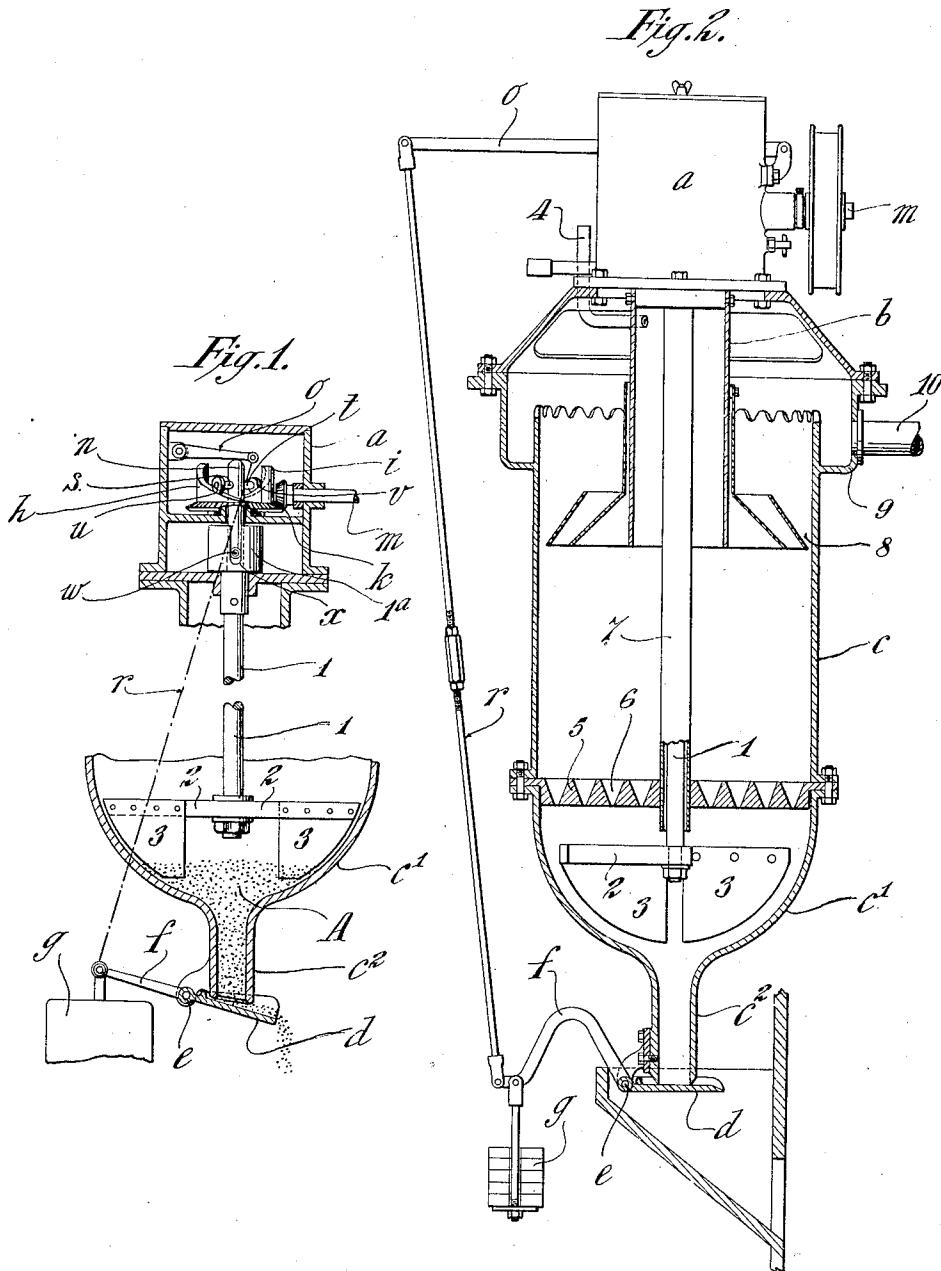


April 3, 1928.

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SAND FROM TANKS OR OTHER RECEPTACLES
Filed July 23, 1927

