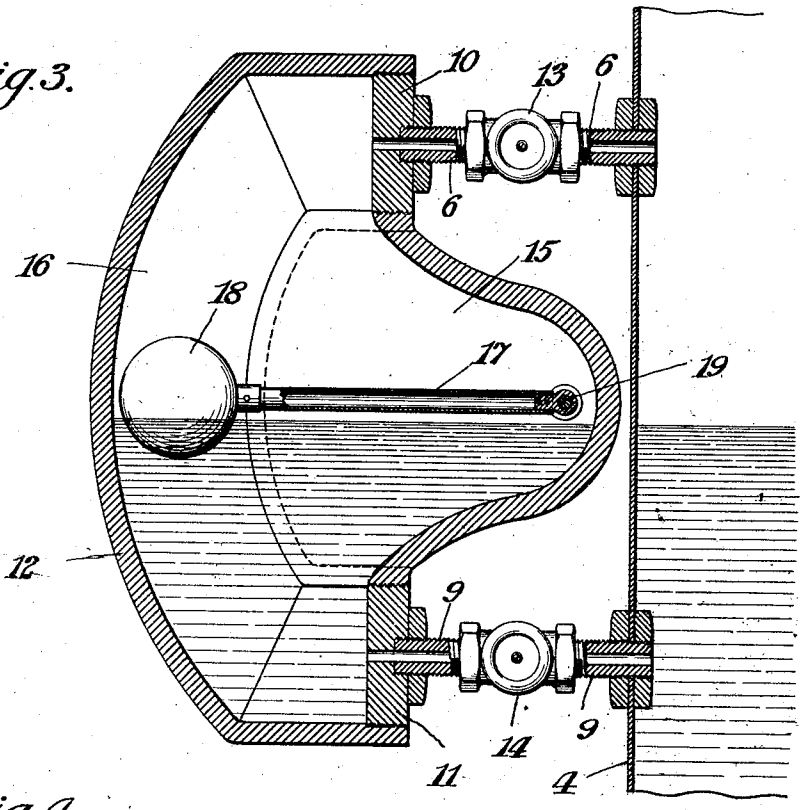
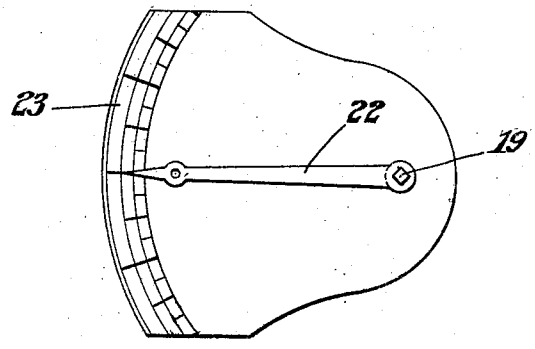


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

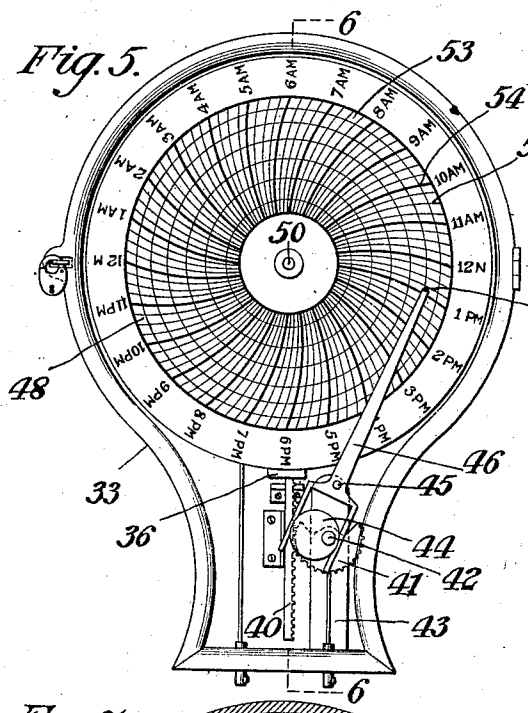


Fig. 6.

