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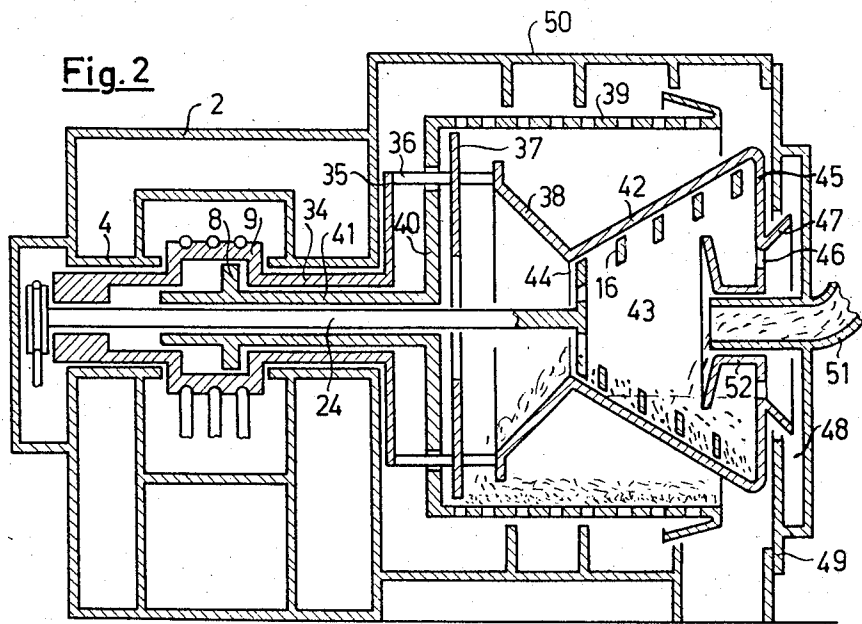
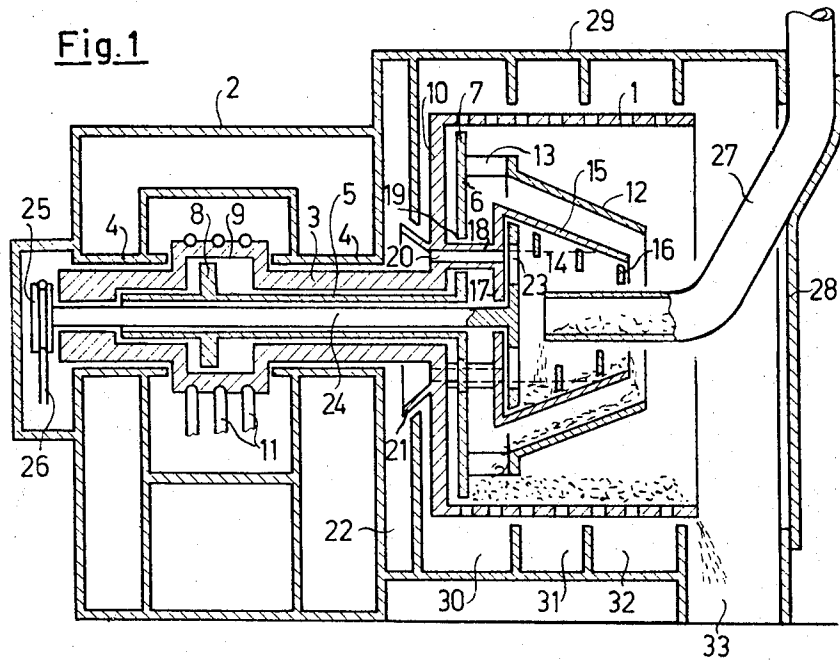
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CONTINUOUSLY OPERATING CENTRIFUGING DEVICE

