R. J. NAULT.

WATER GAGE.

APPLICATION FILED JUNE 17, 1910.

995,414.

Patented June 13, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

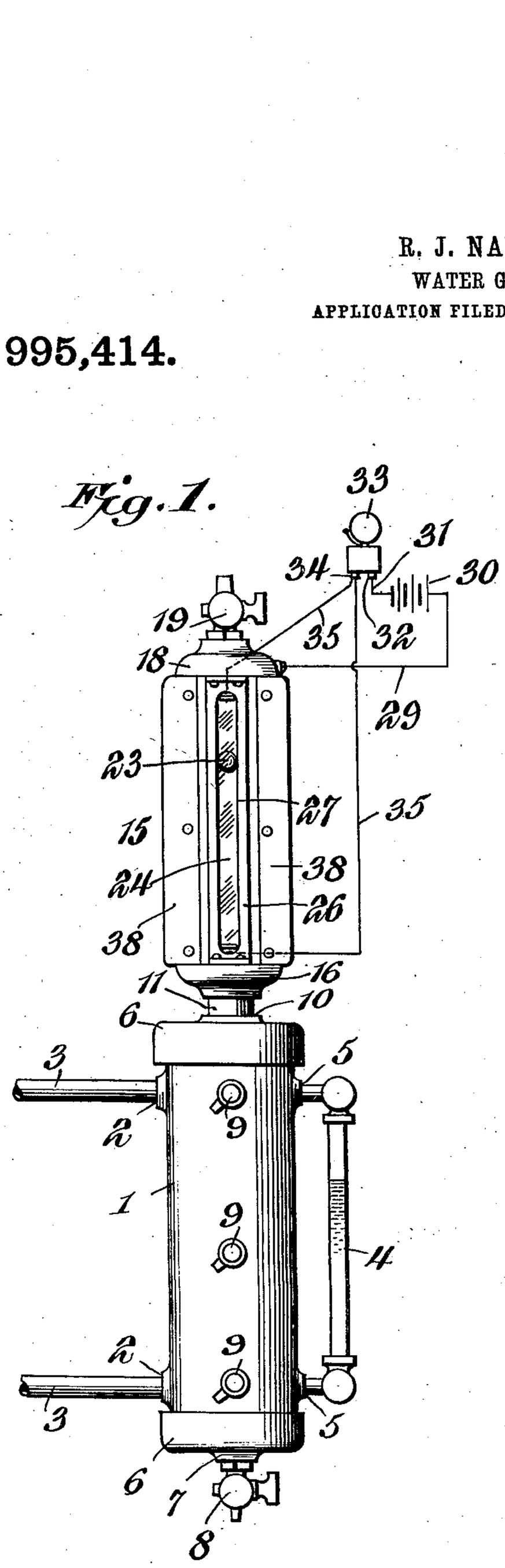


Fig. 4.

