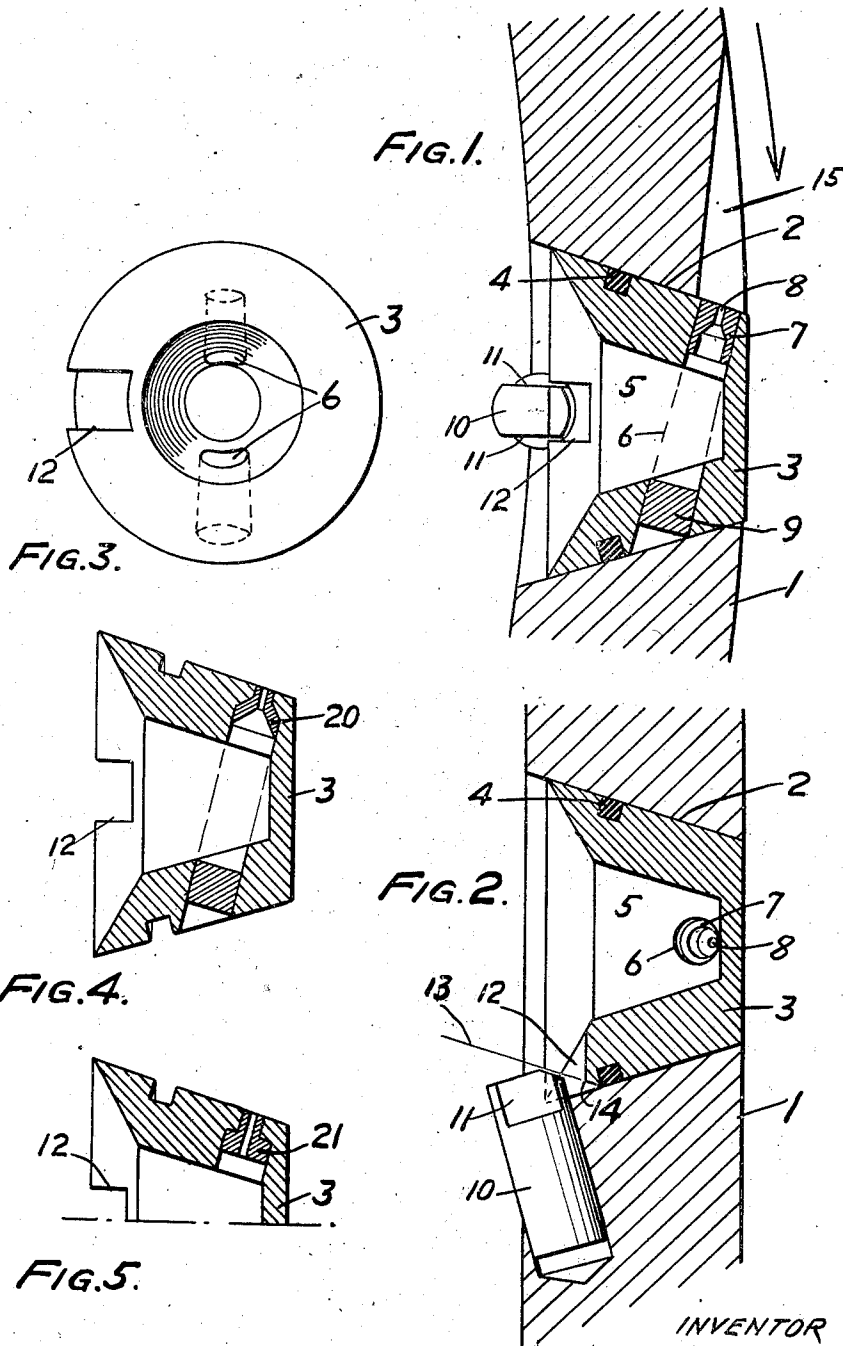


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CENTRIFUGAL SEPARATING BOWL

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CENTRIFUGAL SEPARATING BOWL

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It is known to provide, in the circumferential wall of a centrifugal bowl, or in removable and replaceable nozzles in such wall, holes for the escape of heavy solids with enough liquid to carry them out. Such holes may be used constantly open or may be associated with valves that alternately open and close as a result of conditions within the bowl. With the speed of rotation of the bowl and specific gravity of the material being treated known, the pressure at the entrance to a hole and the size hole for any desired discharge rate can be easily computed.

