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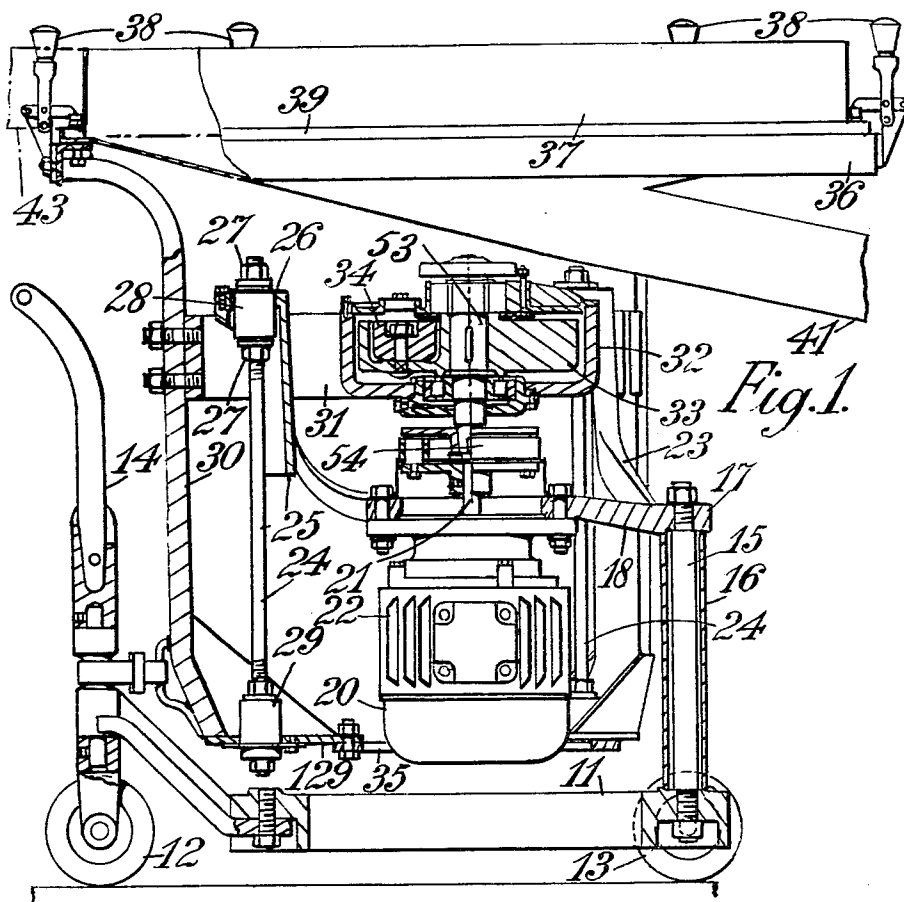
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3,047,151

STRAINING AND SIFTING PROCESSES AND APPARATUS

Filed Sept. 21, 1959

2 Sheets-Sheet 1



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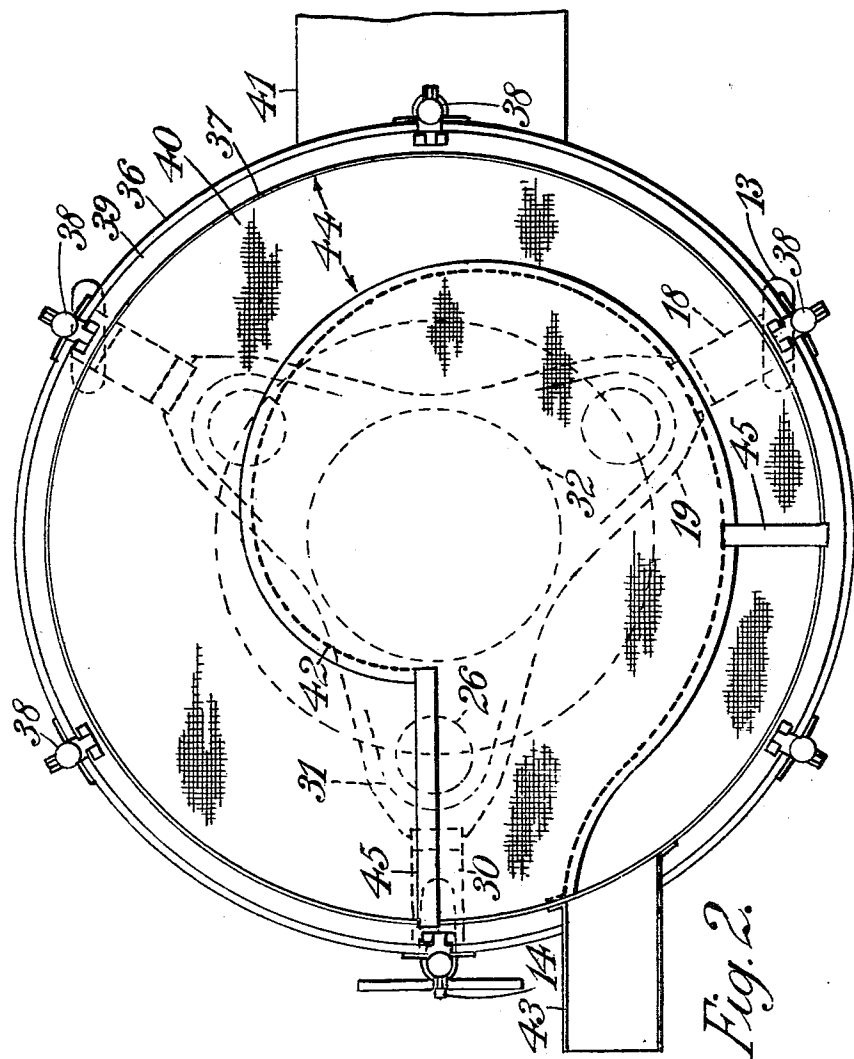
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2 Sheets-Sheet 2



