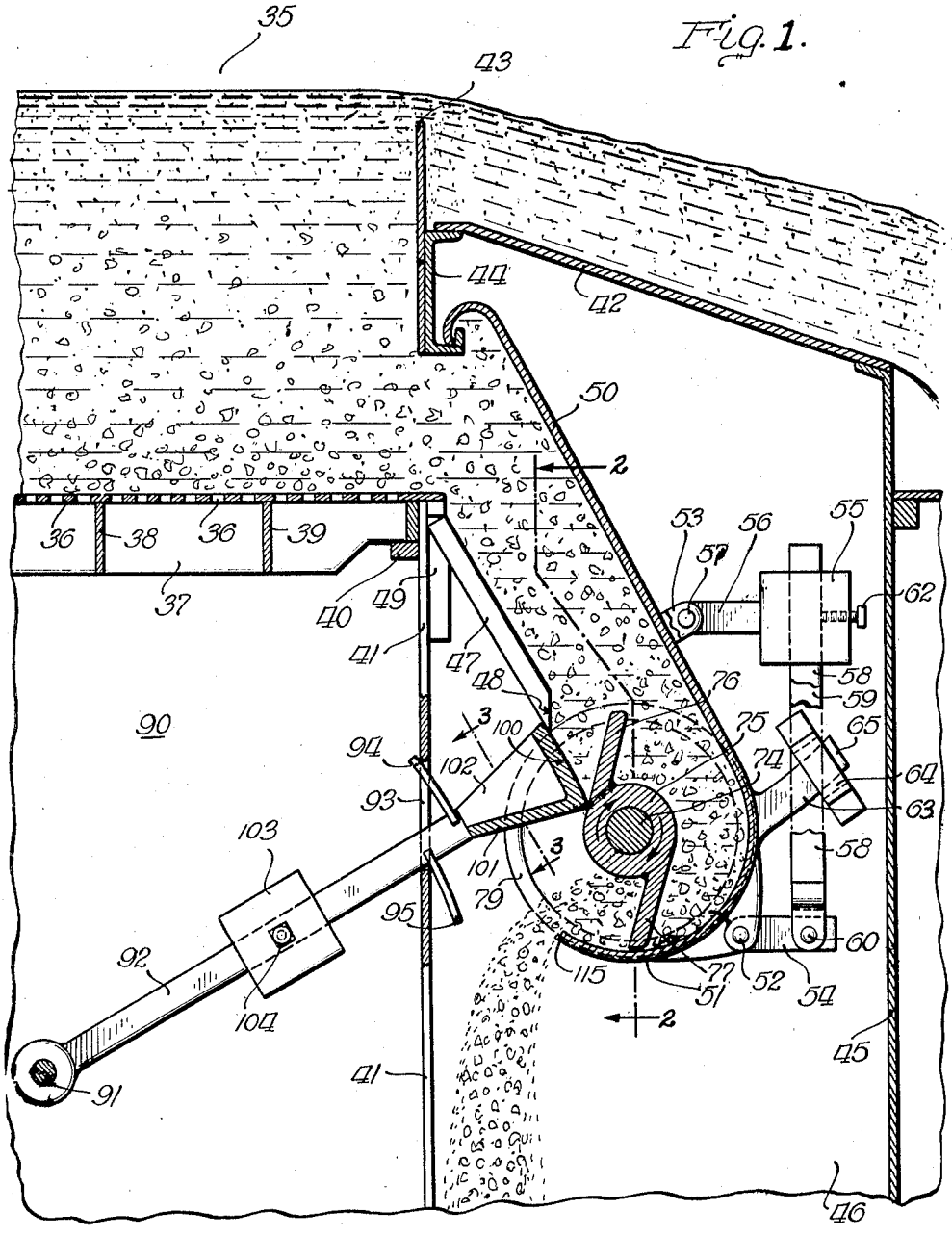
April 4, 1944. H. W. BRENTZ 2,345,866

SEPARATOR AND GATE THEREFOR

Filed Dec. 2, 1941 3 Sheets-Sheet 1

Fig. 1.



