Nov. 7, 1961 K. J. SYLVEST 3,007,575

SCREENING APPARATUS

Filed June 12, 1958

FIG. 2

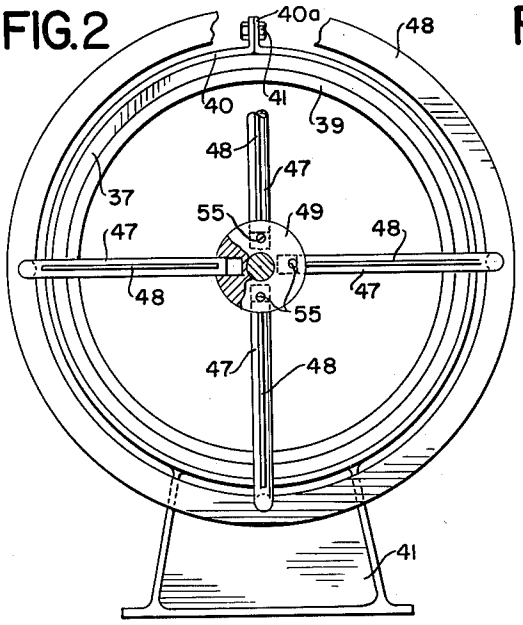


FIG. 3

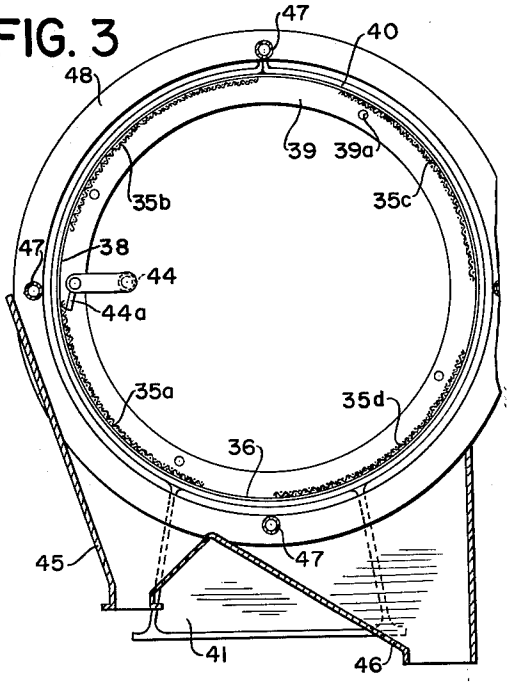


FIG. 4

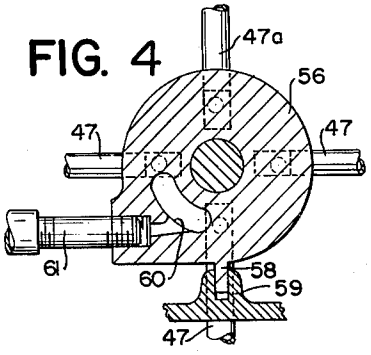
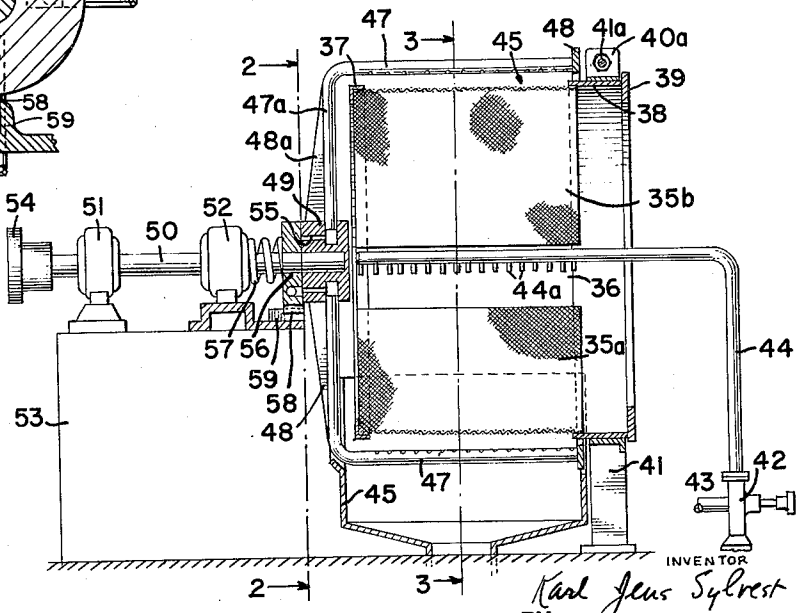