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3,047,151 STRAINING AND SIFTING PROCESSES AND APPARATUS

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4 Claims. (Cl. 209—366.5)

This invention relates to straining and sifting processes and apparatus. Sieves and strainers of the type capable of rapid movement of small amplitude are well-known and described for example in our earlier patents numbers.

Hitherto the object with such sieves and strainers has been to keep the sieving or straining septum vibrating rapidly with movement of small amplitude in, or nearly in, the plane of sieving or straining—usually the horizontal plane.

It has now been found that if, in addition to this orbital movement a certain oscillation or rocking movement in the manner of a swash plate can be imparted the output can be quite considerably increased.

According to one feature of the present invention a process of straining or sieving liquids or powder mixtures consists in feeding the material to be treated on to a strainer or sieve surface which is kept in vibration with a rapid orbital movement of small amplitude combined with a rocking movement like that of a swash plate, the sieve surface being so supported that its centre of gravity is held from any substantial vertical vibrational component of movement.

According to another feature of the present invention a strainer or sieve comprises in combination a rigid sieve-frame on which a straining or sifting septum is stretched and which extends downwardly below the septum to a plurality of suspension points on the frame, which points are located at a distance from the vertical axis passing through the centre of the septum which is not more than three-quarters of the distance of the periphery of the septum from the said axis, flexible suspension rods attached at their lower ends to the frame at said suspension points, a stationary supporting frame to support the upper ends of the suspension rods, an out-of-balance weight mounted on part of the sieve-carrying frame to rotate about the said axis and means for rotating said weight.

According to a still further feature of the invention an apparatus for straining and sifting comprises in combination a sieve-frame having a sieve or straining septum, a spring suspension frame supporting said sieve-frame, a rapidly rotatable out-of-balance weight supported on said suspension frame to impart rapid orbital movement to said sieve-frame and septum, said sieve-frame being of appreciably greater radius than the radius of said suspension frame and the centre of gravity of said suspension frame being higher than the location of the out-of-balance weight whereby in operation there is a torque produced in a vertical plane which at any given moment embraces the out-of-balance weight and said centre of gravity, which torque acts as a tipping moment to bring about a swash plate effect on the septum.

Conveniently the apparatus is provided with a delivery chute constructed in two parts, an upper funnel-shaped portion which is symmetrical relatively to the septum and is secured thereto and a lower lateral delivery chute which is mounted on a fixed part of the apparatus, the two chutes having concentric overlapping portions where they approach one another and a pneumatic tube being disposed in the annular space between the concentric overlapping portions to seal the space, but to permit the relative orbital and swash-plate movements to take place.

One construction of sifting and straining apparatus in

accordance with the invention will now be described by way of example only, reference being made to the accompanying drawings in which:

FIGURE 1 shows in part sectional elevation, a sieving or straining apparatus, and

FIGURE 2 is a plan view of the apparatus showing the sieving or straining septum.

Upon a heavy cast base ring 11 there are secured three symmetrically disposed rollers, 12, 13, 14 to enable the apparatus to be wheeled about. One of the rollers 12 is made steerable by means of an upstanding tiller 14. Upstanding from the base ring 11 and equidistantly spaced therearound are three columns 15. The columns 15 are formed with sleeves 16 therearound extending upwardly and to a point near their tops. Resting on the upper end of each of the sleeves 16 and surrounding the top of each column is a lug 17 formed on the end of an arm 18 of a spider 19. The lugs 17 are secured to the columns 15 and the spider 19 supports the upper end of an electric motor 20 which is disposed concentrically with the ring base 11 and has a vertical drive shaft 21 extending up through the centre of the spider 19. The motor is ventilated by gills 22.

