Oct. 2, 1962 J. G. ABRAHAM 3,056,422

WATER LEVEL CONTROL DEVICE

Filed June 23, 1958 2 Sheets-Sheet 1

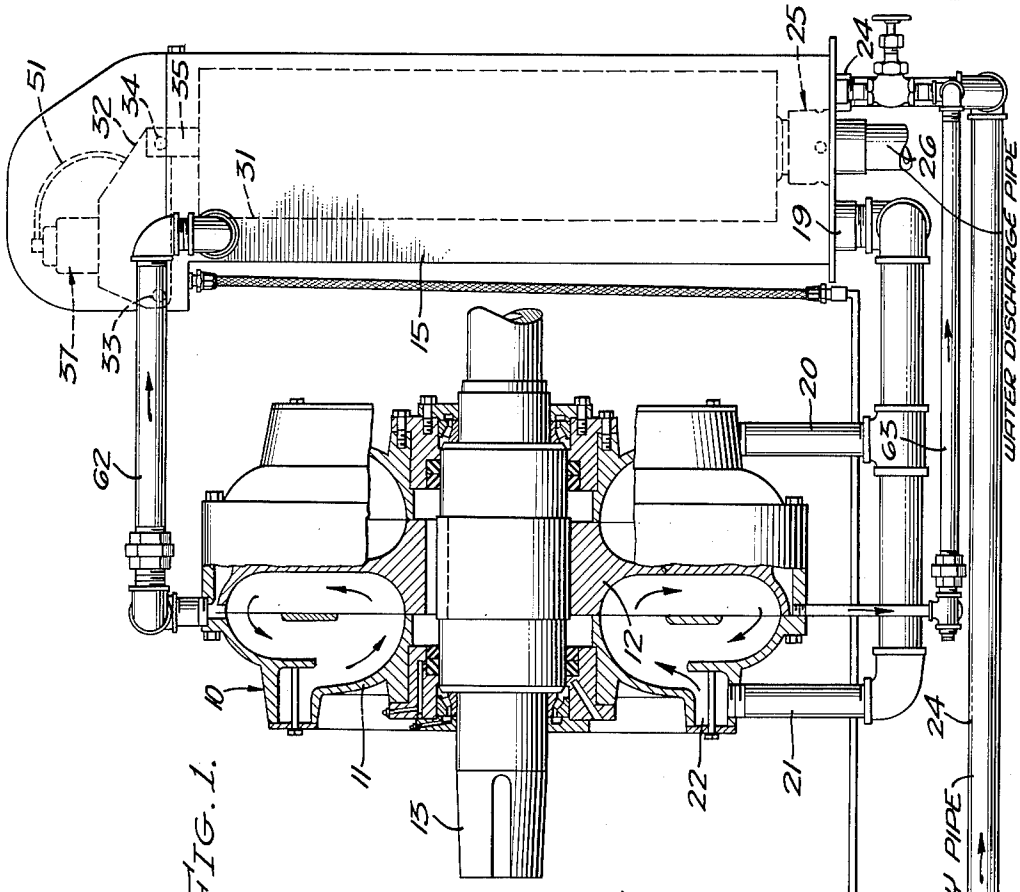


FIG. 1.

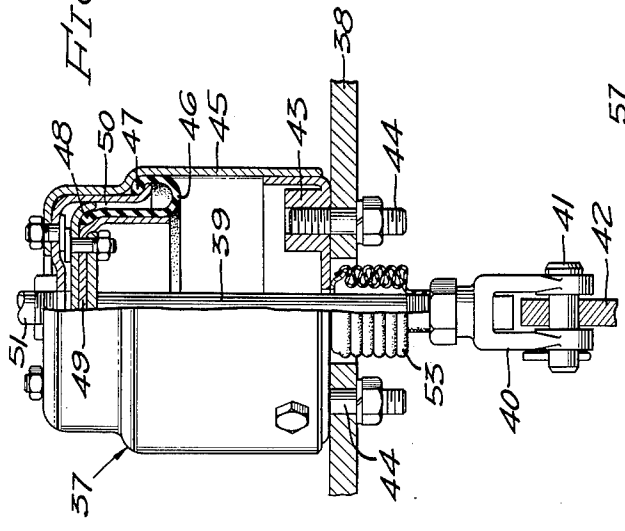


FIG. 3.

