

May 28, 1940.

W. A. COTTON, JR., ET AL

2,202,189

SEPARATING OR CLASSIFYING APPARATUS

Filed July 1, 1938

2 Sheets-Sheet 1

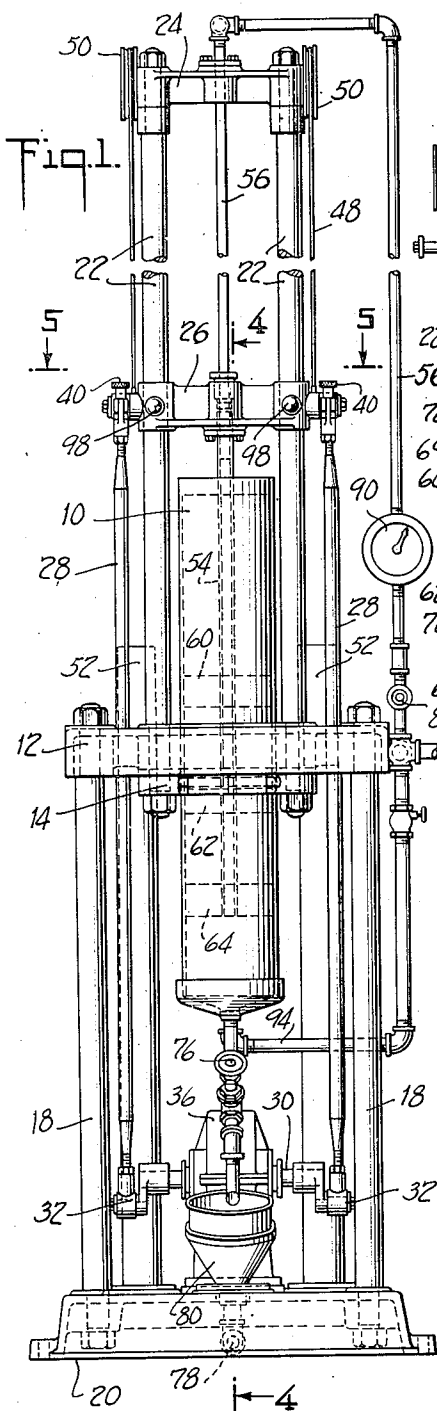
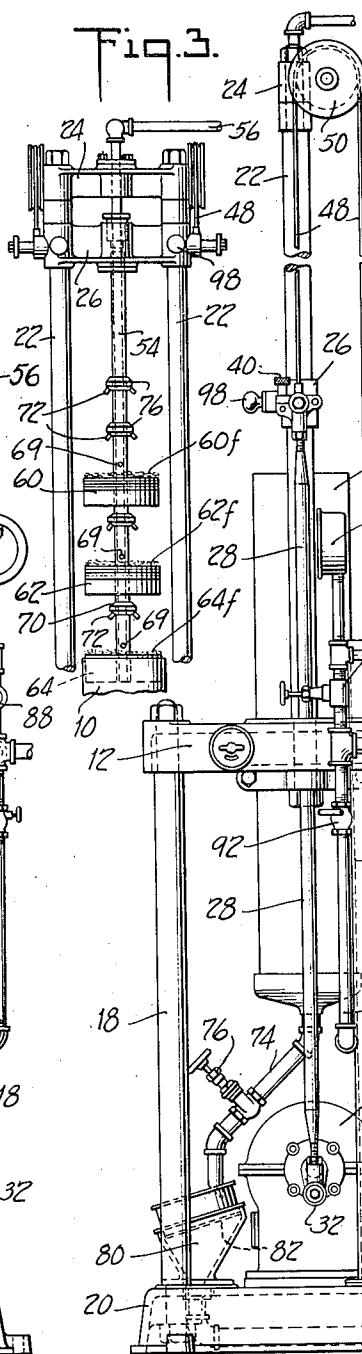
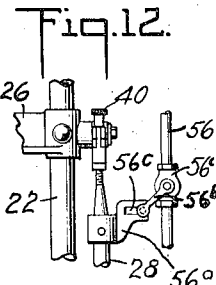
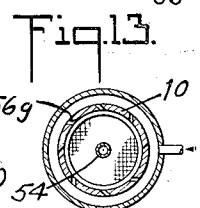
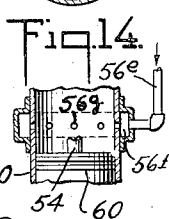


Fig. 2.

