Feb. 2, 1937. C. L. HOWSE 2,069,312

LIQUID LEVEL INDICATOR

Filed May 15, 1933

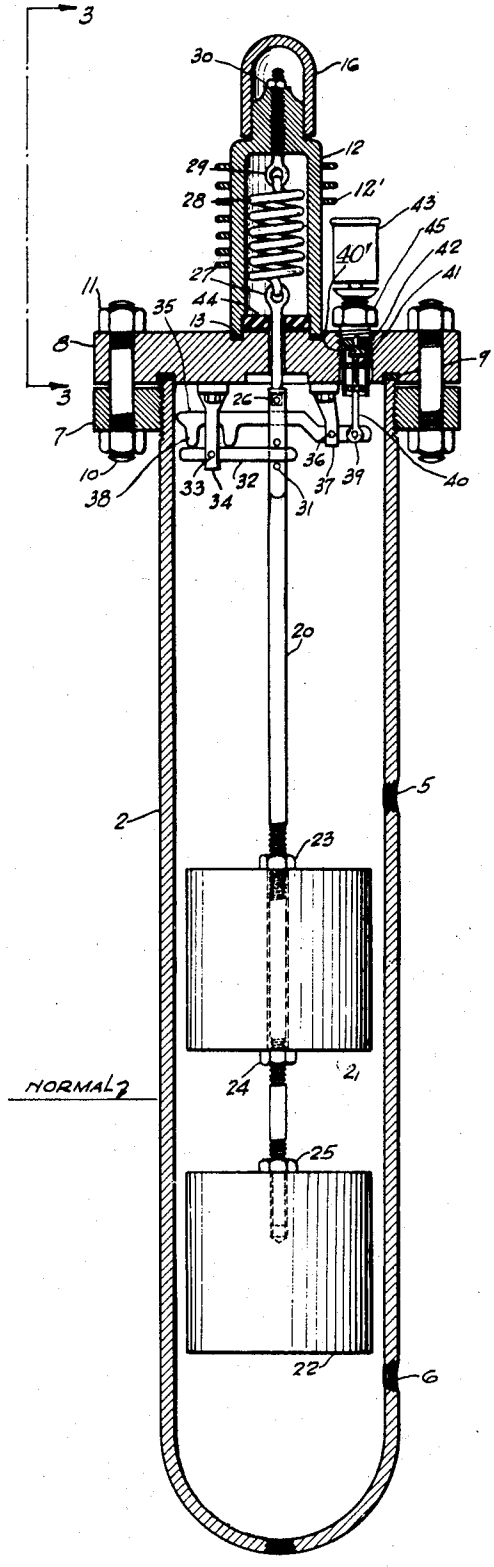


FIG. 2

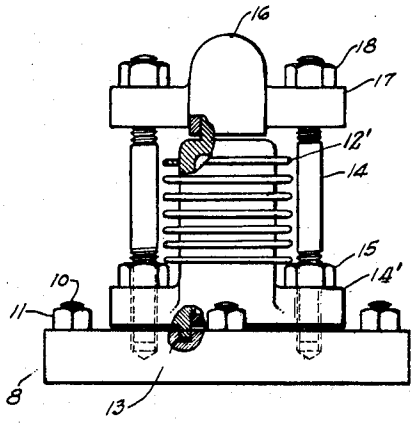


FIG. 3

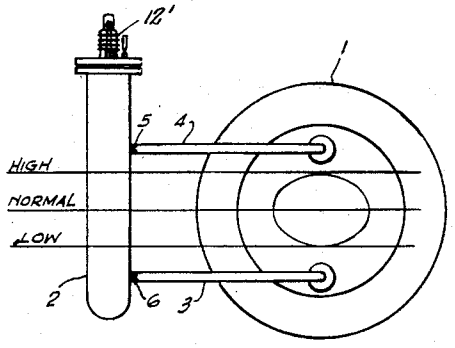


FIG. 1

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Patented Feb. 2, 1937

2,069,312

UNITED STATES PATENT OFFICE

2,069,312

LIQUID LEVEL INDICATOR

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Application May 15, 1933, Serial No. 671,079

13 Claims. (Cl. 116—110)

The invention is directed to an improvement in liquid level indicators particularly of the type in which an alarm is sounded to indicate changes in water level in a container, such, for example, as a boiler drum. More particularly, the invention is directed to an improvement in that form of alarm mechanism employing the weight displacement principle.