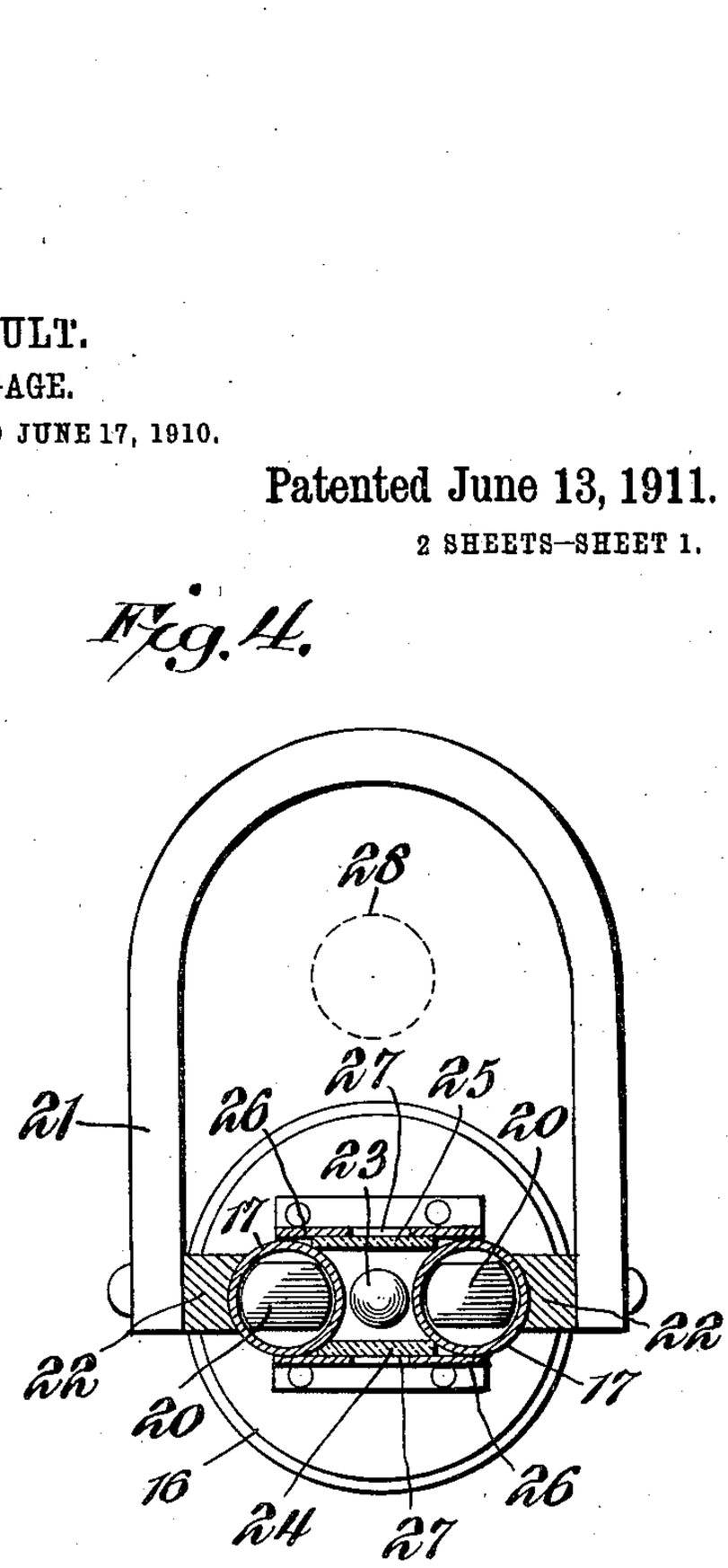
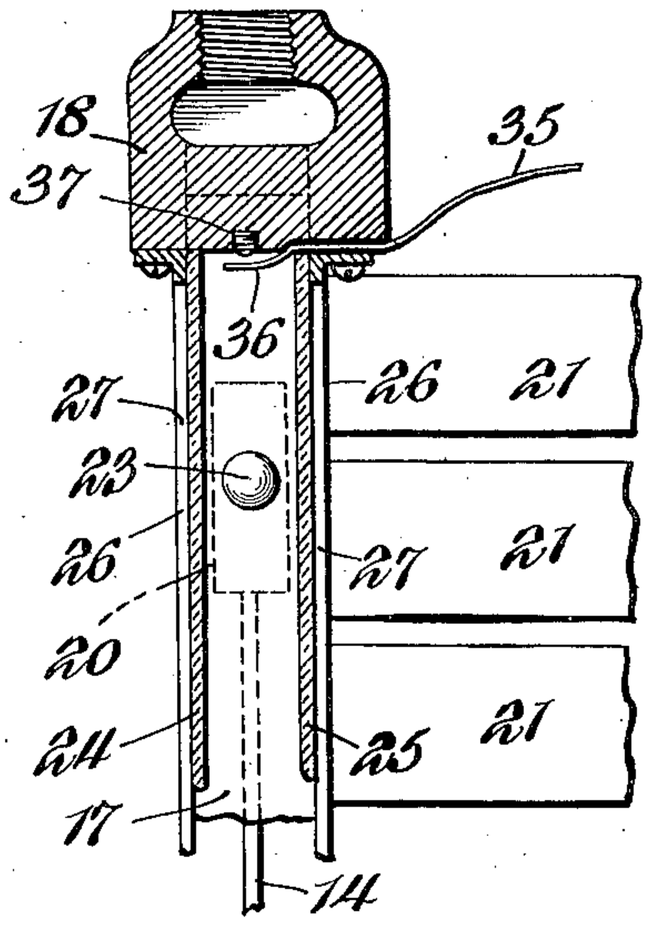


Fig. 5.



Witnesses

Howard D. Ott.

R. H. Bishop.

Raoul J. Nault, Inventor,

By E. G. Siggers.

Attorney

R. J. NAULT.

WATER GAGE.

APPLICATION FILED JUNE 17, 1910.

