March 1, 1938. R. M. GAY 2,109,478

AIR SEPARATOR

Original Filed Sept. 19, 1928

FIG. 1

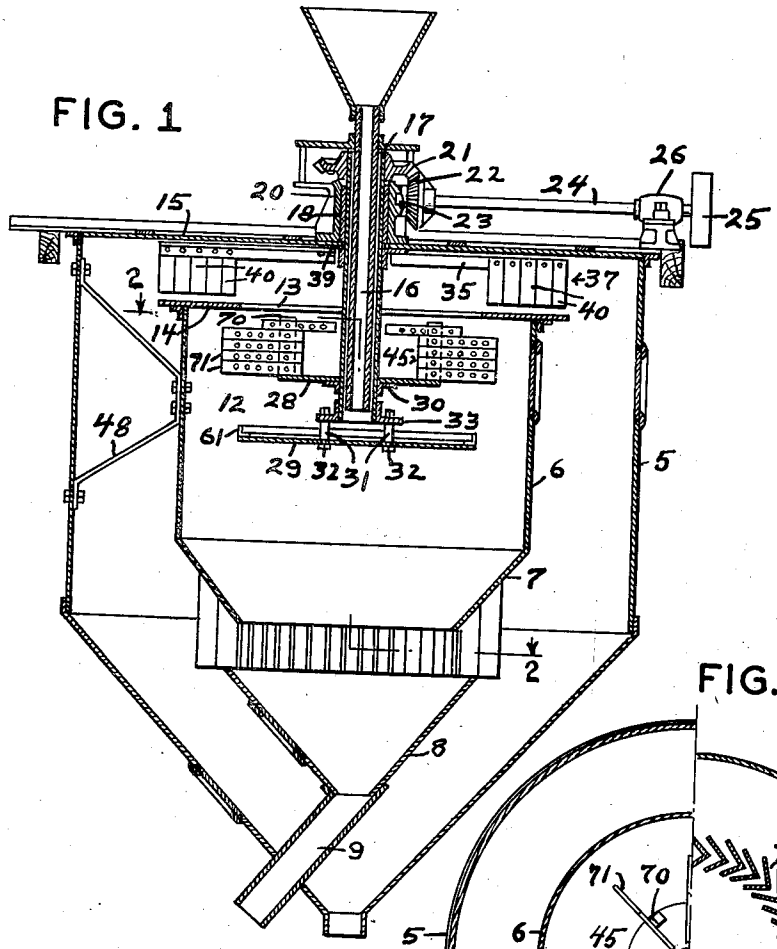


FIG. 2

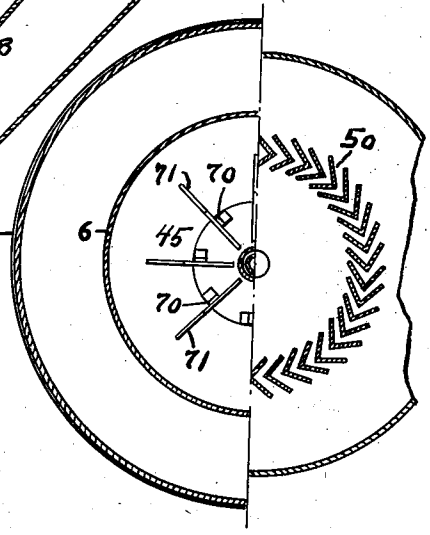
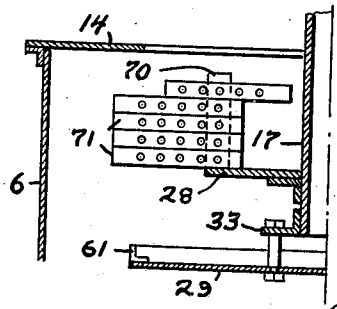


FIG. 3



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UNITED STATES PATENT OFFICE

2,109,478

AIR SEPARATOR

Rubert M. Gay, deceased, late of Boonton, N. J., by Elsa Katherine Gay, executrix, Brightwaters, N. Y., assignor to Universal Road Machinery Company, Kingston, N. Y., a corporation of New York

Original application September 19, 1928, Serial No. 306,936. Divided and this application August 9, 1934, Serial No. 739,069

10 Claims. (Cl. 209—139)

This invention relates to improvements in machines for separating, grading or classifying small particles of solid material and relates particularly to that type of machine in which the particles to be graded are fed into a separating chamber, are suspended in an upwardly moving air current and caused to rotate by fans within the chamber, which rotation creates a centrifugal effect, causing the heavier particles to be thrown out against the inner wall of the chamber down which they settle and pass from the bottom thereof through a suitable discharge opening while the lighter particles are carried by the circulating air up and out of the chamber; this method of sizing having been invented by Rubert M. Gay as disclosed in his Patents Nos. 1,457,110 and 1,517,900.

