Oct. 11, 1966 D. B. BINNIX 3,278,029

PNEUMATIC STRATIFICATION WITH VIBRATORY DRAW-OFF

Filed April 8, 1963

5 Sheets-Sheet 1

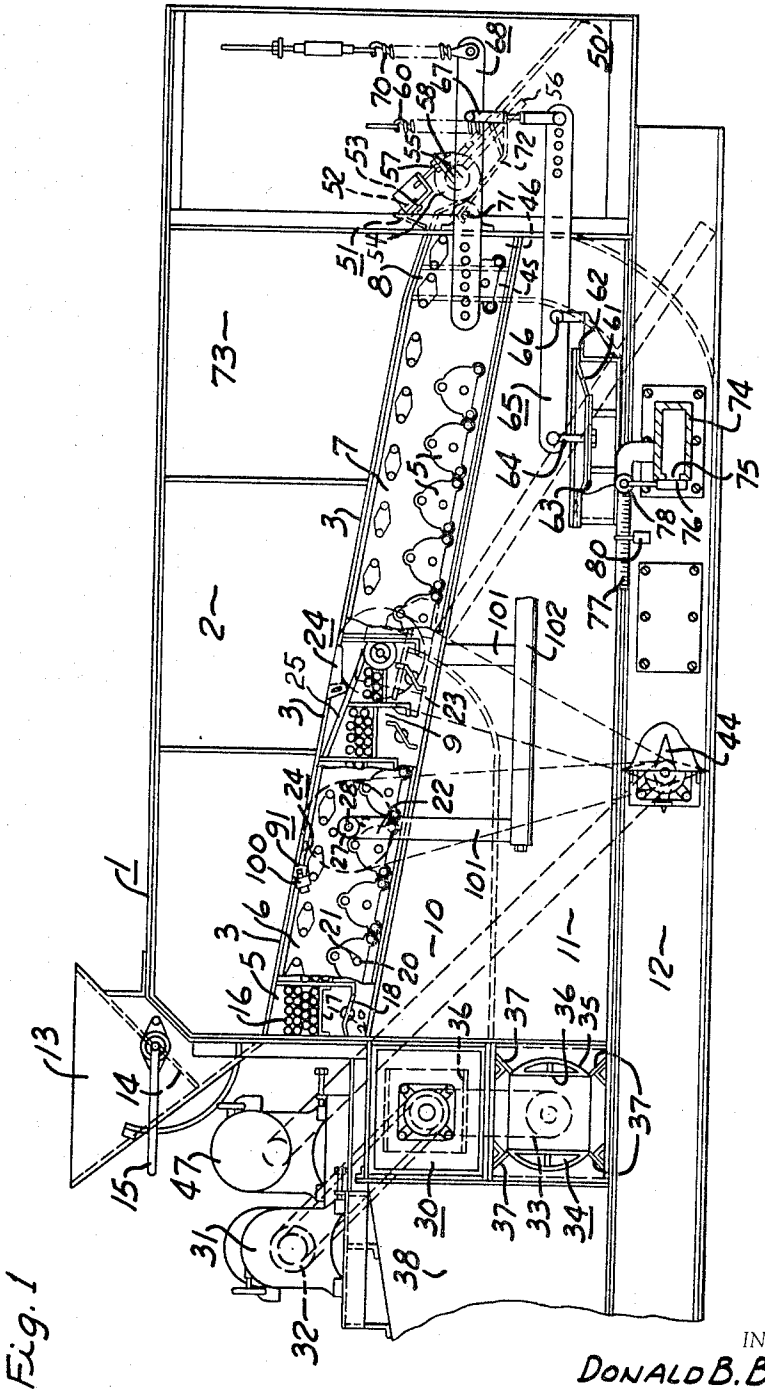


Fig. 1

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PNEUMATIC STRATIFICATION WITH VIBRATORY DRAW-OFF

Filed April 2, 1963 5 Sheets-Sheet 2

