Aug. 8, 1967 G. HILLYAR-RUSS 3,334,743

HEAVY MEDIUM DRUM SEPARATOR

Filed April 13, 1964

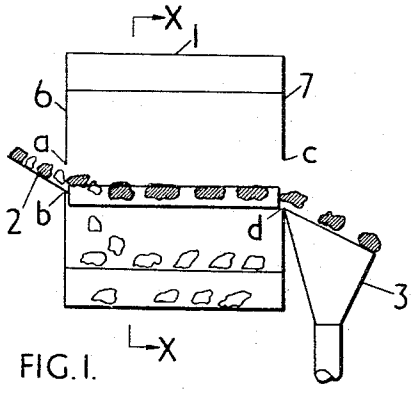



FIG. 1.

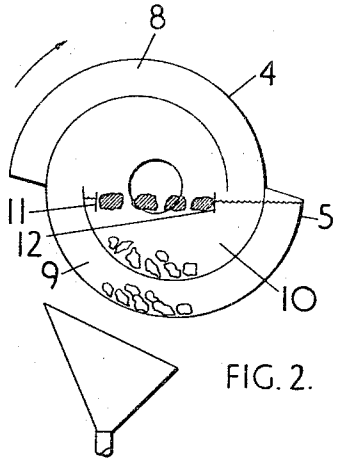



FIG. 2.

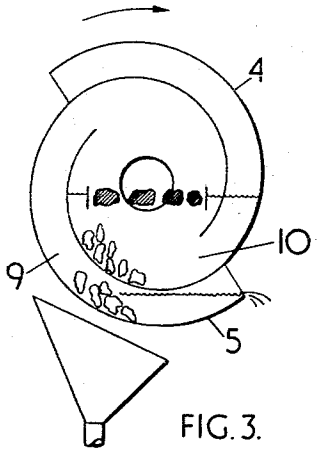



FIG. 3.

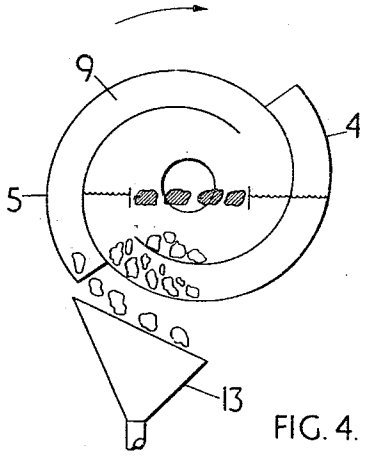



FIG. 4.

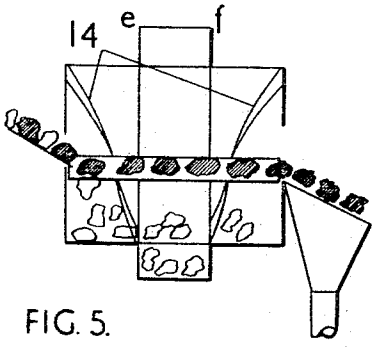



FIG. 5.

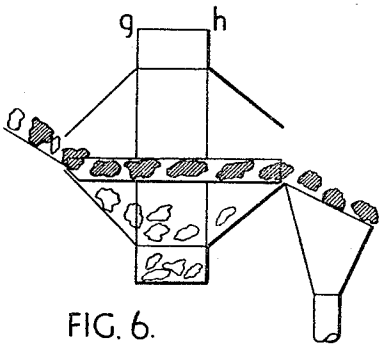



FIG. 6.

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# HEAVY MEDIUM DRUM SEPARATOR

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This invention relates to apparatus for effecting the "float and sink" separation of mixed solid materials by a dense liquid into fractions of different specific gravities.

Known apparatus for effecting separation by the "float and sink" principle includes apparatus in which the separation vessel takes the form of a drum which is mechanically rotated about an axis which is substantially horizontal. In this type of apparatus the raw feed is introduced, as is the dense liquid (the "medium") towards one end of the drum, and the fraction of the solid material which floats in the medium (the "floats") is discharged together with medium at the other end of the drum.

The solid particles which sink in the medium (the "sinks") fall to the base of the drum, from which point they are lifted, in existing apparatus, by flights or similar devices attached to the drum, and discharged by means of a chute or similar device through a hole at one end or other of the drum.

Apparatus of this type has the advantage that the mechanical drive may be arranged remote from the medium (which may be of an abrasive nature) and that scrapers or other mechanical devices moving with the medium are eliminated. It has, however, a number of disadvantages, for example the presence of a chute (or similar device) within the drum for the discharge of the "sinks," together with its supporting structure, adds to the complexity of the apparatus; restricts visibility within the drum; and greatly impedes any inspection or maintenance which may be required within the drum. It is necessary for the "sinks" to be lifted to such a height within the drum that they may drop into the chute for discharge, and this means an unnecessary and unprofitable expenditure of mechanical energy. The flights, or similar devices, fitted within the drum tend to cause turbulance within the medium, which turbulance can cause errors in the separation of the solids.

The present invention is therefore intended to produce an improved apparatus for the "float and sink" separation of mixed solids.

According to the present invention apparatus for separating mixed solid materials by a "float-and-sink" process comprises a drum mounted with its longitudinal axis extending horizontally and for rotation about said axis, the drum being such that mixed material can be fed into one end of the drum, the "float" fraction can be discharged from the other end of the drum, and the "sink" fraction can be discharged by rotation of the drum through at least one arcuate passage which extends around at least a part of the circumference of the drum, the passage communicating at one end with the interior of the drum and at the other end with the exterior of the drum and being of such a length that at no time during revolution of the drum is liquid within the drum free to flow unrestrictedly out of the drum.

