Oct. 12, 1937. R. PEALE 2,095,283

MECHANISM FOR SEPARATING INTERMIXED DIVIDED MATERIALS

Original Filed Sept. 5, 1925 4 Sheets-Sheet 1

Fig 1

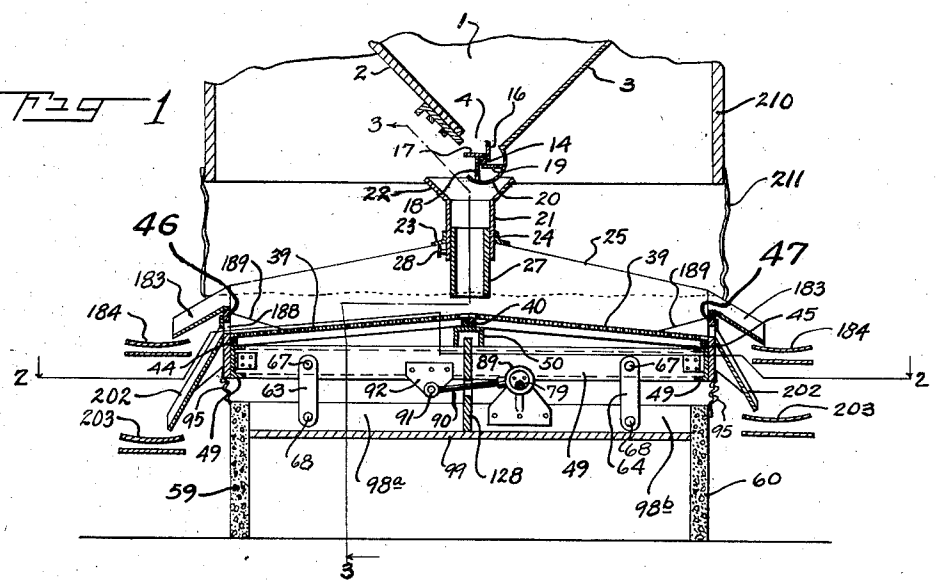
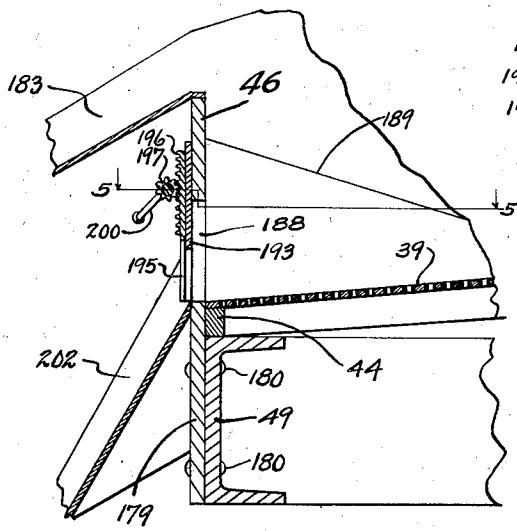