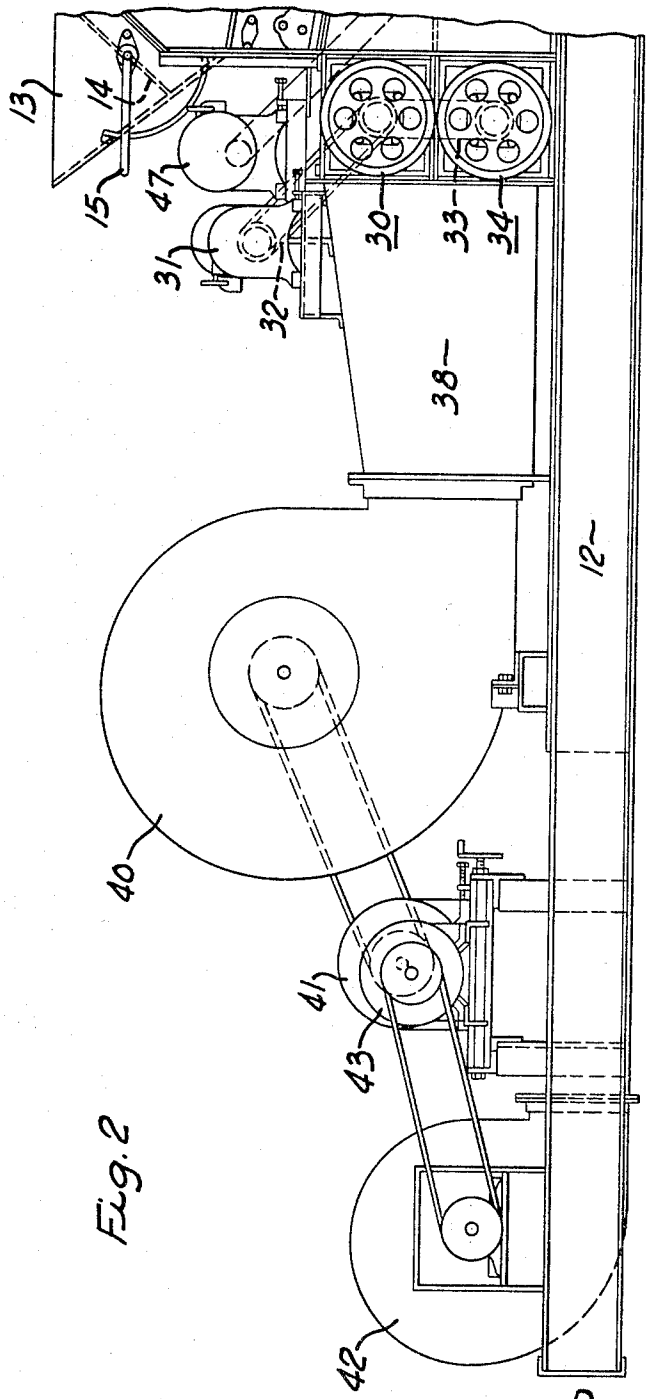


Fig. 2

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PNEUMATIC STRATIFICATION WITH VIBRATORY DRAW-OFF

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Fig. 3

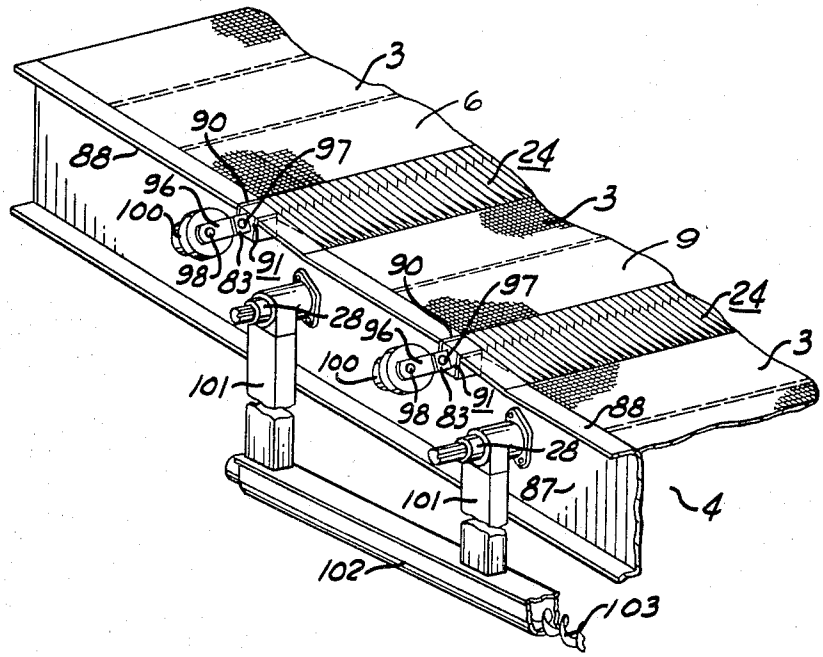
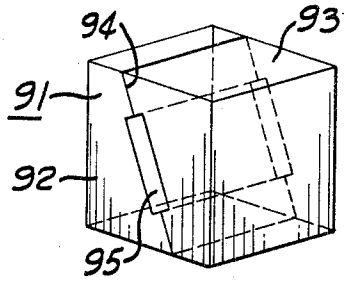


