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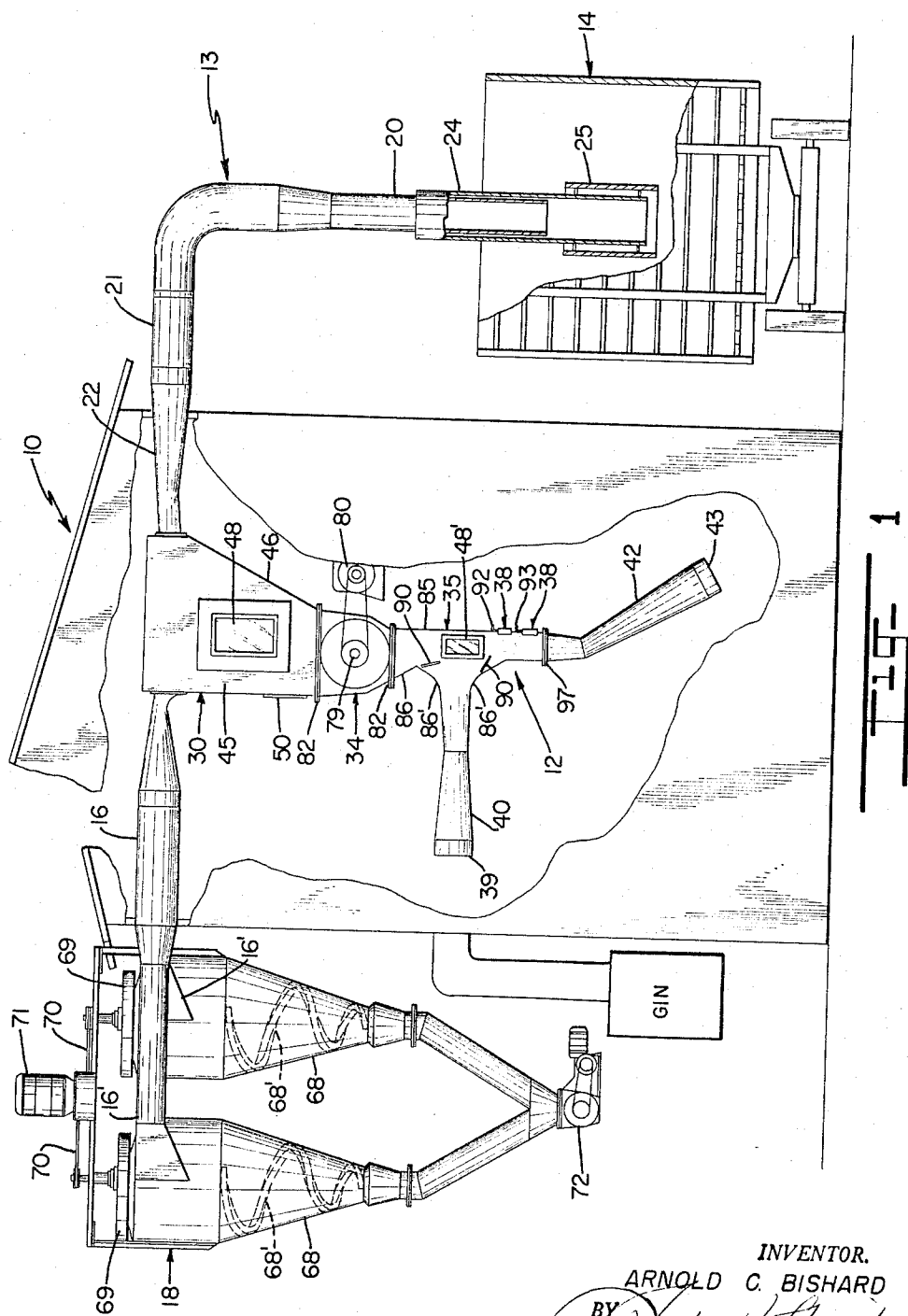
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COTTON CLEANING METHOD AND APPARATUS

