June 20, 1939. F. L. KNIGHT 2,163,342

PNEUMATIC SEPARATOR, CLEANER, CONCENTRATING TABLE, OR THE LIKE

Filed July 28, 1937 2 Sheets-Sheet 1

FIG. 1.

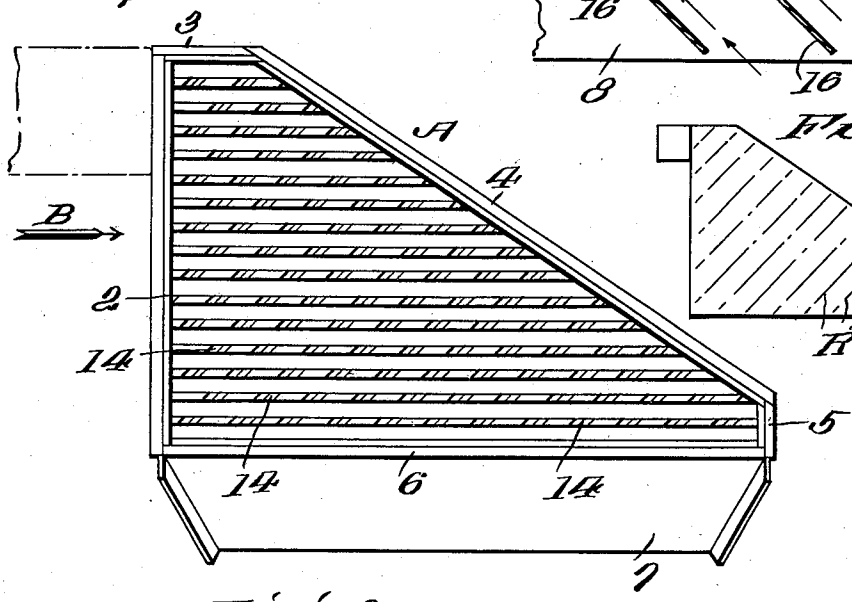


FIG. 7.

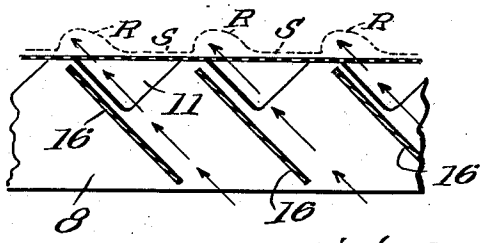


FIG. 8.

FIG. 3.

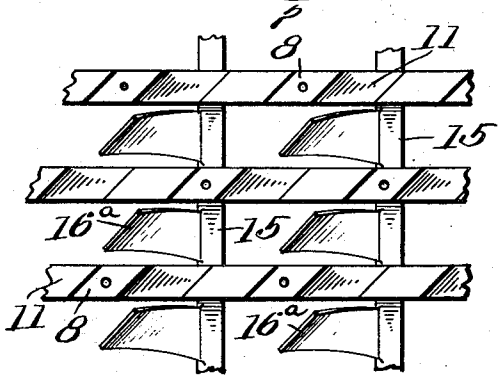


FIG. 5.

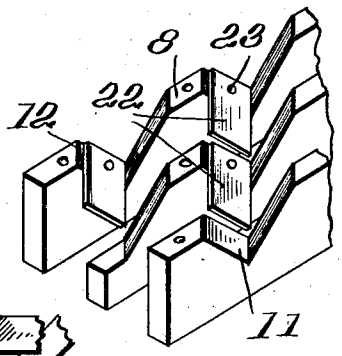
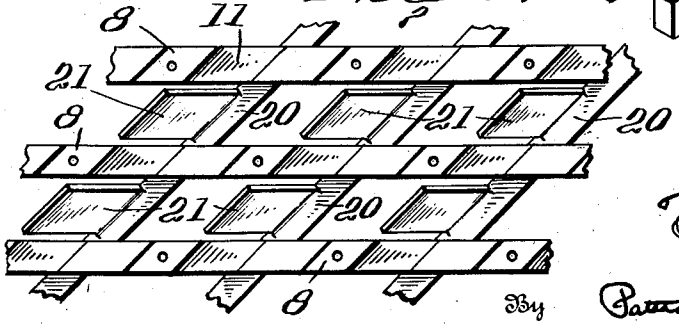


FIG. 4.



