Dec. 30, 1930. K. DAVIS 1,786,739

METHOD AND MECHANISM FOR SEPARATING DIVIDED MATERIALS

Original Filed June 7, 1922 4 Sheets-Sheet 1

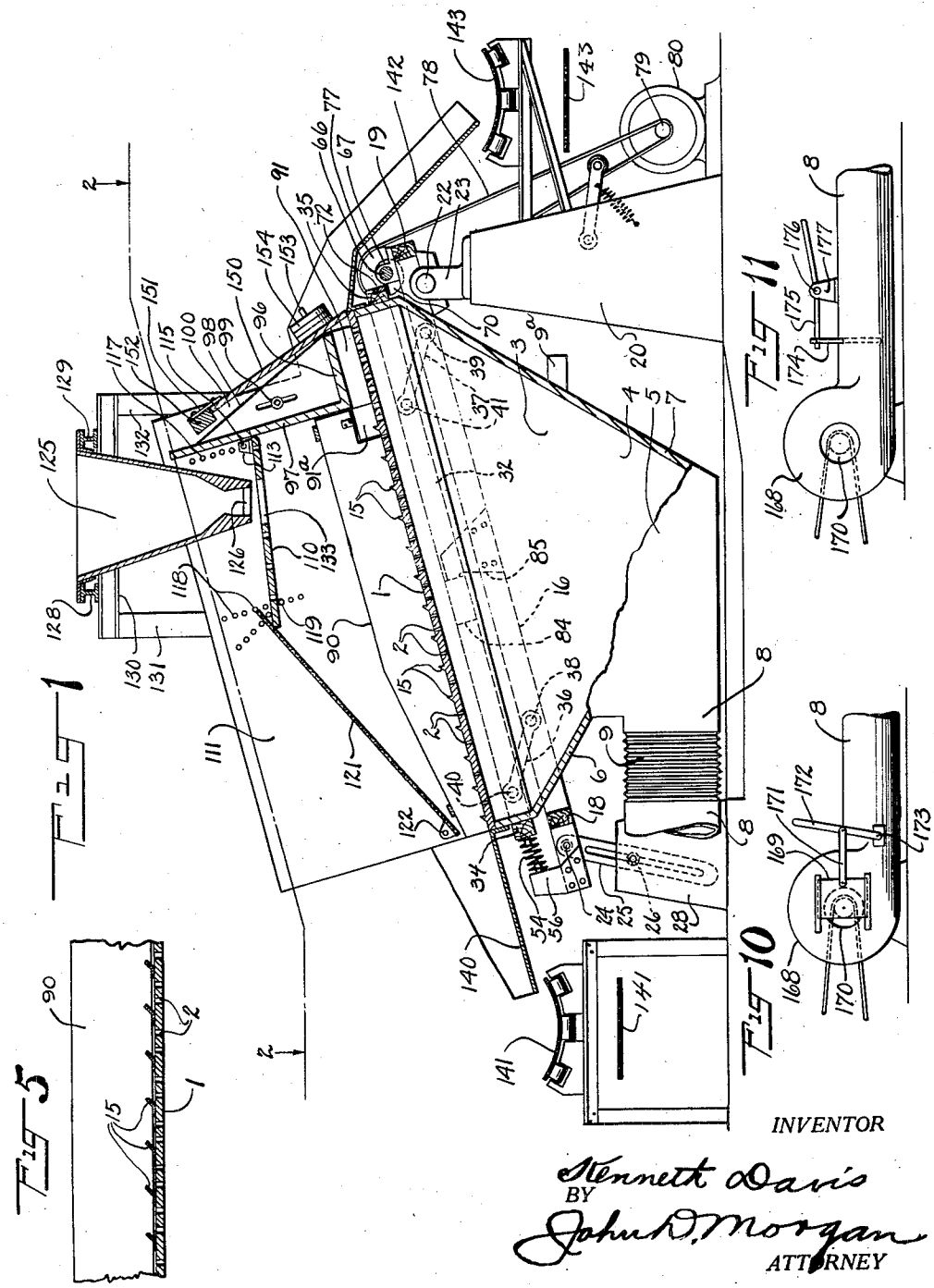


Fig 1

Fig 5

Fig 11

Fig 10

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METHOD AND MECHANISM FOR SEPARATING DIVIDED MATERIALS

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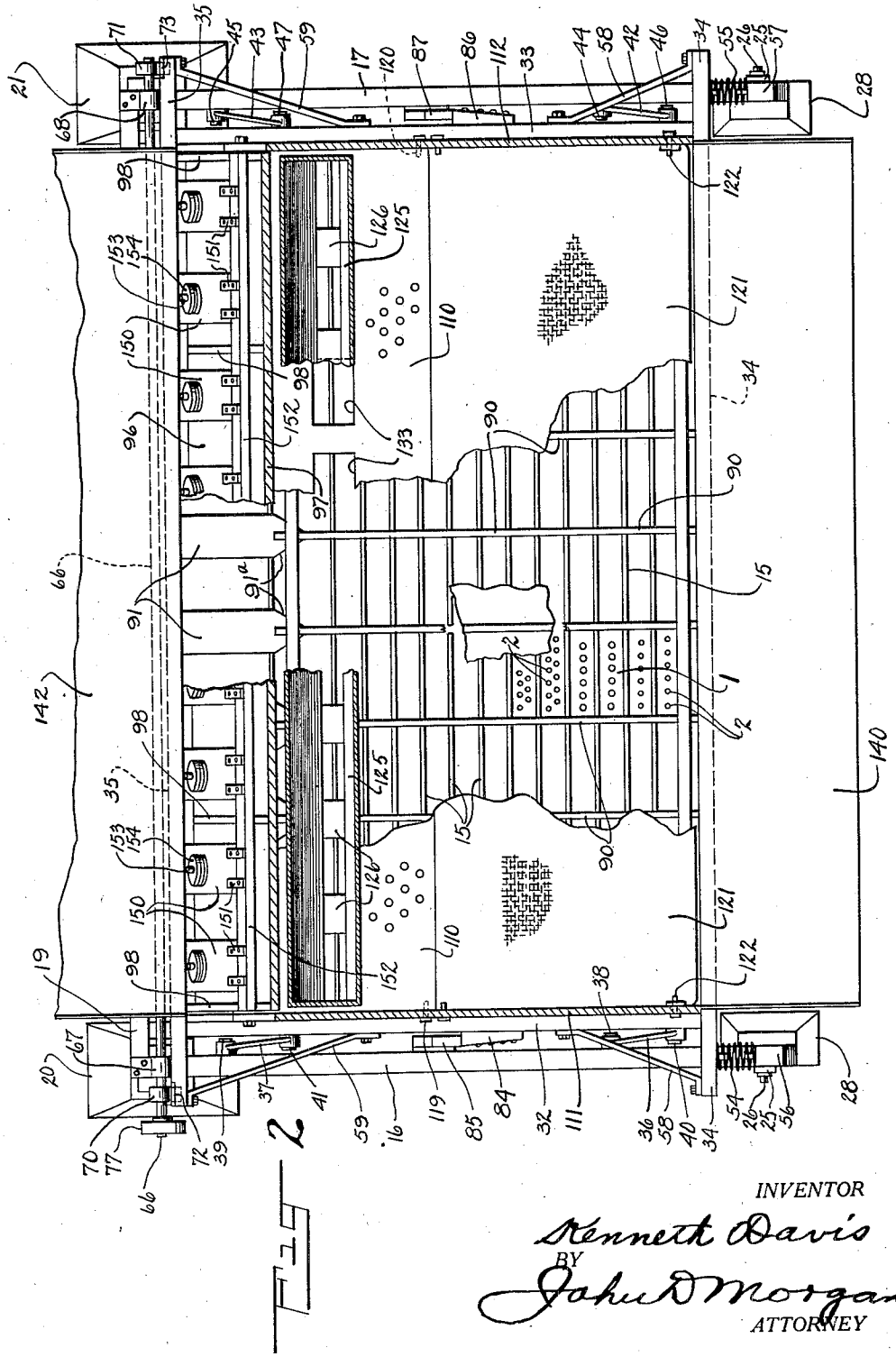