Filed March 12, 1962

2 Sheets-Sheet 1



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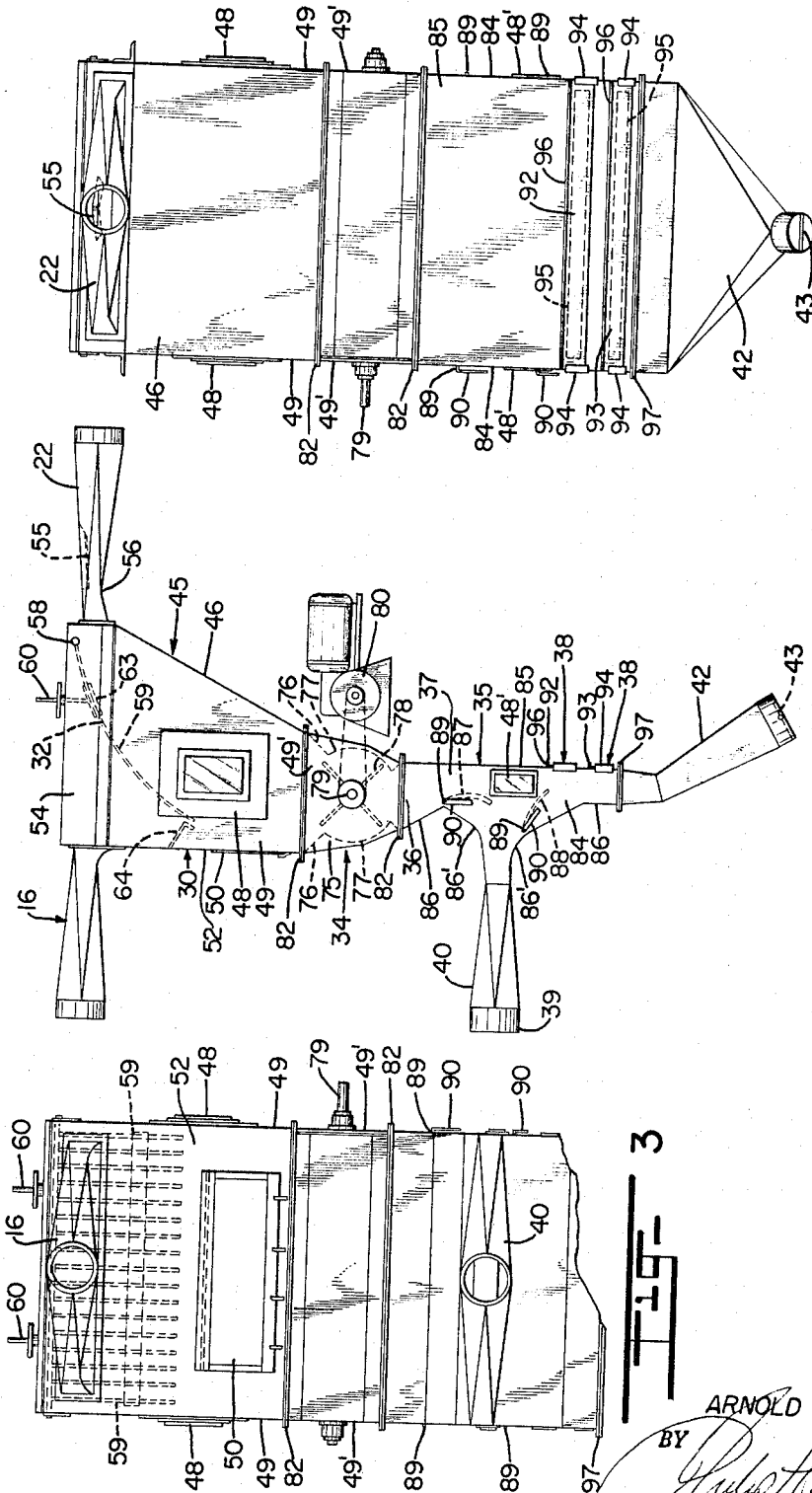


Fig. 4

Fig. 2

Fig. 3

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COTTON CLEANING METHOD AND APPARATUS

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This invention relates to a new and useful method and apparatus for separating materials, and has more particular relation to a pneumatic separating apparatus using energy dissipation principles to clean and generally prepare cotton, especially short staple cotton, for ginning.

