June 12, 1962 M. GRANDKE 3,038,603

SIFTING AND CONCENTRATING DEVICE

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Fig. 1

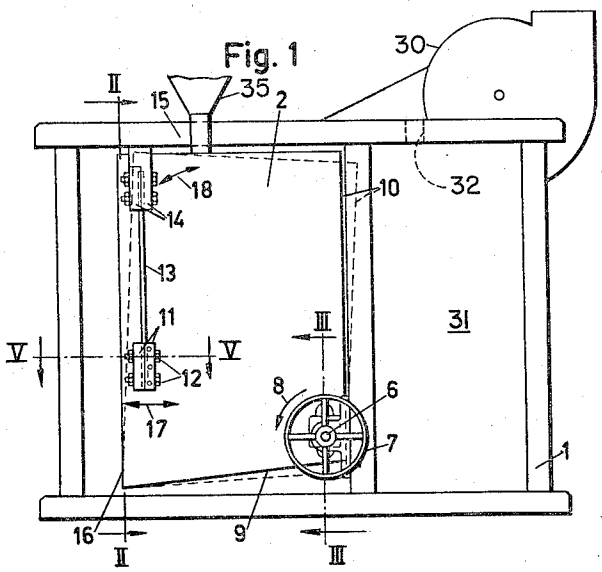


Fig. 2

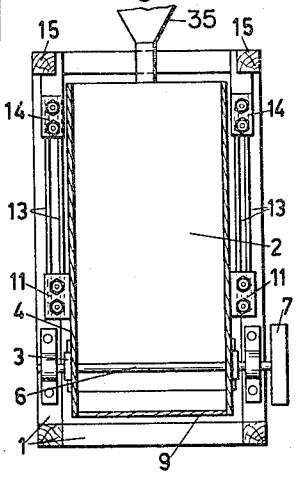


Fig. 3

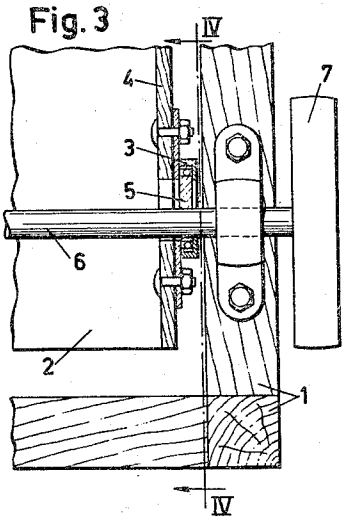
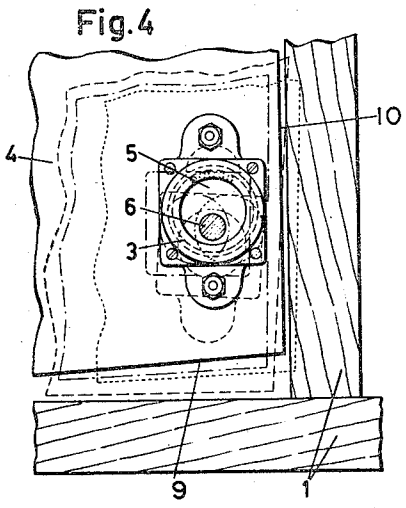