995,414.

Patented June 13, 1911.

2 SHEETS—SHEET 2.

Fig. 2.

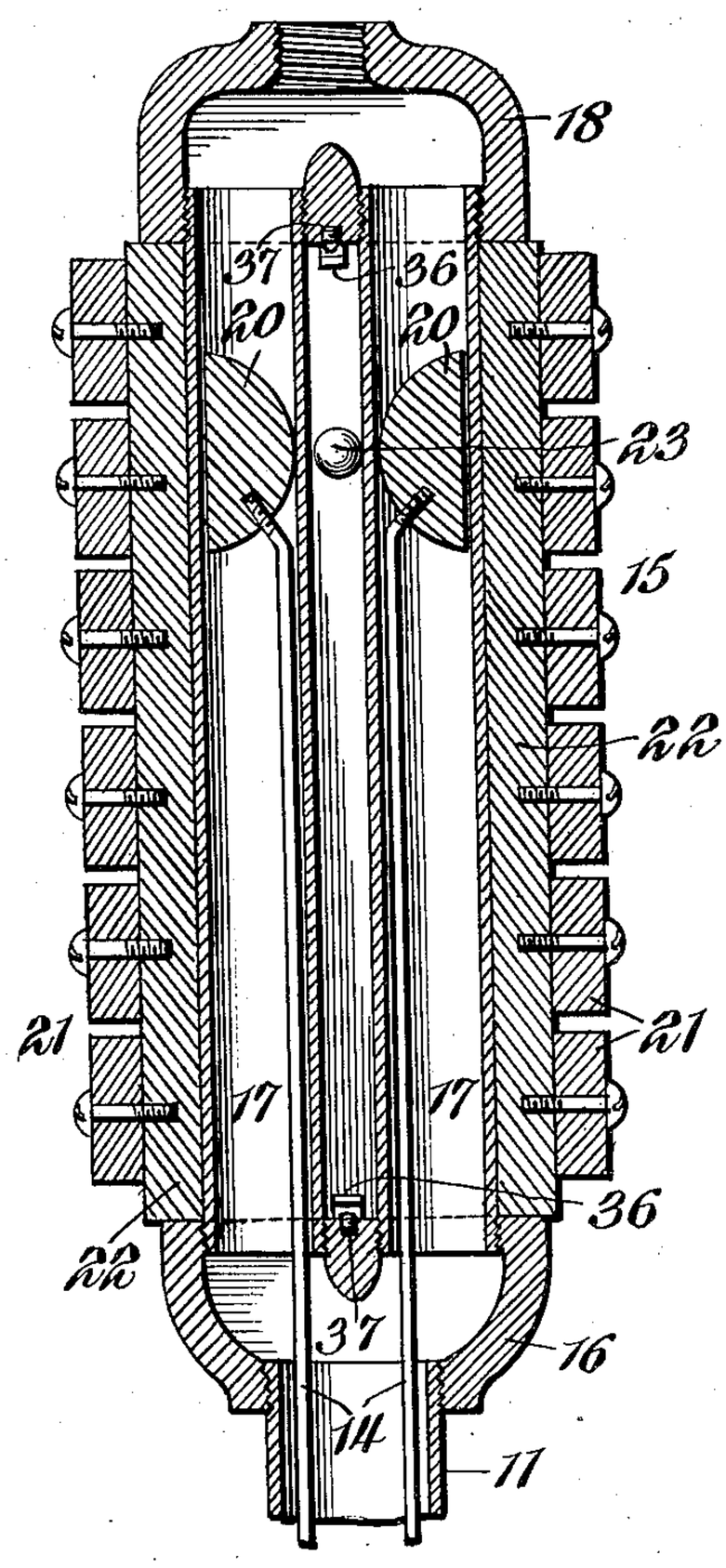
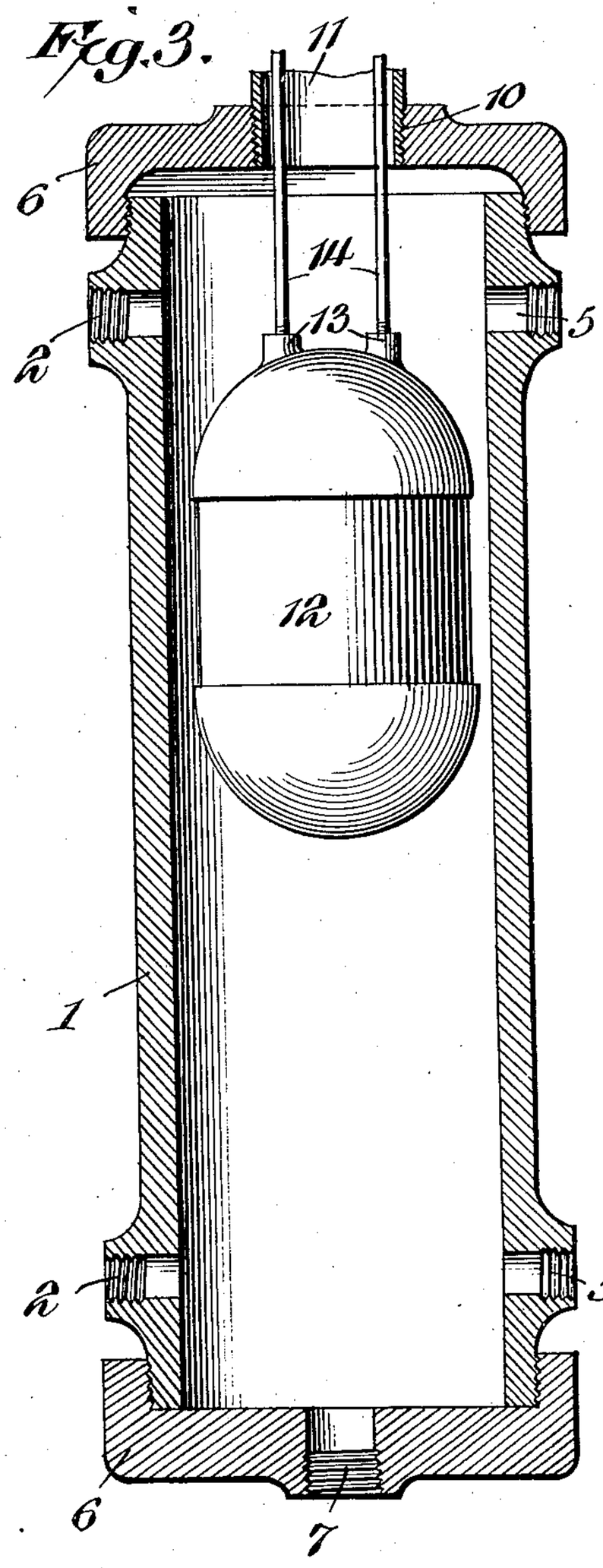