The spider 19 is also formed with inverted V frame members 23 disposed between each pair of columns and encircling the upper end of the motor. This frame forms the support for three depending flexible steel suspension rods 24, each of which is secured to an upstanding bracket 25 secured to the apex of each inverted V section 23 of the frame. The rods 24 are secured to an outwardly turned lip 26 on each bracket 25 by nuts 27 above and below the lip and conical rubber bushes 28 interposed which afford a flexible mounting for the upper ends of the rods 24. It will be observed that the base 11, the columns 16, the spider 19 and the brackets 25 constitute a stationary frame, from which the rods 24 are suspended.

The three suspension rods extend downwardly to about the level of the bottom of the electric motor 20 and at the bottom they enter rubber bushes 29 in lugs 129 on a carrier frame for the sieve and thus the rods 24 are flexibly attached at both ends, at the top to the stationary frame and at the bottom to the sieve carrying frame.

The carrier frame comprises three upstanding channel sectioned frame members 30 each secured at its lower end to one of said lugs 129 and each extending upwardly opposite and outside one of the flexible suspension rods 24. At a point above the electric motor and just below the top of the suspension rods there is secured to the inside of each sieve frame member 30 one apex of a substantially triangular sub-frame member 31. Centrally located within the sub-frame 31, and secured to each side of it, is a circular casing 32 to receive a flywheel 33 and out-of-balance weight 34. The flywheel 33 is mounted on a spindle 53, driven from the motor shaft 21 through the flexible coupling 54.

The disposition of the various elements is such that the three uppermost flexible mountings 27, 28 of the suspension rods 24 are located each within an angle in the said sub-frame 31 and the fly weight casing 32 is vertically over the electric motor 20 and its driving shaft 21.

At their lower ends, as stated, the three frame members 30 are secured one to each lug 129. Each lug 129 extends inwardly and is secured to a ring 35 encircling the base of the electric motor 20.

At their upper ends, above the point of securement of the sub-frame member 31, each sieve frame member 30 is bent outwardly and carries a carrier-ring 36 for a sieve-containing frame 37. Each frame member 30 is firmly secured to the carrier-ring 36. The carrier-ring 36 is provided with six equidistantly spaced toggle clamps 38 which engage a flange 39 provided on the periphery of the sieve frame 37 to hold it firmly on top of the carrier-ring 36.

The sieve frame 37 contains a septum 40 and will be described further below.

The disposition of elements is such that the vertical axis passing downwardly through the centre of the septum 40 also passes through the centre of the fly wheel 33 and electric motor 20. Furthermore the diameter of the septum 40 is strictly related to the disposition of the three suspension points of the sieve frame (being the flexible mountings 27, 28 above referred to) in that the distance of said suspension points from the said vertical axis should not be more than three quarters of the distance of the periphery of the septum from the said axis.

The sieve-containing frame comprises a casing of circular section. An outlet chute in the form of a pipe 41 passes from the aperture outwardly and downwardly to emerge above the aforesaid sub-frame 31 and between one pair of the channel frame members 30. In a particular case the septum is 38 inches in diameter. The laterally extending portion of the chute is of oval cross-section with its greatest axis horizontal.

Inside the casing and secured to the top thereof by spacers 45 so as to stand just slightly above the septum screen 40 is an upstanding thin guide wall 42. The guide wall 42 commences at a point which is offset from the centre of septum 40 by a distance of about a third of the radius of the septum and then curves round substantially concentric with the septum but gradually closing toward the wall of the sieve-frame casing 37 until, having described about 330°, it bends sharply into an aperture in the casing wall. An outlet chute 43 for coarse material leads off from this aperture.

In operation the electric motor 20 is switched on, and the motor drives the out-of-balance fly weight 33, 34 (which is adjustable in known manner). There is thus imparted to the septum 40 rapid oscillation of small amplitude in a horizontal plane. In addition the septum is given a certain rocking movement so that in effect the septum has a movement like that of a swash plate. This rocking movement is produced due to the relative disposition of the various elements and particularly the mounting of the sub-frame 31, which supports the flywheel and the out-of-balance weight, at approximately the level of the upper suspension elements 28; the effect of this is that the center of gravity of the oscillating parts, namely the sieve-supporting ring, the septum, the frame members, the sub-frame, the flywheel and the out-of-balance weight, lies substantially in the same plane as the upper ends of the suspension rods. Consequently the instantaneous moment of the out-of-balance weight about the lower ends of the suspension rods combined with the momentum of the overhanging sieve frame causes the septum to rock; as the out-of-balance weight rotates, the instantaneous moment rotates, the vector representing the momentum of the sieve also rotates, and the septum takes up the described swash-plate motion.