The need for an improved method and apparatus of the type to be described is of increasing significance because of the trend toward automation in cotton harvesting and the consequent inclusion in the picked cotton of undesirable materials such as dust, dirt, sticks, sand, excessive foliage and stems, rocks, green bolls, various stages of maturing cotton, wire, and wood splinters. Short staple cotton, when harvested with a stripping machine, contains a considerable percentage of these undesirable materials which wear out machine parts, elbows, fans, scrolls, and other equipment through abrasion. Dust, sand and rocks also wear out the ginning machines. As a result, the foregoing method and apparatus has been devised to reduce this wear by removing most of the undesirable materials and to materially increase the capacity of ginning machines.

It is therefore a principal and foremost object of the present invention to provide for an improved method and apparatus which is adaptable for use in classifying, cleaning, sorting or separating materials according to size and weight, and to do so in a highly efficient manner using simplified equipment.

It is another object of the present invention to provide for the preliminary removal of more than 90% of all dirt, sand and excessive trash from cotton, thereby reducing wear and replacement on elbows, fans, ducts and other equipment in the cotton gin; and in doing so, to substantially improve the quality and performance of the ginning operation.

It is a further object to make provision for a two-stage method and apparatus to effect the removal of foreign particles from cotton bolls and in such a way that the cotton expands, becomes fluffed and segregated for introduction into the cotton gin in an improved condition.

It is an additional object of the present invention to provide for the novel and efficient removal of loose foreign particles from cotton bolls, prior to delivery into a cotton gin, by passage through a succession of isolated air-separation stages or zones in a continuous manner and employing a minimum number of moving parts.

In accordance with the present invention, staple cotton material is introduced into a first separation zone whereby relatively light foreign particles in the material are entrained in a continuously moving high velocity air stream for removal from the zone; the main stream of material is then advanced through a next separation zone, isolated from the first zone, in which a counter-current of relatively low velocity air flow is established to deflect the cotton in an expanded state and divert it from its original course for removal from this zone into the ginning machinery; and in this second zone the heavier, foreign particles are separately collected for removal. The entire process is continuous and, by isolation of the zones from one another, the material can be separately but continuously treated before delivery into the cotton gin, thus to substantially improve the quality and capacity of the entire operation.

The above and other objects, advantages and features

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of the present invention will become more readily understood from the following detailed description taken together with the accompanying drawings, in which:

FIGURE 1 is a view in elevation of a preferred form of cotton separator installation, in accordance with the present invention;

FIGURE 2 is a front, detailed view of a preferred form of cotton separation apparatus; and

FIGURES 3 and 4 are side elevational views of the preferred form of apparatus shown in FIGURE 2.

Referring in more detail to the drawings, there is shown by way of illustrative example in FIGURE 1 an entire cotton ginning installation in which a cotton gin is represented at 10. A cotton separator assembly 12 is illustrated as being housed within the cotton gin 10 with an inlet portion 13 projecting through the housing for withdrawal of cotton from a trailer 14. On the side opposite the inlet portion 13 a dust outlet 16 projects horizontally through the opposite side of the housing into connected relation with a dust collector assembly 18, all of which form a part of the cotton separator assembly 12.

The inlet portion 13 is more specifically formed of a relatively long, elbow-shaped conduit including a vertical length 20, a horizontal length 21 and a diffuser 22 leading into the assembly proper. At the lower extremity of the vertical length 20, a dual intake section is defined by a pick-up tube 24 positioned for slidable telescoping movement on the length 20 and a lower, spaced outer concentric air intake tube 25. In this manner, the dual intake is adjustable according to the level of cotton in the truck or other supply source and so that the rate of material flow may be regulated; the air intake pipe, by circulating or drawing air into and around the lower end of the tube 24 will prevent clogging and tend to segregate the cotton bolls at this point. In cooperation with the dual intake, the dust outlet 16 and collector 18 form the suction side of the separator so as to draw the cotton bolls from the truck upwardly through the inlet portion into the separator assembly.