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2 Sheets-Sheet 1



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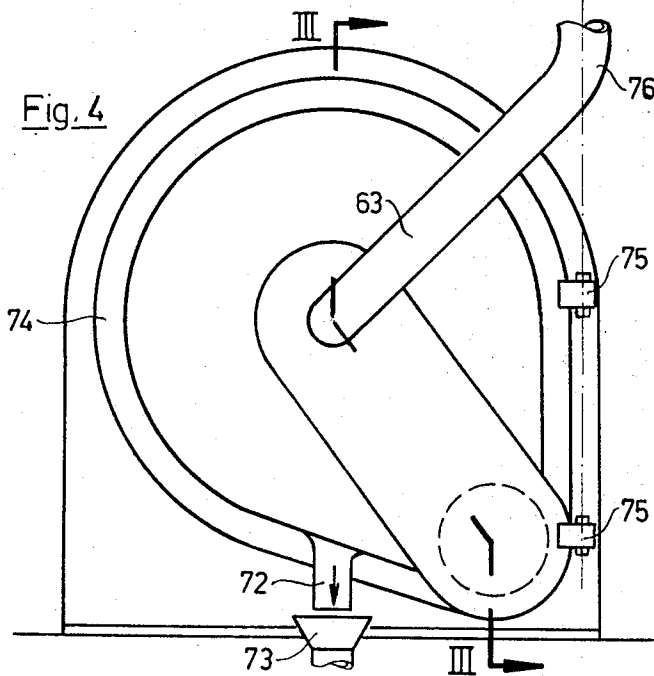
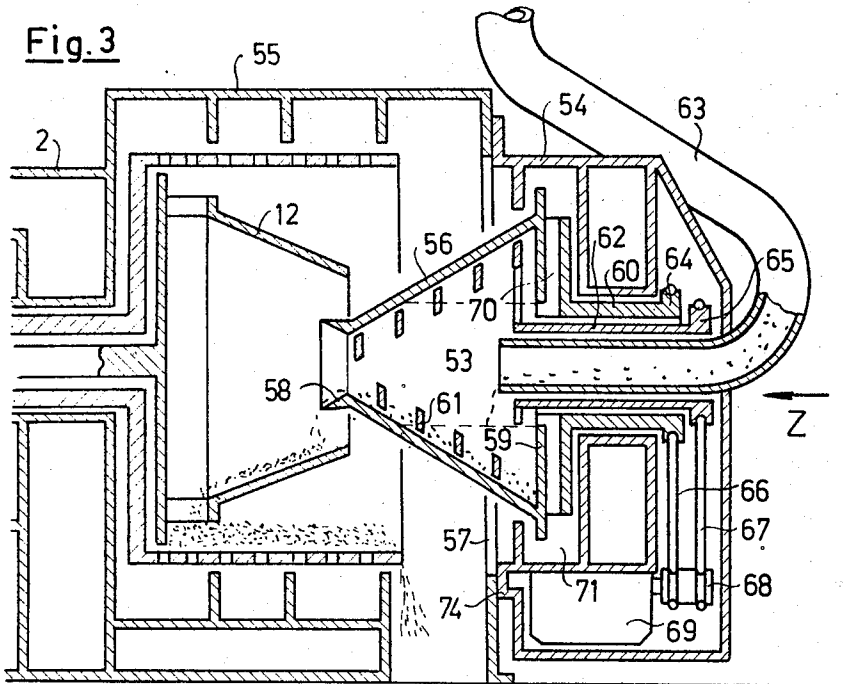
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**CONTINUOUSLY OPERATING CENTRIFUGING DEVICE**

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11 Claims. (Cl. 210—374)

**ABSTRACT OF THE DISCLOSURE**

A centrifuging device for continuously dehydrating a liquid-solids mixture, comprising a clarifying centrifuge and a pusher-type centrifuge incorporated with each other so as to thicken said mixture first in said clarifying centrifuge and then dry in said pusher-type centrifuge; the mixture discharge orifice of said clarifying centrifuge immediately opening into the inlet funnel of said pusher-type centrifuge.

*Background of the invention*

In pusher-type centrifuges, pre-thickening of the liquid-solids mixture to be centrifuged is often necessary, the mixture being freed in large settling tanks from a large part of the water contained in it. In the pusher-type centrifuge, in fact, owing to the necessary ability to be pushed, only a mixture having already a large proportion of solid matter can be economically centrifuged.

*Summary of the invention*

The aim of this invention is to dispense with the thickening plants which occupy much space, and to develop the pusher-type centrifuge in such a way that it can be fed with substantially thinner mixture than heretofore.

