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(54) **A jig washbox control system**

(57) A system for controlling operation of a jig washbox (10) comprising at least one pressure sensor (20) detecting the instantaneous pressure in a respective standpipe (13), a specific gravity sensor (21) detecting the instantaneous specific gravity inside the washbox, sensors (20, 21) feeding signals to a microprocessor which is adapted to remove from the pressure representative signal a bias created therein by the specific gravity representative signal, such that an output control signal from the microprocessor is corrected for use in the adjustment of one or more operating parameters of the washbox.

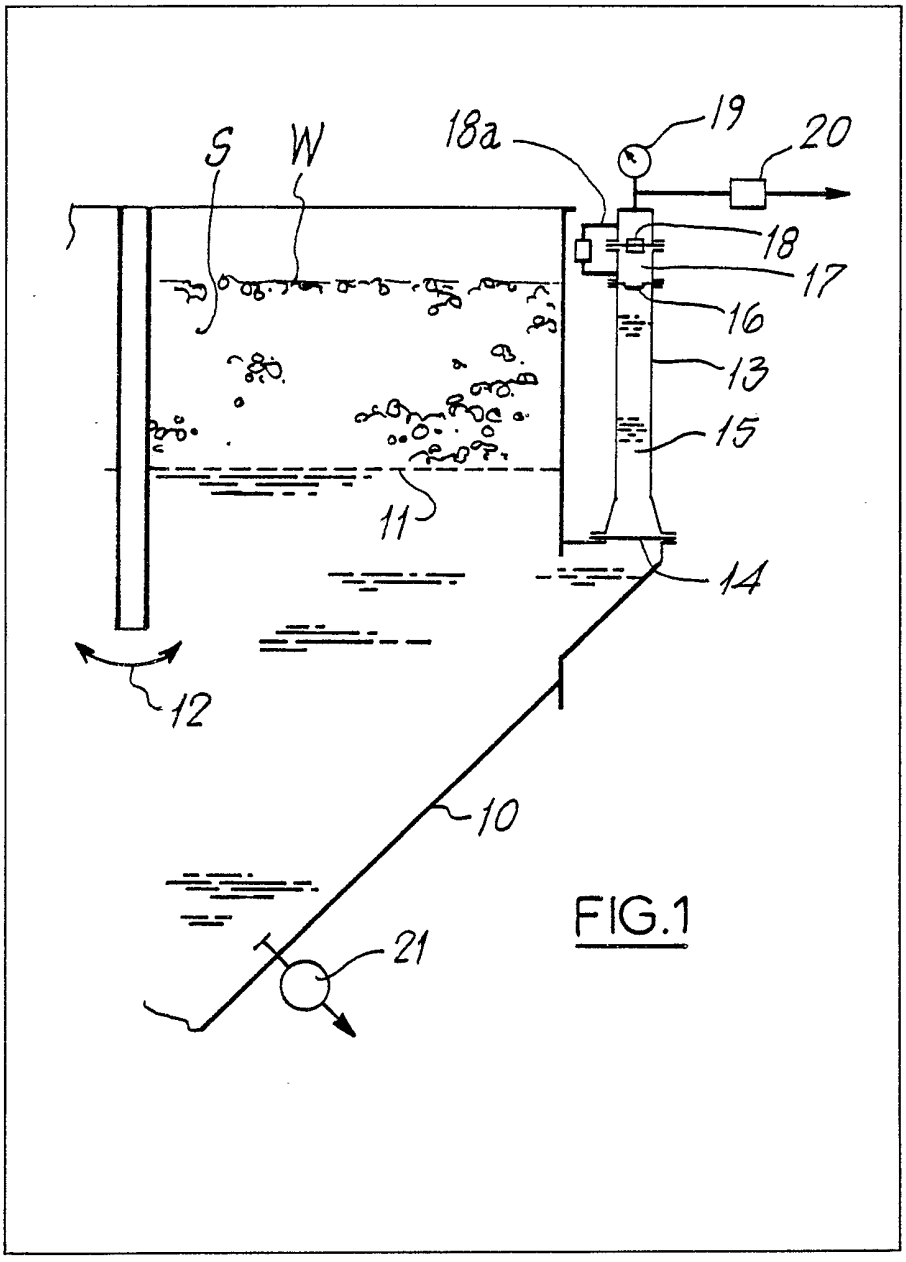

