

J. J. BERRIGAN.
CENTRIFUGAL SEPARATOR.

APPLICATION FILED MAY 11, 1908. RENEWED SEPT. 8, 1911.

Patented May 20, 1913

2 SHEETS—SHEET 1.

1,062,215.

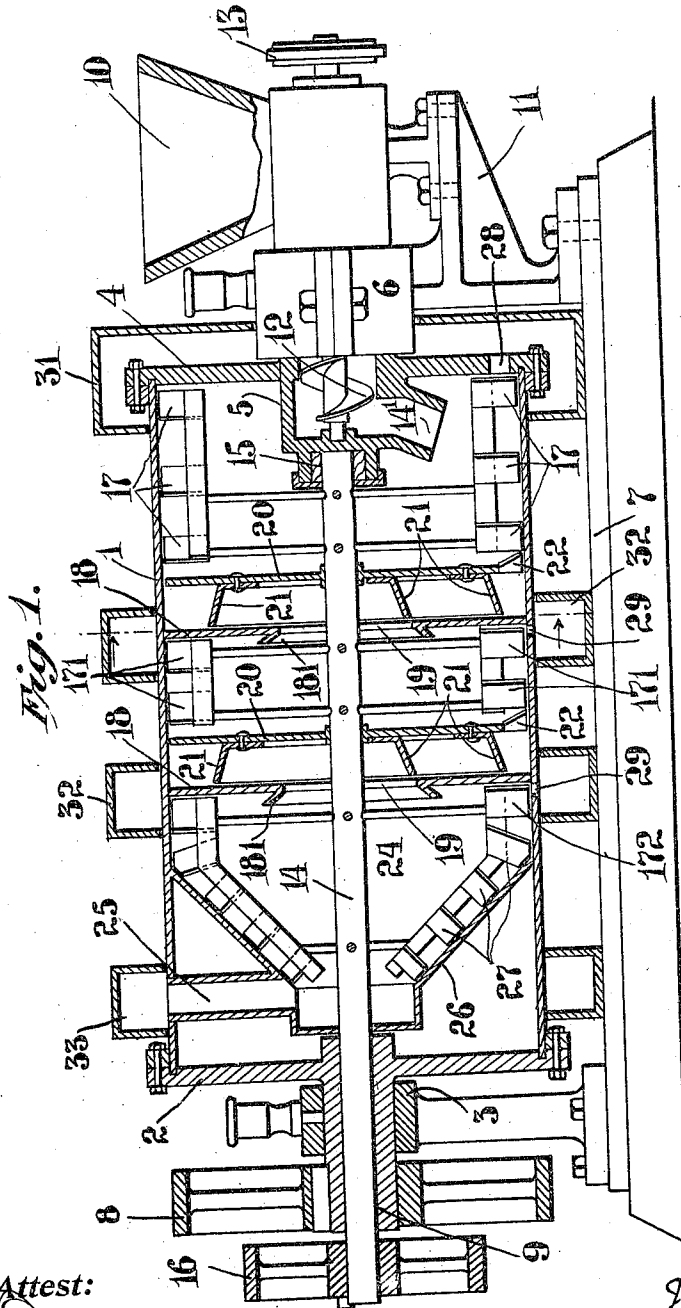


Fig. 1.

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2 SHEETS-SHEET 2.

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Fig. 2.