This problem is solved, according to the invention, by incorporating with the pusher-type centrifuge a clarifying centrifuge so as to lead said mixture first through said clarifying centrifuge and then through said pusher-type centrifuge, said clarifying centrifuge having a conical imperforate drum, and arranged in the latter a rotatable screw conveyor for the mixture, the mixture discharge orifice of the clarifying centrifuge opening into the inlet funnel of the pusher-type centrifuge.

A particularly satisfactory embodiment, in which practically no additional space is required, comprises arranging the imperforate drum of the clarifying centrifuge inside the inlet funnel of the pusher-type centrifuge.

*Brief description of the drawings*

The accompanying drawings, with reference to which the invention will be explained more fully, illustrate embodiment examples of the subject of the invention.

In these drawings:

FIGS. 1 and 2 each show a vertical axial section through a respective pusher-type centrifuge,

FIG. 3 shows an axial section through another pusher-type centrifuge on the line III—III in FIG. 4, and

FIG. 4 shows an end view in the direction of the arrow Z in FIG. 3.

*Description of the preferred embodiments*

The pusher-type centrifuge shown in FIG. 1 has a perforated drum 1, which is mounted in overhung fashion in a stator 2 by means of a hollow shaft 3 and bearings 4 situated in the stator 2. Mounted co-axially in the hol-

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low shaft 3 is a hollow shaft 5 carrying a pusher plate 6, the peripheral part of which forms a pusher ring 7. The hollow shaft 5 carries a piston 8 which is reciprocable in a cylinder 9 of the hollow shaft 3. By suitable control of pressurised-oil ducts, not shown and leading to either side of the piston 8, the pusher ring 7, which is situated in the vicinity of a hub disc 10 connecting the perforated drum 1 to the hollow shaft 3, may be reciprocated by a fraction of the length of the perforated drum 1 axially relative to the latter. The perforated drum 1 together with the pusher ring 7 is adapted to be set in rotation by a motor, not shown, by means of belts 11 and the cylinder 9 of the hollow shaft 3, said cylinder being constructed as a belt pulley. For supplying the mixture to be centrifuged to the perforated drum 1, an inlet funnel 12, arranged concentrically of the perforated drum 1, is provided, which funnel extends to the vicinity of the pusher ring 7 and is connected to the latter by means of struts 13 leaving passages between each other.

According to the invention, there is incorporated with the pusher-type centrifuge a clarifying centrifuge 14 having a conical imperforate drum 15 and, mounted co-axially in the latter, a rotatable screw conveyor 16 for the mixture. The imperforate drum 15, like the inlet funnel 12, has its wide end facing the pusher ring 7 and its shell has substantially the same inclination as the wall of the inlet funnel 12. On its wider end, the imperforate drum 15 has an end wall 17. The latter is secured to the hub disc 10 of the perforated drum 1 by struts 18 passing through orifices 19 of the pusher plate 6. The struts 18 are provided with liquid discharge ducts 20 leading from the interior of the imperforate drum 15 to the side of the hub plate 10 remote from the perforated drum 1. A funnel 21 mounted on the hub plate 10 leads the liquid into a collecting chamber 22.

The screw conveyor 16 is connected by a hub spider 23 to a shaft 24, coaxial with the hollow shafts 3 and 5 and passing through the bore of the hollow shaft 5 to a belt pulley 25 situated at the end of the hollow shaft 3 and adapted to be driven by a motor, not shown, at a speed different from the speed of the hollow shafts 3 and 5, through a belt 26.

The inlet funnel 12 of the pusher-type centrifuge projects at the inlet end axially beyond the imperforate drum 15 of the clarifying centrifuge 14 in all possible axial relative positions between the imperforate drum 15 and inlet funnel 12. The mixture to be centrifuged, thickened in the imperforate drum 15 and discharged by the screw conveyor 16 at the narrow open end of the imperforate drum 15 enters directly the inlet funnel 12 of the pusher-type centrifuge and is centrifuged in the usual manner in the perforated drum 1.