Fig. 2

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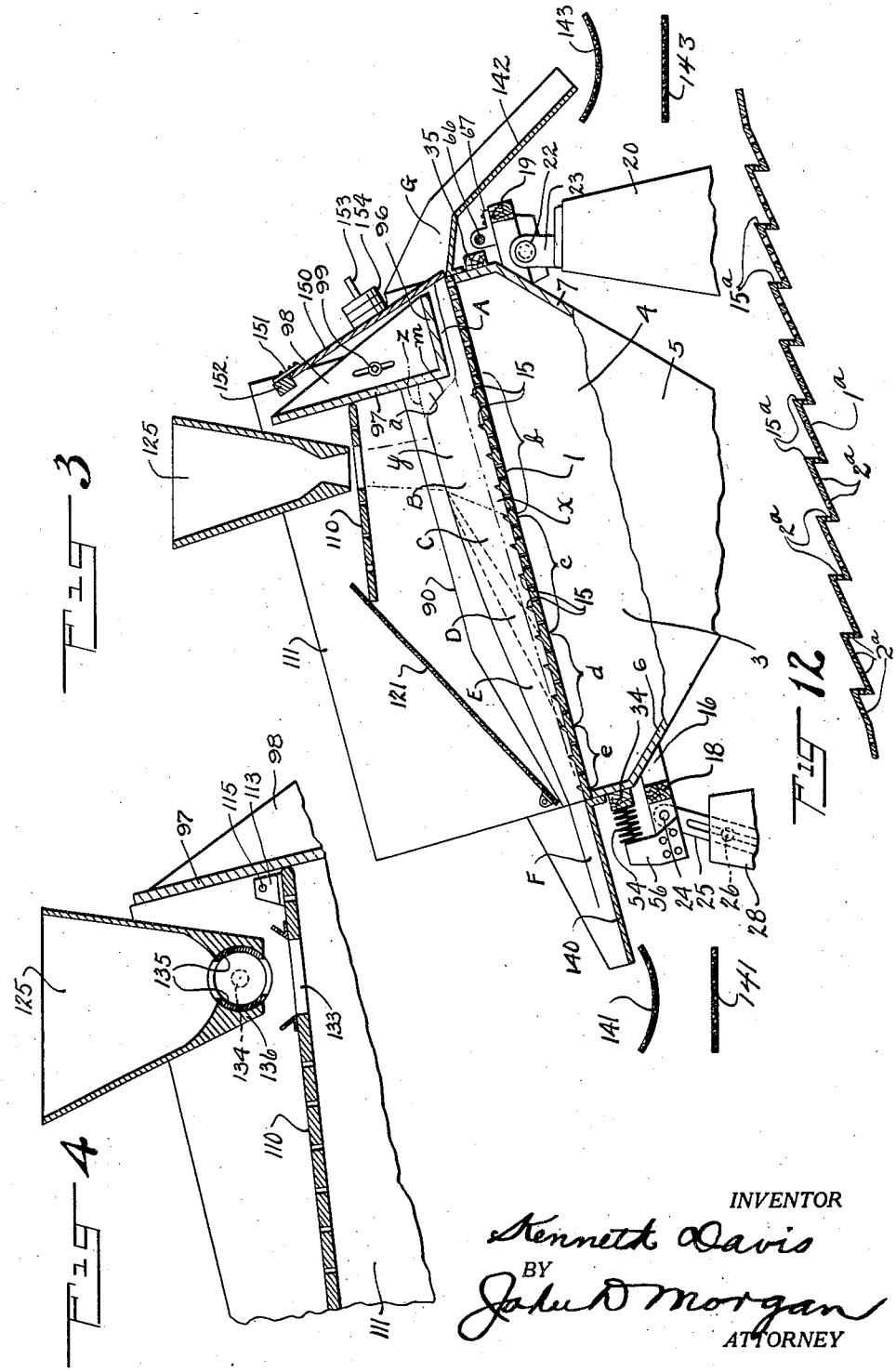


Fig. 3

Fig. 12

Fig. 4

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METHOD AND MECHANISM FOR SEPARATING DIVIDED MATERIALS

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Fig 6

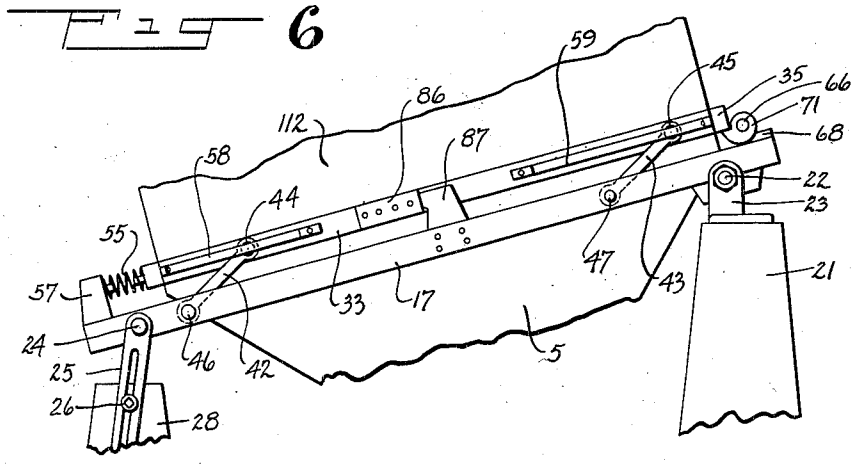


Fig 7

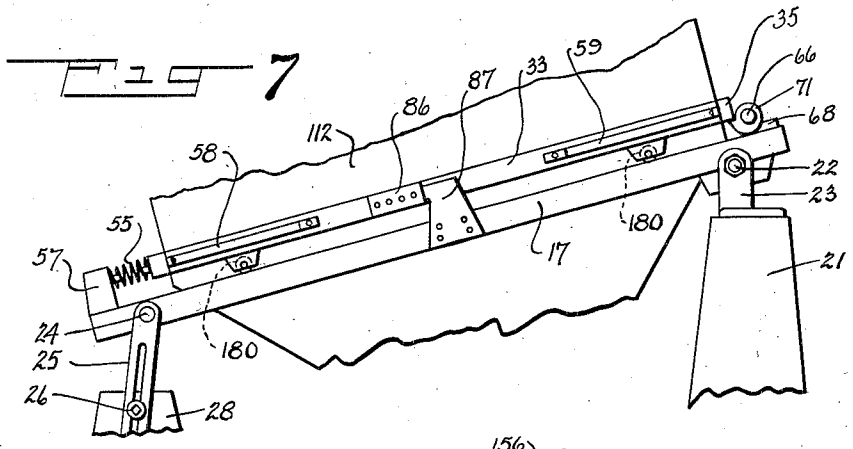


Fig 8

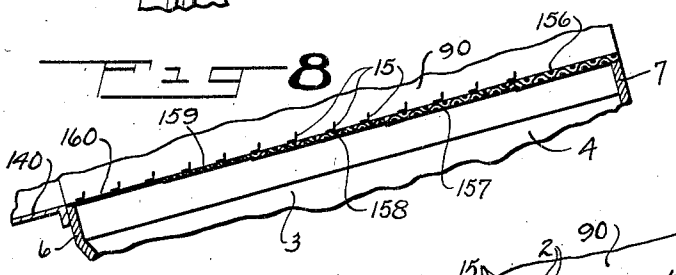
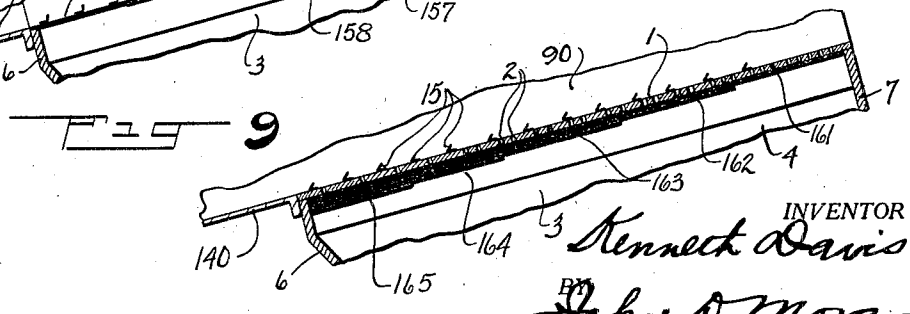


Fig 9



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UNITED STATES PATENT OFFICE

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METHOD AND MECHANISM FOR SEPARATING DIVIDED MATERIALS

Application filed June 7, 1922, Serial No. 566,639. Renewed June 9, 1926.

The invention relates to a process and mechanism for separating intermixed divided materials of different specific gravities, and more particularly in certain of its features to such a process and mechanism utilizing novel and highly efficient combined applications of air currents or pressure, mechanical force and gravity to effect the separating action.

