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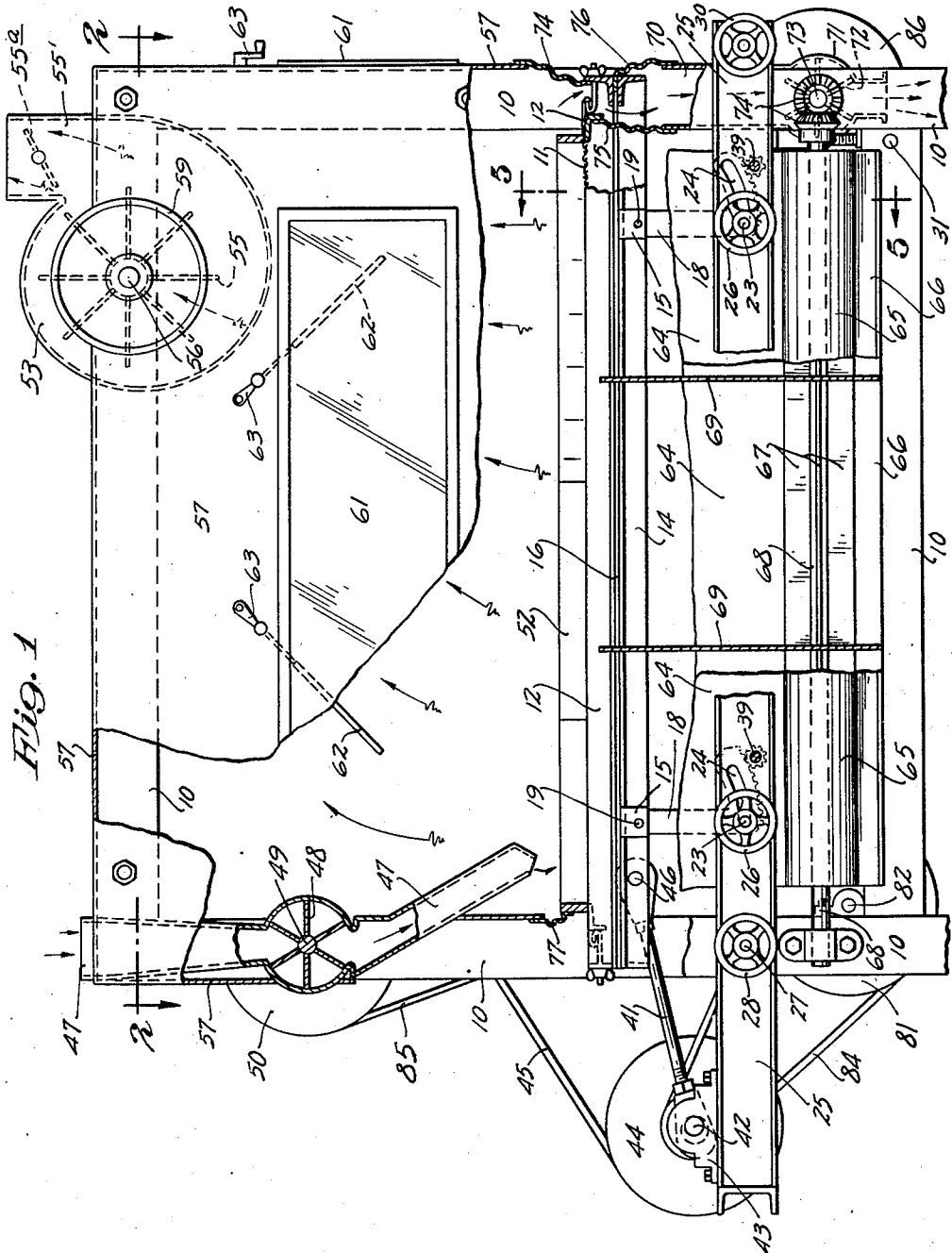
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2,361,601