Fig 4



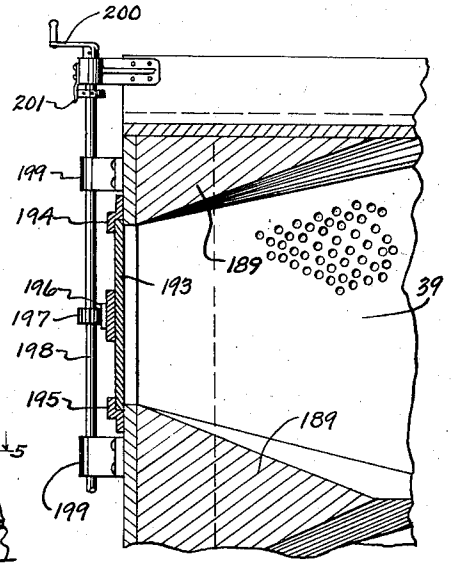


Fig 5

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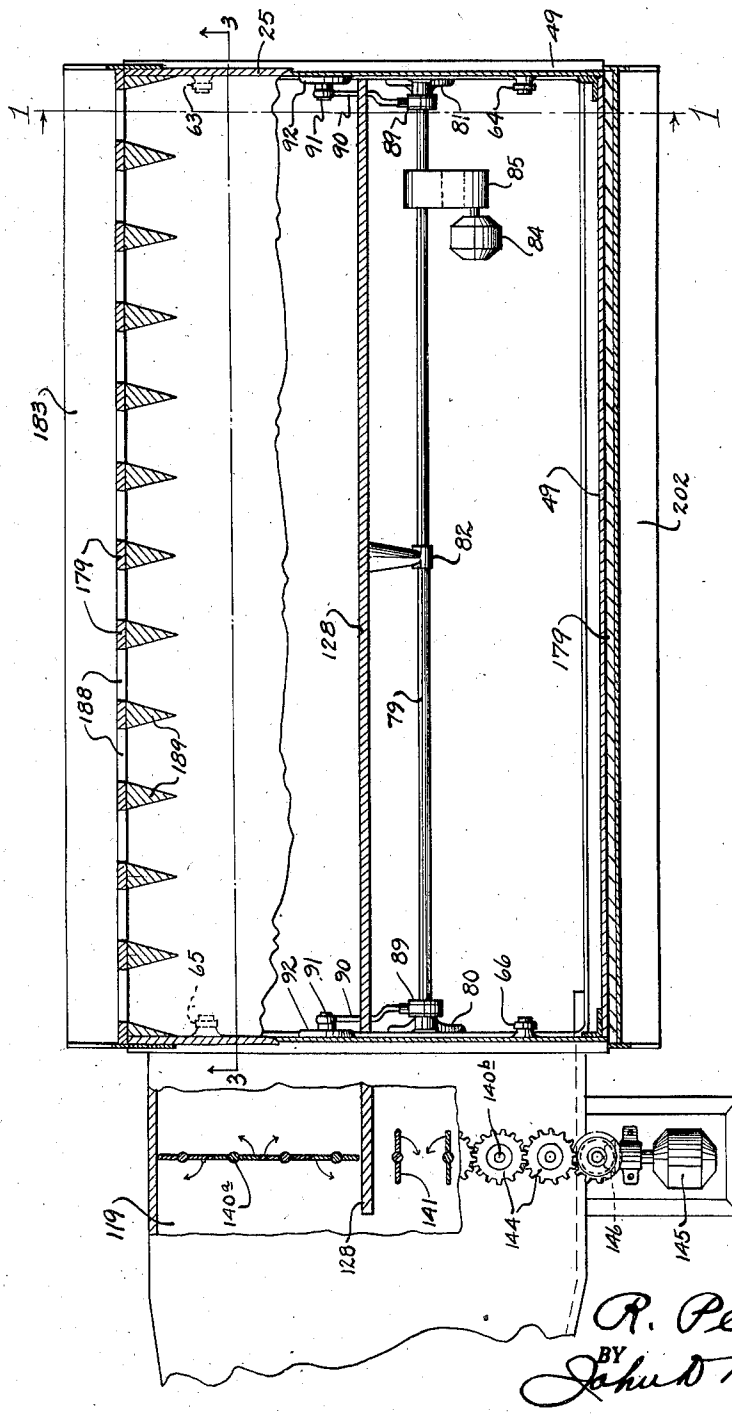