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 practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

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

The accompanying drawings, referred to herein and constituting a part hereof, illustrate one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Of the drawings:—

Fig. 1 is a vertical, longitudinal substantially central section through a mechanism embodying the invention;

Fig. 2 is a full top plan corresponding to Fig. 1, except that parts are in horizontal section on line 2—2 of Fig. 1, and certain other parts broken away to show other parts underneath;

Fig. 3 is a view similar to Fig. 1, with many parts omitted, and showing approximately and diagrammatically the separating action or process;

Fig. 4 is a vertical section, corresponding to the upper right hand part of Fig. 1, but showing a modification;

Fig. 5 is a fragmentary sectional vertical detail of one form of the table or bed;

Fig. 6 is an elevation, with parts omitted, of one form of actuating means for the table;

Fig. 7 is a like view showing a somewhat different form of table actuating means;

Fig. 8 is a diagrammatic view of one form of air current controlling means;

Fig. 9 is a similar view of another form of air controlling means;

Figs. 10 and 11 are detached details in elevation of means for controlling the air currents; and

Fig. 12 is a detached fragmentary detail of a different form of table.

The process and mechanism of the invention are directed to a thorough, rapid and efficient separation of intermixed divided materials of different specific gravities.

The term "divided" will be understood as applying very generally to materials in relatively small parts or particles, or of small size, as contrasted with material in large bulk or in relatively large masses or pieces, and the term will apply to granular, broken, pulverulent or otherwise divided materials in so far as the invention is applicable thereto.

An example of such "divided" materials is raw or impure coal comprising intermixed coal and rock and sometimes an intermixture therewith of "bone" or "bony" as it comes from the mine, the latter being a combustible substance but with a very high ash content.

The present invention is also directed to effecting such a thorough, rapid and otherwise efficient separation of these intermixed materials without requiring the usual very slow, laborious and costly preliminary "sizing" of the intermixed materials, such as the coal and rock.

The usual "sizing" consists in screening or otherwise reducing the materials to practically uniform size within a range of from half an inch down to one-sixteenth of an inch or less and even much smaller sizes, preliminary to separating. The present invention on the other hand will rapidly, thoroughly and efficaciously separate the intermixed materials through a very wide range of sizes. In practice, I have found that two tables will take care of all sizes from two and one-half inches down, but it will be understood that this is merely a statement of present experience and is in nowise restrictive of the invention.

By the present invention, broadly considered, as at present preferably embodied

and practiced, the intermixed materials are simultaneously subjected to an upwardly directed air current (or one having an upward component) and are stratified, preferably with the strata in an inclined position, and with the heavier material beneath and the lighter material above, the latter being suspended in the air current.

The terms "lighter" and "heavier" are applied for convenience to the relative specific gravities of the materials, and not to the relative mass weights of any particular pieces.

An additional force is imposed on one of the strata to move it in one direction, and, as embodied, a mechanical force, in the form of reciprocatory movement and stoppage by impact of a supporting table, is applied to the lower or heavier stratum to propel it by friction and inertia to discharge, preferably up the incline, while the lighter stratum, under the sustaining and impelling action of the air current and by gravity, is moved or propelled to an opposite place of discharge preferably down the incline.

In said embodiment, an inclined air-pervious table or floor receives the intermixed divided materials and by the action of the air forced upwardly through the inclined floor the intermixed materials are separated and stratified above and substantially on the plane of inclination of the table, the stratum of heavier material resting upon the table and the stratum or strata of lighter material being sustained thereabove by the air currents. Preferably, the air currents are regulated in varying degrees of intensity, either by zones or gradual changes longitudinally of the table.

To propel or travel the stratified and separated layers to different and preferably opposite places of delivery, the table is reciprocated, preferably in the direction of its inclination, and is stopped by a sudden impact. The heavier layer, which is in contact with the table, is by this motion and stoppage of the table, gradually impelled up the inclined table and is discharged over the top edge of the table.

The table is preferably provided with ridges or other obstructions or projections which increase the propulsive effect of the moving table upon the stratified material.

The lighter stratified material, floated or supported and preferably also impelled by the air current and under the action of gravity, moves toward the bottom end of the inclined table and is discharged therefrom.

Certain features of the invention claimed in this application, including a process and mechanism for purifying a substantially deep bed of raw coal having wide variations in sizes on a reciprocable, air-pervious table by subjecting said bed to vibration and lifting and loosening air currents through substantially all areas of the bed, whereby the coal floats as a continuous superior stratum and the heavier impurities settle gradually and progressively to an inferior stratum and are mechanically impelled out of the bed, are disclosed but not broadly claimed in my prior copending application Ser. No. 553,250, filed April 15, 1922.

Other features of the invention will be first set forth in connection with the following detailed description, and it will be understood that the preceding general description and the following detailed description are exemplary and explanatory but are not restrictive of the invention. It will be further understood that the statements of theory of operation herein set forth are not necessarily limiting or binding, but are the results of my present best information and knowledge gained from observation of the invention in actual and successful operation.

Referring now in detail to the accompanying drawings, illustrating by way of example the present preferred embodiment of the invention, a support or table 1 is provided, which is preferably inclined to the horizontal and is likewise preferably of rectangular form. This table is of air-pervious structure or material, so that air under pressure may be forced therethrough to create upwardly directed air currents through the intermixed materials above the table to effect the stratification and separation of the materials.

As shown the table 1 is a solid plate with perforations 2 therethrough, these being preferably graduated as to size or number or both to produce different air current strengths or effects in different parts of the table 1. As shown in Fig. 1 they are arranged to give a greater air current action at the upper and forward end of the table 1, and gradually decreasing downwardly and backwardly. This table may be of other kinds of air-pervious materials, such as wire mesh, if desired. It will be understood that the degree of inclination and the proportion of parts, and other features as well, may be varied, as found desirable or efficient with intermixed materials of different kinds or in different physical states.

The means for producing the air current or pressure through the table 1 may be of any desired form so far as concerns most features of the invention. As shown, a chamber 3 is provided beneath and attached to the table 1, having inwardly and downwardly inclined sidewalls 4 and 5 and inwardly and downwardly inclined end walls 6 and 7, these all converging at the bottom toward a supply pipe 8, which connects to a fan, blower or other suitable source of air pressure. The pipe 8 is provided with an expansible and contractible part 9 which permits the air chamber and table to move or reciprocate during the separating action. A

pressure-regulating valve 9a is preferably provided on the air chamber.

Means are provided for reciprocating the table to move the inferior layer of the stratified and separated materials toward the desired place of discharge. This movement may be varied so far as concerns certain features of the invention, but in accordance with one feature thereof, the movement is a relatively short and sharp upward and forward movement, that is, in the direction of the inclination of the table 1, the return movement being preferably slower and downwardly directed.

In connection with the reciprocating motion of the table for traveling the inferior stratified and separated layer of heavier material, there are preferably provided projections upon the upper surface of the table 1 (Figs. 1, 5, 8, 9 and 12), which engage with the material and assist in its travel or propulsion toward the place of delivery. As embodied, a plurality of spaced-apart and preferably parallel ridges 15 are formed integral with, or attached to, the table 1, and are upwardly and forwardly inclined, and are also disposed across the direction of inclination of the table.

In the embodied form of supporting and reciprocating means, a stationary or rather, non-reciprocating frame is provided having parallel inclined side beams 16 and 17, and parallel cross beams 18 and 19. The upper end of this frame is pivotally mounted upon supports 20 and 21 at either side, by means of pins 22 fixed to and projecting outwardly from the forward ends of the side beams 16 and 17, respectively, these pins being pivotally supported in bearing plates 23, respectively, fixed on the tops of the corresponding supports. In connection with the support and mounting of the rear end, means are preferably provided for varying the inclination of the mechanism, and as embodied, said means comprises pins 24 fixed to and projecting outwardly from the rear ends of the side beams 16 and 17, respectively. These pins are pivotally supported by flat legs 25, respectively, the legs 25 having bolt and slot connections 26 with the supports 28. The purpose of varying the inclination of the table by adjustment of the legs 25 is to give an inclination to the table which is best adapted to the characteristics of the materials undergoing separation.

In said embodied form, the table or floor 1, together with the air chamber located therebeneath and fixed thereto, is mounted in a reciprocable frame, comprising side reaches 32 and 33 and a rear cross reach 34 and a front cross reach 35, the upper rectangular part of the air chamber being fixed thereto, and the frame fitting thereabout. This frame is mounted to reciprocate upon the stationary frame already described, and as embodied, arms 36 and 37 are pivotally connected at their lower ends 38 and 39, respectively, to the beam 16 of the stationary frame, and at their top ends 40 and 41, respectively, these arms are pivoted to the reach 32 of the reciprocable frame (to which the table and air chamber are fixed).