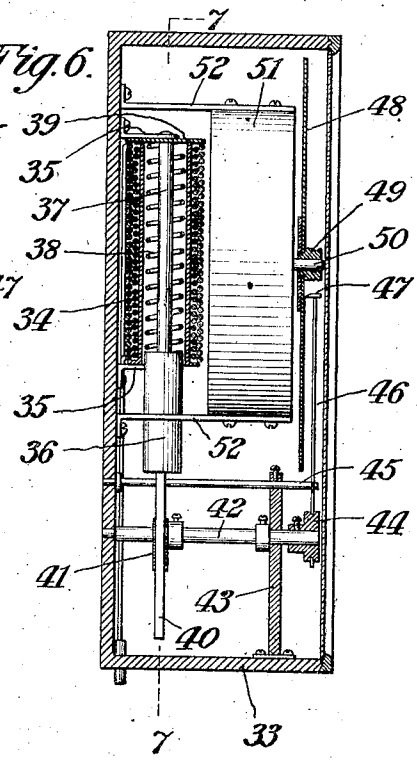


Fig. 7.

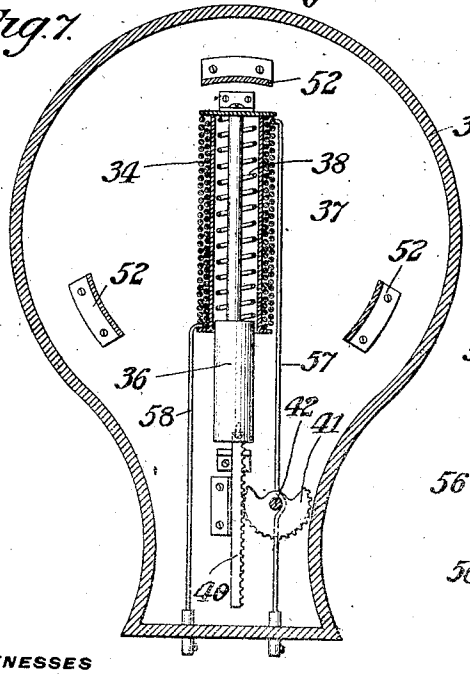
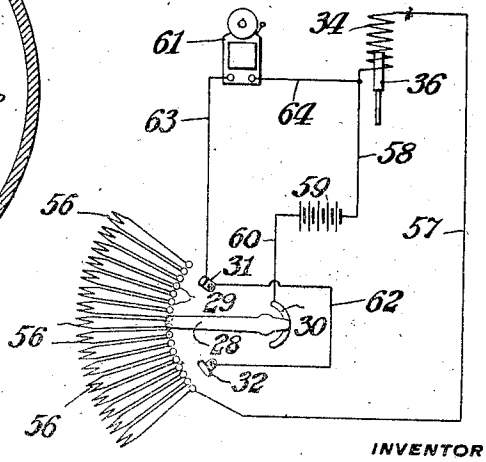


Fig. 8.



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UNITED STATES PATENT OFFICE.

JOHN E. VANNATTER, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-THIRD TO PETER SCHURG AND ONE-THIRD TO JOHNSTON NOLAN, OF PHILADELPHIA, PENNSYLVANIA.

WATER-LEVEL RECORDING AND INDICATING DEVICE FOR STEAM-BOILERS.

996,170. Specification of Letters Patent. Patented June 27, 1911.

Application filed April 16, 1910. Serial No. 555,779.

To all whom it may concern:

Be it known that I, JOHN E. VANNATTER, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Water-Level Recording and Indicating Devices for Steam-Boilers, of which the following is a specification.

The object of my invention is to provide a novel, simple and efficient means for recording the changes of the water level of a steam boiler with respect to the time that such changes take place and also to actuate an alarm device when a certain predetermined high water mark is reached and when a certain predetermined low water mark is reached.

To this end the invention consists in the novel construction and combinations of parts hereinafter fully described and claimed.