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SEPARATOR AND GATE THEREFOR

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Fig. 3

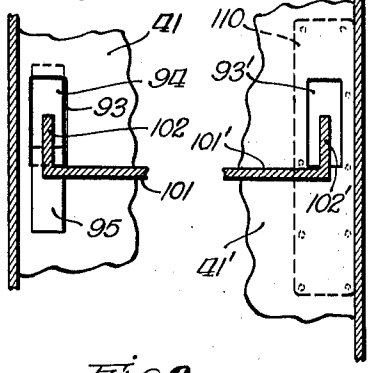
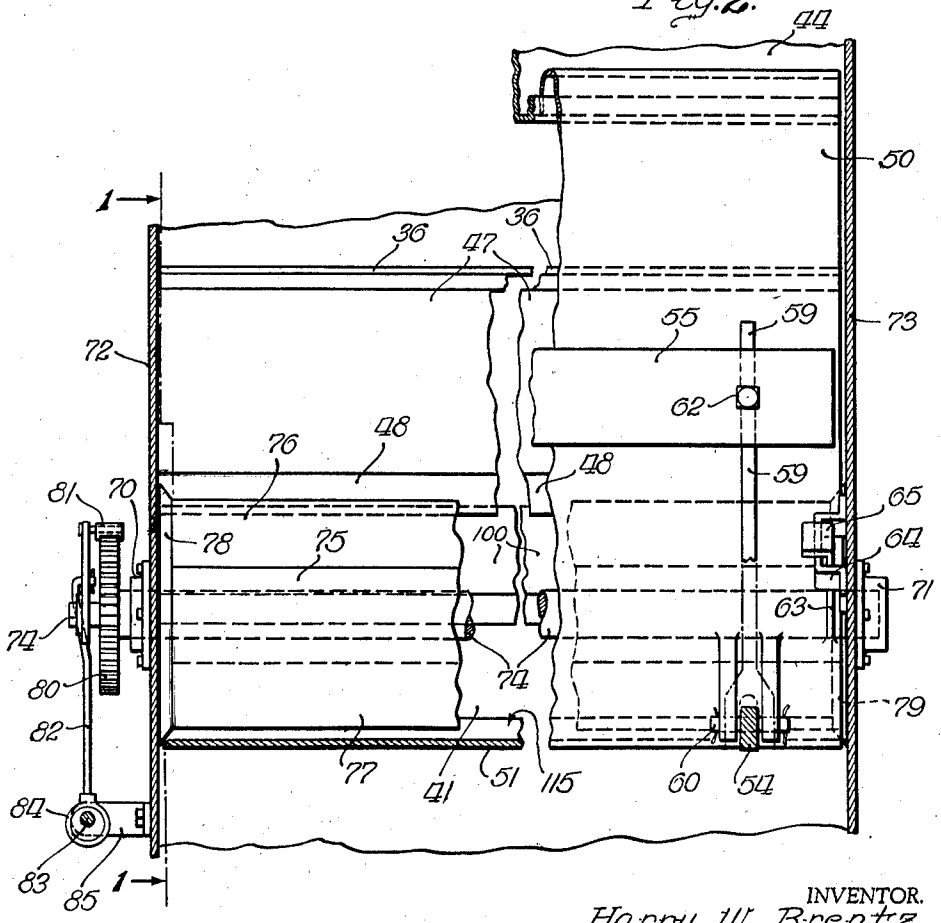


Fig. 5

Fig. 2.



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Fig. 6.

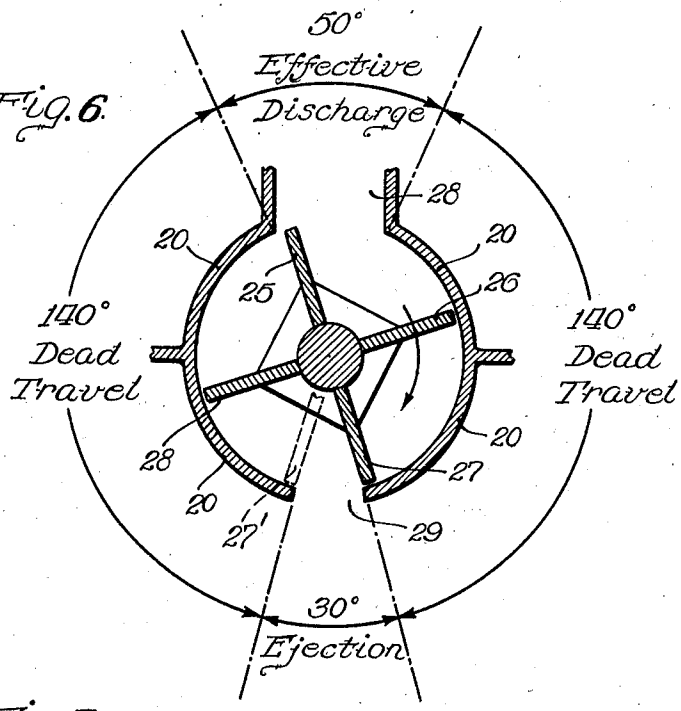


Fig. 7.

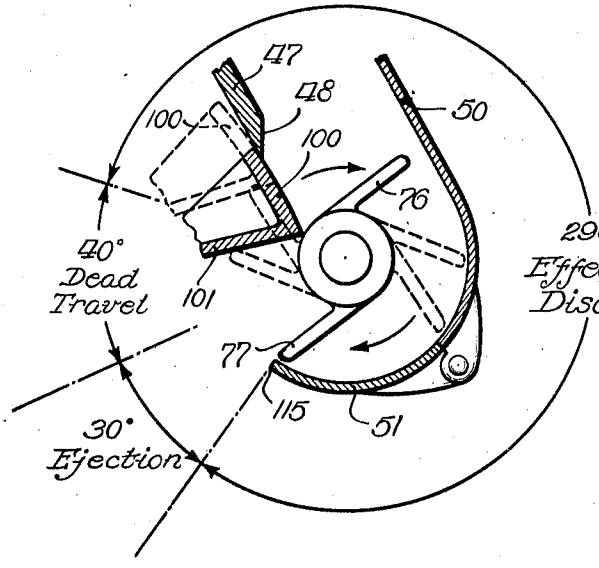
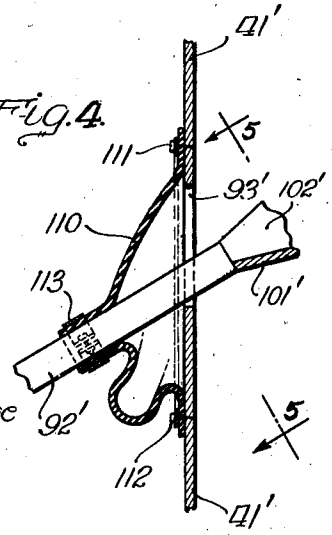


Fig. 4.



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2,345,866

SEPARATOR AND GATE THEREFOR

Harry W. Brentz, Millstadt, Ill.

