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1,994,049

SORTER OR SEPARATOR

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Fig. 1.

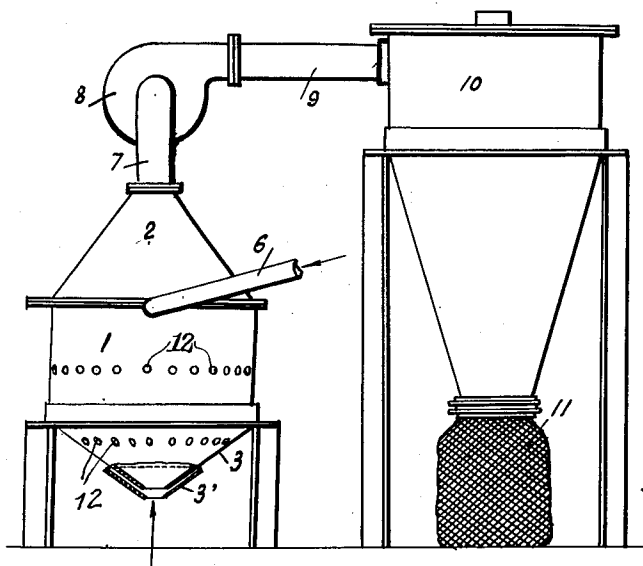


Fig. 2.

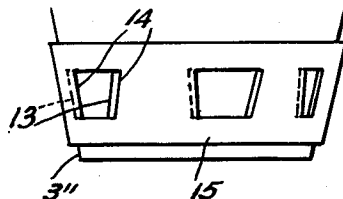
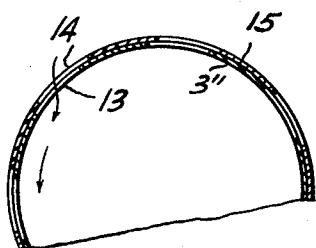


Fig. 3.



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SORTER OR SEPARATOR

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2 Claims. (Cl. 209—144)

This invention concerns a sorter or separator more particularly designed for the separation of elements of different weights or volumes forming any substance. It may likewise be applied to the separation of elements suspended in a fluid or of particles originating from a furnace, a crusher or from any other machine.

The apparatus pursuant to the invention consists essentially of two cones, opposed by their bases and separated by a cylindrically shaped body.

An oblique or horizontal pipe to feed the material whose elements it is desired to separate, opens tangentially into the cylindrical member or at the apex thereof, at the base of the upper cone.

A discharge pipe connects the apex of the upper cone with the suction side of a ventilator.

The apex of the lower cone is open to the outside air and allows the air required by said ventilator to enter by depression.

Material tangentially fed into the middle cylindrical portion of the apparatus is fed therein together with a certain quantity of air normally under pressure. This air, charged with material, imparts a strong rotatory motion to the column of air circulating upwards in the apparatus. This produces a centrifugal action upon the matter suspended and the larger or heavier particles which are subjected to gravity gain within the cylindrical portion where the speed of the air is lowest, a falling velocity much greater than that of the lighter particles. Likewise, in spite of the braking effect of the ascending air stream and in view of their weight, said larger or heavier particles can drop towards the apex of the lower cone, through which they are discharged. The finer or lighter particles, on the other hand, undergo complete braking action before a portion of them and a portion only, reaches the apex of the lower cone, where they are caught up by the secondary air stream fed to the apex of said cone by the effect of the ascending depression which the suction of the ventilator creates within the apparatus. A portion of said fine or light particles does not descend to the bottom of the apparatus but is caught in the ascending motion of the depression, immediately upon entering the apparatus or whilst dropping.

Heavier or coarser material cannot be carried by said ascending current of air for the reason that to do so it would have to rise in a space where the upward speed of the air decreases, owing to the inverted conical shape of

the lower portion of the apparatus. Light or fine particles alone can rise in said stream of ascending air, which draws them towards the apex of the upper cone whence they are discharged.

It is to be noted that the depression which thus acts downward in the apparatus, is at its maximum axially to the same for the reason that such axis is within the extension of the suction side of the ventilator and it is along this line that the fine or light particles gather, since they are less sensitive to centrifugal action and more responsive to the effect of the ventilator.

A double action is therefore at work within the apparatus:

(1) the dispersal of large particles towards the periphery by centrifugal action and the concentration of light particles at the centre, whereby horizontal separation is attained;

(2) vertical upward depression, the effect of which is especially strong at the centre of the apparatus and which brings about the separation of the particles.

In other words, particles are sorted horizontally by centrifugal effect, rotation being due to the injection of air under pressure and the separation takes place vertically, owing to a depression due to the suction of secondary air through the apex of the lower cone and through the apparatus.

The function of the upper cone is to avert any abrupt dragging of the material, such as would take place if the suction pipe of the ventilator were connected directly with the cylindrical member. The material is in contact here with a zone of maximum suction (base of the upper cone) which tapers progressively upwards and no excessively rapid upward suction can therefore take place, calculated to impair the sorting of the material.