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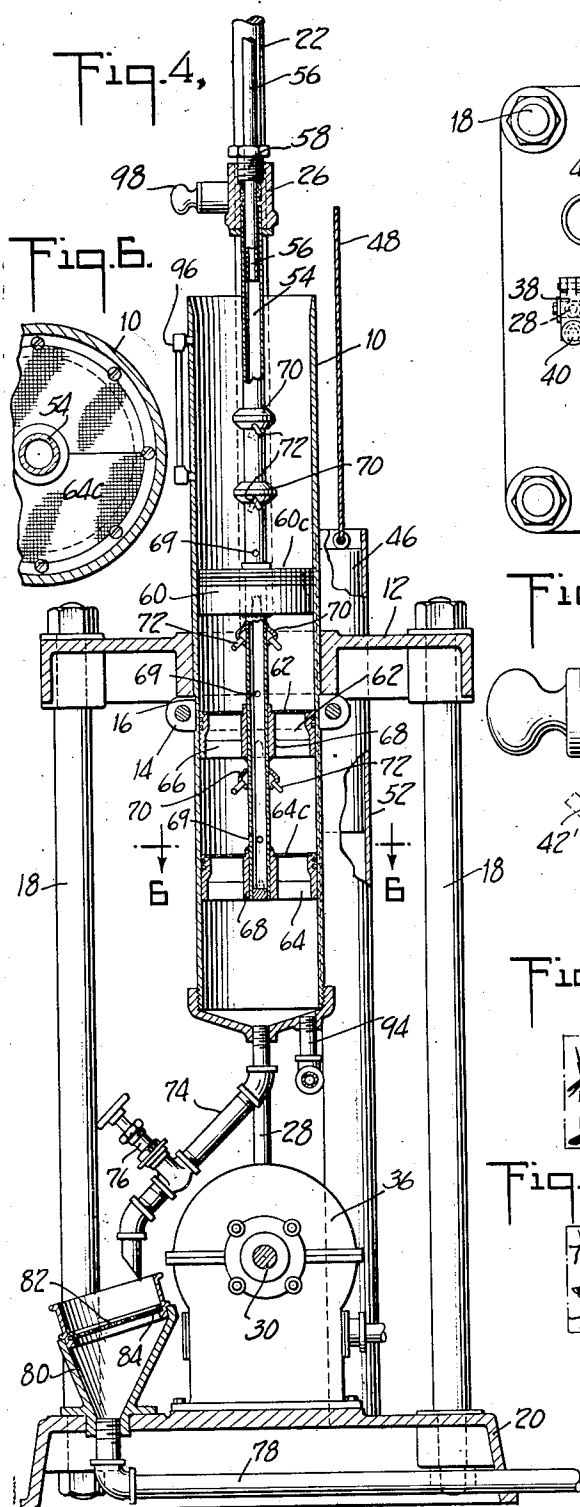
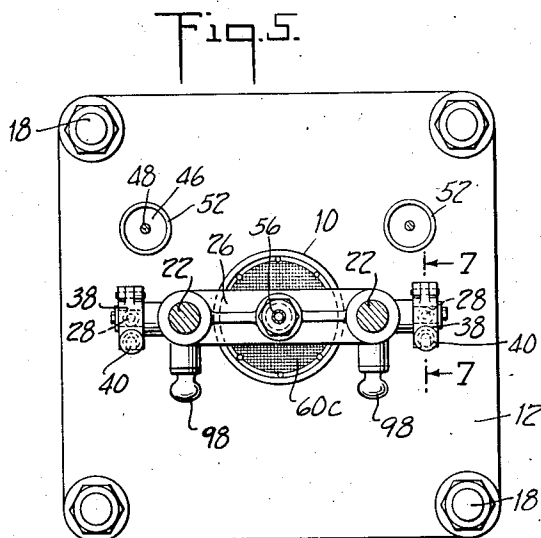
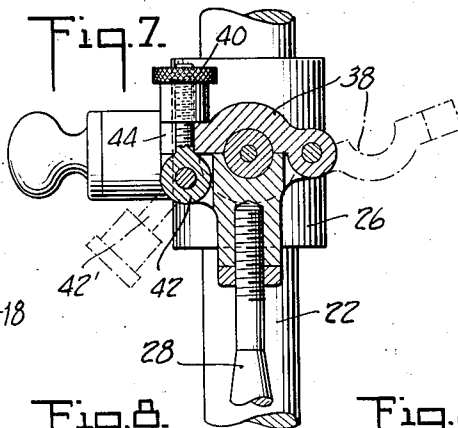
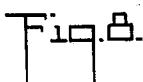
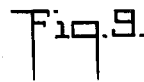
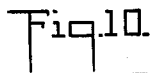
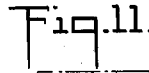
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2,202,189

