

Dec. 23, 1958

H. VELKE

2,865,506

SEPARATORS FOR PULVERULENT MATERIALS

Filed June 15, 1953

6 Sheets-Sheet 1

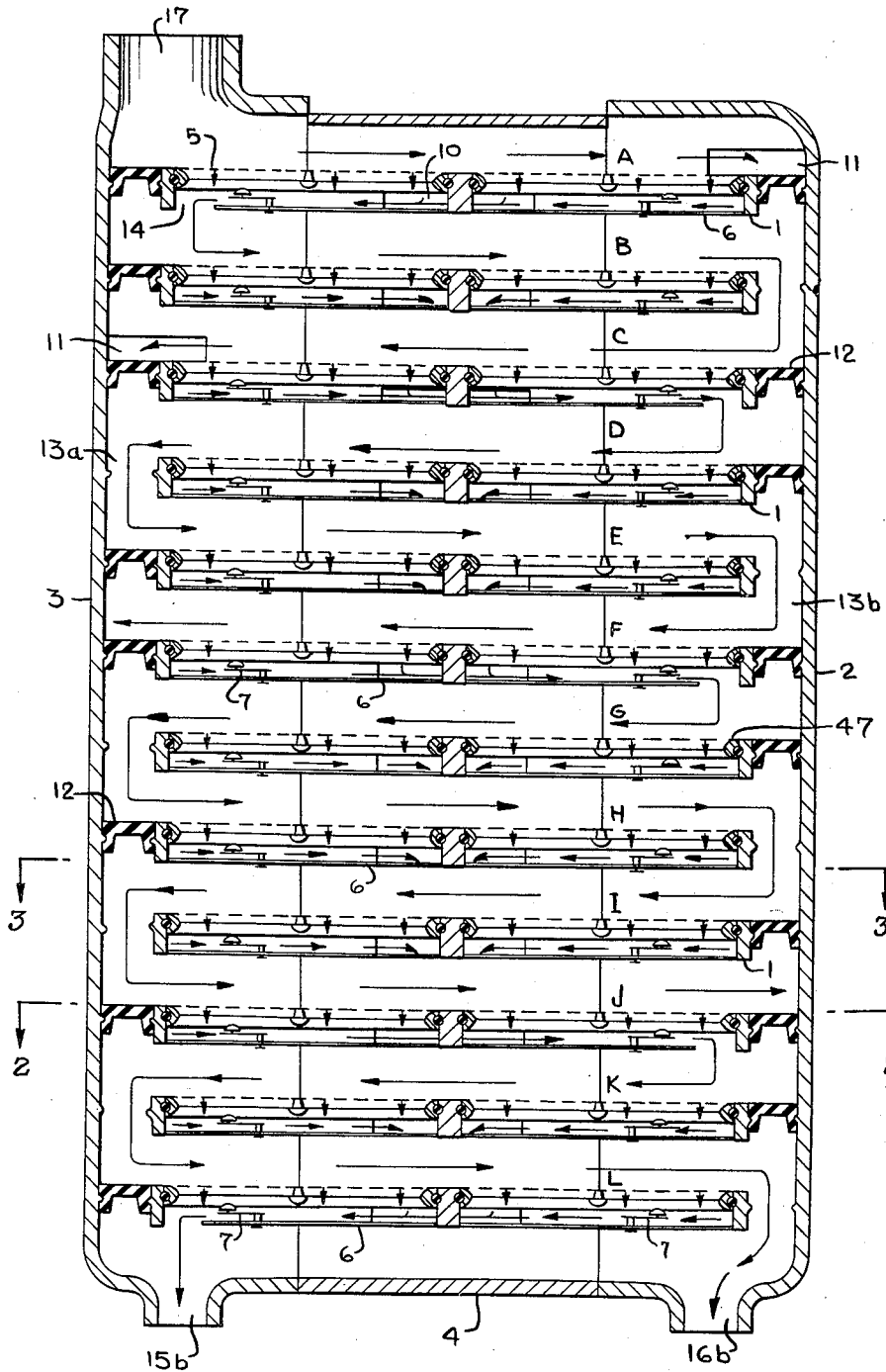


Fig 1

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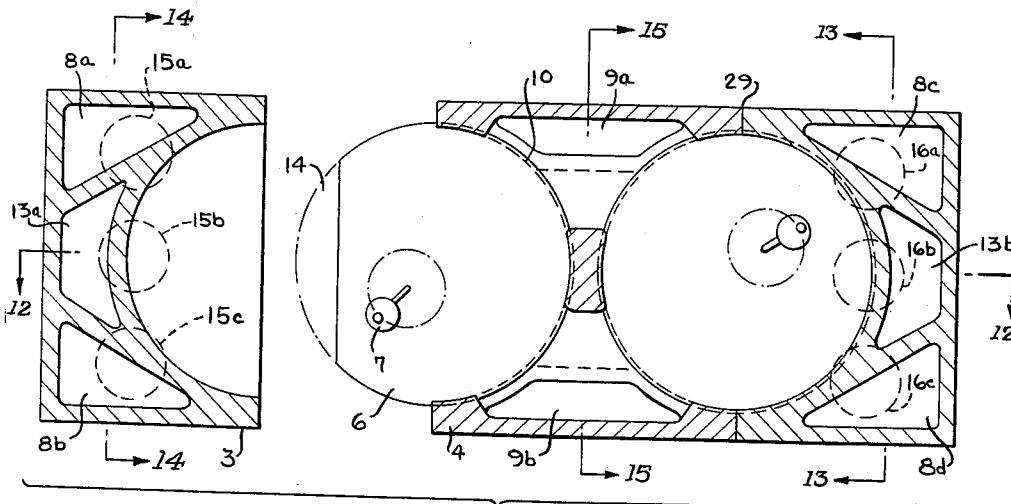