Fig. 7



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PNEUMATIC STRATIFICATION WITH VIBRATORY DRAW-OFF

Filed April 2, 1963

5 Sheets-Sheet 4

Fig. 5

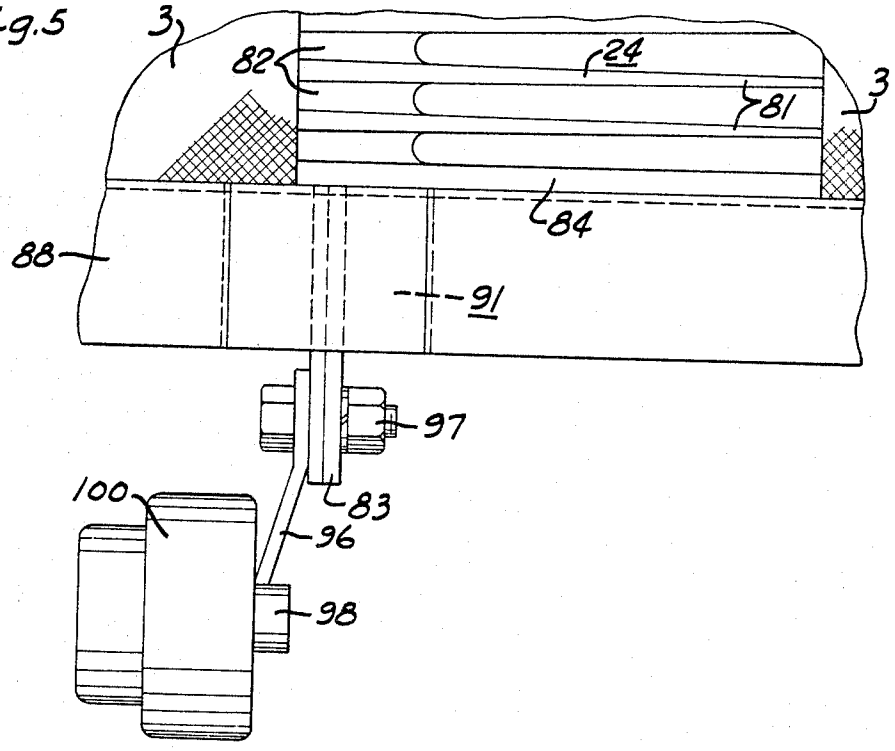
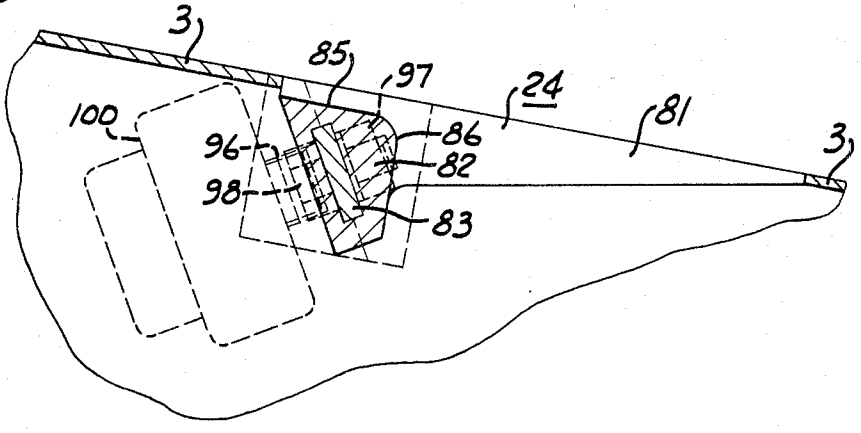


Fig. 6



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PNEUMATIC STRATIFICATION WITH VIBRATORY DRAW-OFF

Filed April 2, 1963 5 Sheets-Sheet 5

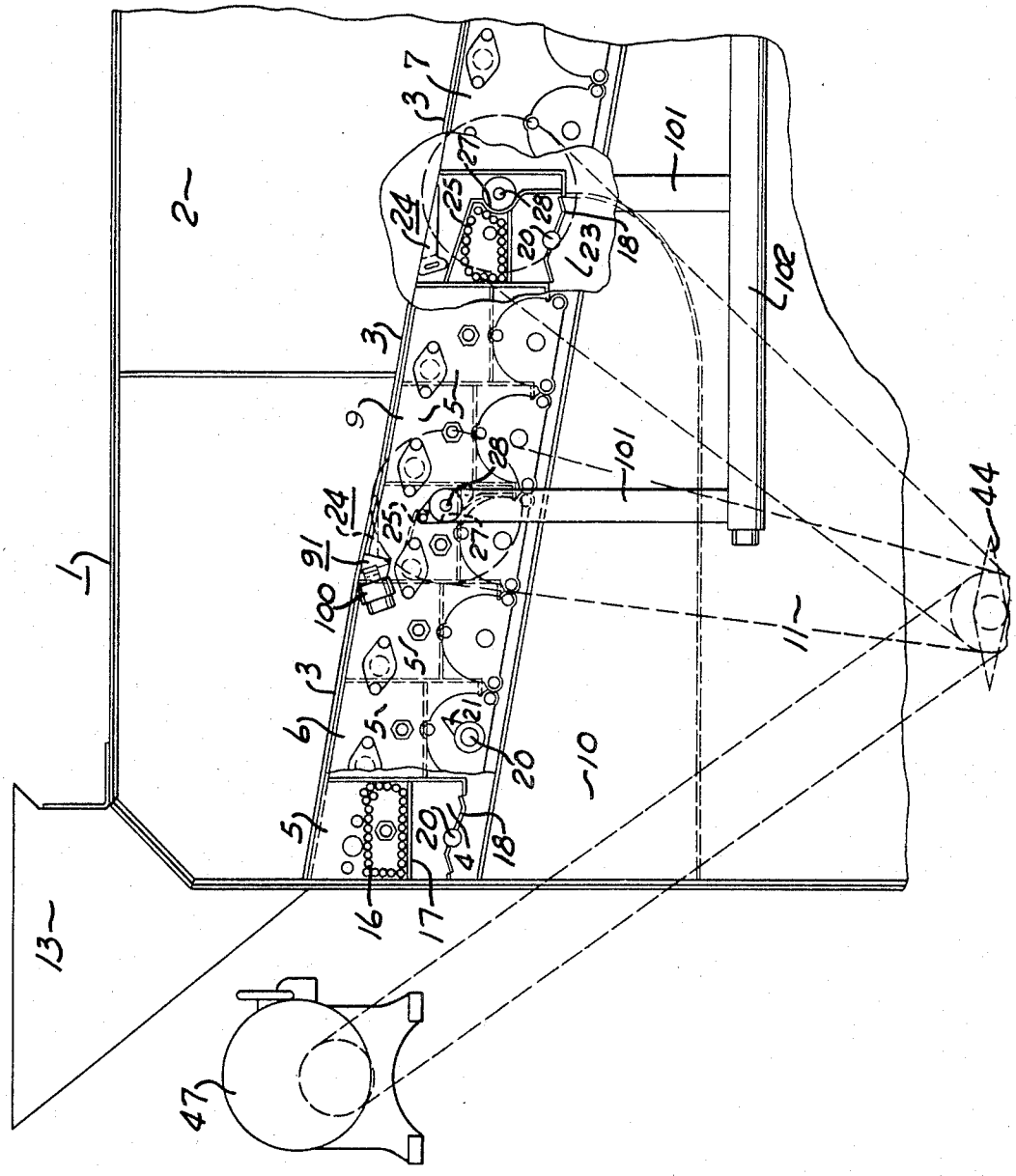


Fig. 4

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United States Patent Office 3,278,029 Patented Oct. 11, 1966