FIG.1

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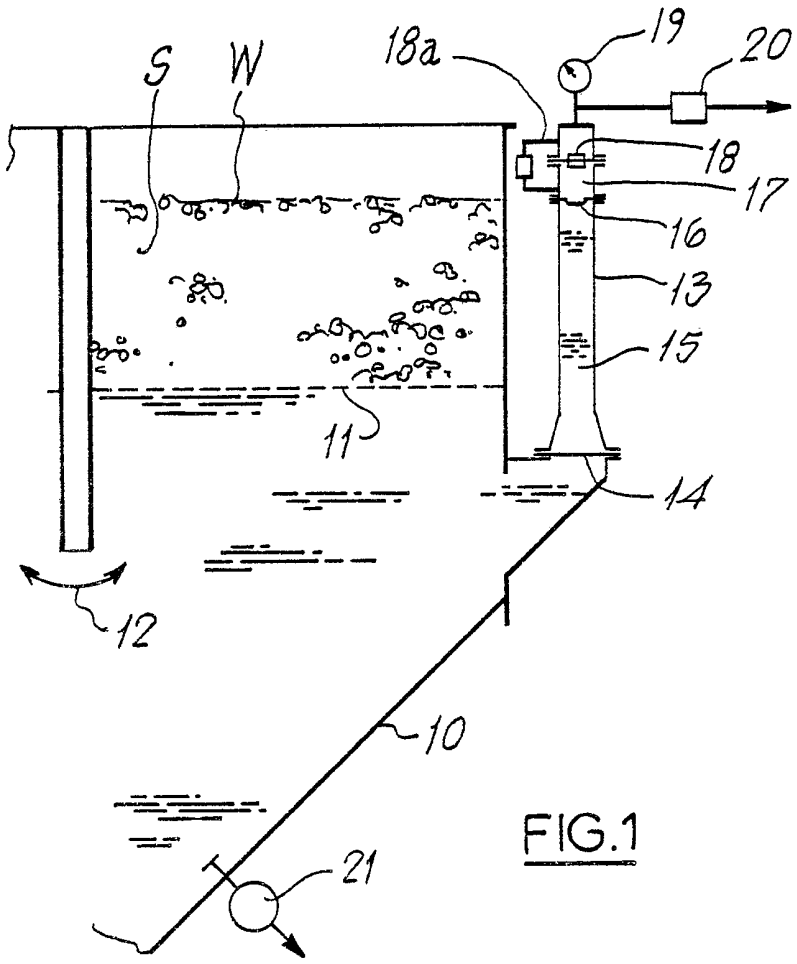

FIG.1

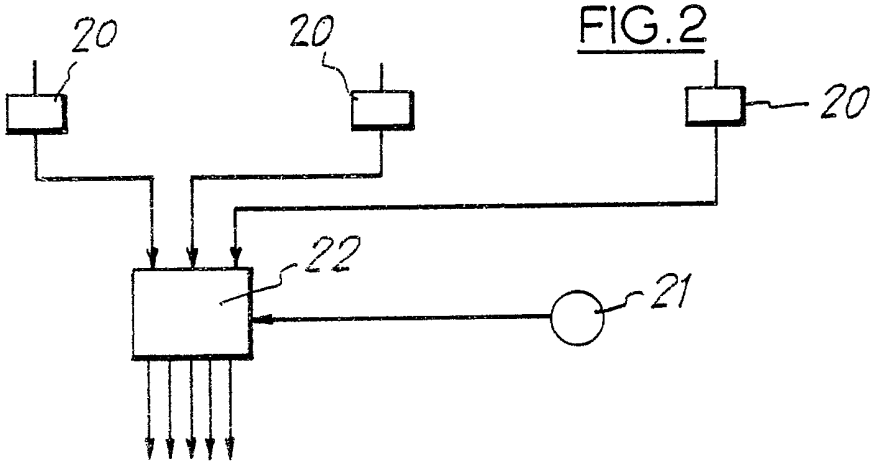

FIG.2

SPECIFICATION

A jig washbox control system

This invention relates to a jig washbox of the kind used, for example, in a coal preparation plant, wherein a bed of solids such as coal and shale is deposited into a water filled vessel, on a submerged perforated deck therein, so that the bed of material can classify, and the denser fraction settles on the deck. A device is usually included to generate upwardly directed surges or pulses of current in the water which serve repeatedly to lift the bed of material thus to assist the classification process.