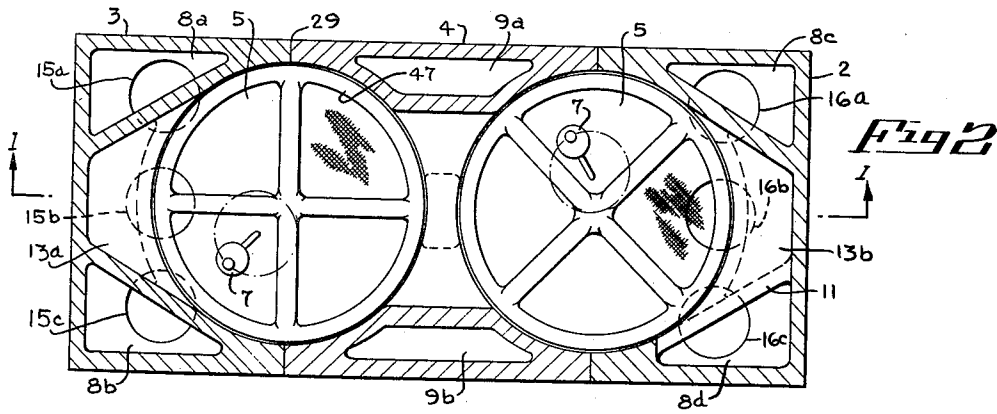


Fig 3

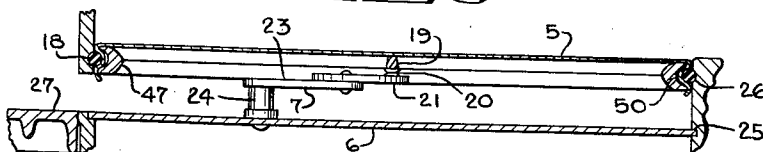


Fig 4

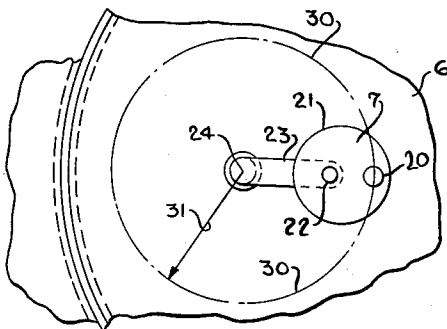


Fig 5

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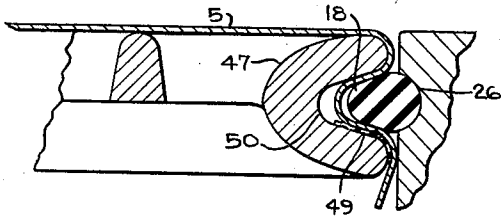