Inventor

F. L. Knight

By Patterson, Wright & Patterson

Attorneys

June 20, 1939. F. L. KNIGHT 2,163,342

PNEUMATIC SEPARATOR, CLEANER, CONCENTRATING TABLE, OR THE LIKE

Filed July 28, 1937 2 Sheets-Sheet 2

FIG. 2.

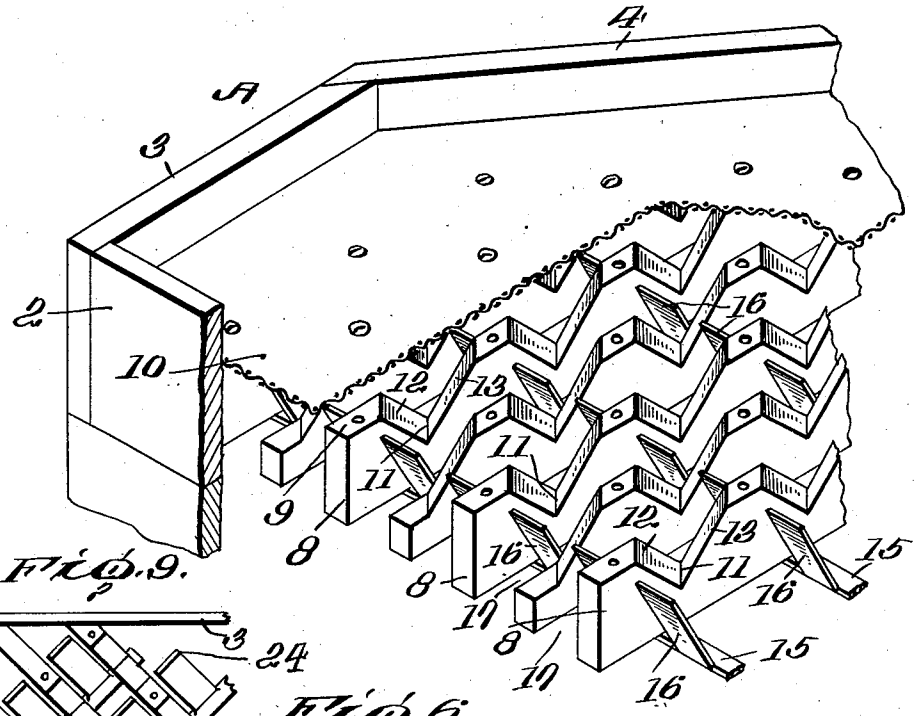


FIG. 9.

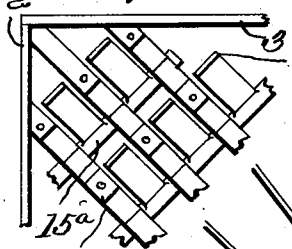
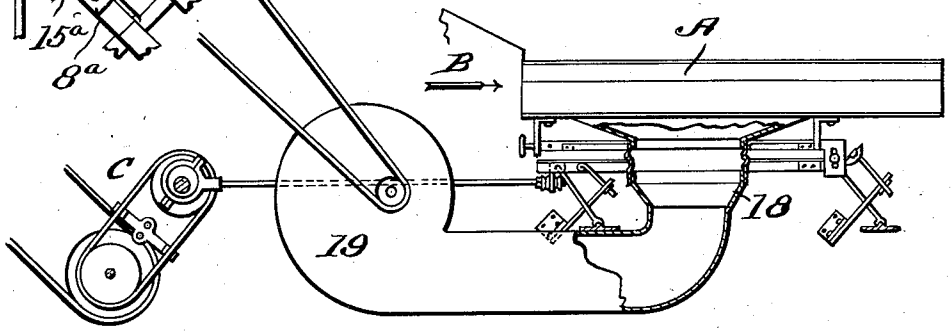


FIG. 6.



