Feb. 19, 1946. M. B. NICHOLLS 2,395,138

HIGH SPEED SIFTER

Filed June 18, 1942

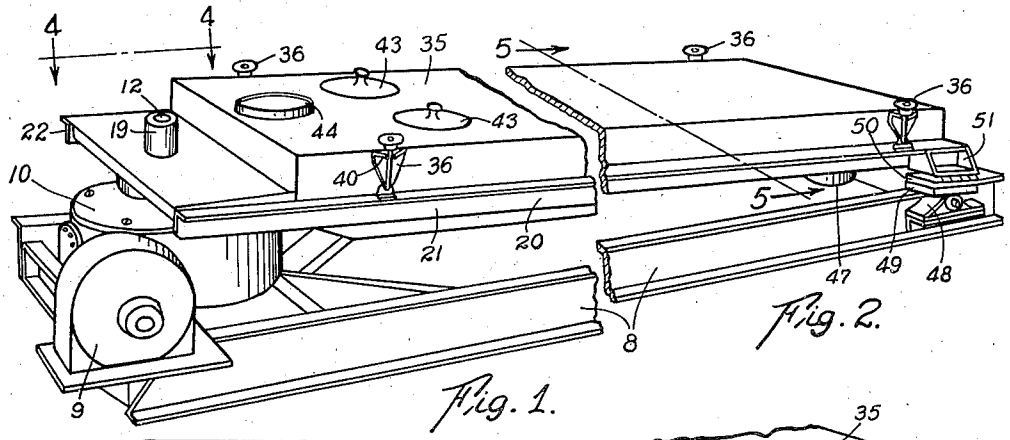


Fig. 1.

Fig. 2.

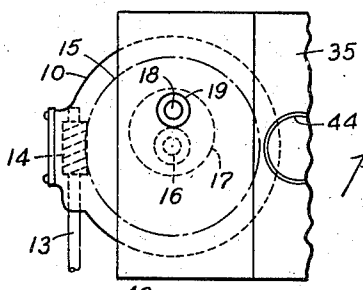


Fig. 4.

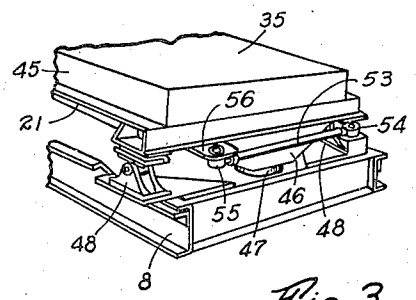


Fig. 3.

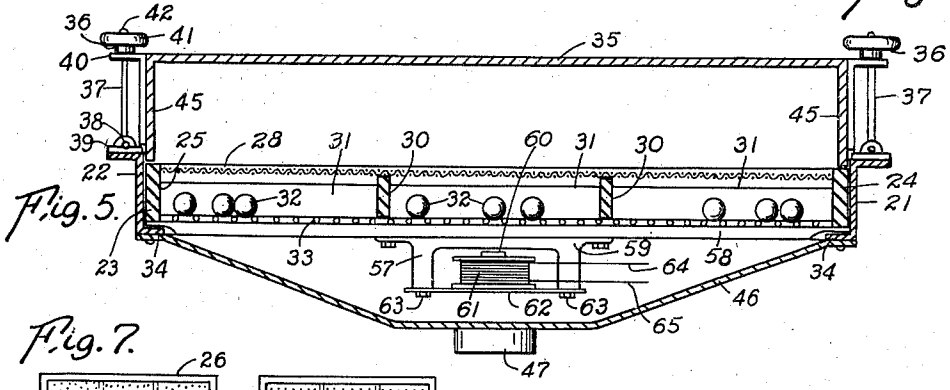


Fig. 5.

Fig. 7.