Application December 2, 1941, Serial No. 421,329

18 Claims. (Cl. 209—495)

This invention relates generally to separators or concentrators, for example, gravity separators, and is particularly concerned with new and improved gates for such separators or related machinery.

The designation "gravity separator," or equivalent language, employed herein refers to machinery or devices such as used, for example, in the ore or coal dressing art, but is not intended to limit the invention either to such specific machinery or to such specific use thereof. Gravity separators in which the invention has been actually used are noted for explanatory purposes. They are machines wherein a raw material, such as coal, ore or other mineral, is treated for separating it into its component parts according to the specific gravities of the particles thereof. The object of the treatment, as in the case of coal, may be to concentrate the light material (clean coal) and to reject impurities and admixtures of heavier specific gravities occurring in the raw feed in the form of so-called bone coal, shale, slate, rock, pyrite, tramp iron or the like, or, as in the case of certain ores or minerals, the object may be to concentrate the heavy components and to reject particles of lighter specific gravities.

In devices and machines of this general type the raw material is caused to stratify in layers for discharge or removal, the heavier particles gravitating downwardly, the lightest particles collecting on top, and particles of intermediate gravities (middlings) massing at an intermediate level. The material bed is usually agitated, for example, mechanically, hydraulically, pneumatically, or by a combination of suitable agitating means so as to facilitate stratification.

Among the best known devices of this kind are the "jig" or "concentrator" usually employing hydraulic agitation; the so-called "dry-cleaner" or "air-cleaner" using an air current or air impulses injected into the material bed; certain types of "wet washers" or "hydro-separators" employing hydraulically agitated separating pockets depending from a feed trough containing the material bed; and apparatus using fluid media or making use of heavy density fluid media with or without uprising currents or mechanical agitation, for floating the light material and permitting the heavy constituents to drop downwardly for discharge.

Whether the particular structure and operation of such machines may be, supply and discharge or draw valves, gates or gears are usually provided for controlling the flow of material relative to the point or space where the separation is accomplished. The gates, valves or gears (the terms are interchangeably used) may be of different structures; for example, the gate may be made in the form of a movable plate or plates disposed in or adjacent to a discharge duct or a feed passage, or in the form of a rotatable wheel, a so-called star wheel, arranged within a housing disposed within or adjacent to a discharge duct or feed passage and operating to move the material. These gates are important parts of the corresponding machine or device and are known to cause a good deal of trouble.

The rotary valve or gate which is widely used may be taken as an example to illustrate the point: Such gate comprises a rotatable shaft with radially disposed blades. The valve rotates within a housing which may be arranged, for example, within or as a part of a discharge duct or chute. It may be driven either by a constantly operating chain drive engaging a sprocket on the valve shaft, or by a reciprocating pawl which may be actuated constantly during the operation of the machine so as to drive the valve by engaging a ratchet attached to the shaft. Suitable means may be used for controlling the rotary speed of the valve so as to provide for minimum and maximum delivery within a certain operating range which may be approximated to or correlated with the rate at which the material is separated.

A shortcoming of such a gate resides in its tendency to pack or clog. It may happen, for example, particularly in the case of handling finely divided wet materials, that the radial spaces between the blades of the rotary gate pack solidly with material, forming with the blades, as it were, a solid cylinder which rotates within its casing in the discharge or delivery duct without moving any material.

Trouble is also frequently experienced in the presence of certain impurities or admixtures, for example, relatively large pieces of rock or pieces of tramp iron. The valve jams rather easily, held by such a piece of material which may be lodged between the tip of one of its blades and the wall of the housing, or across the feed or discharge orifice, again stopping material delivery altogether or causing breakage of parts.

Such rotary valves or gates do not have a positive control of the material to be moved, and the greater part of their angular motion is dead travel, cutting down the efficiency even in the absence of any particular operating trouble such as mentioned above.

Another condition that may be mentioned in this general discussion has to do with the way in

which the old gates move and effect the material. The gates are located in or at the end of a discharge chute through which the material drops by gravity, and they function in practically every instance in the manner of a movable obstruction which permits amounts of material to drop periodically downwardly for discharge. A constant control over the material, in the sense that the material is actually moved in an effective discharge operation, for the greater part of the angular motion of the gate is lacking. The discharge is, therefore, erratic and non-uniform, and the element upon which the material is moved, for example, the discharge conveyor, is unevenly loaded and put under stresses which are damaging to its operation.

There are other shortcoming and troubles connected with such gates, and also with the previously indicated differently constructed gates, but the above noted examples will suffice to show that the known gates do not operate according to reasonably formulated, let alone ideal, operating requirements. They do not provide for positive and reliable operation and for uniform continuous delivery, and cause, in addition thereto, various difficulties in maintaining and adjusting the operation in accordance with the need of the machine. In other words, it is difficult to coordinate the operation of such gates or valves with the rate at which the material is separated. The result of these and other shortcomings is manifest in general inefficiency, frequent stoppage, breakage of equipment, loss of operating time, need for considerable power for the operation, and expenses for repair and replacement of parts.

A critical appraisal of the known gate or valve structures reveals that they attempt to control and to move the material through definitely predetermined passages, disregarding entirely that the material mixture may change due to the presence of foreign parts, or that the makeup of the material mixture or its volume may change. Any one or all of these and other conditions may arise. The structurally rigidly predetermined gate is not adapted to accommodate such changes or contingencies, or to cope with conditions that may lead to or promote the forming of an obstruction. If such obstruction occurs, the gate attempts to overcome it forcibly, and if that is impossible, the gate operation stops or causes damage.

