Aug. 21, 1951 C. DRIGENKO ET AL 2,564,963

SAND CONE

Filed June 7, 1948 3 Sheets-Sheet 1

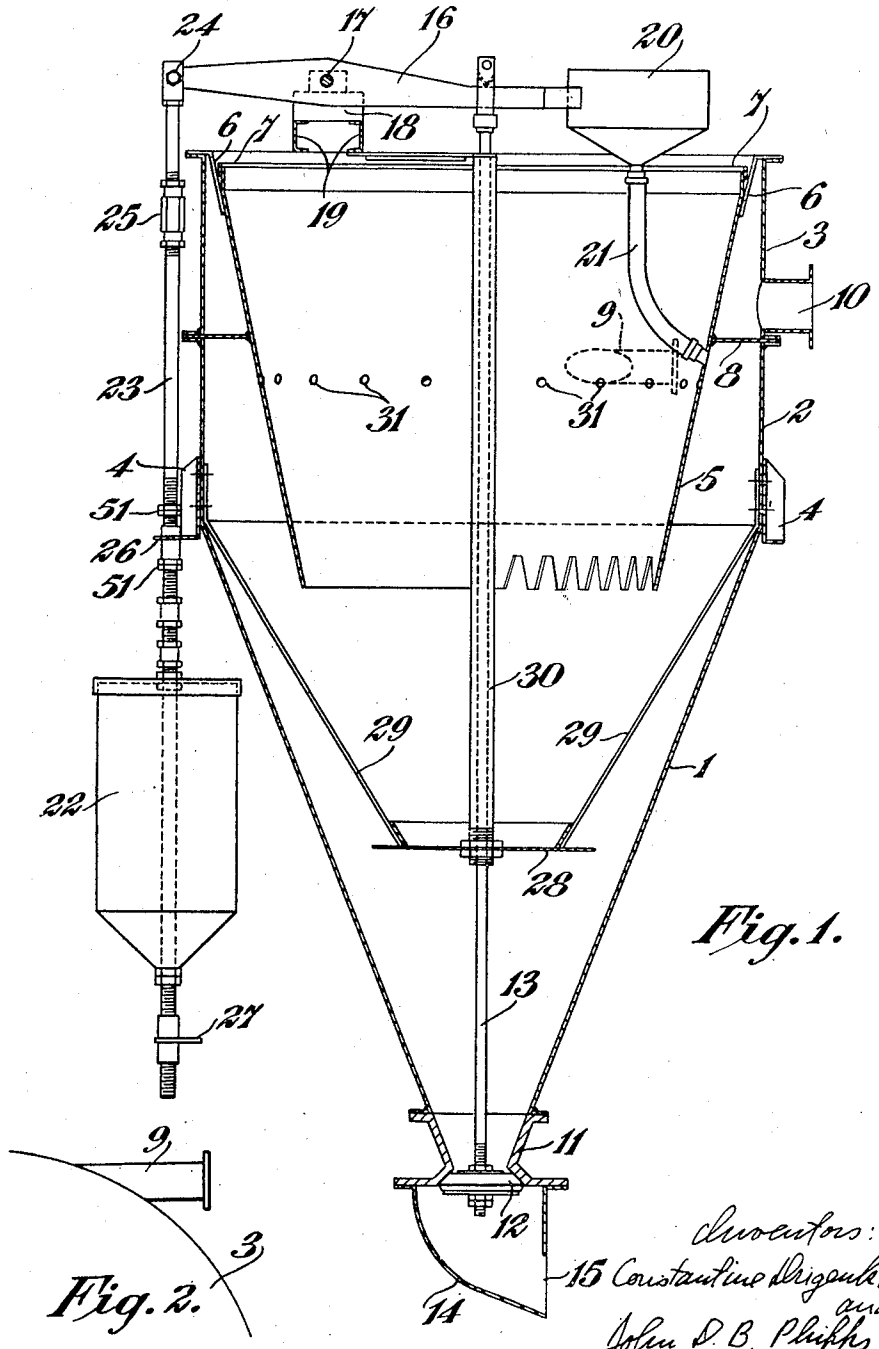


Fig. 1.