Fig. 4



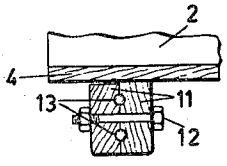


Fig. 5

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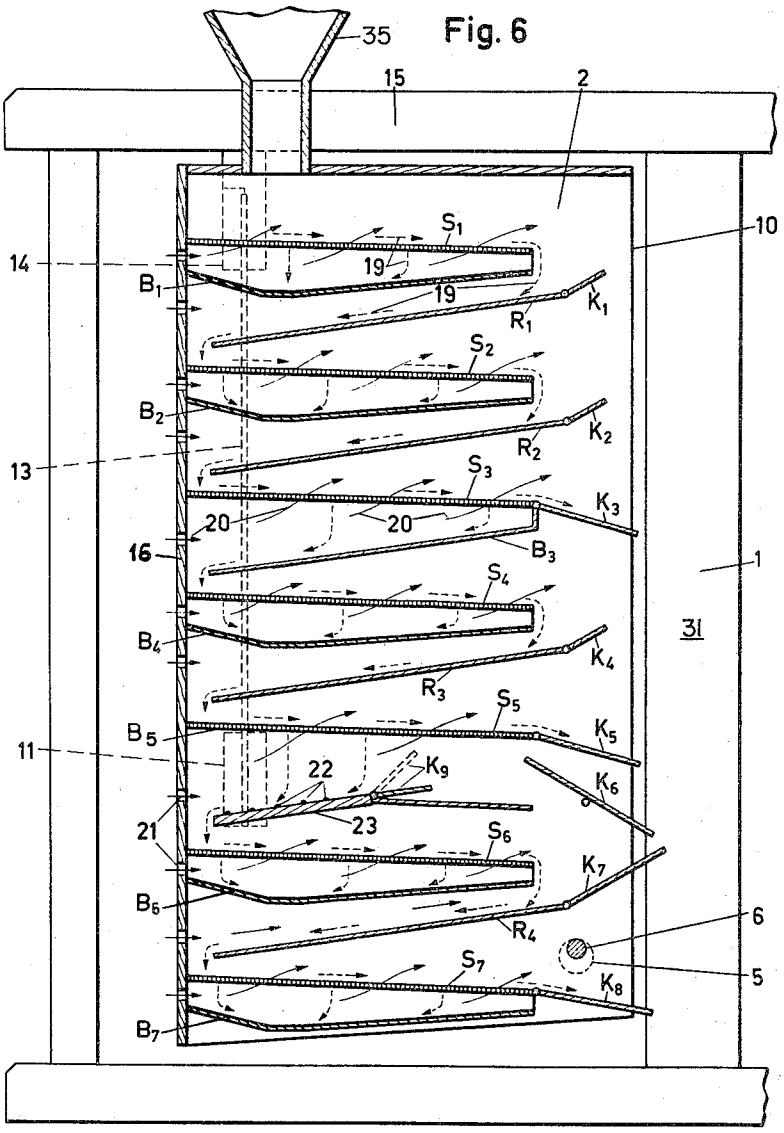
Fig. 6



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SIFTING AND CONCENTRATING DEVICE

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9 Claims. (Cl. 209—19)

The invention relates to a machine having a plan-sifter suspended pendulum fashion and driven by eccentrics which contains a plurality of sieves mounted one vertically above the others and performing different working movements at different points, and particularly to a flour mill machine for the cleaning and grading of grain and grain products comprising such a plan-sifter.

It is known in itself to drive a plan-sifter provided with a nest of sieves in such a manner that it performs different working movements at different points. This is carried out in that the plan-sifter at that end, where the stock is supplied to it, is moved not only to-and-fro but also up-and-down, in that the plan-sifter has a rotary eccentric drive in the range of its input end, while it is suspended pendulum-fashion in the range of its discharge end, where it delivers its sifted products.

This kind of plan-sifter movement is, however, quite unsuitable for a stock which is to be graded not only according to its particle size, but also according to the weight of its particles, and wherein particularly also particles of equal size are to be controlled and graded according to weight. The reason is that in a plan-sifter, which undergoes an up-and-down shaking movement at its input end, all particles to be sorted are vigorously whirled through one another. Light and heavy particles of even size thereby drop in unison through the sieve of the pertinent mesh size, which is just what is to be prevented.

The invention has accordingly the object of providing a plan-sifter in which the aforesaid disadvantage is to be obviated and wherein the grading and cleaning of the stock is effected with the aforesaid desired result in an optimum manner, and in which moreover a remarkable improvement is attained in further essential points, both as regards the possibility of coarser or finer grading and as regards increased output efficiency of the machine.

With these and other objects in view, which will become apparent later from this specification and accompanying drawings, I provide a machine for the cleaning and grading of grain and grain products in flour mills, comprising in combination: a frame, a plan-sifter having a plurality of sieves nested one above the others, a pendulum suspension suspending the end adjacent the point of entry of the stock to be sifted into the sieves of said plan-sifter on said frame, and an eccentric drive journalled in said frame and engaging on the said plan-sifter adjacent its other end, towards which the stock is moved.

Thereby it is attained that the plan-sifter performs at and in the range of its eccentric mounting predominantly a rotary oscillation, while at the point, where it is suspended in a manner permitting only a pendulum movement, it undergoes mainly a reciprocating swinging movement. In this manner it is even attained that certain points of the plan-sifter undergo a jerky tipping movement.