On the opposite side is a corresponding pair of arms 42 and 43, pivoted at their lower ends 44 and 45, respectively, to the beam 17 of the stationary frame, and at their upper ends 46 and 47, respectively, these arms are pivoted to the reach 33 of the reciprocable frame. The arms in the embodiment of Figs. 1 and 2 are brackwardly and downwardly inclined, so that on the reciprocation of the frame, the movement of the table is forwardly and upwardly on one stroke and downwardly and backwardly on the other stroke. The term "forward" herein is applied, as a matter of convenience, to the right hand end of the device as shown in Fig. 1 and the term "backward" to the left hand end as shown in said figure.

In the embodied form of reciprocating means, there is mounted behind the reach 34 of the reciprocable frame a plurality of helical springs 54 and 55, shown as two in number, in compression between the extended ends of the reach 34 and lugs 56 and 57, mounted respectively upon and projecting upwardly from, the side reaches of the non-vibratable frame. The springs are preferably kept in alinement by pins projecting from the respective frames and located within the springs. Braces 58 and 59 may be provided between the end reaches 32 and 33 and the side reaches 34 and 35 of the reciprocable frame.

Further comprised in this embodied form of the reciprocating means, is a shaft 66 journaled in bearings or supports 67 and 68, mounted upon the cross reaches 16 and 17 of the non-reciprocating frame. Fixed on the shaft 66 are a plurality of actuating cams, shown as two in number, 70 and 71, and these cams operate against contact plates 72 and 73, mounted on the top cross reach 35 of the reciprocable frame.

The shaft 66 is rotated in a suitable manner, as by a pulley 77, over which runs a belt 78, the belt also running over a pulley 79, fixed on the shaft of a motor 80. Suitable stopping or limiting devices for the reciprocating movement, operating against the springs 54 and 55, are provided by which the impact or sudden stop is effected at the forward end of the travel of the table. As embodied, on the left-hand side in Fig. 2, a stop 84 is mounted on the reach 32 of the reciprocable frame, and a cooperating stop 85 is mounted on the beam 16 of the stationary or non-reciprocating frame. Similarly, on the right-hand side of Fig. 2, a stop 86 is mounted on the reach 33 of the reciprocable

frame, and a cooperating stop 87 is mounted on the beam 17 of the fixed frame.

When the mechanism is operated, the cams 70 and 71, operating against the frame-piece 35, push the table 1 backwardly and downwardly relatively slowly (by reason of the gradual rise of the cams) against the springs 54 and 55, which are thereby compressed. The table then is driven relatively quickly and sharply forwardly and upwardly by the springs 54 and 55 when the abrupt drop on the cams is reached, the table impacting or slamming against the stops on the frame. Thus, the movement is relatively slowly backward and downwardly and relatively quickly and sharply upwardly and forwardly, terminating in the impact, although so far as concerns certain features of the invention this movement may be varied both in its nature or character and its direction. The stops 84 and 85 and 86 and 87 limit the upward and forward movement of the table under the impulsion of the springs 54 and 55, and provide the impact or sudden stop already described.

In the present preferred form of the mechanism, in actual practice, I construct the unit of considerable width, and preferably divide it longitudinally of the direction of inclination of the table 1 into a plurality of parts or compartments. As embodied, a series of partitions 90 are arranged perpendicularly to and resting upon the top of table 1 and extending longitudinally of its direction of inclination, and they are spaced apart from and preferably parallel with, each other. These partitions may be of varying heights, dependent in part on the nature and also the physical state of the intermixed divided materials, partly upon the air pressure used, and also upon other factors, as may be determined from experience with particular materials and particular conditions thereof. These partitions prevent any tendency to cross-travel of the materials and facilitate the orderly operation of the stratifying and separating process, and cause the heavier material, at rest upon the table, to move to the place of discharge, directly from any place of settlement, and without concentration of the heavier material into a stream.

Means are provided for preventing remixture of the separated materials, and as embodied comprise devices for creating an upward and backward air pressure at the place of discharge for the rock or other heavier material and effecting other functions or actions as later described. As embodied, a plurality of discharge passages are provided. For this purpose, blocks 91 are positioned in spaced-apart relationship to each other, and preferably in alinement underneath the ends of the partitions 90 when these are used and are beveled at their rear ends 91a. These blocks are interchangeable with other like blocks of different heights and widths, so that the discharge openings for the rock or other heavier material may be regulated and sized so as to pass freely the discharging material while preventing any open space thereabove through which the air under pressure would escape, and so as to be proportioned for different proportions of rock in the materials being separated.

Cooperating with these blocks is an air-pressure directing and controlling device comprising a board or plate 96 extending across the entire unit, in contact with and resting upon the tops of the spaced-apart blocks 91. At the lower or back end of the plate or board 96 is an upwardly-extending plate or board 97, the lower edge thereof being continuous with or fixed to the inner edge of the member 96. This entire device is adjustable upwardly and downwardly by suitable means, to vary the size of the discharge opening for the discharging rock or other heavier material. As embodied, angular braces 98 fixed to the members 96 and 97 are provided with bolt and slot adjustments 99, the bolts passing through corresponding upwardly projecting supporting plates 100, fixed to the reaches 32 and 33 of the vibrating frame. This adjustment will be made with blocks 91 of different sizes. By regulating the size of the discharge openings so as just to accommodate the rock, or the like, by means of the blocks 91 of various sizes with a corresponding adjustment of plates 96 and 97, the air current is directed upwardly and backwardly to effect one function of the separating action as later described.

Means are provided for directing the air pressure in the upper stratum of the divided material, and above this stratum, in the backward direction, whereby it assists in the propulsion or travel of the coal or other lighter material in the backward and downward direction towards its place of discharge. In the embodied form, an air deflecting plate 110 extends across the upper part of the unit between upwardly projecting side-walls 111 and 112, located at the two inclined edges of the table 1.

The plate 110 is made adjustable both as to its height and inclination. The length and width of the plate is selected to suit the particular operating conditions. For this purpose it is of any desired width, and is pivotally mounted by means of apertured lugs 113, which are pivoted on pins 115 passing therethrough, these pins being insertible in any one of a series of holes 117 formed in each of the side-walls 111 and 112. Thereby the height of the air-deflecting plate 110 may be varied as desired. The forward end of the plate 110 is in contact, or substantially in contact with the upwardly extending plate or board 97 to prevent the escape of an air current at this point. Back of the plate 110

is a screen 121, pivoted at 122 on the side walls and with its forward end resting on plate 110. This prevents any of the material being blown out by the air currents.

Means are provided cooperating with the foregoing in the adjustment or positioning of plate 110 as to height, and also providing for regulation and adjustment of its inclination relatively to the table 1. As embodied, a series of holes 118 are formed in the respective side-walls 111 and 112, and pins 119 and 120, respectively, are placed in any desired pair of these holes to support the rear end of the plate 110 at a desired inclination with respect to the table 1 and to the pivot bearings for lugs 113. The screen 121 being pivotally supported and resting on plate 110 will accommodate itself to any changes in position of the plate.

Means are provided for supplying the intermixed divided materials in proper position and quantities to the mechanism, and as embodied, a hopper 125 extends transversely across and above the unit near its forward and upper end, and feeds the intermixed materials onto the table 1 just behind the plate 97. The hopper is contracted near but within its lower end, and expands thence toward the point of discharge to prevent jamming or choking of the materials being fed to the table.

If desired, partitions 126 may be provided within the hopper, and located just above the partitions or blocks 90 if desired. The hopper 125 is suitably supported, as upon beams 128 and 129, extending across just in front and behind the hopper. These beams are supported at either end upon a frame having a cross-piece 130, which is supported on legs 131 and 132, fixed to and extending upwardly from, the stationary or non-reciprocable frame beams 16 and 17. An opening 133 is formed in the plate 110 to permit the intermixed materials fed from the hopper to pass therethrough.

In Fig. 4 a positive mechanical feed from the hopper is shown for the intermixed materials to be separated, comprising a shaft 134 mounted in the lower part of the hopper, and having cylindrical segmental blades 135 fixed thereto and rotating in a correspondingly shaped and sized part 136 at the bottom of the hopper. The shaft 134 is driven in any suitable manner. Usually, however, a gravity feed will be found sufficient and efficient.

Suitable discharging or delivery means are preferably provided, and as shown a chute 140 is located or attached at the rear and lower end of the unit for the lighter separated material. This chute discharges on to a belt 141, which may be of any standard and suitable construction for conveying away the separated and divided material. At the upper and forward end of the unit, a chute 142 is provided, discharging on to a conveyor belt 143, which conveys away the heavier separated material, and which may be of any convenient and adequate construction and manner of operation.

