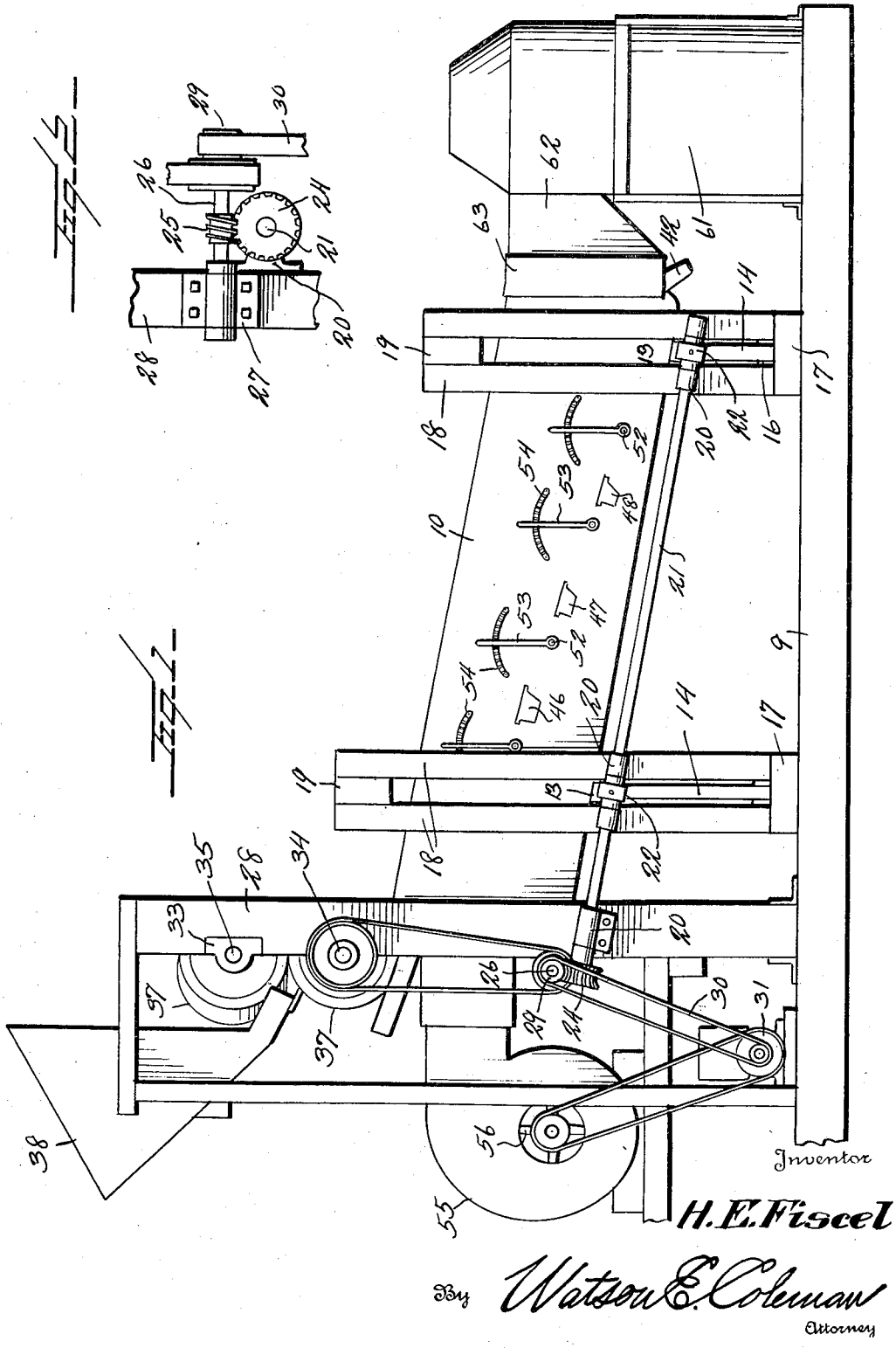
Dec. 13, 1938. H. E. FISCEL 2,139,944

DRY CONCENTRATOR

Filed Sept. 12, 1936 3 Sheets-Sheet 1



Inventor