The present application is a division of the application of Rubert M. Gay Serial Number 306,936, filed September 19, 1928.

The object of this invention is to provide a separator of novel, simple and efficient construction having provision for rotating the air which passes through the separating chamber in a manner to cause the rejection by centrifugal action of the "tailings", heavier, or undesirable particles suspended in the circulating air current as it passes upwardly through the separating chamber.

Another object is to provide an air separator wherein the air is caused to rotate within a separating chamber and to pass through a centrifugal device for increasing the separating action and so arranging this centrifugal device that substantially all of the air will be caused to pass therethrough, producing a more uniform result and efficient action.

Another object is to so arrange a fluid separator that the separating action which may ordinarily be caused by the rotation induced by the centrifugal fan may be accentuated and increased by an additional centrifugal effect produced by the currents of the air passing through the fans or revolving blades and the like so that the effect of the fans will be augmented to further counteract the effect of the apparatus designed to cause the ascending flow of air, producing an increased differential effect between the two counteracting influences but with the upward influence predominating.

Another object of the invention is to provide simple means to vary the amount of rotation imparted to the circulating air column thereby changing the centrifugal effect on the particles in suspension and varying the weight of the particles rejected.

A still further object is to provide means for introducing finely divided particles within a separator of the class above referred to and utilizing means for distributing these finely divided particles in the form of a rotating distributor plate having flanges or upturned projections thereon so arranged as to cause an upward deflection of the particles thus securing a better distribution of said particles.

Other and ancillary objects of the invention will appear hereinafter.

In the accompanying drawing which illustrates the invention—

Fig. 1 is a central vertical sectional view through a separator embodying the invention;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary enlarged axial section showing a portion of the separating chamber and fan therein, of the apparatus of Fig. 1.

Referring now more particularly to the drawing, the casing 5 consists of a cylindrical upper portion and a tapered or conical lower portion. Within the outer casing is the inner structure consisting of the casing 6 having a tapered or conical outlet 7 and a second tapered or conical portion 8, called the "tailings cone". This cone 8 terminates in the outlet passage 9 which may be connected to any desired receptacle, bin or container. The discharge of the coarser particles or "tailings" occurs through this passage 9.

The upper casing 6 encloses the separating or classifying chamber 12, its open bottom providing an inlet for air and the outlet for "tailings", and the top opening 13 providing an outlet for air and for the "fines" carried by the air.

The material to be separated or classified is fed into the chamber 12 through a feed pipe 16 which extends centrally through the top cover 15 of the outer casing 5 and through a hollow shaft 17, which also extends through the cover 15. The hollow shaft 17 is mounted in a bearing 18 carried by a hollow casing 20 which is mounted on the top cover 15 of the casing 5. The shaft 17 is provided with a bevel gear wheel 21 in mesh with a similar wheel 22 which turns in bearings 23 mounted in the bracket 20. The shaft 24 rigidly connected to gear 22 is provided with a pulley or other driver 25 and supported by an outer bearing 26.

The shaft 17 carries two round horizontally disposed discs or plates 28 and 29 within the separating chamber rigidly connected thereto and spaced the requisite distance apart, the upper

plate 28 being carried by a flange or a collar 30 and the lower plate 29 carried by the shaft 17, spaced from the end thereof by means of spacers 31 and bolts 32 secured to flange 33. The upper plate 28 may be arranged in a well known manner so as to be adjustable in a vertical direction as by threadedly securing the flange to which it is fastened and locking it in place with lock nuts.

The structure described above, is the same in a great many respects as that indicated in previous patents of Rubert M. Gay Nos. 1,457,110 and 1,517,900. The general functioning of the parts just described is substantially the same and the present devices operate for the same purposes but with improved or additional features to be described.