The measures described have the effect that stock particles of equal size, when they come on to the sieve, form firstly layers according to their weight, namely in such a manner that the lighter particles arrange themselves on top, while conversely the heavier particles come to lie at the bottom. When these particles are moving along over the sieve, the low lying particles of suitable size ("throughs") fall through the pertinent meshes of the sieve and can be discharged graded as useful goods, while the lighter and very light particles ("overtails") forming the upper layer continue their path over the sieve and can

be easily caught by the cleaning air flow and thus passed on, or spouted away, into the suction chamber, as the case may be. On the other hand, on the discharge or output end of the sieve the stock thereon is not only shaken to-and-fro in a plan-sifter operated according to the invention, but is also thrown up-and-down. This has then the consequence that the lighter "overtails" can be caught particularly intensely and freely flying by the air draft-flowing through the plan-sifter, while the heavy "throughs" fall through the pertinent sieve meshes.

Hereinafter the invention with its details will be described and explained in more detail with reference to the drawings showing an embodiment by way of example.

In the drawings:

FIG. 1 is a side elevation of a cleaning machine having a plan-sifter arranged according to the invention;

FIG. 2 is a vertical sectional view in section on line II—II of FIG. 1;

FIG. 3 is an enlarged part view in vertical section on the line III—III of FIG. 1 through the journalling of the drive shaft of the plan-sifter;

FIG. 4 is a vertical sectional view taken on the line IV—IV of FIG. 3 showing the various rotary motion positions of the plan-sifter in different dotted and chain-dotted lines, and

FIG. 5 shows a detail on a larger scale, in section on the line V—V of FIG. 1 through the attachment of the suspension rods of the plan-sifter;

FIG. 6 diagrammatically shows in section the sieve-nesting provided in the plan-sifter.

In the drawing, **1** is the machine frame. In this frame the plan-sifter or vibration box **2** is mounted which has an upright parallelepipedon shape. It contains in a suitable manner the working sieves nested one above the others for the grading and cleaning of the stock, as will be seen in more detail in FIG. 6. All material is fed into the plan-sifter from above through a charging tube **35**. (See FIGS. 1, 2 and 6.) Moreover, the plan-sifter is ventilated, as will be later described. The plan-sifter is journalled on either side with its ball bearing **3** which is screwed to the wall **4** of the plan-sifter, on an eccentric disc **5**, which is rigidly connected to the driving shaft **6** driven by the belt pulley **7** rotationally in the direction of the arrow **8**. This journalling of the plan-sifter is located not far from the bottom **9** of the plan-sifter, namely adjacent the rear wall **10** of the plan-sifter, on which the stock has its outflow from the sieves. Furthermore, adjacent the front wall **16** of the plan-sifter above the level of the ball bearings **3**, pairs of locking jaws **11** are secured to the plan-sifter and are clamped by screws **12** to rods **13**, preferably made of cane. The upper ends of the rods **13** are similarly gripped by locking jaws **14** secured to the upper longitudinal beams **15** of the machine frame **1**. In this manner a pendulum mounting for the plan-sifter **2** is provided by the canes **13**, which co-operates with the eccentric mounting of the plan-sifter as described hereinabove.

The suspension point of the plan-sifter is thus positioned at the height of the screws **12**, so that it lies higher than the shaft **6** with the eccentric disc **5**. As well be seen by reference to FIG. 1, the suspension point of the plan-sifter is located below its horizontal axis. Moreover it lies adjacent the front wall **16** of the plan-sifter.

In FIG. 1 and FIG. 4 the highest position which the plan-sifter can assume is drawn in full lines. The lowest position is shown in dotted lines. Moreover FIG. 4 shows in chain dotted lines that position, in which the plan-sifter assumes its position shifted as far as possible to the left, and in small dots the position of the plan-sifter when shifted as far as possible to the right. In the range of the eccentric mounting of the plan-sifter the latter accordingly performs a rotational oscillation corresponding

to the arrow 8. Since, however, the suspension point of the plan-sifter cannot partake in this rotational oscillation because the suspension rods 13 prevent this, the plan-sifter moves at and adjacent to the front wall 16 thereof essentially only to-and-fro as indicated by the double arrow 17. The rods 13 oscillate to-and-fro, being deformed S-shape thereby. In the upper portion of the plan-sifter, and particularly towards its front wall 16 a slightly rocking reciprocating swinging motion of the plan-sifter is attained as indicated by the arcuate double arrow 18. This produces for the movements of the plan-sifter the desirable working movement which is different at different points. By varying the distance between the shaft 6 and the suspension point of the plan-sifter, and by differently high arrangement of these points variations in the movements of the plan-sifter can be attained at will. The direction of rotation of the shaft 6 is contra-clockwise, as shown by the arrow 8 in FIG. 1.