Fig. 2.

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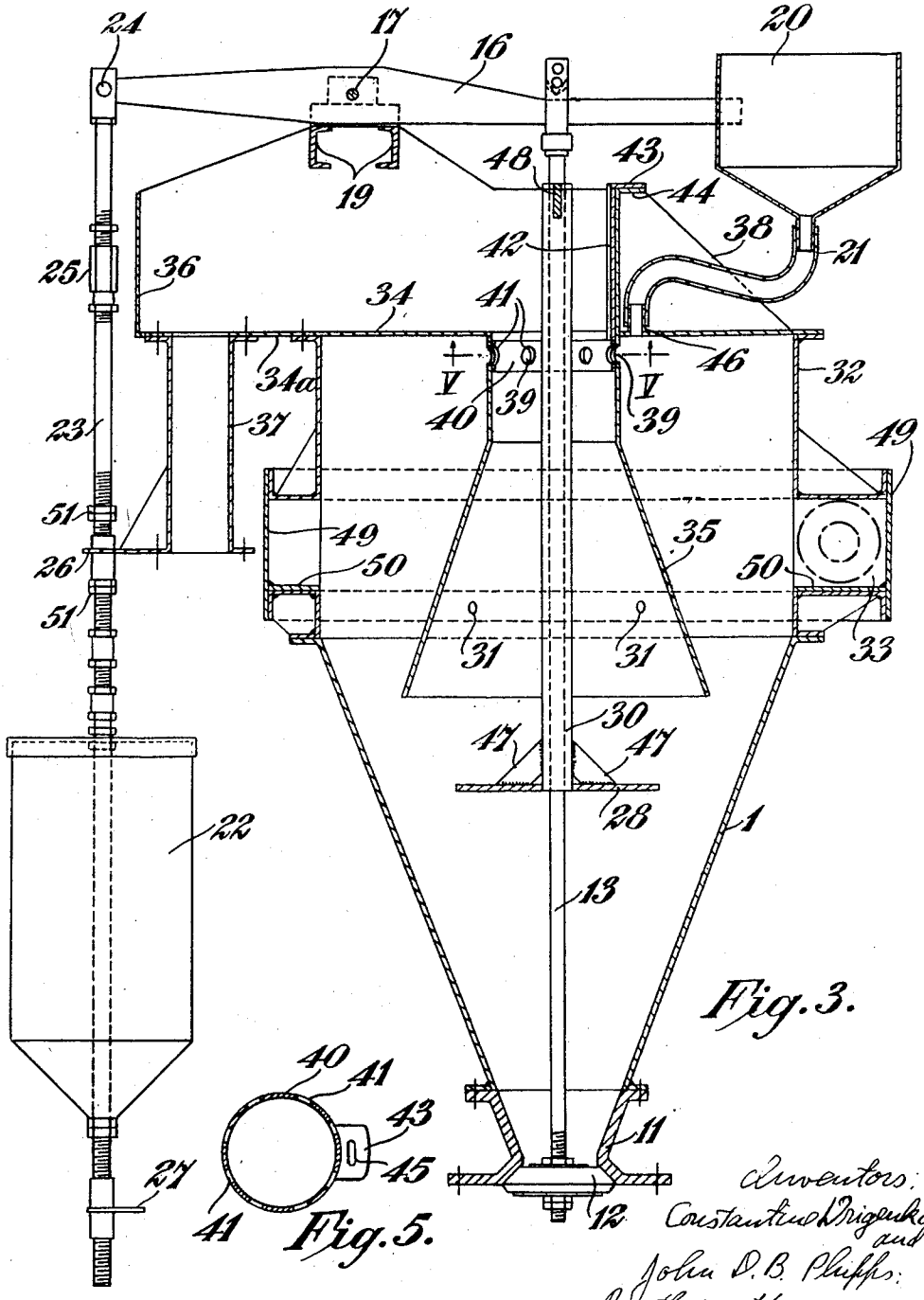


Fig. 3.