FIG 2

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MECHANISM FOR SEPARATING INTERMIXED DIVIDED MATERIALS

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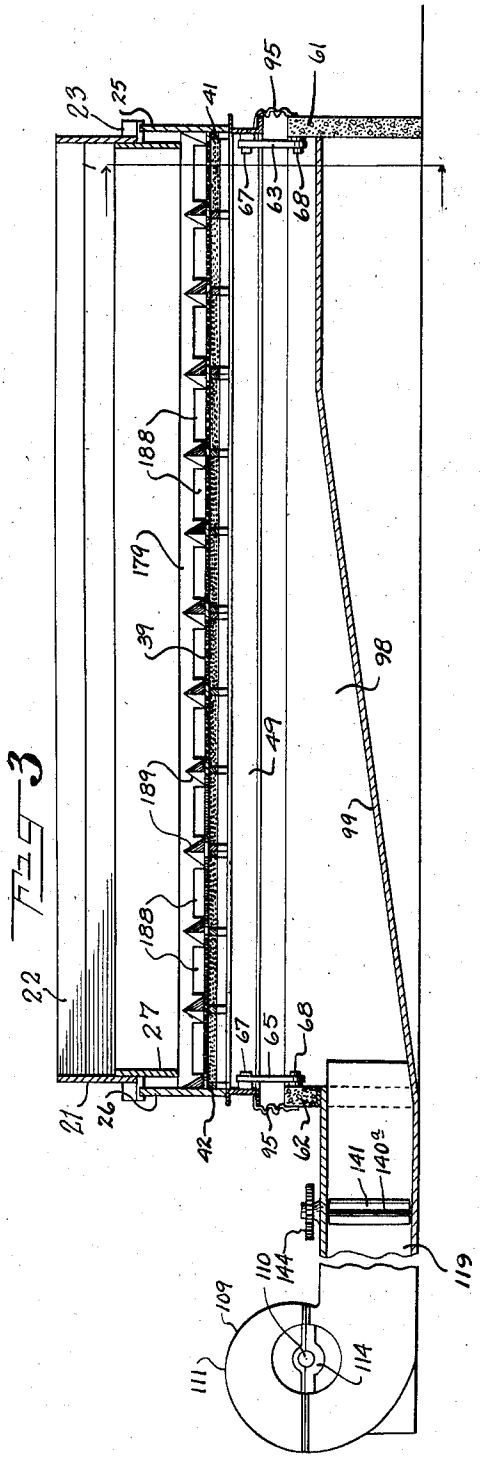


FIG 3

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MECHANISM FOR SEPARATING INTERMIXED DIVIDED MATERIALS

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Fig. 6.

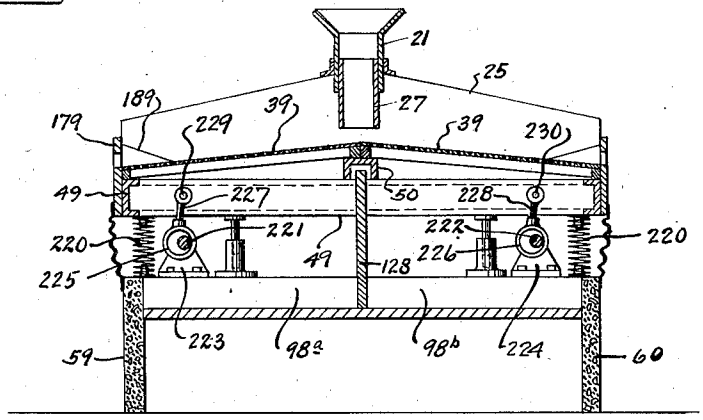
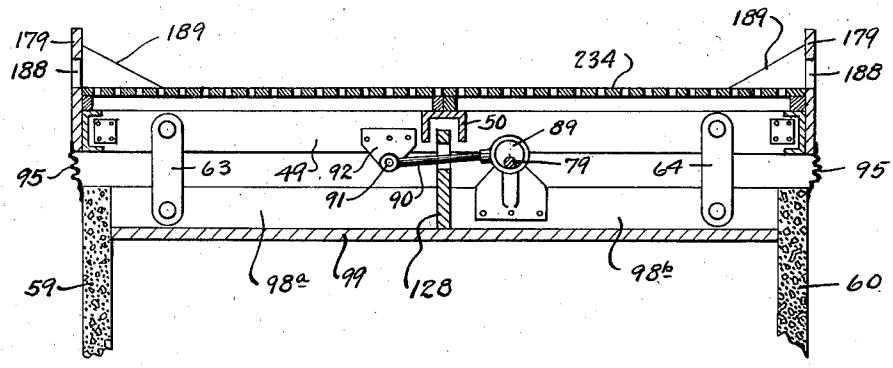


Fig. 7.