The construction and arrangement of the cotton separator is best seen from FIGURES 2-4 and essentially the separator has been devised as a means of performing highly efficient, rapid preliminary separation of the good cotton bolls from the dust, dirt, green bolls and even rock particles which are to be found with the picked cotton bolls. The dust and dirt matter is, of course, relatively light in relation to the cotton bolls; whereas, the green bolls and rock particles are relatively heavy. In accordance with the present invention all this foreign matter is separated from the good cotton bolls in a two-stage, continuous separating operation whereby only the useable cotton bolls are introduced into the ginning machinery in an expanded condition. To this end, the cotton separator proper is essentially comprised of an upper separation chamber 30 having a baffle assembly or spaced grid bars 32 extending across the mouth of the inlet. The dust outlet 16 creates an induced current of air from the diffuser 22 through the upper separation zone of sufficient velocity to pull the lighter dust and dirt particles out of the cotton boll material but the heavier cotton bolls and rock particles are forced to undergo an abrupt change in direction in striking the baffle assembly 32. Beneath the upper separator chamber 30, a rotary air valve 34 receives the heavier boll and rock material and mechanically advances this material into a lower separation chamber 35 while effectively isolating the two chambers 30 and 35 one from another. In the lower separator chamber, a convergent inlet area 36 leads into a baffle chamber 37, and an air stream control section in the form of air vents 38 is positioned beneath the baffle chamber to

create an updraft or induced current of air flowing through the baffle chamber under the influence of a blower arrangement represented at 39. In actual practice this may be located in the dryer stage of the cotton gin and connected into cotton boll outlet duct 40 communicating with the lower baffle chamber. A rock-boll collector 42, having a weighted gate 43, is located beneath the air vents 38 to separately collect the green bolls and rocks for removal from the system. According to the particular relation of parts in the lower separation chamber 35, the baffle chamber and air vents will cooperate to establish an induced current of air flowing counter to the downward advance of boll and rock particles from the air valve 34 so as to pneumatically withdraw lighter bolls in an expanded state from the main stream of material and carry them horizontally through the outlet 40.

Individually, the upper separator chamber 30 is broadly of conventional design; and, for example, a similar construction and arrangement is disclosed in the patent to F. H. Clute, entitled "Material Collector," Patent No. 2,968,400 having an assignee in common with this invention. In the preferred form, however, the separation chamber 30 includes an outer enclosure 45 substantially funnel-shaped in design and with a front face 46 forming a downwardly convergent wall into the air valve 34. Sight windows 48 are mounted in side walls 49 and an access plate 50 is positioned on the back wall 52. The diffuser 22 leads into an upper entry area 54 of oblong rectangular configuration, and the diffuser itself is relatively wide and flat having an inwardly disposed spreader plate 55 projecting downwardly from its top inner surface. The plate forms with the bottom surface a restricted throat area 56 materially increase the flow velocity of material and to uniformly distribute the raw material in the form of a wide stream or curtain of particles entering the separation chamber.

The baffle 32 is mounted in hinged relation, as at 58, at the intersection of the diffuser with the entry area and traverses the entire width of the chamber between the side walls 49. The baffle takes the form of a grid comprised of closely-spaced fingers 59 which curve downwardly through the separation chamber and which together present a concave deflecting surface to the stream of particles flowing into the chamber. A threaded adjusting handle 60 is mounted in the top wall of the chamber and is clipped by plate 63 to the fingers thereby to permit manual adjustment of the baffle in relation to the mouth of the chamber. Adjacent the lower extremity of the baffle, another stationary baffle 64 inclines inwardly from the back wall 52 and terminates adjacent to the lower end of the baffle 32 thereby to insure that only those particles small enough to pass between the fingers will enter the dust outlet.