3,278,029

PNEUMATIC STRATIFICATION WITH VIBRATORY DRAW-OFF

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Filed Apr. 2, 1963, Ser. No. 269,974
4 Claims. (Cl. 209—475)

This invention relates generally to the separation of minerals by pneumatic stratification and more particularly to an improved method and apparatus for independently vibrating one or more portions of a pneumatically suspended mineral bed.

Pneumatic stratification of minerals of different specific gravity for separation requires a downwardly sloping screen. The minerals are fed to the upper end of the screen which is enclosed on the under side thereof by a series of independent diffusion cells along the full length thereof and on the top by a single collecting chamber that draws off the air and dust. A pneumatic pressure is directed upwardly through the diffusion cells, the screen and the mineral bed to suspend the mineral bed causing it to flow down over the sloping screen. This mineral bed would not flow down over this screen without being suspended because the slope of the screen is materially less than the angle of repose of the mineral. The combination of the diffused pneumatic pressure and the slope in the screen causes the mineral bed to flow downwardly and this action permits the minerals to find their own strata due to their specific gravity.

Pneumatic stratification of minerals such as coal presents problems. One serious problem is the infiltration of small sized mineral particles of heavier specific gravity into the stratified layer of the minerals of lighter specific gravity. This is due to the fact that the small size of the particle of heavier specific gravity is so much lighter in weight relative to the other larger particles of heavier specific gravity and when the different strata layers become highly concentrated with their particles of different specific gravity these smaller particles of heavier specific gravity ride at the top of their stratified layer and get shoved and blown into the stratified layer of particles of lighter specific gravity. These small sizes seem to be the governing stratification factor adjacent the discharge end of the mineral bed rather than their specific gravity. This results in an intermingling of small mineral particles of heavy specific gravity in the stratified layers of minerals of lighter specific gravity.

The principal object of this invention is the provision of a method and apparatus to seek out these small mineral particles of heavier specific gravity prior to the time when the downwardly flowing mineral bed has formed the distinctive stratified layers of different specific gravity. In the first part of the downwardly flowing mineral bed one or more portions of this bed may be independently vibrated by a mechanical reciprocation that readily filters these smaller mineral parts of heavier specific gravity in the presence of the pneumatic suspension. Since this is prior to the layer concentration of large particles of heavy specific gravity the pneumatic pressure required to suspend the whole bed is not as high as that required when the layer concentration is greater requiring a much higher pneumatic pressure to suspend the bed. Thus filtering out the smaller particles of heavier specific gravity prior to the formation of stratified layers in the bed results in a greater difference in the degree of specific gravity of adjacent stratified layers at adjacent discharge.

When the mineral particles are being initially moved by the pneumatic suspension it was discovered that a mechanical reciprocation subjected to a portion of the pneumatically suspended bed vibrates the mineral bed and

filters out these smaller particles of heavier specific gravity due to uniform mineral mixture through the depth of the bed. It was also discovered that by vibrating two distinct and separate portions or sections of the bed prior to a high degree of layer stratification resulted in better results than the vibration of a continuous section at the initial portion of the pneumatically suspended mineral bed. It is believed that this is due to the action of the pneumatic suspension of the mineral bed. If the whole of the initial portion of the bed is vibrated it does improve the difference in stratification in regard to the specific gravity, but by vibrating spaced portions of the suspended mineral bed less power is expended in vibrating and substantially the same results are obtained by the use of smaller and less expensive vibrators.

The principal object is to mechanically vibrate the initial portion of the pneumatically suspended mineral bed.

The mechanical vibration of the mineral bed may be accomplished by means of rotary eccentric weights mechanically or electrically driven or one may employ an electromagnetic vibratory motor. The latter is considered the best mode because the direction of reciprocation may be made linear and can be more easily controlled.

Another object of this invention is the provision of a novel plastic screen in the shape of a comb with large or heel ends of the teeth mounted on a transverse bar and the long tapering prongs projecting outwardly in spaced parallel relation to each other. This bar is mounted on spaced isolators to align the top surface of the teeth with the adjacent sections of the stationary screen. The isolators support this screen for vibration as an independent section of the sloping screen. The direction of reciprocation may be obtained by an electromagnetic vibrator that vibrates in a lineal path whether straight or arcuate it may impart a feeding action to this resiliently supported comb type screen. Thus by mounting the lineal electromagnetic motors to oscillate the comb type screen at an angle of approximately thirty degrees to the top surface thereof and in the direction of travel of the mineral bed this vibratory movement will deliver a feeding action to the mineral bed thereabove causing the small mineral parts of heavier specific gravity to filter down through the bed and past the screen where it can be collected under the lower end of this comb type screen and conveyed laterally by a draw off auger and discharged from the machine. By providing a plurality of spaced screens in the first half of the mineral bed, the majority of these small sized mineral particles of heavy specific gravity can be withdrawn from the bed leaving a cleaner product with a vast difference between the specific gravity of the subjacent stratified layers making up the mineral bed at discharge.