In the drawings:—Figure 1 is a side elevation of a portion of a boiler, showing the float chamber and adjuncts of my improved recording device applied thereto. Fig. 2 is a horizontal section on line 2—2 of Fig. 1. Fig. 3 is a vertical section on line 3—3 of Fig. 2. Fig. 4 is an elevation of the dial and the indicator arm for indicating a water level. Fig. 5 is a front elevation of the recording device and the casing therefor. Fig. 6 is a vertical section on line 6—6 of Fig. 5. Fig. 7 is a vertical section on line 7—7 of Fig. 6. Fig. 8 is a diagrammatic view of the electrical connections.

4 designates a boiler and 6 and 9 upper and lower pipes respectively, the inner ends of which are secured to and communicate with the boiler 4. The outer ends of the pipes 6 and 9 are screwed into plugs 10 and 11 respectively, which in turn are screwed into a float chamber 12. The outer ends of the pipes 6 and 9 have communication with the float chamber 12, and they are interrupted by suitable valves 13 and 14 respectively, by means of which communication between the float chamber 12 and the boiler 4 may be shut off when desired. This float chamber 12 may be of any shape and size for its intended purpose, and as shown in the drawings it includes a narrow, vertical portion 15 and an outer, enlarged, curved portion 16.

Arranged within the narrow portion 15 is an arm 17, the outer end of which carries a float 18. The inner end of the arm 17 is secured to a transverse shaft 19 which is mounted to turn in plugs 20 and 21 screwed into the float chamber 12. The narrow portion 15 and enlarged, curved portion 16 of the float chamber 12 are shaped to permit the arm 17 and float 18 to be raised and lowered therein. The float 18 rests upon the water within the chamber 12 and the water level within the chamber 12 remains constant with the water level within the boiler 4 due to the chamber 12 having communication with the boiler 4 through the pipes 6 and 9 as previously described. It will therefore be seen that as the water level within the boiler 4 rises and falls, the float 18 and arm 17 will be correspondingly raised and lowered and the shaft 19 turned. One end of the shaft 19 extends outwardly and its outer end is provided with an indicator arm 22 which is adapted to indicate upon a suitable dial 23 the condition of the water level within the chamber 12 and boiler 4. The dial 23 is mounted within a suitable casing 24 which is secured to the side of the float chamber 12 and is provided with an outer glass face 25 through which the arm 22 and the dial 23 may be seen.

The chamber 12 is provided with a gage glass 26, the upper and lower ends of which have communication with the upper and lower portions of the chamber 12 so that the water level within the chamber and within the boiler may be seen in the gage glass 26 which is of usual and well known construction.

Arranged within the casing 24 on the side of the chamber 12 is an electrical rheostat of the following construction: 27 is a plate of insulating material mounted within the casing 24 and through which the shaft 19 extends. The shaft 19 is provided with a contact arm 28, one end of which is engaged with a series of contact plates 29 mounted upon the plate 27 in spaced rela-

tion to each other and arranged to be successively engaged by the contact arm 28 as the shaft 19 is turned by the raising and lowering of the float 18 within the chamber 12. The contact plates 29 are connected by resistance coils as will be hereinafter described and as is common and well known in electrical rheostat construction. The plate 27 is provided with a contact plate 30 which is constantly engaged by the short end of the contact arm 28 in all positions thereof during its movement under the influence of the float 18; and the plate 27 is also provided with two contact plates 31 and 32 arranged to be engaged by the contact arm 28 when it reaches certain predetermined high and low positions respectively. These contact plates 30, 31 and 32 are included in certain electric circuits which will be hereinafter described. The rheostat contained within the casing 24 as just described, is adapted to control the device for recording the changes of the water level within the chamber 12 and boiler 4, and I shall now describe the devices operated by the rheostat.