By reference again to FIGURE 1, the dust collector 18 is also, broadly, of conventional form and in the preferred form of installation is made up of a pair of cyclones 68 each having a fan 69 located above the point of entry or connection of individual ducts 16' leading from the dust outlet 16. The fans are operated through a pulley drive 70 off of a common motor unit 71 and serve to create a vortex in each of the cyclones and a greatly reduced pressure area in the dust outlet 16 so as to induce by suction the flow of materials from the trailer 14 through the inlet portion 13 into the upper separation chamber. Cotton particles carried into the cyclones 68 will tend to collect along the walls thereof, and to avoid this, spiral ribs 68' are preferably located along the lower interior wall surfaces. The ribs will intercept the cotton and guide it downwardly with the air stream. The cyclones lead into a common rotary air valve unit 72 which operates merely as a means of controlling the discharge of the dust from the cyclones as it is collected therein.

The unit 34 operates essentially to advance or discharge the materials from the upper chamber 30 into the lower separation chamber 35 while effectively isolating the two chambers to permit independent air flow and pressure conditions to be maintained in each. For this purpose, the air valve unit 34 is broadly comprised of an open cylindrical hopper or drum portion 75 having opposite convergent walls 76 forming an entrance or mouth leading into inwardly curved chamber walls 77 and traversing the width of the unit between side walls 49'. Preferably, a series of four paddles 78 are mounted on a common drive shaft 79 for rotation within the hopper chamber and are dimensioned to establish a close running fit with the walls 77, the drive shaft being driven through a suitable pulley drive by a motor drive unit 80. In outer configuration, the air valve unit is generally rectangular and downwardly convergent, and flange connections 82 are provided for interconnection between the upper and lower ends of the unit 34 and the upper and lower separation chambers 30 and 35, respectively. In this way, the air valve unit defines an uninterrupted continuous means of mechanical advancement for the material between the chambers and the spacing of the paddles in relation to the chamber walls 77 will insure complete isolation between the chambers 30 and 35.

In the lower separation chamber 35, the inlet 36, baffle chamber 37 and air control portion 38 have common, flat vertical side walls 84 and a front wall 85; however, at the inlet portion, the back wall 86 is curved inwardly to define a convergent area for the purpose of encouraging the movement of materials from the air valve unit 34 in the form of a curtain along the smoother inner surface of the front wall 85. In the baffle chamber 37 upper and lower spaced back walls 86' curve rearwardly in convergent relation into the duct 40 so as to provide a relatively large baffle chamber in relation to the inlet area formed by the wall portion 86. In the baffle chamber area, upper and lower baffles 87 and 88, respectively, are positioned to control the flow pattern of materials through the baffle chamber. Specifically, the upper baffle 87 is defined by a convex plate traversing the width of the chamber between side walls 84 and is mounted on a pivot rod 89 adjacent the convergent area or inlet 36 and with an adjusting handle 90 projecting from the pivot rod through one side wall 84 to permit angular adjustment of the baffle. The lower baffle 88 is similarly formed of a convex plate mounted on a pivot rod 89 projecting through the side walls adjacent the lower back wall 86' and again with an adjusting handle 90 to control the angular disposition of the baffle. Again, sight windows 48' are mounted in side walls 84 to permit viewing of the entire operation in the baffle chamber.

The air flow control section takes the form of a pair of upper and lower sliding panels 92 and 93 mounted for vertical sliding movement in brackets 94 to regulate opening and closing of air vent openings 95 in the front wall 85 of the chamber. The openings 95 traverse the entire width of the chamber and as the sliding gates or panels are adjusted to control the capacity of air flow therethrough, will regulate the rate of separation of the material; in turn, the baffles 87 and 88 will regulate the effective cross-sectional area in the baffle chamber to control the direction and velocity of air flow therethrough and thus will cooperate with the air control portion 38 in regulating the weight and extent of separation of materials. Outwardly projecting ledges 95 are provided on each of the sliding gates to permit manipulation of the gates toward and away from one another; also, a lower flange connection 97 is provided beneath the gates for interconnection of the chamber 35 and the tubular collector portion 42.