Other objects and advantages of this invention appear hereinafter in the following description and claims.

The accompanying drawings show, for the purpose of exemplification without limiting this invention or the claims thereto, certain practical embodiments illustrating the principles of this invention wherein;

FIG. 1 is a view in side elevation with parts in section showing the pneumatic stratifier comprising this invention.

FIG. 2 is a view in side elevation illustrating the blowers attached to the left end of the machine of FIG. 1.

FIG. 3 is an enlarged perspective view of a portion of the downwardly sloping screen illustrating the independent vibratory screens with parts broken away and omitted.

FIG. 4 is an enlarged view in section of two spaced vibratory screens in the downwardly sloping mineral bed screen.

FIG. 5 is an enlarged plan view of the screen, isolator and motor.

FIG. 6 is a view in section of the screen and one vibratory motor with the isolator indicated in dotted lines.

FIG. 7 is a perspective view of the isolator shown in section.

Referring to FIG. 1 of the drawings the pneumatic stratifier comprises the enclosure 1 being separated in five different chambers, the material chamber 2 the bottom of which contains the sloping pneumatic screen 3. The second chamber 4 lies under the screen 3 and contains a series of independent diffusion cells 5 which extend the full length and width of the bed. These cells are divided in sections on the under side of the screen 3, there being four cells for the first section 6, for the second section 9 there are three cells 5 and in the third section 7 there are six cells, and in the fourth section 8 there are two cells. Sections 6 and 9 each end with a drawoff. The third chamber is a pneumatic chamber 10 that supplies the air to the first section 6 and the second section 9 of the cells 5. The fourth chamber 11 is a pneumatic chamber that supplies air to the second section 7 of the cells 5 and the fifth chamber 12 is a pneumatic chamber that supplies air to the last two cells in the section 8. Thus each of the five chambers within the enclosure 1 provides a function to increase the volume and pressure of the air downwardly along the pneumatic screen 3 to the discharge end.

Chamber 2 is supplied with a mineral such as run of the mine coal which is preferably sized from zero to three-quarter inch that is dumped in the hopper 13, the hopper gate 14 of which is adjustably positioned by the operating handle 15. The limitations of the movement of the gate 14 are shown in the drawing.

The coal proceeds down into the chamber 2 and along the screen 3 and each cell 5 under the screen is divided into two sections, the top section that contains a marble pack which consists of a pack of glass marbles 16 that diffuse the air flowing upwardly through the cell and through the screen 3 to suspend the coal and stratify the same. The marbles 16 are supported on a large screen mesh 17 and the marble pack or bed will vary in depth in the consecutive cells from the beginning of the screen to the discharge thereof. More marbles are provided in the initial cells than in the end cells because the marbles have the effect of not only diffusing the air but also diminishing the volume and pressure of the air to the screen 3 as the pack is increased in depth. Each cell also contains a manually operated vane or valve 18 pivoted on the shafts 20 and provided with an indicator such as shown at 21. The vanes or valves 18 are employed to also regulate the amount of air admitted to each cell. Thus the adjustment of the vanes or valves 18 together with the depth of the marble pack are determining factors in the amount of air that is admitted to that section of the screen 3 supplied by each particular cell 5 for determining the pneumatic suspension of the body of material such as coal.

When the run of mine coal enters this stratifier the particles of heavier specific gravity such as slate and rock and sulphur balls and the like are interspersed throughout the material but as the material is suspended by the air these heavier particles drop to the lower part of the screen; whereas the lighter coal particles stay at the top of the bed of pneumatically suspended coal. As the bed moves down the screen the heavier parts all collect at the underside of the bed close to the screen and become very dense which requires a greater volume of air and a higher pressure of air to suspend the bed which is compensated for by separating the chambers 10, 11 and 12.

Two of the cells 5 have special screen sections in the screen 3. These are numbered cells 22 and 23, a special screen is provided as indicated at 24 over each of these cells and which permits the entry of less than 3/8" reject off the bottom of the suspended coal bed moving thereunder. These rejects are the heavy particles initially separated out from the bed and have not had a sufficient time to become too dense and therefore are more readily removed through the screen 24 from whence it drops on the lower screens 25 and is conveyed transversely through the openings 27 and is conveyed laterally by the screws 28. If these —3/8" rejects were permitted to be conveyed further along the pneumatically suspended bed of coal the increased air pressure from this point on would have the tendency of sending these rejects higher in the pneumatically suspended coal bed and thus create a condition where it would be difficult to insure the removal of a high percentage of the —3/8" rejects at the end of the bed. The separation is, therefore, improved by this intermediate draw-off of the —3/8" rejects before the air volume and pressure becomes too high to cause these rejects to intermingle with the coal. It will be noted that the cells 22 and 23 are intermediate and adjacent the end of the air chamber 10 which is the first chamber of the system. The specific structure and mounting of these screens 24 will be discussed specifically hereinafter since they represent the crux of the invention.