ASPIRATING SEPARATOR

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5 Sheets-Sheet 1



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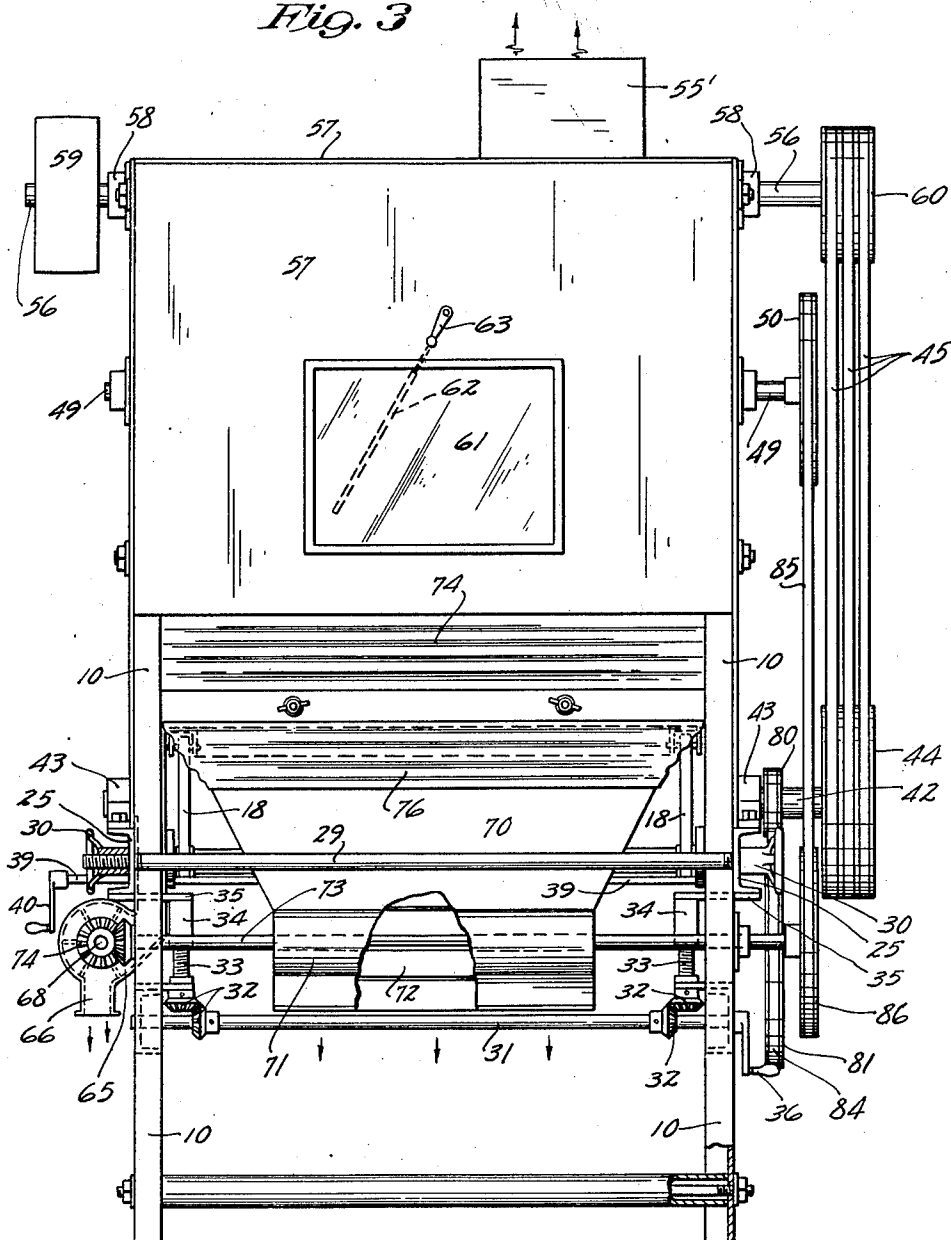
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Fig. 3