In operation, the blower 39 located in the cotton gin will create an induced current of air from the air vent section 38 through the baffle chamber and duct 40. Due to the lighter weight of the cotton bolls both in relation

to heavier rock particles and green, unuseable bolls in the mass of material, the size of openings in the air vent may be regulated by visual observation through the sight windows so as to insure that proper weight separation is taking place. As stated, however, the air vent control sections will actually control the air flow capacity or force; but the baffles 87 and 88, according to their relative disposition, will control the effective cross-sectional area in the baffle chamber and accordingly will control the flow velocity of air thus to cooperate in determining the total force of air flow. Due to the relative disposition of the air vent control section beneath the baffle chamber and in relation to the baffles 87 and 88, a counter-current of air flow will be created and directed upwardly into the baffle chamber at approximately 30° to the vertical front surface 85 of the chamber so as to establish a combined counter and cross current of air flow. Also as stated, the convergent area of inlet 36 will encourage the materials to pass downwardly along the front surface 85 and directly into the path of the air stream so that the lighter cotton boll materials will be expanded and segregated by the air stream for removal through the duct 40 and into the cotton gin. The heavier particles will fall into the collector 42 for removal at desired intervals through the weighted gate 43, and in this respect the gate 43 will prevent air from passing up through the collector and altering the desired air flow pattern created in the baffle chamber.

It will be evident from the foregoing that a highly efficient, two-stage continuous method of separating materials has been devised requiring a minimum of moving parts while permitting adjustability of the unit over an extremely wide range. Classification of materials can be made extremely accurate due to the high efficiency of the first or upper separation chamber for the removal of the lighter foreign matter coupled with the high efficiency of the lower separation chamber in effectively removing the useable cotton boll material from the moving stream of particles. For the purpose of illustration, it has been found that a typical installation of this type can serve as a means of removing more than 90% of all dirt, sand, rocks and unuseable bolls from cotton under capacities ranging from 5 to 18 bales of cotton per hour depending upon the horsepower applied. This of course will speed up the entire cotton ginning operation while removing foreign matter which would otherwise hinder the effective performance of the cotton gin. Moreover, the two-stage operation permits continuous treatment in a single pass through the unit and with minimum wear due to the minimum number of moving parts necessitated. At the same time, in relation to its capacity, the unit is very compact and permits effective isolation between the separation chambers or zones while establishing a continuous operation.

A number of variations and modifications may be made both in the method and apparatus, such as in the independent construction and arrangement of the upper separation chamber as well as the particular design and construction of the dust collector unit and air valve unit, without departing from the scope of the present invention as defined by the appended claims.

What is claimed is:

1. A method of separating foreign particles from cotton bolls prior to introduction of the cotton bolls into a cotton gin and the like, comprising the steps of drawing the material under the influence of a high velocity air stream through a first separation zone, deflecting the bolls and larger particles from the air stream while removing the smaller particles in the air stream from the first separation zone, mechanically advancing the bolls and larger particles from said first separation zone into a second separation zone while isolating said zones from one another, establishing a counter current of relatively low velocity air flow in the second zone to deflect the cotton boll material so as to divert it for removal from the second zone into the cotton gin.

2. The method of classifying particles according to size and weight comprising the steps of continuously drawing the particles in an air stream horizontally through an upper separation zone, deflecting the larger particles downwardly out of the air stream, mechanically advancing the larger particles from said upper separation zone into a lower separation zone while isolating said zones from each other, establishing a counter current of air flow in the lower zone of sufficient force to deflect relatively low density particles and to divert them for removal from the lower zone while permitting the heavier particles to continue downwardly for separate collection.

3. The method according to claim 2 being characterized further by independently varying the capacity and velocity of counter-current flow through the lower zone in accordance with the relative weight of particles to be separated.

4. The method according to claim 2 being characterized further by the step of converging the larger particles from the upper separation zone to a relatively wide, flat stream of particles for passage through the lower separation zone.

5. Apparatus for separating materials according to variations in size and density comprising, a first separator chamber, a materials inlet to the first separator chamber, first blower means to induce the flow of materials in a path through said chamber, baffle means in said chamber projecting across the materials inlet and the path of material flow through the inlet to selectively deflect the larger sized materials out of the path of flow, a second separator chamber, and air valve means between said first separator chamber and second separator chamber for mechanically advancing the deflected material through said second chamber while isolating said chambers from one another, air flow control means associated with said second chamber including an outlet and second blower means to establish a current of air flowing counter to the movement of the material through said second chamber being of sufficient force to separate the relatively low density materials from the main stream of material flow for separate removal through said outlet, and means for collecting the remaining material in said second chamber.

