

May 15, 1951

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FLOW RESPONSIVE APPARATUS

Filed March 21, 1944

2,552,569

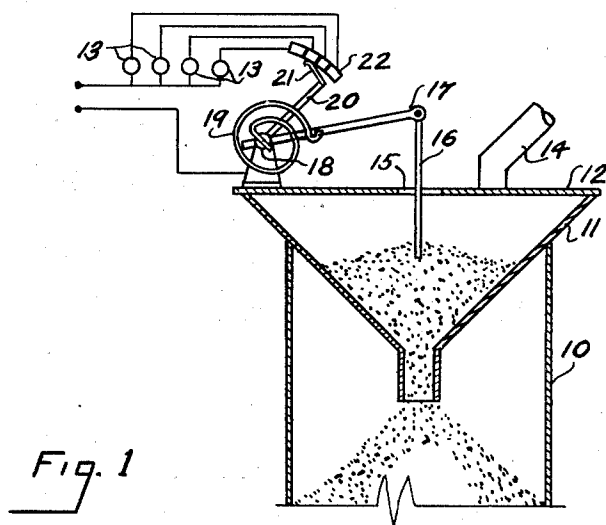


Fig. 1

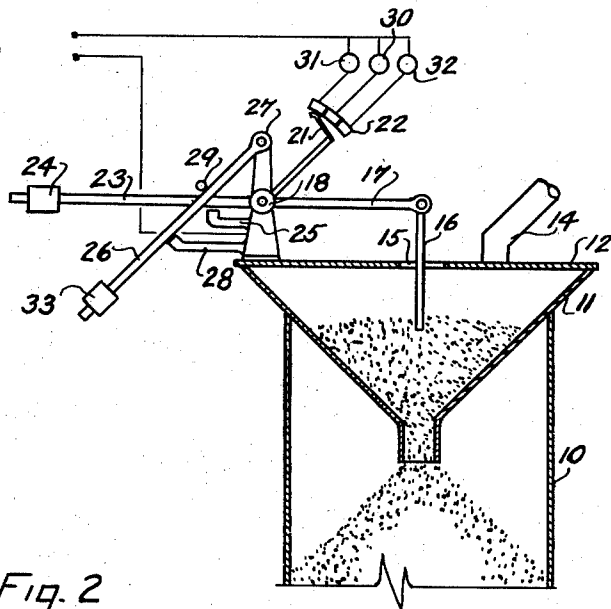


Fig. 2

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2,552,569

FLOW RESPONSIVE APPARATUS

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Application March 21, 1944, Serial No. 527,415

2 Claims. (Cl. 73—194)

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The present application is in part a continuation of my copending application Serial No. 462,876 filed October 21, 1942, Patent 2,368,672, granted February 6, 1945.

This invention relates to apparatus responsive to the flow of a body of granular, pulverant or molded fluent materials and may be employed for indicating or controlling the level of a flowing body thereof.

This apparatus is adapted for use with such apparatus as shown in the application of Hubert A. Shabaker, Serial No. 454,782 filed August 14, 1942 for Method and Apparatus for Adjusting Activity of Contact Material, which disclosed an upright chamber having at its upper end a hopper for supplying material to the chamber wherein it is treated and means associated with the lower end of the chamber for controlling the rate of discharge of the material therefrom. The chamber is to be maintained at all times full of material to assure proper time to effect the desired treatment of the material. The apparatus is likewise useful in other applications, as for instance, in connection with catalytic converters in which a body of the catalyst flows through the converter and in which it is desired to maintain the converter at all times full. In either type of installation the apparatus may be employed either as an indicator or a controller or, if desired, as both.

An object of the present invention is to provide apparatus which moves to varying positions responsive to the level of a body of solid material flowing downwardly in a chamber. Other objects will be apparent from the accompanying drawings in which:

Fig. 1 is a vertical section through a hopper provided with one form of apparatus in accord with this invention;

Fig. 2 is a similar section showing a modified form of the present invention.

Tower 10, which it is desired to maintain full of material at all times, is provided at its upper end with a hopper 11, having a lid 12 fixed thereon. A feed pipe 14 is provided to introduce the solid fluent material through the lid 12. The lid 12 is likewise provided with an opening 15 through which extends a depending bar 16 which is frictionally resistant to the flow of material therealong. The bar 16 is pivotally secured at its upper end to a lever arm 17 pivoted on a fixed shaft 18. A spring 19, which may suitably be of the flat, helical type shown, or any other desired type, is provided for urging the arm 17 upwardly, the inner end of the spring being

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secured in the shaft 18. Any suitable means may be provided for indicating or controlling the level of material in the hopper, responsive to the position of the bar 16 and lever 17. Thus, an arm 20 may be provided for moving with the lever 17, the arm being provided with a finger 21 for engagement with a series of contact segments 22. As shown, these segments individually energize a plurality of signal lamps or relays 23. When lamps are employed, the particular lamp energized indicates the position of the bar 16. When relays are employed, the relays may control the rate of feed of the material to the hopper 11.