Fig. 5.

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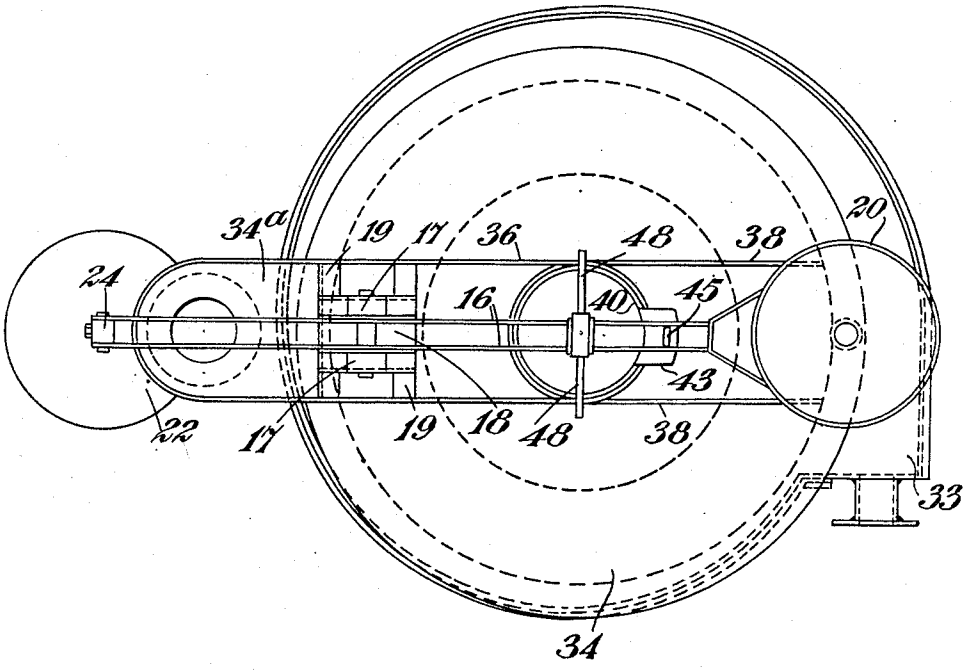


Fig. 4.

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2,564,963

SAND CONE

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In Great Britain June 16, 1947

5 Claims. (Cl. 210—54)

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The invention relates to sand cones, that is to apparatus, usually of inverted conical form, in which a suspension of sand or other granular material in water is separated from the major part of the water in which it is suspended. The suspended solid, which will hereinafter be referred to as sand, collects in the cone and is continuously or periodically discharged through a valve at the bottom, while the excess water overflows continuously from the top.

The invention is directed to what may be regarded as means for opening the valve when a predetermined quantity of sand has collected in the cone and for closing the valve again after discharge. Generally, however, in this kind of separator the valve, instead of opening and closing in alternation, tends to stabilise itself in a position giving a continuous discharge at a rate governed by the rate of input of the suspension. The subsequent description will be based on the idea of alternate opening and closing, but the effect of continuous operation will be clear therefrom.

According to the invention a sand cone has a discharge valve for dewatered sand, and overflow for the water removed, a member within the cone having a lower edge past which some of the water can flow from the inlet to the overflow, means whereby when the said flow is checked by the rise of sand to the lower edge the water level rises in a tank or like vessel, and means by which the discharge valve is moved in the opening direction in response to the increased weight of the tank or like vessel and vice versa.

In most cones for the purpose mentioned the whole cone was suspended and moved downwards to open the valve when a predetermined weight of sand had accumulated therein. The present invention makes it possible to dispense with the heavy counterweights necessary for such cones, and it simplifies the attachement of the sand cone to its supporting tower as well as the connections between the cone and its inlet and outlet pipes or flumes. It has also been proposed to open the valve by means of a float acted on by a rise in water level due to the blocking by the sand of an open-bottomed cone into which the suspension was fed. The present invention makes direct use of gravity and requires no float, thereby providing a simpler and more robust construction.