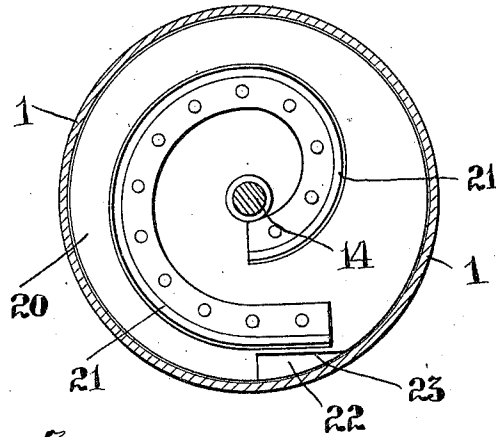
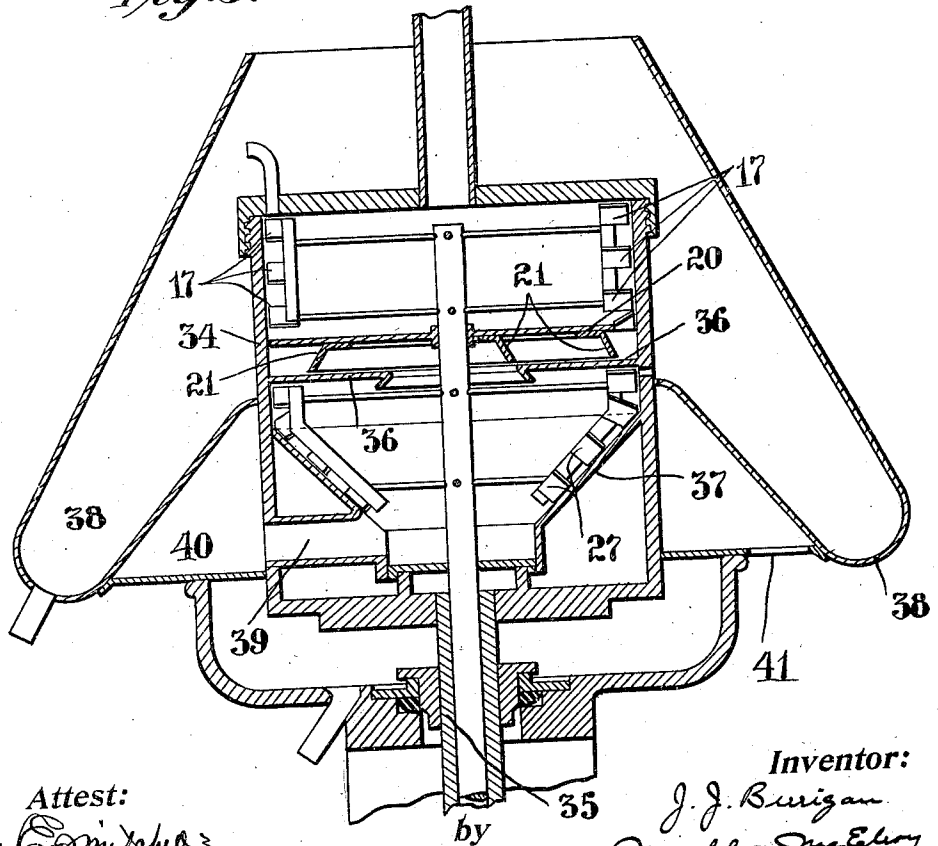


Fig. 3.



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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL SEPARATOR.

1,062,215.

Specification of Letters Patent.

Patented May 20, 1913.

Application filed May 11, 1908, Serial No. 432,224. Renewed September 8, 1911. Serial No. 648,403.

To all whom it may concern:

Be it known that I, JOHN J. BERRIGAN, a citizen of the United States, residing at East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Centrifugal Separators, of which the following is a specification.

My invention relates to improvements in centrifugal separators for separating liquids and solids through the agency of "centrifugal force."

In my application filed November 7th, 1905, Sr. No. 286,193, I have shown a centrifugal separator comprising means for conducting the separation in successive stages, the mixture of solid and liquid material being carried up inclined surfaces by suitable conveying means, the liquid flowing back down such surfaces as it separates.

My present invention comprises means for carrying a mixture up a surface which is at right angles, or nearly at right angles, to the axis of rotation. By so doing I obtain a more rapid separation, require a less number of stages in the apparatus, and make the apparatus much more compact.

The objects of my invention are, to improve and simplify centrifugal separators of the class referred to, and to make them more compact and efficient.

I will now proceed to describe my invention with reference to the accompanying drawings.