The chamber 10 is supplied with air through the rotary valve 30 which is driven by the variable speed motor 31 and reducer mechanism through a chain 32. A second chain 33 drives the lower rotary valve 34. The rotary valves 30 and 34 are the same and have spherical plug members as indicated at 35 with a central passageway 36. The spherical portion of the plug 35 of the valve cooperate with the adjustable port members 37 of which there are four. It will be noted in the drawings that the same motor driving the two rotary valves 30 and 34 control the movement of air therethrough at 180° out of phase from each other as the port 36 of the upper valve plug is shown in a horizontal position while the portion 36 of the lower valve plug is shown in vertical position. In other words, while the valve 30 has its passage 36 so as to let the maximum amount of air from the chamber 38 to the chamber 10 as shown, the valve 34 closes and prevents any passage of air from the chamber 38 to the chamber 11. Thus upon the rotation of both of the valves 30 and 34 the air supplied to the cells 5 is pulsated according to the revolutions per minute of the rotary valves and since these valves are operated simultaneously but at 180° out of phase with each other, the pulsation of air in pneumatically suspending the initial portion of the coal bed is also 180° out of phase than the second portion which is indicated by that portion of the pneumatically suspended coal over the cell 7 fed by the chamber 11. These pulsations not only aid in the suspension of the bed but provide a movement that allows the particles making up the coal bed to arrange themselves in stratification throughout the depth of the bed in accordance with the specific gravity of each of the particles. Thus not only the size and depth of the marbles in the marble pack 16 but also the adjustment of the valves or vanes 18 function to pneumatically suspend the coal bed but the number of air pulsations created by the rotary valves 30 and 34 likewise have an effect in the pneumatic suspension of the coal bed that permits the particles of different specific gravity to reach their own level within the bed. This, too, if further affected by the size and the number of cells pulsated by each of the valves. One thus has many variables which may be adjusted to provide an improved pneumatic suspension of the bed.

The chamber 38 as shown in FIG. 2 is supplied with air from the fan indicated at 40 which is in turn driven by a motor 41. The chamber 12 in turn is supplied with air from the fan 42 driven by the motor 43. The motors 41 and 43 are likewise variable in speed so as to permit a change in the volume of air produced over a given time which is a sixth factor in the control of the supply of air to pneumatically suspend the bed of coal which is thus caused to move down the sloping screen 3 due to gravity and because of this pneumatic pulsating suspension.

The chamber 12 is provided with the rotary valve

member 44 which is a single bladed valve that imparts two pulsations per revolution from the chamber 12 to the end cells 45 and 46. The valve 44 is driven by means of the variable speed motor and reducer 47 and this motor is also employed to drive both screw conveyors 28 as shown.

Thus not only each of the consecutive cells 5 all the way down the screen 3 provide for the passage of an increased volume of air progressively down the screen but the last two cells require a considerably greater amount of air than the cells in the chamber 7 because the bed of coal by this time is substantially all properly stratified with the heavy specific gravity rejects lying along the bottom portion of the bed being substantially uniform in depth and the air supplied through the cells 45 and 46 of the chamber 9 must be materially greater in volume to pulsate the bed at this position for which reason the chamber 9 is supplied with air from an independent source.

At the end of the chamber 2 a discharge chute 50 which is rather steep in its inclination has a lip or dam 51 at its upper end. This dam has upper and lower projections 52 and 53 that fit on the top and bottom of the chute 50 which permit the dam member 51 to be removable and changed for different types of run of the mine coal. It will be noted that the bottom edge of the dam is spaced from the screen 3 and this spacing permits the flow of the reject material from the under side of the stratified bed; whereas the coal will flow over the top of the dam 51 and pass down the chute 50 cleaned of all its reject. The chute 50 rests on the cam 54 which is mounted on the shaft 55 rotated by the hand lever 56. Thus different positions of the lever 56 will cause the cam 54 to vary the height of the chute 50 and thus the opening between the bottom edge of the dam 51 and the screen. A stop 57 prevents the abutment member 58 on the shaft 55 to limit the movement of the lever and the spring 60 is attached to the lever 56 to maintain the movable abutment 58 against the stop 57 and thus at all times maintain a constant opening between the bottom of the dam 51 and the screen 3. If for some reason a large chunk of material descends in the pneumatically suspended bed and tends to clog this opening under the dam one need only to depress the lever 56 and the cam 54 will raise the chute 50 and the dam to permit the large piece that is blocking the dam to pass therethrough to reject. The mere release of the handle 56 causes the spring 60 to move into its fixed position against the stop 57.

The air chamber 12 has exposed thereto a servomotor of pneumatic type containing a flexible diaphragm 61 which is fastened between the annular rings 62 and the center of the diaphragm is provided with the plates 63 which permit it to be attached by the link 64 to the lever 65. The lever 65 is fulcrumed at 66 and its other end is provided with the link 67 that connects to the second lever 68 of the system. The link 67 may be adjusted along the levers 65 and 68 to provide for different weights of the reject material. The end of the lever 68 is supported by the spring 70 and its intermediate portion is fulcrumed as indicated at 71. This fulcrum can be changed in its position along the lever 68 by means of the many holes provided. Thus the lever 68 is adjustable relative to the lever 65 as well as the link 67.

The fulcrum 71 of the lever 68 carries the refuse gate 72 which receives all the refuse that flows under the dam 51. The refuse is held on the gate by reason of the lever system and is opened only when the air effective on the diaphragm 61 is of sufficient pressure which indicates that it is having a very difficult time pneumatically suspending the bed of coal just above the dam 51. As the reject strata in the coal bed on the screen 3 becomes very dense, the pressure in the chamber 12 increases. This dense material is, of course, a measurement of the weight of the reject and since the high density creates an increased pressure on the diaphragm 61 the lever 65 will be rotated clockwise and pull the lever 68 against the tension of the spring 70 and will open the gate 72 and allow more or less reject to flow from the end of the screen 3.