To avoid erosion of these holes it is known to put renewable and replaceable bushings therein.

It is also known to make the final outlets from such holes tangential or approximately tangential to the outer wall of the bowl and direct the jet backward relative to the direction of rotation and thereby reduce the power required to drive the bowl.

My invention relates to the last mentioned type of construction and has for its object a construction whereby the escape of the material is facilitated and whereby the power required to drive the bowl is reduced to a minimum approximating the power required to drive a bowl having a smooth imperforate outer wall.

My invention also embodies a construction wherein the discharge nozzle is carried by a removable body having a frusto-conical pocket adapted to be inserted in a frusto-conical opening through the bowl shell and when so inserted adapted to initially receive the material to be discharged and convey it to the discharge nozzle. Such a nozzle body is particularly adapted to the provision of means whereby it may be readily inserted and removed but cannot be accidentally displaced in or escape from its seat when the bowl is stationary.

My invention also embodies a preferred construction whereby the nozzle body can be insertable into the opening in the bowl wall only when it is first turned, preparatory to insertion, in a direction which, after its insertion, will properly position the nozzle relative to the direction of rotation of the bowl and which is movable into and out of said opening only in a direction approximately parallel to the slope of its upper face and which therefore, after insertion, is prevented from accidental displacement or removal while the bowl is stationary.

In the drawing, which shows a preferred embodiment of my invention:

Fig. 1 is a cross-section through one of the nozzle bodies and the adjacent portions of the

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bowl wall, taken on a plane through the center of the nozzle and at right angles to the axis of the bowl.

Fig. 2 is a cross-section of the construction shown in Fig. 1 taken in a plane at right angles to that of Fig. 1.

Fig. 3 is a view of the inner end of one of the nozzle bodies as seen when looking from the center of the bowl outward.

Figs. 4 and 5 are cross-sections, similar to Fig. 1, of alternative constructions.

1 is the bowl wall in which there is formed a frusto-conical seat 2 with its large end inward. 3 is the body of the nozzle, tapered complementarily to the seat in the bowl wall and having around it a groove containing a packing ring 4 of rubber or other deformable material that makes a tight joint between the body and the bowl wall. The body has a socket 5 in its center and, intersecting that socket, a tapered hole 6 with its smaller end backward, relative to the direction of rotation of the bowl and at a small acute angle outward from a tangential line. In the smaller end of the tapered hole there is a bushing 7, of erosion resistant material, having therethrough a hole 8 of a size proportioned to the desired quantity of discharge through it. The larger end of the tapered hole 6 is closed by a plug 9.

Instead of the tapered hole 6 I may provide a discharge orifice having a larger diameter in the portion nearest the socket 5 and a smaller diameter at its outer end. To this end, if a removable bushing is used, I may provide a large cylindrical hole, as shown in Figs. 4 and 5, and insert therein a bushing of any suitable shape, such as the bushing 20 shown in Fig. 4 or the bushing 21 shown in Fig. 5. Instead of providing a removable bushing, an outlet, having an internal contour corresponding to the orifice in the bushing, may be formed in the body 3 itself. This is only permissible in case the material to be discharged is not erosive.

At the rear side of the nozzle body seat, a recess 15, in the outer part of the bowl wall, gives an opportunity for material, flowing through the hole 8, which, as previously stated, points outward beyond a radial line, to escape without contacting the bowl wall.

It is distinctly preferred that the orifice in the bushing (7, 20 or 21) should not be directed precisely tangentially, otherwise the nozzle body 3 would have to project beyond the bowl; or, alternatively, the discharged material (which would be moving in the same direction as the bowl but at

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a small fraction of the bowl shell speed) would be struck by the back side of the recess 15 and accelerated to a high speed by friction with that wall. This would increase the consumption of power required to drive the bowl. If, on the other hand, the nozzle body 3 is projected far enough the outer wall of the bowl shell to cause the hole 8 to be outside of said wall, the material discharged from one hole will be hit by the next following nozzle body (unless the outlet is at an angle to the horizontal) and will thereby have its speed accelerated to nearly bowl speed, and thereby also require added consumption of power. Moreover, regardless of the direction of discharge, "bodies" projecting from the bowl cause serious loss of power in windage.