H. E. Fiscel

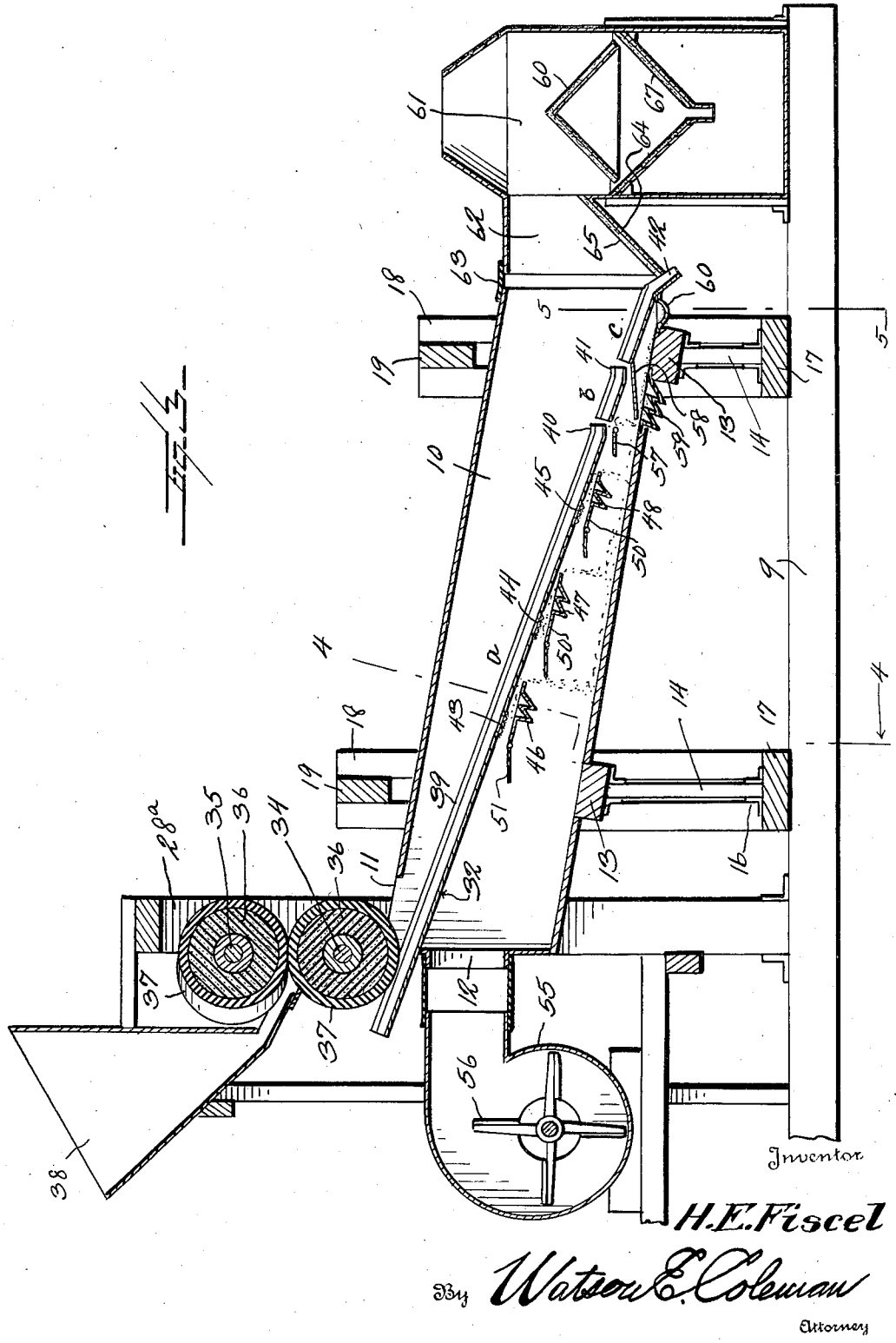
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Dec. 13, 1938. H. E. FISCEL 2,139,944