Inventor

F. L. Knight

By Pattison, Wright & Pattison

Attorneys

Patented June 20, 1939 2,163,342

UNITED STATES PATENT OFFICE

2,163,342

PNEUMATIC SEPARATOR, CLEANER, CONCENTRATING TABLE, OR THE LIKE

Frank L. Knight, Twin Falls, Idaho, assignor to Sutton, Steele & Steele, Inc., Dallas, Tex., a corporation of Texas

Application July 28, 1937, Serial No. 156,222
In Canada January 7, 1937

9 Claims. (Cl. 209—467)

Pneumatic separating or concentrating tables are today utilized in cleaning, separating, stratifying or otherwise treating a wide range of materials. Among those things which are commonly cleaned or treated on pneumatic separating tables today are ores of various kinds, coal, beans, peas and various seeds including field seeds. In the operation and use of pneumatic separators the control of the delivery of air to the separator deck is of great importance to assure an efficient and successful operation.

The primary object of the present invention is to provide an improved air control to the deck of a pneumatic separator so that the separator has a much higher factor of efficiency than have previous existing devices in respect to the completeness with which various ingredients of varying density in a given mass are stratified or separated out one from the other as the mass passes over the separator.

A still further object of the invention is to provide a pneumatic separator which by reason of the air control built into it the separator is effective in obtaining a clean and satisfactory separation of a mass composed of ingredients the density of the particles of which are so close that a successful separation of them has not been possible by the use of separators as now known and in commercial usage.

In accomplishing the desired and improved results, one of the objects of the invention is the provision of an air controlling device or arrangement for directing air to the deck in a novel and improved manner so that the air constitutes an important factor in the separating method.

Another and further object of the invention is the provision of a deck for a pneumatic separator having incorporated therein a novel and improved air controlling and directing means.

Other further specific objects, novel features of construction and improved results of the invention will appear in more detail from the following description when read in the light of the accompanying drawings.

In the drawings:

Fig. 1 is a top plan view of a separator table deck built in accordance with the present invention, the pervious cover thereof having been removed.

Fig. 2 is a fragmentary perspective view illustrating in detail the construction of the improved deck.

Fig. 3 is a fragmentary top plan view of the deck with the deck cover removed to expose a modified form of air controlling and directing vanes.

Fig. 4 is a view similar to Fig. 3 showing a still further modification of the air controlling vanes.

Fig. 5 is a detailed fragmentary perspective view of a portion of the deck supporting or ribbing structure illustrating a slight modification of vane arrangement.

Fig. 6 is a view in side elevation broken away and illustrated partly in vertical section of a complete separating table.

Fig. 7 is a fragmentary diagrammatic view illustrating on the deck the results of the improved air control.

Fig. 8 is a diagrammatic view in top plan illustrating on the deck the results of the improved air control.

Fig. 9 is a view similar to Fig. 3 illustrating a modified form of rib and air vane disposition.

To those skilled in this art it is well known that a pneumatic separator comprises a deck which is composed of a framework across which extend a plurality of ribs to the upper edge of which is secured a pervious covering or decking, and that this construction which is commonly referred to as an entirety as a deck, is supported upon an air chest to which air is delivered by a fan or other suitable source of air supply. It is equally well known that this deck and air chest are given a reciprocatory or oscillating movement by means of any suitable and well known power mechanism. Additionally it is well understood that the porosity of the deck covering will vary in accordance with the nature of the material being treated and that the deck is disposed in a manner whereby there is a transverse inclination to provide the table with a high side and a low side.

Bearing in mind these basic characteristics of pneumatic separating or concentrating machines or tables the novelty as well as the improved features of the present table will be recognized and readily understood from the following detailed description.

Making reference now to the drawings in which like parts are designated by similar reference numerals throughout the description, the deck or table is designated as an entirety by A and consists of a framework including retaining walls **2**, **3**, **4** and **5**. The lower longitudinal edge or side of the deck is designated at **6** but this does not act as a retaining wall inasmuch as in the operation of the table material being operated upon discharges over this lower deck edge on to a discharge board **7**. By reference to Fig. 1 of the drawings it will be seen that the deck or table is illustrated as being substantially triangular in

configuration but no particular or specific table configuration is necessary in carrying out, practicing or utilizing the present improved invention.