It should be noted, that in a plan-sifter arranged according to the present invention the stock moves on the sieves automatically to-and-fro, provided they have an appropriate slope. At the point where the overtails flow from an upper sieve to a lower sieve, raising of the stock is effected in the embodiment described in the range of the rear wall 10 of the plan-sifter. This is so because the plan-sifter performs there substantially an up-and-downward movement so that the stock is always somewhat thrown upward, and during its falling down on to the underlying sieve can be passed through particularly well by the cleaning air flow.

The canes 13 clamped in the grips and locking plates 11 and 14 can be readily exchanged when necessary.

As follows from FIG. 6, in the plan sifter 2, which has an upright parallelepipedon shape, the sieves S1 to S7 are nested one on top of the others, slightly sloping down towards the right. Below these sieves the collecting trays B1 to B7 are arranged. These trays—with the exception of the tray B3—guide the "throughs" falling through the associated sieve in accordance with the mesh size thereof in a direction perpendicular to the plane of the drawing. These trays are arranged at an appropriate slope. Moreover return plates R1 to R4 are provided onto which drop overtails of the associated sieve. These plates are appropriately sloping down towards the left. They let the material dropping on them slide on in the direction opposite to the feed onto the inlet end of the sieve lying next below.

By the arrows 19 indicated in dotted lines it is shown which path is taken by the stock over the various sieves, and how it is transferred from one sieve to the next one, insofar it has not yet fallen through the individual sieves, how it is graded and spouted away by the collecting trays B. The full line arrows 20 on the other hand show the path taken by the cleaning air flow which enters through apertures 21 provided in the front wall 16 of the plan-sifter 2 into the latter and are of a size which is controllable as by means of flaps or slide valves (not shown). This air flow passes across the space of the plan-sifter and in doing so passes at the same time from below through the sieves S1 to S7. It then passes into the suction chamber 31 joining the plan-sifter on the right hand side (compare FIG. 1) and then through an opening 32 connected to a powerful suction fan 30 generating the cleaning air flow.

In FIG. 6 the suspension canes 13 of the plan-sifter 2 are indicated in dotted lines, and likewise on its other end the eccentric drive 5, 6 is indicated in section. The latter is arranged on the bottom portion of the plan-sifter 2, namely on that side thereof where its sieves S overtail.

The attachment 11, 12 of its pendulum suspension lies, on the other hand, on a higher level on the other side of the plan-sifter where the sieves have their input, advantageously below half the height of the plan-sifter.

As illustrated in FIG. 6 the stock runs automatically to-and-fro in zig-zag over the sieves S1 to S7 and the return plates R1 to R4, which run is attained by the motion imparted to the plan-sifter 2 according to the invention. The sieve arrangement illustrated is moreover provided with flaps K1 to K9, which are angularly adjustable in their working position. These flaps serve for catching the stock and exposing the same permanently more or less vigorously to the cleaning air passing transversely through the plan-sifter 2. By means of the flaps K3, K5, K7 and K8 the stock may on the other hand alternatively be passed directly into the suction chamber, when these flaps are completely laid down. By means of the said flaps a further possibility is attainable for the grading operation and the airing of the plan-sifter.

Finally, an intermediate bottom 23 which is lined with small transverse laths 22 is provided in the plan-sifter. On this intermediated bottom 23 collect the "throughs" from the sieve S5 above. They are again effectively stratified on this intermediate bottom so that the remaining small and light bran particles present can be blown off and thereby separated from the useful goods in a faultless manner.

As regards the choice of the sieves it should be stated that the uppermost sieve S1 is the finest sieve and has a covering with silk, e.g. of the mesh number 38. The sieve S2 is slightly less fine and for example has the mesh number 34. The third sieve S3 is a comparatively rather coarse so called preparatory sieve, e.g. No. 20. The stock not allowed to pass through the latter, which consists of coarse or alien particles not suitable for the grading operation, is spouted away into the suction chamber 31 by its downwardly positioned flap K3. The useful stock on the other hand passes over the plate B3 to the next sieve S4 which is again a fine sieve, e.g. of No. 30. S5 is again a preparatory sieve, e.g. of No. 24, which discharges its entire overtails over its flap K5 and spouts it away into the suction chamber. As far as small bran particles are still contained in the useful "throughs" of sieve S5, the same are put into the upper stratum by the swinging intermediate bottom 23 having transverse laths 22 which catches these "throughs," so that these bran particles can be blown off by the cleaning air flow and spouted away. The useful stock drops off the forward edge of this intermediate bottom and on to the sieve S6, which is somewhat coarser than the sieve S4, having for example mesh No. 28. Sieve S7 then follows as the last sieve having for example mesh No. 26. The nests of sieves and dimensioning of sieves described hereinabove assures a high grade finely stepped grading and cleaning of the stock which is extensively aired, both while being conveyed along over the sieves and while tailing over to the next sieve and returning to it in the reverse direction.