SEPARATING OR CLASSIFYING APPARATUS

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14 Claims. (Cl. 209—237)

Our invention relates to separating or classifying apparatus adapted for separating subdivided materials into parts of different degrees of fineness.

According to our invention, the liquid such as water containing the material to be separated into parts of different sizes is flowed downwardly through a screen or screens while the screen is vertically reciprocated to keep its passages sufficiently open to permit the water to flow, and the liquid and its contents are preferably further agitated by delivery of the liquid in jets.

Objects of the invention include the provision of reciprocable separating screens and means for effecting reciprocating movement of the separating screens; the provision of means for delivering the liquid medium, as water, for effecting the separation, through the material to be separated in such a way as to keep the liquid and material carried thereby in agitation; the arrangement of the separating screens so that they may be readily exposed and made accessible to permit the removal of the separated parts of the material collected thereon; the provision for making use of several separating screens in tandem within a single cylinder, and with these and other objects in view the invention consists in the combinations hereinafter described and claimed.

In the accompanying drawings,

Fig. 1 is a front elevation of one form of separator apparatus embodying our invention;

Fig. 2 is a side elevation;

Fig. 3 is a fragmentary view similar to part of Fig. 1 with the screen pistons raised out of their cylinder;

Fig. 4 is a section on line 4—4 of Fig. 1;

Fig. 5 is a plan section on line 5—5 of Fig. 1;

Fig. 6 is a section on line 6—6 of Fig. 4;

Fig. 7 is a detail view showing the detachable attachment of the connecting rods to the slidable head carrying the screen pistons;

Figs. 8 to 11 inclusive are chart-like views to illustrate a type of separation which can be secured in exploded wood fiber;

Fig. 12 is a detail view of a modification providing means for producing pulsating jets; and

Figs. 13 and 14 are transverse and longitudinal sectional views respectively of a modified form in which water is supplied through the cylinder walls. The cylinder 10 is preferably circular in transverse cross section but may be of other cross-sectional formation.

Reference character 10 designates the cylinder in which at least the main part of the separation is carried out.

Cylinder 10 extends centrally through platform 12 and is clamped thereto by clamp ring 14 engaging a recess 16 about the cylinder 10.

Platform 12 is supported by corner posts 18 from the base 20. Platform 12 supports a pair of upwardly extending guide rods 22 which are connected together at their upper ends by the head piece 24. Guide rods 22 guide the slidable cross-head 26 located above the cylinder 10.