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MECHANISM FOR SEPARATING INTERMIXED DIVIDED MATERIALS

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Application September 5, 1925, Serial No. 54,778
Renewed August 20, 1932

2 Claims. (Cl. 209—475)

The invention relates to a mechanism for separating intermixed, divided materials, and more especially to a mechanism for separating such materials, the fragments or particles of which vary very widely in size, while varying relatively very little in their specific gravities.

Objects and advantages of the invention will be set forth in part hereinafter, and in part will be obvious herefrom, or may be learned by practicing the invention; such objects and advantages being realized and attained by the steps, and through the instrumentalities, pointed out in the appended claims.

The invention consists in the parts, combinations, constructions and arrangements herein shown and described.

The accompanying drawings, herein referred to and constituting a part hereof, illustrate one embodiment of the invention and the preferred manner of practicing the same, said drawings together with the description serving to illustrate the principles of the invention.

Of the drawings:—

Fig. 1 is a vertical, transverse section taken on the line 1—1 of Fig. 2, but showing in addition the feeding hopper and dust collector.

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

Fig. 3 is a full vertical longitudinal section taken on the line 3—3 of Figs. 1 and 2;

Fig. 4 is a fragmentary transverse vertical section, greatly enlarged of a part of the central left hand portion of Fig. 1;

Fig. 5 is a horizontal section taken on the line 5—5 of Fig. 4;

Fig. 6 is a transverse, vertical, fragmentary section corresponding generally to Fig. 1, but illustrating a different form of table actuating means; and

Fig. 7 is a fragmentary, enlarged, transverse vertical section, corresponding to the lower, central part of Fig. 1, but illustrating a flat or horizontal table.

The invention is directed to a mechanism for separating intermixed divided materials, the term "divided" being used to designate broken, fragmentary, granular, pulverulent or other material comprising separated parts or pieces of different kinds of materials.

The invention is further directed to effect the automatic separation of such mixtures of materials wherein the various pieces of the different kinds of materials vary very greatly in size, while varying relatively very little in their specific gravities. This presents a problem of great practical difficulty, due to the wide range of variation in the sizes of the pieces of material and the relatively small variance in their specific gravities.

The terms "lighter" and "heavier" as used hereinafter will be understood as applying to the specific gravities of the various intermixed, divided materials, and not to the difference in mass of particular pieces of various sizes.

One kind of intermixed divided materials which the invention is capacitated to separate is a mixture of coal, "bony" and rock, and other impurities, as it comes from the mine, the rock and other impurities being separated from the coal entirely automatically by my invention and without previous "sizing" of the material except as to crushing or removal of the very largest lumps.

By my present invention, the intermixed materials are fed on preferably entirely across the rear end of the air pervious table, and beginning at this time and continuing progressively forwardly along the table, the intermixed particles or fragments of material are loosened apart and separated from each other, and the lighter material gradually forms a flotant top stratum, and the heavier material gradually settles and comes to rest upon the table, and thereafter is progressed forwardly by the combined action of friction and inertia to a place of delivery.

As exemplarily and preferably embodied, so far as concerns the main features of the invention, the separating table comprises a relatively very wide and short air-pervious deck (considered in the direction of travel of the bed of materials). Thus the travel of the intermixed materials over the table during the process of stratification and separation is relatively short, whereas when the material is fed on along the entire long dimension of the table, a large separating capacity is realized while relatively only a small quantity of the intermixed material is fed on at any point or place.

Further, as embodied, with the two tables or units constructed together, they are joined or abut centrally along one of their longest dimensions and both of the tables are inclined preferably downwardly away from this line of juncture. The intermixed materials are preferably fed to both tables simultaneously at this common juncture by any suitable means which provides a variable feed, capable of graduation to meet the exact capacity of the table with the particular kind of intermixed materials which are

being separated or with the materials in a particular physical state or condition.

As exemplarily embodied and in detail, a bin or hopper 1 is provided, shown only fragmentarily, having downwardly and inwardly extending sides 2 and 3, and extending preferably from one side to the other of the joined tables, and approximately above their line of juncture. At the bottom of this supply bin is a relatively long and narrow discharge opening 4, and in this opening is the means for gradually and varyingly causing the discharge of the intermixed materials to the material-receiving or feeding ends of the two tables.