Fig. 3.



Witnesses

Howard D. Orr.

R. H. Bishop

Raoul J. Nault, Inventor,

By E. G. Siggers

Attorney

UNITED STATES PATENT OFFICE

RAOUL JOSEPH NAULT, OF MALDEN, MASSACHUSETTS.

WATER-GAGE.

995,414. Specification of Letters Patent. Patented June 13, 1911.

Application filed June 17, 1910. Serial No. 567,517.

To all whom it may concern:

Be it known that I, RAOUL JOSEPH NAULT, a citizen of the United States, residing at Malden, in the county of Middlesex and State of Massachusetts, have invented a new and useful Water-Gage, of which the following is a specification.

This invention relates to improvements in water gages and the object of the invention is to provide a simple and efficient device by the use of which the level of water in a steam boiler or similar vessel will be indicated with certainty and whereby an alarm will be sounded whenever the water level is abnormally high or abnormally low.

One object of the invention is to provide an apparatus of the stated character which may be advantageously utilized at a point above or below the boiler so that it may be located in a room above or below the building or immediately adjacent thereto, as circumstances may demand.

The invention seeks further to provide a device in which the indicator will be sustained in free suspension so as to be very sensitive and respond instantly to variations in the water level.

The invention seeks further to improve and simplify the construction and operation of water level indicating devices, and all these objects are attained in the use of the device illustrated in the accompanying drawings.

The invention consists in certain novel features of the same which will be hereinafter first fully described and then more particularly pointed out in the appended claims.

In the accompanying drawings,—Figure 1 is an elevation of my improved water gage. Fig. 2 is an enlarged vertical section of the indicating chamber and the elements mounted in and on the same. Fig. 3 is an enlarged vertical section of the float chamber. Fig. 4 is a horizontal section through the indicator chamber with some parts omitted. Fig. 5 is a detail central vertical section taken at right angles to the plane of Fig. 2.

