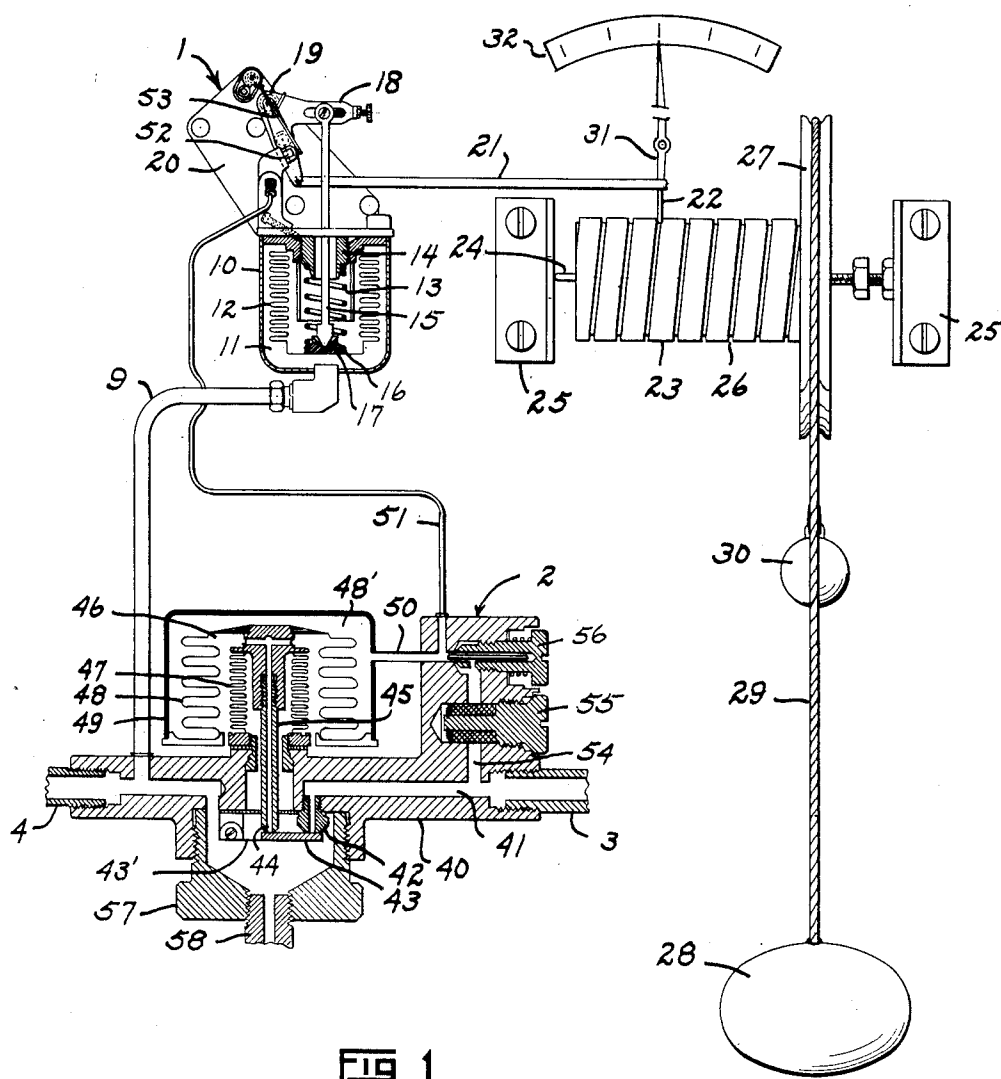


2,618,155

2 SHEETS--SHEET 1



RAY E. CONNER
JOSEPH W. TAYLOR
INVENTORS.
BY *Lester B. Clark*
Ray L. Smith
ATTORNEYS