Fig 6

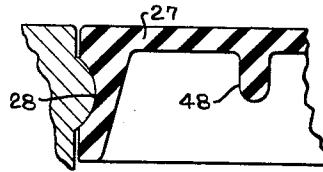


Fig 7

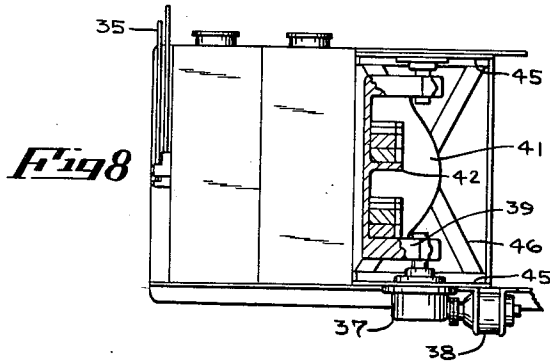


Fig 8

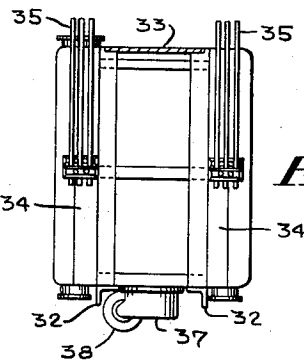


Fig 9

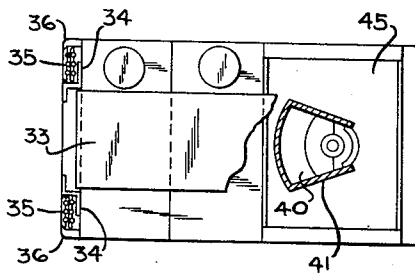


Fig 10

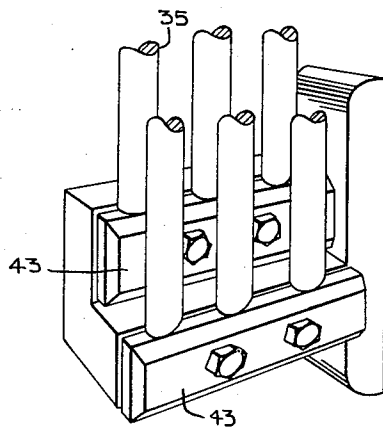


Fig 11

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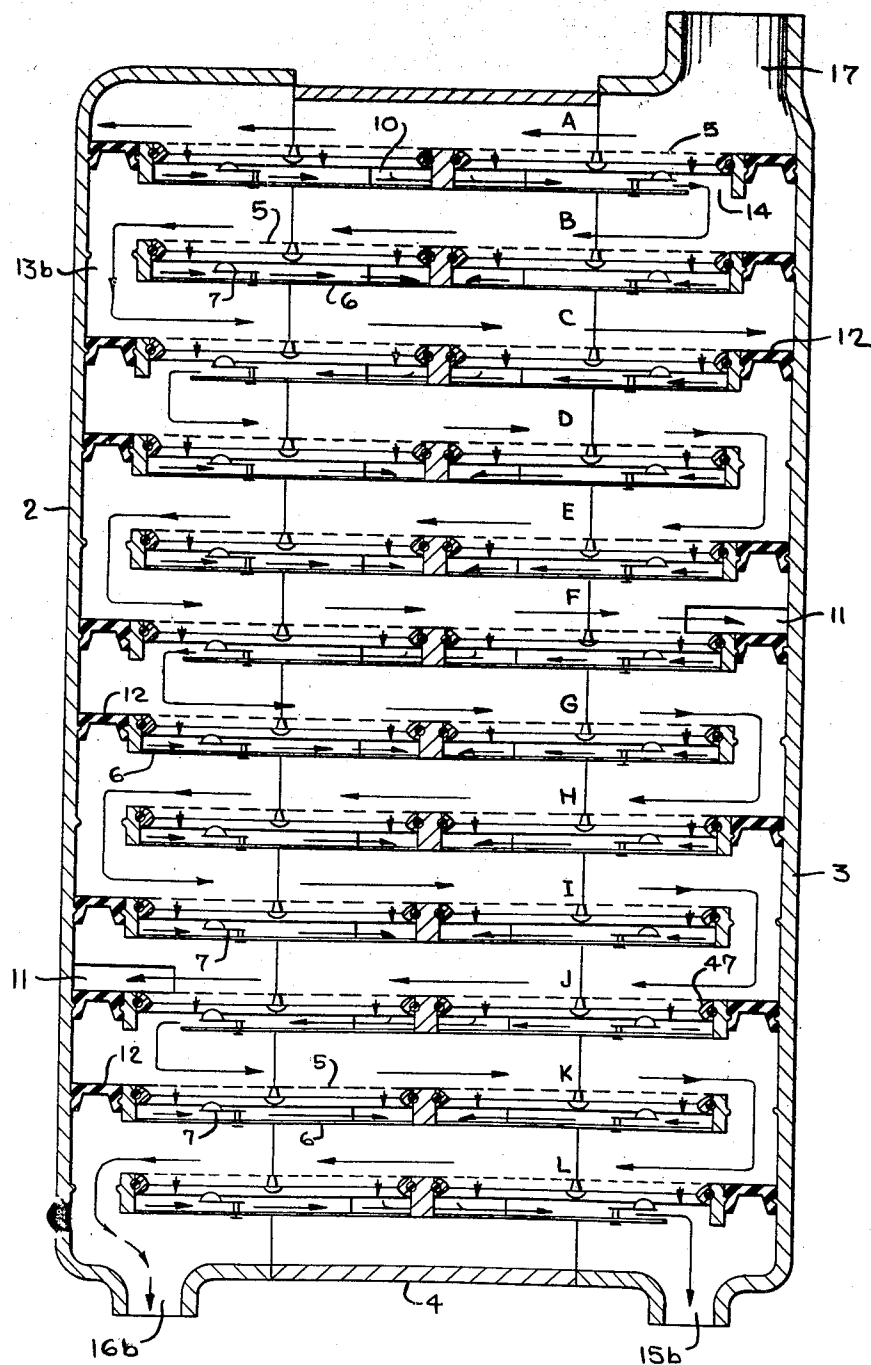