In carrying out my invention, I employ a float chamber or cylindrical body 1 provided, near its opposite ends, with threaded openings 2 adapted to receive the ends of the pipes 3 which extend to the boiler so as to establish communication between the float chamber and the boiler whereby the water in the boiler may freely enter the float chamber and reach the same level in said chamber that it has in the boiler. An ordinary water tube 4 may be secured upon the float chamber, as shown in Fig. 4, and for this purpose the body 1 is provided with threaded openings 5, as will be readily understood. The ends of the float chamber are closed by caps or heads 6, one of which is provided with a small central threaded opening 7 adapted to receive a pet cock 8 whereby the interior of the chamber may be kept clear and the reading through the water tube 4 facilitated. The chamber may, if so desired, be equipped with the usual gage cocks 9. The head 6 at the end opposite the pet cock is provided with a threaded opening 10 in which I secure the end of an extension tube 11 which is carried to or secured in one end of the indicating body or chamber, as will be presently more particularly set forth. Within the float chamber or body 1, I provide a float 12 which may be of any desired form and is equipped with nipples 13 in which the ends of rods 14 are secured, the said rods extending through the extension tube 11 and into the indicator chamber.

In the particular structure shown in the drawings, I have shown the indicator chamber 15 as arranged above the float chamber, and in Fig. 1 have shown the extension tube 11 as being very short, whereby the indicator is brought close to the float chamber, and this arrangement is especially desirable upon automobiles and motor boats and in similar uses. The extension or connecting tube 11, however, may be of any desired length so that the indicator may be located in a room above the boiler room, or the position of the parts may be reversed and the float chamber arranged at or near the upper end of a vertical boiler where the water tube could not be easily observed and the indicator disposed near the lower end of the boiler at a point where it may be easily seen by the engineer. In the following description, therefore, the terms "upper" and "lower" are not to be construed as limitations, but are merely terms of convenience for referring to the parts as they are illustrated in the drawings.

Upon the upper end of the extension tube 11, I secure a coupling or cap 16 of non-magnetic metal, and in the upper side or end of the said coupling I secure the lower

ends of a pair of parallel tubes 17 which are constructed of some diamagnetic material which will withstand high pressure without requiring thick walls. The upper ends of these tubes are open and are secured in a coupling 18, similar in all respects to the coupling 16, whereby continuous communication between the two couplings is established. The upper coupling 18 is preferably fitted with a pet cock 19 in order that impurities which may tend to collect within the tubes may be blown out so that the indicator chamber will be kept clear. The tubes 17 will be of various lengths according to the capacity of the boiler to which the device is applied, and within the tubes, at corresponding points of the lengths of the same, I provide the freely movable blocks or shoes 20 of soft iron which are secured to the upper ends of the rods or wires 14 and constitute armatures for a plurality of permanent horse shoe magnets 21 which are disposed in rear of the tubes and have their ends arranged at opposite sides of the tubes, as shown most clearly in Fig. 4. Soft iron strips 22 are secured to the ends of these magnets and fit against the tubes, as shown clearly in Figs. 2 and 4, the said soft iron strips constituting pole pieces for the several magnets, as will be readily understood. Between the two tubes 17 I provide a small light soft iron ball or float 23 which is held between the two blocks or shoes 20 constituting movable armatures for the magnets, and is unsupported except by the magnetic flux between the armatures. It will be readily understood that the float 12 will rise or fall as the water lever rises or falls and that the armatures 20, being connected with the float, by the wires or rods 14, will necessarily follow the movements of the float. The magnets being permanent, there will be a constant flux between the armatures which will act equally in opposite directions upon the indicator float 23 so that the said float will necessarily rise or fall as the said armatures rise or fall. The level of the water in the boiler will thus be positively indicated at all times by an indicator which is in a state of free suspension so that it will be very sensitive and respond instantly to variations in the water level.

Against the tubes 17, and in front and in rear of the same, I provide glass plates 24 and 25 which are held to the tubes by frames 26 having central vertical slots 27 through which the indicator float may be observed. These frames are secured to the upper and under sides, respectively, of the couplings 16 and 18 and serve to hold the glass plates against the tubes so as to inclose the indicator float and protect the same against any disturbance of the air which might tend to interfere with its successful operation. The indicator float will preferably be given a dull, dark finish, and the rear glass plate 25 will be provided with a ground surface so as to contrast sharply with the indicator float and thereby facilitate the reading. Should the device be located in a dark room or it be necessary to use it at night, a light, indicated at 28, may be placed behind the glass 25 so as to illuminate the indicator. This light may be of any convenient form, and an incandescent electric lamp will be found very suitable.