The valve made in accordance with my invention avoids these troubles and drawbacks. The steady and uniform passage of material is promoted instead of obstructed; the material is always under actual physical control; the efficiency is increased as compared with other gates; and the chances for stoppage or breakage are practically eliminated. The new valve, employing novel principles, meets exacting requirements and contributes numerous advantages, all of which will appear from the detailed description rendered below with reference to the drawings. In these drawings,

Fig. 1 shows part of a separator equipped with an embodiment of a valve or gate made in accordance with the present invention;

Fig. 2 illustrates a view of the new valve mechanism from the end, with parts broken away to show details as they appear approximately along lines 2—2 in Fig. 1;

Fig. 3 is a section through a movable control member taken along line 3—3 of Fig. 1;

Fig. 4 shows a modification of a detail part;

Fig. 5 represents a view of the part illustrated in Fig. 4, taken along lines 5—5 thereof; and

Figs. 6 and 7 are diagrams explaining the operation of an orthodox rotary gate and of the new gate, respectively.

Like parts are designated by like reference numerals throughout the drawings. Details and elements which may be assumed to be well known in the art will be described only to the extent required for supporting the understanding of the invention.

Referring now to Figs. 1, 2 and 3, numeral 35 (Fig. 1) indicates the separating chamber of a jig or concentrator of the general type previously mentioned, having a perforated bottom plate or deck 36 supported on suitable structural members 37, 38 and 39. The supports 37 are in turn held on members such as 40 attached to the end wall 41. The overflow over which the separated light material, for example, coal, is discharged is indicated at 42. It may be provided, if desired, with an adjustable gate plate 43. The structural member 44 extending transversely across the separator at the discharge end thereof forms with the bottom plate 36 an opening through which the separated heavy material can move for discharge. The wall 45 at the right hand end of the structure forms with the intermediate wall 41 a discharge chamber 46 which may be provided with suitable means, for example, a conveyor, for removing the discharged material.

The improved gate comprises a rigidly mounted inclined wall or gate plate 47 having a knife edge, as shown at 48, suitably supported by means including the cross member 49. The gate wall 47 forms the fixed floor of the material passage and extends transversely across the discharge end of the separator, as indicated in Fig. 2. Hingedly or pivotally suspended from or movably mounted on the U-beam 44 is the inclined movable shield or gate wall 50 which is curved at its lower end, as shown in Fig. 1. This shield forms the yieldable roof of the material passage. Pivotally attached to this shield at 52 is an auxiliary shorter movable bottom gate shield or tray 51. The pivotal attachment of these shields or gate plates may be accomplished differently; the showing of Fig. 1 is intended for explanation only. These two shields 50 and 51 extend transversely across the concentrator at the discharge end thereof, and the shield 50 forms with the fixed gate plate 47 an inclined material passage or chute, one wall (roof 50) of which is laterally yieldable. The bottom shield or tray 51 is laterally movable with the shield 50 and is independently yieldable with respect to the shield 50 in a direction paralleling the gravitational flow of the material at the discharge or ejection point of the gate. This auxiliary shield or tray at the end of the inclined material passage receives the material supplied thereto by the action of the discharge rotor in a manner which will be presently explained in detail. The shield 50 is equipped with two brackets such as 53 (Fig. 1), one on each side thereof, and the movable bottom shield 51 is equipped with two like brackets, one extending from each of its hinge or pivot points, as shown in Fig. 1 at 54. A counter-weight 55 is provided with arms 56, one near each end thereof, for pivotal engagement at 57 with the brackets 53 on the movable shield 50. This counter-weight is provided with suitable slots in which are mounted arms such as 58 and 59 extending downwardly for pivotal en-

gagement at 60 with the arms or brackets 54 projecting from the hingedly mounted bottom shield 51. The counter-weight 55 is attached to the arms 58 and 59 by means of screws such as 62.

Extending at an angle from the back of the movable shield or plate 50, at each side thereof, is an arm such as 63 which is slidably mounted in a U-bracket such as 64 attached to the inside of the corresponding wall of the discharge chamber. Each arm is bent hook-like at the end, as indicated at 65. These arms, jointly with the U-brackets, form stops for the movable shield 50, limiting its movement in clockwise direction, toward the rotor, as seen in Fig. 1. These stops are not absolutely required. The rotor may be equipped with end plates 78, 79 (Fig. 2) and the sides of the shields may engage the bevelled edges of these end plates, normally resting upon them. The stops, however, eliminate friction between the rotor and the shields. The shield 50, together with its movable shield 51, can move in counter-clockwise direction, away from the gate rotor 75—76—77, the arms 63 moving within the U-brackets 64.

Mounted in suitable bearings 70 and 71 (Fig. 2) in the side walls 72 and 73 of the separator is the discharge rotor comprising the shaft 74 and the tubular member 75 carrying two vanes or blades 76 and 77 which extend therefrom peripherally and in opposite direction. The rotor may be provided with the two previously noted end plates 78 and 79 having bevelled edges, as particularly indicated in Fig. 2. The tubular member 75 with its vanes 76, 77 is keyed to the shaft and is rotatable with it. The shaft projects from the concentrator at one side thereof, for example, through the side wall 72, and may be provided with a suitable drive. It is assumed in Fig. 2 that the drive comprises a ratchet wheel 80 which is keyed to the shaft and operable by a pawl 81. The pawl may be oscillated by an arm 82 extending from an eccenter 83 mounted in suitable bearings 84. Numeral 85 indicates a bracket for holding part of the drive mechanism. The eccenter 83 may be constantly rotated while the machine is in operation. Accordingly, the arm 82 will move up and down, reciprocating the pawl 81 which in turn engages the ratchet 80 and rotates the shaft 74 with its tubular member and vanes or blades 76 and 77. The rotation is in the direction of the arrows shown in Fig. 1. A different drive may be substituted for the one shown herein.