Nov. 18, 1952

R. E. CONNER ET AL

2,618,155

PIT-LEVEL INDICATOR

Filed Nov. 2, 1945

2 SHEETS—SHEET 2

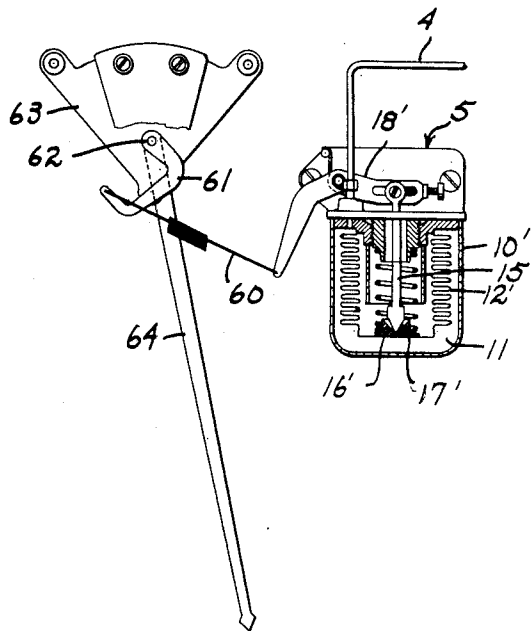


FIG 2

RAY E. CONNER
JOSEPH W. TAYLOR
INVENTORS.

BY *Lester B. Clark*
Ray L. Smith
ATTORNEYS

UNITED STATES PATENT OFFICE

2,618,155

PIT-LEVEL INDICATOR

Ray E. Conner and Joseph W. Taylor,
Houston, Tex.

Application November 2, 1945, Serial No. 626,208

4 Claims. (Cl. 73—316)

1

This invention relates to a pit-level indicator for use in the rotary method of drilling wells for accurately and consistently indicating the level of the drilling mud in the mud pit.

In the drilling of wells by the rotary method drilling fluid or mud is pumped downwardly through the drill string and returns upwardly thereabout for return to the mud pit which is of adequate size to maintain sufficient mud to meet all requirements during drilling operations. The detection of a gradual decline in the mud level indicates the time when additional mud shall be prepared and added. If, on the other hand, there is a rapid decline in the level of the mud, steps may be taken to determine and to remedy the cause of such loss. More important, however, if there is infiltration from penetration of a water sand or a gas or oil sand which immediately results in an increase in the volume of the drilling fluid, prompt detection of the increase in level during drilling will dictate immediate steps to be taken to prevent a blow out and hence avert possible loss of life, equipment, and even of the well itself.

The present invention comprehends, and it is the primary object of the invention, to provide reliable pit level indicating and/or recording means whereby it is possible at all times to note changes of the level of the drilling fluid in the mud pit so that required conditions for efficient drilling and the safety of life and property may be maintained.

Another object is to provide a device for the purpose indicated that is relatively inexpensive to install and maintain, and which at the same time indicates fluid level and changes thereof with a high degree of accuracy.

Still another object is to provide a pit level indicator which includes a float mechanism at the pit and an air operated controller actuated thereby to provide desired information at a selected point at the site of drilling operations.

A still further object is to provide a device which also provides information as to fluid level at the pit.

The foregoing are general objects, which together with other objects and advantages will be more fully apparent from the following description considered in connection with the accompanying drawings in which:

Fig. 1 is a view partly in section showing mechanism that is installed at the mud pit and embodying the invention;

Fig. 2 is a view also partly in section showing a receiver which is located at a convenient point

2

and which utilizes air pressure from the transmitting mechanism of Fig. 1 to provide, at a selected point on the drilling equipment, information of pit level conditions.

The transmitter embodying the invention and shown in Fig. 1 comprises the transmitting unit 1 and the pilot valve 2. A conduit 3 is connected to the pilot valve 2 to supply a pressure fluid at all times to the indicator system. It is intended that, as will be more fully described, the unit 1 shall translate the changes in level indication into units of air pressure, which units are magnified by the pilot valve 2 and are transmitted through the conduit 4 to the receiver unit 5 (Fig. 2) shown as an indicating unit, but which may obviously comprise either an indicator, a recorder or both so that continuous information of the pit level over a period of time is made available.