Means are provided for imparting limited vertical reciprocation to the slidable cross-head 26 and parts carried thereby. In the form shown, slidable head 26 has limited reciprocation imparted thereto by connecting rods 28 actuated from shaft 30 by crank arms 32. Shaft 30 is driven by a source of power here illustrated as an electric motor 34 and speed-reducing gear 36 both supported on base 20. Connecting rods 28 are detachably journaled to the slidable head 26, as by means of the pivoted bearing cap 38 and knurled nut 40 on the pivoted bolt 42 which may be received in the slot 44 of member 38 (see Fig. 7). To detach the slidable head 26 from connecting rods 28, the nut 40 is partly unscrewed and parts 42 and 38 are turned to the position shown in dotted lines in Fig. 7.

Counter weights 46 with cords 48 running over pulleys 50 and attached to slidable head 26 reciprocate oppositely to the slidable head 26, and said counter weights 46 assist in the raising of slidable head 26 and the parts connected thereto and holding same elevated when the slidable head 26 is detached from connecting rods 28. Hollow covers 52 are preferably provided for weights 46 and can conveniently be mounted on base 20 and extend through platform 12.

The tube 54 extends through slidable head 26 and downwardly therefrom into cylinder 10, and carries the separator screens as described below. A water supply pipe 56 extends down through head piece 24 and is inserted in tube 54, the slidable head 26 being provided with a gland 58, through which the water pipe 56 extends, and which is arranged to permit relative movement between slidable head 26 and water pipe 56 without leakage. Pipe 56 telescopes in tube 54 when slidable head 26 and tube 54 are elevated. Tube 54 is closed at its lower end.

In the form shown there are three separator screens carried by pistons in cylinder 10 and these are carried by the central tube 54, same comprise upper screen piston 60, intermediate screen piston 62 and lower screen piston 64. These pistons, which are preferably provided with conventional piston rings, are hollow and are secured

by radial spokes 66 to center rings 68, which fit about and are secured to tube 54. The screens 60c, 62c and 64c form the upper surface of the respective pistons. These screens, which may be of perforated metal, woven wire, or the like, are preferably made readily removable and replaceable so as to enable the use of screens adapted to making separations and classifications of various kinds and grades of fiber or other materials which are to be separated and classified. This may be accomplished, for example, by making the screen plates in halves, and providing a shouldered recess in the upper faces of the pistons in which the screens are received and held by means of screws, as indicated in Fig. 6, or their removability and replaceability may be attained by any other ways. Three of the pistons and screens are shown, but more or less than three may be used and their number may be varied to suit requirements. Thus each of the three screens forms a movable partition in the cylinder and everything that passes through the cylinder can only do so by passing through the screens.

Means are provided for the discharge of water upon the respective screens from above. In the form shown, the tube 54 is perforated and the perforated portion surrounded by hollow collars 70, and such collars 70 are provided with jet nozzles 72 preferably so directed and arranged as to produce rotation of the watery contents of the cylinder 10 over each of the screen pistons. In the form shown, one such collar and jet arrangement is shown over each of the screens 64c and 62c, and two thereof over the uppermost screen 60c in which the greater part of the separation is normally performed. The water jetting means may be varied to enable handling various kinds of fiber. For example, auxiliary jet holes 69 can be provided in tube 54 immediately over each screen and such jets directed to create a swirling action close to the screen, thus keeping fibers small enough to pass the screen from being held back by being matted with larger fibers. Instead of supplying the water continuously through pipe 56 and tube 54, means may be provided for effecting its delivery in pulsating or intermittent jets. This may be accomplished by the modified construction shown in Fig. 12, wherein pipe 56 is provided with a valve 56a which can be opened and closed by rocker arm 56b working in a slot 56c in bracket 56d which may be vertically reciprocated as by its being attached to a reciprocating part, such as one of the connecting rods 28. If desired, all or part of the water flow may be supplied through the cylinder walls at about the highest point of travel of the screens. In Figs. 13 and 14 we have illustrated such an arrangement, the water being supplied through a branch 56e of pipe 56 to a jacket ring 56f surrounding cylinder 10 and thence through the jet openings 56g arranged at an angle to produce a swirling of the water and suspended matter in the cylinder in a region just over each screen or one or more thereof. The delivery of the water through jet openings 56g may be continuous or pulsating, as desired, as may be best adapted for the fiber or other suspended material taken for classification. Yet other ways of delivering the water for classifying purposes may be resorted to.