An inlet pipe 27 for the clarifying centrifuge 14 passes through an opening in an end cover 28 of the centrifuge housing 29 and leads from the outside into the interior of the imperforate drum 15. In the housing 29 are collecting chambers 30, 31, 32 for the liquid centrifuged from the perforated drum 1, and a collecting chamber 33 for the solid matter pushed out of the perforated drum 1.

The mixture to be treated in the pusher-type centrifuge passes through the inlet pipe 27 into the imperforate drum 15. Under the action of the centrifugal forces in the rotating imperforate drum 15, the solids of the mixture drop onto the drum shell, while the liquid collecting above the solids flows away through the ducts 20 into the collecting chamber 22. The solids lying on the drum shell of the imperforate drum are pushed by the screw conveyor 16 along the wall of the imperforate drum 15

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above the level formed by the liquid and then over the outlet edge of the imperforate drum. These solids, freed from a large part of the liquid, enter the inlet funnel 12 of the pusher-type centrifuge and thence onto the perforated drum 1, and on the latter they are pushed over the perforated drum 1 by the continuously reciprocating pusher ring 7. The liquid extracted during the passage of the material through the perforated drum 1 enters the collecting chambers 30, 31, 32, while the centrifuge-dry solid matter issues at the free end of the perforated drum 1 into the collecting chamber 33.

The principal parts of the clarifying centrifuge 14, i.e., the imperforate drum 15 with the screw conveyor 16, are arranged inside the inlet funnel 12 of the pusher-type centrifuge, that is to say, in an otherwise unused space, and the drive of the screw conveyor 16 lies at the free end of the hollow shaft 3, that is to say it is very well accessible. After opening of the end cover 28, the pusher movement, the mixture being centrifuged in the perforated drum and the mixture in the inlet funnel are accessible to observation to the same extent as in the known pusher-type centrifuges. In just the same way, the centrifuging process in the clarifying centrifuge may be observed during operation of the machine.

In the pusher-type centrifuge shown in FIG. 2, there is mounted in the stator 2 a hollow shaft 34 which, by means of a hub plate 35 and struts 36, carries a pusher ring 37 and an inlet funnel 38. A perforated drum 39 is connected by a hub plate 40, having holes for the passage of the struts 36, to a hollow shaft 41, mounted coaxially in the hollow shaft 34. By means of a piston 8 fast on the hollow shaft 41 and a cylinder 9 connected to the hollow shaft 34, in this embodiment the perforated drum 39 is axially reciprocable, while the pusher ring 37 is not moved axially. Fast with the inlet side of the inlet funnel 38 is an imperforate drum 42 of a clarifying centrifuge 43, so that the mixture discharge orifice 44 of the clarifying centrifuge 43, which orifice is situated at the narrow end of the solid-shell drum 42, opens directly into the inlet funnel 38 of the pusher-type centrifuge. On its wider end remote from the inlet funnel 38, the imperforate drum 42 again carries an end wall 45 provided with liquid outlet ducts 46. The liquid escaping through the ducts 46 passes through a funnel 47 secured to the end wall 45 and enters a collecting chamber 48 provided in an end cover 49 of the centrifuge housing 50. An inlet pipe 51, passing through and secured to the housing cover 49, extends co-axially with the axis of the perforated drum 39 of the pusher-type centrifuge and clarifying centrifuge 43 through a hub 52 of the end wall 45, the inlet pipe 51 and the hub 52 forming a radial mounting of the imperforate drum 42 in the housing cover 49 of the pusher-type centrifuge.

In the embodiment examples according to FIGS. 1 and 2, the imperforate drum of the clarifying centrifuge is mounted in each case on the axially immovable element (perforated drum or pusher ring) of the pusher-type centrifuge.

In the pusher-type centrifuge shown in FIGS. 3 and 4, the incorporated clarifying centrifuge 53 has a stator 54, which is independent of the stator 2 of the pusher-type centrifuge, and is mounted outside the housing 55 of the pusher-type centrifuge. An imperforate drum 56 of the clarifying centrifuge 53, however, projects through an end housing orifice 57 of the pusher-type centrifuge into the housing 55, and extends with its mixture discharge orifice by means of an outlet crown 58 into the inlet funnel 12 of the pusher-type centrifuge.