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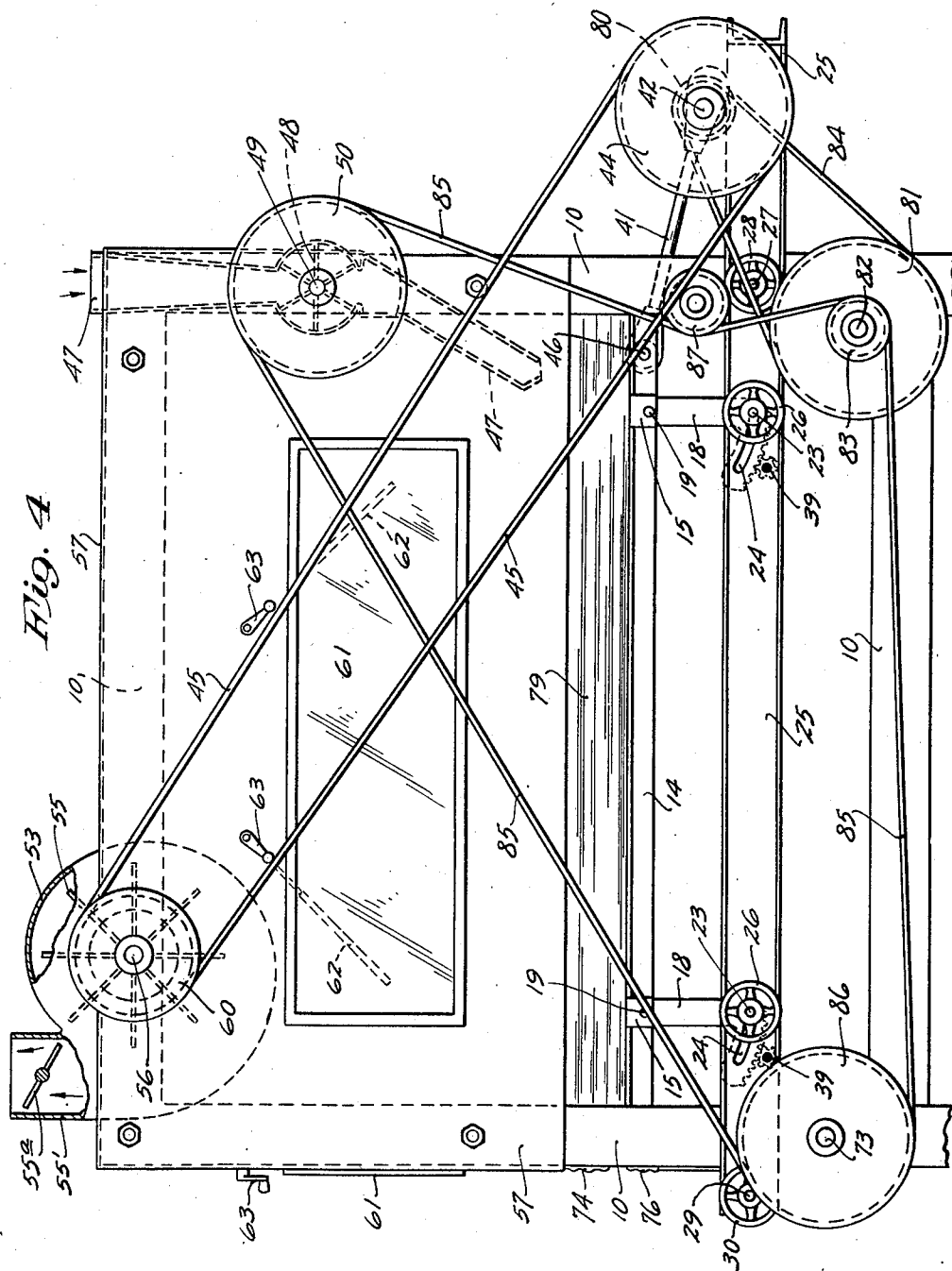
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