FIG. 1



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SCREENING APPARATUS

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3 Claims. (Cl. 209—268)

This invention relates to the separation of wet or dry materials into fine and coarse fractions by a screening operation carried out on a stationary concave screening surface. More particularly, the invention resides in a novel method of screening on a surface of the stated type and in an apparatus, by which the new method may be advantageously practiced. The method of the invention is superior to prior methods in that a better separation of the material being screened is obtained and the equipment used may be constructed to have greater durability.

In the practice of the method, the material in the form of a slurry, for example, is delivered to the concave surface of a stationary screen substantially tangentially to the surface and, as the material moves over the surface, the fine particles pass through the screen openings and the coarse particles pass off the edge of the surface. The tendency of the openings through the surface to become clogged by the material is then overcome by directing jets of fluid upon the convex surface of the screen in a direction opposite to that of the movement of the fine particles through the openings. The jets are caused to move relatively to the screen so that the openings are intermittently subjected to the action of the jets and, as a jet enters an opening, it clears the material therefrom and raises the material slightly above the screen surface. When the jet has passed by the opening, the material is brought back to the screen surface by centrifugal action and fine particles in the material are impelled through the screen. As a result of the repeated raising of the material from the screen surface, the surface is subjected to less wear than in an operation, in which the material is in continuous contact with the surface, and the material subjected to jet action travels along the surface as if it were sliding on a layer or cushion of the fluid. In addition, the effective capacity of the screen is increased by the return of the material to the screen by centrifugal force.

The screen used is preferably of the shape of a surface of revolution and the jets are delivered from nozzles mounted in a structure on the convex side of the screen surface and directing the jets toward the axis of the surface. The nozzle structure is movable in relation to the surface along an arcuate path about the axis of the surface and the movement of the structure may be continuous or reciprocating. Continuous movement is preferred where the construction permits, since such movement avoids loss of energy involved in accelerating, retarding, and reversing the structure and also eliminates possible vibration. If the nozzle structure may not be moved in a circular path because the screening surface is parabolic or otherwise non-circular in the direction of travel of the material, the structure can be reciprocated in a direction perpendicular to the travel of the material along the screen. Whenever the nozzle structure is reciprocated, its stroke should be greater than the space between adjacent nozzles in the direction of movement of the structure.

For a better understanding of the invention, reference may be made to the accompanying drawing, in which

FIG. 1 is a view partly in vertical longitudinal section and partly in elevation of a modified form of the apparatus;

FIGS. 2, 3 and 4 are sectional views on the lines 2—2, 3—3, and 4—4, respectively, of FIG. 1.

The form of the apparatus shown in the drawing has

a screen 35, which is generally cylindrical in form and is made up of four sections 35*a*, 35*b*, 35*c*, 35*d* separated by openings 36. The screen is stiffened at one end by a circular angle iron 37 and, at the other end, has an imperforate cylindrical extension 38 with a radial flange 39. The extension is disposed within a strap 40 resting upon and secured to a support 41 and the strap has end flanges 40*a* connected by a bolt 41*a*. By backing off the bolt to release the strap 40, the screen may be turned angularly and the flange 39 may be provided with openings 39*a* to receive tools, by which the screen may be turned. After having been adjusted to a new position, the screen is secured in place by tightening the strap 40 by means of the bolt.