The embodied form of said means comprises a shaft 14, extending longitudinally of the discharge opening 4, and having circular discs (not shown) affixed thereto at either end and if desired also at median points therealong. Fixed to the discs are a plurality of feed regulating blades 16, 17, 18 and 19, which are arranged preferably approximately tangentially to the shaft 14. The discs and the blades 16, 17, 18 and 19 work within a parti-cylindrical member 20, extending throughout the entire length of the feeding mechanism, and having a discharging opening or orifice at one side of the mechanism just described, through which the intermixed materials are fed out at the desired rate.

There is preferably provided also a directing chute for directing the fed materials on to the table, and as embodied, a relatively long and narrow chute 21, extending preferably for the full length of the table and the feeding mechanism is provided. This chute has preferably an upwardly and outwardly flared top 22. The chute is supported by suitable means, as by angle strips or beams 23 and 24, supported upon and extended between the end walls 25 and 26 of the table structure. The chute 21 may be extensible and contractible in length, and a telescoping section 27 is shown held in adjusted position by clamping bolts 28.

Thus the intermixed materials to be separated may be fed entirely along the abutting material-receiving or feeding edges of the two tables. The quantity of material fed to the tables may be very nicely regulated, as may be found necessary or desirable, depending upon the nature or the physical state of the materials, so as to maintain upon the table and undergoing separation a bed of such thickness as represents the highest efficiency of the mechanism. It will be obvious, of course, that the feeding mechanism may be used for a single table instead of two tables constructed jointly.

In accordance with one feature of the invention, a reciprocatory motion along a relatively short path, and in the direction of travel of the materials along the table during the process of separation is provided. The materials are also subjected to air-pressure action during the process of stratification and separation, and the particular preferred form of this air action and the manner of carrying it out will be later described in detail.

Referring now to the general structure of the table, and having these features especially in view, the two table decks 39 are supported at their central, abutting edges upon frame members 40, which members are carried at either end upon side frame members 41 and 42. The opposite or outer edges of the table decks 39 are carried upon strips 44 and 45, which likewise extend the full length of the table. At either end, or rather side thereof, the tables have upwardly projecting material-retaining walls 46 and 47, connected with the structure just described. The structure just described is supported on a rectangular frame of four channel beams 49, which are connected together and constitute a general frame for the reciprocable table. The members 40 are supported on an inverted channel beam 50, extending along beneath said members and supported at either end upon the cross reaches of the frame 49.

Beneath the structure just described is a stationary air-pressure chamber, having side and end walls 59, 60, 61, and 62, and these walls also serve as a stationary support for the reciprocable tables as well as constituting the lower portion of the air chamber, as will be later described.

The embodied form of reciprocable support for the table, shown in Figs. 1 and 3, gives a reciprocatory movement in the direction of travel of the beds of material being separated, but having a rising and falling component. It will be understood that the nature of this motion may be varied as found to be most efficient with various materials. Said form comprises pairs of links 63 and 64, 65 and 66, at the two ends, respectively, of the table, these links at their upper ends having pivotal connections 67, respectively, with the various reaches of the supporting frame 49. At their bottom ends these links have like pivotal connections 68, respectively, upon the upper part of the stationary walls 61 and 62.

The means for actuating the table may be of any suitable or convenient form, and as embodied a shaft 79 is journaled in bearings 80 and 81, upon the walls 61 and 62 of the stationary supporting structure, the shaft also having one or more intermediate bearings 82, supported in any suitable manner. The shaft 79 is driven by any suitable means, and preferably by some variable speed driving means, said driving means being shown more or less conventionally as comprising a motor 84, and a variable speed drive 85.

Fixed upon shaft 79 are a plurality of eccentrics 89, having respectively eccentric rods 90 pivotally connected at the points 91 to the reciprocable table structure, by means of downwardly extended pivot bearing plates 92. Thus the table, whether single or double, is given a reciprocable motion, variable in speed as may be desired and as found most efficient. The length of the reciprocatory movement may likewise be varied by changing the size of the eccentrics or in any other suitable or preferred manner.

