

Dec. 18, 1923.

1,695,569

R. W. ARMS

DRY SEPARATING MACHINE

Filed April 16, 1924

3 Sheets-Sheet 1

Fig. 1.

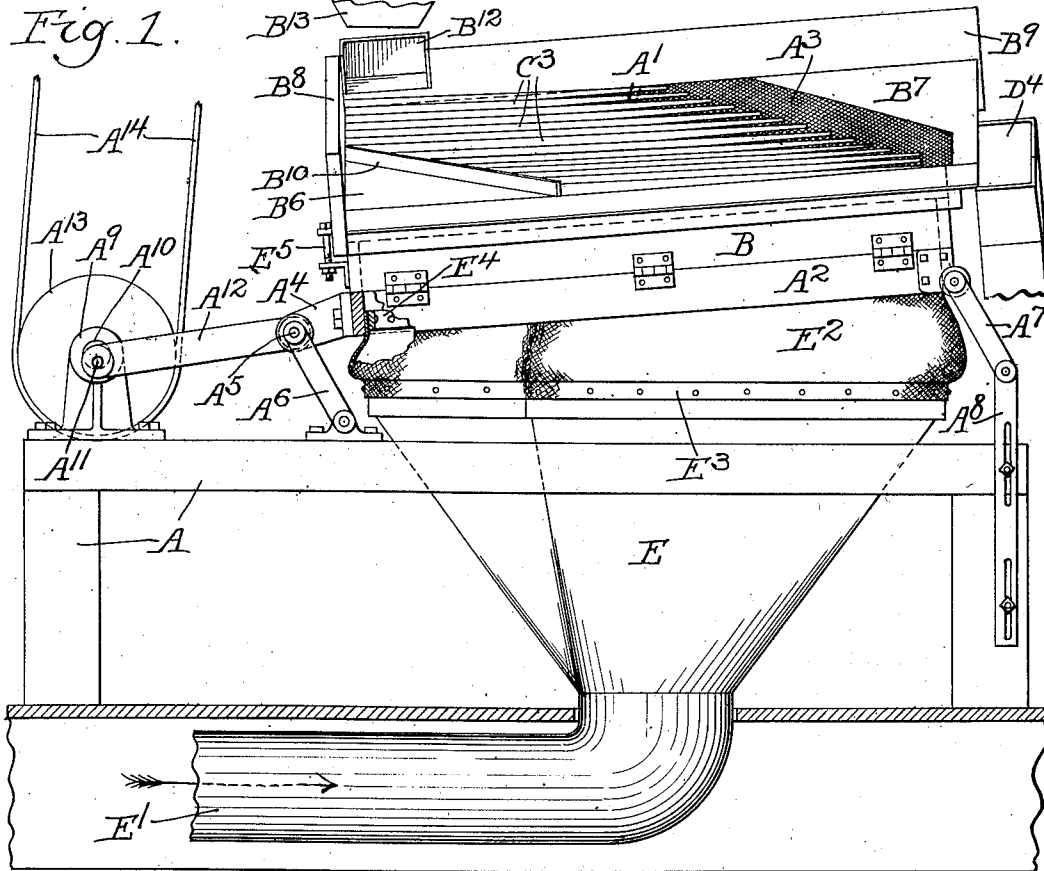


Fig. 2.

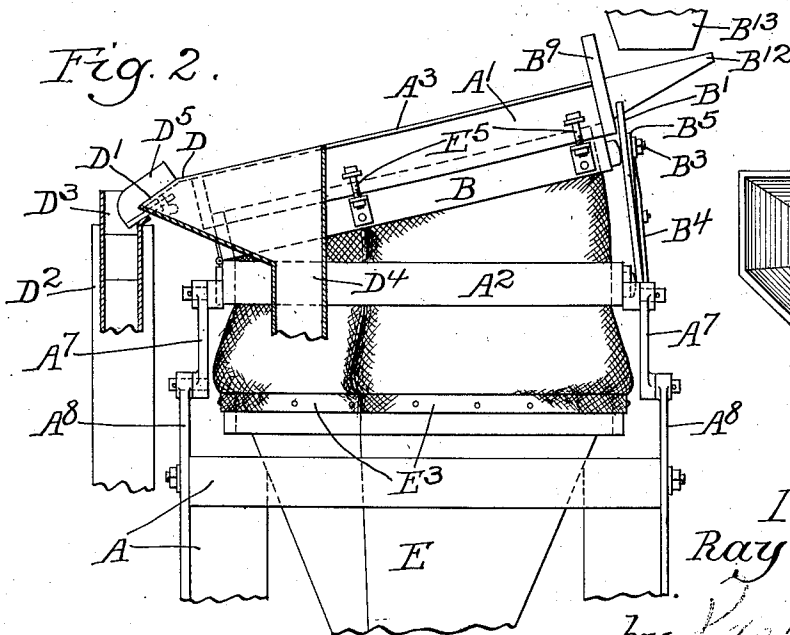
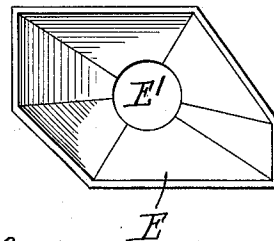


Fig. 10.