Above the upper plate 14 of the inner casing 6 there is arranged the fan 37 having blades each comprising the arms 35 to which the sections 40 are secured, the arms 35 being bolted or otherwise removably secured to a flange or flanges 39 fixed to the shaft 17. The blade sections 40 are adjustably or removably attached thereto. It is desirable to have the fan 37 substantially fill the space between the top 14 of casing 6 and the top 15 of the outer casing 5.

Upon the upper horizontal or baffle plate 28 are mounted the vanes of a fan, each vane comprising an upright 70 fixed upon the plate 28 to which are bolted the vane sections or plates 71 movable in and out, toward and away from the shaft, and secured in any desired position by reason of a series of holes in each section which respectively come into registry with a hole in the upright 70 in the different positions of adjustment so that the section may be bolted in its position to the upright, and so secured in the position. It will also be observed that the sections 71 are independently movable and removable.

As illustrated in Figs. 1 and 3 one of the fan sections (the uppermost) is secured at a position inward of the other sections which are extended outward to their limit, and it will be apparent that any and all of these sections may be adjusted at positions varying in distance from the shaft as may be desired to cause the desired operation. It will be observed that the adjustment of the sections inwardly and outwardly permits the diameter of the fan to be decreased or increased so that the diameter of the fan may be extended outwardly and beyond the edges of the opening 13 in the plate 14, or the diameter of the fan may be lessened so that its outer extremity is within the edge of the hole 13, or the sections may be variously adjusted so that some will extend outside the edge of the hole while others are within that edge.

The inner casing 6 is supported by means of brackets 48 and the lower or conical portion 7 of the casing 6 is attached thereto. A circular series of vertically arranged, spaced V-shaped baffles is positioned between the conical portion 7 and the "tailings cone" 8 on which they may depend for support. This "tailings cone" 8 may be anchored or secured in any desirable manner to the lower portion of the outer casing 5 such as by means shown in the previous patent of Rubert M. Gay No. 1,517,900 referred to. These baffles are more clearly shown in Fig. 2 and consist of V-shaped elements 50 with their vertices all in one direction and arranged in a circular path, pointing in a direction opposite to that in which it is desired to rotate the fans above referred to. The arrangements and spacing of the various blades or vanes of the fan 45 together with the baffle 28 are also clearly shown in this figure.

In order to maintain a more efficient distribution of the particles which may be fed through the pipe 16, an upturned flange 61 of angular or other section may be arranged near or at the outer edge of the distributing plate 29. This flange acts to produce an upward thrust on the materials fed onto the plate 29 thereby maintaining a better distribution and a more efficient action of separation of the particles.

Manholes or handholes may be provided in the various casings 5 and 8 in the usual manner to provide access to the inner parts for purposes of adjustment, removal and variation of position of the sections on the blades of the fans. These manholes could well be located in the upper plate 15 for purposes of adjustment of fans 37 and 45 or through the side 5 of the outer casing as well as through the casing 6 closely adjacent thereto, in order to more readily adjust and vary the number of sections on the fan 45. However these adjustments might readily be made prior to assembling of the apparatus at the factory and arranged in a predetermined manner for accomplishing most sucessfully the work for which the type of separator specified is desired to be accomplished.

In operation, the materials to be separated are fed through the feed pipe 16, the rotating element having been set in motion by a suitable driving means connected to the pulley 25. The rotation of the fan 37 causes a draft of air outwardly through the path described by this fan, sucking the air inwardly through the baffle 50 upwardly through the separting chamber and classifying zone 12 from the lower portion of this chamber through the opening 13, and then downwardly between the casings 5 and 6 in a substantially complete circuit. The rotation of the fan 45 causes a counteracting influence and produces a centrifugal action which is opposing and differential to that produced by the fan 37, said centrifugal action causing a separating of the heavier particles from the lighter suspended in the air within and surrounding the path described by this fan. The rotation of the lower plate 29 causes an outward force to be applied upon the material introduced thereon by the pipe 16, forcibly throwing it outwardly, striking the upward projection 61 in such a way as to toss the materials into the air giving them a considerable upward thrust. This upward thrust causes the particles to be more uniformly distributed in the rising and rotating air current causing a more rapid segregation of the particles of various sizes under the influence of the centrifugal force induced by the fan 45.

The heavier particles being acted on more strongly by centrifugal force than the lighter ones, reach the inner wall of the separating chamber 6 down which they slide falling off the lower edge of cone 7 (passing through the incoming air current) passing down through the tailings cone 8 and out through pipe 9.