Fig 12

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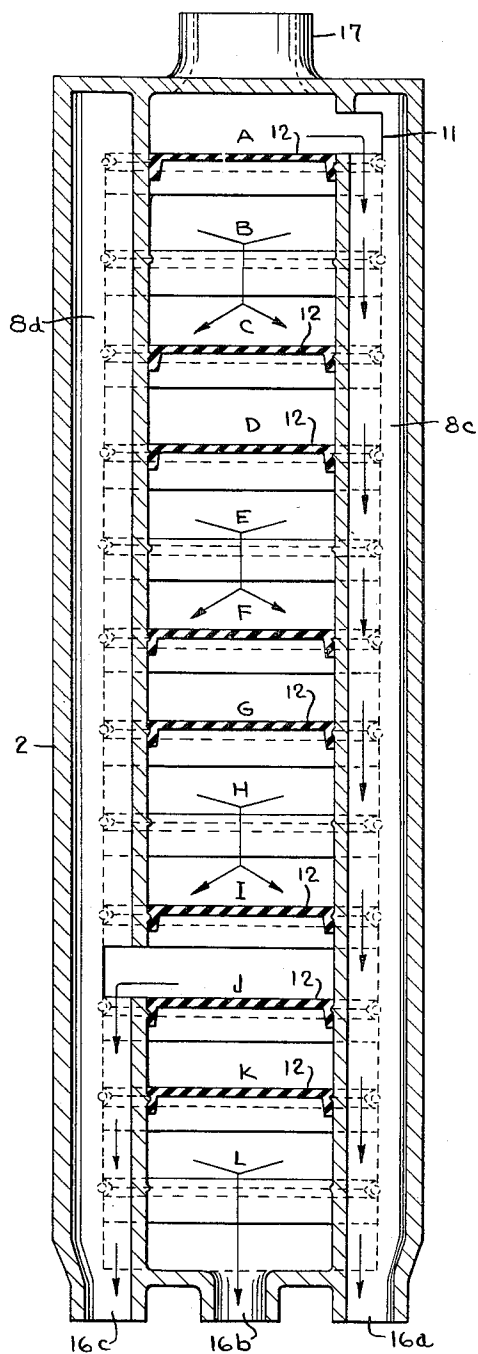