The transmitter unit 1 comprises a bellows shell 10 which forms a chamber 11 about the bellows 12 which is normally urged to extended position by the compression spring 13 abutting the lower end of the adjustable collar 14 above the base 16 of the bellows assembly. The conduit 9 communicates with the conduit 4 and hence fluid pressure supplied to the receiver 5 is also supplied to the interior of the chamber 11 and hence tends to shorten the bellows 12 against the tension of the spring 13. The bellows rod 15 seats within a conical recess 17 in the base 16 of the bellows and extends upwardly for an adjustable pivotal connection to the bell crank lever 18 which is pivoted at 19 to the frame 20 of the unit 1. The lower arm of the bell crank lever is pivotally attached to the connecting link 21 which carries a pin 22 at its outer end.

A drum 23 is mounted upon shaft 24 journaled upon bearing members 25 and this drum has a spiral slot 26 in its periphery into which the pin 22 extends. Attention is directed to the fact that this drum is shown considerably enlarged axially in order to more clearly bring out the construction and mode of operation of this portion of the device.

A sheave 27 is secured to the drum 23 and is adapted to drive the drum whenever there is any movement of the float 28 which rests upon the surface of the liquid of which the level is to be determined. The float is attached to one end of the cable 29 passing over the sheave 27 and carrying a counterweight 30 upon its opposite end to maintain the cable taught and to prevent any back lash from reversal in movement of the float.

It seems apparent that the position of the pin 22 and associated elements is dependent upon the position of the float 28 and that hence any movement of the float is indicative of a change in level and the amount of such change.

As a means of indicating the mud level and the amount of change in such level there is provided, as a part of the device located at the pit, a pointer 31 which is actuated by movements of the connecting link 21 and the pin 22 to move over a scale 32. By means of this arrangement the workmen conducting operations at the pit are informed of the level at all times.

Referring further to the transmitter and particularly to the pilot valve 2 thereof, it will be noted that the body 40 of the pilot valve has a passage 41 which terminates at its inner end in a port 42 which is normally closed by a flap 43. This flap is urged to such closed position by means of the leaf spring 43'. When the parts are in the position shown in the figure the flap 43 also closes the exhaust port 44 in the passage through the stem 45 which terminates in the space 46 at atmospheric pressure between the double bellows 47 and 48. The larger bellows 48 is surrounded by housing 49 thereby forming chamber 49' which is connected by way of passage 50 to the conduit 51 terminating at its upper end in a nozzle 52 through which variable throttling of pressure fluid is effected by movement of the flapper 53 actuated by the bell crank lever 18. This pressure fluid is supplied from the conduit 3 and passage 41 through channel 54, filter plug 55, and fixed orifice 56 so that operating conditions are automatically maintained.

It is to be noted that supplied pressure is applied to the bellows 48 through the orifice 56, whereas transmitted pressure is applied to the bellows 47, and that the ratio of pressure areas of these bellows is relatively large to provide desired magnification in pressure changes so that accurate and significant indications and variations thereof are brought about.

The lower portion of the body 40 is provided with a bore which is closed by a plug 57 to which there may be attached a pressure gauge as through the nipple 58 to indicate the transmitted pressure.

The receiver, indicating and/or recording, unit 5 is identical to the transmitting unit 1 with the exception that the flapper valve construction is omitted, and the conduit 9 is replaced by the conduit 4. Like parts are identified by like primed reference characters. The bell crank lever 18' of this unit is attached through the link 60 to the lever 61 fixed upon pivot 62 in frame 63. The pointer or stylus 64 is also secured to the pivot 62 and hence provides through the resulting movements the desired indication of pit level as will now be described by reference to the mode of operation of the device.

In order to describe the operation of the device it will first be assumed that conditions are static. That is, the float 28 is stationary because of static conditions in the mud pit. Pressure is, of course, applied through the conduit 3 to the passage 41 in which the port 42 is closed by the spring urged flap 43. This pressure fluid moves through the passage 54, filter 55, and the orifice 56 to the chamber 49' and to the nozzle 52 whence there is a slow escape of fluid. The rate of this escape is dependent upon the position of the bell crank lever 18 as determined by the float 28 and the assembly controlled thereby.

