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CENTRIFUGAL APPARATUS FOR SEPARATING PURPOSES.

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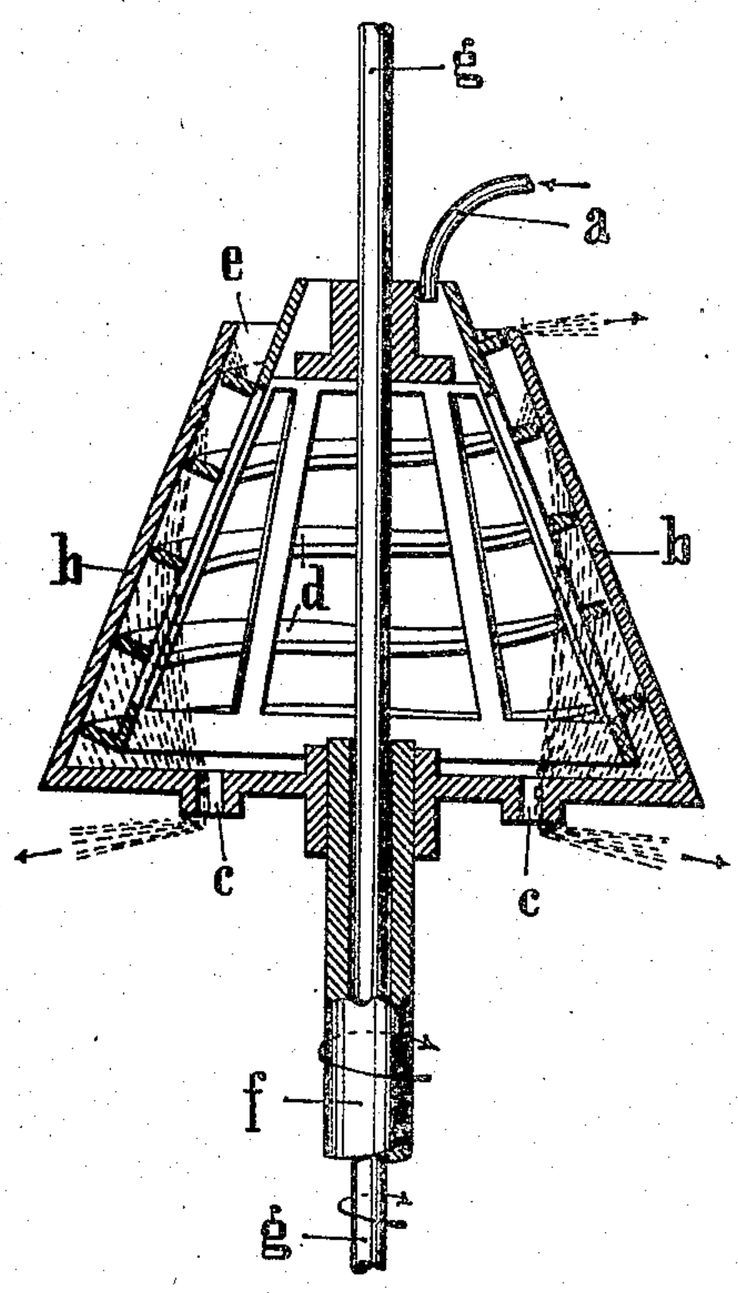

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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL APPARATUS FOR SEPARATING PURPOSES.

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To all whom it may concern:

Be it known that I, ERNST JAHN, civil engineer, a subject of the German Emperor, residing at Arnswalde, in the Kingdom of Prussia, Germany, have invented certain new and useful Improvements in Centrifugal Apparatus for Separating Purposes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to centrifugal apparatus for separating purposes and more particularly to centrifugal apparatus for separating in the order of their specific gravities solid particles suspended in a liquid of less specific gravity. It has been proposed to employ for such purpose centrifugal apparatus having a conical drum receiving the suspended particles at its narrow end, with a worm in the said drum for discharging said particles when separated; a suitable outlet or outlets being provided for the liquid.

The present improvements consist in the arrangement of said outlet or outlets for the suspending liquid in the wide end of the drum, at a distance from the drum axis greater than the radius of the aperture provided in the narrow end of the drum for the entrance and exit of the separated particles. By the rapid rotation of the drum, the lighter particles of the mixture to be separated (which rotate with the drum in an inner zone of the same) are thrown out through the outlet or outlets in the wide end of the drum while the heavier particles which are pressed by centrifugal action against the sides of the drum, are conveyed by means of the worm to the discharge opening at the narrow end of the drum. This opening has a diameter such that the surface of the liquid which assumes a parabolic shape, will not extend as far as the said opening.