DRY CONCENTRATOR

Filed Sept. 12, 1936 3 Sheets-Sheet 2



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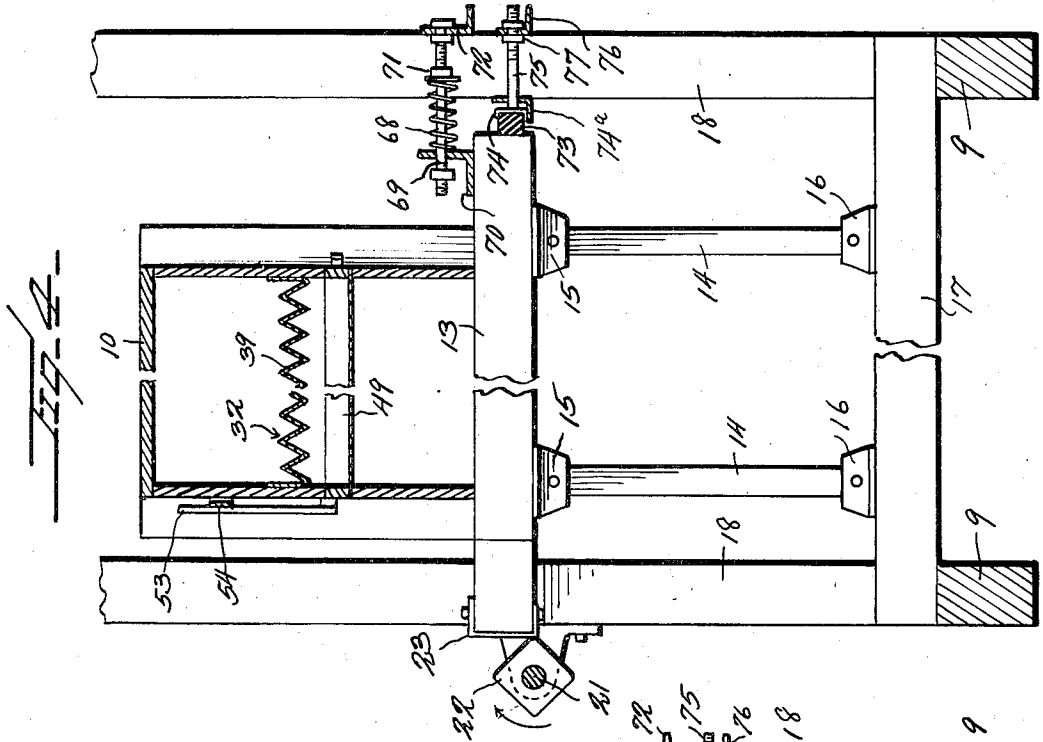
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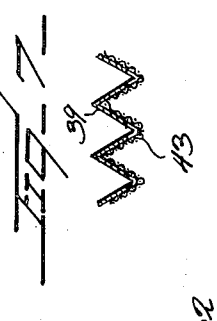
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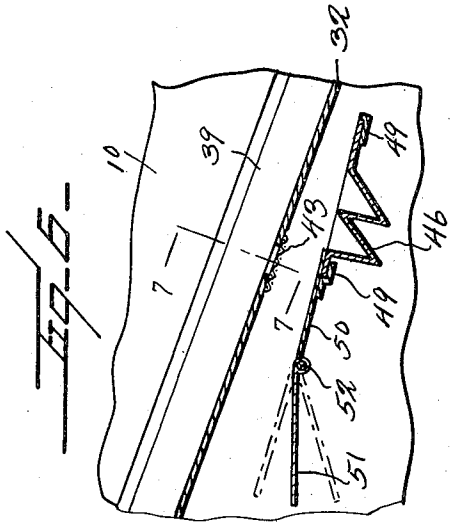
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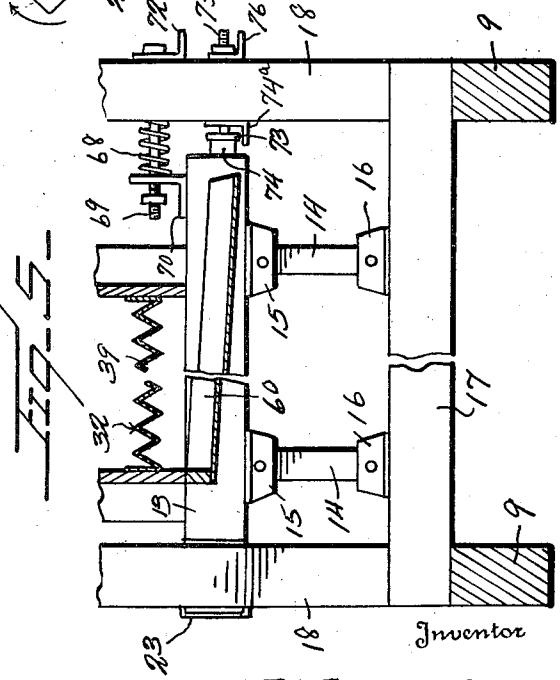
DRY CONCENTRATOR