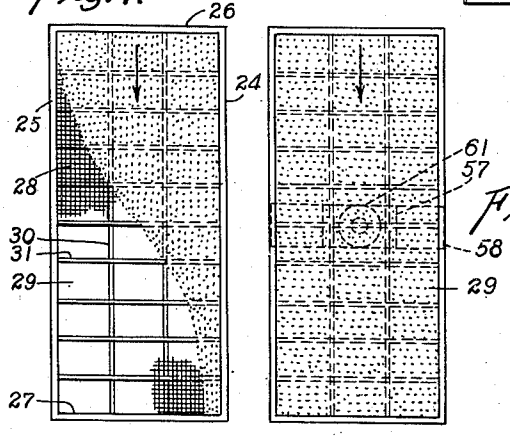


Fig. 6.

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HIGH-SPEED SIFTER

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6 Claims. (Cl. 209—323)

This invention relates to improvements in a power operated commercial sifter such as may be used in the separating or grading of various materials in powdered, granulated, flaked or other pourable form.

One of the objects of the invention is to provide an improved sifter which in speed and efficiency will surpass any known form of commercial sifter of the same size.

Another object of the invention is to obtain superior sifting performance in a gyrating type of sifter, by providing the machine with means to ensure a maximum sifting action over the full extent of the sieve area.

Another object of the invention is to combine in a power operated sifter, a multiplicity of different directional forces so applied as to favorably influence the sifting action and the pattern of the siftable material upon the sieve, with the result that a maximum of sifting in a minimum time period is made possible.

A further object of the invention is to distribute wear evenly over the sieve or sieves of the machine, to minimize replacements and servicing.

The foregoing and other objects are attained by the means described herein and illustrated in the accompanying drawing, in which:

Figs. 1 and 2 collectively illustrate, in perspective, a gyrating type of sifter embodying the improvements of the present invention.

Fig. 3 is a fragmental perspective view showing the tail end of the sifter.

Fig. 4 is a fragmental plan view looking down from line 4—4 at the head end of the machine illustrated in Fig. 1.

Fig. 5 is a cross-sectional view taken on line 5—5 of Fig. 2.

Fig. 6 is a plan view of a sieve frame of the machine, showing uniformity in the pattern and distribution of siftable material upon the screen when operating in accordance with the invention.

Fig. 7 is a view similar to Fig. 6, showing the lack of uniformity of material distribution upon a sieve not equipped with the means of the present invention.

The gyrating screen, in one form or another, has been used quite extensively for the separating or grading of various materials in powdered, granulated, flaked, or other pourable form. Such a machine generally has been constituted of a base having flexible bearing means to support one end of a sieve frame, while the other end of said frame was connected with an eccentric or crank for imparting to the head end of the sieve frame a nearly horizontal oscillating motion. In order to effect movement of the siftable material from one end of the sieve frame to the other, it was common practice to support the sieve frame on a slight angle sufficient to ensure gravitation of the siftable material toward a delivery port during gyration of the sieve frame. Depending upon the nature of the material to be sifted, the screen cloth was either coarse or fine, and in some instances a plurality of screen cloths was provided for effecting two or more separations or gradations of sifted materials. The materials subject to sifting vary widely in nature, some being dry, and others wet or moisture laden, with the physical bulk form varying from powders to granules and flakes.

The sifting of certain types of materials has often been attended with difficulties resulting from the tendency of the material to pile up along one side edge of the screen cloth, leaving a considerable portion of the screen cloth free and unused during the sifting operation. Such a condition is illustrated by Fig. 7 of the accompanying drawing, wherein the series of dots indicates the siftable material resting upon the screen cloth and taking a downward path in the direction of the arrow, with the material objectionably piling up and accumulating at the right side of the screen cloth. The ideal condition is illustrated by Fig. 6 which shows the siftable material uniformly distributed over the screen cloth, and moving in the direction of the arrow toward a delivery port near the lower end of the screen frame. It is assumed that the objectionable pattern illustrated by Fig. 7 results from the inertia of the material particles initiated by the gyratory action of the screen frame, since it has been observed that the objectionable pattern is noticeable only with certain types of siftable material. As stated in the objects of the invention, one purpose of the present invention is to avoid the formation of the objectionable pattern illustrated by Fig. 7, and which materially reduces the efficiency and speed of sifting whenever such a pattern occurs in more or less aggravated form.