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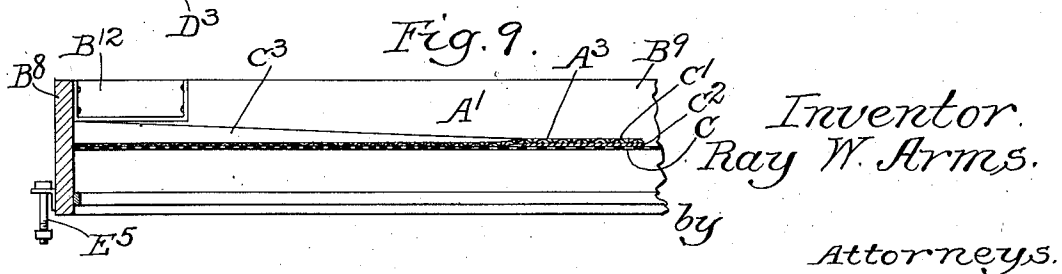
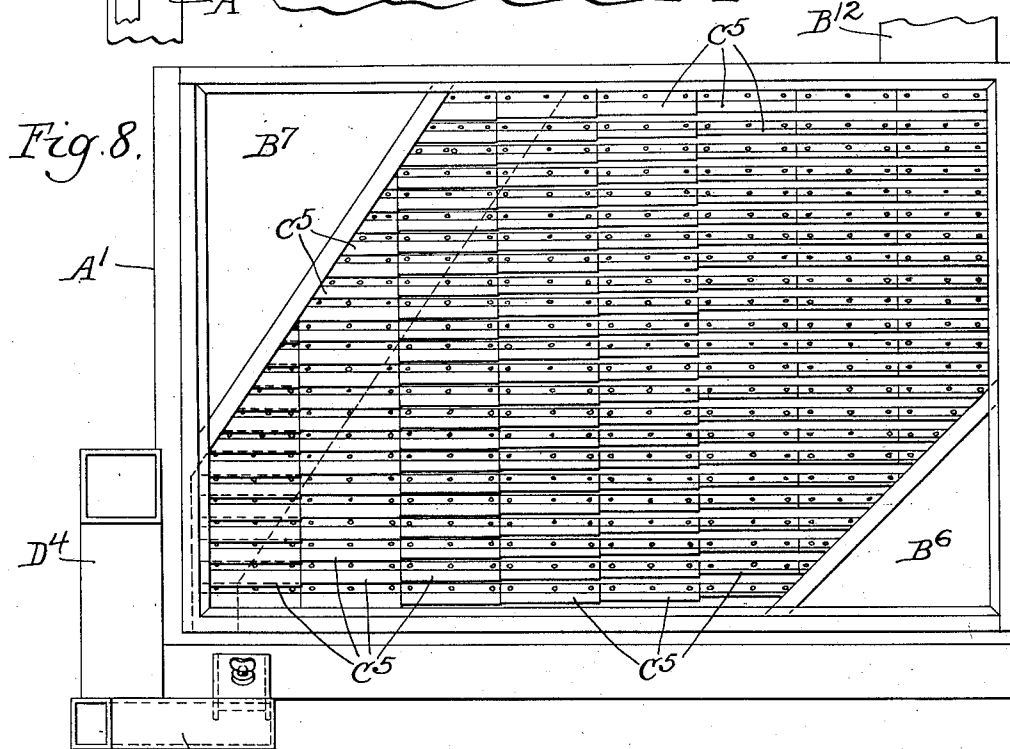
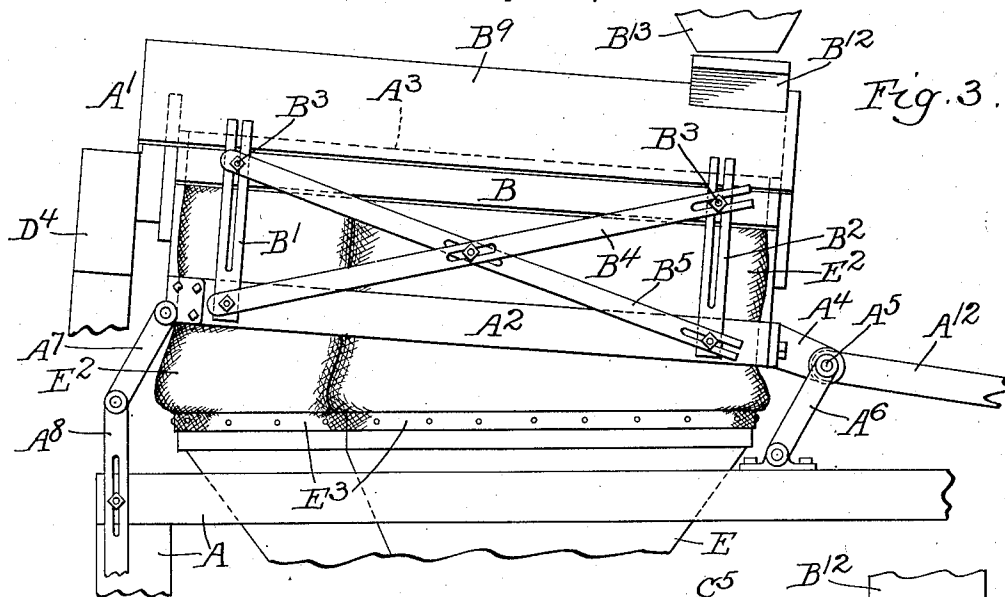
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3 Sheets-Sheet 2