The lighter material or "fines" remaining in the upwardly moving air current passes inwardly through the fan 45, upwardly through the opening 13 back through the fan 37 into the space between casings 5 and 6 and then the air cleared of fines reenters the separating chamber.

Inasmuch as the baffles 50 are arranged to tend to throw outwardly particles striking against them according to the rotation given these particles by the rotating fan blade, a more complete separation is thereby produced and the smaller particles or "fines" which are rotated downwardly, by the fan 37, between the casings 5 and 6 and through the lower portion of the casing 5 to be

drawn off at the bottom thereof, are less likely to be drawn inwardly through the baffle 50 on account of this arrangement of parts.

The sinuous passages through the baffles change the direction of the air currents passing therethrough thereby causing most of the fines still suspended in the air to fall out of the air current.

It is apparent that the classifying zone 12 comprising the space above the distributor plate 29 and below the top plate 14 of the separating chamber allows the particles to segregate in the rotated air current and the baffle 28 will cause all of the upwardly rising air to pass between it and the casing 6 adjacent the outer periphery of the fan 45 in such a way that substantially all of this air will necessarily pass between the blades of the fan.

The passage of the air in a substantially horizontal direction thereby improving the classifying effect, inasmuch as the particles in suspension will receive an intensified centrifugal action within the fan path causing a further classification and the remaining heavier particles will be thrown outward while the lighter particles will remain in the air current and are drawn out through opening 13.

When it is desired that different degrees of fineness, of the particles to be separated out, be acquired, the various sections 71 of the fan blades as well as of the blades of fan 37 may be varied, adjusted or removed accordingly so that the different velocities of air and different intensities of rotation may be maintained in the different portions of the circuit through which the air circulates. Also the baffle plate may be varied in position to vary the classifying zone above it.

This construction, together with the other features indicated herein cooperate to provide a completely operable, easily adjustable separator, having a wide range of uses and not open to the objectionable features which have heretofore been present in previous types of separators.

While the invention has been illustrated in what is considered its best application, it may have other embodiments without departing from its spirit and is not, therefore limited to the structures shown in the drawing.

What is claimed is:

1. In an air separator, the combination with a separating chamber having inlet and outlet openings, a rotatable shaft extending centrally into the chamber, a distributor spaced from the outlet a suitable distance to provide a sizable classifying zone between, a device in said zone, and separately movable vane sections secured to said device and displaced longitudinally of said shaft with relation to each other to adjust the classifying effect in the said classifying zone upon particles of material in the air current, means to connect the device and distributor to the shaft, means to cause a current of air to circulate through the chamber, means to feed particles of material on to the distributor and means to rotate the shaft.

2. In an air separator, the combination with a separating chamber having inlet and outlet openings, a rotatable shaft extending centrally into the chamber, a distributor spaced from the outlet a suitable distance to provide a sizable classifying zone between, a device in said zone and separately movable vane sections secured to said device, said sections being radially displaced to different distances from said shaft and also displaced with relation to each other longitudinally of said shaft to adjust the classifying effect in said zone upon particles of material in the air current, means to connect the device and distribution to the shaft, means to cause a current of air to circulate through the chamber, means to feed particles of material to the distributor and means to rotate the shaft.

3. In an air separator, the combination with a separating chamber having inlet and outlet openings, a rotatable shaft extending centrally into the chamber, a distributor spaced from the outlet a suitable distance to provide a sizeable classifying zone between, a device in said zone and separately movable vane sections secured to said device and displaced longitudinally of said shaft with relation to each other, said vane sections being adapted to be attached or detached to vary the classifying effect in the said classifying zone upon particles of material in the air current, means to connect the device and distributor to the shaft, means to cause a current of air to circulate through the chamber, means to feed particles of material on to the distributor and means to rotate the shaft.

4. In an air separator, the combination with a separating chamber having inlet and outlet openings, a rotatable shaft extending centrally into the chamber, a distributor spaced from the outlet a suitable distance to provide a sizeable classifying zone between, a device in said zone, separately movable vane sections secured to said device, said sections being radially displaced to different distances from said shaft and also displaced with relation to each other longitudinally of said shaft, said vane sections being adapted to be attached or detached to vary the classifying effect in said zone upon particles of material in the air current, means to connect the device and distributor to the shaft, means to cause a current of air to circulate through the chamber, means to feed particles of material to the distributor and means to rotate the shaft.