Referring more specifically to the drawing, the character 8 indicates the stationary base of the sifting machine, which base carries a motor 9 or other prime mover having its driving shaft projected into a gear case or housing 10 containing gearing that drives the crank pin 12 for imparting gyratory motion to one end of the screen assembly. The driving means may be of any suitable form, as such is entirely outside the present invention. For purpose of illustration, there is shown in Fig. 4 the motor drive shaft 13 ex-

tending into the gear housing 10, wherein the drive shaft is provided with a worm 14 meshing with the teeth of a worm wheel 15 whose shaft is indicated at 16. Upon the shaft 16 may be mounted a member 17 that rotates with the shaft, said member 17 carrying a crank pin 18 which is eccentric to the shaft 16. The crank pin 18 extends upwardly through a boss 19 carried by the movable screen assembly. When the shaft 16 is rotated, the crank 18 will revolve about it, and in so doing will impart a gyratory motion to the movable screen assembly.

The movable screen assembly which is indicated generally by the character 20, may comprise longitudinal frame members 21—22, preferably of angle iron formation. These frame members are adapted to support one or more sieve frames indicated at 23, which frames are best illustrated by Fig. 7. The sieve frame may comprise side members 24 and 25 connected to end pieces 26 and 27 to form a shallow box-like structure which is spanned by a screen cloth 28 covering the entire area bounded by the members that constitute the frame. In that form of sieve frame shown herein, the area of the frame is divided into compartments 29 by means of longitudinal partitions 30 and cross pieces 31 arranged at right angles to each other. Each compartment is adapted to house a plurality of rubber balls 32 which rest upon a coarse mesh ball retaining screen 33 this mesh being sufficiently coarse to provide rebounding points which initiate an upward deflection of the balls as the screen frame is shaken sharply by the gyrating motion thereof. The purpose of the rebounding rubber balls is to keep the screen cloth open and free, so that the mesh thereof may not be blinded or clogged during the sifting action. By placing rubber balls within each of the compartments, the entire area of the screen cloth is kept in a state of vertical vibration, facilitating passage of the siftable material therethrough. The sieve frame may rest upon the inwardly turned flanges 34 of the longitudinal frame members 21 and 22.

Under certain circumstances, it may be desirable to provide a cover 35 for retaining the siftable material during the sifting operation. This cover may be securely attached to the frame members of the screen assembly in any suitable manner, such as by means of clamping devices indicated generally by the character 36. These clamping devices are of no importance to the present invention, and are accordingly shown as being merely in the form of upstanding rods 37 having their lower ends 38 pivoted to brackets 39 which permit the rods to swing arcuately outwardly from a forked upper head 40, said head being clamped down by means of a handwheel 41 applied to the threaded upper end 42 of each rod. The brackets 39 are fixed to the frame members 21 and 22, while the forked or slotted heads 40 are carried by the cover 35. Any desired number of clamps may be supplied for holding the cover securely in place.

The top of the cover may be provided with inspection ports as indicated at 43, and is ordinarily provided also with an intake port for siftable material, as indicated at 44. The intake port ordinarily will be receptive of siftable material from an elevated hopper. The upstanding walls 45 of the cover may rest upon the sieve frame, as clearly indicated in Fig. 5.

Beneath the sieve frame, a suitable trough or pan 46 is provided for the purpose of collecting the sifted material that has passed the screen, the material being directed thereby into a delivery port 47 located near the tail end of the movable screen assembly. The trough or pan may be fixed along its periphery, to the flanges 34—34 of frame members 21 and 22.

The tail end of the movable screen assembly is to be supported for oscillatory movement occurring incident to the gyratory action imparted by the crank pin 12, and to this end the base 8 may carry suitable brackets 48 that rockingly support a pair of sliding bearing blocks 49 and 50, one of said blocks being slideable upon the other. Block 50 is carried by a bracket 51 attached to one of the longitudinal frame members 21, while the bearing member 49 is carried by the base bracket 48. The tail end support just described is a common expedient, and should not require detailed description except to state that it allows the tail end of the movable screen assembly to shift in accord with the motion imparted by the crank pin 12. A sliding bearing arrangement is furnished at each of the tail end corners of the screen assembly, as indicated at 48—48 of Fig. 3. The sliding bearings may be kept in proper relationship to one another by means of the drag link at 53 of Fig. 3, the drag link having one pivoted end 54 attached to the base of the machine, and another pivoted end 55 attached to a bracket 56 carried by the movable screen assembly.