2 Sheets-Sheet 1



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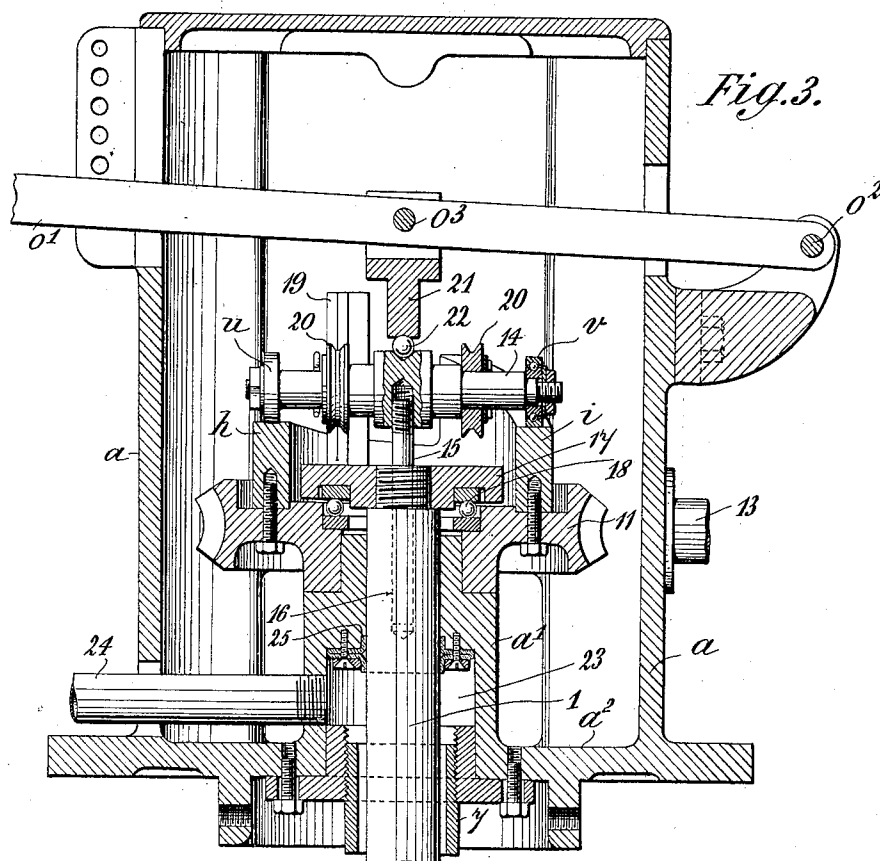
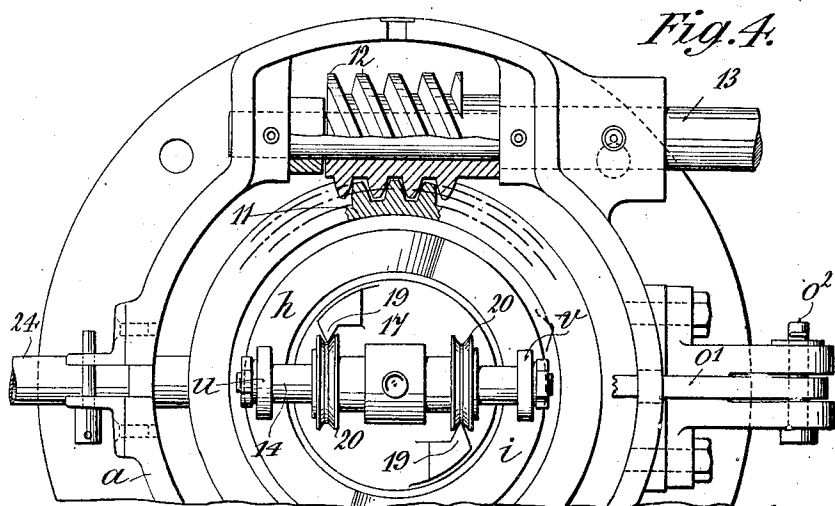
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UNITED STATES PATENT OFFICE.

LEONARD ANDREWS, OF WESTMINSTER, ENGLAND.

VALVE MECHANISM FOR CONTROLLING THE DISCHARGE OF POWDERED MATERIAL AND SAND FROM TANKS OR OTHER RECEPTACLES.

Application filed July 23, 1927, Serial No. 207,978, and in Great Britain July 30, 1926.

This invention has reference to that kind of valve mechanism for automatically controlling the discharge of powdered material or sand from a tank or other receptacle (hereinafter referred to as a tank) wherein the action of said mechanism is dependent upon and accumulation of such material in the lower portion of the tank. The invention has for its object to provide valve mechanism of the kind referred to, that shall be of a robust, powerful and compact construction and be very sensitive in action.

For this purpose, valve mechanism according to the invention, comprises a loaded valve adapted to close the discharge outlet of the tank, a rotary device mounted to rotate in the lower portion of the tank and to be retarded to a greater or less extent by powdered material or sand collected therein, a motor driven cam device and adjustable means arranged to drive the said rotary device and to be acted upon by the loaded valve and by the cam device, the arrangement being such that when the mechanism is in use and little or no solid material has collected in the lower portion of the tank, the valve will be held by its load in the closed position but when material collects in the lower portion of the tank, the resistance offered thereby to movement of the rotary device and of the adjustable means, causes the cam means to move the adjustable means in a direction to open the valve, against the action of its load, to a greater or less extent, depending upon the amount of material collected in the lower portion of the tank.