The jig or concentrator is for illustrative purposes assumed to be of the type in which the material in the separating chamber 35 is agitated by water impulses. These impulses are produced in the chamber 90, shown in Fig. 1, by suitable pumping means and are propagated through the perforate deck plate 36 to agitate the material to be separated. In the pulsing chamber 90 may be located a transversely extending shaft 91 carrying at or near each end an arm such as 92. These arms are thus rotatably disposed within the chamber 90 and extend at an angle toward and through suitable openings in the wall 41, one such opening being indicated at 93. In order to prevent water seeping from the pulsing chamber 90 through the openings 93 into the discharge compartment 46, each arm 92 may be provided with metal rubbing plates or shields indicated at 94 and 95. These shields are suitably curved and contact the corresponding edges in the hole or aperture 93 of the wall 41. When the arms 92 are moved the metal rubbing plates 94 and 95 will remain in contact with the edges of the openings such as 93, and no leakage of water that could be detrimental will occur with respect to the discharge compartment 46. The arms 92 carry at their ends a back stop which is arcuate or roughly segment-shaped in section and comprises an elongated angular member having a curved end wall 100 which is in engagement with the knife edge 48 of the fixed floor member 47, as shown in Fig. 1, and a bottom plate 101. This arcuate back stop constitutes a movable or yieldable subfloor. It extends transversely across the gate at the place shown in Fig. 1, and may be provided with end walls such as 102. The end walls may be part of the corresponding arms such as 92. The arms 92 are provided with a counterweight 103 fastened thereto by means of screws such as 104. If desired, each arm may have its own counter-weight. These counterweights bias the arms 92 and the subfloor 100—101 in clockwise direction and tend to maintain it in the position shown in Fig. 1. The curved back stop or subfloor 100 thus forms a movable part of one wall (47) of the gate chute or gate supply passage. It is movable longitudinally or parallel to the median center line of the passage so as to alter the length of the corresponding wall, whereas the opposite wall is laterally movable so as to adjust the width or capacity of the chute.

Figs. 4 and 5 show an embodiment that dispenses with the metal rubbing plates 94 and 95 for the back stop arms 92. Identical parts are indicated in these two figures by identical, but primed, reference numerals. The arm such as 92' extends again through an opening 93' in the wall 41', but is provided with a rubber boot 110 suitably secured at 111 and 112 to the wall 41', and with a clip 113 to the arm 92'. It will be seen that with this structure no water can leak or seep from the pulsing chamber through the opening 93' into the discharge compartment.

The operation is briefly outlined below:

The raw material is fed to the discharge chamber 35, masses therein and is separated into stratified layers by the agitation imparted thereto through the medium of the water impulses injected from the pulsing chamber through the perforate deck plate 36. The heavy material masses at and above the bottom of the deck plate 36 and the light material concentrates at the top of the bed. Material of intermediate gravity masses at an intermediate level. The light material, for example, coal, is discharged over the overflow 42—43 and the heavy material tends to move toward the discharge opening below the U-beam 44 which leads into the material passage of the gate structure just described. The invention is not concerned with the particular mode of stratification of the material, or with the rate of stratification or the control thereof. It may for illustrative purposes be assumed that the middlings or the material of intermediate gravities are discharged with the heavy material.

The movable back stop or subfloor 100 may be assumed to be in the position shown in Fig. 1. The movable shields 50 and 51 which form the yieldable roof and tray of the gate structure also are assumed to be in the normal position shown in Fig. 1, being held in this position by the counter-weight 55 which exerts a downward pressure tending to keep the tray 51 closed with respect to the roof 50 and to keep both members in a position with the angular stop 63—65 in engagement

with the stop bracket 64, all as shown in Fig. 1. The shaft 74 rotates at a certain rate which may be adjusted to the rate of stratification, and therefore the blades 76 and 77 rotate in the direction of the arrows in Fig. 1. It should be observed that the lip or edge 115 of the tray 51 extends beyond the vertical line of the center of the rotor, and that it is elevated with respect to the lowest point reached by the outer edges of the rotor vanes 76 and 77. The lower edge of the subfloor 100 is immediately adjacent the rotor portion 75 and in yieldable engagement therewith, and no heavy material can accidentally drop downwardly at this point.

With the various elements of the new gate in the positions described above, the discharge proceeds as follows:

The vane 76 exerts a lateral pressure on the material massed at the right thereof, while the vane 77 scoops the material at the left thereof toward the discharge over the edge 115 of the tray 51. The control of the vane 77 is positive with respect to the material to be discharged. The control exercised by the vane 76 is likewise positive because this vane in rotating in clockwise direction exerts a lateral pressure with a downward component upon the material massed at the right thereof, moving this material in a lateral rotary motion toward the right and downwardly in a follow-up movement with respect to the vane 77. The angular placement of the vanes 76 and 77 facilitates this positive discharge and positive scooping discharge and ejection operation with respect to the material. The lateral component is normally insufficient to swing the movable shields (roof and tray) away from the rotor. Such displacement occurs mainly when it is required for handling an obstruction. The vane 77 then travels angularly until its tip reaches the bottom 101 of the back stop or subfloor 100. Further rotary motion of the vane lifts the subfloor 100, the face of the subfloor being curved to move in engagement with and in back of the knife edge 48, so that no material can move in back of the fixed floor 47. The angular placement of the vanes facilitates the operation of the subfloor because the vane engages the bottom portion 101 with its tip, reducing the area of engagement and therewith the resulting friction. As the subfloor is raised material drops upon the vane and is lifted by it in a scooping motion, initiating the effective discharge. Part of the movement of the vane from the edge 115 of the tray or shield 51 until it contacts the bottom 101 of the subfloor is dead travel, and part of its movement while it begins to lift the subfloor may also be charged to dead travel. The remaining motion of the vane is effective discharge and ejection, respectively, as will be pointed out more in detail later on. The effective discharge operation of the blade or vane starts at the moment when it has lifted the subfloor and when its left hand side (for example, in the case of vane 77, Fig. 1) is in a position where it constitutes continuation of the lower or under side of the fixed floor 47, that is, when it has displaced the subfloor and is substantially in the place where the subfloor is shown in Fig. 1, closing the gap between the knife edge of the member 47 and the central portion 75 of the rotor. From this point on, the motion of the blade is effective discharge throughout, maintaining a constant control over the material.

No jamming, stoppage or breakage will be caused in case an unusually large piece of material or tramp iron or the like should have dropped into the gate. Such body finally reaches a position where pressure is exerted on it by one of the vanes, pushing the material and the body sideways in a lateral motion and in turn exerting pressure against the movable shield or roof 50. The shield yields, is appropriately displaced, and permits passage and ejection of such body. The same yielding and displacing action occurs at the lower portion of the gate, due to the pivotal mounting of the auxiliary lower shield or tray 51. After such body that may have given rise to trouble is ejected, the shields return to the normal position shown in Fig. 2.

The operation and efficiency of the new gate may be contrasted with that of the ordinary rotary gate by referring to Figs. 6 and 7. Fig. 6 shows diagrammatically a star wheel or rotary discharge gate of customary construction comprising a housing 20, having an opening at the top, as shown at 28, and a bottom opening, shown at 29. The material to be discharged drops downwardly through the opening 28 into the space between the blades 25 and 26. It should be observed that the outer ends of the blades are immediately adjacent the inner walls of the housing 20 so that they practically rub against these walls. The blades, such as 25, execute an effective discharge motion of approximately 50°, as shown in Fig. 6, that is, from a point somewhat at the left from the position in which the blade is shown until it is in a position to complete the 50° arc. This distance of travel is effective discharge motion of the blade because the material to be discharged has only a downward component, that is, a tendency to travel freely downwardly, and must be pushed sideways to effect the discharge. From the point in which the blade 25 is in line with the right hand side of the 50° angle of motion, the material has a natural downward component; that is, it would drop downwardly without any push or force from the blade. Therefore, the further travel of the blade, amounting to 140°, is entirely dead travel, the blade functioning in the manner of an obstruction to the flow of material, until the blade reaches the position in which the blade 27 is shown in Fig. 6. From this point on, the blade functions to accelerate the ejection of the material, this ejection or accelerated discharge taking place approximately throughout 30° of the travel of the blade (depending on the particular structure) until the blade is shown in the dotted line position 27'. From this point on, the blade travels throughout 140° of dead motion. It does not move the material in a discharge motion at all; it operates dead so far as discharge is concerned, but must lift the material which has dropped downwardly so as to put it in position for effective discharge, thereby consuming power without delivering effective work. It goes through dead travel encumbered by a load. It will be appreciated that this is a very low efficiency of operation. Dead travel in this gate structure amounts to 280° of the angular motion, which is 77.78%, of the total angular motion of 360° the effective discharge and ejection, that is, the efficiency of the gate being, therefore, only 22.22%. In other words, the gate does effective discharge work only for 22.22% of its travel during one complete revolution.

Fig. 7 contrasts in a diagrammatic manner the operation and efficiency of the new gate with that of the old gate shown in Fig. 6. Numerals 50 and 51 indicate the movable shields (roof

and tray) shown by identical reference numerals in Fig. 1. Numerals 76 and 77 indicate the vanes or blades of the new rotor. Numeral 100 represents the curved back stop or subfloor in solid lines in normal position and in dotted lines in partly raised position. Numeral 47 indicates the fixed floor wall provided with the knife edge 48. The direction of rotation of the rotor with its blades 76 and 77 is indicated by the arrows. Effective discharge proceeds approximately at the moment when the blade has almost completely raised the subfloor 100, that is, when it begins to scoop the material and move it in a discharge motion having a lateral component. The blade then travels through 290° effective discharge motion until it is in the position in which the blade 77 is shown in Fig. 7. Throughout this motion the blade has complete control of the material. At no point is there any tendency of the material to drop freely by gravitational force due to the angle at which the discharge passage is disposed and due to the fact that there is always material massed on the upwardly sloping auxiliary shield or tray 51, preventing material in back of it from sliding downwardly. Therefore the blade always has to push the material along, retaining control over it throughout the entire discharge operation. When the tip of the blade moves beyond the edge 115 of the tray 51, it effects and completes the ejection of the material. This part of the motion may be termed "accelerated discharge" or "ejection." The material drops down into the discharge compartment, as indicated in Fig. 1. From a point approximately midway between the edge 115 of the tray 51 and the bottom 101 of the subfloor the blade moves through a dead motion until it has sufficiently raised the subfloor when discharge can again proceed. The efficiency of the new gate is therefore considerably increased and is several times the efficiency of the old gate. Dead travel in the new structure amounts to 40° of the angular motion which is equivalent to 11.12% of the total angular motion of 360°, the effective discharge and ejection, that is, the efficiency of the gate being, therefore, 88.88% compared with an efficiency of only 22.22% for the old gate structure.