It is desirable that means shall be provided to insure that when the nozzle body 3 is inserted in its conical seat 2, the discharge opening 8 will be directed as above described. It is also desirable that, while the nozzle body should be readily insertable and removable, it should be insured against accidental removal or substantial displacement while the bowl is stationary. I have provided means whereby these objects may be effected without the need of manipulating the retaining mechanism, the only requirement being that the nozzle body shall be moved into and out of position by moving it in a direction approximately parallel to the longitudinal extension of its upper face. Such movement cannot accidentally occur while the bowl is stationary. The following is a description of such positioning and retaining means.

A locating pin 10, with its upper end flattened at both sides as shown at 11, is driven into a hole in the bowl wall and projects upward into the lower outside corner of the conical space 2 so as to be straddled by the sides of a notch 12 in the body 3, thereby preventing its rotation away from a proper position. It will be noted that a line 13 drawn from the juncture of the bottom of the notch 12 with the lower side of the body and parallel with the upper side of the body clears the top of the pin 10. Thereby the body, when held against the upper side of its seat, can be easily removed therefrom past the pin 10 by withdrawing it in a direction parallel to the line 13. It will also be noted that the corner 14 in the notch 12 is nearer to the bottom side of the seat than the top of the nearly vertical side of the locating pin 10. Thereby if the body 3 slides downward and inward along the lower side of its seat, its corner 14 will contact the pin and prevent the body from sliding out of the seat.

It is clear that the above described nozzle body positioning and holding means is operative regardless of the direction of discharge through the orifices 8. The outlets might, for example, be radial. However, regardless of the direction of discharge, the shape of the nozzle body 3 is of importance in order to render operative the described nozzle body location and retaining means. The body should be so shaped that its upper wall, when in position in the hole 2 in the bowl shell, shall slope downward and outward, and this requirement is most advantageously embodied in a body of frusto-conical shape.

What I claim and desire to protect by Letters Patent is:

1. A centrifugal bowl the shell of which has an opening therethrough the upper wall of which slopes downward in an outward direction and affording a seat for a nozzle body, a nozzle body of a shape complementary to that of the hole and

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having a closed outer wall which, when positioned in the hole, is substantially flush with the outer wall of the bowl shell, the side wall of said body having through its outer part a discharge orifice extending in a direction approximating parallelism with a line tangential to the outer wall of the bowl shell, the latter being recessed adjacent to said discharge to allow free and unobstructed escape of material ejected therethrough when the bowl is rotated in a direction opposite to the direction of discharge through said orifice.

2. A centrifugal bowl the shell of which has an opening therethrough of frusto-conical shape tapering in width from its wider inner end to its narrower outer end and affording a seat for a nozzle body, a complementary nozzle body of frusto-conical shape seated in said opening the outer closed wall of which is substantially flush with the outer wall of the bowl shell, the side wall of said body having through its outer and narrower part a discharge orifice extending in a direction approximating parallelism with a line tangential to the outer wall of the bowl shell, the outer wall of the bowl shell being recessed adjacent to said discharge orifice to allow free escape of material ejected therethrough when the bowl is rotated in a direction opposite to the direction of discharge through said orifice.

3. A centrifugal bowl the shell of which has an opening therethrough of frusto-conical shape tapering in width from its wider inner end to its narrower outer end and affording a seat for a nozzle body, a complementary nozzle body of frusto-conical shape seated in said opening the outer closed wall of which is substantially flush with the outer wall of the bowl shell, the side wall of said body having through its outer and narrower part a discharge orifice extending in an approximately horizontal direction along a line extending outward nearly tangential to the outer wall of the bowl shell, the bowl shell having in its outer wall a recess the inner end of which overlaps said discharge orifice and the inner wall of which extends from said body, in about the same direction as the discharge orifice, to the outer wall of the bowl.

4. A centrifugal bowl the shell of which has an opening therethrough of frusto-conical shape tapering in width from its wider inner end to its narrower outer end and affording a seat for a nozzle body, a complementary nozzle body of frusto-conical shape seated in said opening the outer closed wall of which is substantially flush with the outer wall of the bowl shell, the side wall of said body having through its outer and narrower part an opening, and a bushing inserted in said opening having therethrough a hole relatively wide at its inner end and relatively narrow at its outer end, said hole extending in a direction parallel with a line approximately tangential to the outer wall of the bowl shell, which is recessed adjacent to said hole to allow free escape of material ejected therethrough.