Means are provided by one feature of the invention, if desired, for regulating the air pressure action at the discharge openings for the rock or other heavier material. As embodied (Figs. 1, 2 and 3), a plurality of doors 150 are provided fitting the apertures between the spacing blocks 91, and thereby opening and closing the passageway for the heavier material. The various doors 150 are separately hinged so as to move freely independently of each other.

As embodied, each door 150 is supported by flexible hinges 151, of leather or other suitable material, from a horizontally-disposed bar 152 extending across between and mounted on the side plates 111 and 112 of the machine. If desired, means may be provided for weighting the doors 150 to any desired degree, to vary their collective or individual opening pressure, and for this purpose, each door has a pin 153 fixed therein and projecting therefrom upon which weights 154 may be hung.

Various devices are provided, as desired, for controlling the total air pressure, the accurate and nice regulation of this pressure determining in very large part the completeness and perfection of the separation of the different intermixed materials.

As previously stated, in accordance with one feature of the invention, the intensity of the air currents is varied or graduated along the table, the stronger air current being at the forward end and the weaker air current at the rearward end, with varying degrees of air-current intensity in between. In Figs. 1 and 2, the means for effecting this comprises holes of different sizes and differing in number in the different parts of the table 1, the showing being more or less diagrammatic for the sake of clearness.

In Fig. 8, a different form of means is shown for producing this difference in air pressure. In this form the table 1 comprises a series of transversely disposed strips or zones of wire mesh of different sizes, to constitute the table 1. That is, a strip or zone 156 of relatively coarse mesh is shown at the front of the table, a strip or zone 157 of somewhat finer mesh extending transversely of the table just to the rearward of the strip 156, and so in succeeding decreases of fineness to the last or rear strip of mesh 160. Thus the air currents will be strongest at the front and gradually decrease in the rearward direction and be weakest at the rear of the table.

In Fig. 9, the table 1 is shown consisting of a perforate plate, or of wire mesh, or other air pervious material or structure, the difference in the intensity of the air currents being

effected by layers of fabric placed on the underside of the table 1. Thus the layer 161 extends the entire length and breadth of the table, whereas the layer 162 extends only for the greater portion of the length of the table and over the entire width, the various layers of fabric decreasing in length to the rearward layer 165. This arrangement will give the same air-current effect as that already described. It will be understood that these figures are all diagrammatic in character.

In Figs. 10 and 11, means are shown for controlling the air supply to the entire machine, which means would vary, as desired, the air pressure upon the entire table, and thereby the intensity of the air currents. The relative intensity of the air currents in different parts longitudinally of the table is governed by the means already described, or equivalent means.

In Fig. 10 a blower 168 is shown having a shutter or slide valve 169, slidable along the intake opening 170 of the blower 168. Suitable means for operating the slide 169 may be provided, and as shown, a link 171 is pivoted to the slide 169 and to the lever 172, which is pivotally mounted at 173. In Fig. 11, a grate valve 174 is shown in the pipe 8, this valve being actuated by suitable means, and as shown a lever 175 is pivotally connected to the valve, and is pivoted at 176 on a suitable support 177.

In Figs. 6 and 7 are shown modifications of the means and manner of reciprocating the separating unit. The only material difference in Fig. 6 from the preceding figures is that the supporting links 36, 37 and 42, 43 are forwardly and upwardly inclined instead of rearwardly and upwardly inclined. With this mounting the table 1 has a sharp descending forward movement terminating in the impact against the stops, and has a slowly rising rearward movement. In Fig. 7 the movement is parallel or straight, by reason of the table, air chamber and associated parts running on rollers 180, these rollers supporting the vibratable frame and running on the non vibrating frame.

The manner of operation of the mechanism hereinbefore described will be understood from the foregoing description, but may be briefly summarized to be substantially as follows:

The intermixed divided materials are fed downwardly through the hopper 125, or other suitable means of supply, in sufficient volume or quantity with respect to the capacity of the unit to keep a substantial bed of the materials on the unit (Fig. 3). The air under pressure in the air chamber 3 creates an air current upwardly through all parts of the table, the air current being varied or regulable in the different parts of the table.

In the cases of most intermixed materials, the air pressure will be strongest at the upper and forward part of the table. This is usually or frequently necessary or desirable, because most of the stratification and separation is effected here, and here the heavier material is discharged, as already described. Care must be taken also to keep back the lighter material so that it will not become intermingled with the discharging heavier material.

The greater part of the work of stratification is done very quickly and very close to the place where the intermixed materials are delivered to the table 1. Most of the heavier material immediately sinks downwardly from the intermixture of materials, and rests upon the table 1, while the lighter material, through the action of the air current, remains or rises upwardly and is supported or is floated by the current or pressure of air.

The forward and upward motion of the table 1, especially with the projections 15 engaging or impacting with the heavier material resting on the table, throws the stratum of heavier separated material upwardly and forwardly toward its place of discharge. On the other hand, the superior stratum of lighter material is not subject to the mechanical upward and forward movement of the table, because the air pressure keeps it out of contact with the table. The action of gravity together with the floating action of the air impels to a great extent this superior stratum downwardly and backwardly. The deflector plate 110 also deflects the air current backwardly and this also impels the lighter material suspended in the air current downwardly and backwardly towards its place of discharge. This air action also increases the capacity of the unit.

As stated, a very large proportion of the intermixed materials are quickly and almost instantaneously stratified, and the larger parts or particles of the heavier material will thus sink almost at once into contact with the table 1. Consequently the greater proportion of the heavier material is soon thrown by the mechanical action of the table upwardly and outwardly at the forward end of the unit. The lighter or rather smaller particles or parts of the heavier material will not stratify quite so quickly as the larger particles or parts, but all of the heavier material will come in contact with the table 1 before the rear and lower end is reached, and the mechanical action of the table will impel this part also of the heavier material forwardly and upwardly to its place of discharge. Thus all of the heavier material is separated and ejected from the forward end of the mechanism, and all of the lighter material is separated and ejected from the rear end of the mechanism.

To guard against any of the lighter mate-

rial passing out with the heavier material at the upward and forward end of the unit, the construction already described is such that a relatively very large volume of air is blown through the table at its upward and forward end, and can find no place of exit upwardly and forwardly. It is therefore deflected upwardly and backwardly through the forward end of the intermixed but stratifying and separating mass of material. The particles of lighter material are thereby driven upwardly for the time being and backwardly toward and to their proper place of discharge.

Should any of the smaller particles of the heavier material be driven upwardly and backwardly by the action of the air current just described, these particles will sink downwardly as they travel backwardly much more quickly than the particles of the lighter material. They will thus come in contact with the table 1 before reaching the back edge thereof, and then will be impelled forward by the mechanical movement of the table. They will thus become intermingled with the larger particles of the heavier material and will be discharged therewith at the forward and upper end of the table.

In the operation of the machine, as shown diagrammatically in Fig. 3, the intermixed materials are fed down through the hopper, and are very largely stratified in the area B, the largest pieces of the rock or other heavier material sinking to and resting upon the bottom 1 within the air pressure zone *b*. The upward air current in the zone *b* will keep all of the coal or lighter material floated, and in addition will keep the smaller pieces of the rock also floated. Through the downward and backward inclination of the bottom 1, the floating action of the air, and the motion of the device, the suspended material will move downwardly and to the left in Fig. 3. In the zone *c* the upwardly directed air currents are less strong, and fragments of rock of the next smaller size will settle against the air currents in the area C and rest upon the bottom 1, while all of the coal and the lesser particles of rock will be suspended or buoyed up on the air current. The same thing will occur in the air current zone *d*, and in the area D still smaller particles of rock will settle against the action of the air current and rest upon the bottom 1. In like manner, even the finest particles of rock will settle in the area E upon the table 1, and all of the separated coal will pass out through the chute F.

When the rock settles upon the table 1, the reciprocatory motion of the table, assisted by the ridges 15 slides the rock forwardly along the table and out through the chute G, the rock being held and projected forwardly by the ridges. This layer of rock is diagrammatically represented by the area *x*. As the finer particles of rock are slid or shifted to the right on the table, and pass again into the zones of stronger air current, they will remain upon the table and will not rise again into the mass of stratifying material above, for the reason that they are now beneath the entire layer and the air pressure is not sufficient to project them back into or through the mass of intermixed material. The area *y*, divided from the area *x* by the dot and dash line, at the right consists of the intermixed material; toward the left, the amount of coal progressively increases and the amount of rock correspondingly decreases, due to settling and upward progress of the rock.