Filed Sept. 12, 1936 3 Sheets-Sheet 3









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UNITED STATES PATENT OFFICE

2,139,944

DRY CONCENTRATOR

Harry E. Fiscel, Pittsburgh, Pa.

Application September 12, 1936, Serial No. 100,549

11 Claims. (Cl. 209—44)

This invention relates to concentrators and particularly to concentrators peculiarly adapted to work on what are known as dry lodes.

The general object of the invention is to provide a concentrator of such a construction that it is very effective for its purpose, and which will secure a very high percentage of recovery with pulverized or granulated ores.

Another object is to provide a concentrator of this character which includes a deck down which the granulated ore is steadily and evenly discharged, the deck having a series of screened openings in its bottom, means for laterally shaking or jarring the deck, and means for discharging a regulated blast of air up through these screens and the openings in the deck to thereby secure a separation of different-sized fine values from the coarse concentrates and middlings, the air which passes through the screens and openings acting to carry lighter particles or dust to a settling chamber.

A further object is to provide a structure of this character in which the feed of the ore to the table is secured by means of yieldingly faced rolls, the said rolls being disposed at a slight angle to each other though in parallel horizontal planes so as to cause a rubbing action on the particles of dirt which will separate and break up any aggregations of particles and will cause an even flow of material down the deck.

A further object is to provide a deck which is transversely corrugated or so formed as to provide a plurality of longitudinally extending channels to thus prevent packing of the material as it passes down the deck due to lateral jar given to the deck.

A still further object is to provide a wind trunk and dispose within this trunk the downwardly inclined deck having screened openings and unscreened gaps, to provide troughs beneath the screened openings through which the screened material can collect and by which this material may be discharged, and to provide regulatable means whereby a blast of air discharged into the rear end of the trunk will be regulatably discharged up through these screened openings to thereby buoyantly support the lighter particles of material as the material passes over the screened openings but permitting the heavier material to be discharged downwardly through the screens and into said troughs.

A still further objects is to provide improved means whereby the wind trunk and the deck disposed therein may be laterally jolted or vibrated.

Still another object is to provide means whereby the dust carried by the air blast out from the end of the trunk may be collected on fabric coated members.

Other objects will appear in the course of the following description.

My invention is illustrated in the accompanying drawings wherein:

Figure 1 is a side elevation of a concentrator constructed in accordance with my invention;

Figure 2 is a fragmentary detailed elevation of the means for driving the vibrator shaft;

Figure 3 is a longitudinal vertical section through the concentrator;

Figure 4 is a transverse section on the line 4—4 of Figure 3;

Figure 5 is a fragmentary transverse section on the line 5—5 of Figure 3;

Figure 6 is a fragmentary longitudinal section through the deck and through the trough and damper associated therewith;

Figure 7 is a transverse section on the line 7—7 of Figure 6.

In the drawings, 10 designates a downwardly inclined trunk closed as regards its bottom, top and sides, but having a material receiving opening 11 in its upper wall at the upper end of the wall, and an air inlet opening 12 at its upper end. This trunk is supported for lateral vibrating movement upon transversely extending supporting beams 13. Two of these beams are shown, and each beam is supported in turn by two legs 14 pivoted at their upper ends to angle irons 15 secured to the underside of the trunk, and at their lower ends to angle irons 16 secured to transverse beams 17 mounted upon the sills 9. Extending upward from each beam 17 are two pairs of uprights 18, there being one pair on each side of the trunk. These are spaced apart to accommodate the transverse beams 13. The uprights are connected at their upper ends by transverse beams 19 or in any other suitable manner.

Mounted in bearings 20 on the trunk is a downwardly inclined shaft 21 carrying on it the cams 22, shown as square in cross-section, and these cams are preferably made of hardened steel. The cams each engage a wear plate 23 carried by the corresponding beam 13. While the shaft 21 may be driven by any suitable means, I have shown it as carrying a worm wheel 24 driven by a worm 25 on a cross-shaft 26 carried by a bearing 27 on an upright 28, this shaft being driven by a pulley 29 from a belt 30 in turn driven from a motor 31.