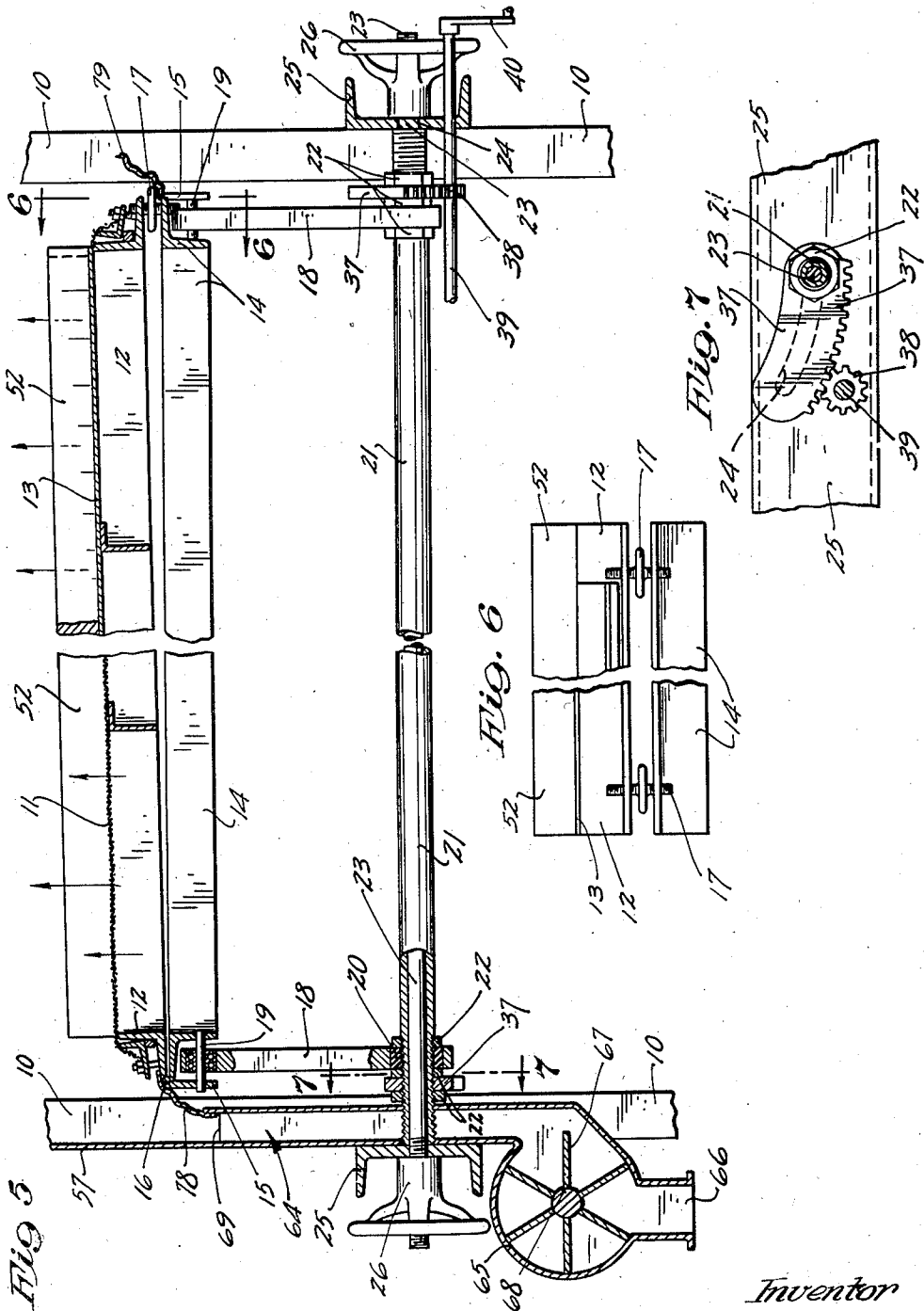
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UNITED STATES PATENT OFFICE