The outstanding features of this new gate include the ability to handle the material without causing jamming, packing, breakage or stoppage of the machine; continuous controlled and uniform discharge; less power required for the operation; and increased efficiency. The material is being fed and moved in a controlled manner, continuously and constantly to the discharge and ejection point. The discharge is therefore continuous, substantially uniform and steady. The gate needs less power for its operation because it does not attempt to overcome by force any condition of obstruction that might occur. The conveyor or other appliance receiving the material from the gate is continuously supplied in a uniform manner, and therefore the danger of overloading or erratic loading is eliminated. The use of the gate is not limited to the discharge mechanism as described.

Changes may be made in details or in the arrangement of parts within the scope and meaning of the appended claims in which I have defined what I believe is new and what I desire to have protected by Letters Patent of the United States.

I claim:

1. In a separator having a compartment wherein material is treated to separate it according to the specific gravities of its component parts, a gate for moving said material relative to said compartment comprising two members disposed substantially in parallel to but spaced from each other and forming a downwardly extending inclined material passage, one of said passage-forming members being pivotally mounted at the upper end thereof, shield means pivotally secured at the lower end of said pivotally mounted member forming a laterally extending tray at the lower end of said passage, and operating means in said passage above said tray for moving said material onto said tray and for discharging it downwardly over the edge thereof.

2. The structure and combination defined in claim 1, together with means for holding said pivotally mounted member and said shield means in normal position relative to said operating means.

3. The structure and combination defined in claim 1, wherein said pivotally mounted passage-forming member and the shield means pivotally secured thereto surround said operating means at the side and the bottom thereof, there being a gap between the lower end of said other passage-forming member and said operating means, and stop means movably disposed in said gap and operable by said operating means.

4. The structure and combination defined in claim 1, wherein said pivotally mounted passage-forming member and the shield means pivotally secured thereto surround said operating means at the side and the bottom thereof, there being a gap between the lower end of said other passage-forming member and said operating means, stop means movably disposed in said gap and operable by said operating means, and means for holding said stop means in normal position relative to said operating means.

5. In combination, a rigidly disposed downwardly inclined member, a pivotally mounted mounted shield spaced from said member and forming a downwardly inclined material passage therewith, operating means disposed at the lower end of said passage for moving material therethrough, said pivotally mounted shield yielding laterally to enlarge the passage responsive to pressure exerted by said operating means on obstructive matter contained in said material, and a concave tray disposed movably below said operating means for receiving and discharging the material moved thereby, and means for pivotally securing one end of said tray at the lower end of said pivotally mounted shield.

6. The combination and structure defined in claim 5, together with link means for movably connecting said shield and said tray, and a counter-weight coacting with said link means for maintaining said shield and said tray in normal position relative to said operating means.

7. The combination and structure defined in claim 5, together with an arcuate stop element for blocking the downward movement of material between the lower end of said rigidly disposed member and said operating means, means for movably mounting said stop element, and means for maintaining said stop element in a downwardly biased normal position relative to said operating means.

8. In combination with means forming a passage for material tending to move therethrough downwardly in bulk, a rotatable operating member for controlling the movement of said material comprising a rotatably mounted central

rotor portion, a vane tangentially extending from said central portion for scooping part of said material during rotation thereof through the upper sector of its arcuate motion and moving said material laterally and downwardly for discharge, a concave tray disposed below said operating member for receiving said material discharged by said vane, said vane scooping the discharged material on said tray and moving it laterally and slightly upwardly for ejection over the edge of said tray during rotation through the lower sector of its arcuate motion, and a movable stop element operable by said vane for blocking material movement with respect to said vane during upward rotation thereof.

9. A separator including a separating compartment and a device for moving material relative thereto, said device comprising a fixed wall extending downwardly at an incline and forming the fixed floor of a material passage, a vane carrying gate member mounted for rotation below and spaced from the lower edge of said fixed floor for moving material through and from said passage, a movably mounted member forming a subfloor extending in continuation of said fixed floor and yieldably engaging said gate member for coaction therewith, whereby downward passage of material is impeded during rotation of said gate member along that side thereof which is yieldably engaged by said subfloor, a yieldably mounted wall extending normally downwardly at an incline in spaced substantially parallel relation with said fixed wall and forming a yieldable roof for said material passage, said roof yielding to enlarge the material passage responsive to outward pressure exerted thereon by obstructive matter contained in the material moving through said passage, whereby the downward movement of material along the free side of said gate member is facilitated during rotation thereof, a counterweight for downwardly biasing said proof against the outward pressure exerted thereon, and link means for movably connecting said counterweight with said yieldable roof.

10. A separator including a separating compartment and a device for moving material relative thereto, said device comprising a fixed wall extending downwardly at an incline and forming the fixed floor of a material passage, a vane carrying gate member mounted for rotation below and spaced from the lower edge of said fixed floor for moving material through and from said passage, a movably mounted member forming a subfloor extending in continuation of said fixed floor and yieldably engaging said gate member for coaction therewith, whereby downward passage of material is impeded during rotation of said gate member along that side thereof which is yieldably engaged by said subfloor, a yieldably mounted wall extending normally downwardly at an incline in spaced substantially parallel relation with said fixed wall and forming a yieldable roof for said material passage, and a tray pivotally secured to said yieldable wall at the lower end thereof and normally positioned underneath said gate member for receiving material moved from said passage responsive to rotation of said gate member, said roof and said tray yielding to outward pressure exerted thereon by obstructive matter contained in the material moving through and from said passage so as to facilitate the movement thereof.