The embodied form of air chamber beneath the table comprises further a flexible, air-impervious member 95, of canvas or other suitable material, fastened at its upper edge entirely about the frame 49 of the reciprocable table and fastened about its lower edge of the upper part of the stationary supporting walls 59, 60, 61 and 62 of the stationary chamber.

Suitable means are provided for rendering uniform the air pressure in all parts of the air chamber, or for regulating it as desired. As embodied, the bottom 99 of the air chamber is preferably uwardly inclined away from the source of air pressure or air-current supply, as best shown in Fig. 3. This floor 99 of the air chamber adjoins the walls of the stationary support, and is supported thereby. The floor of the chamber is shown with the extreme forward end substantially level but this feature, and others as well, may be varied as desired.

The air pressure or air current creating and

regulating means, in accordance with one feature of the invention, provides an air action which rises from a minimum to a maximum and subsiding again to a minimum, together with means for varying both the volume of the air and the timing or rapidity of the cycle of action. In connection therewith, in the preferred form of the invention, the deck or table **39** is of a uniform degree of air perviosity throughout, although this feature may be varied also in connection with certain features of the invention if desired.

In the embodied form of such means, the air pressure or air current action is produced primarily by a fan or blower **109**, having a shaft **110**, projecting from housing **111** of the fan, and has journals **114** in the housing. The fan is driven by any suitable variable speed means, which is not shown in detail, but is indicated by the driving belt **112** running over a pulley **113**, which pulley is fixed on shaft **110**.

In the case of the two tables operating together, as herein preferably and exemplarily embodied, a common air duct **119** leads from the fan to the air chamber **98** beneath the tables. A central partition **128** in such case is provided, this partition preferably beginning at any suitable or desired point with respect to the fan within the air duct **119**, and continuing within the air chamber **98** throughout the length thereof and constituting an air partition between the two parts **98a** and **98b** of the air chamber. The upper edge of the partition **128** projects preferably within the flanges of the angle iron **50**, and it may have air tight flexible connection therewith, although the air loss at this time would usually be so slight that this may generally be omitted.

Referring now to the exemplified form of means for creating the pulsating or varying air pressure or air current action or volume to the table, and referring to the form shown in Figs. 2 and 3, a plurality of rotary air valves are shown within the duct **119**, these valves alternately opening and closing, the opening and closing action being preferably gradual between wide open and shut and the speed of this action being preferably regulable. When the two tables are run as a single unit as herein illustrated, the air valve mechanism for one table will always be in the opposite position to that for the other table, thereby providing approximately a uniform load on the fan or other source of air pressure or air current supply.

In the form shown in Figs. 2 and 3, a plurality of uni-directional, and preferably continuously operating rotary shutters are provided. These comprise, as embodied, a series of vertical shafts **140a** and **140b**, journaled respectively in the floor and top of the air channel **119**, an air valve or shutter **141** being carried medianly upon the respective shafts **140a** and **140b**. As the shafts rotate, these valves **141** pass from the closed position shown at the upper part of Fig. 2 to the wide open position shown at the bottom of Fig. 2 for the other air table. The intermediate positions of the two valve mechanisms will be readily understood.

Thus in the position shown in Fig. 2, the full power of the fan is creating air pressure and air currents in the nearer table of Fig. 2. As the two sets of valves rotate, air is gradually admitted to the air chamber of the uppermost table in Fig. 2 and the air pressure and air currents begin in this chamber and gradually intensify, while in the air chamber for the lower table they gradually decrease, until the condition shown in Fig. 2 as to the two tables is reversed, and so on continuously.

In the embodied form of actuating means, each of the shafts **140a** and **140b** has fixed thereto a gear wheel **144**, these gear wheels being continuously in mesh and producing the action just described. The driving means therefor may be of any suitable or desired form, and is shown herein more or less conventionally as a motor **145**, and a reduction gear connection **146** therefrom to the gear wheels **144**. It will be understood, however, that a variable speed motor or a variable speed drive from the motor, or any known or convenient form of speed varying, power-conveying means may be employed.