The material to be sieved or strained is poured on to the central portion of the septum 40. Due to the special movement imparted to the septum the material tends to be kept moving in a circumferential direction and also continually turned over the whole surface of the septum. The material makes its way from the centre of the septum toward the inner face of the guide wall 42, through which it cannot pass but along which it works its way circumferentially. The material is being sifted continuously of course and finds its way eventually into the portion 44 of the septum between the outer face of the guide wall 42 and wall of the casing 37. Due to the sieve-frame suspension permitting a slight vertical yield in addition to the horizontal displacement there is a vertical rolling movement or "swash-plate" movement which is in phase with the orbital displacement of the frame and it is this which assists movement of the material being sieved or strained around the whole area of the screen.

Thus the material moves gradually around to the por-

tion 44 so that, by the time it leaves at the exit 43, it has been substantially completely sifted. The fine material passes through the septum screen 40 and out through the outlet chute 41.

It is to be noted that according to the invention the speed of operation must be adequate to ensure that with the stiffness of suspension and of up and down movement afforded thereby, the speed is well above the natural frequency of vibration of the suspension in order to secure the swash-plate motion.

It has been found that with a septum of 36 inches diameter and with the screen gyrating at 2800 revolutions per minute clay slip can be dealt with continuously in a substantially non-diluted state. Clay slip, undiluted, is a particularly difficult material to filter continuously. It will at once be apparent therefore that this is a very important technical advance in the art of sifting and straining.

I claim:

1. Apparatus for straining and sifting comprising in combination a stationary frame, spaced suspension rods flexibly attached to said frame and depending downwardly from their points of attachment thereto, a sieve-carrying frame secured flexibly to the lower ends of the suspension rods and extending upwardly above the stationary frame, a sieve septum supported horizontally on the sieve-carrying frame above the top of the suspension rods and overhanging them on all sides, an out-of-balance weight on the sieve-carrying frame located at about the level of the top of the suspension rods, means for rotating the out-of-balance weight at a speed in excess of the natural frequency of vibration of the suspension, and an upstanding wall supported with and surrounding the edge of the sieve septum and an outlet for oversize in said wall.

2. Apparatus for straining and sifting comprising in combination a stationary frame, spaced suspension rods flexibly attached to said frame and depending downwardly from their points of attachment thereto, a sieve-carrying frame secured flexibly to the lower ends of the suspension rods and extending upwardly above the stationary frame, a sieve septum supported horizontally on the sieve-carrying frame above the top of the suspension rods and overhanging them on all sides, an out-of-balance weight on the sieve-carrying frame located at about the level of the top of the suspension rods, means for rotating the out-of-balance weight at a speed in excess of the natural frequency of vibration of the suspension, an upstanding wall supported with and surrounding the edge of the sieve septum, and an outlet for oversize in said wall and a spiral guide wall standing up from the septum, which wall commences near the center of the septum and leads in a spiral path to the outlet for oversize.

3. Apparatus for straining and sifting comprising in combination a stationary frame, spaced suspension rods flexibly attached to said frame and depending downwardly from their points of attachment thereto, a sieve-carrying frame secured flexibly to the lower ends of the suspension rods and extending upwardly above the stationary frame, a circular sieve septum supported horizontally on the sieve-carrying frame above the top of the suspension rods and of a radius at least 25% greater than the radius of the suspension rods, an out-of-balance weight on the sieve-carrying frame located at about the level of the top of the suspension rods, means for rotating the out-of-balance weight at a speed in excess of the natural frequency of vibration of the suspension, and an upstanding wall supported with and surrounding the edge of the sieve septum and an outlet for oversize in said wall.

4. Apparatus for straining and sifting comprising in combination a base, a fixed frame extending upwardly from the base carrying brackets for the upper ends of a plurality of suspension rods, flexible suspension means on the brackets, suspension rods arranged symmetrically around the vertical center-line of the base and depending from the suspension means, a sieve-carrying frame flexibly

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secured to the lower ends of the suspension rods and extending upwardly therefrom outside the rods to a level above the upper ends of said rods, a sub-frame attached to the sieve-carrying frame at about the level of the upper ends of said rods, which is shaped to surround said brackets without touching them and to support a bearing member for a vertical shaft in the center between the rods, an out-of-balance weight on said bearing member, a flexible coupling on the vertical shaft below the bearing member, drive means on the fixed frame for the flexible coupling, a circular sieve-septum of a radius at least 25% greater than the distance of the suspension rods from the vertical center line of the base supported on the sieve-carrying frame above the out-of-balance weight, an up-
 10 standing wall secured around the septum to move there-

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with and having an outlet, and a spiral guide wall standing up from the septum and terminating at the outer periphery thereof by said outlet and a discharge chute on the sieve-supporting frame at said outlet to receive material delivered by the spiral guide wall.
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