Dec. 8, 1931. H. G. LYKKEN 1,835,886

MATERIAL CLASSIFYING DEVICE

Filed Dec. 5, 1928

Fig. 2.

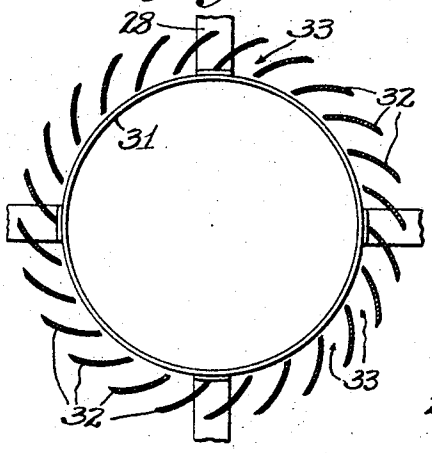

Fig. 1.

Inventor:
Henry G. Lykken
By: Wallace R. Lane
Atty.

Patented Dec. 8, 1931

1,835,886

UNITED STATES PATENT OFFICE

HENRY G. LYKKEN, OF MINNEAPOLIS, MINNESOTA

MATERIAL CLASSIFYING DEVICE

Application filed December 5, 1928. Serial No. 324,030.

The present invention relates to separating or classifying devices for reduced material carried in a moving mass of fluid, whether air, gas, or even a liquid.

Among the objects of the invention are to provide a novel classifier or separator for separating out any given over-size particles of reduced material, whereby any desired particles of given fineness may be retained in the fluid mass and conducted to a locus of use or storage or the like. The separation or classifying is preferably effected in an induced stream of material laden fluid by causing the stream, at a given point, to receive a vorticose movement whereby the larger and heavier particles or granules or the like, will be centrifugally separated from the stream and caused to descend by gravity to a collecting means or to a reducing means for re-reduction. The finer particles are retained in the fluid stream passing out of the device. The degree of fineness of the out-going particles may be varied by varying the rate of the vorticose movement of the stream.

Other objects, advantages, capabilities and features are comprehended by the invention as will later appear and as are inherently possessed thereby.

Referring to the drawings, Fig. 1 is a vertical sectional view of an illustrative embodiment of the invention, and

Fig. 2 is a horizontal sectional view of a part taken in a plane represented by line 2—2 in Fig. 1 of the drawings.

Referring now more in detail to the drawings, the embodiment selected to illustrate the invention is shown in connection with a reducing device comprising a chamber 1, in which is a rotor 2, having impelling arms 3 operating above a bed 4 of material to be reduced. The material is fed from a hopper 5 by a stepped feeder 6 reciprocated by suitable operating mechanism (not shown). The operating mechanism preferably has a feeler 7 engaged by fed material from the hopper such that as the feeler is raised by the fed material, it will control the operating mechanism to reduce the reciprocations of the feeder 6, and when the feeler is lowered by reason of the reduction of the mass of the fed material, it will cause the operating mechanism to increase the reciprocations of the feeder 6. A fluid inlet 8 is provided at the upper part of the chamber 1.

The reducing device has an upper discharge opening 9 communicating with an opening 10 in the lower end of a chamber 11, the lower portion of the chamber 11 having a conical well 12. The upper part of the chamber 11 has a cylindrical wall 13. The upper end of the chamber is provided with a top wall 14, having an opening 15, communicating with a duct 16 leading to an outlet 17, the upper end of the duct 16 being provided with a plate 18.

Within the chamber 11 is telescopically located a chamber section 19, which may be of conical form and having its larger open end uppermost. The lower end of the section 19 has an opening 20 through which extends a hollow cylindrical member or duct 21 having a flared portion 22 which may co-operate with the lower edge 23 of the member 19 so as to define therebetween an annular slot or opening 20 for a purpose later explained. The member 19 is preferably carried by adjusting means comprising screws 24 connected at their lower ends to brackets 25 secured to the inner surface of the member 19. The screws 24 extend upwardly through the wall 14 and are in engagement with hand operated nuts 26 suitably rotatably carried in brackets 27 secured to the wall 14 as shown in Fig. 1. The member 21 may be supported by the member 19 by suitable connecting and supporting brackets 28 secured to both members. The brackets 28 are preferably secured to the duct 21 by bolt and slot connections so that the duct may be vertically adjusted to vary or adjust the size of the slot 20 between the parts 22 and 23.