In said drawings: Figure 1 shows a central vertical section of a horizontal type of separator embodying my invention; Fig. 2 shows a transverse section of the separator and shows particularly the spiral elevator employed; Fig. 3 shows a central vertical section of a vertical type of separator embodying the same principle of operation.

Referring first to Figs. 1 and 2, 1 designates a substantially horizontal cylinder within which are the working parts of the machine; on the head 2 of said cylinder is a hollow trunnion received in a bearing in a fixed standard 3. On the opposite head 4 of said cylinder is a hollow trunnion 5 which is received in a bearing in a fixed standard 6. Standards 3 and 6 rest upon the bed 7 of the machine. The driving pulley 8 for the cylinder 1 is mounted upon the first of said trunnions 9. Power is communicated to said pulley by a suitable belt

(not shown) and in that way cylinder 1 is caused to rotate.

10 designates a feed hopper supported on bracket 11, extending from standard 6. The combined solid and liquid materials to be separated are conveyed into the cylinder 1 by means of a screw conveyor 12 mounted within the hollow trunnion 5 and arranged to be driven by a driving wheel 13; said hollow trunnion having an inclined duct 14 communicating with the interior of cylinder 1.

Within the drum 1 is a conveyer shaft 14 having bearings in trunnion 9 and having its inner end stepped in a bearing 15 in trunnion 5. This conveyer shaft is arranged to be driven by means of a driving wheel 16. At the right hand or receiving end of the drum, this shaft carries conveyer blades 17 arranged to feed the mixture of solid and liquid material which, in the operation of the machine, forms an annulus against the inner periphery of drum 1 to the left. Beyond these conveyer blades 17 there are one or more partitions 18, the right hand or receiving surfaces of which are nearly or quite at right angles to the axis of rotation; and in these partitions are central openings 19 through which the shaft 14 passes, but which are considerably larger than said shaft. Adjacent to these partitions 18, on the right hand or receiving side thereof, are disks 20 mounted on shaft 14 to be rotated thereby and each carrying a spiral elevator blade 21 (see particularly Fig. 2); the surface of which blade is slightly inclined with respect to the axis of rotation. The disks 20 extend nearly to, but not quite to, the periphery of the drum 1 and each such disk is provided opposite the point of commencement or outer extremity of the corresponding spiral blade 21, with a rearwardly turned lip 22 (formed conveniently by cutting the disk along line 23, Fig. 2, and bending backward at a slight angle the lip so formed). The edges of the conveyer blades 21 are in practice quite close to the surfaces of the partitions 18; in Fig. 1 the distance between the edges of the blades and the said partitions is exaggerated for purposes of illustration, as otherwise it would be difficult to indicate that there is in fact a slight space between said blades and partitions. A conveyer blade formed as is blade 21 will, when rotated relatively to the drum, raise a

mixture of liquid and solid material toward the axis of rotation, the liquid draining off as the mixture is raised and flowing back through the narrow space between the edge of the blade and the surface of the adjacent partition; and when the solid material, with more or less liquid still remaining in it, has reached the level of the edge of orifice 19, such solid material will flow off the face of the blade, under the influence of centrifugal force, and, passing through orifice 19, will fall to the periphery of the drum again. In Fig. 1 I have shown two partitions 18 and two corresponding spiral elevators 21, but there may be more or less of these partitions and elevators, corresponding to a greater or less number of stages of separation, as preferred and as the characteristics of the particular material treated may render desirable. Where there is more than one such partition 18 I provide between such partitions, conveyer blades 171, corresponding to blades 17, and like them, arranged to be rotated by shaft 14.