Disposed within the trunk 10 and extending longitudinally thereof is a downwardly inclined deck 32 which at its upper end extends beyond the rear wall of the trunk. Carried in bearings 33 on the uprights 28 and 28a are two shafts 34 and 35, each carrying relatively large feed rolls. Each roll has a relatively soft and elastic core 36 as, for instance, formed of sponge rubber, and each roll has a covering or facing of relatively harder rubber, such as live tread rubber, this outer covering being designated 37. I thus provide a more lasting wearing surface for the rolls than would be provided by the sponge rubber if it was not covered.

The lower roll is at right angles to the deck 32 but the upper roll, while horizontally parallel to the lower roll, is at an angle relative to the lower roll. This secures a rubbing effect, liberating the particles of material from each other, breaking up agglomerations and securing the even feed of material to and entirely across the deck. The deck 32 is supported by the side walls of trunk 10 and, as shown in Figures 4, 5 and 7, is transversely corrugated to thereby provide channels extending longitudinally of the deck, these corrugations being preferably angular in cross-section. These corrugations provide longitudinally extending channels along the entire surface of the deck, and these channels prevent the material from being shifted toward one side of the deck and prevent any packing of the material. Each channel or valley defined by the corrugations has downwardly and inwardly or medially inclined sides and these act, as will be later stated, to exert a squeezing action on the material, which causes the heavier particles to move downward toward the middle of the valley and the lighter particles to be forced upward.

The deck is divided into three sections; a main, relatively long section *a*, which is slightly separated from but discharges onto a relatively short section *b*, which in turn is separated from but discharges onto the terminal section *c*. The lower end of section *a* at 40 is bent to a horizontal plane at 41, and the same is true of section *b*. Section *c* has a downwardly discharging terminal portion 42. The purpose of the horizontally bent portions 40 and 41 at the gaps between the sections is to retard the movement of material at this point, so that the material will not jump these gaps so rapidly as not to be affected by a blast of air discharged into the air trunk below the deck by means to be later described.

The main section *a* of the deck is formed with a plurality of screened openings, the screens thereof being designated, respectively, 43, 44 and 45; that is to say, each valley of the corrugated deck at the several points has a screen discharge opening or slot, as shown in Figures 6 and 7.

Disposed below and slightly ahead of the several openings are the transversely extending concentrate receiving troughs 46, 47 and 48. Each trough is transversely corrugated, as shown in detail in Figure 6. Each trough is slidingly mounted, like a drawer, in the guides 49 attached to the sides of the trunk, and each of the troughs is withdrawable from one side of the trunk 10, as shown in Figure 4.

Likewise carried by the side walls of the trunk are the plates or aprons 50, one for each trough, and which are disposed in advance of their respective troughs. Oscillatably mounted at the upper edge of each plate 50 is a wind controlling damper 51 carried on a shaft 52. Each shaft carries at its outer ends an arm 53 movable over a latching segment 54. Discharging into the upper end of the trunk below the deck is a fan casing 55 having therein a blower 56 driven by a belt from the motor 31. A blast of air is thus discharged beneath the entire length of the deck, a portion of this blast being directed upward through each screen 43, 44 and 45, the amount of the blast and its direction being regulated by the dampers 51. A pivoted damper 57 is also disposed beneath a gap between the sections *a* and *b*, and a deflecting plate 58 is disposed beneath the gap of the sections *b* and *c*. Below the deflector 58 and forming a continuation of the lower wall or floor of the trunk is a transversely extending corrugated coarse-concentrate trough 59. It will be noted that all of the concentrating troughs have their corrugations V-shaped and that one wall of each corrugation is perpendicular to the floor of the trough 10, while the forward wall is upwardly and forwardly inclined relative thereto. The upper face of the lower beam 13 is flush with the floor of the trunk and guides the material passing downward over said floor into a middlings trough 60.