In telescopic relation with the member 21 is provided a device for causing vorticose movement of the fluid in the separator. This device comprises a plate 30 which may be located opposite the discharge outlet or opening 31 of the member 21. This plate has a series of depending vanes or blades 32 arranged in a circular series around the mem-

ber 21 and enclosing a space within said series and above the outlet 31 of the duct or passage 21 to form a chamber from which the fluid may pass through the ports 33 between the blades or vanes 32.

The vanes or blades are preferably curved as clearly shown in Fig. 2, and are disposed at an angle such that fluid passing between the same will be caused to be projected tangentially and rotated into a vorticose movement or eddy outside of the blade assembly. The device may be supported by means of a rod 34 secured to the plate 30 and passing upwardly through the cover 18, the rod 34 being threaded and engaging in a hand nut 35 whereby the turning of the hand nut 35 will cause the raising or lowering of the vane assembly and thus increase or decrease the effective areas of the ports 33 between the vanes 32.

The upper part of the reducing chamber tapers or converges toward the openings 9 and 10, such parts comprising an inclined wall 36 carrying retard members 37 for retarding the moving mass of material in the chamber and preventing a sliding thereof as the rotor acts thereon. On the opposite side is an inclined wall 38 carrying a number of spaced impact members 39 which may be in the form of cross bars or the like. A ledge or baffle 40 may be provided over a part of the stream of material acted upon by the rotor.

In operation, material is placed in the hopper 5 and is fed by the feeder 6 into the rotor chamber. This material will form a bed 4 in the bottom of the chamber. The rotor operates at a high speed and entrains with it a whirl of air or other fluid used in the device, whereby a vorticose movement of the air is set up over the surface of the bed so as to entrain part of the material and cause the same to move in the form of an eddy about and outside of the rotor.

Centrifugal force or radial stresses are effective through the moving mass of material and fluid so that particles of the materials rub against each other with such radial stresses so as to reduce the material. The reduced material, upon arriving at the upper part of the rotor is cast or projected more or less tangentially some of the material being thrown against the impact bar 39 to be further broken up and to be passed back so as to form a sort of a cloud of the fine material in the fluid. Air is induced by any suitable inducing means connected with the outlet 17 so that the air is drawn through the machine from the inlet 8. Air passes downwardly from the inlet 8 and upwardly through the opening 9 and the projected material therein, as also the cloud formed therein, to carry up the particles. The air or other fluid will cause a rise of particles upwardly through the openings 9 and 10. Particles too heavy to be carried upwardly will be carried downwardly from the bars 39 to the material in the machine to be acted upon again.

The upwardly moving fluid with suspended particles will pass through the passage or duct 21 and into the space beyond the outlet 31 thereof and beneath the plate 30. The path will then be diverted toward the side to pass through the openings or parts provided between the vanes 32. The vanes 32 are so positioned as to direct the stream tangentially so as to cause a whirl or vorticose movement of the mass in the chamber surrounding the blade assembly. Inasmuch as the induce movement of the fluid will cause an upward movement of the mass as a whole, this whirl or vorticose movement will rise gradually and the fluid with the finer particles will pass out through the opening 17 to a place of use or storage. As the mass is diverted and whirled or rotated in the chamber, the heavier and larger particles wil be cast radially toward the outer walls of the chamber, and they will collect upon and course down the incline wall of the member 19 toward the outlet 20. The opening 20 forms a sort of trap for the material which will pass over the flared portion 28 and fall into the reducing chamber.

The centrifugal action of the material laden fluid may be varied either in accordance with the suction effective through the discharge opening 17 or by varying the effective size of the ports 33 between the vanes 32. When a given amount of air or other fluid is to be passed through in a given interval of time, the variations mentioned are effected by varying the port area. Decreasing the port area increases the tangential velocity and the centrifugal action, and hence, there is a greater amount of throw-out of the particles to be separated. In this case, the particles carried by the fluid to the discharge outlet 17 will be finer. Conversely when the port area is increased, the tangential velocity and centrifugal action will be decreased and the particles carried out by the fluid will not be so fine. The greater the centrifugal action, the finer will be the product passing out with the fluid and conversely the less the centrifugal action, the less fine will be the product passing out with the fluid.