33 designates a casing within which a vertically-arranged solenoid 34 is supported by brackets 35. The core 36 of the solenoid is adapted to move vertically and is guided by a fixed rod 37 extending through the solenoid into an opening in the core 36. The core 36 is pressed downwardly by the action of a spring 38 engaged with the top of the core and with a fixed plate 39 at the top of the solenoid. The core 36 is adapted to be raised against the action of the spring 38 by an electric current passing through the solenoid, as is well known, and the vertical position of the core is controlled by the strength of the electric current passing through the solenoid, that is to say, as the current passing through the solenoid increases in strength the core 36 will be moved upwardly against the action of the spring 38, and that as the current decreases in strength the core 36 will be moved downwardly by the action of the spring 38. The lower end of the core 36 carries a downwardly projecting gear rack 40, the teeth of which are engaged with the teeth of a sector 41 secured to a shaft 42 which is mounted to turn in the casing 33 and a bracket 43 therein. The shaft 42 is provided with an eccentric 44 which is embraced by the lower bifurcated end of an arm 46 carried by a shaft 45 mounted in the casing 33 and bracket 43. The upper end of the arm 46 is provided with a suitable marking device 47 which is engaged with a circular recording chart or disk 48. This disk 48 is carried by a head 49 on a shaft 50 of a clock works motor 51 which is supported by arms 52 within the casing 33. The clock works motor 51 is of usual and well known construction, and the shaft 50 thereof is geared to make one complete revolution every twenty-four hours, thus causing the chart 48 to make one complete revolution every twenty-four hours.

From the construction just described it will be seen that when the solenoid core 36 is raised and lowered under the control of the electric current passing through the solenoid, the gear rack 40 will operate the sector 41 and thereby turn the shaft 42 and therewith the eccentric 44 which in turn will act upon the lower bifurcated end of the arm 46 to move it toward and from the center of the recording chart 48. It will be further seen that if the chart 48 be rotated by the motor 51 during the movement of the arm 46 toward and from the center of the chart, the marking device 47 will mark a line around the center of the chart, the line being of unequal distances from the center of the chart as dictated by the variation in the electric current, passing through the solenoid 34.

The chart 48 is provided on its face with circular lines 53 arranged at different distances from the center of the chart and corresponding with different positions of the water level within the chamber 12 and boiler 4, as will be hereinafter explained; and the chart 48 is also provided with heavy curved lines 54 dividing the chart into the twenty-four hours of a day, and with light curved lines 55 dividing the hours into fractions, as clearly shown in Fig. 5. The curved lines 54 and 55 are each struck from the axis of the shaft 45 when each particular line is under the marking device 47. It will therefore be seen that each of the lines 54 and 55 will come under the marking device 47 in prescribed order with relation to the rotation of the chart 48 irrespective of the position of the marking device 47.

I shall now describe the electrical connections, referring to Fig. 8. The various contact plates 29 of the rheostat are connected by suitable resistance coils 56 as usual. The lowermost plate 29 is connected by a wire 57 to the upper end of the solenoid coil 34; the lower end of the solenoid coil is connected by a wire 58 to a battery 59 and the battery 59 is connected by a wire 60 to the contact plate 30 thus completing an electric circuit through the wire 60, contact plate 30, contact arm 28, contact plates 29, resistance coils 56, wire 57, solenoid 34 and wire 58.

61 designates an electric bell which is included in a normally open electric circuit as follows: Leading from the contact plate 32 to the contact plate 31 is a wire 62; leading from the contact plate 31 to the bell 61 is a wire 63; leading from the bell 61 to the wire 58 which leads to the battery 59 is a wire 60; and leading from the battery 59 to

the contact plate 30 is the wire 60 previously mentioned. The contact plate 30 is engaged with the contact arm 28, and the circuit just described is normally open between the contact arm 28 and the contact plates 31 and 32. It will thus be seen that when the contact arm 28 reaches a certain predetermined high position it will engage the contact plate 31 thereby closing the circuit for the bell 61 and effecting the actuation thereof. It will also be seen that when the contact arm 28 reaches a certain predetermined low position it will engage the contact plate 32 thereby completing the circuit for the bell 61 and effecting the actuation thereof.