2,361,601

ASPIRATING SEPARATOR

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4 Claims. (Cl. 209-467)

My present invention provides an improved and highly efficient machine or apparatus for the classification and separation of farinaceous stock, sizings or unpurified middlings, into its different elements or particles, such as endosperm, bran, and other portions, according to their respective specific gravities or formation; and the invention also involves an improved method or process of manipulating the stock, whereby an improved and more highly efficient separating action is produced.

This improved apparatus is adapted to operate as an aspirator and separator of the various particles; and it relates to and is an improvement on separators of the type wherein the stock is fed over a vibratory screen or perforate deck that is laterally inclined so that the different particles will be delivered laterally off the lower side edge thereof, at different points in the general direction of the travel of the stock.

In machines of the type just indicated, it has hitherto been the common practice to cause the stock to float on or over the screen by means of an air blast that produces an upward pressure of air against the bottom of the screen or perforated deck and through the perforations of the screen or deck. In the hitherto used screen just noted, it is found that the upwardly directed air blast will produce, below the screen, a pressure very greatly in excess of atmospheric pressure and will produce, above the screen, an air pressure that is less than the air pressure below the screen, but, nevertheless, to a considerable extent above atmospheric pressure. This statement is especially true when a protecting hood is placed above the screen.

In accordance with my invention a marked improvement in the desired separating action is accomplished by placing a hood over the screen and producing within the hood a partial vacuum or pressure that is very greatly less than that of the atmospheric pressure. Moreover, with the fan or other device arranged with its air intake to produce the upward flow through the perforations of the screen, located above and operating solely from above the screen, a partial vacuum much less than that produced above the screen, but less than atmospheric pressure, takes place below the screen.

As a further and highly important novel feature involved in my improved apparatus, the screen or deck is provided, near or at its delivery end, with a blank or imperforate zone or portion; and the intake of the fan, which is to produce the partial vacuum above the screen, is located over

or above this blank or imperforate portion. Very important actions result from this novel arrangement just indicated, and which will be more fully discussed and disclosed after having first described more in detail a preferred embodiment of the invention which also includes various other minor but important features.

The accompanying drawings, wherein like characters indicate like parts throughout the several views, illustrate what I believe at present to be the preferred embodiment of the invention.

Referring to the drawings:

Fig. 1 is a view in elevation looking at the right hand side of the machine, some parts being broken away and some parts being shown in vertical section;

Fig. 2 is a horizontal section taken approximately on the line 2-2 of Fig. 1;

Fig. 3 is a view in elevation looking at the rear end of the machine, some parts being broken away and shown in section;

Fig. 4 is a view in elevation looking at the left hand side of the machine, some parts being broken away and shown in section;

Fig. 5 is a view in vertical section taken approximately on the line 5-5 of Fig. 1, some parts being shown in full;

Fig. 6 is a fragmentary view in elevation looking at parts found in the vicinity of the line marked 6-6 on Fig. 5, some parts being broken away; and

Fig. 7 is a fragmentary view taken in section on the line 7-7 of Fig. 5.

All of the parts of the machine are mounted directly or indirectly upon a strong rectangular framework indicated as an entirety by the numeral 10. This framework is preferably made of channel steel properly trussed and braced. The element herein frequently designated as a "screen" does not accomplish separation of the particles of mill stock or stream, does not operate as a customary screen through which the finer particles are passed, but operates as a perforate feed deck through which air is drawn by partial vacuum or suction produced above the screen, and the arrangement is such that the commingled stock will be moved with a sort of a floating action over the screen surface. In fact, a portion of this perforate feed deck is blank or imperforate for a purpose already indicated in a general way but hereinafter to be more fully described. The perforate surface is preferably a finely woven wire screen 11 which is directly secured to and tightly stretched over a rectangular screen or deck frame 12. The feed deck is made up of this screen 11

and an imperforate deck portion 13. The screen of deck frame 12 is mounted on a rectangular shoe or carrying frame 14 shown and preferably made of angle iron to which is welded a flange-forming bar 15, see particularly Fig. 5. The screen, and in fact the complete deck 11—13, is inclined transversely and at its lower side is fulcrumed to the shoe 14 at 16 and at its opposite side is adjustably secured to the shoe by suitable means such as right and left "center wheel screws" 17.

The shoe 14 is supported for vibratory movements by four upright links 18 which, at their upper ends, are pivotally connected to the sides of the shoe by pivot pins 19. At their lower ends the links 18 are pivoted on bushings 20 applied on the threaded ends of a transverse spacing tube 21 located between clamping nuts 22, best shown at the left in Fig. 5. Extended through the spacing tube 21 is a tie rod 23, the ends of which extend through segmental slots 24 formed in the webs of a pair of parallel transversely spaced carrying beams 25. These slots 24 are concentric to the axis of the pivot pins 19, see particularly Fig. 1. The extended ends of clamping rod 23 are threaded and provided with nut-acting clamping wheels 26 which, when tightened, clamp the ends of spacing tube 21 against the inner faces of the webs of the two beams 25. The two beams 25 are pivoted on a transverse rod or shaft 27, see Fig. 1, and which, as shown, is provided with nut-acting wheels 28 at its outer ends. Extended through the long free or rear ends of the two beams 25 is a clamping rod 29 provided on its threaded outer ends with nut-acting hand wheels 30 or the like. Clamping rod 29 works free from all of the fixed parts of the frame-work and when its nut-acting wheels 30 are tightened, tightly clamps the ends of the beams against the sides of the framework. The beams 25 and parts carried thereby, including the shoe and screen, are connected for common adjustments by suitable means preferably involving manually operated transverse shafts 31 connected by miter gears 32 to short upright screw rods 33 that work in nut-acting sleeves 34 shown as provided with projecting arms 35 that bear against or are rigidly secured to the vertically movable free end portions of the two carrying beams 25, see particularly Fig. 3. Shaft 31, at one end, is shown as provided with an operating crank or handle 36.