The cam device may comprise part circular rotary cams having inclined faces, and the adjustable means comprise rollers arranged to bear against the cam faces and to act against the loaded valve through a lever. Also, the cam device and adjustable means may be arranged within a case supported at the top of the tank and the adjustable means be arranged in driving connection with the rotary device in the tank through a vertical shaft, the adjustable means being free to lift independently of the shaft.

Valve actuating mechanism embodying the invention can be variously constructed and arranged.

In the accompanying illustrative drawings, Fig. 1 shows in vertical section, one construction of valve mechanism according to the invention applied to a tank, from the

bottom of which material is to be discharged in an automatic manner. Fig. 2 shows partly in side elevation and partly in vertical section, valve mechanism according to the invention, applied to apparatus for use in the classification of powdered material by elutriation. Fig. 3 shows partly in elevation and partly in vertical section and Fig. 4 in plan, with parts removed, the valve actuating and controlling mechanism used with the loaded valve in the dewatering arrangement shown in Fig. 2.

In the construction shown in Fig. 1, *a* is a gear box mounted upon the top of a tube *b* through which liquid containing powdered material is delivered into a tank *c* the lower portion *c*¹ of which, of bowl shape, serves as a receptacle for solid material *A* precipitated from the liquid. Such receptacle has a contracted outlet *c*² adapted to be closed by a valve *d* pivoted at *e* and provided with an arm *f* connected to a load, shown as a weight *g*, that tends to close the valve. The mechanism for operating and controlling the valve, comprises a pair of semi-circular shaped cams *h* and *i* having upwardly inclined faces arranged to be rotated at a very slow speed, as by bevel gear *k* from a shaft *m* driven from any convenient source, and a vertical centrally arranged rotary spindle *n* (hereinafter called the floating spindle) which acts against a lever *o* that is connected to the loaded valve *d* through a flexible or rigid tension member *r*. The floating spindle *n* is provided with a pair of lateral arms *s* and *t* carrying rollers *u* and *v* which bear on the respective faces of the cams. The degree of slope of the cam faces is not constant but increases from bottom to top. The floating spindle *n* is provided with a second pair of co-axial arms *w* which engage in oppositely arranged vertical slots *x* in an enlarged end 1^a of a vertical spindle 1 that extends centrally through the tank *c* into the collecting chamber *c*¹ and is there connected by a pair of arms 2 to two quadrant shaped blades 3 arranged within the collecting chamber, where they become more or less embedded in the mass of coarse particles *A* collected therein. The arrangement is such that the floating spindle *n* is constantly subjected to two opposing stresses, namely, a downward pressure caused by the lever arm *o*, due to the weight *g* acting to close the valve *d* and acting to cause the rollers

u and v to run down the faces of the cams h and i and thus permit the valve to be closed, and to a retarding torque, due to motion of the blades 3 in the mass of coarse particles A and which tends to cause the rollers to roll up the faces of the said cams and thereby raise the floating spindle n and lever o and open the valve d to a greater or less extent. The arrangement is such that, at starting, when there are no oversize particles in the collecting chamber c^1 , the valve d is held in its closed position by the weight g , and the cams h and i , rollers u and v , floating spindle n , vertical spindle 1 and blades 3 rotate slowly as a whole. When oversize particles have collected in the chamber c^1 and offer a certain degree of resistance to motion of the blades 3, the rollers u and v are caused to move a short distance up the faces of the cams h and i and thereby open the valve d to a small extent which allows coarse particles to escape, and if coarse particles are deposited in the chamber c^1 at the same rate as coarse particles are being discharged through the outlet c^2 , the valve will remain practically stationary and allow coarse particles to be discharged continuously at a constant rate. If coarse particles are deposited in the chamber c^1 faster than they are being discharged, the mass of particles will increase and offer a greater resistance to motion of the blades 3 and thereby cause the said rollers u and v to travel to a higher position on the faces of the cams h and i and thereby cause the valve d to open to a greater extent and permit of a greater discharge of particles to take place. If the coarse particles are being discharged at a greater rate than they are being deposited, the mass of particles will offer less resistance to the motion of the blades, and the said rollers will descend the faces of the cams and permit the valve to move and reduce the rate of discharge of particles. If the rate of deposit of coarse particles falls to such an extent that the mass thereof offers little or no resistance to movement of the blades, the said rollers will fall sufficiently to enable the valve d to close the discharge outlet c^2 and the valve will not be again opened until a sufficient mass of particles has formed to offer sufficient resistance to motion of the blades as to cause the rollers u and v to travel up the faces of the cams h and i and thereby again open the valve to a greater or less extent to enable the discharge of particles to again take place. Thus, the discharge of coarse particles from the tank c is caused to take place continuously or intermittently, in an automatic manner, according to the rate of deposit of coarse particles in the lower portion of the tank.