INVENTOR.
JAMES G. ABRAHAM
BY Lyon & Lyon
ATTORNEYS

Oct. 2, 1962 J. G. ABRAHAM 3,056,422

WATER LEVEL CONTROL DEVICE

Filed June 23, 1958 2 Sheets-Sheet 2

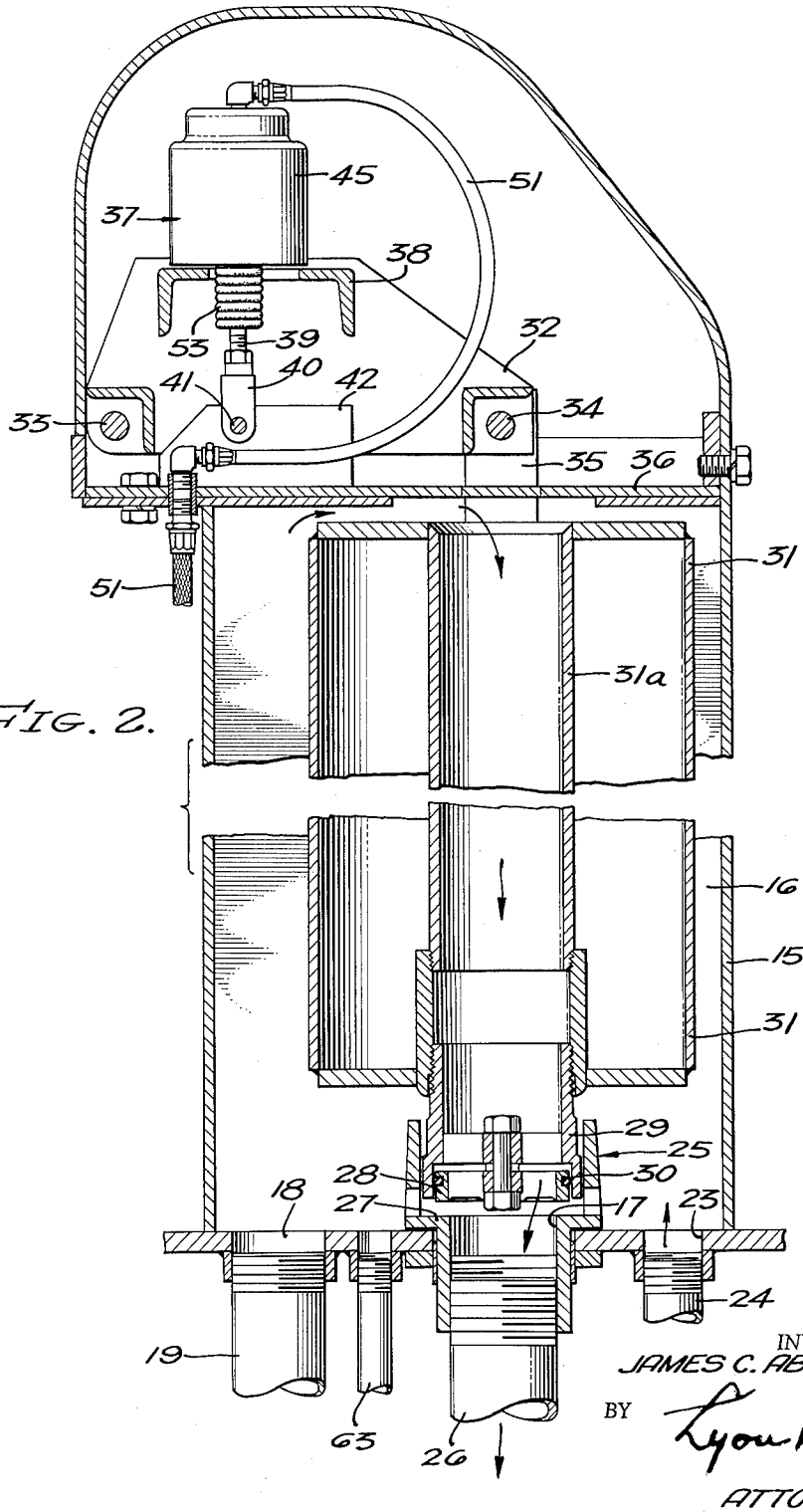


FIG. 2.

INVENTOR.
JAMES C. ABRAHAM
BY Lyon & Lyon
ATTORNEYS

United States Patent Office

3,056,422
Patented Oct. 2, 1962

3,056,422

WATER LEVEL CONTROL DEVICE

James G. Abraham, Rolling Hills, Calif., assignor, by mesne assignments, to Armco Steel Corporation, Middletown, Ohio, a corporation of Ohio

Filed June 23, 1958, Ser. No. 743,582
1 Claim. (Cl. 137—398)

This invention relates to a water level control device and is particularly directed to apparatus for controlling the amount of water within the casing of a Froude brake or the like. Such water brakes commonly have a vaned rotor within a vaned casing. The power absorbing ability of such brakes is very large in proportion to their size and they are commonly used to supplement the band type friction brakes used on drawworks of the type employed in the drilling of oil wells.