Fig 13

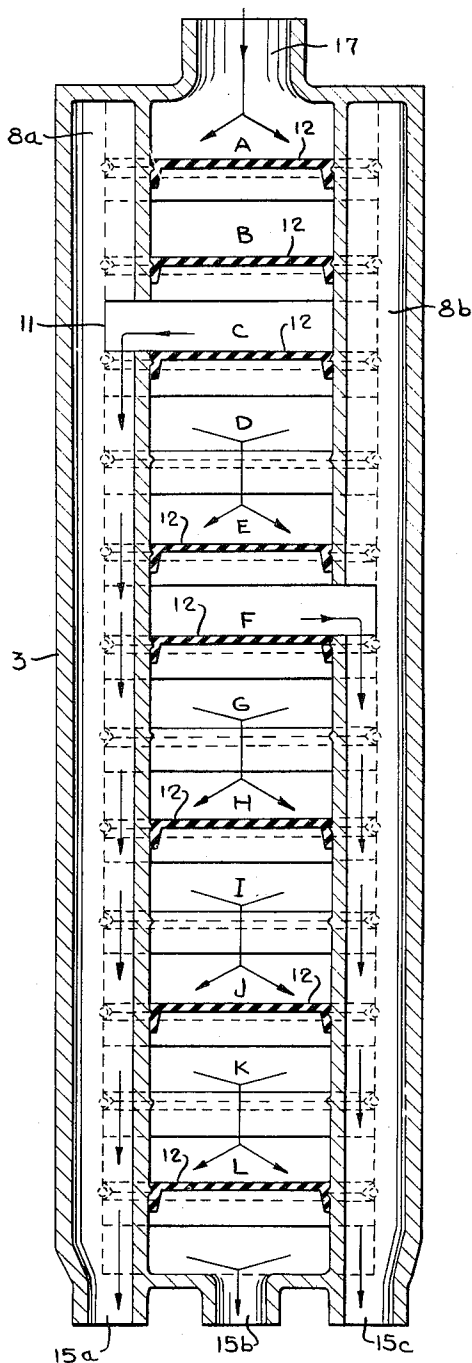


Fig 14

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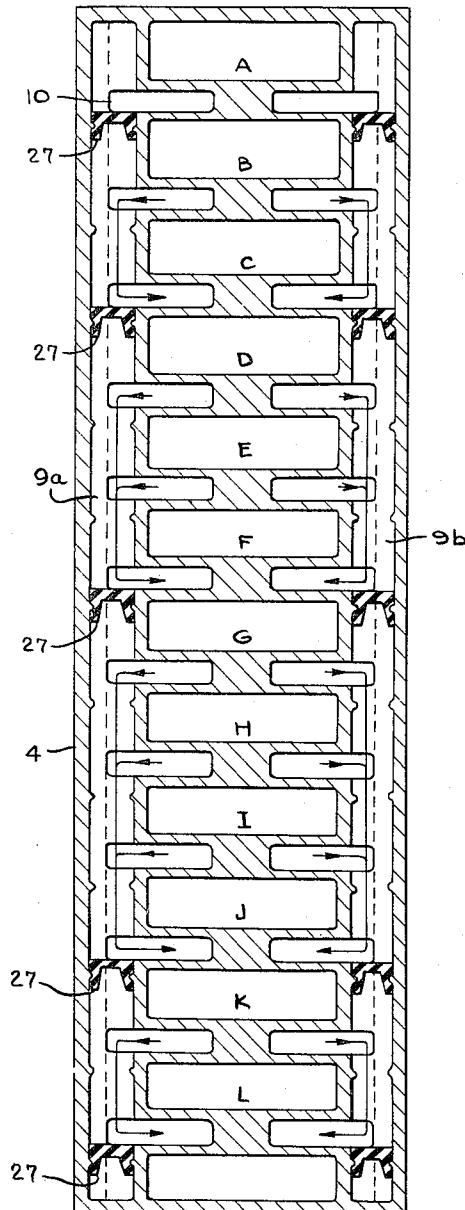
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SEPARATORS FOR PULVERULENT MATERIALS

Herbert Velke, Uzwil, Switzerland, assignor to Gebrueder Buehler, Uzwil, Switzerland

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8 Claims. (Cl. 209—315)

This invention relates to plansifters for pulverulent materials which may have been size-reduced in roller mills and other disintegrating and crushing devices.

It is the function of the plansifters to subdivide the comminuted materials into fractions of a different grain size.

The hitherto customary plansifters, which are provided with vertically superposed screens, have numerous drawbacks.

The location of the screen holding frames at the right and the left side of centrally located driving means renders the approach to the inner part of the plansifters difficult; if, for instance, a lower screen must be inspected, all the higher screens as well as the cover must be removed from the plansifter.

Plansifters provided with longitudinal sieves or screens adapted to be pulled from their frames or casings do not have this disadvantage; however, on the withdrawal side there must be a space provided for at least one sieve length.

Screen holding and securing devices applied to the frame structure of the plansifters increase the manufacturing costs and necessitate the application of numerous small parts, which upon being loosened may cause damages and create spaces which can only be cleaned with great difficulty.

A change of the separating or transport schedule of the charged materials is practically impossible and extremely time consuming since certain parts of the plansifters must be exchanged. Engageable and disengageable guide valves serve this purpose incompletely and the price of the plansifters is therefore steadily increased by the attempts to improve their operation.

Moreover, the space requirement for the plansifters increased constantly in comparison with their working capacity and the desire to obtain a higher efficiency; on the other hand the problem of maintaining or reducing their space capacity became more and more important, so that in a shorter time a larger amount of materials to be separated would pass through the sieves or screens mainly consisting of woven materials.

In the stapled or superposed wooden plansifter types the heavy supporting frames surround the plansifters. These frames require a large space and project far beyond the superposed screens.

Since in plansifters provided with exchangeable screens the front and rear side must be accessible the horizontal frames were retained and carrier frames were installed above and below the same, whereby much space was lost in accordance with the height of the frames.

In order to serve a reliable operation of the plansifters vertically disposed rod holders must be placed at the four outer corners; these holders project with the hitherto known plansifter structures far beyond the outer outline of the sifter compartment. Since a frequent passage between two adjacent plansifters is often unavoidable, the danger arises that the passing persons are caught by the projecting parts of the plansifters.

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In order to clean the screens brushes are generally used which are applied from below; these brushes do not operate satisfactorily. The screen netting is only properly cleaned at the place of direct contact with the brushes whereas the other parts remain to a surprisingly large extent clogged with meal or flour particles. Moreover, it is not recommendable to bring flour, which is to be used for human consumption, in contact with hair made brushes; abrasion is unavoidable and therefore minute particles of the hair will accumulate in the flour.

Furthermore, the brushes push the products which have passed through the screen netting into transport channels; consequently, an abrasive action is caused between the bristles of the brushes and the bottom plates of the screen frames; since these bottoms generally consist of steel or aluminum sheets, this abrasive action may cause a discoloration of the screened products.