In the embodied form of material-discharging means, and in connection therewith certain elements of the structure for maintaining the uniform bed for materials undergoing separation, a front plate **179** is provided, extending along the front of each table, and preferably riveted to the corresponding frame member **49** by rivets **180**. The lighter material from the top of the bed is discharged over the upper edge of these front walls **179**, respectively, and is conducted by chutes **183** on to conveyor belts **184**, respectively, and thereby is conveyed away. It will be obvious that the height of the top edge of the front plates could be raised or changed as desired, to vary the thickness of the bed of materials maintained upon the table.

The means for discharging the heavier material, comprises a plurality of openings **188** in the front plates **79**, between which openings are provided guiding blocks or devices **189**, of angular form, tapering from the front wall both downwardly and laterally inwardly along the table or deck **39**, to direct the heavier and stratified material, toward and into the openings **188**.

Means are provided preferably for varying the size of the openings **188** to conform to the volume of heavier material which is separated and is impelled forward along the floor **39** to discharge. In the embodied form thereof, slidable plates **193** are reciprocably mounted in vertically disposed guides **194** and **195** at either side thereof. Longitudinally and centrally the gates **193** are provided with a straight geared rack **196**. Meshing with each of the geared racks **196** is a corresponding pinion **197**, fixed on a shaft **198**, extending along the front of each of the tables. The shaft **198** is journaled in suitable bearings **199**, and may be provided with a crank **200**. A detent device **201** may be provided to hold this mechanism in any desired position. Chutes **202** are provided for each of the openings **188**, or preferably one continuous chute may be provided along the entire front of the table, such chutes discharging the material on to conveyor belts **203**.

In Fig. 6 a different form of table-reciprocating mechanism is shown, adapted to give a vertical reciprocating motion to the table. In the embodied form of such means the supporting frame **49** is mounted on a plurality of springs **220**, sufficient in number for the purpose desired. Two shafts **221** and **222** are arranged along beneath the tables within the air chamber, these shafts being journaled respectively in series of bearings **223** and **224**, mounted upon the top of the walls of the stationary part of the air chamber, and also elsewhere if found desirable or convenient. Fixed to the shafts **221** and **223**, respectively, are a plurality of eccentrics **225** and **226**, having, respectively, rods **227** and **228**, pivotally connected at corresponding points **229** and **230** to the frame **49**

of the table. The eccentrics thus vertically reciprocate the table, the weight of the table being compensated by the springs **220**, which act to reduce the work necessary to effect the reciprocatory action.

In Fig. 7, a pair of cooperating tables is shown with a flat air-pervious deck **234**, which may be used if desired, the table being shown more or less diagrammatically.

Dust collection means are preferably provided, and such means is fragmentarily shown at **210** in Fig. 1 of the drawings, the structure **210** carrying a depending flexible skirt or curtain **211**, extending downwardly past the upper part of the table.

From all the foregoing it will be understood that a mechanism has been provided constituting an exemplary embodiment of the invention, and realizing the objects and advantages herein set forth, together with other objects and advantages. It will be understood further that departures may be made from the exact mechanism as shown and described, within the scope of the accompanying claims, without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:—

1. A mechanism for separating intermixed divided materials of different specific gravities including in combination a separating unit having a plurality of independent separating tables or decks disposed side-by-side on a frame or chassis, a box divided longitudinally by partition means to provide an independent pneumatic chamber for each table or deck, means for ensuring air tightness of the chambers one against another, a fan or blower, and control means adapted for admitting pulsations of air pressure sequentially or alternately to the pneumatic chambers from the fan or blower, said control means comprising rotary valves adapted to rotate out of phase with respect to each other.

2. A mechanism for separating intermixed divided materials of different specific gravities including in combination a separating unit having a plurality of independent separating tables or decks disposed side-by-side on a frame or chassis, a box divided longitudinally by partition means to provide an independent pneumatic chamber for each table or deck, means for ensuring air tightness of the chambers one against another, a fan or blower, and control means adapted for admitting pulsations of air pressure sequentially or alternately to the pneumatic chambers from the fan or blower, said control means comprising a plurality of rotary valves for each chamber and the valves for one chamber being adapted to rotate out of phase with those for another chamber.

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