When the table is moving freely, the line *m* will approximately diagrammatically represent the position of the front end of the pile. When the table slams against the stops at the forward end of its movement, the front end of the pile is thrown against the plate 97 as indicated by the line *z* and temporarily closes the passage. The rock is thrown under the plate 96 and will not move or be blown back because of the baffling effect of the plate. If the rock that is under the plate is not thrown far enough forwardly at the first impact to go into the chute, it will be thrown at the next impact far enough forward so the outward air current will carry it out.

When the pile is in the form of line *m*, the air current through the zone *a* together with the following impact tends to move or propel the rock under the plate 96 and through the chute G and also produces an upward and backward air current inside the plate 97, which throws back all the coal tending to travel in that direction as it is fed in from the hopper. When the pile is thrown to the position of *z*, the air current in the passage A is forced forwardly and outwardly, and strongly ejects the rock into the chute G. The respective gates 150 are weighted so as to regulate the air current at each corresponding outlet or chute in the manner desired.

When the front of the pile is in the position of line *m* the air current has no strong tendency to expel the rock from the chute except at the forward end, but at this time it is functioning to prevent the passage of any coal into the chute, as described. When the impact of the table against the stop occurs, the rock is projected forcefully forwardly along the chute. When the front of the pile is in the position *z*, the back pressure of air will still hold back the coal. The rock at the forward end of the chute is continuously being impelled outwardly by the air current and is intermittently impelled in the same direction by the impact of the table against the stops. It will be understood that the statement of the theory of the operation is not binding or

restrictive of the general features of the invention.

In Fig. 12 is shown a longitudinal section through a different form of the floor or table. This form 1^a is shown as a sheet successively bent or corrugated transversely, and alternate bends in the plate corresponding to and effecting the functions of the ridges 15 in the other form. One feature of this form is that some of the air perforations 2^a are in the parts of the table corresponding to the effective faces of the ridges, whereby the air currents are projected into the material in the forward direction as well as in the upward direction. In this figure, the size and location of the air holes 2^a are utilized for the "zoning" or other regulation of the relative amount of the air-currents in the different parts of the table, the stronger current being at the right-hand end of the table and gradually decreasing toward the left-hand end.

From all the foregoing it will be understood that a mechanism has been provided adapted to carry out conveniently and efficaciously the process of separation described, and realizing the objects and advantages herein set forth; also that changes may be made in the structure, proportions, and directions of movements, and other features without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:—

1. The process of separating intermixed divided materials, comprising feeding the intermixed materials onto an air pervious table at a locus median of the length of the table to maintain a continuous bed of separating material thereon, forcing air upwardly through the bed to float the lighter material and to permit the heavier material to settle upon the table, impelling the settled heavier material by friction and inertia to delivery at one end of the table, and impelling the lighter flotant material to discharge at the opposite end of the table, both the lighter and heavier materials during their respective movements, being subjected substantially continuously to the action of the upwardly flowing air currents.

2. The process of separating intermixed divided materials, comprising feeding the intermixed materials onto an air pervious table at a locus median of the length of the table to maintain a continuous bed of separating material thereon, forcing air upwardly through the bed to float the lighter material and to permit the heavier material to settle upon the table, impelling the settled heavier material by friction and inertia to delivery at one end of the table, impelling the lighter flotant material to discharge at the opposite end of the table, both the lighter and heavier materials during their respective movements, being subjected substantially continuously to the action of the upwardly flowing air currents, and laterally deflecting some of the upwardly flowing air at one end of the table for aiding the separation at that point.

3. The process of separating intermixed divided materials of different specific gravities, comprising feeding the intermixed materials onto an inclined air-pervious table at a point between the upper and lower ends thereof, subjecting the materials to vibration and to the action of upwardly flowing air currents, whereby the materials are stratified, and the strata separated by the movement of one stratum up the table and another stratum down the table, both strata during their movements being continually subjected to the upward air currents.

4. The process of separating intermixed divided materials of different specific gravities, comprising feeding the intermixed materials onto an inclined air-pervious table at a point between the upper and lower ends thereof, subjecting the materials to a vibration having a component longitudinally of the table, and to the action of upwardly flowing air currents, the vibration being quicker upwardly of the table, whereby the materials are stratified and different strata moved up and down the table, respectively, to different places of discharge, the strata, during their movement, being subjected substantially continuously to the action of the air currents.

5. The process of separating intermixed divided materials of different specific gravities, comprising feeding the intermixed materials onto an inclined, air-pervious table between the upper and lower ends thereof, forcing powerful air currents upwardly through the table, which are strong enough to float the lighter materials into an upper stratum, and subjecting the table to a vibration having a component longitudinally of the table, whereby the heavier materials next the table, and the lighter materials, are moved up and down the table, respectively, to different places of discharge both strata, during such upward and downward movements, being subjected to the action of the upwardly flowing air currents.

6. The process of separating intermixed divided materials of different specific gravities, comprising feeding the intermixed materials onto an inclined air-pervious table between the upper and lower ends thereof, so as to form a pile of substantial size, and subjecting the materials on the table to a vibration having a component longitudinally of the table, and to the action of upwardly flowing air currents, whereby the materials are stratified into strata some of which are inclined with respect to the table, and whereby the lower stratum is given an intermittent upward push toward the upper end of the table.

7. The process of separating intermixed divided materials of different specific gravities, comprising subjecting a downwardly inclined bed of materials to upwardly flowing air currents of varying intensity in different parts of the bed, and to vibration, whereby the materials are stratified and caused to move up and down the bed to opposite places of discharge, both strata, during such upward and downward movements, being continually subjected to the action of the air currents.

8. A mechanism for separating intermixed divided materials of different specific gravities, comprising an air-pervious table, transversely extending, material propelling projections on the table, means for blowing air upwardly through the table, means for vibrating the table with a vibration having a component longitudinally thereof, whereby the materials are stratified and moved in opposite directions to different places of discharge.

9. A mechanism for separating intermixed divided materials of different specific gravities, comprising an air-pervious table, transversely extending, material propelling projections on the upper surface of the table, means for passing air upwardly through the table, and means for vibrating the table in a direction having a component longitudinally thereof, the vibrating movement being short and quick in one direction, and slow in the opposite direction, whereby the materials are stratified and moved up and down the table to different places of discharge.

10. A mechanism for separating intermixed divided materials of different specific gravities including in combination an inclined air-pervious support provided with transverse ribs, means for forcing air through the support to stratify the intermixed materials into superposed upper and lower strata, means for reciprocating the support to impel the inferior stratum along the support to a place of discharge, and means for feeding the intermixed materials onto the air-pervious support at a point between the upper and lower ends thereof.

11. A mechanism for separating intermixed divided materials of different specific gravities including in combination an inclined air-pervious support provided with transverse ribs, means for forcing air through the support to stratify the intermixed materials and means for moving the support to impel the inferior stratum along the support to a place of discharge and means for deflecting the air current over and down the inclined upper stratum.

12. A mechanism for separating intermixed divided materials of different specific gravities including in combination an inclined air-pervious support provided with transverse ribs, means for forcing air through the support to stratify the intermixed materials and means for moving the support in the direction and plane of its inclination to impel the inferior stratum upwardly along the support to a place of discharge and means for deflecting the air current over and down the inclined upper stratum.

13. A mechanism for separating intermixed divided materials of different specific gravities including in combination an inclined air-pervious support provided with transversely extending, material propelling ribs, means for forcing air through the support to stratify the intermixed materials, means for reciprocating the support together with the ribs thereon with a quick short forward movement and providing an impact to impel the inferior stratum along the support to a place of discharge and means for feeding intermixed materials onto the air-pervious support at a point between the upper and lower ends thereof.

14. A mechanism for separating intermixed divided materials, comprising a downwardly inclined air permeable support, provided with transversely extending material propelling ribs, the permeability of the support decreasing toward its lower end, means for blowing air through the support, means for reciprocating the support together with the ribs thereon, in a direction transversely of the ribs and means for feeding the intermixed materials onto the air permeable support, intermediate the upper and lower ends thereof.

15. A mechanism for separating intermixed divided materials, comprising a downwardly inclined air permeable support provided with transversely extending material propelling ribs thereon, means for blowing air through the support, means for reciprocating the support transversely with respect to the ribs and an air deflecting device near the high end of the support for creating a backwardly flowing air current.

16. A mechanism for separating intermixed divided materials, comprising a downwardly inclined air permeable support provided with transverse ribs thereon, means for blowing air through the support, means for reciprocating the support transversely with respect to the ribs, an air deflecting device near the high end of the support for creating an upwardly and backwardly flowing air current, and a swinging gate located just beyond the said air deflecting device.