The operation briefly described is as follows:—As the water level within the boiler 4 rises and falls the float 18 within the chamber 12 is raised and lowered therewith thereby raising and lowering the contact arm 28 and causing it to move over the contact plates 29 of the rheostat in a manner to increase the number of resistance coils 56 included in the electric circuit for the solenoid 34 during the upward movement of the float 18, and to decrease the number of resistance coils included in the circuit for the solenoid 34 during the downward movement of the float 18. It therefore follows that the strength of the electric current supplied to the solenoid 34 increases as the water level within the boiler 4 moves downwardly, and decreases as the water level moves upwardly, thus causing a down and up movement of the solenoid core 36 corresponding with the up and down movement of the water level. As the solenoid core 36 moves downwardly the marking device 47 is moved outwardly upon the chart 48 through its connection with the solenoid core as previously described; and as the solenoid core 36 moves upwardly the marking device 47 is moved inwardly upon the chart 48. As the marking device 47 thus moves outwardly and inwardly in accordance with the rise and fall of the water level within the boiler 4 the chart 48 is being rotated by the clock works motor 51 thereby causing the marking device 47 to mark a line upon the chart 48, which line records the condition of the water level within the boiler upon the chart 48. The concentric circular lines 53 of the chart indicate various water levels within the boiler 4 and the curved lines 54 and 55 indicate the hours of the day and fractions thereof; and the chart 48 moves a distance equal to the space between two of the lines 53 each hour of the day. It will therefore be clearly understood that the position of the line marked by the marking device upon the chart 48 with respect to the lines 53, 54 and 55 of the chart will correctly record the particular condition of the water level within the boiler at all times during the day, the position of the recording line with respect to the lines 53 of the chart indicating the water level, and the position of the recording line with respect to the lines 54 and 55 of the chart indicating the time of day. A new recording chart is provided for each day.

When the water level within the boiler 4 reaches a certain predetermined high position the contact arm 28 will engage the contact plate 31 and actuate the alarm device 61; and when the water level within the boiler reaches a certain predetermined low position the contact arm 28 will engage the contact plate 32 and thereby actuate the alarm device 61. Thus the bell 61 will be sounded to call attention to the fact that the high water mark is reached and also that the low water mark is reached.

By suitable wiring the bell or alarm device 61 may be located at any desired distance from the boiler so that the high and low water alarm may be given wherever desired; and also the recording device may be located at any distance from the boiler. For example, in large plants the recording device may be located in the office of the superintendent remote from the boiler room, thereby enabling him to see at all times that the boiler or boilers are receiving proper attention. The condition of the water level within the boiler may be readily ascertained at the boiler itself upon reference to the gage glass 24 or the indicator arm 22.

In cases of boiler explosions, it will be readily understood that the recording chart will not only accurately record the time an explosion takes place, but it will also indicate whether or not the explosion was occasioned by insufficient water within the boiler. This is a valuable feature of my invention.

I claim:

1. In a water level indicator and recorder, the combination of a float; supporting means for the float; a recording chart; means for supporting and actuating said chart; a marking device engaged with said chart; a rheostat operated by said float; a solenoid; an electric circuit including said rheostat and said solenoid; and means operated by said solenoid for moving said device relatively to said chart.

2. In a water level indicator and recorder, the combination of a float; supporting means for the float; a recording chart; means for supporting and actuating said chart; a marking device engaged with said chart; a rheostat operated by said float; a solenoid; an electric circuit, including said rheostat and said solenoid; a solenoid core; a gear rack carried by said core; a toothed sector engaged with said rack; and means operated by said sector for moving said device relatively to said chart.

3. In a water level indicator and recorder, the combination of a float; supporting means

for the float; a recording chart; means for supporting and actuating said chart; a pivoted arm; an eccentric; means for operating said eccentric by said float; a pivoted arm operated by said eccentric; and a marking device carried by said arm and engaged with said chart.

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

JOHN E. VANNATTER.

Witnesses:
A. V. GROUPE,
S. I. HARPER.