The imperforate drum 56 of the clarifying centrifuge 53, on its wider end remote from the inlet funnel 12, carries an end wall 59 on which is fitted a hollow shaft 60, the imperforate drum 56 being mounted in overhung fashion in the stator 54 by means of the hollow shaft 60. A screw conveyor 61 of the clarifying centrifuge 53 is secured to a hollow shaft 62 mounted concentrically in

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the hollow shaft 60. An inlet pipe 63 of the clarifying centrifuge leads through the hollow shaft 62 into the interior of the imperforate drum 56. The hollow shafts 60 and 62, on their ends remote from the imperforate drum 56, carry pulleys 64 and 65, respectively. The pulleys 64 and 65 have different diameters and are driven by means of belts 66 and 67, respectively, by a twin pulley 68 of an electric motor 69 attached to the stator 54.

Ducts 70, opening into a collecting chamber 71 in the stator 54, are provided in the end wall 59 for the discharge of the liquid from the interior of the imperforate drum 56. A pipe 72 leads from the collecting chamber 71 into a discharge funnel 73 situated a short distance below said pipe.

The stator 54 is secured to an end cover 74 of the centrifuge housing 55. The cover 74 is pivoted in hinges 75, the common axis of which is vertical. Since the axis of the connecting part 76 of the inlet pipe 63 also lies on the axis of the hinges 75, the cover 74 can be opened without trouble. In this embodiment, a standard pusher-type centrifuge may be used, and the end housing cover 74, carrying the clarifying centrifuge, can be opened just as easily as the cover of a standard pusher-type centrifuge.

I claim:

1. A centrifuging device for dehydrating a liquid-solids mixture, comprising a clarifying centrifuge and a pusher-type centrifuge incorporated with each other so as to lead said mixture first through said clarifying centrifuge and then through said pusher-type centrifuge; said pusher-type centrifuge having a stator, a perforated drum mounted in overhung fashion in said stator, a pusher ring reciprocable axially relatively to said drum, and an inlet funnel for leading said mixture into said perforated drum in the vicinity of said pusher ring; said clarifying centrifuge having a conical imperforate drum, a rotatable screw conveyor for said mixture arranged in said imperforate drum, a liquid overflow and a mixture discharge orifice; said discharge orifice of the clarifying centrifuge opening into said inlet funnel of the pusher-type centrifuge.

2. The device defined in claim 1, in which said imperforate drum of the clarifying centrifuge is arranged inside said inlet funnel of the pusher-type centrifuge.

3. The device defined in claim 2, having a hub disc for mounting said perforated drum of the pusher-type centrifuge, and struts arranged on said hub disc to secure said imperforate drum of the clarifying centrifuge to said hub disc.

4. The device defined in claim 3, having liquid discharge ducts in said struts, leading from inside said imperforate drum of the clarifying centrifuge to the side of said hub disc, situated remote from said imperforate drum.

5. The device defined in claim 2, in which said inlet funnel of the pusher-type centrifuge projects axially on the inlet side beyond said imperforate drum of the clarifying centrifuge.

6. The device defined in claim 1, in which said imperforate drum of the clarifying centrifuge and said inlet funnel of the pusher-type centrifuge are axially arranged in series, being rigidly secured to each other.

7. The device defined in claim 6, in which said imperforate drum, at the side remote from said inlet funnel, is radially mounted in said stator of the pusher-type centrifuge.

8. The device defined in claim 1, in which said pusher-type centrifuge has a shaft with a central bore, said screw conveyor of the clarifying centrifuge having a driving shaft passing through said central bore.

9. The device defined in claim 1, in which said clarifying centrifuge has a stator separate from said stator of the pusher-type centrifuge.

10. The device defined in claim 9, in which said clarifying centrifuge has a first hollow shaft for mounting said

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imperforate drum in said separate stator of the clarifying centrifuge, a second hollow shaft for mounting said screw conveyor in said first hollow shaft, and an inlet pipe for leading said mixture into said clarifying centrifuge, said inlet pipe passing through said second hollow shaft.

11. The device defined in claim 9, in which said pusher-type centrifuge has a housing confining said perforated drum; said housing having hinges and a cover pivotally mounted in said hinges; said separate stator of the clarifying centrifuge being mounted on said cover.

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