When handling fiber such as wood fiber, the effluent from cylinder 10 will usually contain very small fibers, and means are preferably provided for collecting such fiber. In the form shown, cylinder 10 has a central bottom outlet pipe 74

controlled by gate valve 76 and discharging to the waste pipe 78 through a funnel 80. Funnel 80 is provided with a fine screen 82 which may rest upon a shoulder 84 so as to be readily removable and replaceable when desired. Screen 82 collects practically all the fiber or other material passing through the screens in cylinder 10.

The piping connections may, of course, be varied considerably, but in the form shown we have illustrated a water supply pipe 86 communicating upwardly with the water pipe 56 through the gate valve 88 and having connected with such upper piping a pressure gauge 90 located beyond the control valve 88. Supply pipe 86 communicates downwardly through a gate valve 92 to supply water to the cylinder 10 at the bottom thereof as indicated at 94.

With the parts in the position of Figs. 1 and 4, the specimen of fiber or other material to be separated and classified and examined may be inserted into the top of the cylinder 10, and water admitted at 94 to raise the water content of cylinder 10 to a desirable level, which may be indicated, for example by the gauge glass 96, or the material to be separated, etc., may be mixed with water in a vessel and the contents of the vessel poured into the chamber, etc., etc. Valves 76 and 88 are now opened preferably simultaneously, their degree of opening being preferably interrelated and also related to the pressure indicated on gauge 90 so as to maintain substantially a uniform level in the cylinder 10 which may be observed in gauge glass 96, and the slidable head 26 and therewith the screen pistons 60c, 62c and 64c are subjected to vertical reciprocation by means of power applied to the motor 34.

The water supplied through the valve 88 is delivered to the compartments over the respective piston screens through pipe 56, tube 54 and nozzles 72, and as stated above, the watery contents of the respective screening chambers are agitated by the water jets, nozzles 72 being suitably directed for this purpose.

When operation has been carried on for a sufficient time to separate the several parts of fiber or other material by means of the screens, for example several minutes with wood fiber, the water supply valve 88 is closed and the power turned off, and the remaining water allowed to run out through pipe 74.

The slidable head 26 is now detached from the connecting rods 28 by loosening nuts 40 and turning back the journal caps 38, whereupon the operator, with the assistance of the counter weights, raises the slidable head 26 and connected parts by grasping knobs 98, thus bringing the parts to the position indicated in Fig. 3, the counterweights holding them up.

It remains only to remove the collection of classified fiber or other material indicated at 60f, 62f and 64f from the respective classifying screens and also to collect the fine material from the screen plate 82 to have the original sample classified into its four parts of varying degrees of fineness.

Figs. 8-11 roughly illustrate, for purposes of comparison, the separation characteristics of exploded wood fiber, Fig. 8 indicating the fiber size of the part collected on the screen 60c, Fig. 9 that collected on the next finer screen 62c, Fig. 10 that collected on the next finer screen 64c, and Fig. 11 the finest fiber collected on screen 82. So separated, the respective amounts of the various finenesses of fiber or other material obtained can

be ascertained by drying and weighing, and other observations made thereon and comparisons obtained as may be desired.

It will be seen that the reciprocating motion of the screens, combined with the downward flow of the water, and the agitation produced by the water jets accomplishes the work of separation very effectively; and that after the separation is accomplished, each of the classified portions can be readily presented where it is accessible for ready removal; also that the screens can be readily replaced to enable classification of a wide variety of materials. While the apparatus is primarily used to classify fibrous materials, such as paper and wallboard stock, it can be used for the classification of other fibrous materials as well as non-fibrous materials of a granular or flaky nature, such as exploded mica and many others.