Mounted on the ends of the spacing tubes 21 and extending parallel to the curved slots 24, see particularly Figs. 1, 4 and 7, are gear segments 37. The front pair and the rear pair of these segments 37 are arranged to be independently operated by co-operating pinions 38 on transverse shafts 39 that are journaled in the beams 25 and provided with operating cranks or handles 40. The perforate feed deck is arranged to be reciprocated through a pitman or connecting rod 41, see particularly Fig. 1, and is driven from a crank-shaft 42 mounted in bearings 43 on the front ends of the pivotally supported beams 25. Crank-shaft 42 may be driven in any suitable way but, as will presently appear, is provided with a pulley 44 over which runs a power-driven belt 45. The extended end of pitman 41 is pivotally connected at 46 to the shoe 14. In the preferred and illustrated arrangement the pitman 41 and connections described are in duplicate with the connecting rods one at each side of the shoe, see particularly Fig. 2.

The farinaceous stock will, of course, be delivered onto the perforated or screen portion of the feed deck; and preferably, this is accom-

plished through a delivery spout 47 in which is a wing feeder or feed gate 48, see particularly Fig. 1. The shaft 49 of wing feeder 48 is journaled in suitable bearings on the framework and at one end is provided with a pulley 50.

Secured on the face on the feed deck is a banking rail 52, see Figs. 1, 2 and 4, that marks a dividing line between the perforate portion 11 and imperforate portion 13. By reference particularly to Fig. 3, it will be seen that, in the preferred embodiment of the invention illustrated, the banking rail 52 extends in a general direction obliquely or diagonally across the deck, starting at the upper receiving end portion of the deck and terminating at the lower delivery end portion of the deck. The fan that creates partial vacuum or pressure below atmospheric pressure above the feed deck is, as already indicated, located above the imperforate portion of said feed deck. More important, the inlet passage or passages of the fan are located over the imperforate portion of the feed deck. The fan illustrated and thus applied involves a fixed fan casing 53 with axial intake passages 54, both of which are located above the imperforate portion 13 of the deck, and a blade-equipped fan head 55 working in said casing. The fan casing 53 illustrated is provided with an air discharge spout 55' in which is a damper or valve 55a by means of which the effective force of the fan can be controlled. Fan head 55 is carried by a transverse power shaft 56.

Secured to the framework and extended above and over the feed deck is a housing 57 preferably of sheet metal and shown as enclosing the fan casing 53 and as being provided with bearings 58 in which the power shaft 56 is journaled. Since the outlet from housing 57 is through fan casing 53 having its inlet passages 54 located over the imperforate portion 13 of said deck, it may be said that the outlet or discharge passage or passages of the housing 57 are located above the imperforate portion of the said deck. Shaft 56, at one end, is shown as provided with a pulley 59 over which will run a power-driven belt, not shown, that furnishes power for all of the running parts of the machine. At its opposite end power shaft 56 is provided with a pulley 60 over which runs the belt 45. Belt 45 in the drawings is preferably of the multiple V-belt type.

Casing 57, in one or more of its side walls, is preferably provided with a transparent pane or window 61 through which the operations that are taking place within the machine may be readily observed without actually opening up the casing. In Figs. 1, 3 and 4 I have illustrated manually operable window wipers including blades 62 working against the inner face of the transparent pane and provided outside of the casing with operating cranks 63.