The variations above described or mentioned, may be effected by either raising and lowering the blade assembly or by raising or lowering the section 19 and duct 21, so as to increase or decrease the areas of the ports 33. If it be desired to vary the volume of the space in the upper part of the chamber and above plate 30, the adjustment may be made by raising and lowering the blade assembly only. If that space is to be maintained, then the variation is effected by low-

ering or raising the member 19 and the connected member 21 so as to increase or decrease the effective port areas. The effect on the final product may be thus changed by having more or less volume of space for the material to pass through in the upper part of the chamber 11.

While I have herein described and upon the drawings shown an illustrative embodiment of the invention, it is to be understood that the latter is not limited thereto but may comprehend other constructions, details, arrangements of parts and features without departing from the spirit thereof.

Having thus disclosed the invention, I claim:

1. A material classifier comprising a chamber having an outlet, a duct extending into said chamber and for conducting a material laden fluid stream into said chamber, a baffle opposite the outlet of said duct and spaced therefrom to provide a port for lateral flow of said fluid into said chamber, means for adjusting the relation of said baffle and said duct, means for causing a rotation of said fluid in said chamber, the walls of said duct and said chamber forming a trough therebetween for reception of separated particles of material, and the lower end of said trough having an opening for discharge of said particles.

2. A material classifier comprising a chamber provided with telescopic chamber sections, telescopic duct sections extending into said chamber, one of said duct sections having tangential outlets for directing material laden fluid passing through said duct into a vorticose movement in said chamber.

3. A material classifier comprising a chamber having an inlet and an outlet, a chamber section positioned in said chamber, a duct supported by said chamber section and in spaced relation thereto, so as to provide an annular slot between them, the lower end of said duct being positioned adjacent to said inlet, tangential vanes positioned adjacent to the inner end of said duct and exteriorly thereof for directing the flow of material laden fluid tangentially from the duct into the chamber, and means for axially adjusting said chamber section and the duct carried thereby with respect to said vanes, so as to vary the tangential velocity imparted to the material laden fluid by said flow directing means.

4. A material classifier comprising a chamber having an inlet and an outlet, a duct positioned within said chamber with its lower end opposite said inlet, vanes positioned within said chamber and enclosing the outlet end of said duct directing the flow of material laden fluid tangentially from said passage into said chamber, so as to impart a vorticose movement to said fluid, adjustable suspension means for said duct depending from the top of said chamber, and other adjustable suspension means for said vanes, so that either or both of said duct and said vanes may be adjusted each with respect to the other.

5. A material classifier comprising a chamber having an inlet and an outlet, a chamber section suspended in said chamber, a duct supported by said chamber section and having a lower flared end portion in spaced relation thereto so as to form a trough between them, said trough having an opening for discharge of material entering said trough, flow directing vanes arranged in telescoping relation with respect to the inner end of said duct so as to direct the flow of material laden fluid tangentially from the duct into said chamber, and means for raising or lowering said chamber section, so as to vary the extent of overlap between said duct and said vanes.

6. A material classifier comprising a chamber having an outlet, a chamber section, adjustable rods suspended from the top of said chamber and supporting said chamber section, a duct supported by said chamber section adjacent to said inlet, means positioned adjacent to the inner end of said duct and exteriorly thereof for directing the flow of material laden fluid tangentially from the duct into said chamber, and means for adjusting said rods so as to change the relative positions of said duct and said fluid directing means.

7. A material classifier comprising a chamber having an outlet, a chamber section forming the inlet of said chamber and having a lower opening, a duct concentrically disposed with respect to said opening and having an inlet end depending below the same so as to provide an annular space between them, means for axially adjusting the duct with respect to said chamber section so as to vary the size of said opening, means positioned adjacent to the outlet end of said duct and exteriorly thereof for directing the flow of material laden fluid tangentially from the duct into the chamber, and means for adjusting the position of said chamber section so as to vary the relation between said duct and said flow directing means.

In witness whereof, I hereunto subscribe my name to this specification.

HENRY G. LYKKEN.