In high and low liquid alarm apparatus employing this principle, as heretofore constructed, the entire system of weights and supporting levers has been mounted inside the column, or the like, connected by the usual means to the boiler drum or container. As heretofore constructed, the entire system of weights has been suspended from and supported by the system of levers used to actuate the valve controlling the supply of steam to the alarm device, such as the whistle. Even though the system of levers be supported on knife edges due to the fact that they have had to carry the weight of the displacement members, the action of the affair has been sluggish and has been subject to certain very definite limitations. Where the weights are carried by such lever supports, the mechanism is somewhat dependent in its action upon the temperature of the water in the column. Moreover, at pressures higher than 600 lbs. approximately, the density of the water decreases to such a point that weights of excessive size are employed. This can only be accomplished by increasing the vertical dimension of the weights in order to procure the additional force required to operate the leverage system against the higher pressures and particularly to open the valve against such higher pressure. This additional weight causes increased friction which further increases the sluggishness of operation of the device employing the weight displacement principle. In fact, practice has indicated that approximately 600 lbs. is the limit where apparatus of this type may be satisfactorily employed.

In the present invention this objection is overcome by providing an independent support for the weight system so that the system of levers employed has only to actuate the valve controlling the flow of steam or the like to the alarm device. A novel type of leverage mechanism is used as will be hereinafter described. Furthermore, other features and advantages of the invention will be noted as the description proceeds, reference being had to the accompanying drawing wherein like parts are designated by like reference characters throughout and wherein:

Figure 1 is an end elevation of the boiler drum to which is attached a conventional water column embodying the invention;

Figure 2 is a view principally in section but partly in elevation and with some of the parts broken away, the view being taken longitudinally through a water column embodying the invention; and

Figure 3 is an elevation partly broken away substantially along the line 3—3 of Figure 2.

Referring, first of all, to Figure 1, the boiler drum is designated at 1; 2 represents the conventional column connected to the boiler drum above and below the water level therein through connections 4 and 3, threadably engaging the column 2 at 5 and 6 respectively. This view also indicates the normal water level to be maintained in the drum and further indicates the high and low limits of water level.

Referring now to Figure 2, the column 2 is threadably engaged at its top by the flange 7; the open top of the column 2 is closed by cover 8 through a suitable gasketed joint 9, bolts 10 and nuts 11 being employed to fix the cover 8 to the flange 7.

In a gasketed recess 13 in the top of the cover 8 is mounted the member 12 to receive the spring mechanism to be hereinafter described. The hollow member 12 is provided as shown in Figure 3 with bosses 14', receiving studs 14 which, in conjunction with nuts 15, fix the body 12 to the cover 8.

Mounted on top of the hollow member 12 is the cap 16 provided with the bosses 17. These are engaged also by studs 14 and nuts 18 are employed to force the cap member 16 into a fluid tight engagement with the hollow member 12.

On the rod 20 located interiorly of the column 2, are mounted the weights 21 and 22. Nuts 24 and 23 engaging threaded portions of the rod 20 serve to adjustably fix the weight 21 in position. Similarly the lower portion of rod 20 threadably engages weight 22 and in conjunction with nut 25 adjustably fixes the weight 22 in position on rod 20. The feature of adjustability allows the weights to be positioned at the proper point on rod 20 to actuate the alarm device at the desired limits of high and low water level.

Fixed to rod 20 at 26 is an eye-bolt 27 extending upwardly through an opening in cover 8. To the upper portion of this eye-bolt 27 is fixed a spring 28. To the upper portion of this spring is fixed a second eye-bolt 29 threadably engaged in the top of the hollow member 12. Adjusting nut 30 is provided to engage eye-bolt 29 and to adjust the tension of spring 28 in dependence

upon the amount of weight suspended therefrom.

A suitable opening in cover 8 is provided to receive rod 27, this being made as small as practical in order to minimize the amount of steam which will pass into the upper hollow chamber 12. It is desirable to maintain spring 28 located in this chamber at as low a temperature as possible. To aid in this, the insulating sheet 44 may be provided at the bottom of chamber 12 and the chamber 12 might, if desired, be provided with radiating fins 12' or the like to dissipate the heat therefrom and maintain the same at as low a temperature as possible.

The composition of the spring 28 is of particular importance in connection with this invention. This is preferably made of an alloy of beryllium and copper in which the beryllium is present in the amount of 2 to 2½ percent and the balance is copper. A spring constructed of this material is non-corrodible and is extremely valuable in spring characteristics. In particular, it has an unusually high fatigue limit and, in general, the material has properties which admirably fit it for the present application.