Disposed in advance of the trunk 10 is a Cyclone dust collector which includes a chamber 61 open at its upper contracted end. A rearwardly directed inlet chute or mouth 62 extends from the upper end of the chamber 61 and is flexibly connected at 63 to the trunk. This chute has an upwardly and forwardly directed wall 64 covered with fabric 65. The dust collecting chamber has a hopper 66 therein with a central discharge opening and the face of the hopper is covered with fabric 67. Above the hopper is a substantially conical deflector 68 also covered with fabric. The fabric layers on the deflector and the fabric 65—67 may be of corduroy, pressed seaweed, cocoa matting, burlap or other material which will hold the fine dust values.

The hardened steel cams 22 give lateral jolts to the trunk and to the deck and the trunk is urged in a reverse direction against the action of the cams by compression springs 68, each surrounding a rod 69, the rod passing through an angle iron abutment 70 and the spring bearing at one end against this abutment and at the other end against a washer and nut 71 on the rod to thus adjust the tension of the spring. Each rod is adjustably supported by an angle iron 72. For the purpose of cushioning the stroke of the beams 13 carrying the trunk and giving a jolt to the trunk and screens as the beams 13 are thrown laterally by the cams, I provide a rubber bumper 73 for each beam 13 supported in a section of channel iron 74 carried by an adjustable rod 75 in turn supported by an angle iron 76 and held in adjusted position by opposed nuts 77.

The reason for forming the deck with longitudinal corrugations, as before stated, is to hold the material being concentrated in longitudinally extending channels or zones and prevent the material from packing towards one side of the deck, thus permitting the heavier particles to freely settle down through the ore bed. This prevention of packing is also assisted by the action of the rubber bumpers which counteract the otherwise one-sided impact of the cams. Without these bumpers, the load would travel toward the side when impact is applied. The springs 68 cause the return movement of the trunk and the adjustment of these springs also governs the length of stroke. The trunk is, of course, wind tight except at its entrance and discharge ends and at the middlings trough 60. In

actual practice, the trunk will be approximately four feet long but, of course, it is understood that this dimension is merely given to show the relative proportions of the parts on the drawings, and that the trunk may have any desired length or cross-sectional area.

The operation of the concentrator is as follows:

The granulated ore made up of particles preferably not larger than 1¼" is fed from the hopper between the elastic rolls, these rolls acting to break up any agglomeration of particles and feed the ore in an even sheet onto the deck.

The vibration of the deck and its inclination will cause the dirt, gravel or granulated ore to flow downward and the heavier concentrates will settle into the lowest portions of the longitudinally extending valleys or channels. When the material reaches the first screen **43** (which is a 30 mesh screen) the finest concentrate particles will drop through the screen onto the trough **46**. At the next screen **44**, (which is a 16 mesh screen) the next coarser particles will drop into the trough **37**, and at the screen **45** (which is an 8 mesh screen) the next coarser concentrates will be discharged into the trough **48**. The air volume at any one screen **43**, **44** or **45** will be regulated by the respective dampers as to allow the heavier concentrate to flow through the screen while buoying up or floating the lighter dirt so that it may flow across the screen. Due to the lateral vibrations given to the trunk, the rich values in the troughs **46**, **47** and **48** will settle to the bottom while the lighter portions of the material delivered into these troughs will flow downward over the forward lips of the troughs and will be discharged upon the inclined floor of the trunk and will be finally discharged into the middlings trough **59**.

The sections *b* and *c* are for receiving the coarser values and the horizontal terminal portions **40** and **41** thereof will act to stop these coarser particles from going over the gaps between the sections of the trough with any notable forward speed, so that the wind discharged upward through these gaps will have full action in driving the lighter particles forward to the next succeeding section and allowing the heavier grains to fall straight downward into the concentrate trough **59**.

The middlings trough **60** constitutes the end of the trunk floor and, as shown in Figure 5, will slope downward and discharge to one side. The materials discharged from trough **60** may be rerun or, if by sampling, they are found to carry sufficient values, this material will be milled.

In view of the fact that the air blast or wind discharged from the blower and discharged through the lower end of the trunk is in turn discharged into a standard dust collector, the cloud of dust which is nearly always present where dry cleaning of ores is being proceeded with, will be entirely eliminated.