The invention is illustrated in the accompanying drawings, in which

Figure 1 is an elevation of a sand cone in accordance with the invention, mostly in section on the centre line,

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Figure 2 is a part plan of the body of the same to show the tangential inlet.

Figure 3 is an elevation similar to Figure 1 of and alternative form of sand cone,

Figure 4 is a plan of the same, and

Figure 5 is an inverted plan of the regulator for the water outlet taken in section on the line V—V of Figure 3.

Referring first to Figures 1 and 2, the main structure of the sand cone externally comprises a conical portion 1 apex downwards, a cylindrical portion 2 on the upturned base thereof, and another cylindrical portion 3 on the portion 2 and of the same diameter. The portion 2 is provided with feet 4, 4 for mounting on a supporting structure (not shown). A trunco-conical member 5 open at top and bottom is suspended inside the portions 2 and 3 by four straps 6, 6. This member may conveniently be termed a control cone. The lower (smaller) end of the control cone 5 projects a short distance into the portion 1 of the cone, while its upper end is nearly as large as the portion 3 of the cone and terminates in an adjustable weir plate 7, by which the effective height of thin edge can be varied.

An annular plate 8 is welded around the control cone 5 and is tightly bolted between the portions 2 and 3 of the cone. The spaces above and below the plate 8 are thereby sealed from each other and only communicate by a devious route, as will appear subsequently. A tangential inlet 9 (see Figure 2) is provided just below the plate 8 and causes the suspension of sand and water to swirl on entering. The space above the plate 8 serves as a launder to collect the water overflowing the weir 7, which is removed through a pipe connection 10.

The lower end of the conical portion 1 is formed as a separate renewable casting 11 with a conical valve seat, on to which a rubber valve 12 is drawn upwards by a central vertical rod 13 by mechanism to be described later. A hood 14 with lateral aperture 15 localises the sand discharge from the valve 12, which might otherwise spray in all directions.

In order that the functions of the various parts yet to be described may be understood, it may be stated here that the suspension of sand and water is fed in at 9; the sand falls into the conical portion 1 to be discharged by the valve 12, and the water rises inside the control cone

5, overflowing at 7 and passing out by the pipe connection 10.

The rod 13 is suspended by a knife edge on a lever 16 pivoted by a solid rubber bearing 17 in a block 18, which is supported on two channel irons 19, 19 spanning the portion 3. The lever 16 carries at its right hand end (in the position shown in Figure 1) a water tank 20 connected by a flexible hose 21 to the space below the plate 8. To counterbalance the weight of the valve 12 and the pressure of the sand and water acting on it, including the weight of the rod 13 and that of the water tank 20 and part of its contents, a weight box 22 is suspended by a rod 23 on the left hand end of the lever 16 by a solid rubber bearing 24. The rod 23 has a shackle 25 for length adjustment and is guided in a bracket 26 attached to one of the feet 4 and a bracket 27 attached to the supporting structure. The upward pull by the rod 13 on the valve 12 is adjusted by inserting a suitable number of weights in the box 22.

A horizontal plate 28 is mounted in the conical portion 1 by straps 29, 29 to prevent the sand from froming a vortex, through which water might otherwise be discharged from the valve 12. A pipe 30 open at both ends surrounds the rod 13 and serves to break any vacuum below the plate 28. A row of holes 31 is provided in the control cone 5 a little below the level of the plate 8.

In operation the weights in the box 22 are adjusted to give a certain upward pull on the valve 12 when the sand is not up to the bottom edge of the control cone 5. When the accumulated sand reaches this level, the pressure of the incoming suspension drives water up the hose 21 into the tank 20, which overcomes the effect of the weight box 22 and causes the valve 12 to open and discharge sand. Without the holes 31, 31 a sudden access of water into the tank 20 would cause an overflow and perhaps damage the cone. Nevertheless, the holes have too small a combined area to prevent the water from rising into the tank 20, when the suspension is fed in at the normal rate.

The rubber bearings 17 and 24 provide a certain damping in the movements of the lever 16 and associated parts, and as a result the valve 12 is held steady at a degree of opening which will just balance the feed, keeping the top surface of the sand at the level of the lower edge of the control cone 5.