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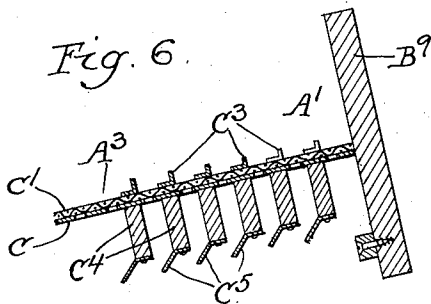
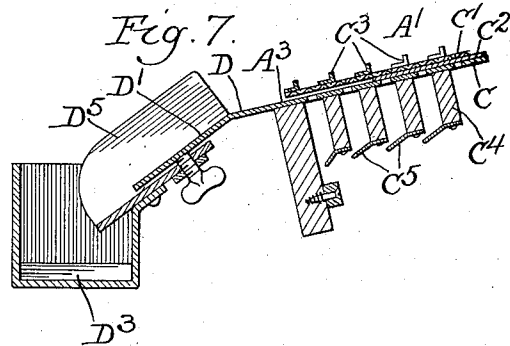
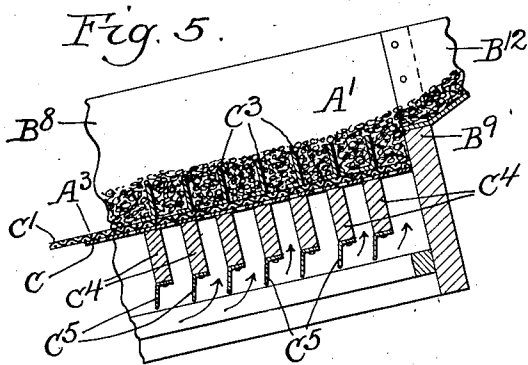
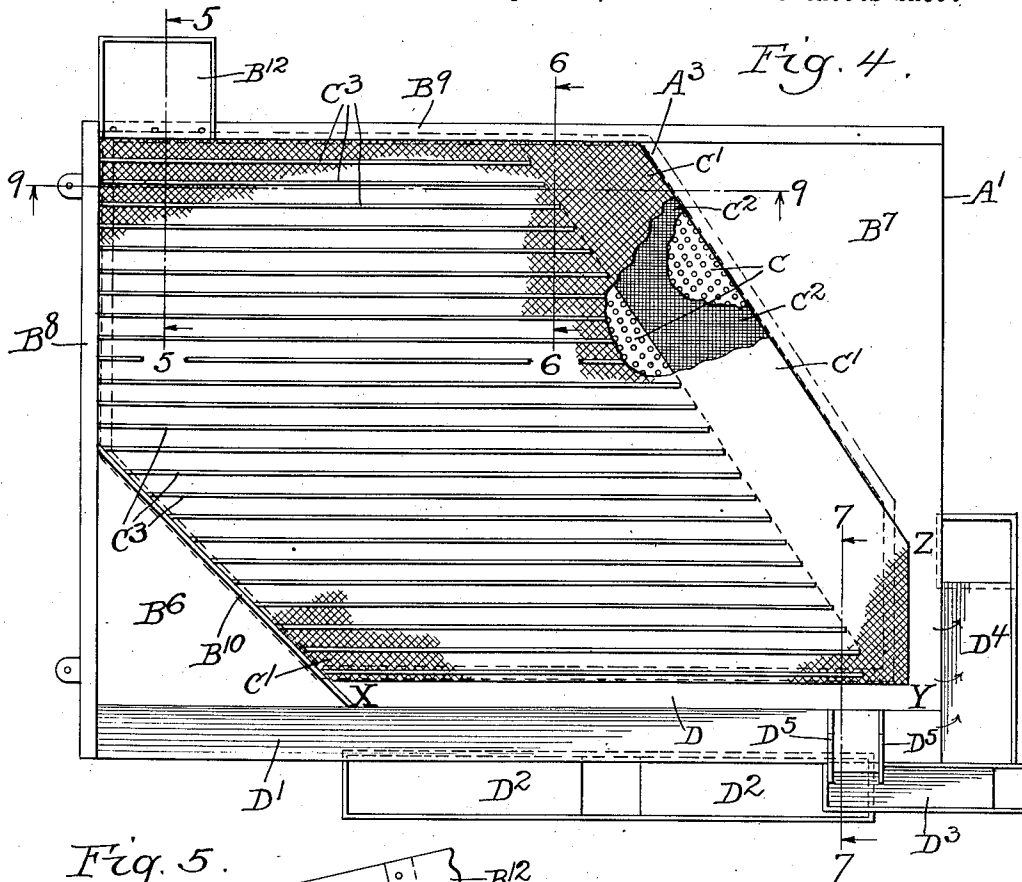
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R. W. ARMS