The slurry is fed to the screen by a centrifugal pump 42 having an intake line 43 leading from the slurry reservoir and a line 44 leads from the outlet of the pump and enters the screen 35. Within the screen, the line 44 is provided with a plurality of nozzles 44*a*, which lie at a closing spacing and direct the slurry upon the quadrant 35*a* of the screen near the upper edge thereof and substantially tangentially of the screen surface. A hopper 45 lies below the screen quadrant 35*a* to collect the fine fraction issuing through the screen and the coarse fraction which passes off the top of the screen, travels through the adjacent opening 36 and enters a hopper 46.

The nozzle structure comprises four pipes 47, which lie outside the screen and extend parallel to the axis thereof. The pipes are connected at one end by a ring 48 and, at the other end, each pipe has a radial section 47*a*, which is stiffened by a rib 48*a* and is mounted in an opening in a hub 49. The hub is attached to the end of a shaft 50 mounted for rotation in bearings 51, 52 on a foundation 53 and the shaft is driven by any suitable means through a coupling 54. The hub has a passage 55 leading from the end of each pipe 47 to open through the end surface of the hub and a distributor disk 56 mounted loosely on the shaft is held against the end surface of the hub by a spring 57 encircling the shaft and bearing at one end against the disk and at the other against bearing 52. The disk is kept from rotating with the shaft and hub by a lug 58 lying between spaced stops 59 on the base of bearing 52. The disk has a curved passage 60 formed in its face in engagement with the hub 49 and fluid is supplied to the passage by a pipe 61 threaded into an opening in the hub. The passage 60 lies opposite the quadrant 35*a* of the screen.

In the operation of the apparatus, a slurry is discharged through nozzles 44*a* at high velocity upon the quadrant 35*a* of the screen and the nozzle structure consisting of pipes 47 and hub 49 is rotated at high speed. As a pipe 47 starts to travel past the quadrant 35*a* of the screen, the passage 55 in the hub leading to the pipe comes into registry with the passage 60 in the disk 56 and air is supplied to the pipe and is discharged in the form of jets upon the convex surface of the screen quadrant 35*a*. As the pipe reaches the end of screen 35*a*, its passage 55 in the hub passes beyond the passage 60 in the disk and the supply of air to the pipe is cut off. As the next pipe 47 reaches the upper end of the screen 35*a*, the operation of supplying air is repeated. Accordingly, as each pipe travels past the screen quadrant, upon which the material is being discharged, it is supplied with air, which is discharged upon the screen in the form of jets, and, as each pipe passes beyond the screen, the air supply thereto is cut off.

By way of example, the screen in the form of apparatus shown in the drawing, may be 3′ in diameter with 2 mm. openings and the air nozzles may be spaced 3 mm. from one another and from the screen. The nozzle structure may operate at 1,000 r.p.m. and the velocity of the air issuing from the nozzles may be 300′ per second. The slurry may be delivered upon the screen at a speed

of 10′ per second but it is preferable to employ a higher speed such that the centrifugal acceleration is a multiple of 50 times or more the gravitational acceleration. To obtain such a gravitational acceleration with a screen 3′ in diameter, the slurry should be discharged from the nozzles upon the concave surface of the screen at a rate of about 50′ per second.

I claim:

1. An apparatus for separating a material into fine and coarse fractions which comprises a stationary screen structure of generally cylindrical form and including arcuate screen sections circumferentially separated by discharge openings, the sections and openings extending substantially the full length of the structure, means for discharging the material upon the concave surface of one section only of the screen in the form of a row of high velocity jets impinging at a low angle upon said screen section near one longitudinal edge thereof, the row of jets extending substantially the length of said screen section, a nozzle structure for directing spaced jets of fluid upon the convex surface of said screen section to clear the screen openings, means for moving the nozzle structure along a circular path concentric with the screen structure, and means for supplying fluid only to the nozzles directing jets upon said screen section.

2. The apparatus of claim 1, in which the screen structure is mounted for angular adjustment to place its screen sections successively in position to receive material from the delivering means.

3. The apparatus of claim 2, in which the screen structure includes an imperforate cylindrical end section, a releasable strap encircles the end section and holds the structure in place, and the strap is secured to a support.

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