11. A separator including a separating compartment and a device for moving material relative thereto, said device comprising a fixed wall extending downwardly at an incline and forming the fixed floor of a material passage, a vane carrying gate member mounted for rotation below and spaced from the lower edge of said fixed floor for moving material through and from said passage, a movably mounted member forming a subfloor extending in continuation of said fixed floor and yieldably engaging said gate member for coaction therewith, whereby downward passage of material is impeded during rotation of said gate member along that side thereof which is yieldably engaged by said subfloor, a yieldably mounted wall extending normally downwardly at an incline in spaced substantially parallel relation with said fixed wall and forming a yieldable roof for said material passage, a curved tray yieldably secured to said yieldable wall at the lower end thereof and partially encircling said gate member, a counterweight, and link means for movably connecting said counterweight with said yieldable roof and with said tray, said roof and said tray yielding outwardly responsive to pressure exerted thereon by obstructive matter contained in the material moving through and from said material passage so as to facilitate the movement thereof, and said weight counteracting such pressure to secure the operation of said roof and said tray.

12. A separator including a separating compartment and a device for moving material relative thereto, said device comprising a fixed wall extending downwardly at an incline and forming the fixed floor of a material passage, a vane carrying gate member mounted for rotation below and spaced from the lower edge of said fixed floor for moving material through and from said passage, a movably mounted member forming a subfloor extending in continuation of said fixed floor and yieldably engaging said gate member for coaction therewith, whereby downward passage of material is impeded during rotation of said gate member along that side thereof which is yieldably engaged by said subfloor, a yieldably mounted wall extending normally downwardly at an incline in spaced substantially parallel relation with said fixed wall and forming a yieldable roof for said material passage, a curved tray yieldably secured to said yieldable wall at the lower end thereof and partially encircling said gate member, a counterweight, and link means for movably connecting said counterweight with said yieldable roof and with said tray, said roof and said tray yielding successively and independently outwardly responsive to pressure successively exerted thereon by obstructive matter contained in the material moving through and from said material passage so as to facilitate the movement thereof, and said weight counteracting such pressure to secure the successive independent operation of said roof and said tray.

13. In a separator including a separating compartment wherein material is separated in accordance with the specific gravities of its component parts and having an agitation compartment wherein agitation is furnished for said separation and a discharge compartment which receives separated material for discharge, a device for effecting the movement of such material from said separating compartment into said discharge compartment comprising means forming an opening in said separating compartment, a fixed member extending from said opening downwardly at an incline into said discharge compartment and forming therein the fixed floor of

a material passage, a discharge wheel mounted for rotation below and spaced from the lower edge of said fixed floor for moving material through said passage into said discharge compartment, a member forming a subfloor in continuation of said fixed floor disposed between said fixed floor and said discharge wheel and engaging said wheel, and means in said agitation compartment for pivotally mounting said member for movement relative to said fixed floor.

14. The combination and structure defined in claim 13, together with a pivotally mounted shield extending from said opening downwardly at an incline into said discharge compartment and forming therein a yieldable roof for said material passage, said shield extending beyond the line of the axis of said discharge wheel, and a curved tray pivotally secured to said shield at the lower end thereof and partially encircling said discharge wheel.

15. In a separator having a separating compartment and a device for moving material relative thereto, said device including a downwardly inclined material chute having a floor comprising a fixed upper member and a yieldably mounted lower member which is normally disposed in continuation thereof and is movable relative thereto, constituting a movable extension of said fixed member, whereby said floor can be downwardly extended and contracted, means for downwardly yieldably biasing said yieldably mounted lower member tending to maintain the normal position thereof in continuation of said fixed member, a roof for said material chute comprising a pivotally mounted shield which is normally disposed laterally spaced from and extending substantially in parallel relation with said floor, a discharge wheel mounted for rotation within said chute at the lower end thereof, a curved tray pivotally mounted at the lower end of said pivotally mounted shield and extending across the lower end of said chute and partially encircling said wheel in normally concentric relationship therewith, and means for yieldably biasing said pivotally mounted shield and said tray tending to maintain the normal relationship thereof with respect to said floor and said discharge wheel.

16. A separator having a separating compartment and a device for moving material relative thereto, said device comprising a fixed wall, a pivotally mounted wall laterally spaced from said fixed wall and extending normally in parallel relationship therewith, said walls forming a downwardly directed material chute, a curved shield pivotally mounted at the lower end of said pivotally mounted wall and laterally extending therefrom across said chute at the lower end thereof, and a material discharge member mounted for rotation within said chute above said curved shield.

17. The combination and structure defined in claim 16, wherein said pivotally mounted wall extends downwardly beyond the lower end of said fixed wall, the free edge of said curved shield being positioned substantially perpendicularly below and spaced from the lower end of said fixed wall, said discharge member ejecting material over the free edge of said shield.

18. The combination and structure defined in claim 16, wherein said pivotally mounted wall extends downwardly beyond the lower end of said fixed wall, the free edge of said curved shield being positioned substantially perpendicularly below and spaced from the lower end of said fixed wall, said discharge member ejecting material over the free edge of said shield, together with yieldably mounted means coacting with said discharge member and with said fixed wall for directing the downward flow of material onto said curved shield for discharge therefrom.

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