DRY SEPARATING MACHINE

Filed April 16, 1924

3 Sheets-Sheet 3



Inventor.
Ray W. Arms.

by

Attorneys.

UNITED STATES PATENT OFFICE.

RAY W. ARMS, OF CHICAGO, ILLINOIS, ASSIGNOR TO ROBERTS AND SCHAEFER COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

DRY-SEPARATING MACHINE.

Application filed April 16, 1924. Serial No. 706,853.

My invention relates to improvements in air separating tables and has for one object to provide a new and improved form of air separating table whereby granular material may be separated or classified by weight by the combined action of a vibratory supporting the table and a supporting column of air or gas upon which the granular material is with the cooperation of the table carried. Another object of my invention is to provide a table wherein classification and concentration of the lighter particles may be rapidly and easily effected. Another object is to provide a table wherein the angle of inclination of the supporting table and its cooperation with the air or gas column may be adjusted. Another object is to provide a light, durable, easily manufactured and easily operated device. Other objects will appear from time to time in the specification and claims.

My invention is illustrated more or less diagrammatically in the accompanying drawings, wherein—

- Figure 1 is a side elevation in part section;
- Figure 2 is an end elevation;
- Figure 3 is a rear elevation;
- Figure 4 is a plan view;
- Figure 5 is a section along the line of 5—5 of Figure 4;
- Figure 6 is a section along the line 6—6 of Figure 4;
- Figure 7 is a section along the line 7—7 of Figure 4;
- Figure 8 is an underside plan view of the deck;
- Figure 9 is a section along the line 9—9 of Figure 4;
- Figure 10 is a top plan view of the air chimney.

Like parts are indicated by like characters through the specification and drawings.

A is a main frame, A¹ an oscillating table made up of an oscillating frame A² and perforate deck or screen A³. The oscillating frame has ears A⁴ projecting outwardly therefrom pivoted to an oscillating shaft A⁵ supported by links A⁶ pivoted on the frame A. The links A⁷ pivoted on the oscillating frame at one end are pivoted at the other end on slides A⁸ which are vertically adjustable on the main frame A to support the oscillating table leaving it free to oscillate but making it possible to adjust it angularly about the oscillating shaft A⁵ in a plane parallel with the line of oscillation. A⁹ is an eccentric bearing on the main frame carrying an eccentric shaft A¹⁰ having an eccentric A¹¹ driving an eccentric rod A¹² engaging at its free end the oscillating shaft A⁵. A¹³ is a pulley on the eccentric shaft driven by a belt A¹⁴ from any suitable source of power.