To receive the particles of the mill stock that are discharged laterally from the deck at the lower side thereof, the casing is provided with a long receiving spout 64 that leads to a long approximately cylindrical drum 65 having a discharge opening 66. Working in the drum 65 is a rotary wing gate or feeder 67, the shaft 68 of which is journaled in the ends of the drum 65 and in suitable bearings on the framework. The receiving spout 64, the drum 65, and its discharge opening 66, are divided into a multiplicity of compartments by partition plates 69, see particularly Fig. 1; and the blades of the feed gate 67 are correspondingly divided by the partitions 69. At the delivery end of the machine, and located

in position to receive from the imperforate portion 13 of the feed deck, is a receiving spout 70, see particularly Figs. 1 and 3. This receiving spout 70, much like the receiving spout 64, includes a drum-like portion 71 in which works a wing feeder or gate 72, the shaft 73 of which is connected by miter gears 74 to the shaft 68 of wing feeder 67.

The numerals 74, 75, 76, 77, 78 and 79 indicate flexible joint strips applied to the various parts where they are indicated, in accordance with common mill practice in analogous cases.

Crank shaft 42, see particularly Figs. 2, 3 and 4, is provided with a small pulley 80 aligned with a larger speed-reducing pulley 81 journaled to a shaft 82 journaled in suitable bearings on the main frame and provided with a smaller pulley 83. A belt 84 runs over the pulleys 80 and 81. A transmission belt 85 runs over the pulley 82, over the heretofore noted pulley 50, over a pulley 86 on shaft 73, and against a belt tightening pulley 87.

Operation

The commingled farinaceous stock will, of course, be fed onto the receiving end of the vibratory feed deck, from the spout 47; and under the vibratory movement of the deck the stock will be progressively fed longitudinally of the feed deck, while subject to the action of gravity which latter will cause the commingled stock to drift toward the low side of the said deck. The character of the vibratory movement of the feed deck and the manner in which the progressive feed of the stock is produced, is generally known and, briefly stated, such feed movement is produced by that part of the vibratory movement of the deck which lifts and projects the stock forward.

In the illustrated improved support for the vibratory feed deck, the character of the forward or progressive feed movement given to the deck may be modified by independent adjustments of the links 18, which link adjustments, as already described, may be produced by loosening of the hand wheels 26 and shifting the rods 23 in the segmental slots 24. The pitch or longitudinal inclination of the feed deck, as already noted, may be produced by simultaneous adjustments of the beams 25 on their common supporting pivot shaft 27.

The lateral inclination of the feed deck, note particularly Figs. 5 and 6, may be varied by adjustments of the "right-and-left threaded adjusting screws" 17; and, of course, the greater the lateral inclination of the deck, the greater will be the tendency of the stock to drift toward the low edge of the deck.

Under endwise vibratory movements of the feed deck the heavier particles will be projected longitudinally farther toward the delivery end of the deck than will the lighter particles, and the lighter particles will travel faster and more quickly toward and off from the low edge of the deck. For example, with the machine shown, wherein the longitudinal catch drum or trough 65 is divided into three compartments by two partitions 69, the bran will be delivered into the first section, the middlings with attached bran into the second compartment, and the pure middlings or farina into the third or last section. Of course, the number of these sections may be greater or less than illustrated in the drawings so as to make more or less fine divisions between the various particles of the stock.

It will, of course, be understood that in this improved machine the perforate deck or screen is not primarily used or intended for use as a screen proper and that the perforations therein are intended simply for the passage of air, to more or less lift and sort of float the stock on the vibratory deck. It has been quite generally assumed that the movement of the air through the perforations of the screen or perforated feed deck must be produced by creating a blast above atmospheric pressure immediately below the screen. However, I have demonstrated in actual practice that this is not the best method or manner of producing the flow of the air upward through the perforations or air passages in the deck; but on the contrary, that the purifying and separating action can be improved by primarily producing partial vacuum or below atmospheric pressure immediately above the screen or perforated deck.

When sufficient partial vacuum or suction is produced immediately above the screen, air will, of course, be drawn upward through the perforations and that will produce also low pressure or pressure below atmospheric pressure immediately under the screen, and herein is found an important improved action in which the air drawn upward is moved to and through the perforations of the screen, in the form of myriads of upwardly converging air cones, each directed toward one of the perforations; whereas, an air blast directed against the bottom of the screen would tend to spread over the bottom of the screen and only finally be forced upward through the perforations.