To the body of either coupling 16 or 18, I secure the end of an electric conductor 29 which extends to a battery or other source of current, indicated at 30. From the opposite pole of the battery, a conductor 31 extends to one binding post 32 of an electric bell or other alarm 33, while from the other binding post 34 of said bell, conductors 35 extend to the opposite ends of the indicator chamber. These conductors 35 each pass into the space between the tubes 17 and the glass plates 24 and 25 where they are equipped with spring terminals 36 arranged in juxtaposition to contacts 37 secured in the inner faces of the couplings, as shown most clearly in Figs. 2 and 5. These spring terminals 36 and the conductors 35 are, of course, insulated from the couplings and the frames 26 so that the circuit will ordinarily be broken. Should the water level reach an abnormally high or an abnormally low point, the indicator float will be carried against the spring terminal 36 at one or the other end of the indicator, and the said terminal will be thereby forced against the contact point 37 and thereby establish an electric circuit through the coupling or the body of the indicator to the conductor 29, and thence to the battery and from the battery through the bell and one conductor 35 to the spring terminal 36 and the coupling, as will be readily understood. Immediately upon the closing of the circuit, the alarm will be sounded and the attention of the engineer at once called to the dangerous condition of the boiler.

In order to give a neat ornamental finish to the device, I secure to the strips 22 a pair of plates 38, shown in Fig. 1, which will cover the ends of the magnets and will also facilitate the reading of the indicator by presenting a continuous surface and thereby avoid any carelessness or inaccuracy which might be caused by the effect upon the eye of the ends of the magnets, located adjacent to the indicator float.

It will be readily seen that my device provides a strong magnetic field extending the entire length of the strips 22, the lines of force of which tend to pass through the diamagnetic tubes so that the attraction upon the armatures 20 and the indicator float between the same will be constant, whatever

their position may be. The said armatures are kept in alinement by the rods or wires 14 which are of diamagnetic non-corrosive metal, and are secured to the float, as shown and described, in order that the armatures will be forced to positively follow the movement of the float. The constant magnetic flux between the armatures will cause the float to remain in the magnetic field, even though a severe concussion is imparted to the indicator tubes and the float can be driven out of this field only by unusually heavy blows which would only cause the float to drop upon the lower terminal 36 and thereupon close the electric current and sound an alarm so that the faulty condition would at once be made known. The armatures will preferably be plated with a non-corrosive metal so that they will prove very durable. The armatures are disposed in a chamber which is remote from the chamber containing the float and, consequently, will not be subjected to the influence of the steam or hot water in the float chamber to such an extent that the strength of the magnets and of the armatures is injuriously affected. There are no delicate pivots, or magnetic needles, or loose joints, or other elements in my device which are liable to get out of order, and all the parts are readily accessible for repairing or cleaning. Should it be necessary to recharge or replace the magnets, this can be done without in any way affecting the position or adjustment of any of the other parts of the apparatus.

While my device may be used in connection with the ordinary water tube for ordinary pressures, it may be utilized as a complete substitute for the water tube, and for high pressure apparatus will be so used.

While I have described the principle of operation of the invention, together with the apparatus which I now consider to be the best embodiment thereof, I desire to have it understood that the apparatus shown is merely illustrative, and that such changes may be made when desired as are within the scope of the claims appended hereto.

Having thus described my invention, what I claim is:—

1. A device for the purpose set forth comprising a plurality of magnets, a pair of movable armatures disposed between the ends of the magnets, and an indicator held in free suspension by and between the said armatures.

2. In a device for the purpose set forth, means for the production of a magnetic field, means for locally concentrating the lines of force of said field, means controlled by the conditions to be indicated for shifting the concentrating means with relation to the means for producing the magnetic field, and an indicator controlled by the concentrated lines of force and participating at all times in all shifting movements thereof.

3. In a water level indicating apparatus, the combination of a float, a plurality of magnets, a pair of armatures movable between the ends of the magnets, an indicator held in free suspension by and between the said armatures, and connections between the armatures and the float.

4. The combination of a float, a magnet arranged remote from the float, a pair of armatures movable across the plane of the ends of the magnet, connections between the said armatures and the float, and an indicator held in free suspension by and between the said armatures.