B is a frame hinged on the oscillating frame A² for angular movement about a line perpendicular to the oscillating shaft A⁵. It carries the perforate deck A³. B¹, B² are standards projecting upwardly from the frame A² slotted to engage holding bolts B³ on the frame B whereby the frames A² and B may be locked in angular relation. B⁴, B⁵ are transverse struts, each of them pivoted at one end on one of the frames and slotted on the other for engagement with a holding bolt on the frame so that when the bolts are loosened for angular adjustment of the frame, these struts may work in or out. When the bolts are tightened, these struts are tightened up so as to resist lateral thrust in either direction between the two frames, thus locking them together as a rigid unit and protecting the frame from torsional strain caused by the vibratory movement applied to the frame A². B⁶, B⁷ are impervious portions of the deck A³, there being boundary walls B⁸, B⁹ intersecting at one corner of the rectangular frame B and bounding two sides of the pervious portion of the deck. B¹⁰ is an inclined wall bounding the inclined portion of the cross section of the pervious deck. B¹² is a chute carried on the deck A³ and discharging thereupon. B¹³ is a spout discharging material to be separated into the chute.

The pervious deck is made up preferably of a thin sheet of perforate zinc C, there being a sheet of screen fabric overlying the perforate zinc and at one side of the perforate portion of the deck inclined to the line of reciprocation there is a strip of cheesecloth C² or other loosely woven fabric interposed between the zinc C and the screen fabric C¹. This cheesecloth has for its purpose to retard the air flowing upwardly through the perforations in the zinc and the screen cloth. C³, C³ are riffles projecting upwardly from the surface of the pervious portion of the

deck parallel with the line of reciprocation. These riffles taper downwardly from the discharge end toward and terminate at the edge of the resistance area where the cheesecloth is located.

Beneath the pervious portion of the deck in line with the riffles are supporting beams or cross members C⁴ built into the frame and furnishing an adequate support for the deck. The riffles themselves are angle members fastened through the pervious deck to the supporting members C⁴. Carried on these supporting members are a series of relatively thin flexible separately adjustable shutters C⁵ whereby the supply of air to various portions of the deck may be adjusted, as indicated in the various drawings, by bending these shutters.

The discharge portion of the pervious deck extends from the point X across to the point Y, thence up to the point Z. The pervious portion of the deck is continued as shown in Figure 7 by an impervious extension D discharging onto inclined chute surfaces D¹ which in turn discharges into troughs D², D³, D⁴. Deflector blades D⁵ are mounted on the chutes D¹ and may be moved to cut and distribute the flowing sheet of material, there being preferably two of them. These two blades are so positioned that they divide the sheet of material as it flows off the table into three sections looking at Figure 4 for instance, the right hand part of the sheet takes the material running off from the point, to a point just short of the end of the riffles. This material is pure coal. The left hand section of the sheet comprises the material from the point Z to a point just beyond the riffles. This is pure rock or refuse. The balance of the sheet is between the right and left hand portions and comprises part coal and part refuse and is called middlings and the two deflectors D⁵ may be adjusted with respect to each other and to the total width of the sheet depending upon the condition of the sheet and the width of the middling zone so as to give any desired classification or grouping.

E is a chimney to which air or gas under pressure is fed from any suitable source through the pipe E¹. This chimney extends upwardly to conform to the cross section of the pervious portion of the deck. E² is a bellows attached to the upper periphery of the chimney E at its bottom and to the underside of the deck at its top extending up through the frame A² so that the bellows closes the gap between the chimney and the pervious deck no matter what the angle of inclination and no matter what the position during reciprocation. This bellows is preferably attached to the chimney by means of a binding strip E³ nailed in position to hold the bellows tight and, attached to the deck by means of binding strips E⁴. The deck is held in place on the frame B by bolts E⁵.

It will be evident that while I have shown in my drawing an operative device, still many changes might be made in the size, shape and disposition of parts without departing materially from the spirit of my invention. I wish, therefore, that my showing be taken as in a sense diagrammatic.

The use and operation of my invention are as follows:

Air or gas under pressure is fed upwardly through a chimney and discharged upwardly through the pervious surface of the deck. The only control of this air is by the series of permanently bent adjustable shutters which equalize or adjust the flow of air immediately below the pervious deck so as to provide the proper supply. The deck is reciprocated in a direction parallel with the riffles. Granular coal or other material is fed onto the deck through the chute at one corner thereof, the reciprocation of the deck in cooperation with the throw given to it by the supporting links causes the material to feed out in a direction parallel with the riffles. Ordinarily the deck would be inclined upwardly from the feed, material would feed up against the force of gravity along the riffles. The inclination of the links will give an up and down movement to the deck and material will be thrown up and vibrated in a vertical direction to some extent by the movement of the deck. The air forced upwardly through the deck tends to carry the sheet of granular material, this sheet being partially supported by the air column. The vibration of the mass of material together with the supporting action of the air tends to stratify the material, the heavier particles that is, refuse, tending to gravitate to the bottom of the sheet as it travels forwardly away from the supply end. Owing to the downward inclination of the deck in a plane perpendicular to the line of reciprocation, there will be a tendency of the material to move across the line of reciprocation, the heavier particles gravitating to the bottom of the sheet will be caught by the riffles and constrained to a movement parallel with them, the lighter particles, like coal, will be permitted to travel downwardly across the direction of reciprocation and since the deck is completely covered by a sheet of moving materials, movement of the coal across the lower edge of the deck looking at Figure 1 will take place. This material will be clean and there will be substantially no refuse with it. As the refuse moves out, being in smaller quantities than the coal and as the coal moves down across the line of reciprocation the sheet of material becomes thinner, the air resistance less and the effect of the concentrating or classification action of the air column and reciprocation will be less accurate owing to the boiling of the sheet of material. In order to compensate for this, the cheese cloth is used so as to provide a concentration