17. A mechanism for separating intermixed divided materials comprising a downwardly inclined air permeable support provided with transverse ribs thereon; means for blowing air through the support, means for reciprocating the support transversely with respect to the ribs, and a plurality of spaced blocks located at the upper end of the

table for defining a plurality of discharge passages.

18. A mechanism for separating intermixed divided materials comprising a downwardly inclined air permeable support provided with transverse ribs thereon, means for blowing air through the support, means for reciprocating the support transversely with respect to the ribs, a plurality of spaced blocks located at the upper end of the table for defining a plurality of discharge passages, and an air deflecting element located above said blocks for creating an upwardly and backwardly flowing current of air.

19. A mechanism for separating intermixed divided materials comprising a downwardly inclined air permeable support provided with transverse ribs thereon, means for blowing air through the support, means for reciprocating the support transversely with respect to the ribs, a plurality of spaced blocks located at the upper end of the table for defining a plurality of discharge passages, an air deflecting element located above said blocks for creating an upwardly and backwardly flowing current of air, and a swinging gate located at the end of said discharge passages.

20. The process of separating intermixed divided materials differing relatively greatly in size and differing relatively little in specific gravities which comprises maintaining a continuous bed of the intermixed materials of substantial depth undergoing separation upon an air-pervious table, forcing air currents upwardly through substantially all parts of the bed to effect stratification by continuous flotation of a lighter material and by settlement of a heavier material upon the bed, and subjecting the bed to longitudinal vibratory movement impelling the heavier and lighter stratified materials respectively to different places of discharge and causing the settled heavier material to move substantially unidirectionally along the table to discharge while preventing the accumulation of the heavier material in a narrowing stream.

21. The process of separating intermixed divided materials differing relatively greatly in size and differing relatively little in specific gravities which comprises maintaining continuously a bed of the intermixed materials of substantial depth undergoing separation upon an air-pervious table, forcing air currents upwardly through substantially all parts of the bed to effect stratification by substantially continuous flotation of a lighter material and by settlement of a heavier material upon the bed, and subjecting the bed to longitudinal vibratory movement causing the superior flotant layer to move longitudinally of the bed to discharge at one end of the bed, impelling the heavier settled material to a separate place of discharge.

22. The process of separating intermixed divided materials differing relatively greatly in size and differing relatively little in specific gravities which comprises maintaining continuously a bed of the intermixed materials of substantial depth undergoing separation upon an air-pervious table, forcing air currents upwardly through substantially all parts of the bed to effect stratification by substantially continuous flotation of a lighter material and by settlement of a heavier material upon the bed, and subjecting the bed to longitudinal vibratory movement impelling the settled heavier material directly longitudinally of the table to discharge at one end of the table and impelling the flotant lighter material to a separate place of discharge.

23. A mechanism for separating intermixed divided materials varying relatively greatly in size but varying relatively little in their specific gravities including in combination an air-pervious table, means for longitudinally vibrating the table, means for feeding the intermixed materials to maintain a bed thereof of substantial depth upon the table, means for forcing air upwardly through substantially all parts of the bed of materials, means for discharging a superior stratified flotant material at one end of the bed, and means for discharging the heavier material at rest upon the table along substantially the entire extent of a discharge edge.

24. The process of separating intermixed divided materials which comprises maintaining a substantially deep bed of the materials on a longitudinally inclined support, subjecting the bed to lifting air currents and mechanical vibration, progressing flotant lighter material straight downwardly throughout the length of the table to discharge at the lower end thereof, and impelling settled heavier material upwardly along the support to discharge.

25. The process of separating intermixed divided materials which comprises maintaining a substantially deep bed of the materials on a longitudinally inclined support, subjecting the bed to lifting air currents and mechanical vibration, progressing flotant lighter material straight downwardly throughout the length of the table to discharge at the lower end thereof, preventing lateral discharge of the lighter material, and impelling settled heavier material upwardly along the support to discharge.

26. The process of separating intermixed divided materials which comprises maintaining a substantially deep bed of the materials on a longitudinally inclined support, subjecting the bed to lifting air currents and longitudinal vibration, permitting a superior stratum of lighter material to flow downwardly to discharge from the lower end of

the support, successively gradating the lifting force of the air along the table beneath the lighter material, permitting heavier material to settle to the table surface, and impelling the settled heavier material unidirectionally along the support solely by forces substantially opposite to its direction of gravital flow to discharge upwardly above the lighter material.

27. The process of separating intermixed divided materials which comprises maintaining a substantially deep bed of the materials on a longitudinally inclined support, subjecting the bed to lifting air currents and longitudinal vibration, permitting a superior stratum of lighter material to flow downwardly to discharge from the lower end of the support, gradually decreasing the lifting power of the air along the path of travel of the lighter material, permitting heavier material to settle to the table surface, and impelling the settled heavier material unidirectionally along the support solely by forces substantially opposite to its direction of gravital flow to discharge upwardly above the lighter material.

28. A mechanism for separating intermixed divided materials, including in combination a longitudinally inclined, air-pervious support, means for maintaining thereon a substantially deep bed of the materials, means for forcing lifting air currents upwardly through the bed, means for longitudinally reciprocating the support, means for laterally confining a flotant stratum of lighter material and for discharging said stratum at the lower end of the support, and means for impelling settled heavier material from the point of settling unidirectionally upwardly along the support to discharge.

29. A mechanism for separating intermixed divided materials, including in combination a longitudinally inclined, air-pervious support, means for maintaining thereon a substantially deep bed of the materials, means for forcing lifting air currents upwardly through the bed, means for longitudinally reciprocating the support, means for laterally confining a flotant stratum of lighter material and for discharging said stratum at the lower end of the support, and means for impelling settled heavier material from the point of settling unidirectionally upwardly along the support to discharge, including material-impelling members disposed on the support transversely of the direction of reciprocation.

30. A mechanism for separating intermixed divided materials, including in combination a longitudinally inclined, air-pervious support, means for maintaining thereon a substantially deep bed of the materials, means for forcing lifting air currents upwardly through the bed, means for varying the lifting air force in a gradated series of zones along the table, means for longitudinally reciprocating the support, means for laterally confining a flotant stratum of lighter material and for discharging said stratum at the lower end of the support, and means for impelling settled heavier material upwardly along the support to discharge.

31. The process of separating intermixed materials of different specific gravities, which comprises feeding the materials medianly on a support, subjecting the materials to upwardly flowing air currents which gradually and progressively decrease in intensity toward the points of discharge for the lighter materials, and to forces of vibration, friction and inertia, whereby the materials are stratified and the different strata caused to move on the support in opposite directions from the point of feed, to opposite points of discharge.

32. The process of separating intermixed, divided materials of different specific gravities which comprises feeding the materials medianly on a support, subjecting the materials to upwardly flowing air currents and forces of vibration, friction and inertia, whereby the materials are stratified in superposed strata according to their specific gravities and the different strata caused to move along a support in opposite directions from the point of feed to opposite points of discharge, the superior and inferior strata being maintained in superposed relation substantially throughout their opposite movements on the support.

33. A mechanism for separating intermixed divided materials, comprising in combination an inclined air-pervious table, means for vibrating the table longitudinally thereof, means for flowing air upwardly through the table, the vibrating and air currents causing the materials to stratify, means including a pressure operated gate, for discharging the heavier materials in the lower stratum at the upper end of the table, means for discharging the lighter materials in the upper stratum at the lower end of the table, and means for feeding the intermixed materials onto the table near the upper end thereof.

34. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, vibrating the bed, subjecting substantially all parts of the bed simultaneously to lifting and loosening air currents whereby the coal floats in a superior stratum and the heavier impurities sink through the bed, progressing the flotant material in a substantially continuous stream toward a place of discharge while causing the heavier impurities to gradually and progressively settle to the bottom of the bed by gradually and substantially continuously

decreasing the intensity of the lifting and loosening air force in the path of flow of the stream of flotant material whereby said stream is progressively purified, and propelling the settled stratum of heavy impurities to discharge separately from the stream of purified coal.

35. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, reciprocating said bed, subjecting substantially all parts of the bed simultaneously to lifting and loosening air currents to stratify the bed by causing the coal to float and the heavier impurities to sink through the bed, progressing the flotant strata in a substantially continuous stream toward a place of discharge while causing the heavier impurities to gradually and progressively settle to the bottom of the bed substantially in order of decreasing size by passing through a series of intermerging zones of gradually decreasing intensity of air force, propelling the settled heavier particles along the bottom of the bed as soon as they settle thereto and in a direction different from that of the flotant stream of progressively purifying coal, and separately discharging the settled impurities and clean coal.

36. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, vibrating the bed, subjecting substantially all parts of the bed simultaneously to lifting and loosening air currents whereby the coal floats in a superior stratum and the heavier impurities sink through the bed, progressing the flotant material in a substantially continuous stream straight longitudinally of the bed to discharge at one end thereof while causing the heavier impurities to gradually and progressively settle to the bottom of the bed by gradually and substantially continuously decreasing the intensity of the lifting and loosening air force in the path of flow of the stream of flotant material whereby said stream is progressively purified, and propelling the settled stratum of heavy impurities to discharge separately from the stream of purified coal.

37. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, vibrating the bed, subjecting substantially all parts of the bed simultaneously to lifting and loosening air currents whereby the coal floats in a superior stratum and the heavier impurities sink through the bed, progressing the flotant material in a substantially continuous stream straight longitudinally of the bed to discharge at one end thereof while causing the heavier impurities to gradually and progressively settle to the bottom of the bed by gradually and substantially continuously decreasing the intensity of the lifting and loosening air force in the path of flow of the stream of flotant material whereby said stream is progressively purified, and propelling the settled stratum of heavy impurities to discharge separately from the stream of purified coal in a plurality of individually regulable streams.

38. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, reciprocating said bed, subjecting substantially all parts of the bed simultaneously to lifting and loosening air currents to stratify the bed by causing the coal to float and the heavier impurities to sink through the bed, progressing the flotant strata in a substantially continuous stream straight longitudinally of the bed to discharge at one end thereof while causing the heavier impurities to gradually and progressively settle to the bottom of the bed substantially in order of decreasing size by passing through a series of intermerging zones of gradually decreasing intensity of air force, propelling the settled heavier particles upwardly along the bottom of the bed as soon as they settle thereto in a plurality of individual streams and in a direction different from that of the flotant stream of progressively purifying coal, and regulating the discharge of said streams by pneumatic and mechanical pressure.

39. A mechanism for purifying raw coal, the particles of which have a substantial variance in size, including in combination a reciprocable, air-pervious table, means for maintaining thereon a substantially deep bed of said raw coal undergoing stratification and separation, means for forcing lifting and loosening air currents upwardly simultaneously through all parts of the moving bed to float the coal and permit the heavy impurities to settle through the bed to the table surface, means for progressing a continuous flotant stratum of coal toward a place of discharge, means for causing the different sizes of heavy impurities to gradually and progressively settle to the table surface compris-

ing a series of intermerging zones of gradually decreasing intensity of air force arranged in the path of flow of the coal stratum, and means for propelling the settled heavy impurities along the surface of the table to discharge.

40. A mechanism for purifying raw coal, the particles of which have a substantial variance in size, including in combination a reciprocable air-pervious table, means for maintaining thereon a substantially deep bed of said raw coal undergoing stratification and separation, means for forcing lifting and loosening air currents upwardly simultaneously through all parts of the moving bed to float the coal and permit the heavy impurities to settle through the bed to the table surface, means for progressing a continuous flotant stratum of coal toward a place of discharge, means for maintaining said flotant stratum of coal extending substantially the width of the bed down to the point of discharge, means for causing the different sizes of heavy impurities to gradually and progressively settle to the table surface comprising a series of intermerging zones of gradually decreasing intensity of air force arranged in the path of flow of the coal stratum, and means for propelling the settled heavy impurities along the surface of the table to discharge.

41. A mechanism for cleaning coal including in combination an inclined, reciprocable, air-pervious table, means for maintaining thereon a bed of raw coal undergoing separation, means for passing lifting and loosening air currents through the bed, means for propelling settled heavy impurities upwardly along the table surface to discharge in a plurality of individual streams, and means for individually controlling the discharge of each stream comprising means for passing a discharge-resisting current of air through each stream.

42. A mechanism for cleaning coal including in combination an inclined reciprocable, air-pervious table, means for maintaining thereon a bed of raw coal undergoing separation, means for passing lifting and loosening air currents through the bed, means for propelling settled heavy impurities upwardly along the table surface to discharge in a plurality of individual streams, means for individually controlling the discharge of each stream comprising means for passing a regulable discharge-resisting current of air through each stream, and means for imposing a yielding mechanical pressure to the discharge of said streams.

43. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, vibrating the bed, passing lifting and loosening air currents simultaneously through substantially all parts of the unsized bed to loosen the intermixture and to float the lighter material, and regulating the air action along the bed to effect a gradual and progressive sinking of the heavier impurities, continuing said vibration and air action throughout the travel of the bed until all sizes of heavier impurities have been settled to an inferior stratum and substantially all the coal is flotant as a superior stratum, and separately delivering said strata.

44. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, vibrating the bed, passing lifting and loosening air currents simultaneously through substantially all parts of the unsized bed to loosen the intermixture and to float the lighter material, and regulating the air action along the bed to effect a gradual and progressive sinking of the heavier impurities, continuing said vibration and air action throughout the travel of the bed until all sizes of heavier impurities have been settled to an inferior stratum and substantially all the coal is flotant as a superior stratum and removing the separated heavier material from the bed and controlling said removal by regulable pressure.

45. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, vibrating the bed, passing substantially continuous lifting and loosening air currents simultaneously through substantially all parts of the unsized bed to loosen the intermixture and to float the lighter material, and regulating the air action along the bed to effect a gradual and progressive sinking of the heavier impurities, continuing said vibration and air action throughout the travel of the bed until all sizes of heavier impurities have been settled to an inferior stratum and substantially all the coal is flotant as a superior stratum, and substantially continuously removing the settled heavier material from the traveling bed.

46. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it

comes from the mine, vibrating the bed, passing lifting and loosening air currents simultaneously through substantially all parts of the unsized bed to loosen the intermixture and to float the lighter material, and regulating the air action along the bed to effect a gradual and progressive sinking of the heavier impurities, continuing said vibration and air action throughout the travel of the bed until all sizes of heavier impurities have been settled to an inferior stratum and substantially all the coal is flotant as a superior stratum and mechanically impelling said heavier inferior stratum out of the bed.

47. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, vibrating the bed, passing lifting and loosening air currents simultaneously through substantially all parts of the unsized bed to loosen the intermixture and to float the lighter material, and regulating the air action along the bed to effect a gradual and progressive sinking of the heavier impurities, continuing said vibration and air action throughout the travel of the bed until all sizes of heavier impurities have been settled to an inferior stratum and substantially all the coal is flotant as a superior stratum, and mechanically impelling said heavier inferior stratum out of the bed and controlling the discharge of said heavier material by regulable pressure.

48. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, predeterminately inclining said bed according to the characteristics of the materials constituting the bed, vibrating the bed, passing lifting and loosening air currents simultaneously through substantially all parts of the unsized bed to loosen the intermixture and to float the lighter material, regulating the air action to effect a gradual and progressive sinking of the heavier impurities by controlling both the total pressure of the air and its relative intensities along the bed, continuing said vibration and regulatory air action throughout the travel of the bed until all sizes of heavy impurities have been settled to an inferior stratum and substantially all the coal is flotant as a superior stratum, and mechanically impelling said settled heavy impurities out of the bed in a direction different from that of the lighter material.

49. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, predeterminately inclining said bed according to the characteristics of the materials constituting the bed, vibrating the bed, passing lifting and loosening air current simultaneously through substantially all parts of the unsized bed to loosen the intermixture and to float the lighter material, regulating the air action to effect a gradual and progressive sinking of the heavier impurities by controlling both the total pressure of the air and its relative intensities along the bed, continuing said vibration and regulatory air action throughout the travel of the bed until all sizes of heavy impurities have been settled to an inferior stratum and substantially all the coal is flotant as a superior stratum, and mechanically impelling said settled heavy impurities out of the bed against the inclination of the bed and in a direction different from that of the lighter material.

50. The process of purifying coal which comprises maintaining a continuous, traveling bed of substantial depth of raw coal which has not been subjected to close preliminary size classification, including in intermixture relatively large pieces and fine particles such as are present in coal as it comes from the mine, vibrating the bed, subjecting substantially all parts of the unsized bed simultaneously to lifting and loosening air currents to loosen the intermixtures and to float the lighter material, progressing the flotant material in a substantially continuous stream toward a place of discharge, and regulating the air action along the bed to effect a gradual and progressive sinking of the heavier impurities through the unsized bed by gradually, progressively and substantially continuously gradating the intensity of the lifting and loosening air action in the path of flow of the stream of flotant material, continuing said vibration and gradated air action until all sizes of heavier impurities have been settled to an inferior stratum and substantially all the coal is flotant as a superior stratum, and mechanically impelling said settled heavier material out of the bed.

In testimony whereof, I have signed my name to this specification.

KENNETH DAVIS.