6. Apparatus according to claim 5, said first and second chambers being in the form of a vertical, downwardly convergent column, said first blower means establishing the horizontal flow of material through said first chamber, and said baffle means deflecting the larger material downwardly through said first chamber.

7. Apparatus according to claim 6, said baffle means being in the form of a series of spaced fingers.

8. In a separation apparatus adapted for separating materials differing in size and density having a first separation chamber including a materials inlet to the separation chamber, air flow means to induce a path of materials flow through the materials inlet, means for separating relatively small particles from the materials including baffle means projecting across the materials inlet to deflect the larger materials out of the path of flow through the material inlet, of the relatively light particles, the combination therewith of a second separation chamber having an inlet portion to receive the main stream of materials deflected in the first separation chamber, mechanical advancing means adjacent to the inlet portion for selectively advancing the larger materials to said second separation chamber, said advancing means including means for effectively isolating air flow streams of said chambers one from the other, second air flow means including an outlet and a blower communicating with said second chamber for drawing air transversely therethrough at a velocity sufficient to induce the movement of relatively low density particles into said outlet, and means for collecting the remaining material in said second separation chamber.

9. In a separation apparatus adapted to separate foreign particles from seed cotton for delivery of the seed cotton to a cotton gin and the like, having a first separation chamber including a materials inlet to the separation chamber, air flow means creating an air stream to induce

the passage of the materials in a path through the chamber inlet and through the chamber, and baffle means projecting across the materials inlet to deflect the larger particles including the seed cotton out of the path of flow of the air stream, the combination therewith of a second separation chamber having an inlet portion to receive the larger particles deflected in the first separation chamber, rotary mechanical advancing means in the inlet portion to advance the larger particles to said second separation chamber, said advancing means including means for effectively isolating air flow streams of the air flow stream of said first separation chamber from an air flow stream in said second separation chamber, an outlet including a blower associated therewith and a variable air flow control vent generally opposite said outlet for drawing air across the path of particle flow through said second chamber and said outlet, and variable flow control means in said second chamber adjacent said outlet and being adjustable to control the effective cross-sectional area flow of air through said chamber, said air flow control vent and variable flow control means thereby cooperating to control the capacity and velocity of air flow through said second chamber necessary to induce the movement of the relatively low density seed cotton through said outlet.

10. A separation apparatus adapted for the continuous separation of foreign particles from relatively low density cotton balls prior to delivery of the cotton balls into a cotton gin and the like comprising, an upper separation chamber including an inlet for introduction of the cotton ball material, means communicating with said chamber opposite said inlet to create an air stream carrying the material into said chamber through said inlet, a baffle having downwardly depending, spaced fingers extending across the material inlet and across the path of flow of the cotton ball material from the inlet, the spacing between fingers being less than the size of the cotton balls thereby to deflect only the cotton balls and larger foreign particles out of the air stream for movement under gravity through said upper chamber, an air valve

beneath the upper chamber including mechanical advancing means to receive the deflected material for discharging the material while isolating said upper separation chamber from a lower separation chamber disposed beneath said air valve, said lower separation chamber having an inlet and gravity feed passage for downward movement of the material discharged from said upper chamber, a collection area beneath said feed passage, blower means including a blower outlet passage disposed in communication with one side of said feed passage and air flow control means on the side of said feed passage opposite said outlet passage to establish the counter flow of air through said feed passage of sufficient velocity to deflect the cotton balls for removal through said outlet passage while permitting the heavier particles to continue downwardly into said collection means.

11. A separation apparatus according to claim 10, said feed passage having upper and lower spaced baffles therein to control the effective cross-sectional area of flow of air through said feed passage.

12. A separation apparatus according to claim 10, said feed passage having a flat wall surface opposite said outlet passage and a convergent inlet area directly beneath said air valve to encourage the downward movement of materials in the form of a wide, relatively flat stream along the flat wall surface.

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