The adjustable spring support just described obviously carries the weight of the rod 20, plus the displacement weights 21 and 22. These weights are, therefore, not carried by the system of levers used to actuate the valve controlling the flow of steam to the alarm device. An advantageous construction is thus provided which is very much more active and surer in operation than is the conventional weight displacement high and low liquid alarm mechanism in which the weights are suspended from the valve operating leverage system.

The upper portion of rod 20 is provided with a slot as indicated broken away in Figure 2. Through the slotted portion of the rod are mounted the pins 31 between which is loosely fitted the lever 32. This lever, in turn, is pivotally supported at 33 from bracket 34 fixed to the under side of cover 8. Projections 38 on lever 35 are adapted to engage the upper surface of lever 32 and to be actuated thereby in a manner to be, hereinafter, described. Lever 35 is pivotally supported at 36 from bracket 37, also fixed to the under side of cover 8. To the extreme right-hand end of lever 35 is pivotally fixed valve stem 40. This valve stem terminates in an upper cone shaped valve member and is provided with the spiders 41 to guide the valve stem movement in an opening formed in member 45 screwed into cover 8. This opening is further provided at its upper extremity with the tapered seat portion 42. Fixed to the member is the alarm device 43 which may be a whistle of conventional design.

The normal water level is indicated in Figure 2 and will occupy a position between the top of weight 22 and the bottom of weight 21. With water in the column at such normal level, spring 28, through adjusting screw 30 is so regulated that valve 40' will engage seat 42 and no steam from the upper space of the column will be passing to the alarm device 43. In this normal position of the apparatus, the alarm will, therefore not be sounded.

If, in operation, the water level falls, weights 22 and 21 will move downwardly carrying with them lever 32. This, in turn, will actuate the left-hand boss 38 on rod 35, this rod 35 acting as a lever about fulcrum 36 and pulling the valve stem 40 downwardly. This will pull the valve away from the seat 42 admitting steam or the like to the alarm device 43 which will sound to indicate an undesirable change in the water level in the boiler drum. Conversely, when the two weights with their connected rod 20 move upwardly, lever 32 again moves, this time contacting with the right-hand boss 38 on lever 35, the action of this lever being in this instance the same as before. It swings around fulcrum 36, moves valve stem 40 downwardly away from seat 42, thus admitting steam to the alarm device or whistle 43.

It will be apparent that when the water level in column 2 lowers so as to partly or completely uncover weight 22, spring 28 will be stretched out in length by the addition of the unbuoyed weight, this being dependent upon the portion of 22 that is uncovered. This increase in weight will operate to lower the rod 20 with associated weights 21 and 22 with the result hereinbefore described. Similarly, when the water raises above normal water level, weight 21 will be partly submerged. The effective weight of rod 20 with associated weights will be thereby decreased in dependence upon the amount of the portion of weight 21 thus submerged which, in turn, will take a part of the weight or load from spring 28. The result is that the weights 21 and 22 and associated rod 20 will rise upon attainment of this higher water level, with the result hereinbefore described.

It is an important feature of applicant's invention that suitable adjustments may be made in the position of the weights without taking the boiler out of service. If, for example, it is desired to carry the normal water level in the boiler higher or lower due to changes in operating conditions, the alarm mechanism may be readily adjusted to compensate for the desired change, without taking the boiler out of service to reach the interior of the column. In the conventional type of column this is not at all possible since the entire alarm mechanism is entirely supported inside the column.

This adjustment can obviously be accomplished by means of the adjusting screw 29 and adjusting nut 30 which may be reached by removal of the cap 16, and by means of member 45 which may be raised or lowered by virtue of its threaded mounting in the cover 8. Thus it will be apparent that by adjusting the spring 28 the weights 21 and 22 may be raised or lowered and that the displacement of levers 32 and 35 effected by this raising or lowering of the weights may be compensated for by vertical adjustment of the member 45 and thus of the valve seat 42. According to present practice, valves are not permitted between the water column and the boiler drum with the result that in order to adjust the conventional high and low alarm mechanism, it is necessary to take the boiler out of service. It is an important feature of applicant's invention that desirable adjustments may be made without in any way disturbing the operation of the boiler.

While I have shown and described one particularly preferred embodiment of my invention it is understood that the same may be varied without departing from the spirit of my invention and I wish to be limited only as set forth in the appended claims.

What I claim is:

1. In a liquid level indicator, a container for the liquid, a rod suspended interiorly of the container, a weight fixed to said rod above the normal liquid level in the container, a second weight fixed to said rod below the normal liquid level in the container, a spring suspension for said rod

and associated weights and means actuated by said rod operable to indicate when the level of the liquid reaches predetermined high or low limits.