Under the circumstances just described, pressure fluid is entrapped within the conduit 4 whereby the bellows 12' are held in a certain condition of extension. The bell crank lever is thus held in a fixed position as is the pointer 64 whereby the level of the mud in the pit is indicated.

If, however, the liquid in the pit rises, the flapper 53 is moved toward the nozzle 52 whereby pressure within the chamber 49' is increased to effect downward movement of the stem 45 to open the supply port 42. The resultant flow of the pressure fluid causes an increase in the pressure in the conduit 4 and the receiver 5. As movement of the float 28 ceases static conditions again obtain, but the pointers 31 and 64 are then in new indicating-positions.

If the float 28 moves downwardly due to a lowering of the level in the mud pit, the flapper 53 is moved away from the nozzle 52 whereby pressure within the bellows chamber 49' decreases. Pressure within the conduit 4 is then instrumental in expanding the bellows 47 to lift the stem 45 and open the port 44 whereby the indicator needle 54 moves to a new position which indicates the new liquid level at the mud pit. At the same time, of course, the pointer 31 has moved to a new position so that workmen at the pit are apprised of the newly assumed level of the mud in the pit.

Broadly the invention comprehends an air actuated pit level indicator for well drilling operations, such indicator providing at all times accurate information of the level of the mud within the pit whereby necessary operational steps may be taken to maintain efficient and safe drilling conditions.

What is claimed is:

1. An apparatus for indicating the level in the mud pit employed in well drilling operations including, a float responsive to changes in liquid level in said pit, a rotatable drum element, means for operatively connecting the drum element to said float whereby rotation is imparted to the drum in accordance with movement of the float, a pivoted indicator adjacent the drum and having one end co-acting with the outer periphery of the drum so that rotation of the drum imparts movement to the indicator to indicate the level of the fluid in the pit, a second indicator remote from the first indicator, means for controlling operation of said second indicator, and an operating member connected with the first indicator for operating said control means in accordance with the movement of the first indicator whereby said second indicator is actuated by the movement of the first indicator.

2. An apparatus as set forth in claim 1, wherein the rotatable drum element is formed with an external helical groove and wherein one end of the pivoted first indicator is engageable within said groove to impart movement to the indicator upon rotation of the drum.

3. An apparatus for indicating the level in the mud pit employed in well drilling operations including, a float responsive to changes in liquid level in said pit, a rotatable drum element, means for operatively connecting the drum element to said float whereby rotation is imparted to the drum in accordance with movement of the float, said drum having an external helical groove in its outer surface, an indicator arm pivotally mounted adjacent said drum element and having one end engaged within the groove whereby rotation of the drum imparts a swinging move-

5

ment to the arm, an indicating dial associated with the arm and calibrated to indicate the liquid level in the mud pit in accordance with rotation of the drum element as caused by the float, a second indicator remote from the first indicator, means for operating said second indicator, and an actuating member having connection with the first indicator and movable thereby and operatively connected with the operating means whereby the second indicator is movable in accordance with the movement of the first indicator.

4. An apparatus as set forth in claim 3, wherein the operating means for the second indicator is a pressure-actuated means and also wherein operation of the actuating member which is connected to the first indicator controls the pressure applied to said pressure actuated means.

RAY E. CONNER.

JOSEPH W. TAYLOR.

6

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,676,848	Au -----	July 10, 1928
2,006,531	Arntzen -----	July 2, 1935
2,022,582	Avigdor -----	Nov. 26, 1935
2,248,322	Annin -----	July 8, 1941
2,307,229	Moore -----	Jan. 5, 1943
2,342,696	Rover -----	Feb. 29, 1944
2,369,571	Jones -----	Feb. 13, 1945
2,381,948	Gess -----	Aug. 14, 1945

FOREIGN PATENTS

Number	Country	Date
633,274	Germany -----	July 23, 1936