We claim:

1. In a separating apparatus, a cylinder through which liquid containing material to be separated is passed, a screen arranged to form a transverse movable partition in the cylinder so that all the material passing through the cylinder, other than the part retained by the screen, must pass through the screen, and means for imparting bodily translatable reciprocating movement to the screen within the cylinder and in directions parallel to the length thereof.

2. Apparatus as in claim 1, and also having means for supplying liquid material above the screen in such manner as to produce agitation of the contents of the cylinder over the screen.

3. Apparatus as in claim 1 and also having jet means for supplying liquid material over the screen in the cylinder and adapted to produce agitation of the contents of the cylinder over the screen.

4. Apparatus as in claim 1 and in which the screen is removable from the cylinder together with material collected on the screen.

5. In a separating apparatus, a cylinder, a plurality of pistons in said cylinder and connected together, screens carried by said pistons, means for reciprocating said pistons, and means for passing a liquid medium downward through said screens whereby material to be classified carried in said liquid medium is collected upon said screens.

6. In separating apparatus, a cylinder, means for traveling fluid containing material to be separated through the cylinder, a plurality of screen pistons in said cylinder and connected together, means for reciprocating said screen pistons in unison, and said reciprocating means being arranged to permit the withdrawal of the screen pistons from the cylinder for ready removal of material lodged upon the screens.

7. In a separating apparatus, a cylinder, a plurality of connected-together screen pistons within said cylinder, guide means for said screen pistons above said cylinder, detachable means for reciprocating said screen pistons in the cylinder, and means whereby the screen pistons, guided by said guide means, can be elevated out of the cylinder when the reciprocating means are detached.

8. In separating apparatus, a cylinder, a plurality of screen pistons in the cylinder, a tube connecting the screen pistons and having lateral outlets over each screen, guide means over the cylinder, a cross head guided by said guide means and to which said tube is secured, detachable reciprocating means for reciprocating the cross head, tube, and screen pistons, and counterweight means connected with said crosshead and tending to elevate same and the tube and screen pistons when the reciprocating means is detached, and a water supply pipe extending through said cross head and telescoping with said tube.

9. In a separating apparatus, a cylinder through which liquid, containing materials to be separated, is passed, a series of screens of successive fineness arranged over one another in said cylinder, and each of said screens forming a transverse partition in the cylinder and movable in the cylinder bore by bodily translatable movement, and means for imparting the above described movement to all the screens and so arranged that the screens can all be drawn out of the end of the cylinder.

10. In a separator, an upright chamber, a sliding cross head guided for vertical movement over the chamber, screen pistons of successively increasing screen fineness fitting the bore of the chamber, a tube depending from the cross head into the chamber and supporting the screen pistons and provided with laterally directed jet outlets above the respective screen pistons, a driven crankshaft, connecting rods actuated by the crankshaft, pivoted bearing caps for detachably attaching the connecting rods to the crosshead, a water supply pipe telescoping in said tube, counterweights for said slidable cross head, the said tube, and screen pistons being adapted to be reciprocated in said chamber when the connecting rods are attached to the crosshead, and the crosshead, tubes, and screen pistons, and collected material lodged thereon being adapted to be elevated with the screen pistons out of the chamber when the connecting rods are detached.

11. In a classifying apparatus, a cylinder, screens extending transversely of the cylinder and having a bodily translatable movement of reciprocation lengthwise of the cylinder, and means for supplying water within the cylinder in pulsating jets over the screens.

12. In a classifying apparatus, a cylinder, screens within the cylinder at different levels and having a bodily translatable movement of reciprocation lengthwise of the cylinder, means for imparting such movement to the screens, and means for delivering water in through the cylinder walls above and substantially adjacent to the screens and in direction adapted to keep suspended material held back by the screens in agitation.

13. Apparatus as in claim 12 and wherein the water delivering means are adapted to effect a pulsating delivery of the water.

14. Apparatus as in claim 12 and wherein the water delivering means are adapted to effect a swirling delivery of the water.

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