With reference now to Figs. 5 and 6, attention is directed to the attachment of a magnetic vibrator indicated generally by the character 57 the function of which is to impart sharp vertical impulses to the sieve frame and the screen cloth mounted thereon. The vibrator may be applied to a transverse strut 58 mounted at its ends upon the side members of the sieve frame, with the base 59 of the vibrator bolted or otherwise secured to the strut as shown. The base may form the armature of the vibrator, to be attracted by the magnetic core piece 60 which is surrounded by the windings of the coil 61 mounted upon a resilient support 62 fastened to the base as at 63—63. The element 62 may be of spring material, such as a leaf spring, or a suitable arrangement of coil springs as may be evident. The conductors 64 and 65 are adapted to supply a pulsating or alternating electric current to the coil of the vibrator magnet. By energizing the coil with a pulsating or alternating current of suitable value, which preferably may be varied dependent upon the nature of the material to be sifted, vertically applied forces will be transmitted to the sieve frame for vibrating the screen cloth. Depending upon the size of the sieve frame and the nature of the material to be sifted, one or more magnetic vibrators may be applied to the sieve frame. Thus, the sieve frame is given a rapid succession of vertical vibrations, in addition to the sidewise movements imparted by the crank pin 18.

According to tests performed upon a machine of the type herein disclosed, the nature of the results, and the extent thereof, were greatly beyond expectations. The gyrating sifter without the magnetic vibrator was found to sift a given material at a rate substantially equal to the rate of sifting obtained by eliminating the gyrating motion and utilizing only the magnetic vibrator as the power source for the device. It would be expected, therefore that the rate of sifting would be approximately doubled by combining the gyrating motion with the rapid vertical motion of the magnetic vibrator, but as a matter

of fact, the combining of the two motions actually increased the sifting action by approximately three hundred percent, over that obtained by utilizing one or the other of the two motions separately. In addition to the increased capacity of the machine thereby obtained, the pattern of the flow of material indicated in Fig. 7, was changed to the uniform pattern of Fig. 6. In other words, instead of the material being diverted over to one side of the sieve frame and leaving a substantial part of the mesh inactive, the combined motions resulted in a uniform distribution of the siftable material over the entire area of the screen cloth, thereby not only increasing the sifting action but also distributing wear evenly over the screen cloth. Accordingly, a sieve cloth used under conditions made possible by the present invention, will wear out uniformly over its entire surface and will therefore require less frequent replacement and servicing during the lifetime of the screen cloth. In a machine equipped with the means of the invention, it is impossible to localize the wear or abrasive action of the siftable material upon the screen cloth. As a consequence, the continued usefulness of the machine as a whole is enhanced, and the sifting rate is increased to a remarkable extent. By utilizing the present invention in equipment of this type, it has been possible to reduce the number of sifters required in a battery of sifters arranged to handle given amounts of material. Where floor space is limited, and when maintenance costs must be kept at a minimum, the machine herein disclosed affords substantial advantages.

As previously stated herein, the particular design of the magnetic vibrator is not vital to the invention, and the number of vibrators employed may be varied depending upon the nature of the material to be sifted. The invention is applicable to sifting machines which employ one or more screen cloth areas. In conclusion, it is to be understood that various modifications and changes may be made in the structural details of the device, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. A sifter construction including in combination, a screen assembly including a slightly inclined screen cloth, shiftable bearing means supporting one end of the assembly, means at the opposite end of the assembly for imparting a gyrating motion to said opposite end to keep in motion a quantity of siftable material fed onto the screen cloth, a foraminous sheet member beneath the screen cloth providing a series of abutments spaced apart, a plurality of rubber-like free balls disposed upon said member and adapted to be struck by said abutments and deflected upwardly against the screen cloth under the influence of the gyratory motion, for keeping the mesh open and free to expedite passage of siftable material therethrough, and means including a magnetic vibrator operative upon the ball-supporting foraminous sheet member to impart a rapid succession of impulses thereto at right angles to the plane of said member as the balls move in response to lateral gyratory movements of said member.