The pulsating air pressure in the chamber 12 is effective to vibrate the lever system in the period of the pulsations of air which vibration makes the lever system sensitive to slight variations in pressure and the gate 72 is thereby maintained open to the proper amount for the exit of the reject at a speed correlated with the density of the reject in the last portion of the screen. In this manner a very high degree of accuracy is maintained in the separation of reject from the coal by this gaseous suspension stratifier.

The sides 73 of the chamber 2 may be made of a clear plastic when the stratifier is employed for the separation of rejects from coal. Such plastic side walls may be made of methyl methacrylate and will last a considerable length of time which is rather difficult to understand as one would think that such a material would become scratched by the coal and other particles traveling therethrough. However, the methyl methacrylate is found to stand up far better than that of glass which is much harder and it permits the operator to frequently view the stratification of the reject in the pneumatically suspended pulsating coal bed. It is believed that the plastic is lubricated by the coal and does not set up a charge that will hold the dust particles which permits the bed to be readily observed through plastic rather than through glass.

The lateral throat 74 connecting the chamber for the diaphragm 61 has the valve opening 75 on one side thereof which is closed by the valve 76 attached to the valve bell crank lever 77 having a fulcrum at 78 and carrying a poise 80. The poise is adjustable along the horizontally disposed arm of the bell crank 77 in the manner of that of a beam balance. The pressure that the poise exerts on the valve opposes the internal pneumatic pressure of the fifth chamber 12. Thus the area of the valve 76 that is exposed together with the weight of the bell crank and poise must be calibrated against the air pressures built up in the chamber 12 for different coal having varying amounts of bone, slate and other waste. This bell crank arm is also readily operable by hand.

It should be noted that the valve 76 is out of the way of the path of flow of air so that the actual movement of air is ineffective on the valve.

Referring specifically to FIGS. 5 and 6 each screen member or conveyor section 24 is made up of a series of projections 81 molded integral with the body member 82 which is mounted on the transverse bar member 83 which extends outwardly beyond the sides of the screen 24. The end members 84 of the screen 24 are preferably made heavier by making the same wider as illustrated in FIG. 5. This screen is preferably made of nylon or other similar plastic materials and it may be molded as a series of independent tooth members integrated in a single unit or it may be molded as a single unit as shown in FIGS. 3 and 5. Although the screen may change in relative size, the screen shown has an opening between the projections or fingers of one-eighth of an inch so that they will pass any thing less than three-eighths of an inch. These fingers or projections extend back to the body 82 which functions as a spacer between the projections or fingers which spacers are arcuate in shape both on the horizontal portion 85 and the vertical portion 86. The transverse bar 83 on which the screen is mounted is constructed so as to have little or no vibration in itself. It is obvious that the molding of the body 82 of the screen 24 over the rod would render this section inoperable as an independent vibratory section of the screen.

As shown in FIGS. 3 and 4 particularly a portion of the sides of the chamber 4 are constructed by the channel member 87 and the upper outturned flange 88 is provided with a socket member 90 which is substantially rectangular in shape to receive the elastomer support or isolator member 91 which is made of two sections 92 and 93 as illustrated in FIG. 7. This elastomer member is substantially square in cross section as illustrated in FIGS.

4 and 7 and is slit diagonally along the plane 94 but short of the corners of the square elastomer block. A cavity 95 is provided in this elastomer to receive the transverse bar member 83. This cavity is formed half in the part 92 and half in the part 93 along the singular diagonal plane 94 so that when the two halves of the elastomer are fitted and cemented together on the transverse rod 83 and inserted in the upwardly open sockets 90 the transverse rod 83 functions to interlock the two elastomer sections 92 and 93 together owing to the fact that the front and back face of these opposed elastomer sections are fitted snugly in the opposed parallel walls of the upwardly open sockets 90.

Thus the rod 83 not only projects beyond the ends of the conveyor section 24 but also beyond the elastomer isolator members at each end thereof that are set in their upwardly open sockets 90 and the projection therebeyond is sufficiently large to receive the end of the vibrator mounting arm 96 which is bolted to the transverse rod 83 by means of the bolt member 97. The opposite ends of this arm are provided with a mounting bolt 98 to secure the vibrator 100 to the arm 96. The vibrator 100 is illustrated in U.S. Letters Patent No. 2,958,792. It will be noted that this vibrator hangs freely in the air and vibrates the member to which it is attached. The vibrators 100 at opposite ends of each bar 83 are connected to the same phase so that they will vibrate synchronously and create a reciprocation of the bar 83 as a unit in the direction at right angles to the wide face of the bar 83 and thus in a plane that would pass through the axial centers of each of the vibrators on one transverse rod 83. As illustrated in FIG. 6 the axis of the greatest dimension of the cross section of the bar 83 lies at an angle substantially 30° from the normal or the opposing parallel faces in the upwardly open sockets 90. This angle of application of reciprocating forces through an elastic medium is conducive to applying a vibratory feeding action to the upper surface of the screen 24 and since the projected fingers become increasingly heavier toward the body 82 they will vibrate as a unit and any heavier mineral particles will drop therethrough. The screen 3 may be of square mesh or it may consist of a series of holes in the plate, but the holes of the screen are usually materially smaller than the distance between the fingers of the screen 24. A screen of this type permits long slender and light minerals of heavier specific gravity to be jostled thereon and slid between the fingers. Thus fairly large thin mineral particles may be filtered out by this screen, which particles might be shoved upwardly into the strata of lighter specific gravity owing to their flatness and relative weight. The coal particles of the comparable size would not have the tendency of being long and the air would have the effect of forcing them into an upper strata even at the beginning of the sloping screen 3. Thus the vibrators 100 function to add a reciprocratory vibration to that portion of the bed thereabove which is of relatively high frequency being in the order of 120 to 60 times per second for frequencies of 60 cycles. If the vibrators are driven by the 60-cycle current they will vibrate 120 times per second. If, however, a diode or some form of rectifier is placed in series with the vibrator it will vibrate 60 times per second. This is materially higher than even the air impulses created by the motors operating the rotary valves.