In the drawing the control cone 5 has been shown with a plain edge on the left hand half, but in some cases it may be found desirable to make the edge serrated, as shown on the right hand half.

The cone just described is suitable for many cases, but where a smaller and cheaper construction is required for the same output, a modified form of construction shown in Figures 3, 4 and 5 is preferable.

The conical portion 1 with its lower end 11 are as previously described, as also are the valve 12, valve rod 13, lever 16 with its supports and bearings, tank 20, weight box 22 and suspension rod 23 with its shackle and guides. The upper portion 32 of the cone is cylindrical with a volute 33 near its lower end for the incoming feed. The portion 32 is closed at the top by a plate 34 having a central hole, around the periphery of which is fixed a control cone 35 extending downwards inside the cone which has its upper part cylindrical and its lower part conical diverging downwards.

By means of an upstanding wall on the plate 34 and on an extension 34*a* thereof overhanging the edge of the portion 32 a launder 36 is formed of rectangular shape in plan with rounded ends. One end is concentric with the cone 1, 32 and the control cone 35, and the other (overhanging) end has a vertical pipe connection 37 attached to the under side of the plate 34*a* for removal of the water discharge. The walls of the launder 36 are continued to the right as gusset plates 38, 38 to stiffen the plate 34.

The control cone 35 has a row of holes 39, 39 near the top for the discharge of water from the space under the plate 34 to the launder 36. These holes should have a total area more than sufficient to pass the maximum quantity of water discharged. The effective area may be regulated by means of a ring 40 (see also Figure 5) having corresponding holes 41 and mounted close inside the upper part of the control cone 35. The ring 40 is suspended by a vertical arm 42 with horizontal end 43 resting on a flange 44 which spans the gusset plates 38, 38. The end 43 has in it an elongated hole 45, by which it can be bolted to the flange 44 in any position from that in which the holes 39 and 41 are in register to that in which they are completely closed.

The hose 21 is connected to a pipe spigot 46 projecting upwards through the plate 34. The pipe spigot 46 should be as near the centre as possible to obviate any increase of head in the tank 20 due to centrifugal action of the whirling suspension. The plate 28 is in the present case suspended on the pipe 30, being welded thereto through the medium of gusset plates 47, 47. The control cone 35 has as before a row of holes 31 below the level of the volute 33. In the present figure there are four. The pipe 30 is suspended from the top by two flat plates 48, 48 welded thereto on edge, which are dropped into vertical slots cut in the side walls of the launder 36. It will be noted that in Figure 4 the pipe 30 is hidden by the parts at the top of the rod 13.

In the construction of Figures 3 and 4 the water rises against the force of gravity as in Figures 1 and 2, but in contrast thereto it flows inwards with increasing angular velocity against centrifugal force to a central outlet in the plate 34, for which reason it is proposed to call this form a "vortex cone." The grains of sand are thrown outwards by centrifugal action and are drawn downwards by gravity. This double action makes possible a considerable reduction in the diameter of the cone, the one actually described being 4 to 5 ft. in diameter to handle up to 18,000 gallons (British) of water plus 20 to 30 tons of sand per hour.

In either form of construction the holes 31 (and 39 in the second form) should have a total area such as to cause a rise of water level in the hose 21 and tank 20 sufficient to open the valve 12. If the valve 12 does not immediately open when the sand reaches the lower edge of the control cone, the weir 7 should be raised or the ring 40 should be turned to close the holes a little, until the valve 12 opens fully. The sand will then discharge until it is approximately level with the lower edge, whereupon the valve 12 is brought into a steady state of opening with possibly a few oscillations of diminishing amplitude.

The quantity of water rising inside the control cone 35 from the holes 31 in the second form of construction may conveniently be about one fifth of the total water passing out into the launder 36. The upward velocity may then be low enough to

leave behind all grains above 100 mesh. The otherwise useless centre space is thereby made use of, though the bulk of the dewatering (say four fifths) is carried out by the space surrounding the control cone.