The material **65**, **67** and **68** may be any kind of inexpensive loosely woven material which may catch any values which may be carried into the dust collector with the dust. As these fine particles flow down over the cone **68** and the hopper **67**, the heavier particles will settle down into the matting or fabric and the particles can be dusted out from this fabric or the fabric burned and the valuable particles thus recovered.

The concentrate troughs **46**, **47**, **48** and **59** are corrugated in the manner shown in Figure 3, in order to secure a high-grade concentrate. In experimenting and testing my invention, I originally used troughs like the trough **60** for receiving the concentrates, but I found that the middlings and concentrates were collected together in this type of trough. By using the concentrate trough of the type shown in Figure 3, however, I find that nothing but rich concentrates remain in the troughs while the middlings collect in the trough **60** and may be used particularly for sampling purposes and to give further treatment if justified. The concentrate troughs may extend horizontally across the machine or at a slight angle to the bottom of the machine.

I find also, by actual experiment, that by discharging all sizes of gravel together on the deck, the coarser material keeps the fine continuously agitated, whereas if the gravel is screened before passing upon the deck into, for instance, fine, medium and coarse material, that the fine material lay practically dead on the deck.

As will be noted from Figure 4, the beam **13** is against the rubber bumper **73**. The bumper, when the beam **13** has been forced over to its fullest extent by the cam **22**, will be slightly in compression. I do not, however, wish to be limited to this exact position for the rubber bumper as it is obvious that a slight movement of the beam **13** might be permitted before it struck the rubber bumper. The position of the rubber bumper is readily adjusted by means of the bolt **75** which carries the bumper. The angle iron **74***a* upon which the member **74** is supported, as shown in Figure 4, acts to prevent the bumping shock from bending the bolt **75** and getting the rubber out of proper alinement.

A very important feature of my invention resides in the fact that the air is applied only through very small openings such as the opening **43** in Figures 6 and 7. If these openings were large or the deck **32** was in the form of a sheet perforated over its entire extent or in the form of a screen, the amount of air required to act as a buoying agent would necessitate the use of a high-powered engine for running the blower and be entirely too expensive for handling low-grade ores. By forming these screen openings **43** relatively small, however, and disposing them in the bottom of the valleys formed by the corrugated sheet **39**, only a small amount of power to run the blower is required. The blast of air passing through the discharge end of the trunk **10** enters the casing of the dust collar **61** at a tangent and causes a whirling or cyclonic movement of the dust, thus requiring no exhaust fan to be connected to the blower.

What is claimed is:

1. A concentrator of the character described, including a wind trunk, a downwardly extending longitudinally channeled deck, the deck at intervals having screened openings, the screens for said openings being successively larger in mesh towards the discharge end of the deck, means below the openings for receiving the material discharged therethrough and carrying the material laterally, means for discharging air into said trunk below the deck, regulatable means, individual to each opening, for controlling the flow of air up through said screened openings, and means for laterally vibrating the deck.

2. In a concentrator of the character described, a downwardly inclined longitudinally channeled deck, the channels being approximately V-shaped in cross-section and having screened openings at intervals in the bottom of the channels, the screens increasing in mesh downward, means for

laterally vibrating the deck, and means for forcing air up through said screened openings.

3. In a concentrator of the character described, a downwardly inclined longitudinally channeled deck having screened openings at intervals, the screens increasing in mesh downward, troughs disposed below said openings and discharging material laterally, means for discharging air below said deck whereby to buoy up the lighter material passing over said openings and means, individual to each screened opening for controlling the discharge of air up through said opening.

4. In a concentrator of the character described, a transversely corrugated deck, the corrugations defining a plurality of channels extending longitudinally of the deck the valleys of said channels at spaced intervals being formed with longitudinally extending slots, and screens disposed below said slots and attached to the deck and means for laterally vibrating the deck.

5. A concentrator of the character described, including a longitudinally extending wind trunk closed at its top, bottom and sides, a downwardly extending transversely corrugated deck mounted within the trunk and inclined with reference thereto, the corrugations defining a plurality of channels extending longitudinally of the deck the deck being formed to provide a relatively long section and a plurality of short sections spaced from each other, the long section of the deck at intervals having screened openings, the screens increasing in mesh toward the lower end of the long section, laterally discharging troughs disposed below the screened openings, said troughs being longitudinally corrugated, the bottom of the deck adjacent its lower end having transversely extending coarse-concentrate troughs, the lower end of the bottom of the trunk having a middlings trough and the lower end of the lowest section of the deck having a tailings discharge, means for discharging air into the rear end of the trunk below the table, adjustable dampers associated with each of said openings whereby to control the volume of air discharged upward through said openings, and means for laterally vibrating the trough.