2. A sifter construction including in combination, a base structure and a supporting frame, and means mounting the supporting frame upon the base structure for oscillatory movement, said supporting frame including opposed sieve-supporting seats, a sieve supported upon said seats and comprising a frame having rigid side members to rest upon the seats of the supporting frame, and a fabric arranged to furnish a substantially open bottom for the sieve frame, a transverse rigid strut having opposite ends fixed to the side members of the sieve frame beneath the fabric, a magnetic vibrator secured to the rigid strut intermediate its ends and depending from the strut beneath said fabric, and a pan member suspended from the supporting frame in position to enclose the vibrator between the pan and the fabric.

3. A sifter construction including in combination, a base structure and a supporting frame, and means mounting the supporting frame upon the base structure for oscillatory movement, said supporting frame including opposed sieve-supporting seats, a sieve supported upon said seats and comprising a frame having rigid side members to rest upon the seats of the supporting frame, and a fabric arranged to furnish a bottom for the sieve frame, a transverse rigid strut having opposite ends fixed to the side members of the sieve frame beneath the fabric, a magnetic vibrator secured to the rigid strut intermediate its ends and depending from the strut beneath said fabric, a sifter screen sheet forming a top for the sieve frame in spaced relationship to said fabric, and partition means spanning the space between the sifter screen sheet and said fabric for transmitting vibrations to and from the sheet and the fabric, and a pan member suspended from the supporting frame in position to enclose the vibrator between the pan and the fabric.

4. A sifter construction including in combination, a base structure and a supporting frame, and means mounting the supporting frame upon the base structure for oscillatory movement, said supporting frame including opposed sieve-supporting seats, a sieve supported upon said seats and comprising a frame having rigid side members to rest upon the seats of the supporting frame, and a coarse fabric arranged to furnish a bottom for the sieve frame, a transverse rigid strut having opposite ends fixed to the side members of the sieve frame beneath the coarse fabric, a magnetic vibrator secured to the rigid strut intermediate its ends and depending from the strut beneath said fabric, a sifter screen sheet forming a top for the sieve frame in spaced relationship to said coarse fabric, means including rebounding bodies between the sifter screen sheet and said fabric for transmitting vibrations to and from the sheet and the fabric, and a pan member suspended from the supporting frame in position to enclose the vibrator between the pan and the coarse fabric.

5. A sifter construction including in combination, a base structure and an exterior supporting frame, and means mounting the supporting frame upon the base structure for oscillatory movement, said supporting frame including opposed sieve-supporting seats, a sieve supported upon said seats and comprising an inner frame having rigid side members to rest upon the seats of the supporting frame, a sifter fabric on the sieve frame reaching from one side member thereof to the other, a partition structure fixed relative to the sieve frame and including members to physically contact a series of intermediate areas of the sifter fabric between the sieve frame side members, and a magnetic vibrator applied to the partition structure thereby to shake the sifter

fabric at a series of locations of contact through the intermediary of the partition structure.

6. A sifter construction including in combination, a base structure and an exterior supporting frame, and means mounting the supporting frame upon the base structure for oscillatory movement, said supporting frame including opposed sieve-supporting seats, a sieve supported upon said seats and comprising an inner frame having rigid side members to rest upon the seats of the supporting frame, a sifter fabric on the sieve frame reaching from one side member thereof to the other, a partition structure fixed relative to the sieve frame and including members to physically contact a series of intermediate areas of the sifter fabric between the sieve frame side members, and a magnetic vibrator including a base fixed relative to the partition structure of the inner frame beneath the sifter fabric, and a magnetic coil resiliently supported upon the vibrator base in position to vibrate the latter upon intermittent energization of said coil, and to vibrate the sieve through the intermediary of the partition structure.

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