The operative capacity of the screens may also be increased by the use of high frequency vibrators which apply vibrational movements to the screens. In this manner it may be possible to keep the screens at their lower surface free from dust particles; however, it seldom happens that particles upwardly thrown by these pulsators during their downward movement hit a hole of the screen and pass through the same. If, however, these particles hit upon a thread of the screen netting, they are again upwardly thrown and a lamination in conformity with the weight is prevented. The heavy or fine particles, which are to reach the meshes of the screen, are again upwardly thrown into different levels.

It is the main object of the invention to eliminate the above recited disadvantages.

It is also an object of the invention to secure a highly satisfactory standardization of the screening work.

It is a further object of the invention to render possible a series production of the plansifters which is dependent upon the special field of their application.

It is also an object of the invention to enable a cheap mass production of the plansifters.

With these and further objects in view, which will become apparent as this specification proceeds, the invention will now be described in detail and with reference to the accompanying drawings.

In the drawings:

Fig. 1 is a vertical sectional view of plansifter compartment taken on line 1—1 of Fig. 2;

Fig. 2 is a horizontal sectional view of the plansifter compartment taken on line 2—2 of Fig. 1, along the plane of the screen of a screening set;

Fig. 3 is a horizontal sectional view of the plansifter compartment taken on line 3—3 of Fig. 1, along the bottom portion of a screening set;

Fig. 4 is a sectional view of a screening set showing the screen clearing mechanism;

Fig. 5 is a plan view of the clearing mechanism;

Fig. 6 is a vertical sectional view on an enlarged scale of the edge of the screening cloth securing frame structure;

Fig. 7 is a sectional view on an enlarged scale of a clamping member;

Fig. 8 is in part a front and in part a sectional view of the plansifter;

Fig. 9 is a lateral view thereof;

Fig. 10 is a top view of the same partly in section;

Fig. 11 is a perspective view of a structural detail;

Fig. 12 is a vertical sectional view of the compartment on line 12—12 of Fig. 3;

Fig. 13 is a vertical sectional view of the compartment on line 13—13 of Fig. 3;

Fig. 14 is a vertical sectional view of the plansifter compartment taken on line 14—14 of Fig. 3; and

Fig. 15 is a vertical sectional view of a center section of the plansifter compartment taken on line 15—15 of Fig. 3.

The plansifter forming the subject matter of this invention is composed of compartments, as shown in the drawings, each compartment being provided with a plurality of vertically superposed screening sets, each accommodating two sieves 5, Fig. 2, which are adjacently located in the same horizontal plane. The screens 5 have a circular shape. A bottom plate 6 is coordinated to each screen. The screening sets consisting of the screens 5 are housed in casings consisting of a center section 4 and two lateral sections 2, 3 the casing being separable into three constituents. The frames 47 and the bottom plates 6 of the screens are supported in grooves 25, 26, Fig. 4, of the tripartite casing. Vertical passages 8, 9, 13, Fig. 2, are provided in the casings for the transport of the produced separation products. These passages are subdivided in accordance with the operating or flow scheme of the plansifter compartment by clampable members 12, 27.

The center section 4, the lateral sections 2, 3 of the casings as well as the circular frame or rim 47 of the individual sieves 5 may consist of cast light metals, plastics, or a combination thereof; injection molding is particularly suited for their production.

The frames 47 of the screen cloth 5 enclose a peripheral, wedge-shaped groove 50, Figs. 4, 6. The screen cloth, Figs. 1, 4, 6, is pulled over the frame 47 and secured in the groove 50 by a resilient ring 18, Fig. 4, made, for instance, of rubber.

The holding structure for the screen cloth may be made of metal or of plastics and may be advantageously produced by injection molding. The frames 47 supporting the screen cloth and the rings 18 are pushed into the circular groove 26. By advancing a lateral section such as section 2, towards the center section 4 the recess formed by grooves 26 and 50 is closed and the ring 18 is firmly clamped along its entire circumference. By a compression of these parts, the ring 18 is deformed in the direction of the smallest resistance, whereby it tightly pulls the screen cloth into the groove 50, Fig. 4.

This clamping action may be further improved by the application of a slide preventing layer 49 for instance, made of rubber, Fig. 6 to the frame or rim 47.

The screen cloth 5, which may be made of silk or other textile material, does not slide on the rubber layer 49 and is solidly pressed at its upper and lower end onto its supports. Since the upper edge of the rim 47 consists of a smooth material, the screen cloth easily slides over the frame edge and is uniformly stretched. The rubber ring 18, Fig. 6, may be made in conformity with the character of the screen cloth of a soft or a hard rubber and it is, therefore, adapted to equalize tensional difference during its application and during the operation of the device.