The Froude type water brakes used on oil field drawworks are often clutch connected to the drum shaft so that when the drill pipe is being lowered back into the hole after changing of the bit the speed of descent of the drill pipe is limited by the retarding action of the water brake. As additional stands of drill pipe are added, section by section, the weight of the drill pipe increases correspondingly, and it is desirable to increase the braking effect in proportion to maintain the lowering speed of the drill pipe within safe limits. Accordingly, the amount of water within the brake casing is increased to augment the retarding effect, and the maximum braking effect is achieved when the casing is full of water. The water in the casing is heated by the braking action and accordingly, water is continuously circulated into and out of the casing.

The water brake normally operates only during the operation of lowering the drill pipe sections into the hole, and the brake is disconnected from the drum shaft during the interval while the empty blocks are being raised preparatory to adding another "stand" of pipe. Accordingly, the brake rotor operates on an intermittent cycle. When the rotor is turning, water is pumped out of the brake casing by the centrifugal action of the rotor. Water continues to flow into the brake casing during the interval that the rotor is at rest, however. The result is that if no level control means are provided, the amount of water in the brake casing varies over a considerable range, even though a valve is provided for controlling the rate of delivery of water to the casing. This is true because the time cycle of lowering "stands" of pipe into the hole varies somewhat and, furthermore, as the total weight of the drill pipe string becomes greater, additional braking effort is required to maintain the same speed of descent. It is not uncommon in conventional practice for the braking effect to vary considerably in spite of attempts by the driller to control the amount of water in the brake casing by adjusting the rate of water flow to the casing inlet.

It is the principal object of this invention to eliminate this difficulty and to provide means for accurately regulating the quantity of water within the casing of the water brake in order to obtain accurate regulation of the braking effect.

Another object is to provide a novel form of level control apparatus particularly adapted for a water brake having an intermittent cycle of operation, but with water flowing continuously into and out of the brake casing. A more particular object is to provide a float chamber in communication with the brake casing chamber, a float in the float chamber connected to open a valve for discharging water from the chambers, means for constantly delivering water into said chambers, and a remote control pressure operated device for modifying the buoyant force

of the float exerted upon the valve. Other and more detailed objects and advantages will appear hereinafter.

In the drawings:

FIGURE 1 is a side elevation partly in section and showing a preferred embodiment of this invention.

FIGURE 2 is a sectional side elevation showing details of the water level control apparatus.

FIGURE 3 is a side elevation partly in section showing the pressure responsive actuator for applying an upward force to the float.

Referring to the drawings, the Froude type water brake generally designated **10** may be similar in construction to that shown in the Pohl Patent 2,750,009, and includes a vaned casing **11** enclosing a vaned rotor **12** fixed on a shaft **13**. The casing **11** is stationary and is mounted on a suitable framework to prevent it from turning. Power received by the shaft **13** causes the rotor **12** to turn within the casing **11**.

In accordance with this invention, stationary shell **15** defines a float chamber **16** having a discharge opening **17** in the bottom wall thereof. Another opening **18** in the bottom wall communicates by way of piping **19**, **20** and **21** with the chamber **22** within the casing **11**. A water inlet pipe **24** leading from a source of water pressure (not shown) communicates with the float chamber **16** through the opening **23**. Water admitted into the float chamber **16** seeks the same level in the casing chamber **22** via the connections **19**, **20** and **21**.

A valve generally designated **25** controls discharge of water through the openings **17** and discharge pipe **26**. This valve **25** includes a stationary seat **27** adapted to be engaged by the lower surface of a movable ring **28**. The ring **28** is loosely carried on a tubular valve head **29**. A seal ring **30** prevents leakage between the ring **28** and the valve head **29**. A float **31** positioned in the chamber **16** is fixed to the valve head **29** at its lower end. The length of the float is approximately equal to the distance from the top to the bottom of the working circuit of the brake casing chamber. With no other forces acting, the buoyancy of the float **31** is such that it rises to lift the valve ring **28** off the seat **27** only when the water level of the float chamber **16** has risen to a height corresponding to complete filling of the chamber **22** within the brake casing **11**.

Means are provided for applying a controlled lifting force to the float **31**. As shown in the drawings this means includes a lever **32** pivotally mounted at **33** on the shell **15** and pivotally connected at **34** to the projection **35** fixed on the upper end of the float **31**. This projection **35** extends loosely through an opening in the plate **36** which defines the upper limit of the float chamber **16**. A pressure responsive actuator **37** is fixed on a bracket **38** attached to the lever **32** and the actuator **37** includes a piston rod **39** carrying a clevice **40** pivoted at **41** to the stationary bracket **42**. As shown in FIGURE 3 the actuator includes a base **43** attached to the bracket **38** by removable fastenings **44**. This base is fixed to the cover **45**. A rolling diaphragm **46** is clamped on its outer periphery **47** against the cover **45** and is clamped on its inner periphery **48** to the piston **49**. When air pressure is supplied into the space **50** above the diaphragm **46** through the control line **51**, the piston rod **39** moves downward, extending the bellows **53**. When pressure in the control line **51** is relaxed, the weight of the float, lever, etc. returns the parts to the position shown in FIGURE 3. Since the piston rod **39** is pivotally connected to the stationary bracket **42** by means of the clevice **40**, a downward force applied to the piston rod **49** results in an upward force supplied to the cover **45**, base **43** and bracket **38**. This upward force applied to the bracket **38** serves to cause the lever **32** to apply

an upward force to the float 31 through the pivotal connection 34.