6. A concentrator of the character described, including a longitudinally extending wind trunk closed at its top, bottom and sides, a downwardly extending transversely corrugated deck mounted within the trunk and inclined with reference thereto, the corrugations defining channels extending longitudinally of the deck, the deck being formed to provide a relatively long section and a plurality of short sections spaced from each other, the long section of the deck at intervals having screened openings, the screens increasing in mesh toward the lower end of the long section, laterally discharging troughs disposed below the screened openings, said troughs being longitudinally corrugated, the bottom of the deck adjacent its lower end having transversely extending coarse-concentrate troughs, the lower end of the bottom of the trunk having a middlings trough and the lower end of the lowest section of the deck having a tailings discharge, means for discharging air into the rear end of the trunk below the table, adjustable dampers associated with each of said openings whereby to control the volume of air discharged upward through said openings, means for laterally vibrating the trough, a dust collector into which the lower end of the trunk discharges, and means for collecting the dust discharged into said dust collector including members having dust collecting surfaces of textile fabric.

7. A concentrator of the character described, including a downwardly inclined wind trunk closed at its top, bottom and sides, a downwardly inclined transversely corrugated deck disposed within the wind trunk and discharging at the lower end of the wind trunk, the corrugations defining channels extending longitudinally of the deck the deck having a plurality of openings, means for discharging air into the rear end of the trunk below the deck, legs pivotally engaged with the wind trunk and supporting the same, the legs being pivotally supported at their lower ends, a longitudinally extending shaft, many-sided cams mounted upon the shaft, transversely extending members supporting the trunk and engaged at their ends by the rectangular cams, springs resisting the movement of the trunk under the action of said cams, and elastic bumpers with which said members engage as they are impacted by the cams.

8. In a concentrator of the character described, a transversely corrugated deck, the corrugations defining channels extending longitudinally of the deck, said channels being approximately V-shaped in cross-section, the bottoms of the valleys of said corrugations at spaced intervals being formed with longitudinally extending slots and screens attached to the deck below said slots, the screens increasing in mesh from the receiving end of the deck to the discharge end thereof, means for giving lateral vibration to the deck, and means for discharging air under pressure upward through said slots.

9. In a concentrator of the character described, a wind trunk, a corrugated deck extending downward within the trunk at an inclination from the upper end of the trunk to the lower end thereof, the corrugations defining channels extending longitudinally of the deck the lower portions of the valleys of said corrugations having screened openings, transversely extending longitudinally corrugated downwardly inclined troughs disposed within the wind trunk and below said openings and receiving material therefrom, the troughs being spaced from the deck, the trunk, deck and troughs being mounted for unitary transverse movement, means on one side of the trunk for giving transverse jolting jars to the trunk, deck and trough, elastic bumpers with which the wind trunk operatively engages and disposed on the opposite side of the trunk from said jolting means whereby to give a jolt to the wind trunk in the reverse direction, and means for discharging a blast of air into the upper end of the wind trunk into and across the space between the transversely extending troughs and the deck and upward through said screened openings of the deck.

10. In a concentrator of the character described, a downwardly inclined deck having channels disposed closely adjacent each other and extending lengthwise of the deck, the channels being defined by downwardly and inwardly inclined walls whereby to cause the heavier material to flow toward the middle of each channel and squeeze up the lighter material, the channels at intervals having screened openings therethrough, the screens increasing in mesh toward the discharge end of the deck, and means for laterally vibrating the deck.

11. A concentrator of the character described, including a transversely corrugated deck, the corrugations defining channels extending longitudinally of the deck, each channel having downward-

ly and inwardly inclined side walls whereby to cause the heavier material to flow toward the middle of each channel and squeeze out the lighter material, the valleys of said corrugations at the lowest point thereof being formed with longitudinally extending slots, screens attached to the deck and disposed below said slots, and means constructed and arranged to give laterally directed blows against the deck and means engaging the deck and yieldingly resisting such lateral impacts.

HARRY E. FISCEL.