Some further constructional features may be mentioned which do not affect the principles upon which the invention is based but conduce to greater convenience in operation.

The first relates only to the second form of construction. The outside wearing plate **49** and the bottom wearing plate **50** of the volute **33** are welded together but not to the other parts, as may be seen from the weld marks in Figure 3. These plates can therefore easily be renewed when worn, or they may be lined with rubber. During the interchange the weight of the empty portion **1** of the cone can be taken by the valve **12**.

The other features are common to both forms of construction. Nuts and lock nuts **51**, **51** are provided on the rod **23** to cooperate with the bracket **26** in limiting the up and down movement of the weight box **22** and thereby also of the valve **12**. When the nuts are properly adjusted, the valve **12** cannot be drawn too tightly against the seating on **11** when the cone is empty. Wear of the valve **12** may be taken up by adjusting the length of the rod **23** between its supporting bearing **24** and the bracket **26**. The shackle **25** is provided for this purpose. The tube **30** serves not only to break any vacuum which might form under the plate **28**, but also as a reservoir for a small amount of lubricating water to assist the discharge of sand when the valve **12** opens after having been completely closed.

What we claim is:

1. A sand cone comprising an outer casing, a discharge valve at the bottom of the casing for dewatered sand, a control cone within the casing open at its upper and lower ends, a plate attached to the outer casing and to the outside of the control cone whereby the spaces above and below the plate have no communication with each other outside the control cone, tangential inlet means to the space below the plate but above the lower end of the control cone for the suspension to be dewatered, outlet means above the plate for water overflowing the upper end of the control cone, and means responsive to an increase of pressure at the inlet means for opening the discharge valve.

2. A sand cone comprising an outer casing, a discharge valve at the bottom of the casing for dewatered sand, a control cone within the casing open at its lower end, a plate closing the top of the casing and having an aperture at which the control cone is attached, tangential inlet means to the casing above the lower end of the control cone, an overflow launder on top of the casing to receive water rising inside the control cone and discharge it, holes near the top of the control cone to pass water to the overflow and means responsive to an increase of pressure at the inlet means for opening the discharge valve.

3. A sand cone in accordance with claim 2 in which an adjustment device is provided whereby the effective area of the holes near the top of the control cone can be varied.

4. A sand cone comprising an outer casing, a discharge valve at the bottom of the casing for dewatered sand, a control cone within the casing open at its upper and lower ends, a plate attached to the outer casing and to the outside of the control cone whereby the spaces above and below the plate have no communication with each other outside the control cone, tangential inlet means to the space below the plate but above the lower end of the control cone for the suspension to be dewatered, outlet means above the plate for water overflowing the upper end of the control cone, a water tank in communication with the space below the plate so located that water rises therein when the flow of water past the lower end of the control cone is checked by the rise of sand to the said lower end, and a normally balanced lever supporting the water tank and the movable part of the discharge valve whereby the said movable part is moved in the opening direction in response to an increase in weight of the tank and in the closing direction in response to a reduction in weight of the tank.

5. A sand cone comprising an outer casing, a discharge valve at the bottom of the casing for dewatered sand, a control cone within the casing open at its lower end, a plate closing the top of the casing and having an aperture at which the control cone is attached, tangential inlet means to the casing above the lower end of the control cone, an overflow launder on top of the casing in communication with the interior of the control cone above the lower edge thereof to receive water rising inside the control cone and discharge it, holes near the top of the control cone to pass water to the overflow, a water tank in communication with the space below the plate so located that water rises therein when the flow of water past the lower end of the control cone is checked by the rise of sand to the said lower end, and a normally balanced lever supporting the water tank and the movable part of the discharge valve whereby the said movable part is moved in the opening direction in response to an increase in weight of the tank and in the closing direction in response to a reduction in weight of the tank.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,147,356	Allen	July 20, 1915
1,258,100	Dull	Mar. 5, 1918
1,326,908	Boyland	Jan. 6, 1920
1,350,204	Allen	Aug. 17, 1920
1,447,610	Allen	Mar. 6, 1923
2,379,753	Sebald	July 3, 1945