zone where the refuse is concentrated as it commences its desired travel beyond the ends of the riffles. There will be a middling zone between the clean coal and pure refuse just about the ends of the riffles and the operator gets satisfactory results by adjusting the deflecting blades back and forth so as to divide the three zones as they discharge over the table to throw the coal in one chute, the middlings in another, and the refuse in another. Material varies constantly and it is necessary to be able to change the point of separation from time to time to take care of the difference in product. The purpose of the adjusting blades beneath the deck is to compensate for the different thicknesses of the sheet of material as it thins out. This compensation being made once and for all to take care of the general type of material being treated and the general condition under which separation takes place. It will be noted that the material is nowhere banked up and there is nowhere any obstruction offered to its travel except the obstruction offered by the riffles to the cross movement of the heavier particles. The result is that the material is always freely moving except that the heavier particles which segregate down through the bed when they come into engagement with the riffles are compelled to change their movement from a diagonal path inclined to the riffles to a path generally parallel with the riffles beneath the flowing sheet of coal and the path of the heavier particles is thus at the bottom of the sheet or bed inclined to the path of the coal. When the device is in operation, it will be noted that in every instance the sheet of material is thickest toward the feed end and thins out both in a direction parallel to and in a direction perpendicular to the riffles and at some point on the zone of reduced air pressure the bale or sheet of refuse will peter out and no material will go beyond the terminal zone but will travel down parallel with the zone.

I claim:

1. A dry separating table comprising a reciprocating pervious deck, riffles on the upper surface thereof extending generally parallel with the line of reciprocation, means for feeding granular material to the deck at one end, means for catching material discharged from the deck adjacent the other end and means for supplying air under pressure to and forcing it upwardly through the deck to partially support the material, there being a zone adjacent the termination of the riffles where the supporting effect of the gas is reduced, means located at the discharge edge of the table for dividing the flow of material thereacross to segregate it, said means being movable along the deck to permit adjustment and division of the material.

2. A dry separating table comprising a reciprocating pervious deck, riffles on the upper

surface thereof extending generally parallel with the line of reciprocation, means for feeding granular material to the deck at one end, means for catching material discharged from the deck adjacent the other end and means for supplying air under pressure to and forcing it upwardly through the deck to partially support the material, there being a zone intersecting the line of movement of the material and adjacent the ends of the riffles where the supporting effect of the gas is reduced, means located at the discharge edge of the table for dividing the flow of material thereacross to classify it.

3. In an air separating table, a reciprocating frame, a pervious deck hinged thereon for angular adjustment about a generally horizontal line, vertically disposed guide members interposed between the frame and the deck and means for positioning said guide members to hold the parts in adjusted angular relation, means associated with said guide members for preventing relative lateral movement of deck and frame.

4. In an air separating table, a reciprocating frame, a pervious deck hinged thereon for angular adjustment about a generally horizontal line, vertically disposed guide members interposed between the frame and the deck and means for positioning said guide members to hold the parts in adjusted angular relation, means associated with said guide members for preventing relative lateral movement of deck and frame, said means comprising adjustable diagonal struts interposed between the deck and the frame.

5. In an air separating table, a reciprocating frame, a pervious deck hinged thereon, guide and supporting members projecting upwardly from the frame and in adjustable engagement with the deck at a point removed from the hinge, diagonal struts extending from the upper portion of one guide and supporting member to the lower portion of the other, said struts intersecting centrally and means for removably fastening the struts and the guide members in position to hold the parts in angular adjustment and to prevent lateral displacement of the frame and deck during reciprocation.