From the foregoing it will be obvious that the deck is inclined to the horizontal with the discharge edge or side 6 being the low side. Ordinarily but not necessarily the table is also inclined longitudinally upwardly from its end 2 towards its end 5.

Extending across the framework of the table and disposed in spaced parallel relationship are a series of ribs 8 and to the upper edges 9 thereof is secured a pervious covering 10 which may consist of cloth, wire mesh or any other like and suitable pervious material. The elements composing the mass which is to be operated upon is fed upon this pervious covering and in the table illustrated in Fig. 1 of the drawings is preferably fed on over the side 3 of the table.

Each of the ribs is provided in its upper edge with a series of substantially V-shaped notches 11 which are arranged in spaced apart relationship throughout the length of the rib. These ribs 8 are preferably thick enough so that inner surfaces 12 and 13 of these notches are obliquely disposed with relation to the vertical faces or surfaces of the ribs. In respect to adjacent ribs the notches are out of perpendicular alignment so as to provide a series of passageways which extend diagonally downwardly and rearwardly from the high side 4 of the table to the low discharge 6 thereof. These air passageways also extend diagonally or obliquely to the direction of oscillation or reciprocation of the table as indicated by the arrow B in Fig. 1 of the drawings. In operation the table or deck is reciprocated in a direction at right angles to the direction of feed onto the table and in a direction at right angles to the direction of the movement of the elements of the mass as caused by gravity due to the transverse inclination of the deck.

In Fig. 1 of the drawings the series of diagonally extending air passageways made up of the series of U-shaped apertures or notches 11 are designated by 14.

In Figs. 1–2 inclusive of the drawings one form of the air vane or air baffle is illustrated and here it will be seen that a plurality of strips 15 are secured to the lower edges of the ribs 8 and extend substantially at right angles thereto and are disposed in spaced apart parallel relationship. Each of the strips is provided with a plurality of vanes or baffles 16 which are disposed in the spaces 17 intermediate the ribs. These vanes or baffles are inclined upwardly and rearwardly towards the feed end 2 of the deck so as to direct the air as it comes from the air chest against the under side of the pervious decking 10 in a direction opposed to the direction of oscillation of the deck. The width of the vanes or baffles 16 in respect to the width of the spaces 17 between the ribs is optional but preferably they are sufficiently wide as to contact the ribs. Preferably, although not necessarily, the air vanes or baffles are composed of a pliable metallic material so that their angle of inclination can be adjusted at will.

From the description thus far given it will be seen that air as it passes upwardly from the air chest of the table into the spaces between the ribs will be deflected rearwardly by the vanes 16 and that each pair of vanes 16 will constitute an air pocket for directing air into and through the adjacent V-shaped passageways 11 of the ribs. Thus it will be seen that air currents are delivered to the pervious deck in a direction opposed to the direction of oscillation of the deck and also in a series of paths beneath the lower surface of the deck and in a direction oblique to the direction of oscillation of the deck.

Due to the air current described opposing separating forces are set up. The air vanes 16 set up air currents which are opposed to the thrust of the deck or table, while the diagonally moving air currents through the passageways in the ribs set up a thrust which is backward towards the feed end of the deck and which will cause the lighter elements in the mass being treated to travel backwardly on a diagonal line towards the feed end of the deck while the heavier elements of the mass which are lying below the upper lighter strata is propelled forwardly due to the thrust occasioned by the oscillation of the deck. The result of this operation has been found to be of a much higher efficiency than has been obtained in tables heretofore constructed and operated, and has been found to perform a vastly superior separation and a separation which is economical and will permit of a commercially acceptable separation of materials which are difficult to separate due to the closeness of the density of the different elements constituting the mass being treated.