In the machine shown, there is, first of all, an initial separation of the mixture supplied, into concentric annuli of liquid and solid material, in the space through which the blades 17 travel; the solid annulus in this region still containing considerable liquid, however. In the passage of the material from this solid annulus upward toward the opening 19 of the first partition 18, the greater part of the liquid remaining drains off and flows back, joining the liquid in the annulus at the receiving end of the machine. In the chamber between the two partitions 18 this material forms another annulus in which some further separation occurs; and in the passage of material from such annulus toward the opening 19 of the second partition a further separation occurs, by which practically all of the remaining liquid will, in most cases, be separated out and caused to flow back; the remaining solid material passing through the opening 19 of such second partition into the chamber 24 at the delivery end of the machine. The solid material may be conveyed from the outside of such delivery chamber 24 to the discharge duct 25 by any suitable means. I have indicated for the purpose, a conical partition 26 with conveyer blades 27 movable thereover and arranged to be rotated by shaft 14 and other blades 172 for feeding the solid material from the annulus in chamber 24 up such inclined surface 26. Any moisture remaining in the material when it reaches this chamber 24 will, in general, be separated out during the passage of the material up surface 26.

For the escape of liquid at the receiving end of the drum, I provide, in head 4, a discharge orifice 28, the position of which with respect to the inner surface of drum 1,

regulates the depth of the liquid annulus in this portion of the apparatus. In the chamber between the partitions 18 I provide another discharge port 29; and the first partition 18 is provided with a lip 181 which throws the solid material beyond this port 29, so that the solid material does not escape therethrough. I may also provide a similar discharge port 29 for chamber 24. The discharge from port 28 is received in an annular delivery chamber 31; and the discharge from ports 29 is received in corresponding annular delivery chambers 32. The solid material escaping through the duct 25 is received within an annular delivery chamber 33.

The operation of this apparatus is as follows: Drum 1 being in rotation, and conveyer shaft 14 rotating with respect to said drum (the actual speed of rotation of shaft 14 being usually somewhat less than that of drum 1, so that there is relative rotation of the shaft with respect to said drum) and a mixture of solid and liquid material being fed from hopper 10 through hollow trunnion 5 and duct 141 into drum 1 by the conveyer 12, this material forms an annulus against the wall of the drum, in the space through which the conveyer blades 17 travel. These blades feed the material of this annulus to the left until such material is picked up by the lip 22 and moved to the left into position to be lifted by the first of the spiral elevators 21. Such elevator blade then conveys the material upward to the opening 19 of the first partition 18, the greater part of the liquid draining off during such movement, as previously explained, the remaining solid material being caused to pass through opening 19 into the chamber between partitions 18. In this chamber the operations are repeated, the practically dry solid material being delivered through the opening 19 of the second partition into chamber 24 and being carried up along inclined surface 26 in said chamber to the ducts 25 and thence outward. The liquid draining back in these successive separation operations escapes through ports 28 and 29.

My invention is not restricted to horizontal machines; and in general it is, in principle, substantially immaterial whether machines such as these be arranged vertically or horizontally, though certain mechanical conditions limit the height and permissible diameter of vertical machines, so that in general, for machines of large capacity, the horizontal arrangement is preferable. In Fig. 3, I show one form of vertical machine having my invention applied thereto, the same comprising a bowl 34 corresponding to drum 1, and arranged to be rotated by a shaft 35. Within said bowl there is a single substantially flat partition 36, corresponding to partition 18, and a conical partition 37,

corresponding substantially to partition 26, and there are conveyer blades 17 and 27 and a spiral elevator blade 21, substantially the same as in the device shown in Fig. 1. The liquid is received in pan 38 surrounding the bowl, and the solid material is delivered through a duct 39 into a space 40 and thence passes out through an opening 41.

What I claim is:—

1. A centrifugal separator comprising in combination a rotatable drum provided with one or more transverse orificed partitions therein and means for conveying material from near the periphery of such drum along such partition or partitions to the orifices thereof, comprising a rotatable continuous spiral blade.

2. A centrifugal separator comprising in combination a rotatable drum provided with one or more transverse orificed partitions therein and means for conveying material from near the periphery of such drum along such partition or partitions to the orifices thereof comprising a rotatable continuous spiral blade, the edge of which is in a plane perpendicular with respect to the axis of rotation.