There may advantageously be provided two arcuate passages through which the "sink" fraction can be alternately discharged by rotation of the drum.

Each such arcuate passage may be of such a width that it extends over the whole length of the drum or of such a width that it extends over only a fraction of the length of the drum. In the latter case, means may be provided by which upon rotation of the drum the "sink" fraction is fed into the paths of the end of the or each arcuate passage which communicates with the interior of the drum and such means may be constituted by sloping walls forming part of the drum or by helical guides provided on the interior of the circumferential wall of the drum.



The drum may be provided with two or more parts each provided with one or more arcuate passages, the adjacent parts being separated by a dividing wall having there-through an aperture which is co-axial with the axis of the drum and which is of greater diameter than the opening through which mixed material can be fed to the drum. In such an arrangement dense mediums of differing specific gravities may be fed to the parts so as to effect separation into three or more fractions.

A second apparatus of similar construction may also be provided, the second apparatus being arranged in series with the first apparatus such that in operation one of the discharged fractions of the first apparatus is fed into the second apparatus as the "mixed material."

Embodiments of the present invention will now be described in greater detail, by way of example only, with reference to the accompanying drawings in which the invention is illustrated diagrammatically and of which:

FIGURE 1 being a longitudinal cross-section of an apparatus according to the invention,

FIGURE 2 a cross-section of the apparatus on the line X—X of FIGURE 1,

FIGURES 3 and 4 are similar views to FIGURE 2 but at different positions in the revolution of the drum,

FIGURES 5 and 6 sectional views of two modified forms of apparatus according to the invention.

The apparatus of FIGURE 1 to 4 comprises a drum **1** which is rotated about a horizontal axis by mechanical means not shown, with a chute **2** by means of which the raw feed solids (sinks and floats mixed) and medium are introduced into the drum **1** through a co-axial hole of diameter *a–b*.

A further co-axial hole, of larger diameter *c–d*, than *a–b*, is situated at the other end of the drum **1**, and the "floats" and medium are discharged here, for example for subsequent separation by a screen **3** or otherwise.

The walls of the drum **1** (see FIGURE 2) are formed by two spiral members **4** and **5**. These members **4** and **5** together with the ends **6**, **7** of the drum (FIGURE 1) from convoluted scroll-shaped ducts **8** and **9**. These ducts **8** and **9** are of such a length that, no matter what the annular rotational position of the drum the medium **10** within the drum is retained by one or other of the members **4** and **5**.

Thus if the drum be not rotated no medium will be discharged through the ducts **8** and **9**.

Side curtains **11** and **12** are arranged to confine the floating solids within the centre section of the drum. These side curtains **11** and **12** are supported by any convenient means (not shown).

FIGURE 3 shows the drum after it has rotated further in the clock-wise sense indicated by the array. Part of the medium **10** in the duct **9** is now being discharged (for collection and subsequent recirculation), but it will be noted that the main body of medium **10** is retained by the member **4**.

FIGURE 4 shows the drum after further clockwise rotation. Here the "sinks" are being discharged by gravity, for further separation from the medium by means of a screen **13** or otherwise. Most of the medium **10** remains contained in the drum by the member **4**.

It will be noted that the apparatus as described offers various advantages, for example:

(a) Only one moving member is required, and this can be of simple and rugged construction.

(b) The drum can be constructed of rolled and flat plates.

(c) The drum is entirely self draining, and as the "sinks" move in the same general direction as the medium discharge, a very dense or unstable medium can be used if desired, without risk of settling out.

FIGURE 5 shows a drum in which only a central section *e, f,* is constructed like the drum of FIGURES 1 to 4, the front and back portions being cylindrical, and provided with spiral guides **14** to bring "sinks" towards the central section *e, f.*

FIGURE 6 shows a drum in which only a central section *g, h,* is constructed like the drum of FIGURES 1 to 4, the front and back sections being coned in a direction which will guide sinks toward the central section.

I claim:

Apparatus for separating a mixture of solid material including a "floats fraction" and a "sinks fraction" by a sink and float process, comprising a drum rotatable about a horizontal axis, the drum including a first drum end (**6**) having means defining a central inlet (*a–b*) for material to be treated; material feed means (**2**) communicating with the inlet opening; a second drum end (**7**) having means defining a central outlet (*c–d*) for the discharge of the "floats fraction," said means additionally defining the level for the working fluid of the drum; "floats fraction" discharge means (**3**) communicating with the outlet; two wall-members (**4, 5**) interconnecting said first and second drum ends, each of said wall members extending a substantially complete spiral turn around said inlet and outlet and forming two convoluted scroll-shaped ducts (**8, 9**) so arranged that they overlap over a circumferential length of at least as great a length as the submerged perimeters of the drum ends when the working fluid is at the said level, each said ducts having an inlet opening communicating with the interior of the drum, and a discharge opening on the exterior of the drum, said discharge openings being diametrically opposite to each other with respect to the horizontal axis; and non-rotatable guide means (**11, 12**) within the drum for guiding the "floats fraction" from the inlet opening to the outlet opening and for preventing the "floats fraction" from entering a duct.




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