2. In a liquid level indicator, a container for the liquid, a rod suspended interiorly of the container, a weight fixed to said rod above the normal liquid level in the container, a second weight fixed to said rod below the normal liquid level in the container, a spring suspension for said rod and associated weights located in a chamber separate from said container, and means actuated by said rod operable to indicate when the level of the liquid reaches predetermined high or low limits.

3. In a liquid level indicator, a container for the liquid, a rod suspended vertically interiorly of the container, a weight fixed to said rod above the normal liquid level in the container, a second weight fixed to said rod below the normal liquid level in the container, means actuated by said rod operable to indicate when the level of the liquid reaches predetermined high or low limits, and means accessible exteriorly of the column to adjust the vertical position of said rod and associated weights.

4. In a liquid level indicator, a container for the liquid, a rod suspended interiorly of the container, a weight fixed to said rod above the normal liquid level in the container, a second weight fixed to said rod below the normal liquid level in the container, a spring suspension for said rod and associated weights located in a chamber separate from but in constant communication with said container, and means to maintain said chamber at a relatively low temperature.

5. In a liquid level indicator, a column to receive the liquid, a rod suspended interiorly of the column, a weight fixed to said rod, said rod and weight being movable vertically either upwardly or downwardly from a normal intermediate position upon changes in the liquid level in the column, an alarm device communicating with the column, a valve controlling said communication, a lever actuated by the rod upon upward or downward movement thereof away from said normal intermediate position to open the valve, and means independent of the lever to support the rod and associated weight.

6. In a liquid level indicator, a column to receive the liquid, a rod suspended interiorly of the column, a weight fixed to said rod above the normal liquid level in the column, a second weight fixed to said rod below the normal liquid level in the column, said rod and weights moving vertically upon changes in the liquid level in the column, a whistle, a valve controlling communication between said whistle and the column, a lever actuated by the rod to operate the valve, and means independent of the lever to support the rod and associated weights.

7. In a liquid level indicator, a container to receive the liquid, a rod suspended in the container, a weight fixed to the rod, and a spring for suspending the rod and weight made of a copper-beryllium alloy containing beryllium between two and two and one half percent.

8. In a high and low alarm mechanism, a column, a whistle, a valve to control communication between the whistle and the column, a lever movable to operate the valve and means swingable in two directions in a vertical plane to actuate the lever, said lever being provided with two depending portions, one of which is engaged by the actuating means when it moves upwardly and the other of which is engaged by the actuating means when it moves downwardly whereby the lever is moved in the same manner regardless of the direction of movement of the actuating means.

9. In a high and low alarm mechanism, a column to receive a liquid, a rod suspended interiorly of the column, a weight fixed to said rod above the normal liquid level in the column, a second weight fixed to said rod below the normal liquid level in the column, said rod and weights moving vertically upon changes in the liquid level in the column, an alarm device, and means operating upon the vertical movement of the rod to a predetermined high or low position for controlling the actuation of said alarm device.

10. In a liquid level indicator, an open top column to receive the liquid, a closure member for the top of the column, a rod suspended interiorly of the column, a weight fixed to the rod, a member to support the rod and weight passing upwardly through an opening in said closure member, a spring fixed to the upper portion of said member to support the member and the rod with its associated weight and means actuated by said rod operable to indicate when the level of the liquid reaches predetermined high or low limits.

11. In a high and low alarm mechanism, a column to receive a liquid, a rod suspended interiorly and centrally of the column, a weight fixed at its center to the rod and located entirely above the normal liquid level in the column, a second weight fixed at its center to the rod and located entirely below the normal liquid level in the column, said rod and weights moving vertically upon changes in the liquid level in the column, and an alarm device operated in dependence upon vertical movement of said rod and associated weights to predetermined high or low positions.

12. In a high and low alarm mechanism, a container, an alarm, a lever movable to operate the alarm, and means swingable in two directions to actuate the lever, said lever being provided with two depending portions, one of which is engaged by the actuating means when it moves in one direction and the other of which is engaged by the actuating means when it moves in the other direction whereby the lever is moved in the same manner regardless of the direction of movement of the actuating means.

13. In a high and low alarm mechanism, a container, an alarm, a lever movable to operate the alarm, means swingable in two directions to actuate the lever, said lever being provided with two depending portions, one of which is engaged by the actuating means when it moves in one direction and the other of which is engaged by the actuating means when it moves in the other direction whereby the lever is moved in the same manner regardless of the direction of movement of the actuating means, and a rod movable vertically in the container in response to changes in the level of the liquid therein arranged to actuate said actuating means.

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