A rotatable screen cloth clearing mechanism 7, Figs. 1, 2, is mounted upon the bottom plate 6 of the circular sieves and it is operated by the circular movements of the plansifter compartment. The center of rotation 24, Figs. 4, 5, of this clearing mechanism is located at the length of radius 31, Fig. 5, from the center of the bottom sheet 6. The arm 23 carries a swing disc 21, which is eccentrically rotatable about pivot 22. The protuberance 20 hits along its circular path 30 the center stud 19 which is solidly connected to the frame 47. The pin or protuberance 20 may be made of a material having a hardened surface and the same applies to the stud 19.

Due to the eccentric location of the swing disc 21 the protuberance 20 may evade the stud 19 at the start of its movement, but during its further rotation it strongly impacts upon said stud. The force of the impacts depends upon the degree of the overlap of stud 19 and pin 20, upon the weight of the swing disc 21, upon

the radius 31, upon the number of revolutions and upon the working range of the separator.

The impacts exerted upon the sieve frame from below loosen the charged materials at the lower side of the screen 5, keep the materials on the same in a loose state and in movement and, therefore, greatly improve the operation. Due to the elastic positioning of the sieve frame by means of ring 18 the same are slightly movable in the vertical direction. The number of the impacts may be increased, if desired, by the installation of three or more impact mechanisms.

The plansifter shown in Figs. 8—11 and consisting of four plansifter compartments is rotatably suspended by four groups of rod shaped holders 35, which are fastened by means of vertically staggered clamping plates 43, Fig. 11, to the frame of the plansifter which, as stated before, is composed of the parts 2, 3, 4; in this manner a space saving and compact structure is created. The rod holders 35 fit in with Z-irons 34, Fig. 10, and do not project beyond the outer contours of the plansifter.

The plansifter is covered at both ends by a cover plate 36. The vertical Z-shaped profiles 34, Fig. 10, are connected at their lower end with angular carriers 32, which may be strongly built, as there is sufficient space for this purpose below the plansifter. The centrifugal weight resulting from this circular movement of the separator is taken up by the horizontal shanks of the angular carriers 32 and by the plate 33 extending throughout the total length of the separator.

The angular carriers 32, the Z-shaped profiles 34 and the plate 33 form the frame which supports the plansifter.

By application of the plates 45, Fig. 10, to the carriers 32, to the plate 33 and to the cross-shaped connection 46 a stable housing is produced for the reception of the entire plansifter driving mechanisms. The electromotor 38 and the worm gear 37 swing with the plansifter.

A free-wheel clutch, not shown, may be used to protect the driving means upon a stoppage of the motor. The use of the worm gear 37 renders possible the use of a light, relatively small motor having a large number of rotations.

A swing weight 39 is provided and the height of this swing weight is nearly the same as that of the separator; therefore, the insertable additional weights 40 may be made of cast iron instead of lead.

By the provision of projection 42, Fig. 8, an upper and a lower chamber is created for the compensation weight 40, Fig. 10. By the application of this swing weight, which is nearly as high as the plansifter, more mass can be concentrated on a smaller gravity radius. Consequently, the distance between the two median compartments may be reduced. The jaw 41, Fig. 10, imparts to the compensation weight 40 a welcome strength in the critical cross sectional area.

The above described structure of the plansifter compartments enables a highly satisfactory location of the passages 13 and the channels 8 and 9. These passages 13 may be interrupted by clampable parts 27 which are made of plastic or elastic materials, for instance, rubber; these parts are entered from below until the bulge 28, Fig. 7, coincides with the recess provided in parts 12 or 27; conveniently at this place a seal is produced along the entire circumference of the clamp. The clamps 12, 27, Fig. 7, have a reinforcing rib 48.

In order to reduce the number of parts of the compartment and to increase their uniformity the use of perforated bottom plates is avoided and cut-outs 14 of the bottom plate are applied in replacement therefrom. These cut-outs 14 serve as a passage for the collected through-flows of the screening sets, which through-flows thus enter the initial portion of the next screening plane.

The materials are fed to a screening plane where they are divided into coarser portions which are led from the screening plane by means of openings 11 into the chan-

nels 8 or into the passages 13, and finer portions or through-flows which pass through the screen cloth are collected on the bottom plates 6 and leave the screening set through openings 10 leading into the channels 9 or through cut-out 14 of the bottom plates 6.

The operation of the plansifter compartments will now be explained with reference to the drawings the parts shown in Figs. 2 and 12-15 being additionally denoted by reference to letters A to L denoting the superposed screening sets.