With the two screens positioned before the first half of the bed and in spaced relation from each a considerable amount of the small particles of minerals of heavier specific gravity may be drawn out at this time by the application of the screen. In applicant's Patent Nos. 3,065,853 and 3,066,800 a screen 24 is provided which is different than the screen 3. However, this screen is not vibrated or otherwise moved nor is it supported for vibration as the screens 24 in this application.

It will also be noted from FIGS. 3 and 4 that that portion occupied by the spaced screens 24 slopes a little more sharply than that of the screen 3 adjacent thereto. It is believed that this slight increase in inclination increases the effectiveness of the vibrations of the screen 24 on the bed thereabove by providing a greater impetus in the speeding action relative to the adjacent sections of the screen 3. This again is believed to increase the effectiveness in the operation of the screens 24 in withdrawing smaller sized mineral particles of greater specific gravity so that they do not tend to cement the stratified layer of heavier specific gravity adjacent the discharge. By eliminating substantially all of the minerals of heavy specific gravity a much looser lower strata results adjacent the discharge end of the mineral bed. It provides an improved operation of the machine.

As indicated, both shafts operating the screw conveyors 28 are provided with sprockets connected with their respective chains to the shaft of the valve 44 in the chamber 12 to withdraw the discharge parts laterally from the bed where they drop down the vertical chutes 101 to the horizontal trough 102 that has a screw conveyor 103 to withdraw these parts to the refuse conveyor.

I claim:

1. A vibratory screen consisting of spaced side walls with aligned sockets, a pair of oppositely disposed elastomer isolators mounted in said sockets on said side walls, a bar secured to said elastomer isolators for vibration and spanning the distance between said side walls, an integral screen secured to said bar between said elastomer isolators, and vibratory means fastened to said bar to reciprocate said screen on said elastomer isolators at an angle to the surface of the screen to impart a feeding action to materials on said screen in a direction transverse of said bar.

2. A vibratory screen consisting of spaced side walls with aligned sockets, a pair of oppositely disposed elastomer isolators mounted in said sockets on said side walls, said sockets and said elastomer isolators being substantially square in cross section to securely mount the latter in the former, aligned slanting cavities extending through said elastomer isolators, an integral screen having a solid body portion with spaced parallel comb projections extending from said body portion to form a screen, a transverse bar of greater width than thickness to fit in and extend through said slanting cavities of said elastomer isolators and mounted in said screen body to support and guide said screen for vibration in a movement to feed materials on said screen toward the ends of said comb projections, and a pair of vibrator means each suspended on an arm secured by a single bolt to the opposite ends of said bar beyond said elastomer isolators to impart a feeding vibratory action to said screen.

3. The method of separating materials which consists in the steps of providing a chamber with a downwardly sloping stationary screen over which a mineral bed is suspended above the screen by supplying pneumatic pressure upwardly through the screen and through the mineral bed for the full length thereof to create a downward flow of the mineral bed and to allow the minerals of heavier specific gravity to seek a lower strata in the flowing mineral bed, separating the stratified layers of the continuously flowing mineral bed at the lower end thereof, and vibrating at least two spaced and independent intermediate sections of the screen to provide a stationary screen section up the screen slope from each vibrating screen section to effect spaced quiescent zones of the mineral bed and effect vibration of spaced zones to the underside of the flowing mineral bed following to draw off small size materials of heavier specific gravity before the lower strata of the flowing bed becomes too dense.

4. A machine for separating materials including a chamber having side walls and enclosing a downwardly sloping stationary screen with a mineral intake above its upper end and a strata separator at its lower end and a supply of pneumatic pressure upwardly through the screen for its full length to suspend a mineral bed over the full length of the screen and cause it to flow downwardly to stratify the materials of different specific gravity, at least

two spaced screen sections of said sloping screen independently supported for vibration and each positioned down said sloping screen from quiescent zone sections of said sloping screen and to vibrate the under side of the pneumatically suspended mineral bed after passing a quiescent zone section of screen to draw off screen sized mineral particles of heavy specific gravity before the lower strata becomes too dense, said indepndently suspended screen section consists of a pair of oppositely disposed elastomer isolators mounted in sockets in said side walls, a bar suspended by said elastomer isolators, said spaced independently suspended screen sections supported by said elastomer isolators independently of said sloping screen and forming a continuous screen surface therewith, and said vibrator means secured to said bar to reciprocate said screen sections on said elastomer isolators in the direction of the mineral bed flow.

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