3. A centrifugal separator comprising in combination a rotatable drum provided with one or more transverse orificed partitions therein and means for conveying material from near the periphery of such drum along such partition or partitions to the orifices thereof comprising a rotatable continuous spiral blade, the edge of which is in a plane perpendicular with respect to the axis of rotation, said blade located in close proximity to the said partition.

4. A centrifugal separator comprising in combination a rotatable drum provided with one or more orificed partitions, one or more corresponding disks located in proximity to such partitions and provided with a spiral elevator blade in the space between such disk and corresponding partition.

5. A centrifugal separator comprising in combination a rotatable drum provided with one or more orificed partitions, one or more corresponding disks located in proximity to such partitions and provided with a spiral elevator blade in the space between such disk and corresponding partition, said disk having a lip adapted to feed material into the range of action of said elevator blade.

6. A centrifugal separator comprising in combination a rotatable drum provided with one or more transverse orificed partitions therein and means for conveying material from near the periphery of such drum along such partition or partitions to the orifices thereof, comprising a rotatable continuous spiral blade and means for feeding material into the range of action of such blade.

7. A centrifugal separator comprising in combination a rotatable drum provided with

one or more orificed partitions and with means for feeding in the mixture to be separated, elevating means operating in proximity to each such partition comprising a continuous spiral rotatable elevator blade, rotatable conveyers for feeding the material into the range of action of said elevating means, and means for rotating said elevating means and conveyers with respect to the drum.

8. A centrifugal separator comprising in combination a rotatable drum provided with one or more orificed partitions and with means for feeding in the mixture to be separated, elevating means operating in proximity to each such partition comprising a continuous spiral rotatable elevator blade, rotatable conveyers for feeding the material into the range of action of said elevating means, and a shaft rotatable with respect to said drum and arranged to rotate said elevating means and conveyers.

9. A centrifugal separator comprising a rotatable drum provided with one or more orificed partitions and with means for feeding into said drum at one end material to be separated, elevating means operating in proximity to said partitions and comprising a continuous spiral rotatable elevator blade, a conveyer in the space between the point of delivery of the material and such elevating means, a discharge duct, an inclined surface between such discharge duct and partitions, conveying means for feeding material up such inclined surface to such discharge duct, and means for rotating said conveyers and elevating means.

10. A centrifugal separator comprising a rotatable drum provided with one or more orificed partitions and with means for feeding into said drum at one end material to be separated, elevating means operating in proximity to said partitions and comprising a continuous spiral rotatable elevator blade, a conveyer in the space between the point of delivery of the material and such elevating means, a discharge duct, an inclined surface between such discharge duct and partitions, conveying means for feeding material up such inclined surface to such discharge duct, and a shaft rotatable with respect to said drum and carrying said conveyers and elevating means.

11. A centrifugal separator comprising in combination a rotatable drum provided with a centrally orificed partition arranged substantially at right angles to the axis of rotation, and conveying means arranged to convey material along said partition from near the periphery of the drum to the orifice of said partition.

12. A centrifugal separator comprising in combination a rotatable drum provided with an orificed partition arranged substantially at right angles to the axis of rotation, and

4
a spiral conveyer arranged to convey material along said partition from near the periphery of the drum to the orifice of said partition.

5 13. A centrifugal separator comprising in combination a rotatable drum provided with a centrally orificed partition arranged substantially at right angles to the axis of rotation, a rotatable disk arranged in proximity
10 to said partition, and conveying means on said disk arranged to convey material along said partition from near the periphery of the drum to the orifice of said partition.

14. A centrifugal separator comprising in
15 combination a rotatable drum provided with

an orificed partition arranged substantially at right angles to the axis of rotation, and rotatable spiral conveyer arranged to convey material along said partition from near the periphery of the drum to the orifice of said partition, the conveying surface of said conveyer inclined somewhat with respect to the axis of rotation. 20

In testimony whereof I affix my signature, in the presence of two witnesses.

JOHN J. BERRIGAN.

Witnesses:

H. M. MARBLE,

FRANK E. RAFFMAN.