More particularly, the invention is concerned with a process for monitoring conditions within the washbox during operation thus to enable an operator to make adjustments in, for example, the rate of supply of material to the washbox and/or the rate of discharge of classified materials therefrom. Additionally, the supply of washing liquid, and other operational aspects such as the movement of the liquid within the box must be controlled in order to optimise performance.

In one known form of control system, means are provided to sense pressure variations in the liquid below the perforated deck, which are created by changes in density of the material above the deck. One common form of this kind of system is a standpipe alongside the washbox and connected to the interior thereof below the deck. Such a standpipe may be open to atmosphere at its upper end above the water level or sealed to provide a pressure chamber therein.

At the connection to the washbox the standpipe may provide a free passage for the fluid in the box to enter the standpipe, or alternatively the fluid in the standpipe can be isolated from that within the box by a flexible diaphragm to allow only the transmission of pressure from the washbox to the base of the standpipe.

In operation, the conditions within the washbox and the requirements for control thereof are detected by the effect upon the liquid in the standpipe. The indication thus provided can be related to the density of the materials being treated, since a greater density will produce a greater resistance to water flow through it and consequently a greater pressure in the region below the perforated deck, which is reflected in the sensing capability of the standpipe.

A system of this kind will operate efficiently so long as the density of the bed is the only variable factor affecting the pressure in the standpipe. However another important factor which varies is the specific gravity of the liquid in the washbox. Owing to the amount of material being treated and to the repeated use of the liquid in treating substantial quantities of materials over an extended period, even though the liquid in the washbox is clear at commencement of operation, a considerable quantity of fines is collected in suspension so that it is necessary to involve systems for removing these fines continuously. In a well controlled plant the specific gravity of the liquid in the washbox can be maintained at a steady figure, and the various control systems can be set and operated on that basis. However even in the best controlled plants some deviation in specific gravity can occur, for example, by temporary malfunction of some part of the system. In this way, control over the operation of the washbox can deteriorate.

An object of the present invention is to provide a system for controlling the operation of a jig washbox, wherein compensation is made for the aforementioned loss of control in order to optimise performance.

According to the present invention there is provided a process for controlling operation of a jig washbox comprising the steps of sensing the instantaneous pressure of liquid within the washbox, generating a first signal representing said instantaneous pressure, sensing the instantaneous specific gravity of said liquid within the washbox, generating a second signal representing said instantaneous specific gravity, and providing means capable of processing said first and second signals and interrelating same thus to remove from said pressure representative signal a bias created therein by said specific gravity representative signal and thus to produce an output control signal which is corrected for use in the adjustment of one or more operating perameters for the washbox.

Further according to the invention, there is provided apparatus for carrying out the aforesaid method.

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a fragmentary vertical section of a jig wahsbox including a control system in accordance with the invention; and

Figure 2 is a diagrammatic illustration of the various integers of the control system.

Referring now to Figure 1, the washbox comprises a vessel 10 containing water and having a fixed perforated deck 11 therein upon which rests the denser fraction of a bed of solids to be treated. The solids *S* may comprise coal and shale. The water in the vessel 10 is caused to pulsate to and fro as indicated by the arrows 12 to assist in the treatment process such that the bed of material classifies into the lighter fraction and the heavier fraction. Communicating with the interior of the vessel 10 below the water level *W* therein is a vertically disposed standpipe 13 located outside the vessel and closed at its upper end. A flexible diaphragm 14 isolates the water in the vessel from a first zone 15 which is filled with a liquid and is defined at its upper end by a second flexible diaphragm 16. Both diaphragms are capable of flexural movement thus to displace equal volumes of the liquid contained in the zone 15. An upper zone 17 above the diaphragm 16 contains air, and in said zone there is located a rigid diaphragm 18 which permits passage of air only in a direction away from the diaphragm 16. A controlled bleed of air past the rigid diaphragm in the reverse direction is permitted by means of a bypass line 18*a*. A pressure gauge 19 is connected to the upper end of the standpipe, and a transmitter 20 is provided to

generate an electrical signal representing the instantaneous pressure in the zone 17. Thus the instantaneous pressure in the liquid below the perforated deck 11 is represented as a signal produced by the transmitter 20.

A device 21 of a known kind is provided to generate a signal representing the specific gravity of the liquid circulating within the plant.