6. In an air separating table, a fixed support, a reciprocating frame, pivot links interposed between them arranged for adjustment to change the angle of inclination of the frame, a pervious deck pivoted on the frame, adjusting means adapted to vary the angle of inclination of the deck with respect to the frame, an air supply chimney projecting upwardly through the fixed support and carried thereby and a bellows interposed between the upper extremity of the air chimney and the pervious deck.

7. In an air separating table, a pervious deck, means for discharging air upwardly under pressure therethrough, means for re-

ducing the flow of air through the deck along one side thereof, riffles projecting upwardly from the deck and terminating at the zone of lower pressure.

8. In an air separating table, a pervious deck, means for discharging air upwardly under pressure therethrough, means for reducing the flow of air through the deck along one side thereof, riffles projecting upwardly from the deck and terminating at the zone of lower pressure, the riffles decreasing in height toward their termination at the zone of lower pressure.

9. In an air separating table, a pervious deck, means for discharging air upwardly under pressure therethrough, means for reducing the flow of air through the deck along one side thereof, riffles projecting upwardly from the deck and terminating at the zone of lower pressure, means for reciprocating the deck in a direction parallel with the line of the riffles.

10. In an air separating table, a pervious deck, means for discharging air upwardly under pressure therethrough, means for reducing the flow of air through the deck along one side thereof, riffles projecting upwardly from the deck and terminating at the zone of lower pressure, the riffles decreasing in height toward their termination at the zone of lower pressure, means for reciprocating the deck in a direction parallel with the line of the riffles.

11. In an air separating table, a pervious deck, means for discharging air upwardly under pressure therethrough, means for reducing the flow of air through the deck along one side thereof, riffles projecting upwardly from the deck and terminating at the zone of lower pressure, means for feeding material to the deck at a point far removed from the zone of lower pressure and for conveying it along the deck toward such zone in a direction parallel with the riffles.

12. In an air separating table, a pervious deck, means for discharging air upwardly under pressure therethrough, means for reducing the flow of air through the deck along one side thereof, riffles projecting upwardly from the deck and terminating at the zone of lower pressure, the riffles decreasing in height toward their termination at the zone of lower pressure, means for feeding material to the deck at a point far removed from the zone of lower pressure and for conveying it along the deck toward such zone in a direction parallel with the riffles.

13. In an air separating table, a pervious deck, means for discharging air upwardly under pressure therethrough, means for reducing the flow of air through the deck along one side thereof, riffles projecting upwardly from the deck and terminating at the zone of lower pressure, means for feeding material to the deck at a point far removed from

the zone of lower pressure and for conveying it along the deck toward such zone in a direction parallel with the riffles, the riffles decreasing in height from the feed toward the discharge end.

14. In an air separating table, a pervious deck, means for discharging air upwardly under pressure therethrough, means for reducing the flow of air through the deck along one side thereof, riffles projecting upwardly from the deck and terminating at the zone of lower pressure, the riffles decreasing in height toward their termination at the zone of lower pressure, means for feeding material to the deck at a point far removed from the zone of lower pressure and for conveying it along the deck toward such zone in a direction parallel with the riffles, the riffles decreasing in height from the feed toward the discharge end.

15. In an air separating table, a pervious deck, means for reciprocating it, means for discharging air upwardly under pressure therethrough, means for reducing the pressure exerted by the air along one side of the perforate deck, means for feeding material to be separated to the deck at a point removed from the zone of lower pressure, riffles extending parallel with the line of reciprocation gradually decreasing in height toward and terminating at the zone of lower pressure.

16. In an air separating table, a pervious deck, means for reciprocating it, means for discharging air upwardly under pressure therethrough, means for reducing the pressure exerted by the air along one side of the perforate deck, means for feeding material to be separated to the deck at a point removed from the zone of lower pressure, riffles extending parallel with the line of reciprocation gradually decreasing in height toward and terminating at the zone of lower pressure, the deck being downwardly inclined in a direction across the riffles from the material supply point.

17. In an air separating table, a pervious deck, means for reciprocating it, means for discharging air upwardly under pressure therethrough, means for reducing the pressure exerted by the air along one side of the perforate deck, means for feeding material to be separated, to the deck at a point removed from the zone of lower pressure, riffles extending parallel with the line of reciprocation gradually decreasing in height toward and terminating at the zone of lower pressure, the deck being inclined in a direction across the riffles from the material supply point.

18. In an air separating table, a pervious deck, means for reciprocating it, means for discharging air upwardly under pressure therethrough, means for reducing the pressure exerted by the air along one side of the perforate deck, means for feeding material

to be separated to the deck at a point removed from the zone of lower pressure, riffles extending parallel with the line of reciprocation gradually decreasing in height toward and terminating at the zone of lower pressure, the deck being inclined in a direction across the riffles from the material supply point and means for adjusting the angle of inclination.