Fig. 2 shows valve mechanism according to the invention applied in connection with the discharge valve at the bottom of appa-

ratus of the kind described in the specification of another application for Letters Patent of even date herewith and numbered 14,548, according to which the tank c is provided at the top with a vertical inlet tube 4 through which a mixture of water with powdered material to be classified, is projected downward towards a horizontal partition 5 formed with a number of inverted conical passages 6 through which coarse particles of the powdered mixture separated from the water can fall into the bottom portion c^1 of the tank c and be discharged through the outlet c^2 under the control of the valve d in the manner hereinbefore described, whilst a stream of clean water, called teetering water, is admitted by a pipe 7 below the partition 5, called a teetering partition, so as to flow upward through the passages 6 therein and remove fine particles from the coarse particles in the said passages and carry them into the water above the partition where they are carried off with other fine particles in the water flowing from the upper portion of the tank through an outlet passage 8 to the top of the tank and through an overflow trough 9 to an outlet pipe 10, as fully described in the said other specification.

Figs. 3 and 4 show a modified arrangement for automatically controlling the outlet valve. This arrangement, is shown applied to the classifying apparatus shown in Fig. 2. In this example, the cams h and i are fixed to a worm wheel 11 driven by a worm 12 on a driving shaft 13 and journaled upon the upper end of a central support a^1 carried by the bottom plate a^2 of the gear box a . This gear box is fixed to the top of the tank c as in the arrangement shown in Fig. 1. The pair of rollers u and v are carried by a horizontal shaft 14 to the central portion of which is fixed a vertical spindle 15 extending freely into a hole 16 in the shaft 1 to the lower end of which the blades 3 (Figs. 1 and 2) are fixed. To the upper end of the said shaft is fixed a horizontal plate 17 supported by a ball bearing 18 and provided with a pair of vertical guide bars 19 of V section that engage with the V shaped grooved peripheries of a pair of wheels 20 mounted to turn on the shaft 14. o^1 is a lever pivoted at one end at o^2 and connected at its other end through a rod r to the weighted end of an outlet valve d (Fig. 2), like the lever o in Fig. 1. An intermediate portion of the said lever has jointed thereto at o^3 an abutment device 21 that bears through a ball bearing 22 upon the central portion of the horizontal shaft 14. In this modified arrangement the vertical shaft I is driven from the rotating cams h and i through the rollers u and v , shaft 14, grooved wheels 20, guide bars 19 and plate 17, the whole rotating as one piece

when there are no coarse particles in the collecting chamber c^1 in which the blades 3 connected to the shaft 1 rotate. When the motion of the blades is retarded owing to accumulation of coarse particles in the said chamber, as hereinbefore described, the cams h and i move faster than the rollers u and v bearing thereon and lift the latter and the shaft 14, which, through the abutment device 21, lifts the lever o^1 on its pivot o^2 and opens the discharge valve d to a greater or less degree, as in the arrangement shown in Fig. 1.

In the example shown in Figs. 2, 3 and 4, the pipe 7 used for supplying teetering water to the collecting chamber c^1 below the teetering partition 5 (Fig. 2), is arranged to surround its shaft 1 and extend, like such shaft, through the teetering partition into the collecting chamber c^1 . It receives its supply of water from a chamber 23 formed in the central support 1^a and connected to a supply pipe 24. A liquid tight packing 25 is arranged between the support 1^a and shaft 1 at the top of the chamber 23.

The details of construction can be modified in various ways.

What I claim is:—

1. For automatically controlling the discharge of powdered material from the outlet at the lower portion of a tank, mechanism comprising a loaded valve adapted to close the discharge outlet of the tank, a rotary device arranged to rotate in the lower portion of the tank and to be retarded to a greater or less extent by solid material therein, a motor driven cam device and adjust-

able means arranged to drive the rotary device and to be acted upon by the loaded valve and by the cam device, the arrangement being such that when the mechanism is in use and little or no solid material has collected in the lower portion of the tank, the valve is held by its load in its closed position but when material collects in the lower portion of the tank, the resistance offered thereby to movement of the rotary device and of the adjusting means, causes the cam device to move the adjusting means in a direction to open the valve, against the action of its load, to a greater or less extent and depending upon the amount of solid material collected in the lower portion of the tank.

2. Apparatus according to the preceding claim, wherein the cam device comprises part circular rotary cams having inclined surfaces and the adjustable means comprises rollers arranged to bear against the cam faces and to act against the loaded valve through a lever.

3. Mechanism according to claim 1, wherein the cam device and adjustable means are arranged within a case supported at the top of the tank from which solid material is to be automatically discharged and the adjustable means are in driving connection with the rotary device in the lower end of the tank through a vertical shaft, the adjustable means being free to lift independently of the shaft.

Signed at London, England, this 14th day of July, 1927.

LEONARD ANDREWS.