5. In a device for the purpose set forth, the combination of a plurality of magnets, fixed armatures secured to and connecting the corresponding ends of all the magnets, a pair of movable armatures arranged between the fixed armatures, means for automatically moving said armatures, and an indicator held in free suspension by and between said movable armatures.

6. The combination of a pair of diamagnetic tubes, couplings at the opposite ends of the said tubes, magnets disposed externally to the said tubes with their ends adjacent the same, armatures mounted within the tubes and freely movable, means for automatically moving the said armatures, and an indicator arranged between the tubes and held in free suspension by the armatures.

7. The combination of a plurality of permanent magnets, armatures secured to and connecting the ends of all the magnets, a pair of spaced parallel diamagnetic tubes arranged against and between said armatures, a freely movable armature within each of said tubes, means for simultaneously moving said armatures, and an indicator arranged between the tubes and held in free suspension by the armatures therein.

8. The combination of a plurality of permanent magnets, armatures secured to and connecting the ends of all the magnets, a pair of spaced parallel diamagnetic tubes arranged against and between said armatures, a freely movable armature within each of said tubes, means for simultaneously moving said armatures, and an indicator arranged between the tubes and held in free suspension by the armatures therein.

9. The combination of a pair of diamagnetic tubes, couplings at the opposite ends of the said tubes, magnets disposed externally to the said tubes with their ends adjacent the same, armatures mounted within the tubes and freely movable, means for automatically moving the said armatures, an indicator arranged between the tubes and held in free suspension by the armatures, transparent plates arranged against the

front and rear of the tubes and bridging the space between them, and slotted frames bearing against said plates and extending between and secured to the couplings.

10. The combination of a pair of diamagnetic tubes, couplings at the opposite ends of the said tubes, magnets disposed externally to the said tubes with their ends adjacent the same, armatures mounted within the tubes and freely movable, means for automatically moving the said armatures, an indicator arranged between the tubes and held in free suspension by the armatures, transparent plates arranged against the front and rear of the tubes and bridging the space between them, and slotted frames bearing against said plates and extending between and secured to the couplings.

11. The combination, in a water gage, of a plurality of magnets, a pair of movable armatures disposed contiguous to the magnets, means for automatically moving the said armatures, an indicator held in free suspension by and between the said armatures, and means for confining the indicator, said means including a glass plate through which the indicator is visible.

12. The combination, in a water gage, of a pair of tubes, armatures mounted within the tubes and freely movable, means for automatically moving the said armatures, an indicator arranged between the tubes and held in free suspension by and between the armatures, and transparent plates bridging the space between the tubes and confining the indicator but allowing its movement to be visible through the plates.

13. In an indicator, means for the production of an elongated magnetic field of an extent equal to the indicating range, means in said field for concentrating the lines of force to a restricted path, means for moving the concentrating means in the magnetic field in accordance with changes in the characteristic to be indicated, and an indicating means in the concentrated portion of the field and movable with the same.

14. An indicator having means for the production of an elongated magnetic field in extent corresponding to the indicating range, means in said magnetic field for concentrating the lines of force to a restricted path, means responsive to changes in the characteristic to be indicated for moving said restricting means, and a magnetic body held in suspension by the constricted portion of the field and responsive to changes in location in said restricted portion of the field due to changes in the characteristic to be indicated.

15. An indicator having means for the production of an elongated magnetic field in extent corresponding to the indicating range, means in said magnetic field for concentrating the lines of force to a restricted path, means responsive to changes in the characteristic to be indicated for moving said restricting means, a magnetic body held in suspension by the restricted portion of the field and responsive to changes in location of said restricted portion of the field due to changes in the characteristic to be indicated, and means responsive to the body held in suspension and located at the end of the travel thereof for causing an indication when such body reaches said limit of its travel.

16. An indicator having means for the production of a magnetic field elongated in a direction transverse to the direction of the lines of force of said magnetic field, means in said field for concentrating the lines of force to a restricted path, means responsive to variations in the characteristic to be indicated for moving said restricting means, a magnetic body held in suspension by the restricted magnetic field and movable therewith for showing changes in the characteristic to be indicated, and a signal means responsive to the indicating body when the latter is moved by the action of gravity on escaping from the influence of the magnetic field.

In testimony, that I claim the foregoing as my own, I have hereto affixed by signature in the presence of two witnesses.

RAOUL JOSEPH NAULT.

Witnesses:
ELLIOT T. STURGIS,
STANLEY W. INGALLS.