The accompanying drawing illustrates in central longitudinal section a construction of centrifugal separator having a vertical axis embodying the improvements in this invention.

b represents a frusto-conical drum having its upper end open, as shown at *e*. The drum is centrally mounted on the hollow shaft *f*, which is revolved by any suitable means (not shown). The bottom of the drum is flat, and in said bottom are provided outlets *c*. These outlets are located at a greater distance from the axis of the drum than the length of the radius of the upper open end of the drum. *g* is a shaft passing centrally through the hollow shaft *f* and centrally through the drum, and this shaft *g* may also be revolved by any suitable means (not shown). To the shaft *g* is attached a conical skeleton frame, having a worm or spiral conveyer *d* on its outside, which fits closely within the drum *b*.

a is a pipe for supplying the material under treatment to the drum.

The worm *d* may be either right-handed or left-handed, as desired. There may be a series of outlet openings *c*.

The worm may rotate in the same direction as the drum. According as the worm is left-handed or right-handed, its speed of rotation will be slightly greater or less than that of the drum. In any case, it engages the heavy particles that are thrown against the inner wall of the drum, and it conveys them gradually toward the narrow opening of the drum. By this means special blades for collecting the separated substances are dispensed with, whereby the wear and tear caused by such heavier substances is lessened and the machine runs easier.

The mode of operation of the centrifugal apparatus is as follows: It is assumed that the separator is rotating on a vertical axis, and that the mixture to be separated, say for example, water containing washed clay in suspension, is being charged into the drum through the pipe *a*. This mixture of water and clay is at once thrown against the sides of the drum *b*. As is well known, washed clay like most substances for which the apparatus is designed, is composed of larger and smaller particles. The larger heavier particles are thrown off at once against the sides of the drum *b*, and are conveyed upward by the worm. The smaller lighter particles of clay pass down with the water, and are separated gradually, in their passage down along the sides of the drum, until they are engaged by the worm and conveyed upward in their turn. Thus the heavier particles have only a short distance to travel in the drum, while the lighter particles travel almost to the bottom of the drum, whence they are carried up by the worm along the entire length of the drum to the top thereof. The rapidity with which the particles are

separated and the speed of their travel to the top of the drum depend on the manner in which the mixture is charged into the drum, because only the same quantity of liquid can flow out from the outlet *c* as is charged in at the top through the pipe *a*. During the centrifugal treatment, the constituent of the mixture which is situated nearest the axis of the separator, that is to say, the liquid, forms a parabolic surface the apex of which is situated either inside or outside the drum, according to the speed of rotation of the latter. Now, since the radius of the upper opening in the drum is smaller than the distance of the outlet *c* from the axis of the drum, the surface of the liquid will not extend as far as the discharge spring *e* of the drum, because assuming that the amount of mixture discharged into the drum is not greater than the apparatus is able to discharge, so much liquid will always flow out through the outlet *e* that the upper edge of the liquid cannot reach the opening *e*. The fact that the upper discharge opening in the drum has a smaller diameter than the circle struck from the drum axis as a center through the outlet *c*, is therefore a feature of considerable importance. Owing to this difference there is produced in front of the discharge opening *e* a dry zone through which the heavier particles will be conveyed out of the surface of the liquid by the worm. The amount of the said difference will determine the width of this zone, and the width of this zone will determine the length of time during which the material will be raised out of the liquid by the worm and thereby practically dried to a certain extent. This length of time may be varied for instance by lengthening or shortening the upper part of the drum, or by varying the area of the outlet or outlets *c*. The operation is the same if the apparatus has a horizontal axis of rotation.

The improved centrifugal apparatus is capable of working continuously after adjustment.

I claim:—

1. In a centrifugal apparatus the combination of a driving shaft; a vertically disposed frusto-conical drum mounted on said driving shaft, said drum having its upper end entirely open and its lower end closed, said closed lower end being provided with a downwardly disposed discharge outlet situated farther from the axis of the drum than the periphery of the open end; a second shaft entering said drum centrally; a skeleton frame, of the same contour as said drum, carried by said second shaft; the periphery of said frame at its lower end being disposed between the wall of said drum and said discharge outlet and at a considerable distance beyond said discharge outlet; and means introducing the material to be treated into said skeleton frame; substantially as described.

2. In a centrifugal apparatus the combination of a hollow shaft; a vertically arranged frusto-conical drum centrally mounted on said shaft, said drum having its upper end entirely open and its lower end closed, downwardly disposed discharge outlets being provided in said closed end; a second shaft passing through said hollow shaft; a skeleton frame secured to said second named shaft, having its longitudinal members parallel to the inner surface of said drum and extending upwardly through the open end of said drum; a spiral conveyer mounted on the outside of said skeleton frame; and means for feeding the material to be treated into the upper open end of the skeleton frame; said downwardly disposed discharge outlets being positioned in a line within said skeleton frame at a point substantially distant from said skeleton frame and at a distance from the axis of said drum farther than the distance from the axis of said drum to the periphery of its upper open end, substantially as described.

In testimony whereof, I have affixed my signature, in presence of two witnesses.

ERNST JAHN.

Witnesses:
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