5. A centrifugal bowl the shell of which has an opening therethrough of frusto-conical shape tapering in width from its wider inner end to its narrower outer end and affording a seat for a nozzle body, a complementary nozzle body of frusto-conical shape seated in said opening the outer closed wall of which is substantially flush with the outer wall of the bowl shell, the side wall of said body having through its outer and narrower part an opening, and a bushing inserted in said opening having therethrough a hole relatively wide at its inner end and relatively narrow

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at its outer end, said hole extending in an approximately horizontal direction along a line extending in a direction which is at an acute angle to a line tangential to the outer wall of the bowl shell, the bowl shell having in its outer wall a recess the dinner end of which overlaps the outlet end of said hole and the inner wall of which extends from said body, in about the same direction as the direction of discharge from said hole, to the outer wall of the bowl.

6. The combination with a centrifugal bowl having therethrough a radial hole, tapered with its smaller end outward, of a locating pin projecting upward from the bottom of the larger end of said hole, a plug in said hole tapered complementarily thereto and having a notch at its larger end with at least part of the end wall of said notch approximately perpendicular to the axis of the plug, said notch being adapted to straddle said pin, said plug having cut near its larger end a groove, a deformable packing ring in said groove, said plug having also an axial socket with a closed outer end and a hole the inner end of which is larger than its outer end, said hole communicating with said socket and located at the intersection of a plane through the center of the plug at right angles with the axis of the bowl and another plane parallel to said axis and intersecting at an acute angle a plane tangential to the bowl wall, a bushing in said hole with a bore adapted to discharge there-through a given quantity at a given pressure, the bowl shell having, adjacent said hole, a notch in line with the outlet from said bushing.

7. The combination with a centrifugal bowl having through its peripheral wall a radial frusto-conical hole, of a locating pin projecting upward into the bottom of the larger end of said hole, a frusto-conical plug adapted to fit said hole and having in its lower side a notch with its end intersecting the lower periphery of the plug and adapted to straddle the locating pin, the distance from the upper side of said notch to the upper side of said plug being less than that from the top of the locating pin to the upper side of the hole and the distance from the bottom side of said plug to the farthest inward portion of the outer wall of the notch being less than that from the bottom side of said hole to the top of the pin.

8. The construction defined in claim 1 combined with a retaining and locating pin seated in the bowl wall and extending upward beyond the bottom edge of said opening, the nozzle body having in its lower inner edge a notch straddling the projecting end of the pin, thereby preventing the rotation of the body, the notch being so shaped that an imaginary line drawn from the juncture of

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the bottom of the notch with the lower side of said body and parallel with the higher side of the body barely clears the top of the pin, whereby the body is locked from placement and removal except in a direction approximately parallel with a line extending along the higher side of the nozzle body.

9. The combination with a centrifugal bowl having a frusto-conical seat in its wall with its smaller end outward, of a retaining and locating pin seated in the bowl wall and extending upward beyond the bottom edge of said opening, the nozzle body having in its lower inner edge a notch straddling the projecting end of the pin, thereby preventing the rotation of the body, the notch being so shaped that an imaginary line drawn from the juncture of the bottom of the notch with the lower side of said body and parallel with the higher side of the body barely clears the top of the pin, whereby the body is locked from placement and removal except in a direction approximately parallel with a line extending along the higher side of the nozzle body.

10. The construction defined in claim 2 combined with a locating pin inserted in the bowl wall and projecting upward from the lower side of the seat into the opening at a position radially farther from the center of the bowl than the inner end of the nozzle body when seated, and a notch, cut in the lower side of such body to a location not further from the upper side thereof than that from the top of the pin to the nearest spot on the opposite side of the seat whereby, when a body is moved into or out from a seat with its upper side in contact with the upper side of the seat, the notch in the body will pass over the upper end of the pin and, when the body slides downward and inward along the lower side of the seat, the portion adjacent the notch will contact the pin and prevent farther inward movement.

11. The construction defined in Claim 1 comprising also a nozzle body locating and retaining member extending upward from the lower side of said seat into the opening, and a notch, complementary to said member, cut in the lower side of the body to a distance from the opposite side thereof less than that from said member to the opposite side of the seat whereby, when a body is moved into a seat in contact with the upper side thereof, the notch in the body will pass over the member and, when the body moves toward the center of the bowl in contact with the lower side of the seat, the notch will straddle the member till the end thereof contacts it and prevents further movement.

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