A self-lapping valve assembly 55 is positioned at a location remote from the actuator 37 and is connected thereto by means of the control line 51. The valve assembly 55 is also connected to the air supply line 56 and is also provided with an exhaust port (not shown). When the valve handle 57 is in the position shown in FIGURE 1, air pressure at a predetermined maximum value is supplied through line 51 to the actuator 37, thereby applying a maximum lifting force to the float 31. When the valve handle 57 is swung one-quarter turn in a counterclockwise direction as viewed in FIGURE 1, the pressure in the line 51 is reduced to atmospheric pressure. For intermediate positions of the valve handle 57 corresponding air pressure intensities are produced in the control line 51. Accordingly, the position of the valve handle 57 determines the magnitude of the upward force applied to the float 31.

In operation, the valve 60 in the water supply pipe 24 is opened to admit water at a constant rate into the float chamber 16 and into the chamber 22 of the brake casing 11 via the conduit 19, 20 and 21. The valve 60 need be opened only to the degree necessary to provide adequate cooling for the work at hand. The rate of flow of water is limited only by the capacity of the bottom discharge pipe 26. The size of this pipe 26 is relatively large as compared to the size of the inlet pipe 24 in order that substantially no back pressure be imposed by the pipe 26. The air pressure applied to the acuator 37 through the line 51 determines the water level in the float chamber 16 and in the chamber 22 within the brake casing 11. The float 31 is heavy enough so that it keeps the discharge valve 25 closed unless the brake chamber 22 is completely filled with water, or unless air under pressure is supplied to the actuator 37 through the line 51. When air pressure is applied to the actuator 37, an upward force is applied to the float 31 to assist the float in lifting the valve ring 28 from the valve seat 27. The water level in the float chamber 16 and brake casing chamber 22 for any given intensity of air pressure in the line 51 is such that the buoyancy of the float 31 added to the upward force on the float applied by the actuator 37 (acting through lever 32) is just equal to the weight of the float. Any further increase in filling of the float chamber 16 will unseat the valve 25 and allow water to flow out through the discharge opening 17 and discharge pipe 26. Maximum filling of the float chamber 16 is thus obtained with zero gauge pressure in the air supply pipe 51, and minimum filling is obtained with maximum air pressure in the line 51.

Water return pipe 62 connects the upper end of the chamber 22 with the upper end of the float chamber 16. Water return pipe 63 connects the lower ends of the chambers 22 and 16. The valve 64 on the drain pipe 65 is normally open.

The overflow pipe 31*a* runs down the center of the float 31. As an overflow pipe it functions only under abnormal conditions such as a leak in the float or interference with the action of the lever 32. For normal operation however, the presence of the overflow pipe 31*a* in the center of the float 31 provides an essentially balanced valve action; the buoyant force on the float is relatively unaffected by degree of valve opening.

The discharge pipe 26 may return water to a supply tank, not shown, and the inlet pipe 24 may be supplied with water from said tank by means of a pump, not shown. In this way, water is circulated between the water brake 10 and the supply tank, thus conserving the supply of water.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details herein set forth, but my invention is of the full scope of the appended claim.

I claim:

A water level control device for a Froude brake, or the like, comprising in combination: a stationary upright shell defining a float chamber, the float chamber having an outlet passage in the lower end thereof provided with a valve, an inlet passage for delivering water into the float chamber, a float in the float chamber connected to open the valve upon upward movement of the float, the float being provided with an axial opening extending therethrough and connected to the valve to discharge overflow water from the float chamber, vertically spaced conduits connected to the float chamber and adapted for connection to the brake, the buoyancy of the float being such as to maintain the valve closed until the water level in the float chamber reaches a predetermined maximum height, and means for modifying the buoyant force of the float exerted upon said valve.

References Cited in the file of this patent

UNITED STATES PATENTS

1,906,277	McGee	May 2, 1933
1,985,889	Mater et al.	Jan. 1, 1935
2,055,297	Lane	Sept. 22, 1936
2,078,106	Temple	Apr. 20, 1937
2,172,647	Widman	Sept. 12, 1939
2,540,361	Whitley	Feb. 6, 1951
2,619,984	Ashton et al.	Dec. 2, 1952

FOREIGN PATENTS

6,345	Switzerland	Mar. 6, 1893