Starting with the hopper 11 empty, material is fed therein at a rate greater than the rate of outlet from the hopper, whereby the level of the material in the hopper rises. When the level rises to a sufficient height, it engages the bar 16 for a short distance along its length. The frictional resistance of the bar 16 to the flow of material therealong causes the bar 16 to be moved downwardly against the action of the spring 19 from the normal position of the bar and spring shown in Fig. 1. It will be noted that as the bar 16 moves downwardly the torque exerted by the spring 19 increases. As the level of the material continues to rise the bar 16 will move gradually downwardly. At all times the position of the bar 16 is such that the frictional force of material tending to move the bar downwardly is equal to the force exerted by the spring tending to move the bar upwardly. Whenever the level of material is lowered, the frictional force tending to pull bar 16 downwardly is decreased whereby the spring 19 will pull the bar upwardly until balance is again attained. In case the bar 16 is accidentally elevated at any time when it should be in a lowered position, there will be a sufficient level of material to move the bar downwardly to its proper position, since the level would necessarily be above the level which initiates the movement of the bar downwardly. Accordingly, there is at all times an accurate indication of the level of the material in the hopper unless the apparatus has been accidentally displaced, in which case the apparatus will return to its proper position rapidly.

In the form of the invention shown in Fig. 2, a modified means for increasing the upward force on the lever arm 17 as it is moved downwardly is provided. In this form of the invention a weighted lever arm 23 is provided, fixedly secured to the lever arm 17 to move therewith

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about the fixed pivot 18. The arm 23 is provided with a weight 24 to overbalance the bar 16 and arm 17 and to hold the arm 23 normally in engagement with stop 25. A second weighted arm 26 is provided, which is pivoted on shaft 27, a stop 28 being provided to limit the downward movement of the arm 26. A finger 29 is secured to the arm 26 for engagement with the arm 23 after movement of the latter from its normal position against the stop 25.

In the form of the invention shown in Fig. 2, when the level of material in hopper 11 rises to the point that the bar 16 starts its downward movement, the bar will continue to move downwardly until the arm 23 engages the finger 29. Engagement with the finger 29 increases the torque, tending to prevent rotation of the arm 17 by bar 16. In this form of the invention this position in which arm 23 engages but does not lift finger 29 is the normal operating position. In this position the element 30 is energized, which may be an indicating lamp or the normal feed operating means for the hopper. In the initial position of the bar 16 prior to being moved downwardly, the finger 21 engages the particular segment 22 which energizes element 31, which may be either a lamp indicating that the hopper contains insufficient material, or a means for feeding more than the normal amount to the hopper. If the level of material builds up to a point in the hopper such that the force of arm 23 against the finger 29 is adequate to raise the arm 26 from its position of rest against stop 28, the third one of segments 22 will energize element 32 which may give an indication that the hopper is too full, or may energize means for decreasing the rate of flow. It is to be noted that after the weighted arm 26 is initially raised by the arm 23 the torque increases as movement of the bar 16 downwardly continues, inasmuch as the finger 29 moves outwardly on the arm 23 from pivot 18 and as the weight 33 on arm 26 goes farther in a horizontal direction from the pivot 27.

While two embodiments of the present invention have been shown and particularly described, it is obvious that there are other embodiments of the present invention not shown here in detail.

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The scope of the present invention is therefore limited only by the scope of the appended claims.

I claim as my invention:

1. Level indicating and control means for fluent solid material comprising in combination, a receptacle having inlet and outlet means adapted to provide a compact moving bed of solids continuously passing therethrough, a lever arm pivotally supported above said receptacle, a bar pivotally suspended by one end from a side of said lever arm, the lower end of said bar extending downwardly into said moving bed and having the submerged portion of its surface frictionally resistant to the flow of solids therealong, a weight on the opposite side of said lever arm producing a torque effect tending to raise said bar, a stop engageable with said lever arm to limit upward movement of said bar, a second weighted lever arm pivotally mounted adjacent the first-mentioned lever arm, a second stop normally supporting the free end of said second lever arm, and means interposed between said lever arms for adding the torque effect of said second lever arm to said first lever arm, said means being operative only after said bar has been lowered a predetermined distance.

2. Apparatus as defined in claim 1 in which the additional torque effect produced by said last-mentioned means is of progressively increasing magnitude as said bar is lowered.

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