Referring now to Figure 2 the control system includes three pressure signal transmitters 20 connected individually to standpipes disposed at spaced positions respectively along the washbox, to sense the instantaneous pressure in the liquid at the three separate stations. The pressure representative signals are fed from transmitters 20 to a microprocessor 22. Also fed to the microprocessor is the specific gravity-representative signal from device 21. The microprocessor has full mathmetical capability to receive multiple control signals simultaneously and to produce one or more corresponding rectified signals. Thus the microprocessor will correct the pressure-representative signals to extract therefrom the bias created by the instantaneous specific gravity as represented by the signal from the device 21. Corrected signals are therefore emitted by the microprocessor to control various adjustable parameters in the operation of the washbox.

It is not intended to limit the invention to the above example only, many variations, such as might readily occur to one skilled in the art, being possible without departing from the scope of the invention.

The principle of the invention is the measurement of the specific gravity of the washing liquid and the adjustment of the control signals to eliminate the influence of the specific gravity variation on the control. Whilst we have considered a sealed standpipe isolated from the washing liquid, other standpipes in direct communication with the washing liquid have similar problems to a varying degree since, even where the washing liquid itself passes into the standpipe, there is reduced activity in the standpipe which allows the solids therein to settle so that an imbalance similar to that experienced where the standpipe is isolated from the washbox, may be experienced. Similarly, standpipes which are open to atmosphere at their upper ends contain water which effectively is trapped and is not exchanged with the main body of the water in the washbox so that again settling of fines in the standpipe can produce the imbalance referred to above. In such cases, it would be preferable to ensure that clean water flows into the standpipe to produce a standard condition therein for comparision with the specific gravity of water within the body of the vessel.

Further, the invention can be applied to control systems which do not employ standpipes, such as, for example, where a direct pressure reading is taken from the side of the washbox below the level of the perforated deck. Appropriate compensation would be made in the mathematical comparisons between instantaneous pressure and instantaneous specific gravity.

CLAIMS

1. A process for controlling operation of a jig washbox comprising the steps of sensing the instantaneous pressure of liquid within the washbox, generating a first signal representing said instantaneous pressure, sensing the instantaneous specific gravity of said liquid within the washbox, generating a second signal representing said instantaneous specific gravity, and providing means capable of processing said first and second signals and interrelating same thus to remove from said pressure representative signal a bias created therein by said specific gravity representative signal and thus to produce an output control signal which is corrected for use in the adjustment of one or more operating parameters for the washbox.

2. A process according to Claim 1, wherein said first and second signals are compared and processed in a microprocessor.

3. A process according to Claim 1, wherein said instantaneous pressure is sensed in a standpipe which communicates with the body of liquid in the washbox.

4. A process according to Claim 1, in which said instantaneous pressure is sensed by means connected directly to the wall of the washbox.

5. A process according to Claim 1 or Claim 2, wherein said instantaneous specific gravity is sensed by means connected directly to the wall of the washbox.

6. Apparatus for controlling operation of a jig wahsbox comprising first sensing means for generating a signal representing the instantaneous pressure of liquid within the washbox, second sensing means for generating a signal representing the instantaneous specific gravity of said liquid within the washbox, and means for processing said signals thus to remove from said pressure representative signal a bias created therein by said specific gravity representative signal such that an output control signal from said processing means is corrected for use in the adjustment of one or more operating parameters for the washbox.

7. Apparatus according to Claim 6, wherein said first sensing means is connected to a standpipe disposed outside the washbox but in communication therewith, there being a pair of spaced flexible diaphragms within said standpipe having liquid therebetween which is isolated from the liquid in the washbox and from an air-filled zone to which said pressure sensing means is connected.

8. Apparatus according to Claim 7, wherein said air-filled zone includes a rigid diaphragm adapted to permit pulses of air to bypass it in one direction only, with means to enable a controlled bleed of air past said diaphragm in the opposite direction.

9. Apparatus according to Claim 6, wherein said second sensing means is connected directly to the wall of the washbox for detecting the instantaneous specific gravity inside said wall.

10. Apparatus according to Claim 6, wherein said processing means comprises a microprocessor.

11. Apparatus according to Claim 6, including a plurality of said pressure sensing means adapted to

sense the instantaneous pressure of the liquid within the washbox at spaced positions therein, said signals being fed to said processing means for processing individually with the signal from said second sensing means.

12. A process for controlling operation of a jig washbox, substantially as hereinbefore described.

13. Apparatus for controlling operation of a jig washbox, substantially as hereinbefore described, with reference to, and as illustrated in the accompanying drawings.

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