In Figures 7 and 8 of the drawings I have illustrated diagrammatically the effect on the deck of the improved air control. In Fig. 7 particularly it will be seen that the air follows the direction indicated by arrows by passing upwardly through the pockets formed by the parallel and rearwardly inclined vanes 16. These vanes together with the diagonally extending air passageways formed by the notches 11 causes on the deck a series of high pressure air areas R. Those skilled in this art know that with the air passing through the pervious deck cover at a pressure which is induced or produced within the air chest expands on the deck surface to atmospheric pressure. This results in a film of air, which is designated as S in Fig. 7 of the drawings, immediately above the deck surface. By reason of the aforementioned and hereinafter described air controlling mechanism this air film forms the high pressure air areas or lines R which extend across the deck in parallel diagonal lines as indicated in Fig. 8 of the drawings. The effect of these high pressure air areas is that as the material being treated is fed from the feed end of the deck the lighter particles of the mass are caused to travel backwardly towards the feed end of the deck along the diagonal lines of these high air pressure zones R. The heavier elements of the mass are propelled through or across the high pressure zones and move forwardly towards the opposite or discharge end of the deck with the final result that the lighter particles will discharge over the low side 6 of the deck nearer the feed end 2 while the heavier elements of the mass will be discharged from the low side 6 of the deck nearer what I have termed the discharge end 5 thereof.

As illustrative of a complete machine, reference should be made to Fig. 6 of the drawings where the deck as an entirety is again designated as A and the direction of oscillation thereof by the arrow B. The air chest is designated at 18 and the fan for supplying air thereto at 19. The power means for oscillating the deck is designated as an entirety by C.

Referring now to Fig. 4 it will be seen that a slightly modified form of vaning or baffling arrangement is illustrated. In this construction the strips 20 are similar to or correspond to the

strips 15 in the previously described embodiment of the invention. In this instance however the strips 20 rather than being disposed perpendicularly to the ribs 8 extend obliquely in respect to the ribs. The vanes 21 are disposed in the spaces between the ribs and extend upwardly and rearwardly at an incline. The ribs are provided with the same V-shaped notched out apertures 11.

Fig. 3 illustrates a slight modification in the vaning described in the first embodiment of the invention. Similar reference numerals are applied in this figure of the drawings to those parts which are similar to like parts illustrated in the embodiment appearing in Figs. 1 and 2 of the drawings. The only difference in the construction appearing in this figure of the drawings over the first embodiment is that the vanes 16a Fig. 3 in addition to inclining upwardly and rearwardly are edge-twisted whereby they urge or direct the air angularly upwardly and rearwardly so that the air contacts the pervious deck obliquely to the direction of reciprocation of the deck rather than at right angles to the reciprocation of the deck.

Fig. 5 is illustrative of a modified or optional manner of connecting the air vanes in place. In this instance the strips 15 in the preferred embodiment are discarded and each vane is an individual member in the form of a metallic plate 22 which at one edge is suitably fastened as at 23 to the rear inclined face 12 of the notches 11. In this form of the invention the air vanes 22 function in a manner identical to the heretofore previously described vanes 21 with the exception that the vanes are disposed to direct the air rearwardly towards the feed end of the table in a direction which is oblique to both the direction of oscillation of the deck and the direction of the feed to the deck.

Fig. 9 is illustrative of a slightly modified form of the invention in that the ribs 8a instead of extending longitudinally of the deck and in parallelism with the direction of oscillation of the deck extend diagonally across the deck in a direction which is oblique to the direction of oscillation of the deck as well as the feed thereto. Similarly the strips or bases 15a which carry the vanes 24 extend across the deck in a diagonal direction with the result that the vanes 24 direct the air to the under side of the deck in a direction which is not only rearwardly but which is oblique to the direction of oscillation of the deck and to the feed end 2 and particularly the feed corner 3 of the deck.

The result of the air control effected by the arrangements illustrated in both Figs. 5 and 9 is that the diagonally extending high pressure areas indicated as R on Fig. 8 are set up not only due to the passage of air through the ribs in a diagonal direction but also due to the fact that the air vanes themselves assist in directing the air so as to set up these diagonally extending lines of high pressure air areas on the deck.

With a separator built in accordance with the present invention a much improved method of separation is provided as has been pointed out in the objects of the invention and as will now be apparent from an understanding of the improved construction. A separator built in accordance with the present invention is durable, economical of manufacture and highly efficient in operation and is capable of performing a commercially acceptable separation of intermixed materials which tables as heretofore constructed have been unable to successively treat.