The materials to be separated are fed into the plansifter compartment through the opening 17, and due to the rotational movement and the pressure exerted by the continuous feed are conducted in the direction of the arrows over the screen cloth 5 of the uppermost screening set A, see Fig. 1. The tailings are conducted at the end of this screening set through the opening 11, Fig. 1, into channel 8c, Fig. 13 and 8a, and leave the plansifter compartment through the outlets 16a, Figs. 13 and 14. The through-flows fall through cut-out 14, Fig. 1, onto screening set B which is in series with screening set C by means of passage 13b, Fig. 1. The tailings of screening sets B, C, Fig. 1, are led through the openings 11C into channel 8a, Fig. 2, and leave the plansifter compartment through the outlet 15a, Figs. 14, 2. The through-flows of screening set B, Fig. 1, are led through the openings 10B, Fig. 1, into the channels 9a, 9b and through the openings 10C, Fig. 1, over the bottom plates 6C where they join the through-flows of screening set C. These joint through-flows fall through cut-out 14C, Fig. 1, onto screening set D which is in series with screening sets E and F, Fig. 1. The tailings of the screening sets D, E, F, are led through opening 11F into channel 8b, Fig. 14, and leave the plansifter compartment through the outlet 15c, Fig. 15. The through-flows of screening set D, Fig. 1, are led through the openings 10D, Fig. 1, and the through-flows of screening set E, Fig. 1, through the openings 10E, Fig. 1, into the channels 9, Figs. 2, 3, and through the openings 10F, Fig. 1, onto the bottom plates 6F, Fig. 2, where they join the through-flows of the screening set F, Fig. 1. These joint through-flows fall through cut-out 14F, Fig. 1, on screening set G which is in series with the screening sets H, T, J, Fig. 1. The tailings of the screening sets G, H, I, J, Fig. 12, are led through the openings 11J, Fig. 1, into channel 8d, Figs. 13 and 2, and leave the plansifter compartment through outlet 16c, Fig. 13. The through-flows of screening set C, Fig. 2, are led through the opening 10G, Fig. 1, the through-flows of screening set H through the opening 10H, Fig. 1, and the through-flows of screening set I through the openings 10I, Fig. 1, into the channels 9a, b, and through the openings 10J, Fig. 1, onto the bottom plates 6J, Fig. 1, where they join the through-flows of the screening set J. These joint through-flows fall through cut-out 14J, Fig. 1, onto the screening set K which is in series with the screening set L. Tailings fall from the screening set L through passage 13b and leave the plansifter compartment through outlet 16b. The through-flows of screening set K pass through the openings 10K, Fig. 1, into the channels 9a, b, Fig. 3, and through the openings 10L on the bottom plates 6L where they join the through-flows of screening set L. These joint through-flows pass through the cut-out 14L and leave the plansifter through the outlet 15b, Fig. 12.

As apparent from the above, in this particular scheme the flow of materials, entering the plansifter through the opening 17, is divided into six separate outlet-flows which have particles of a different size.

Having thus described the invention, what I claim as new and desire to be secured by Letters Patent, is as follows:

1. A plansifter compartment for the separation of fine materials comprising a plurality of superposed screening sets forming superposed screening planes, a casing housing said superposed screening sets comprising separable center and lateral sections, each of said screening sets having at least two sieves, each sieve comprising a frame, a screen cloth and means to clamp said screen cloth onto said frame and a bottom plate conforming to each sieve.
2. In a plansifter according to claim 1, a peripheral groove formed on the outside of said frame and a ring of an elastic material located in said groove to press the screen cloth onto said groove.
3. In a plansifter according to claim 2, said casing having vertically superposed grooves adapted to accommodate said elastic rings, having grooves therebetween formed to accommodate said bottom plates.
4. In a plansifter according to claim 1, vertical passages formed in said casing for the passage therethrough of the separation products and clampable members inserted into said vertical passages.
5. In a plansifter according to claim 1, said bottom plate defining a passage for the transition of the materials from one to the next screening plane.
6. In a plansifter according to claim 1, a rotatable impacting mechanism eccentrically fastened to said bottom plate and means to force said impacting mechanism during each revolution thereof at least once against said sieve frame.
7. A plansifter compartment for the separation of fine materials comprising a plurality of superposed screening sets forming superposed screening planes, a casing housing said superposed screening sets comprising separable center and lateral sections, each of said screening sets having at least two sieves, each sieve comprising a frame, a screen cloth and means to clamp said screen cloth onto said frame and a bottom plate conforming to each sieve, outer peripheral grooves formed in the sieve frame and corresponding grooves in the casing, and elastic rings in said peripheral grooves and extending into the grooves of the casing.
8. A plansifter compartment for the separation of fine materials comprising a plurality of superposed screening sets forming superposed screening planes, a casing housing said superposed screening sets comprising separable center and lateral sections, each of said screening sets having at least two sieves, each sieve comprising a frame, a screen cloth and means to clamp said screen cloth onto said frame and a bottom plate conforming to each sieve, elastic rings encircling the frames to clamp the lower edge portion of the screen cloth into the circumferential recesses of the frames, and slide preventing material layers between the elastic rings and the screen frames.

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