5. In an air separator, the combination with a separating chamber having inlet and outlet openings, a rotatable shaft extending centrally into the chamber, a distributor plate secured to said shaft and spaced from the said outlet opening a suitable distance to provide a sizeable classifying zone between, separately movable vane sections in said zone secured to said shaft and displaced longitudinally of said shaft with relation to each other, a baffle plate in said zone between said distributor plate and said outlet opening and secured to said shaft, said vane sections being adapted to be attached or detached to vary the classifying effect in said zone upon particles of material in the air current, means to cause a current of air to circulate through the chamber, means to feed particles of material on to the distributor plate and means to rotate the shaft.

6. In an air separator, the combination with a separating chamber having inlet and outlet openings, a rotatable shaft extending centrally into the chamber, a distributor plate secured to said shaft and spaced from the said outlet opening a suitable distance to provide a sizeable classifying zone between, separately movable vane sections in said zone secured to said shaft and radially displaced to different distances from said shaft and also displaced with relation to each other longitudinally of said shaft, a baffle plate in said zone between said distributor plate and said outlet opening and secured to said shaft, said vane

sections being adapted to be attached or detached to vary the classifying effect in said zone upon particles of material in the air current, means to cause a current of air to circulate through the chamber, means to feed particles of material on to the distributor plate and means to rotate the shaft.

7. In an air separator, the combination with a separating chamber having inlet and outlet openings, a rotatable shaft extending centrally into the chamber, a distributor plate secured to said shaft and spaced from the said outlet opening a suitable distance to provide a sizeable classifying zone between, separately movable vane sections in said zone secured to said shaft and displaced longitudinally of said shaft with relation to each other, a baffle plate between said distributor plate and said vane sections and secured to said shaft, said vane sections being adapted to be attached or detached to vary the classifying effect in said zone upon particles of material in the air current, means to cause a current of air to circulate through the chamber, means to feed particles of material on to the distributor plate and means to rotate the shaft.

8. In an air separator, the combination with a separating chamber having inlet and outlet openings, a rotatable shaft extending centrally into the chamber, a distributor plate secured to said shaft and spaced from the said outlet opening a suitable distance to provide a sizeable classifying zone between, separately movable vane sections in said zone secured to said shaft and radially displaced to different distances from said shaft and also displaced with relation to each other longitudinally of said shaft, a baffle plate between said distributor plate and said vane sections and secured to said shaft, said vane sections being adapted to be attached or detached to vary the classifying effect in said zone upon particles of material in the air current, means to cause a current of air to circulate through the chamber, means to feed particles of material on to the distributor plate and means to rotate the shaft.

9. In an air separator, the combination with a separating chamber having inlet and outlet openings, a rotatable shaft extending centrally into the chamber, a distributor plate secured to said shaft and spaced from the said outlet opening a suitable distance to provide a sizeable classifying zone between, separately movable vane sections in said zone secured to said shaft and displaced longitudinally of said shaft with relation to each other, a baffle plate between said distributor plate and said vane sections and secured to said shaft, said baffle plate being of a radius at least as great as the distance of the outermost point of said sections from the shaft center, said vane sections being adapted to be attached or detached to vary the classifying effect in said zone upon particles of material in the air current, means to cause a current of air to circulate through the chamber, means to feed portions of material on to the distributor plate and means to rotate the shaft.

10. In an air separator, the combination with a separating chamber having inlet and outlet openings, a rotatable shaft extending centrally into the chamber, a distributor plate secured to said shaft and spaced from the said outlet opening a suitable distance to provide a sizeable classifying zone between, separately movable vane sections in said zone secured to said shaft and radially displaced to different distances from said shaft and also displaced with relation to each other longitudinally of said shaft, a baffle plate between said distributor plate and said vane sections and secured to said shaft, said baffle plate being of a radius at least as great as the distance of the outermost point of said sections from the shaft center, said vane sections being adapted to be attached or detached to vary the classifying effect in said zone upon particles of material in the air current, means to cause a current of air to circulate through the chamber, means to feed particles of material on to the distributor plate and means to rotate the shaft.

ELSA KATHERINE GAY,
Executrix of the Last Will and Testament of Rubert M. Gay, Deceased.