The volume of secondary air admitted through the apex of the lower cone must be regulated proportionately to the work required, since the capacity of the effect of depression to carry along the particles of matter in effect depends upon the supporting power of the air stream used in the apparatus and this is, in a great measure, a function of the volume of secondary air fed through the apex of the lower cone.

Regulation of the quantity of secondary air admitted through the apex of the lower cone may, for example, be effected by one or a plurality of additional cones arranged so as to extend, more or less, the lower cone of the apparatus, or by any other suitable means.

Attached drawing exemplifies without limiting the same, in diagrammatical form a separator pursuant to the invention.

In the drawing:

Fig. 1 shows a side elevation of a separator constructed in accordance with the invention.

Fig. 2 is a side elevation of a portion thereof showing a modification.

Fig. 3 is a horizontal section taken through the device of Fig. 2.

As shown in the drawing, the apparatus consists essentially of a cylindrical chamber 1 joining two conical members 2, 3, the bases of which are opposed each to the other.

Material, whose elements are to be separated, is fed by duct 6 connected with a crusher (not shown) or any other machine (gas generator etc.) and said duct enters the separator either obliquely downward, as exemplified in the drawing, or horizontally.

In either case, the end of the duct opens substantially at the intersection of cylindrical chamber 1 and its upper conical portion 2. The latter is extended at its apex by discharge pipe 7 for the light or small particles, said pipe connecting with the suction side of ventilator 8, whose pressure side is connected, by tube 9, with chamber 10 where said particles are collected, in a bag 11 of filter-cloth, for instance.

Delivery pipe 9 may, of course, equally well open into a hearth or at any other spot to which it is desired to discharge the fine particles.

The lower cone 3 is open at its apex to the outside air.

The apparatus functions as previously explained.

The secondary air admitted by the apex of cone 3 may be regulated by varying the size of the aperture therein, for example by means of additional cones which more or less extend the original cone, whose apex exhibits the maximum aperture which may be varied as desired by fitting thereon the additional cone whose apex has the desired opening. The advantage of this arrangement is that it does not impede the circulation of material. Use may likewise be made of an additional cone 3 having a minimum aperture and also longitudinal slots 13 which may be closed by means of movable shutters 14 forming slots in an outer movable cone 15, whereby a variable opening can be obtained. Care should be taken, however, that the ingress of air through said shutters is in the same direction as the direction of rotation of the air within the apparatus. This device aims at obviating the need for a plurality of cones. Use may lastly be made of a conical cover piece, movable as desired as to height, placed below and some distance from the aperture of the lower cone of the apparatus, said cover-piece being arranged to leave between its walls and said aperture a space of lesser or of greater size for the passage of air.

If, as shown in the drawing, it is desired to reduce the section of the air admission aperture of cone 3, the latter is extended by means

of an additional cone 3' whose apex has the required size of inlet and which is interchangeable with another desired cone.

Said additional cone may likewise be a variable inlet cone suited to be regulated by means of shutters, as stated above.

If desired, the wall of the lower cone might be drilled, together with that of the cylindrical member, with holes of a diameter preferably not exceeding 1 m/m as at 12.

The effect of the general depression prevailing in the apparatus is to cause a slight return of air to take place inwards through these holes, such returns of air serving to propel horizontally towards the interior of the apparatus the light or fine particles driven towards the wall of the cone amongst the heavy or coarse particles and thus to bring the former back to the influence of the central depression, by means of which they may then be drawn upwards with the rest.

I claim:

1. A classifier of the character described, comprising a cylindrical member the interior of which is unobstructed, a pair of outwardly directed cones one at each end of the cylindrical member and forming therewith a classifying chamber converging at its opposite ends, means for tangentially introducing material into said chamber substantially at the upper end of the cylindrical member and at the base of the upper cone for obtaining a horizontal centrifugal separation of the fine and coarse particles comprising the material, said lower cone having its apex open to form an outlet for the coarse material and an air inlet for creating a vertical draft and further separation of the particles while subjected to the horizontal separation, and suction means applied at the upper end of the upper cone for creating said vertical draft and for carrying off the fine particles of the material.

2. A classifier of the character described, comprising a cylindrical member the interior of which is unobstructed and having openings therein for the admission of air, a pair of outwardly directed cones at each end of the cylindrical member and forming therewith a classifying chamber converging at its opposite ends, means for tangentially introducing material into said chamber substantially at the upper end of the cylindrical member and at the base of the upper cone for obtaining a horizontal centrifugal separation of the fine and coarse particles comprising the material, said lower cone having its apex open to form an outlet for the coarse material and an air inlet for creating a vertical draft and further separation of the particles while subjected to the horizontal separation, suction means applied at the upper end of the upper cone for creating said vertical draft and for carrying off the fine particles of the material and an interchangeable conical valve applied at the outlet of the lower cone and having a smaller opening than said outlet.

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