The particular plan-sifter motion attained according to the invention has moreover the advantage, that the stock, as far as it has not yet fallen through the meshes of the sieves, flows over all the sieves nested on top of one another in the plan-sifter in succession in the same direction of movement, and between the sieves likewise automatically slides back in the opposite direction. This result, which allows to attain a particularly great variability of the grading operation, an improvement of its quality and a remarkable increase in the output of the machine, has not been attainable hitherto.

While I have described herein and have illustrated in the accompanying drawings what may be considered a typical and particularly useful embodiment of my said invention, I wish it to be understood that I do not limit myself to the particular details and dimensions described and illustrated; for obvious modifications will occur to a person skilled in the art.

What I claim as my invention and desire to secure by Letters Patent, is:

1. A machine for clearing and sorting grain and grain products comprising a frame, a vibration box carried by said frame, said vibration box having cleaning air apertures in the front wall thereof, a charging tube fixed to

and extending through the top of said box adjacent the front vertical wall thereof for feeding material thereto, a plurality of sieves mounted one above the other in said box upon the uppermost of which material is fed by said charging tube, concentric journals fixed to opposite side walls of said box adjacent its bottom and the rear wall thereof, a horizontal drive shaft having an eccentric disc rotatable in each of said journals, a suction chamber at the rear of said vibration box, and a suction fan positioned above said suction chamber to draw cleaning air through the apertures in the front wall of said vibration box, across said vibration box, through the sieves therein and through said suction chamber to pass on the lighter particles and to spout away the very light particles from said vibration box during vibration thereof, in combination with flexible vertical rods clamped to said frame above said box and to said box adjacent the front wall thereof and below the horizontal axis thereof, whereby said vibration box and said sieves within it are subjected to a rotary motion applied adjacent the rear wall of said box and a substantially horizontal oscillatory motion at the front wall thereof.

2. A machine as claimed in claim 1, wherein said rods are flexible in bending but stiff in their longitudinal direction.

3. A machine as claimed in claim 2, comprising grips and locking plates rigidly clamping the ends of the said rods to the said frame and to the said plan-sifter, respectively.

4. A machine as claimed in claim 2, wherein at least two of the said rods are arranged on either side of the plan-sifter.

5. A machine for the cleaning and grading of grain and grain products in flour mills, comprising in combination: a frame, a plan-sifter having a front wall, a plurality of sieves nested one above the other, a suction chamber arranged in the frame on the side of the plan-sifter remote from the front wall thereof, a pendulum suspension suspending the plan-sifter adjacent the front wall from said frame and an eccentric drive horizontally journalled in said frame adjacent said suction chamber parallel to the front wall of said plan-sifter and engaging said plan-sifter at its bottom portion, air entry apertures being provided in the front wall and the opposite side of the plan-sifter being in communication with the suction chamber, a suction fan positioned above said suction chamber for sucking the cleaning air through the apertures in the front wall of said plan-sifter and above and below said sieves, substantially in the direction of the stock to be cleaned, towards said suction chamber whereby the very light particles are easily picked up by the cleaning air carried to said suction chamber and carried out of the machine.

6. A machine as claimed in claim 5, comprising collecting trays mounted in said plan-sifter below the said sieves, respectively, the said trays being inclined perpendicular to the plane of motion of the said plan-sifter so as to guide the movement of the "throughs" and to contribute to the guiding of the said cleaning air.

7. A machine as claimed in claim 6, comprising return plates mounted in the said plan-sifter below the said collecting trays, respectively, and sloping towards the front wall, the said return plates guiding overtails of one sieve to the entry of the seive next below.

8. A machine as claimed in claim 7, comprising flaps pivotally mounted at the ends of the said return plates near the said suction chamber, the said flaps regulating by their position angular of the said return plates the flow of the cleaning air and guiding the spouting away of overtails discharged from the said sieves into the said suction chamber.

9. A machine as claimed in claim 8, comprising an intermediate bottom having small transverse laths, the said intermediate bottom being mounted in the said plan-sifter sloping towards the front wall thereof between two adjacent lower sieves thereof.

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