I claim:

1. In a pneumatic separator or concentrating table for the dry separation of elements of a mass, an oscillating pervious deck to which air under pressure is delivered, a series of spaced ribs for supporting said deck, a series of baffles disposed in the spaces between said rib for directing air to said deck in a direction opposed to the direction of oscillation of said deck, and a series of air passageways in said ribs for directing a plurality of air streams in a direction oblique to the direction of oscillation of said deck, for the purpose described.

2. In a pneumatic separator or concentrating table for the dry separation of elements of a mass, an oscillating pervious deck to which air under pressure is delivered, said deck being disposed at an inclination to the horizontal to provide a high side and a low discharge side, a series of spaced ribs for supporting said deck, a series of baffles disposed in the spaces between the said ribs for directing air to said deck in a direction opposed to the direction of oscillation of said deck, a series of air passageways in said ribs for directing a plurality of air streams in a direction oblique to the direction of oscillation of said deck, and said air passageways extending diagonally from the low side towards the high side of said deck, whereby said air streams move towards the feed end of the deck, for the purpose described.

3. In a pneumatic separator or concentrating table for the dry separation of elements of a mass, an oscillating pervious deck to which air under pressure is delivered, a series of spaced ribs for supporting said deck, a series of air passageways in said ribs for permitting the passage of a plurality of air streams diagonally across the under side of said deck, and a plurality of vanes disposed in the spaces between said ribs to direct air upwardly therebetween and into the air passageways of the ribs.

4. In a pneumatic separator or concentrating table for the dry separation of elements of a mass, an oscillating pervious deck to which air under pressure is delivered and to which the elements composing the mass is fed for separating action, a series of spaced ribs for supporting said deck, a series of vanes disposed in the spaces between said ribs for directing air to the under side of said deck at an angle oblique to the direction of oscillation of said deck, and a series of air passageways in said ribs for directing the passage of a plurality of air streams to and across the under side of said deck in a direction oblique to the direction of oscillation of said deck.

5. In a pneumatic separator or concentrating table for the dry separation of the elements of a mass, an oscillating pervious deck to which air under pressure is delivered, a series of spaced ribs beneath and supporting said deck and extending across the same in a direction diagonal to the direction of oscillation of the deck, a series of baffles disposed in the spaces between said ribs for directing air to said deck in a direction oblique to the direction of oscillation of said deck, and a series of air passages in said ribs for directing a plurality of air streams in a direction oblique to the direction or oscillation of said deck, for the purpose described.

6. In a pneumatic separator or concentrating table for the dry separation of the elements of a mass, a pervious deck to which air under pressure is delivered, a series of ribs under said deck and supporting it, each rib of said series having air

openings therein, the openings in the adjacent ribs extending in a diagonal line across the underside of the table and vanes under said deck arranged in diagonal lines corresponding with the said arrangement of the openings in said ribs whereby air is supplied to the deck in parallel diagonal lines across said deck.

7. An improved pneumatic separator or concentrating table, comprising a pervious concentrating deck, a deck supporting rib structure there-beneath, a series of spaced passageways through each rib, the passageways in each succeeding rib commencing from the foremost rib being disposed in alignment diagonally with reference to the longitudinal axis of the deck, and said rib passageways providing air passageways extending diagonally across the under side of said pervious deck.

8. In a pneumatic separator or concentrating table, a pervious deck, a series of spaced ribs therebeneath and supporting said deck, each of said ribs being provided with a plurality of spaced apart substantially V-shaped apertures in its upper edge, the apertures of each rib being disposed in alignment diagonally with reference to the longitudinal axis of the deck to provide a series of rows of diagonally disposed apertures constituting a series of air passageways extending diagonally across the under side of said deck.

9. In a pneumatic separator or concentrating table for the dry separation of the elements of a mass, a pervious deck to which air under pressure is delivered, a series of ribs under said deck and supporting it, each rib of said series having air openings in its upper edge and vanes under said deck adjacent said rib air openings for directing air upward through said rib openings, whereby air is directed to the deck at said rib openings.

FRANK L. KNIGHT.