19. In an air separating table, a pervious deck, means for reciprocating it, means for discharging air upwardly under pressure therethrough, means for reducing the pressure exerted by the air along one side of the perforate deck, means for feeding material to be separated to the deck at a point removed from the zone of lower pressure, riffles extending parallel with the line of reciprocation gradually decreasing in height toward and terminating at the zone of lower pressure, the deck being inclined in a direction along the riffles.

20. In an air separating table, a pervious deck, means for reciprocating it, means for discharging air upwardly under pressure therethrough, means for reducing the pressure exerted by the air along one side of the perforate deck, means for feeding material to be separated to the deck at a point removed from the zone of lower pressure, riffles extending parallel with the line of reciprocation gradually decreasing in height toward and terminating at the zone of lower pressure, the deck being inclined in a direction along the riffles; and means for adjusting the angle of inclination.

21. In an air separating table, a pervious deck, means for reciprocating it, means for discharging air upwardly under pressure therethrough, means for reducing the pressure exerted by the air along one side of the perforate deck, means for feeding material to be separated to the deck at a point removed from the zone of lower pressure, riffles extending parallel with the line of reciprocation gradually decreasing in height toward and terminating at the zone of lower pressure, the deck being downwardly inclined in a direction across the riffles from the material supply point and upwardly inclined along the riffles toward their lower ends, there being means for adjusting the angle of inclination of the deck.

22. In an air separating table, a rectangular deck pervious throughout its entire area except at two diagonally opposed corners, an air supply conduit discharging against the underside thereof and a bellows interposed between the conduit and the deck and conforming to the pervious portion of the deck.

23. In an air separating table, a rectangular deck pervious throughout its entire area except at two diagonally opposed corners, means for discharging air upwardly under pressure through the pervious portion and

means for reducing the pressure exerted by the air in a zone along one diagonal side of the pervious portion of the deck.

24. In an air separating table, a rectangular deck pervious throughout its entire area except at two diagonally opposed corners, means for discharging air upwardly under pressure through the pervious portion and means for reducing the pressure exerted by the air in a zone along one diagonal side of the pervious portion of the deck, riffles projecting upwardly from the deck and terminating at said zone.

25. In an air separating table, a rectangular deck pervious throughout its entire area except at two diagonally opposed corners, means for discharging air upwardly under pressure through the pervious portion and means for reducing the pressure exerted by the air in a zone along one diagonal side of the pervious portion of the deck, riffles projecting upwardly from the deck and terminating at said zone, said riffles decreasing in height toward the reduced pressure zone.

26. In an air separating table, a rectangular deck pervious throughout its entire area except at two diagonally opposed corners, means for discharging air upwardly under pressure through the pervious portion and means for reducing the pressure exerted by the air in a zone along one diagonal side of the pervious portion of the deck, riffles projecting upwardly from the deck and terminating at said zone, said riffles being parallel with one side of the rectangle.

27. In an air separating table, a rectangular deck pervious throughout its entire area except at two diagonally opposed corners, a wall surrounding a part of the pervious area on two adjacent sides of the rectangle and on one of the inclined sides of the pervious portion.

28. In an air separating table, a rectangular deck pervious throughout its entire area except at two diagonally opposed corners, a wall surrounding a part of the pervious area on two adjacent sides of the rectangle and on one of the inclined sides of the pervious portion, riffles projecting upwardly from the deck and parallel with that wall of the rectangle furthest removed from the inclined wall.

29. In an air separating table, a rectangular deck pervious throughout its entire area except at two diagonally opposed corners, a wall surrounding a part of the pervious area on two adjacent sides of the rectangle and on one of the inclined sides of the pervious portion, riffles projecting upwardly from the deck and parallel with that wall of the rectangle furthest removed from the inclined wall, each riffle decreasing in height away from the inclined wall.

30. In an air separating table, an air pervious deck comprising a coarsely perforated

- plate and a screen cloth overlying it, riffles projecting upwardly from the screen cloth and supporting bars located beneath the plate in line with the riffles, the riffles terminating
5 short of the edge of the perforate portion of the plate and a fabric strip of finer mesh than the screen plate interposed between the screen and the cloth throughout the area where the riffles are not located.
- 10 31. In an air separating table, a perforate deck, a plurality of spaced ribs located below and supporting it and a plurality of relatively short baffle strips mounted on the ribs and adapted to be bent to adjustably control the flow of air through the space between the ribs
15 to the deck.
- Signed at Chicago, county of Cook, and State of Illinois, this 31st day of March, 1924.
- RAY W. ARMS.