It is not intended that any of the very fine particles, such as flour, would pass downward through the perforations of the deck or screen, but some such fine particles may get into or even pass downward through the perforations, but in that case, such fine flour particles will be immediately caught and picked up by the upwardly converging air cones and will be drawn back through the perforations to the top of the screen; whereas, if such fine particles were thus picked up by a high pressure blast from below the screen, they would be more or less scattered against the bottom of the screen.

The improved action resulting from the suction or partial vacuum, both above and below the screen, also gives a better floating action to the stock on the screen, in that the lighter particles will be lifted or raised to the top of the floating stream of stock and sort of divided into strata in which the lighter strata will be lifted above the heavier and lower strata; whereas, if the upward movement of the air was produced by high pressure below the screen, the air, before reaching the lighter portions of an upper stratum of the stock, would have to pass against and through the heavier particles of the lower strata.

The imperforate section or portion of the feed deck herein illustrated is also a very highly important and improved feature. In the machine described, some of the very light particles, such as dust, "bees wings or fine bran particles," will be picked up by suction and carried over the rail 52 toward the intake of the fan, which latter, for an important reason, is located above the imperforate portion of the deck. When these relatively light portions, such as stated, reach a point over the imperforate deck portion, the upward draft or suction will be decreased and all or nearly all thereof will be precipitated on the

said imperforate deck and discharged therefrom into the transverse end spout 70 and from thence into drum or catch trough 71. The air drawn to the fan may contain some very light dust, but most of the light particles will be precipitated and discharged as just described.

The casing that encloses the space above the perforate deck is highly important not only for the reason that it causes the partial vacuum produced above the deck to act with maximum efficiency, but prevents outside air currents from modifying or interfering with the operations produced within the casing. The transparent windows, as is obvious, permit the operator to observe the actual operations that are taking place within the casing.

A commercial embodiment of the invention is illustrated in the accompanying drawings, but it will, of course, be understood that various alterations and changes therein may be made within the scope of the invention disclosed and herein broadly claimed.

What I claim is:

1. In a machine of the kind described, a casing, a fan having an intake opening from said casing and an outlet discharging outside of said casing, a perforate vibratory feed deck located in said casing and having an imperforate portion located directly under the intake of said fan, said feed deck being laterally inclined for the selective transverse delivery of stock from the lower side edge of said deck according to the specific gravity thereof, means for vibrating said deck endwise to produce the feeding action, means for receiving from the delivery end of the imperforate portion of said deck light particles carried over onto said imperforate portion by suction from said fan and a raised baffle marking the line of division between the perforate and imperforate deck portions.

2. In a machine of the kind described, a perforate longitudinally vibratory feed deck laterally inclined for transverse drifting and delivery of the commingled stock toward the lower side edge thereof, means located above said deck and operative simultaneously to produce partial vacuum both above and below the perforated surface of said deck, the partial vacuum produced

above said deck being somewhat greater than that produced below said deck so as to produce an upward movement of air through the perforated feed deck and stock, the character of the perforated feed deck and the velocity of air movement upwardly therethrough being such that classification and separation of the commingled stock will be accomplished entirely above the vibratory deck, in further combination with laterally spaced intermediately pivoted beams, a shoe mounted for endwise vibratory movements on said beams, said perforate feed deck being mounted on said shoe, means for the delivery of commingled stock onto the receiving end of said deck, and in further combination with a casing enclosing the space above said deck, said deck having an imperforate portion located directly under the intake of said partial vacuum producing means, and a raised baffle marking the line of division between the perforate and imperforate deck portions.

3. In a machine of the kind described, a casing, a fan having an intake opening from said casing and an outlet discharge outside of said casing, a perforate longitudinally vibratory feed deck located in said casing below the intake of said fan so that air moved by said fan will pass upwardly through said feed deck, said feed deck being laterally inclined for the selective transverse delivery of stock toward the lower edge of said deck, and means for selectively receiving the stock from the lower side edge of said feed deck progressively and according to specific gravity thereof, the character of the perforated feed deck and the velocity of air movement upward therethrough being such that the classification and separation of the commingled stock will be accomplished entirely above the vibratory deck, said deck having an imperforate portion located directly under the intake of the fan and having a raised rail following the line of division between the perforate and imperforate portions of the deck.

4. The structure defined in claim 3 in which the said raised rail extends diagonally of the feed deck from its upper receiving end portion toward its lower delivery end portion.

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